

MHI

TECHNICAL MANUAL

Natural refrigerant CO₂

Heat Pump Water Heater

ESA30E series

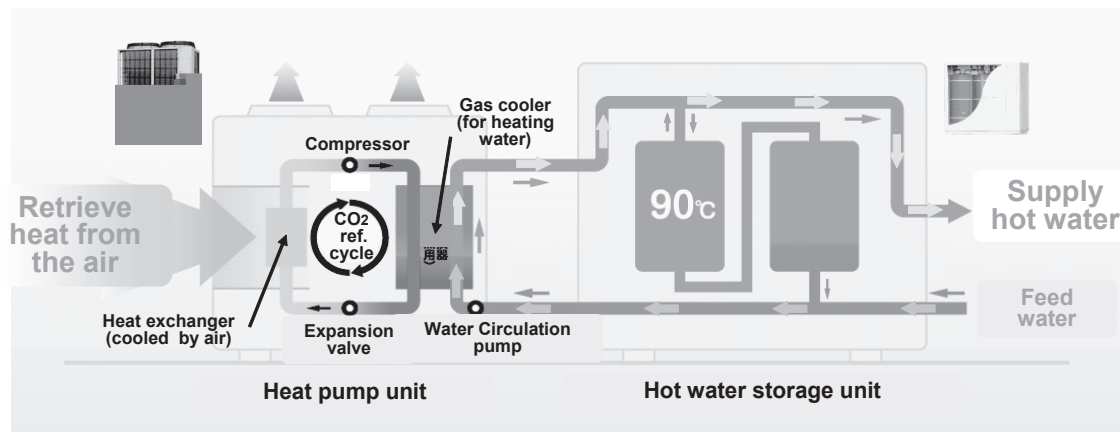
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1. General description

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 unit does not need any acceptance of notification by local authority due to exempt of regulation.



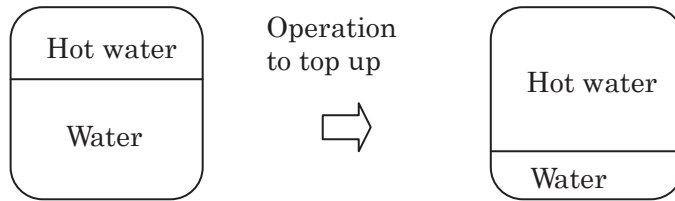
<Merit of CO₂ as refrigerant>

- The global warming potential (GWP)=1 (it is good for ecology)
*R410A : GWP=2090
- 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 unit 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

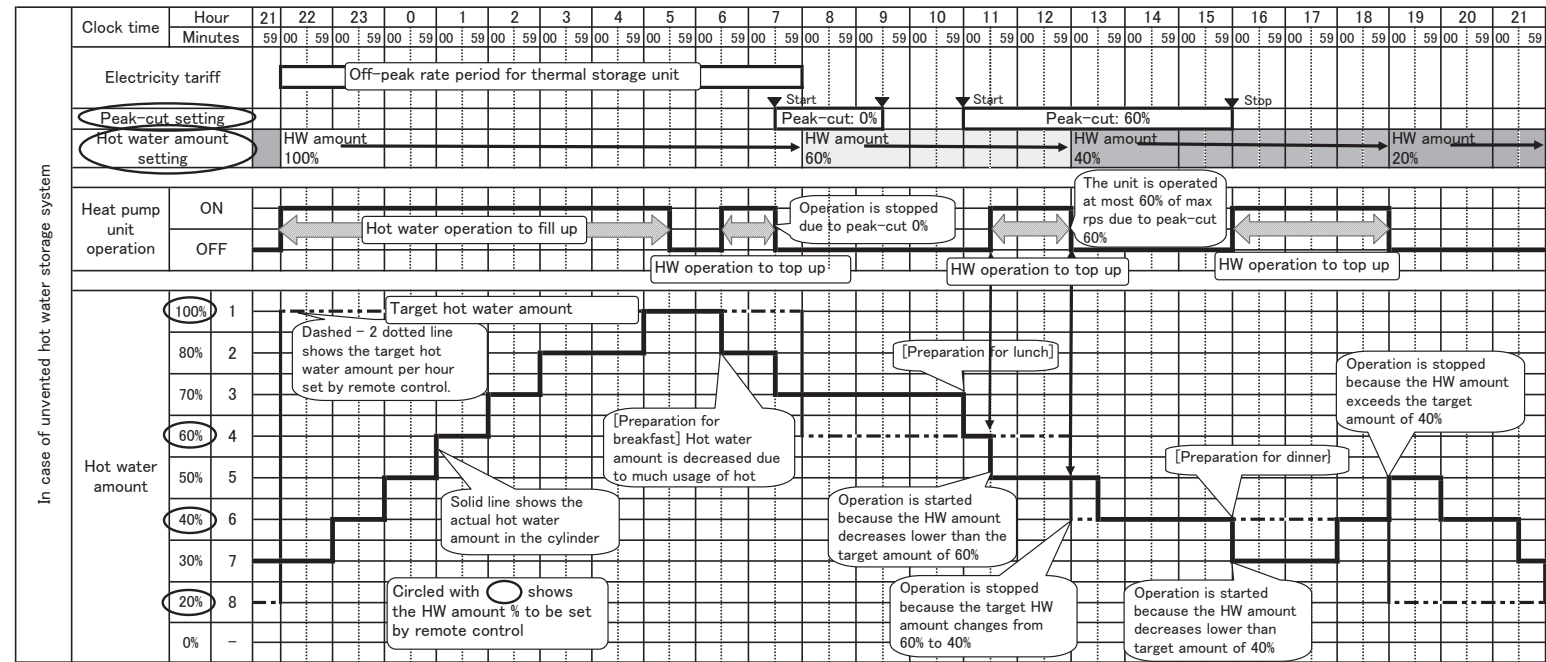


What is the unvented hot water storage cylinder?

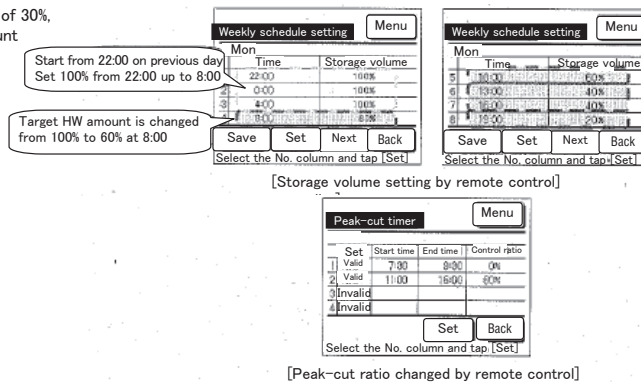
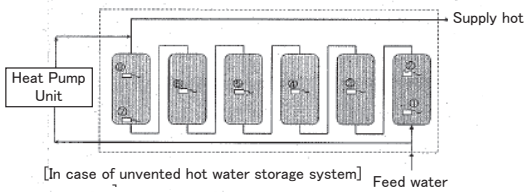
The storage cylinder is unvented and is pressurized by fully filled hot water.

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



Example: If the sensor No. 7 detects [(Set temp) - (15°C)] or higher temp, it judges the WH amount of 30%, and if the sensor No. 7 detects [(Set temp) - (20°C)] or lower temp, it judges the HW amount is less than 30%



1.4 Feature of natural refrigerant CO₂

1.4.1 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.

- a) It is colorless and odorless gas, but when interacting with water, it produces mild acidity and irritating odor.
- b) When dissolving it with water, it will be mild acidic and may cause metal to corrode.
- c) It is heavier than air and remains on the floor in the unvented room.
- d) In case of high density, it may have a risk for addiction or suffocation.
- e) Carbon oxide gas is effective for fire extinction because of noncombustible and nonflammable gas.
- f) 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.
- g) 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

1.4.2 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

Items		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	2090
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

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.

1.4.3 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 unit 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 unit

Model			ESA30E-25
Item			
Power supply			3-phase 380V±5%, 400V±5%, 415V±5% 50Hz
Operation to top up (In intermediate season)* ¹	Heating capacity	kW	30
	Water amount	Liter/min	8.97
	Power consumption	kW	6.98
	COP	—	4.3
Operation to top up (In cold region)* ²	Heating capacity	kW	30
	Water amount	Liter/min	5.06
	Power consumption	kW	10.73
	COP	—	2.8
Operating sound* ³			dB(A)
Outside dimension	Height	mm	1,690
	Width	mm	1,350
	Depth	mm	720 + 35 (Water pipe connection)
Current	Max	A	21
	Starting	A	5
Unit weight			kg
Color			375 (During operation 385) Stucco white (4.2Y7.5/1.1 approx.)
Compressor	Type x Pcs		Hermetic inverter compressor × 1
	Nominal output	kW	6.4
Refrigerant	Type		R744 (CO2)
	Charged amount	kg	8.5
Refrigerant oil	Type		MA68
	Charged volume	cc	1200
Crankcase heater			W
Anti-freezing heater	for water pipe	W	48 × 3
	for drain pan	W	40 × 2
	for drain hose	W	40 × 2 + 48
Heat exchanger, Air side			Copper pipe straight fin type
Heat exchanger, Water side (Gas cooler)			Copper pipe coil type
Fan	Type		Axial flow type (direct coupled motor) × 2
	Output x Pcs	W	386 × 2
	Air volume	m ³ /min	260
	External static pressure	Pa	50
	Type x output		Non-self-suction spiral type inverter pump × 100W
Water pump	Materials contacting to water		Bronze, SCS13
	Actual pump head	m (kPa)	5m (49kPa) @17L/min
Usage temp range	Outdoor air temp	°C	-25 to +43
	Feed water inlet temp	°C	Top up: 5-35, Warm up: 35-65
	Hot water outlet temp	°C	60-90
Water pressure range			kPa
Defrost			500 or lower
Vibration and sound proofing devices			Hot gas type
Protection devices			Compressor: placed on anti-vibration rubber and wrapped with sound insulation High pressure switch, over current protection, power transistor overheat protection and anomalous high pressure protection
Pipe size	Feed water inlet		Rc3/4 (Copper 20A)
	Hot water outlet		Rc3/4 (Copper 20A)
	Drain water outlet		Rc3/4 (Copper 20A)
Electric wiring	Earth leakage breaker		30A, 30mA, 0.1sec
	Power cable size		□14 × 4 (Length 40m)
	Molded-case circuit breaker		Rated current: 30A, switch capacity: 30A
	Grounding wire size		M6
Design pressure			0.3mm ² × 2 cores shielding wire (MVVS)
IP code			High pressure : 14.0, Low pressure : 8.5
			IP24

(Note)

- Performance of operation to top up in intermediate season shows the capacity measured under the conditions that outdoor air temp is 16°C DB/12°C WB, water inlet temp is 17°C and hot water outlet temp is 65°C.
- Performance of operation to top up in cold region shows the capacity measured under the conditions that outdoor air temp is -7°CDB/-8°CWB, water inlet temp is 5°C and hot water outlet temp is 90°C excluding heater for anti-freezing water (345W).
- 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.
- The actual hot water outlet temp may vary ±3°C from target temp according to the change of outdoor air temp and water inlet temp. And then if feed water inlet temp is 30°C or higher and outdoor air temp is 25°C or higher, hot water outlet temp may be controlled not to increase too high.
- Please use the clean water. The water quality should follow a guideline of JRA-GL.02:1994.
If the water quality is out of the standard, it may cause troubles such as scale buildup and/or corrosion.
- These articles mentioned above may vary without any notice according to the development status.

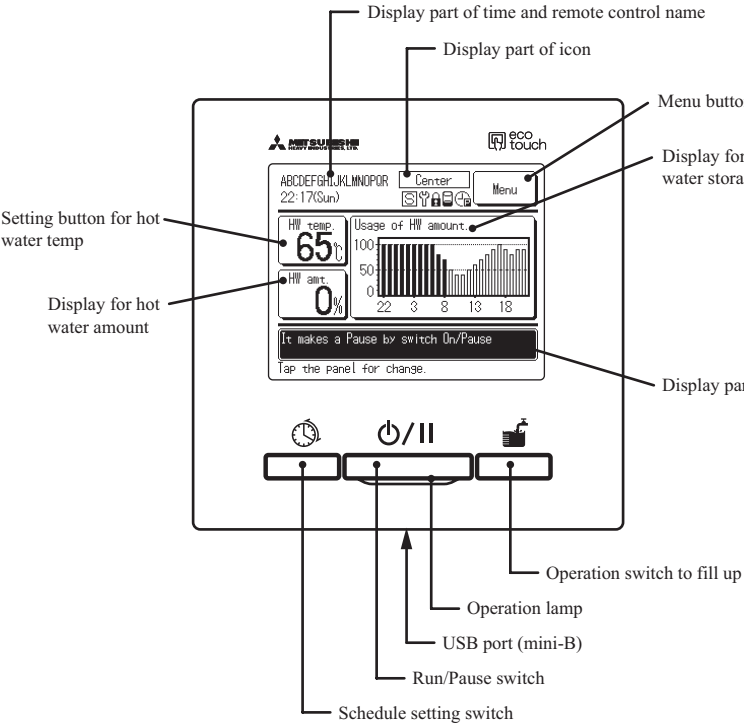
Fixing heat pump unit

Anchor bolt	M10 × 4
According to the installation conditions, please take a measure to prevent from falling, cross wind and heavy snow.	

(2) HW storage unit (Unvented cylinder)

- Commercial use
- Volume: 500 liter or more
- Design pressure: 500kPa or more
- Max. flow rate: 50 liter / min
- Max. water temp 90°C

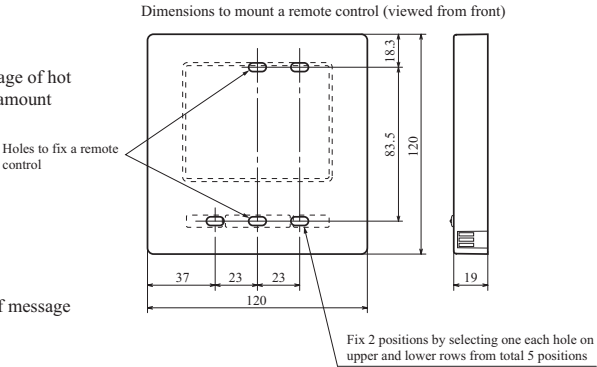
(3) Remote control for heat pump water heater (Model : RC-Q1E)
(a) Outline dimensional drawing



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-Q1E for details.

Dimensions to mount a remote control

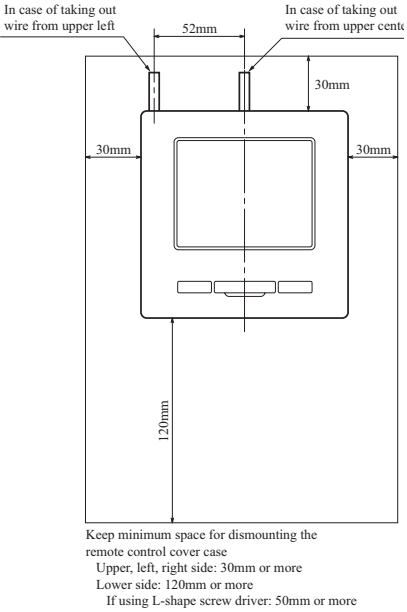


Installation of remote control

Please do not install a remote controller 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 install it on the flat surface of wall**
- (7) **Do not install it on the place where the surrounding temp can increase to 40°C or higher or can decrease to 0°C or lower.**
It may cause discoloration, deformation, malfunction and failure.

Installing space



Electric wiring specifications

- (1) Remote control wire size: 0.3mm² × 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 shielding wire (MVVS)
100-within 200m	0.5mm ² × 2cores
Within 300m	0.75mm ² × 2cores
Within 400m	1.25mm ² × 2cores
Within 600m	2.0mm ² × 2cores

(b) List of setting functions

Setting and display items		Detailed contents
1. Remote control network		
1	Multiple heat pump unit control	Max. 16 sets of heat pump units in one superlink network can be connected to one remote control and controlled by it. Heat pump units shall be set addresses.
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 temp	Set the temp to top up and the temp to keep warm
3	Hot water amount	Set the hot water amount. (More/Usual/Less)
4	Usage of hot water amount	Display the usage of hot water amount 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 settings		
1	Setting of weekly operation pattern	Set the operation pattern for one week. Set target hot water amount and time <ul style="list-style-type: none"> ●It is available to set 8 operation patterns per day ●It is available to set time at 1 hour intervals. ●It is available to set all. (Week days/ Saturday & Sunday/All days)
2	Setting of day off	If setting off day, the operation of heat pump unit to top up becomes invalid. <ul style="list-style-type: none"> ●It is available to set off day in every week ●It is available to set off day for specific period of time ●It is available to set off day on specific day.
3	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 %. <ul style="list-style-type: none"> ●It is available to set peek-cut for whole week. ●It is available to set max 4 patterns per day ●It is available to set time at 5min intervals ●It is available to select the peak-out % from 0, 40, 60, 80% ●It is available to set invalid. ●It is available to set all. (Week days/ Saturday & Sunday/All days)
4	Checking of operation pattern	It is available to check the current operation pattern
4. Initial settings		
1	Clock setting	Set or correct the current date and time <ul style="list-style-type: none"> ●In case of power failure within 80hours, 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 an be set
5. Administrator settings		Adminstrator password is required
1	Enable/Disable setting	<ul style="list-style-type: none"> ●Permission/prohibition setting of following operations can be set. [Run/Pause], [Operation to fill up], [Schedule setting] [Change set temp], [Change amount of top up]
2	Night tariff setting	In order to calculate the power consumption in day/night time, the time zone applied night tariff can be set.

Setting and display items		Detailed contents
3	HP unit selection	The heat pump unit to be displayed on RC can be selected.
4	RC display setting	RC name and HP unit name can be registered. On/Off of [Defrost operation display] and [Display status of HW amount] display can be set.
5	Step size of HW temp	Step size of HW temp (at 5°C or 1°C intervals) can be set. (Factory default is 5°C)
6	Change administrator password	Administrator password can be changed
7	User environment	By selecting the operation pattern of typical business type, the detailed operation pattern can be set easily.
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 available to start test run
	Primary setting of operation	It is available to start [Primary setting of operation].
	Water pump test run	It is available to start [Water pump test run].
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 units are connected, the applicable range of units 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 units can be connected to a remote control. The connected heat pump units 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 units 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 units in one system can be stopped.
9. Contact company		Contact company and phone No. are displayed
10. Check of RC setting		Current setting list of RC and HP unit can be checked
11. PC connection		
	USB connection	Set all from PC

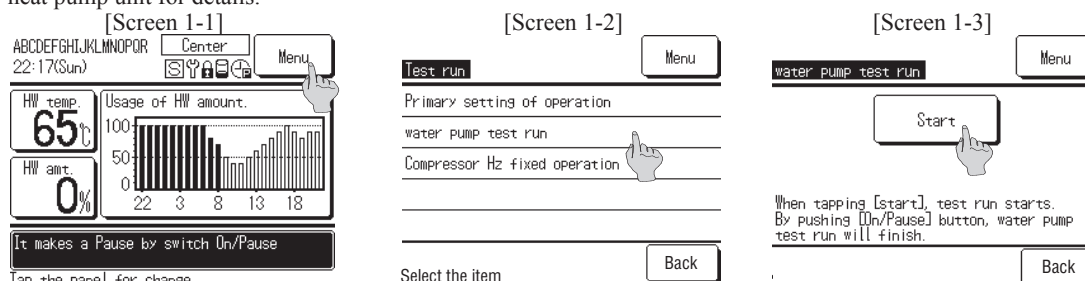
(c) Setting method of remote control for heat pump water heater

[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 controller of heat pump unit as well. Refer to user's manual for heat pump unit for details.



[Caution 1]

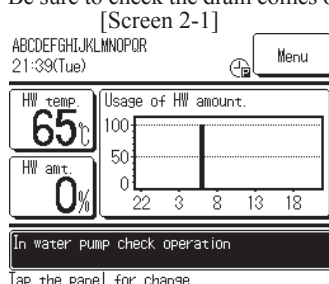
If starting operation by pushing [Run/Pause] switch before the end of water pump test run, the heat pump unit starts the operation to top up in case that the current hot water amount is less than the set amount.

Since it may cause failure of heat pump unit, **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).

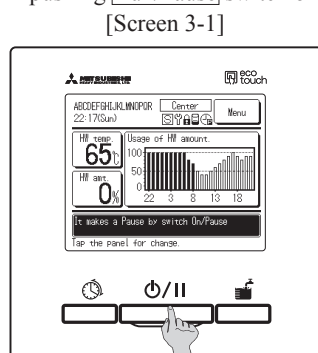
Purge air by operating test run of water pump.

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.

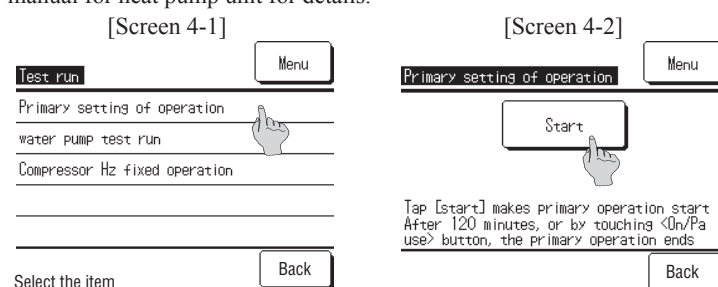
If pushing [Run/Pause] switch on the panel of remote control to stop operation, the water pump test run is stopped (Screen 3-1)



4. Start the "Primary setting of operation" of the heat pump unit.

[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 controller of heat pump unit as well. Refer to user's manual for heat pump unit 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).

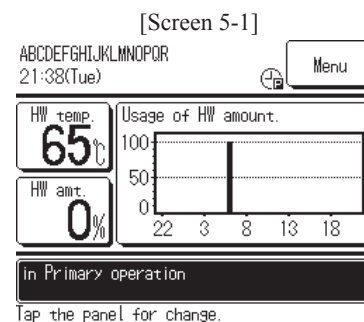
When completing the primary setting of operation, the heat pump unit is stopped and the message of “In primary operation” is disappeared (Screen 1-1).

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 unit does not start the operation to top up, even though the current hot water amount is less than the set amount.

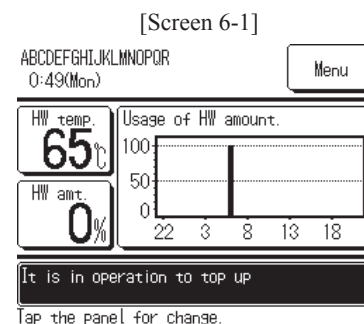
However, for anti-freezing of water in the pipe, water pump and compressor may start operation.



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

When the heat pump unit 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.



[Setting example]

[Setting method] and [Operation pattern of heat pump unit] 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.

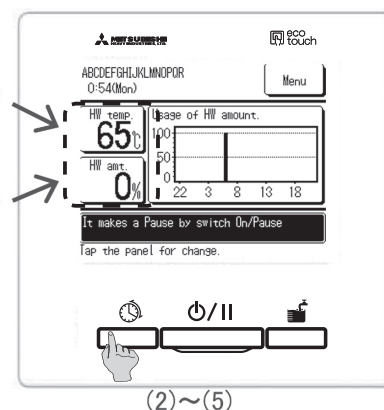
1. Setting method (* Please see user's manual for details)

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

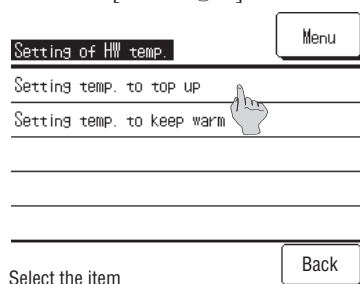
The setting of above setting conditions (1) to (6) can be set by pushing the buttons (1) and switches shown in the right figure.

(1) Set the hot water temperature at 90°C

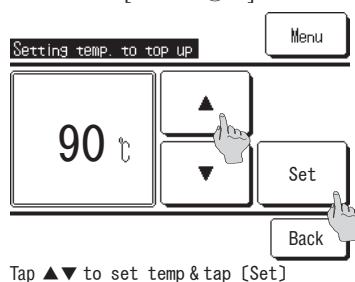
- ① When tapping the [HW Temp.] button on the TOP screen, the [Setting of HW temp] menu screen is displayed. (Screen ①-1)
- ② When tapping [Setting temp to top up], [Setting temp to top up] screen is displayed (Screen ①-2).
- ③ Set the hot water temperature by tapping ▲ ▼ buttons and tap [Set] button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



[Screen ①-1]



[Screen ①-2]



Tap ▲▼ to set temp & tap [Set]

(2) 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.

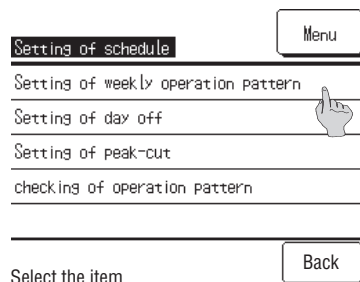
[Week days] Set all days from Monday to Friday

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

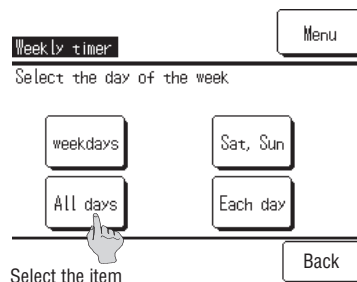
[All days] Set all days from Monday to Sunday

[Each day] Set each day

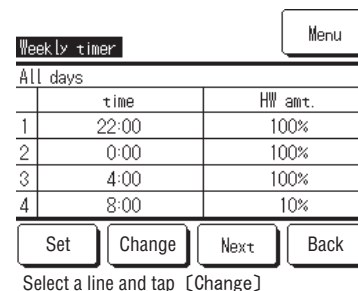
[Screen ②-1]



[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.

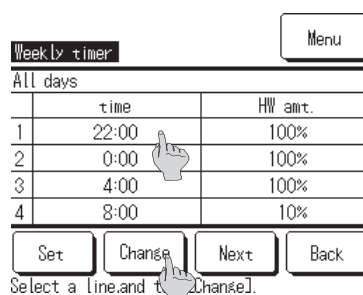
When tapping the line of [1/22:00/100%], the column of set item 1 is highlighted in reverse. Tap [Change] button. (Screen ②-4)

④ [Hot water amount setting] screen is displayed.

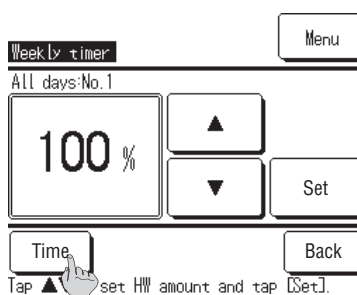
For setting the time, tap [Time] button. (Screen ②-5)

Since [Time setting] screen is displayed, tap [23:00] and tap [Set] button (Screen ②-6).

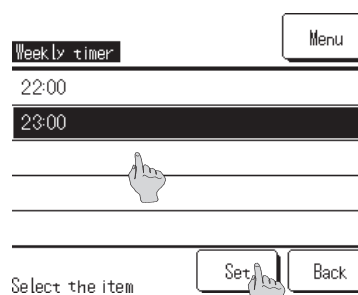
[Screen ②-4]



[Screen ②-5]



[Screen ②-6]



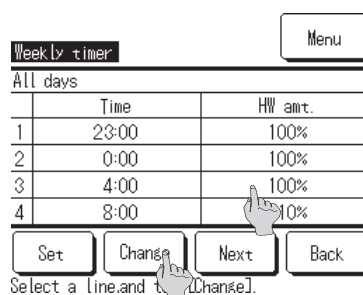
⑤ When tapping [Set] button, the screen for confirming the set contents is displayed (Screen ②-7).

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.

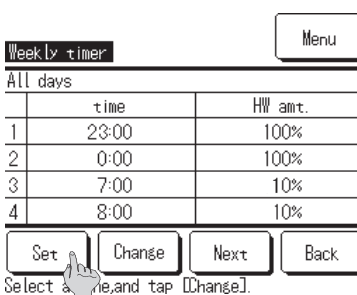
⑥ After changing the time, tap [Set] button on the screen for confirming the set contents. (Screen ②-8)

⑦ Since the acknowledge screen for confirming all set contents is displayed, tap [Yes] to save all settings. (Screen ②-9)

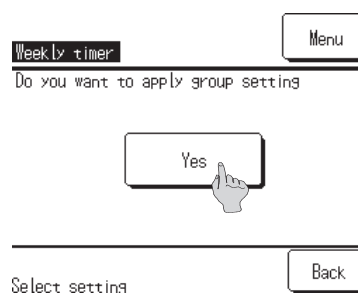
[Screen ②-7]



[Screen ②-8]



[Screen ②-9]



(3) 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]

	time	HW amt.
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]

30 %

Set

Time Back

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

[Screen ③-3]

	time	HW amt.
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].

(4) 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]

weekdays Sat, Sun

All days Each day

Back Set

Select the item

[Screen ④-2]

Set	Start time	End time	Peak-cut
1 Invalid			
2 Invalid			
3 Invalid			
4 Invalid			

Set Change Back

Select a line, and tap [Change].

[Screen ④-3]

Invalid Start time

Peak-cut 80% End time

Change

Back

Select settings

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]

valid Start time

Peak-cut 80% End time

Change

Back

Select settings

[Screen ④-5]

0 %

Set Back

Tap ▲▼ to set %, & tap [Set].

[Screen ④-6]

10:00

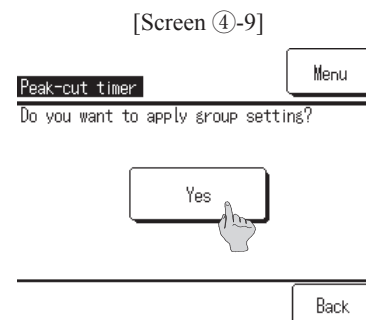
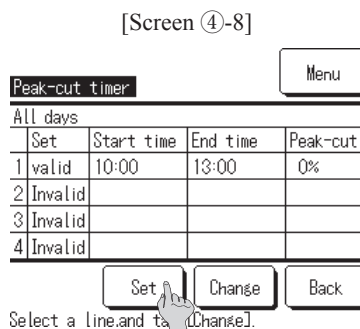
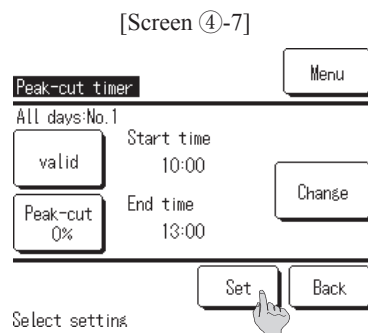
Set Back

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)



(5) Set all Sundays to day off

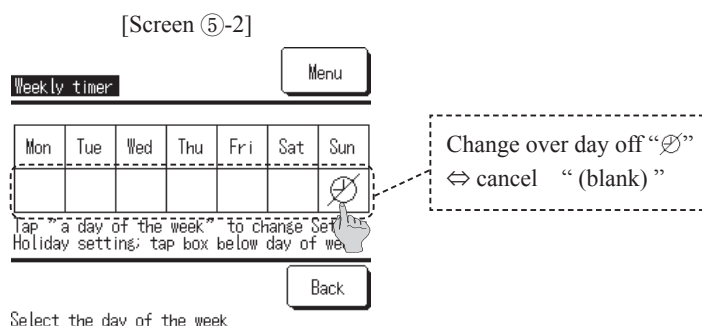
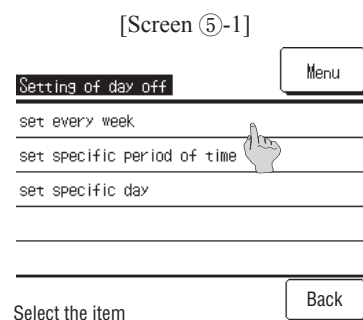
① When pushing [Schedule setting] switch on the panel of RC, the [Setting of schedule] menu screen is displayed (Screen ⑤-1)

② When tapping the [Setting of day off] on screen ⑤-1, 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 “∅” 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 “∅” ⇔ “(blank)” at every tapping.



(6) 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)

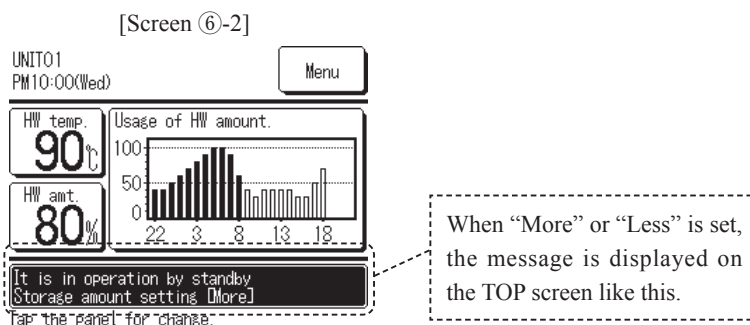
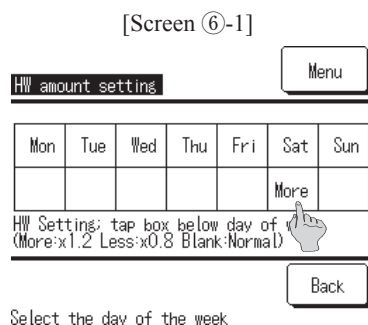
② When tapping the blank column just below Saturday to be set “More”, the “More” is displayed. (Screen ⑥-1)

<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)

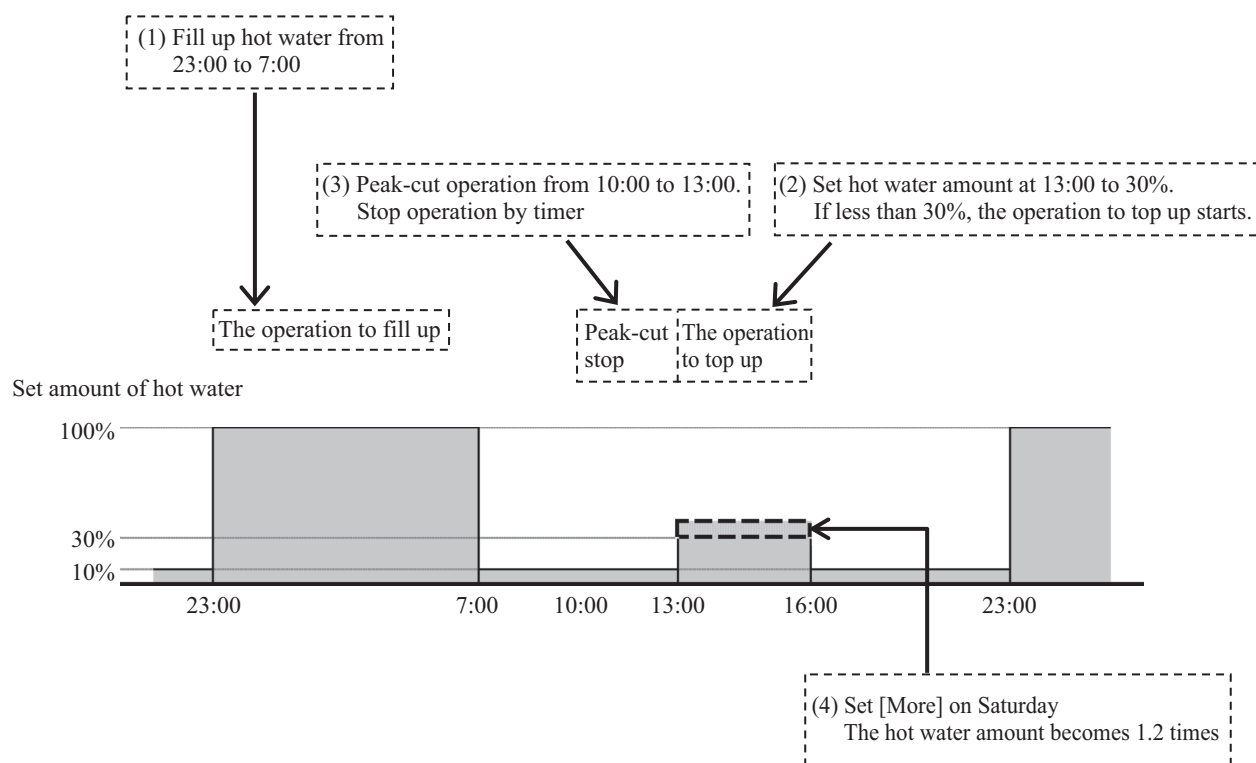
100% is the maximum value to be able to set “More” and 10% is the minimum value to be able to set “Less”.

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)



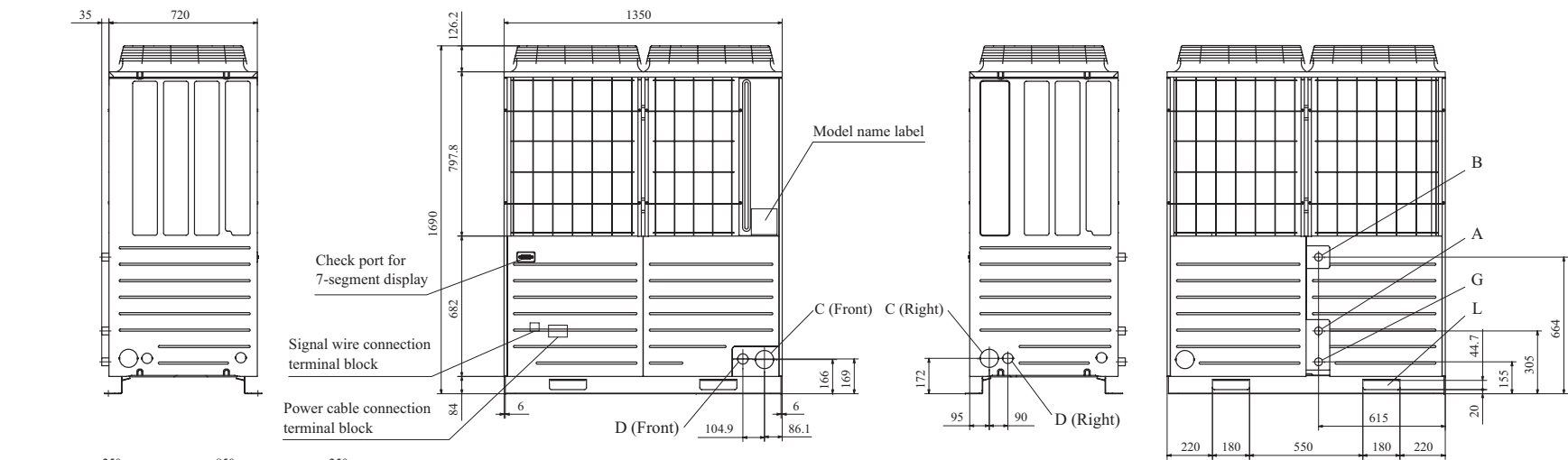
2. Operation pattern of heat pump unit

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

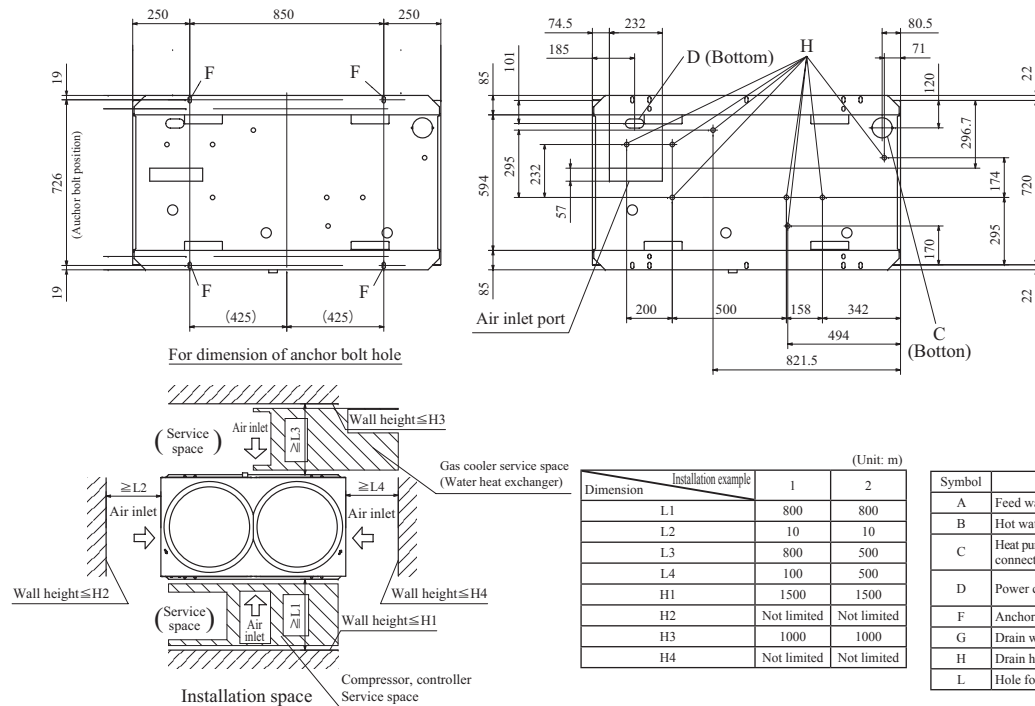


2.2 Exterior dimensions

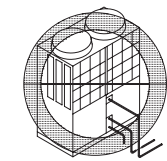
(1) Heat pump unit
Model : ESA30E



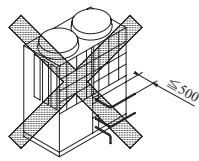
- Note
- (1) Be sure to fix the unit with anchor bolts
 - (2) Be sure to keep space above the unit at least 2m
 - (3) the connection of water pipes (Feed water inlet, Hot water outlet, Drain water outlet) should be done on site locally.
 - (4) The holes for power cable inlet, and connection wire outlet from heat pump unit to HW storage unit are half-blanked. Therefore please punch out the hole by cutting the residual portion and use it.
 - (5) For fixing the unit, the hole (Symbol F) for anchor bolts (M10 x 10) can be used.
 - (6) In heavy snow region, please take following measures in order for the air inlet/outlet port and the bottom part of unit not to be covered with snow
 - ① Place the unit on the rack in order to make the bottom of unit higher than the snow surface.
 - ② Install a snow prevention hood (locally prepared according to the drawing provided by MHI) on the outlet port of the unit.
 - ③ Install the unit at the space under the eaves or the snow prevention roof (locally prepared)
 - (7) If ambient temp becomes below 0°C, it may cause break of water pipes and damage on the unit due to freezing. Be sure to apply anti-freezing heater to feed water piping, hot water piping and drain water piping in order to prevent from freezing.
 - (8) Be sure to keep enough service spaces of more than 800mm in front of the unit service panel for easy inspection of the unit and replacement of components. When piping work is done, be sure not to interfere the pipes with the unit service space. If the service space cannot be kept, please install the piping below the unit by placing the unit on the rack. (refer to following sample)



Symbol	Contents	
A	Feed water inlet port	RC3/4 (Copper tube 20A)
B	Hot water outlet port	RC3/4 (Copper tube 20A)
C	Heat pump unit-HW storage unit connecting wire outlet port	φ 88 (or φ 100)
D	Power cable inlet port	φ 50 (right, front) Long hole 40x80 (bottom)
F	Anchor bolt hole	M10 × 4pcs
G	Drain water pipe outlet port	RC3/4 (Copper tube 20A)
H	Drain hole	φ 20 × 8
L	Hole for carrying in or hanging	180 × 44.7



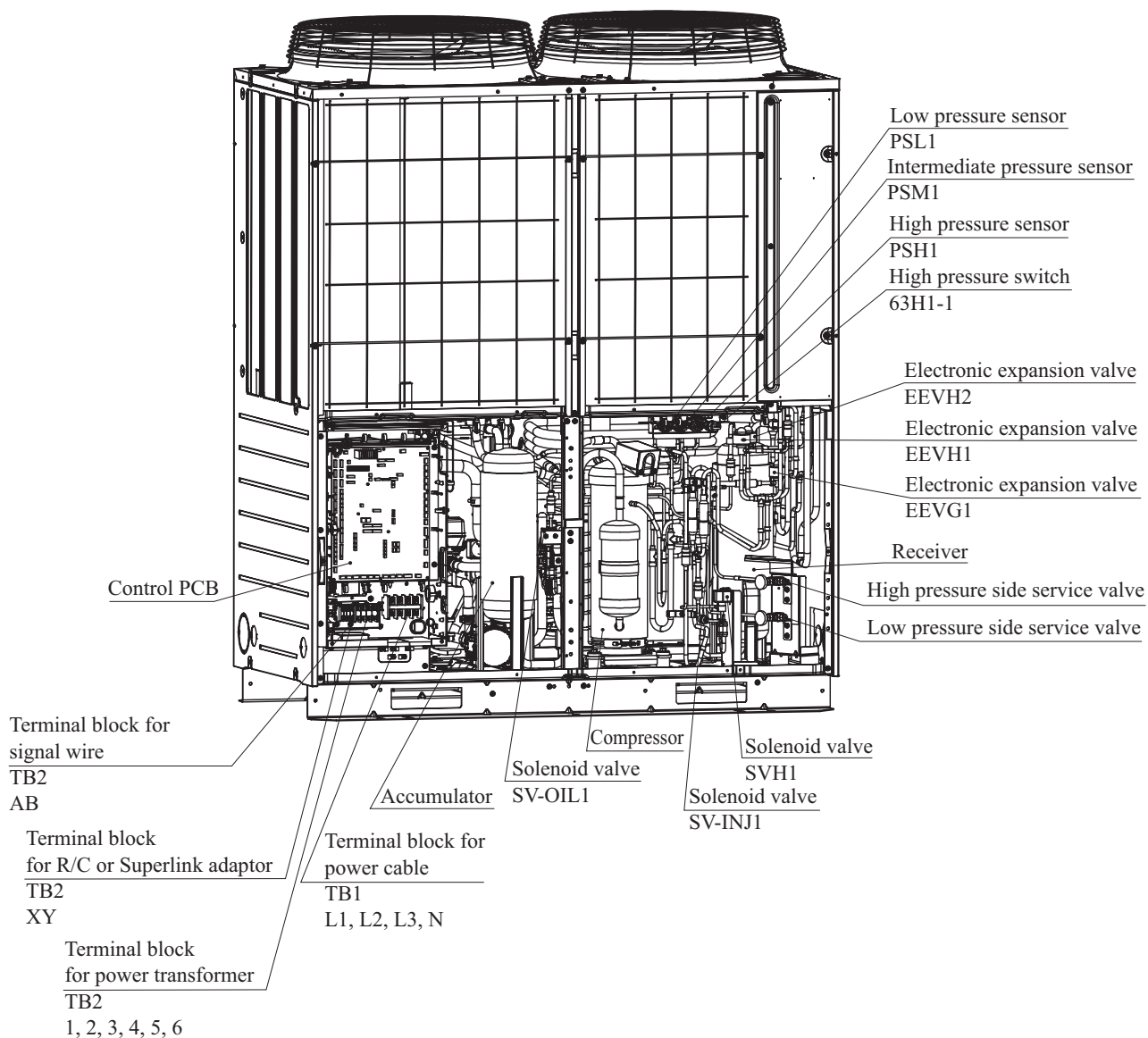
Good sample
Place the unit on the rack and piping work is done below the unit.



Bad sample
Service space is not enough, because pipe runs near the service panel.

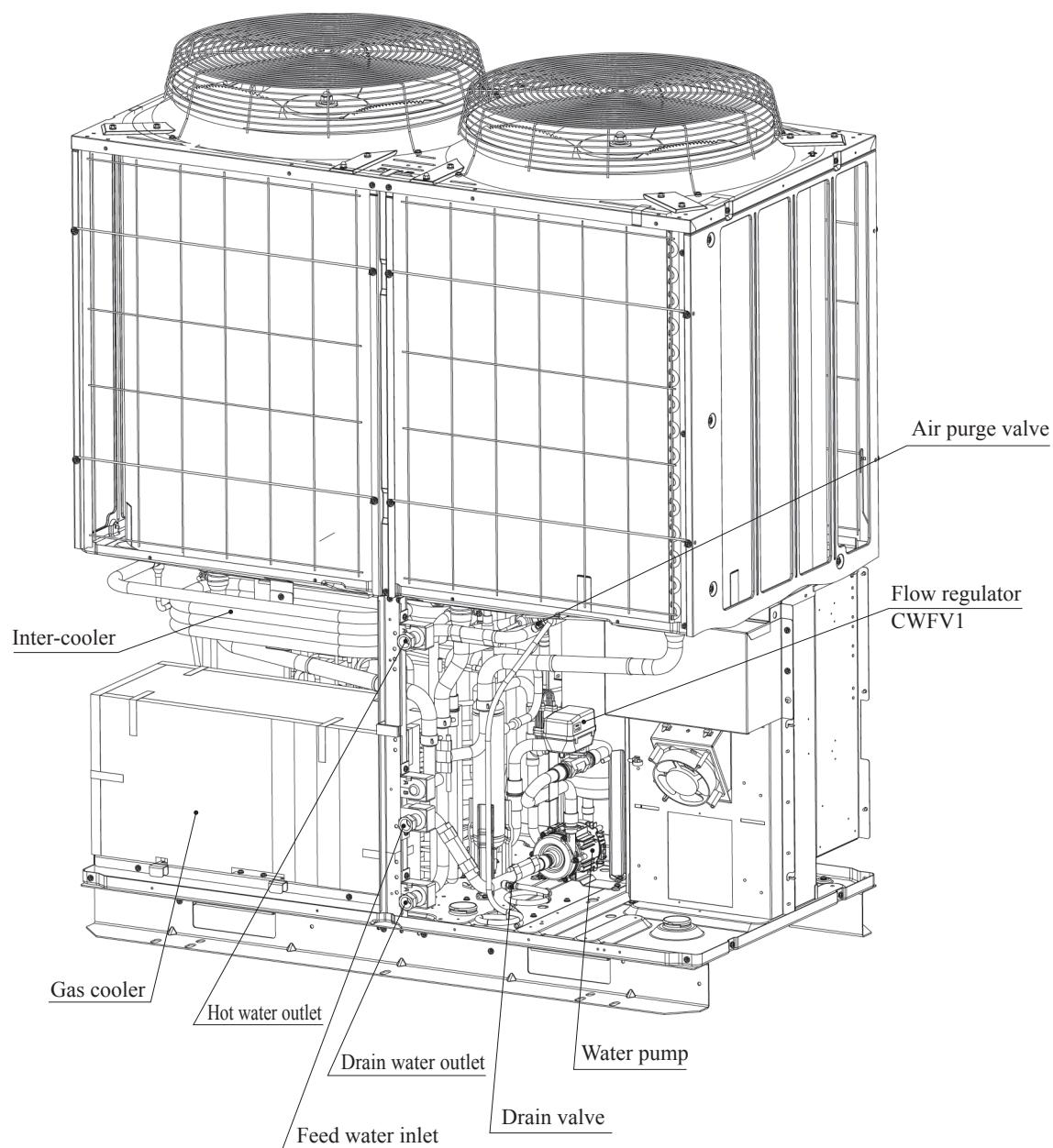
2.3 Inner structure

Heat pump unit



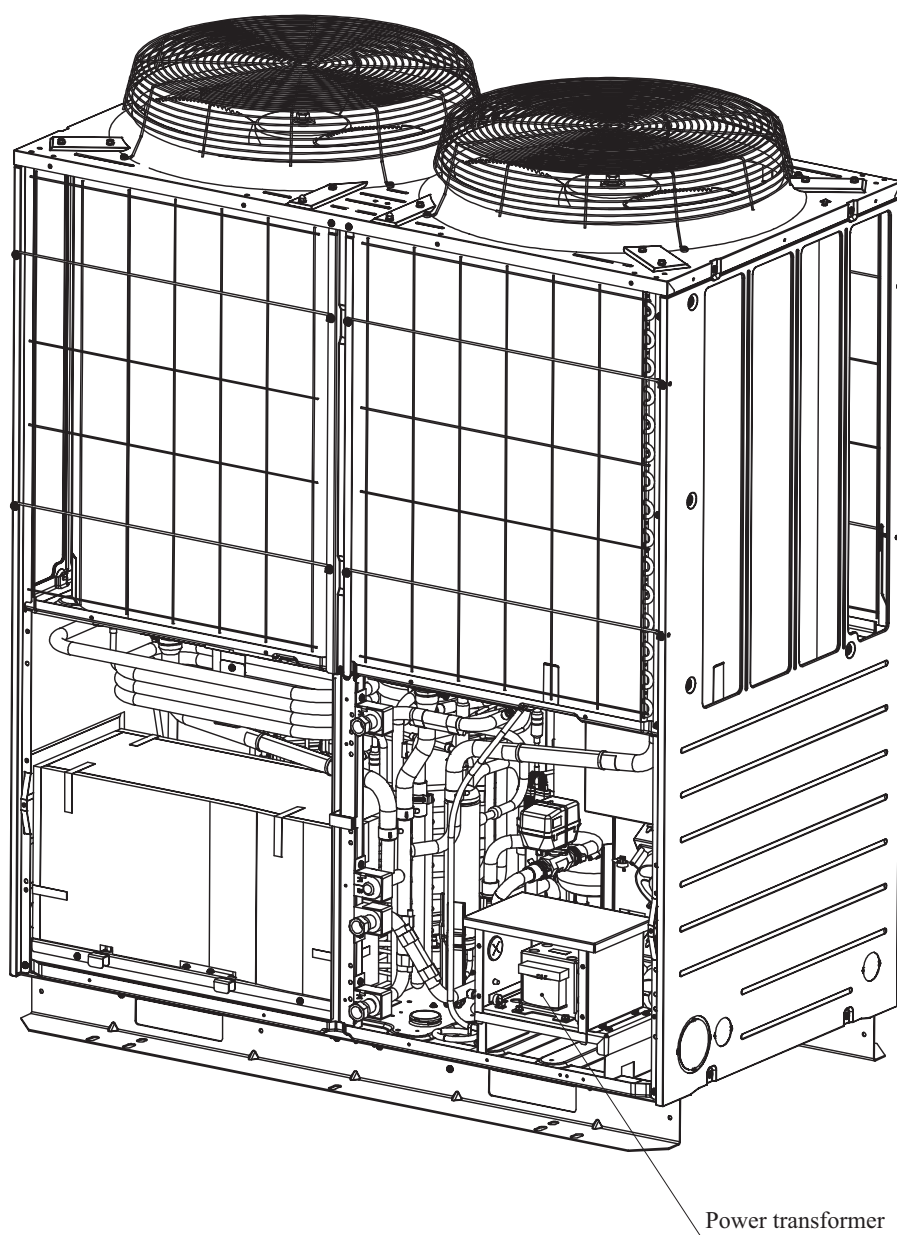
Front view

Without transformer



Rear view

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



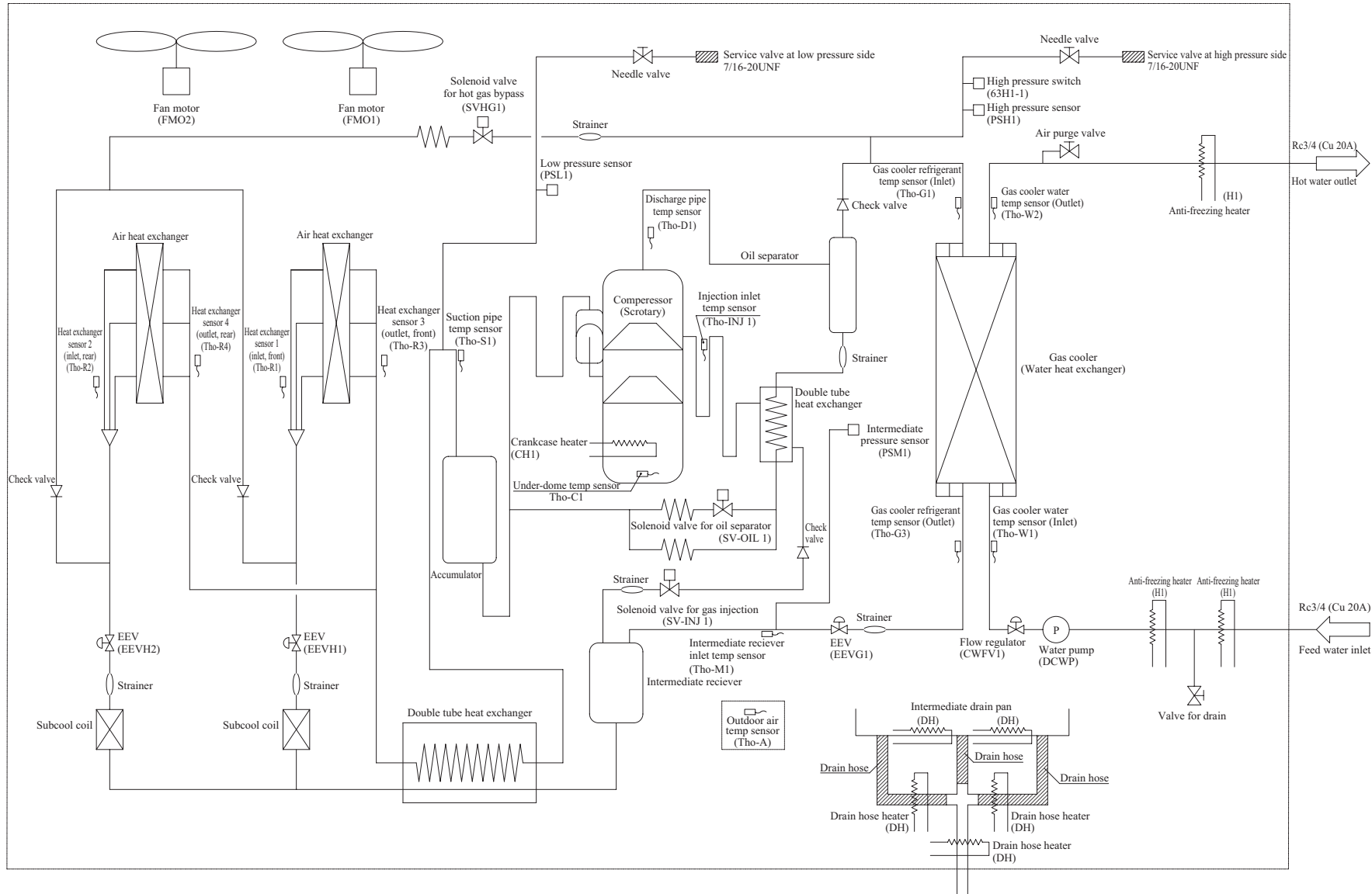
Rear view

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

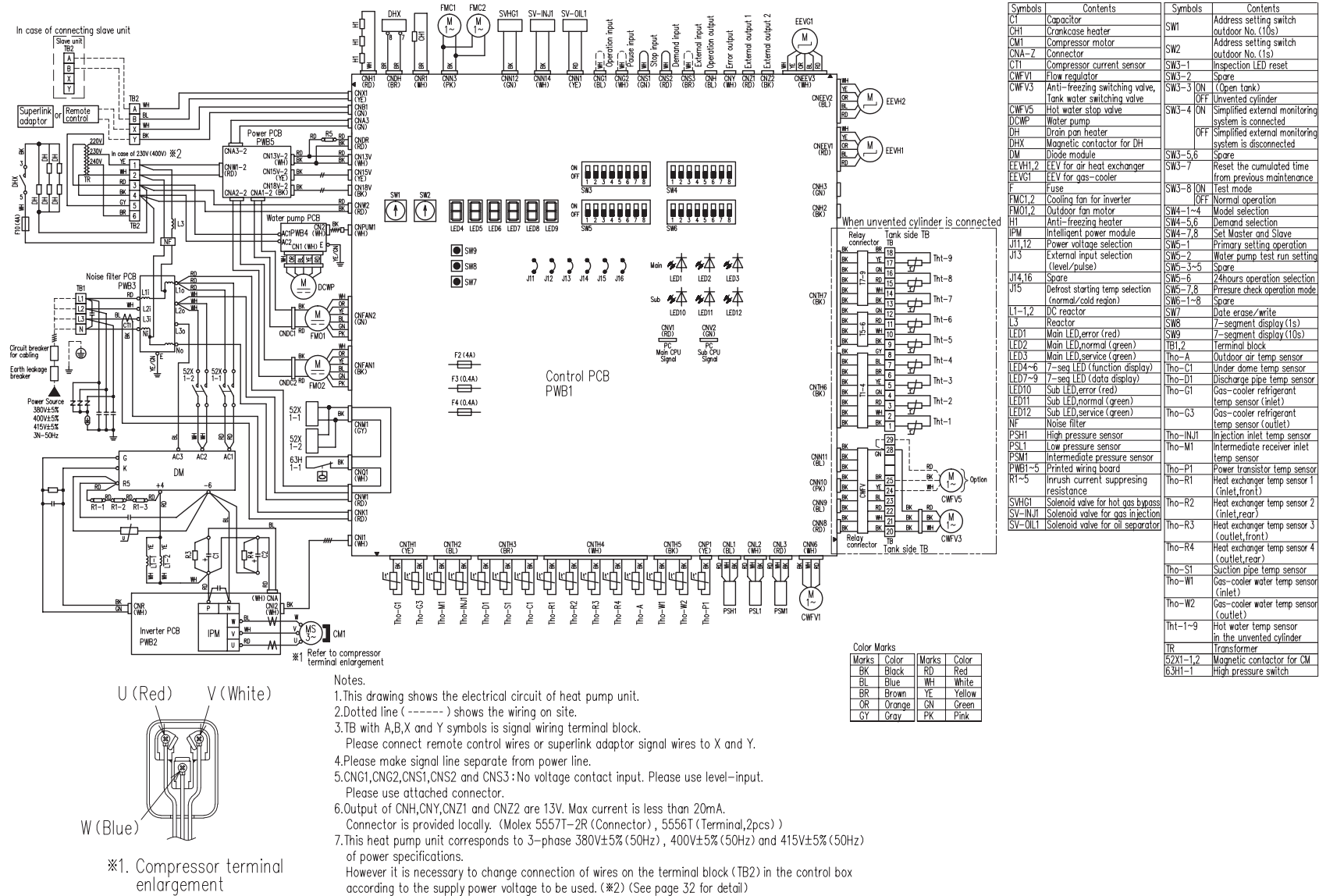
2.4 System diagram

(1) Heat pump unit (Overall view)

ESA30E-25



2.5 Electrical wiring drawing
Heat pump unit



2.6 Heating performance characteristics for the operation to top up

(1) Heating performance characteristics table for the operation to top up

(a) At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\leq 75\%$

Hot water outlet temp: 65°C		Heating capacity	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	5.83	5.15
	16°C	30.0	6.08	4.93
	7°C	30.0	7.14	4.20
	2°C	30.0	10.09	2.97
	-7°C	30.0	10.59	2.83
	-10°C	28.5	10.88	2.62
	-20°C	24.0	9.73	2.47
	-25°C	21.0	9.03	2.33
17°C	25°C	30.0	6.60	4.55
	16°C	30.0	6.98	4.30
	7°C	30.0	8.04	3.73
	2°C	30.0	11.46	2.62
	-7°C	30.0	11.52	2.60
	-10°C	28.5	11.83	2.41
	-20°C	24.0	10.60	2.26
	-25°C	21.0	9.81	2.14
24°C	25°C	30.0	7.21	4.16
	16°C	30.0	7.49	4.01
	7°C	30.0	8.65	3.47
	2°C	30.0	11.81	2.54
	-7°C	30.0	11.88	2.53
	-10°C	28.5	12.41	2.30
	-20°C	24.0	11.27	2.13
	-25°C	21.0	10.46	2.01

Hot water outlet temp: 70°C		Heating capacity	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	6.17	4.86
	16°C	30.0	6.45	4.65
	7°C	30.0	7.53	3.98
	2°C	30.0	10.59	2.83
	-7°C	30.0	10.73	2.80
	-10°C	28.5	10.88	2.62
	-20°C	24.0	10.22	2.35
	-25°C	21.0	9.75	2.15
17°C	25°C	30.0	7.05	4.26
	16°C	30.0	7.36	4.08
	7°C	30.0	8.49	3.53
	2°C	30.0	11.57	2.59
	-7°C	30.0	11.57	2.59
	-10°C	28.5	11.83	2.41
	-20°C	24.0	11.09	2.16
	-25°C	21.0	10.61	1.98
24°C	25°C	30.0	8.17	3.67
	16°C	30.0	8.31	3.61
	7°C	30.0	9.14	3.28
	2°C	30.0	12.32	2.44
	-7°C	30.0	12.26	2.45
	-10°C	28.5	12.41	2.30
	-20°C	24.0	11.76	2.04
	-25°C	21.0	11.26	1.87

Hot water outlet temp: 90°C		Heating capacity	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	8.86	3.39
	16°C	30.0	8.99	3.34
	7°C	30.0	9.24	3.25
	2°C	30.0	11.05	2.71
	-7°C	30.0	10.73	2.80
	-10°C	28.5	10.88	2.62
	-20°C	24.0	11.22	2.14
	-25°C	21.0	10.86	1.93
17°C	25°C	30.0	9.46	3.17
	16°C	30.0	9.80	3.06
	7°C	30.0	9.89	3.03
	2°C	30.0	11.97	2.51
	-7°C	30.0	11.57	2.59
	-10°C	28.5	11.84	2.41
	-20°C	24.0	12.02	2.00
	-25°C	21.0	11.65	1.80
24°C	25°C	30.0	10.38	2.89
	16°C	30.0	10.62	2.82
	7°C	30.0	10.85	2.76
	2°C	30.0	12.62	2.38
	-7°C	30.0	12.26	2.45
	-10°C	28.5	12.42	2.29
	-20°C	24.0	12.53	1.92
	-25°C	21.0	12.20	1.72

Note 1. The data of power consumption in this table does not include the power consumption of anti-freezing heater (352W)

In case of outdoor air temp $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.

Note 2. The data in this table is taken account of the performance decrement for defrosting.

(b) At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\geq 76\%$

Hot water outlet temp: 65°C		Heating capacity to top up	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	5.83	5.15
	16°C	30.0	6.08	4.93
	7°C	30.0	7.14	4.20
	2°C	30.0	10.09	2.97
	-7°C	30.0	10.59	2.83
	-10°C	27.8	10.81	2.57
	-20°C	20.6	8.61	2.39
	-25°C	17.8	7.85	2.27
17°C	25°C	30.0	6.60	4.55
	16°C	30.0	6.98	4.30
	7°C	30.0	8.04	3.73
	2°C	30.0	11.46	2.62
	-7°C	30.0	11.52	2.60
	-10°C	27.8	11.79	2.36
	-20°C	20.6	9.46	2.18
	-25°C	17.8	8.59	2.07
24°C	25°C	30.0	7.21	4.16
	16°C	30.0	7.49	4.01
	7°C	30.0	8.65	3.47
	2°C	30.0	11.81	2.54
	-7°C	30.0	11.88	2.53
	-10°C	27.8	12.34	2.25
	-20°C	20.6	10.05	2.05
	-25°C	17.8	9.17	1.94

Hot water outlet temp: 70°C		Heating capacity to top up	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	6.17	4.86
	16°C	30.0	6.45	4.65
	7°C	30.0	7.53	3.98
	2°C	30.0	10.59	2.83
	-7°C	30.0	10.73	2.80
	-10°C	27.8	10.81	2.57
	-20°C	20.6	9.06	2.27
	-25°C	17.8	8.55	2.08
17°C	25°C	30.0	7.05	4.26
	16°C	30.0	7.36	4.08
	7°C	30.0	8.49	3.53
	2°C	30.0	11.57	2.59
	-7°C	30.0	11.57	2.59
	-10°C	27.8	11.79	2.36
	-20°C	20.6	9.90	2.08
	-25°C	17.8	9.32	1.91
24°C	25°C	30.0	8.17	3.67
	16°C	30.0	8.31	3.61
	7°C	30.0	9.14	3.28
	2°C	30.0	12.32	2.44
	-7°C	30.0	12.26	2.45
	-10°C	27.8	12.34	2.25
	-20°C	20.6	10.49	1.96
	-25°C	17.8	9.88	1.80

Hot water outlet temp: 90°C		Heating capacity to top up	Power consumption	COP
Feed water temp	Outdoor air temp	kW	kW	-
5°C	25°C	30.0	8.86	3.39
	16°C	30.0	8.99	3.34
	7°C	30.0	9.24	3.25
	2°C	30.0	11.05	2.71
	-7°C	30.0	10.73	2.80
	-10°C	27.8	10.81	2.57
	-20°C	20.6	10.00	2.06
	-25°C	17.8	9.59	1.86
17°C	25°C	30.0	9.46	3.17
	16°C	30.0	9.80	3.06
	7°C	30.0	9.89	3.03
	2°C	30.0	11.97	2.51
	-7°C	30.0	11.57	2.59
	-10°C	27.8	11.79	2.36
	-20°C	20.6	10.73	1.92
	-25°C	17.8	10.31	1.73
24°C	25°C	30.0	10.38	2.89
	16°C	30.0	10.62	2.82
	7°C	30.0	10.85	2.76
	2°C	30.0	12.62	2.38
	-7°C	30.0	12.26	2.45
	-10°C	27.8	12.40	2.24
	-20°C	20.6	11.16	1.85
	-25°C	17.8	10.78	1.65

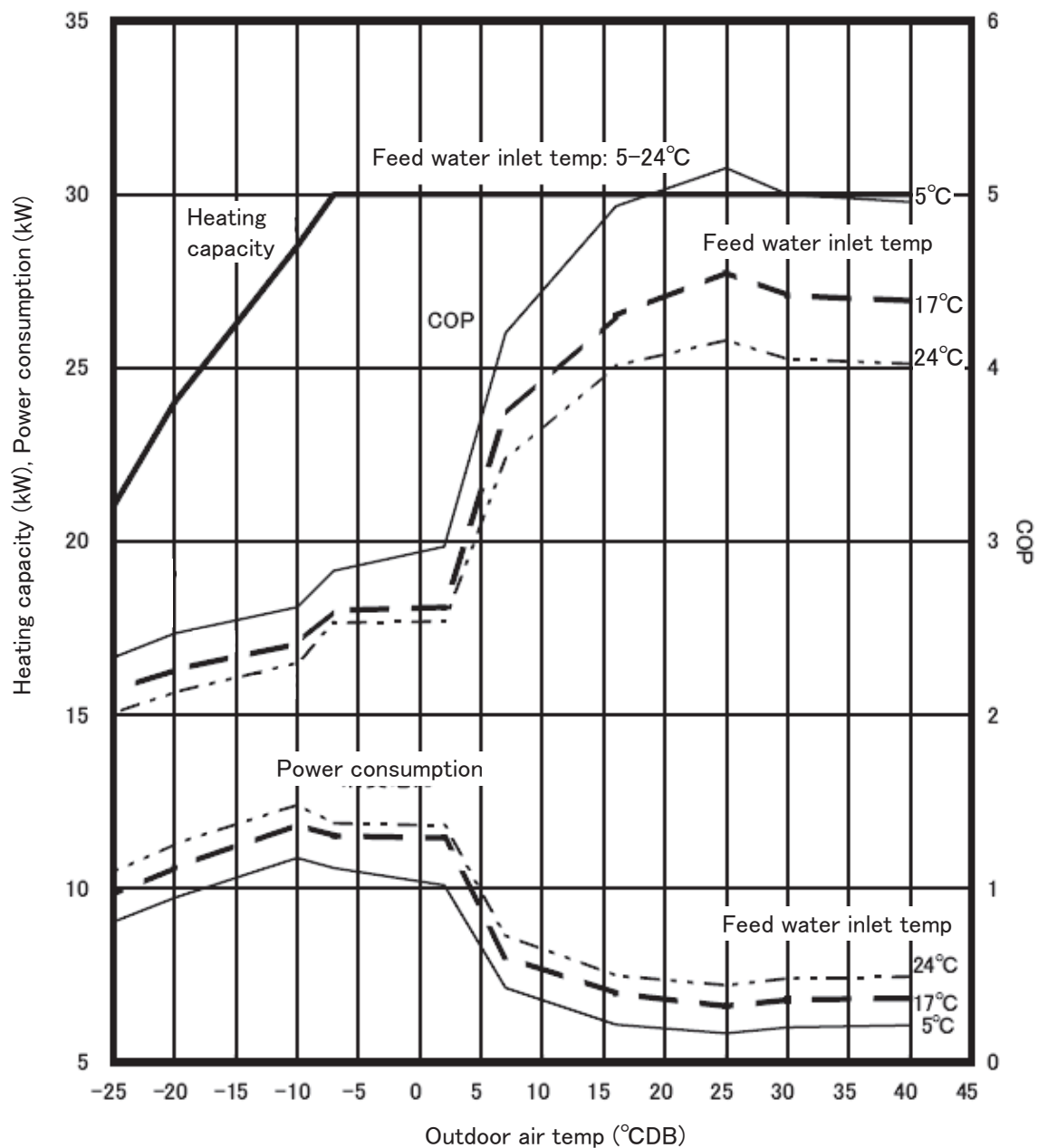
Note 1. The data of power consumption in this table does not include the power consumption of anti-freezing heater (352W)

In case of outdoor air temp $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.

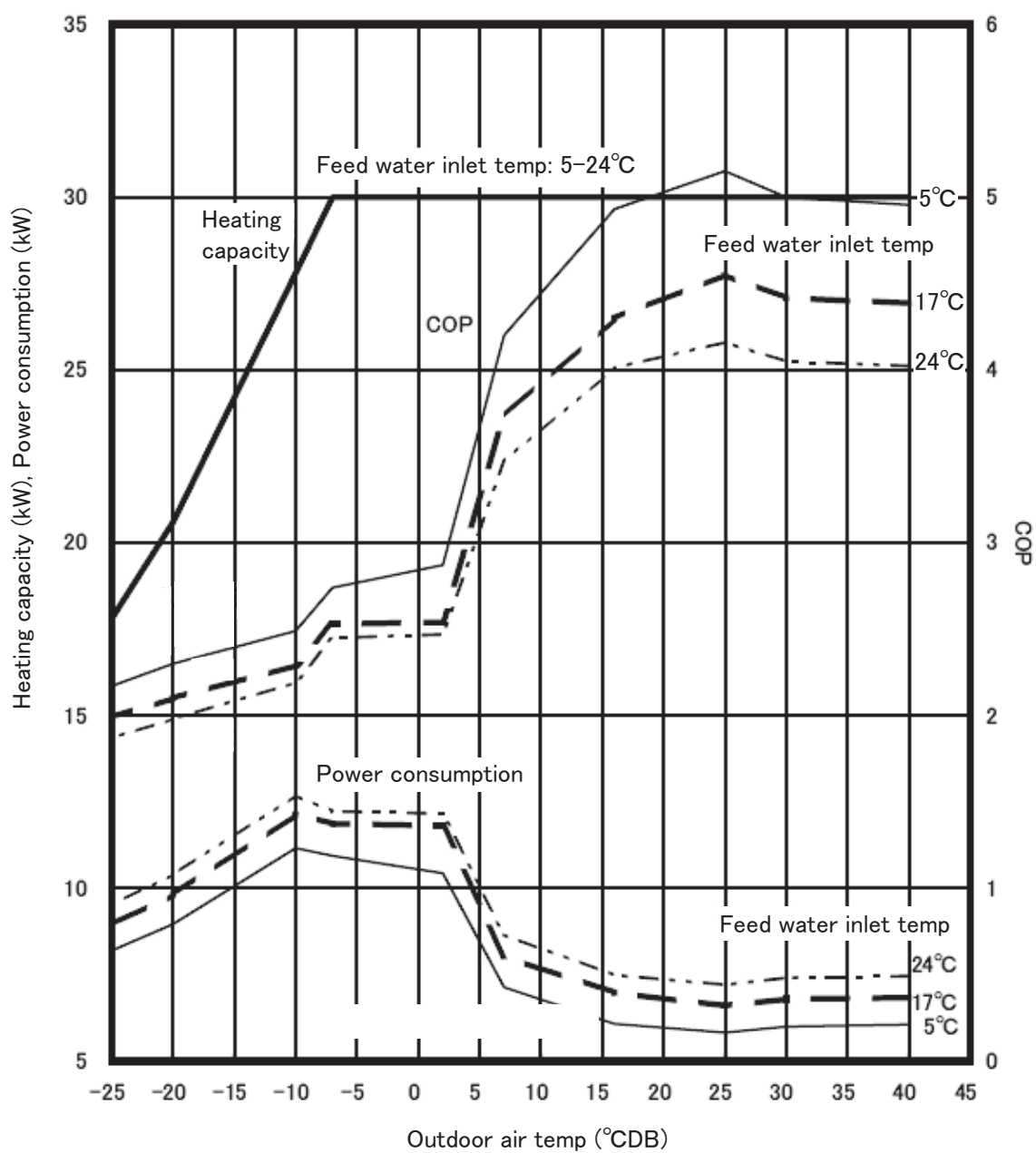
Note 2. The data in this table is taken account of the performance decrement for defrosting.

(2) Heating performance characteristics curve for the operation to top up

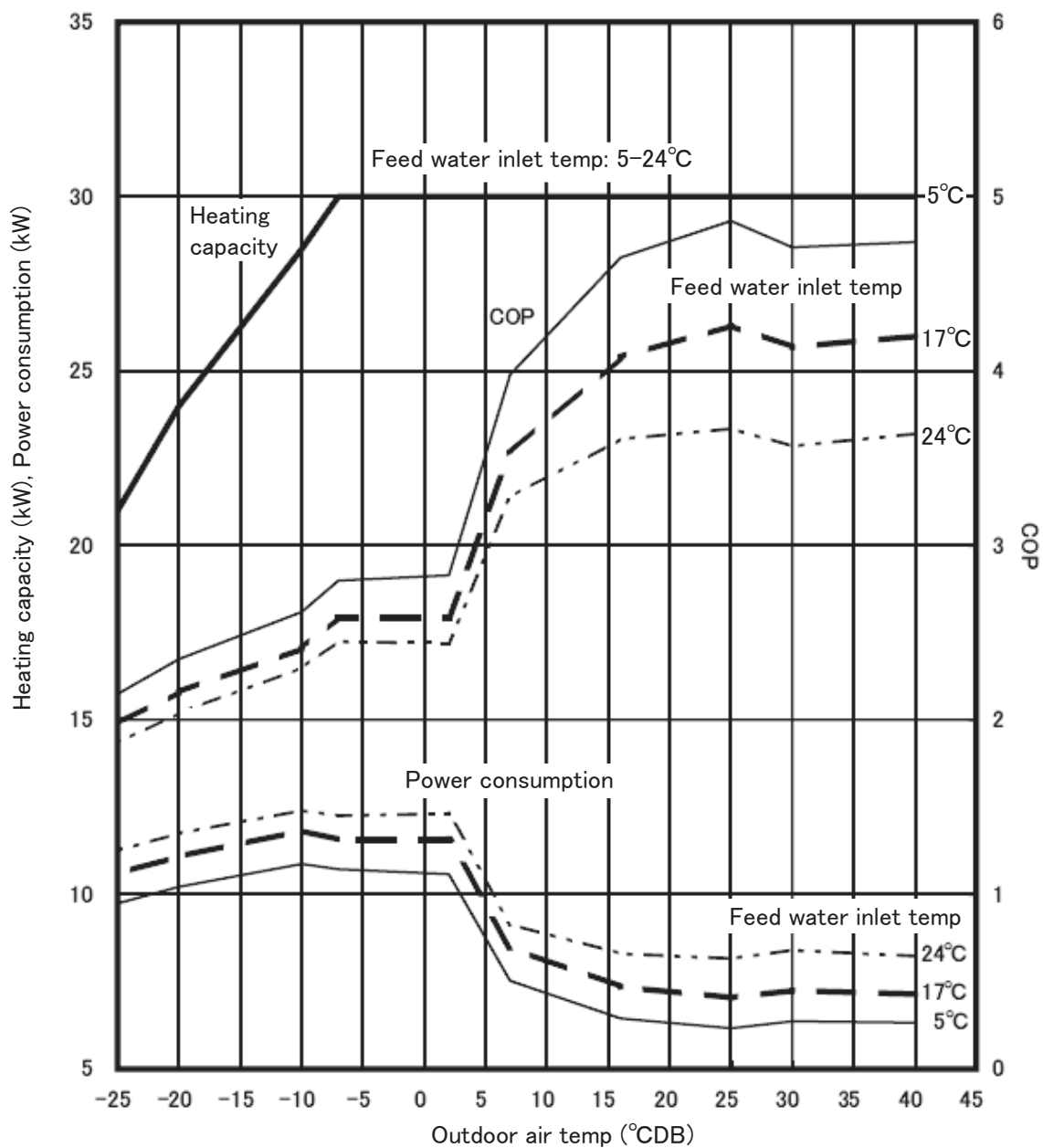
(a) Hot water outlet temp: 65°C

① At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\leq 75\%$ 

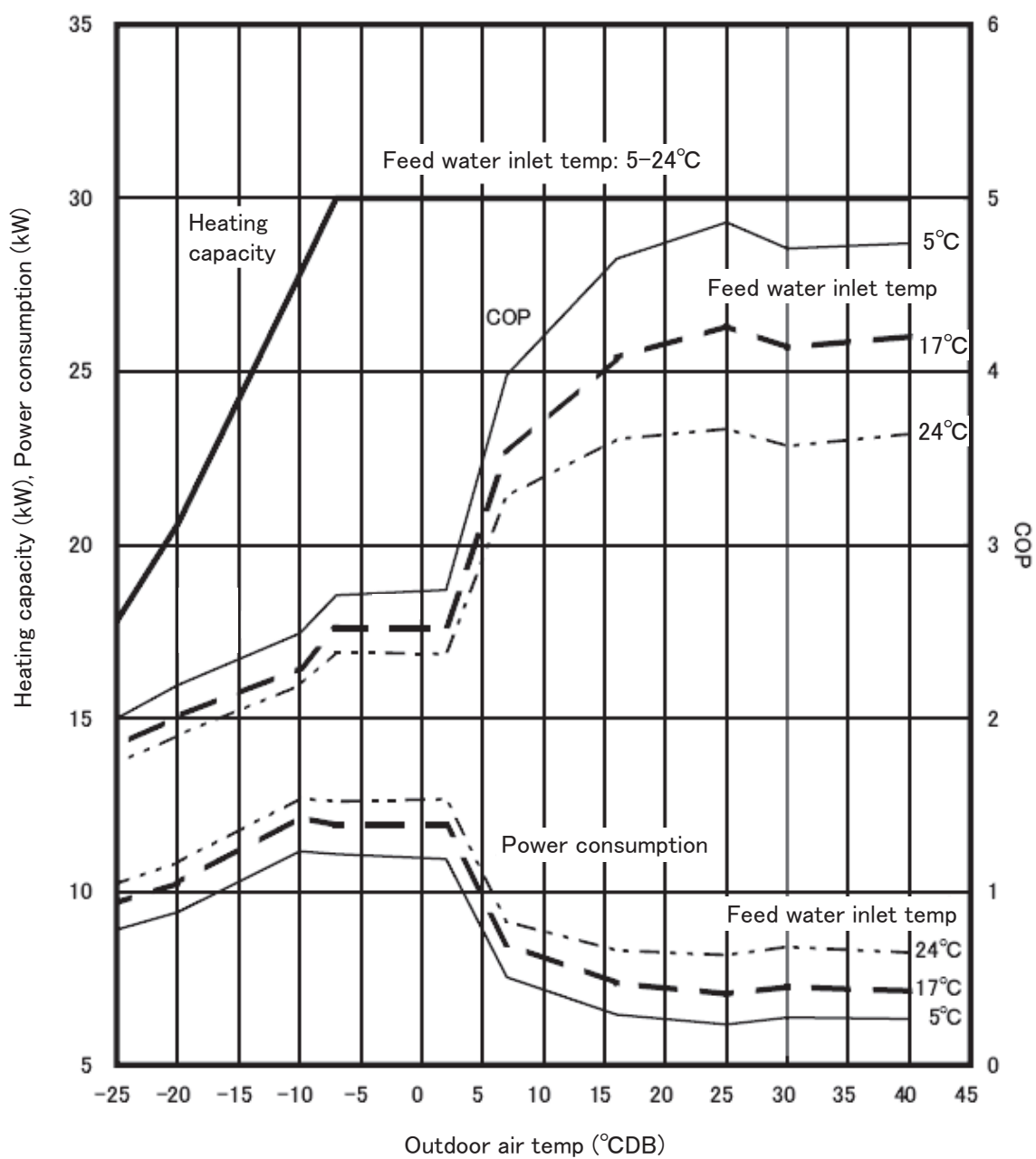
② At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\geq 76\%$

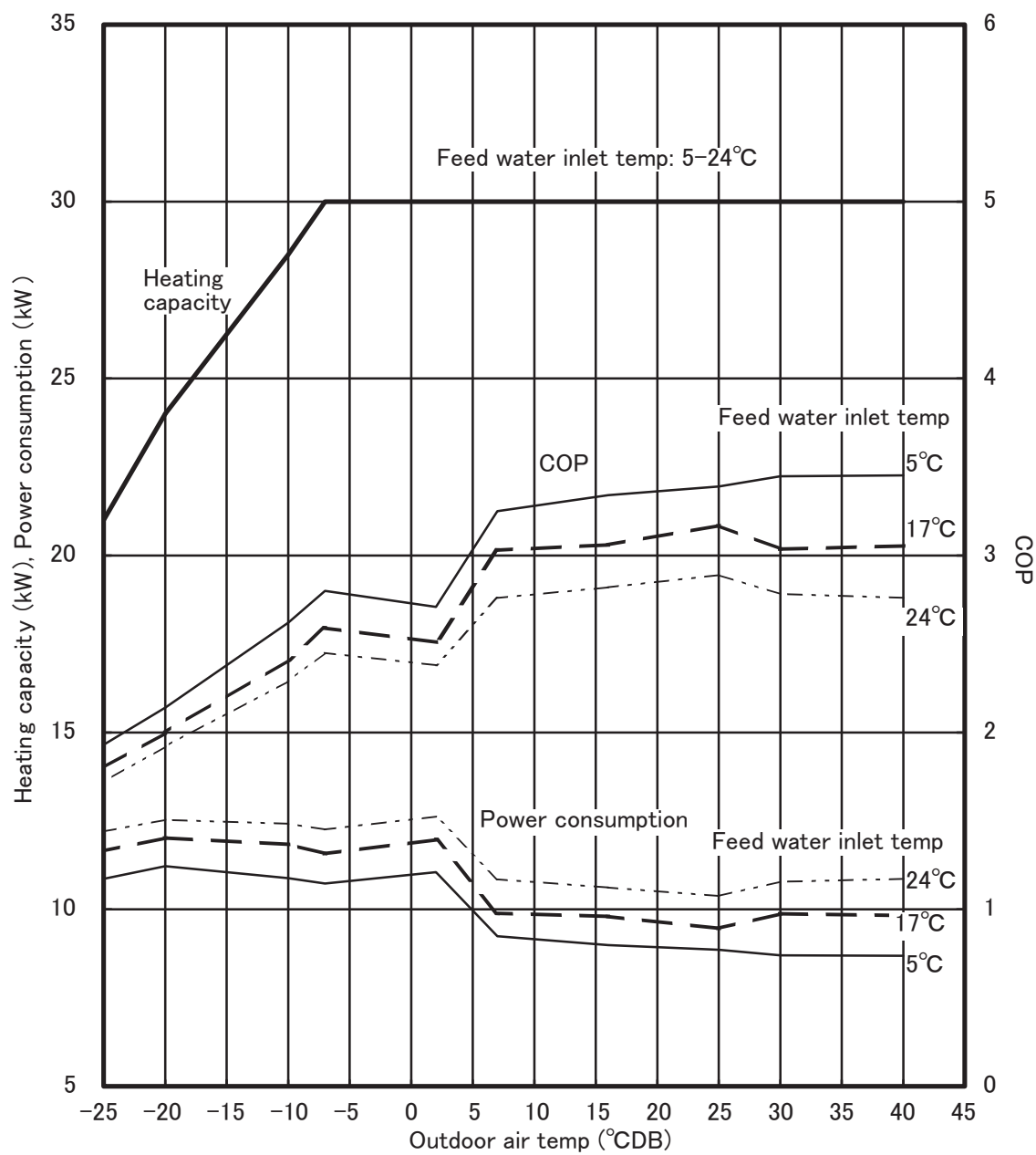


(b) Hot water outlet temp: 70°C

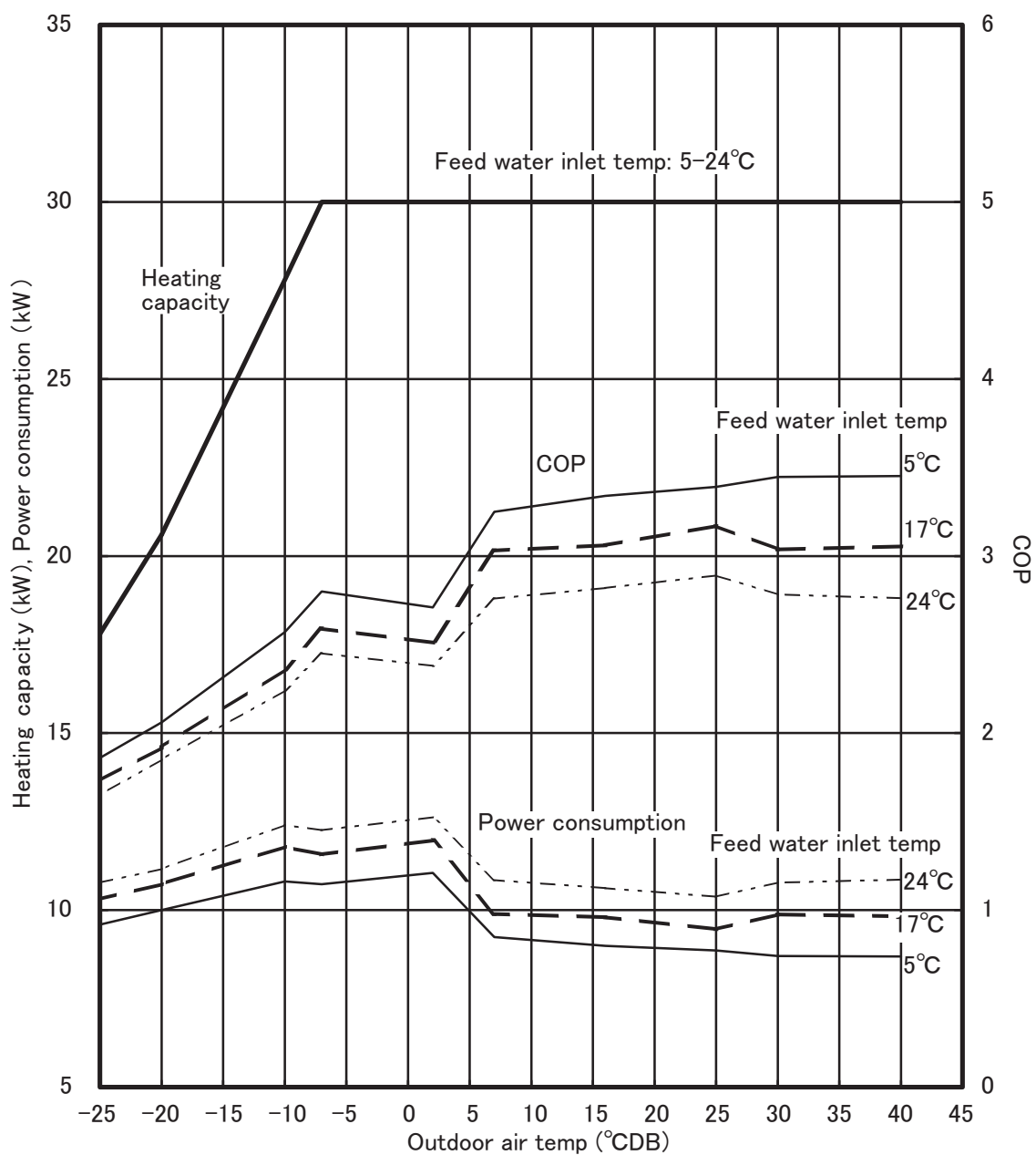
① At outdoor air temp $\leq -7^\circ\text{C}$ and relative humidity $\leq 75\%$ 

② At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\geq 76\%$



(b) Hot water outlet temp: 90°C① At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\leq 75\%$ 

② At outdoor air temp $\leq -7^{\circ}\text{C}$ and relative humidity $\geq 76\%$



(3) Heating performance characteristics table for the operation to keep warm

Feed water inlet temp: 40°C	Heating capacity to keep warm	Power consumption	COP	Available hot water outlet temp	Water volume
Outdoor air temp	kW	kW	-	°C	liter/min
25°C	21.9	7.82	2.80	57	18.0
16°C	25.8	9.42	2.74	61	18.0
7°C	25.0	10.64	2.35	60	18.0
-7°C	20.3	10.97	1.85	56	18.0
-15°C	15.7	10.06	1.56	53	18.0
-25°C	4.8	5.22	0.92	44	18.0

Feed water inlet temp: 50°C	Heating capacity to keep warm	Power consumption	COP	Available hot water outlet temp	Water volume
Outdoor air temp	kW	kW	-	°C	liter/min
25°C	16.5	7.89	2.09	63	18.0
16°C	20.0	9.39	2.13	66	18.0
7°C	20.3	10.91	1.86	66	18.0
-7°C	16.2	11.41	1.42	63	18.0
-15°C	11.2	10.47	1.07	59	18.0
-25°C	3.5	5.28	0.67	53	18.0

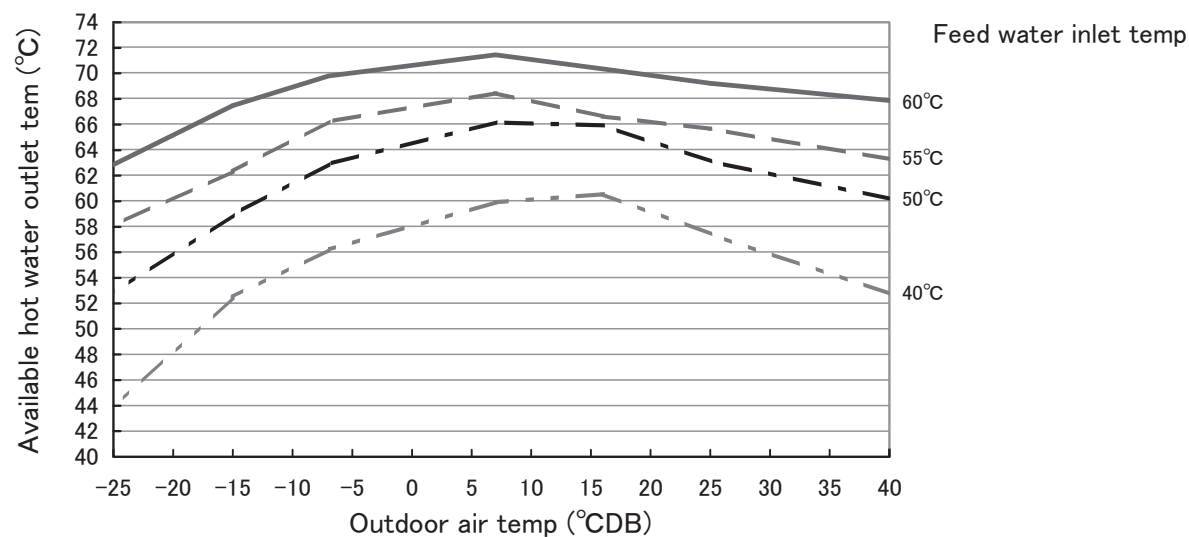
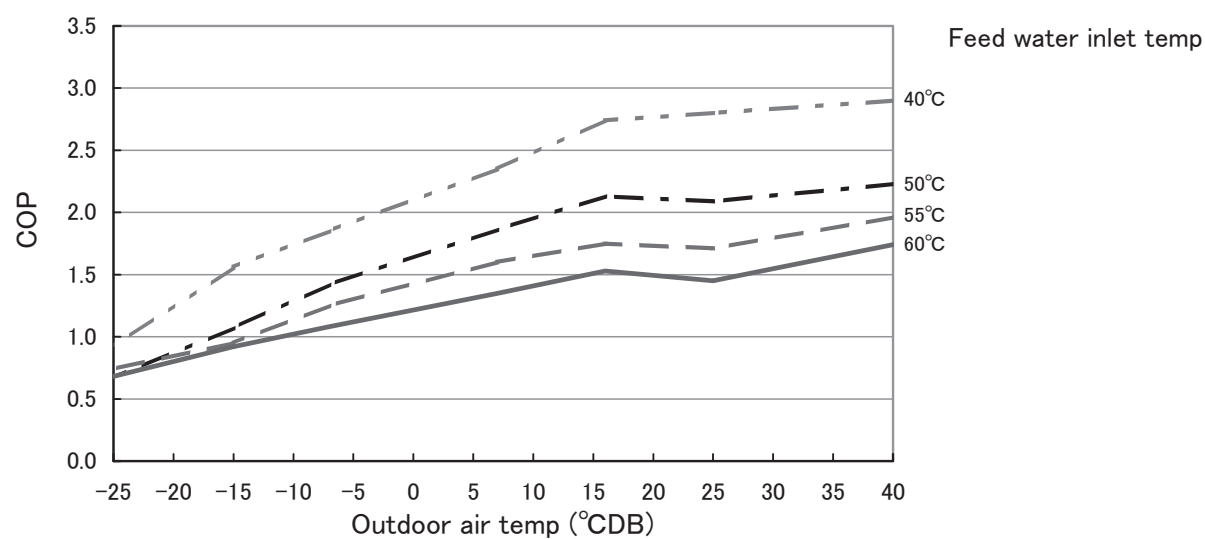
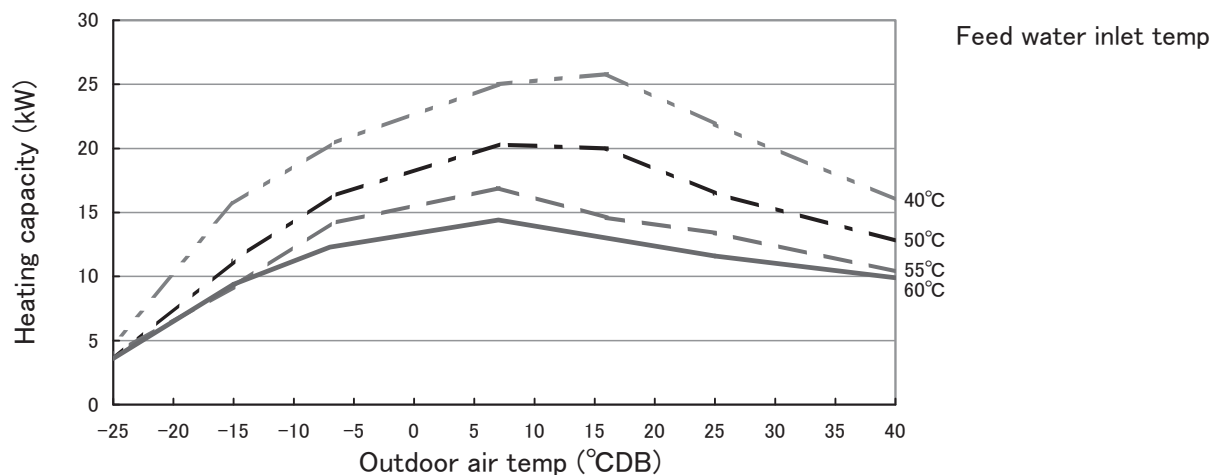
Feed water inlet temp: 55°C	Heating capacity to keep warm	Power consumption	COP	Available hot water outlet temp	Water volume
Outdoor air temp	kW	kW	-	°C	liter/min
25°C	13.4	7.84	1.71	66	18.0
16°C	14.6	8.34	1.75	67	18.0
7°C	16.9	10.56	1.60	68	18.0
-7°C	14.1	11.28	1.25	66	18.0
-15°C	9.2	9.68	0.95	62	18.0
-25°C	3.9	5.72	0.74	58	18.0

Feed water inlet temp: 60°C	Heating capacity to keep warm	Power consumption	COP	Available hot water outlet temp	Water volume
Outdoor air temp	kW	kW	-	°C	liter/min
25°C	11.6	8.00	1.45	60	18.0
16°C	13.0	8.50	1.53	70	18.0
7°C	14.4	10.67	1.35	71	18.0
-7°C	12.3	11.39	1.08	70	18.0
-15°C	9.4	10.22	0.92	67	18.0
-25°C	3.6	5.29	0.68	63	18.0

Note 1. The data of power consumption in this table does not include the power consumption of anti-freezing heater (352W)

In case of outdoor air temp $\leq 3^{\circ}\text{C}$, please take account of the power consumption for anti-freezing heater.

Note 2. The data in this table is taken account of the performance decrement for defrosting.

(4) Heating performance characteristics curve for the operation to keep warm

2.7 Opearion sound

Model: ESA30 series (50Hz)

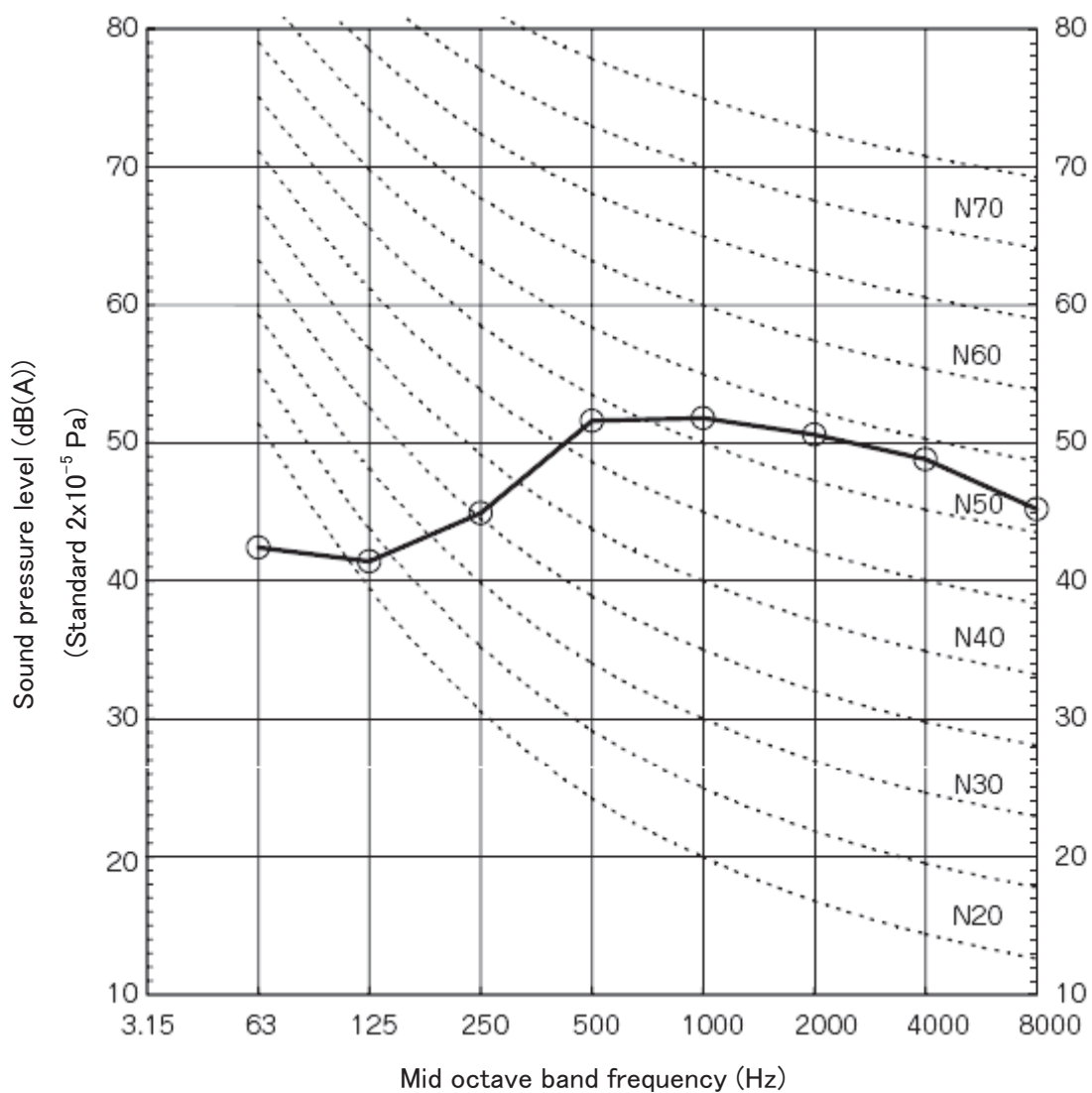
Measurement condition: Heating operation to top up in intermediate season

Outdoor air temp: 16°CDB/12°CWB

Feed water inlet temp: 17°C

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

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



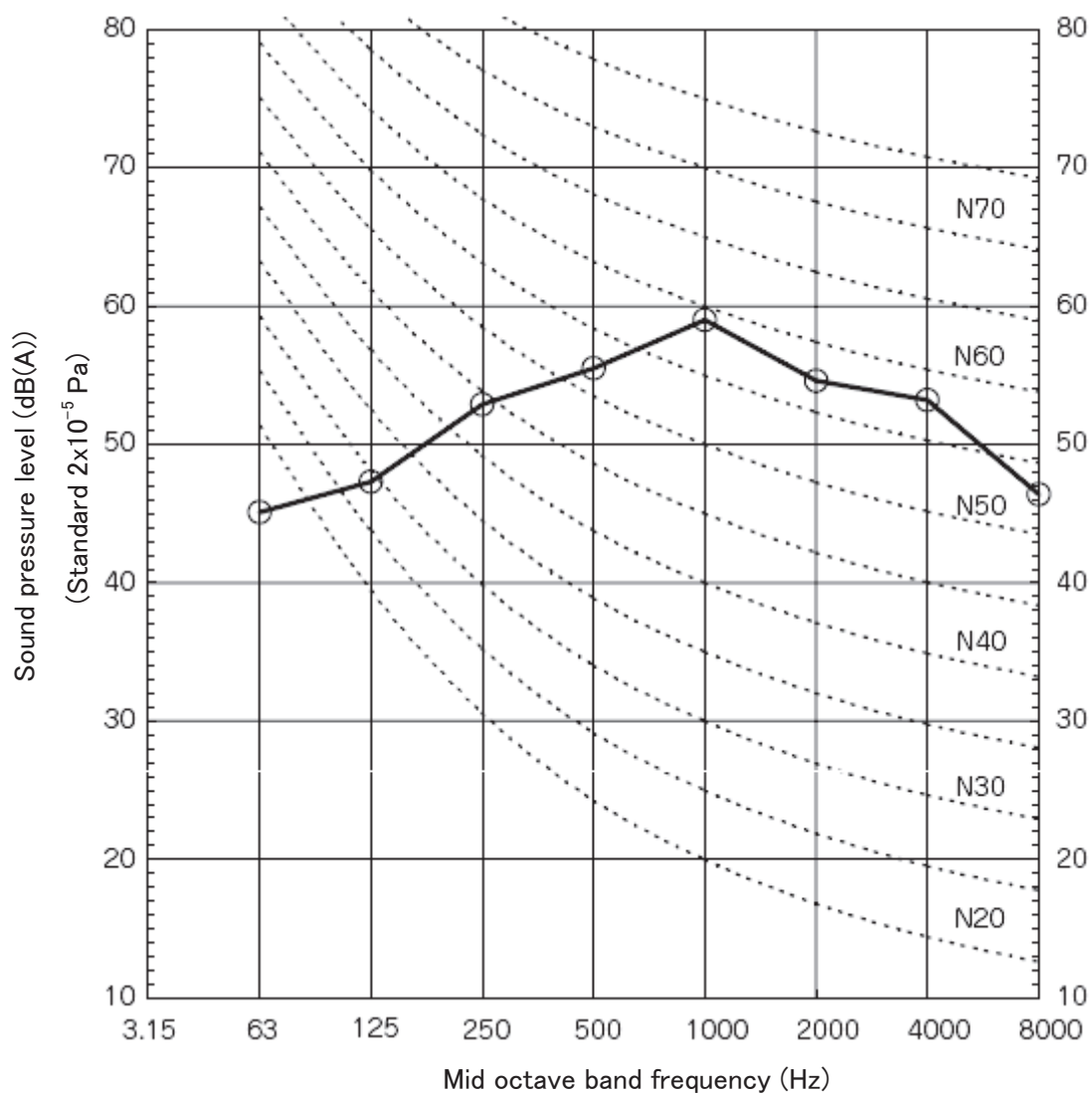
Measurement condition: Heating operation to top up in frosting season

Outdoor air temp: 2°CDB/1°CWB

Feed water inlet temp: 5°C

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

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



2.8 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 temp, feed water inlet temp and hot water outlet temp set by remote control. Control range of compressor speed: 42-104rps The target speed of compressor can be checked with MentePC.	-
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: 0-1000rpm	-
3	EEVG1	Electronic expansion valve for gas cooler	EEVG1 is used for discharge pipe temp control The target temp of discharge pipe is decided by outdoor air temp, feed water inlet temp and hot water outlet temp set by remote control. Control range of target discharge pipe temp: 77-125°C The target discharge pipe temp can be checked with MentePC.	-
	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].	Page39
		Injection circuit		
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].	Page37
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 temp 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].	Page40
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].	Page40
	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].	Page41
	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].	Page39
9	Tho-A	Outdoor air temp sensor	Tho-A is used for compressor control, anti-freeze control of water pipe and EEV control.	-
	Tho-C1	Under-dome temp sensor	Tho-C is used for under-dome temp protection control.	Page42
	Tho-D1	Discharge pipe temp sensor	Tho-D1 is used for discharge pipe temp control, discharge pipe temp protection control and detection of discharge pipe temp anomaly. As for the contents of discharge pipe temp anomaly detection control and discharge pipe temp protection control, please refer to [Discharge pipe temp protection control].	Page39
	Tho-G1,3	Temp 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 MentePC.	-
	Tho-INJ1	Temp sensor at inlet injection port	Tho-INJ1 is used for checking the operation status. Tho-INJ1 can be checked with MentePC.	-
	Tho-M1	Temp sensor at inlet port of intermediate pressure receiver	Tho-M1 is used for checking the operation status. Tho-M1 can be checked with MentePC.	=
	Tho-P1	Power transistor temp sensor	Tho-P1 is used for power transistor temp protection control. As for the contents of power transistor temp protection control, please refer to [Power transistor temp protection control].	Page42
	Tho-R1,2,3,4	Temp 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 temp 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 temp is 1°C or lower and/or during 5 minutes period after finishing defrost, DH 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 temp to the set temp set through remote control. DCWP is used for anti-freeze control of the water pipe. Control range of pump rotation speed: 2000-4000rpm As for the control details, please refer to [Water flow volume control] and [Anti-freeze control of water pipe].	Page44 Page45
2	CWFFV1	Flow regulator (Flow regulating valve)	CWFFV1 is used for controlling hot water outlet temp. The opening of CWFFV1 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].	Page44 Page45
	CWFFV3	Switching valve for anti-freeze	When circulating the inlet/outlet water of the unit, CWFFV3 is switched to form C position. When feeding clean water, CWFFV3 is switched to form B position.	Page38
	CWFFV5	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, CWFFV3 is closed. As for the control details, please refer to [Preventing control from disproportionate water flow].	Page38
3	Tho-W1	Gas cooler water temp sensor (Inlet)	Tho-W1 is used for ①Discharge pipe temp control, ②Compressor control, ③Detection of feed water inlet temp anomaly. Condition to detect feed water inlet temp anomaly. Judging anomaly: 63°C or higher Release : lower than 60°C As for the control details, please refer to [Discharge pipe temp control] and [Compressor control].	Page46
	Tho-W2	Gas cooler water temp sensor (Outlet)	Tho-W2 is used for ①Hot water outlet temp control, ②Detection of hot water outlet temp anomaly. Condition to detect feed water outlet temp anomaly. Judging anomaly: 100°C or higher for 5sec Released : lower than 60°C. Or the temp difference between the inlet and outlet water temp of gas cooler is within As for the control details of hot water outlet temp, please refer to [Water 10°C flow volume control].	Page44 Page45

(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 unit, 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) Start condition

① Start condition A

If all of following conditions are established

- (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 defrosting operation is 60 minute or more.
- (d) Either one of temp sensors on the inlet of heat exchanger (Tho-R1, -R2) detects lower temp than the defrost start temp, which is decided by the outdoor air temp, 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 start temp, which is decided by the outdoor air temp, for 180 seconds continuously. (Fig 1-2)

② Start condition B

If all of following conditions are established

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

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

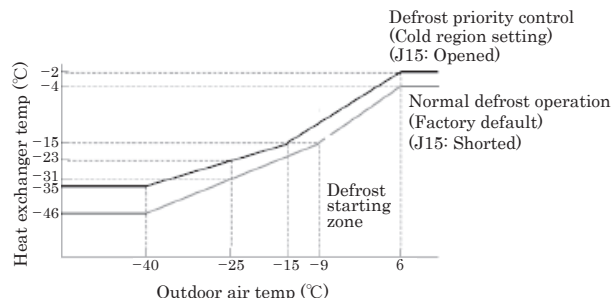
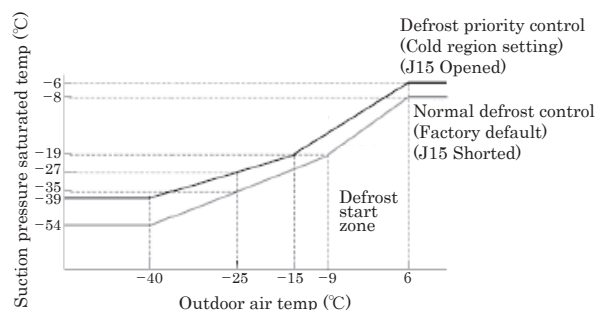
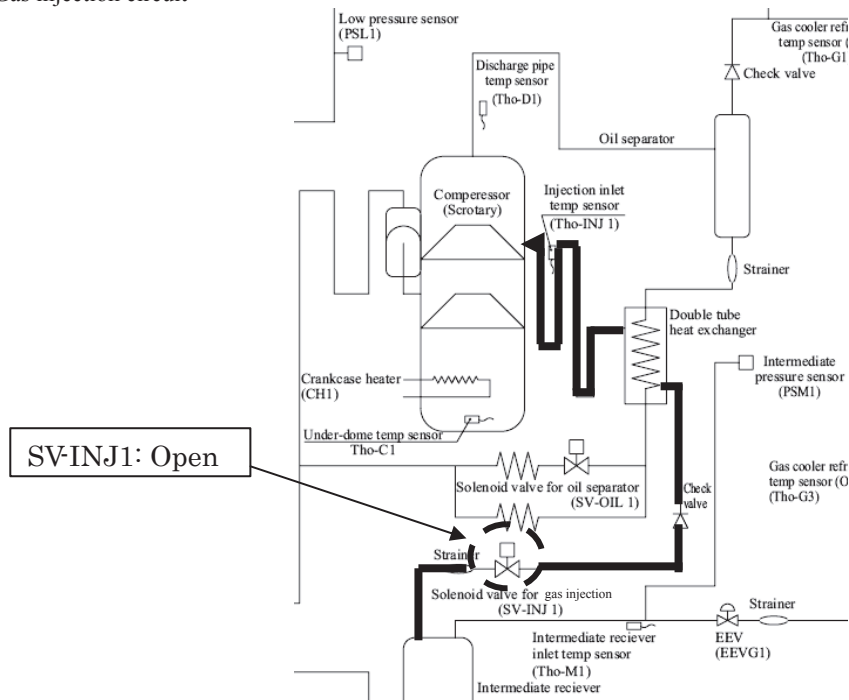


Fig 1-2 Defrost start condition by suction pressure saturated temperature



(3)-2 Gas injection control

<Gas injection circuit>

**(1) Start condition**

If all of following conditions are established;

- (a) Compressor is ON.
- (b) Compressor is ON or 2 minutes has elapsed after the end of defrosting.
- (c) Suction super heat of compressor < 5degC is detected for 30 seconds or more continuously.
- (d) Intermediate pressure sensor < 7.0MPa
- (e) Outdoor air temp < 5°C
- (f) Inlet water temp ≤ 30°C

(2) End condition

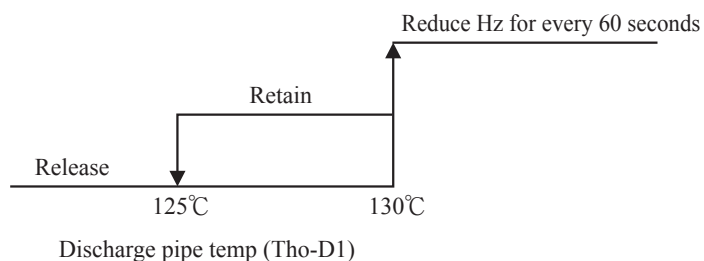
If one of the start conditions (a) (b) (d) is not established.

(3) Contents of control

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

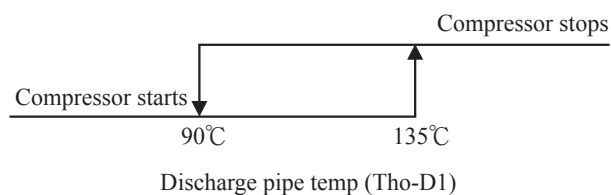
(3)-3 Discharge pipe temperature protection control**(1) Protection control**

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



(2) Anomalous stop control

- (a) If the discharge pipe temperature exceeds the set value shown in the following figure, compressor is stopped.
- (b) If this anomalous stop happens 5 times within 60 minutes, [E36] is displayed on the remote controller and it becomes error stop mode.



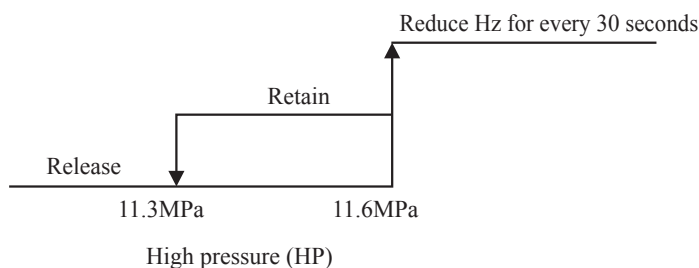
(3) Release error stop mode

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 Hz is controlled to suppress the rise in high pressure.

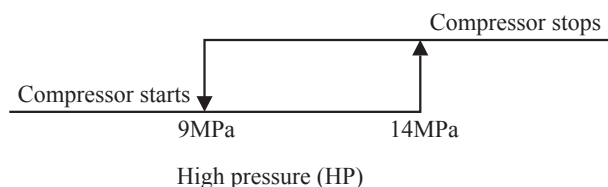


(2) Anomalous stop control

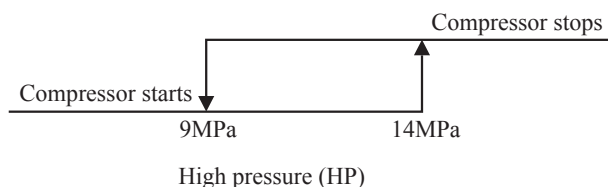
(a) Start condition

If one of the following conditions is established;

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



- ② 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.

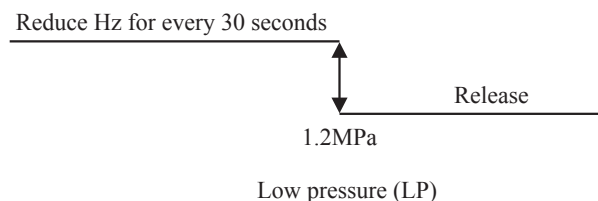


(b) Contents of control

- ① Stop compressor
- ② 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)-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 Hz is controlled to suppress the decrease of low pressure.

**(2) Anomalous stop control****(a) Start condition**

If one of the following conditions is established;

① Start 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 Start 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) End 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 unit exceeds the set value, compressor Hz is controlled to protect the inverter.

1-1 Current safe control by inverter primary current.

(a) Start condition

If all of the following conditions are established;

① Compressor is ON

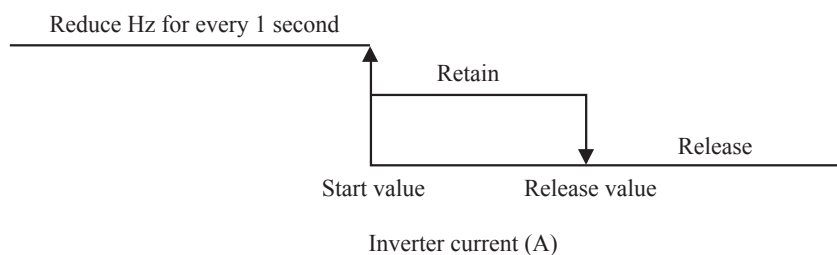
② Except that the actual Hz is kept on decreasing or it is within 1 second after the actual Hz decreased.

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

(b) End 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) Start condition

If all of the following conditions are established;

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

(b) End 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.

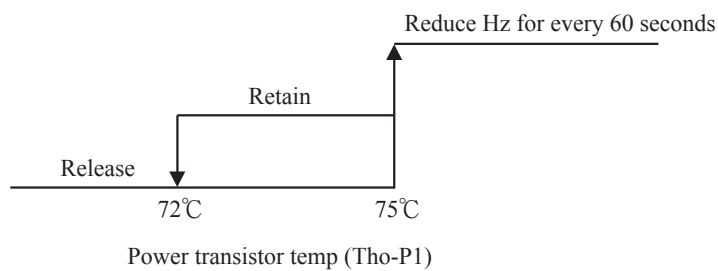
If one of following condition is established, [E42] is displayed on the remote controller and it becomes error stop mode.

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

(3)-7 Power transistor temp protection control

(1) Protection control

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

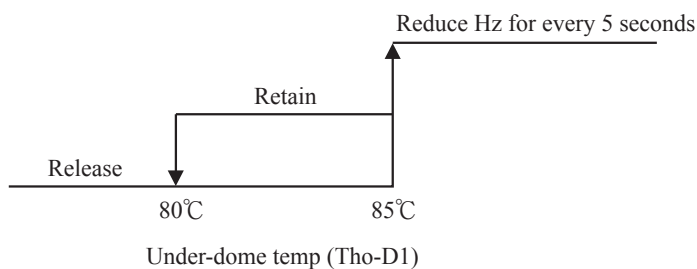


(2) Anomalous stop control

- (a) If the power transistor temp 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 controller and it becomes error stop mode.
- (c) If this anomaly is detected for 15 minutes continuously, [E51] is displayed on the remote controller and it becomes error stop mode.

(3)-8 Under-dome temp protection control

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



(3)-9 Detection of temp or pressure sensors disconnection**(1) Start condition**

If one of following conditions is established;

- ① Outdoor air temp sensor, Heat exchanger temp sensors, Intermediate receiver inlet temp sensor, Suction pipe temp sensor, Gas cooler water temp 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 temp sensor, Under-dome temp 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 temp 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 temp $\geq 0^{\circ}\text{C}$.

(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 established, compressor is stopped.

- (a) Under the outdoor fan control mode, the outdoor fan speed $\leq 100\text{rpm}$ 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 controller and it becomes error stop mode.

(3)-11 Feed water inlet temp anomaly

If feed water inlet temp exceeds usage range, it makes the heat pump unit stopped.

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

(1) Start condition

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

- (a) Compressor is ON
- (b) Not in defrost operation
- (c) Following high water inlet temp condition is established
 - [High water inlet temp condition]
 - Feed water inlet temp $> 63^{\circ}\text{C}$ is detected for 2sec or more. (Upper limit)
 - Or at outdoor air temp $\geq 40^{\circ}\text{C}$, feed water inlet temp $> 58^{\circ}\text{C}$ is detected for 2sec or more.
- (d) One of following water inlet temp change conditions is established
 - [Water inlet temp change condition 1]
 - When 20degC or more temp difference Δt of feed water inlet temp (Tho-W1) is detected for 5sec continuously.
 - [Water inlet temp change condition 2]
 - When 10degC or more temp difference Δt of feed water inlet temp (Tho-W1) is detected for 5sec continuously within 10 minutes.

(2) Control content

- (a) Stop compressor and after 3minutes delay, restart compressor if end condition is established.
- (b) During establishing [High water inlet temp condition], water pump is operated intermittently in case of connecting unvented cylinder.
- (c) Other functional components comply with the behavior at compressor stopping.

(2) End condition

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

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

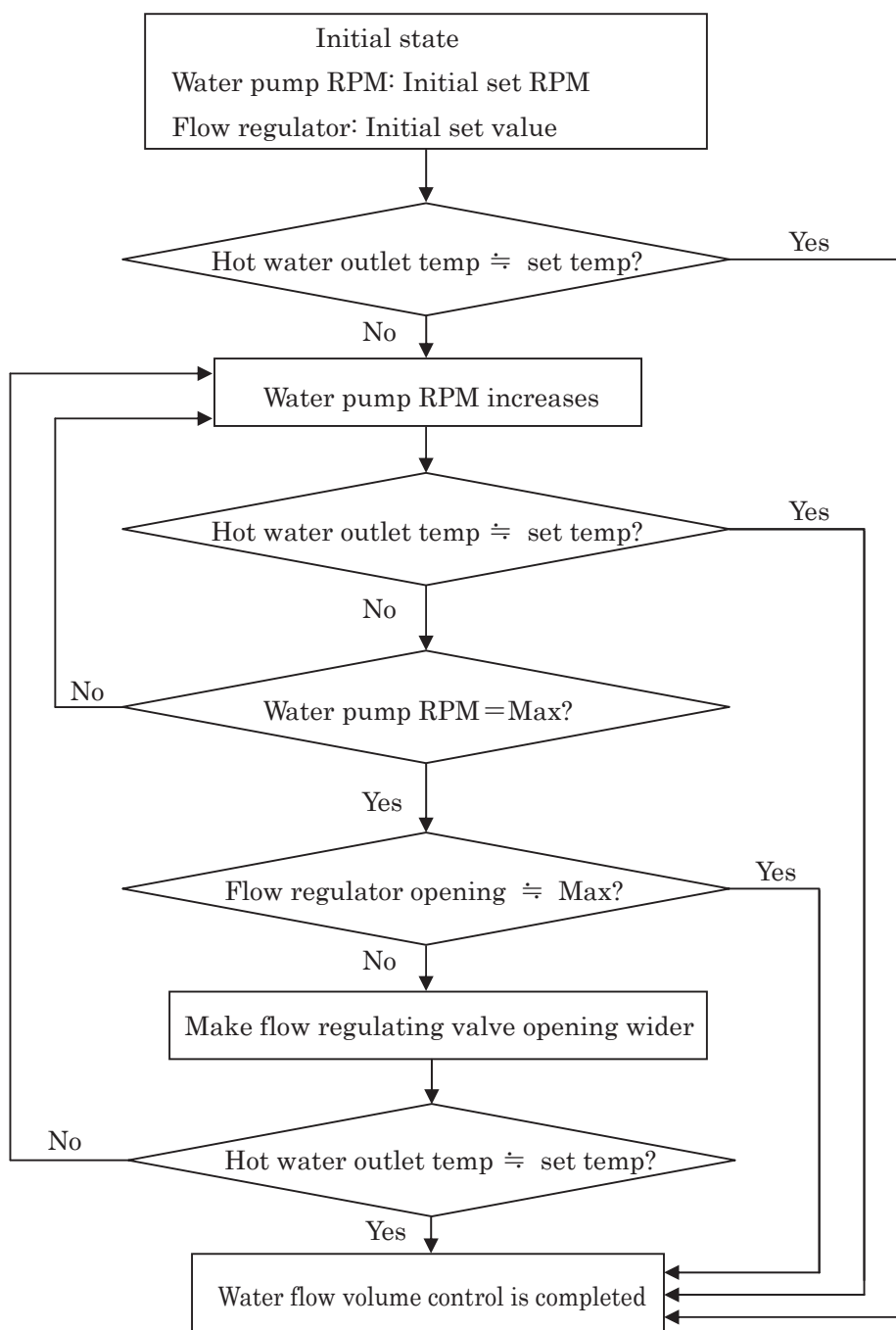
If the hot water amount detected by the cylinder temp sensor is less than the set amount in the cylinder, the heat pump unit starts operation to top up the hot water and storage it.

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

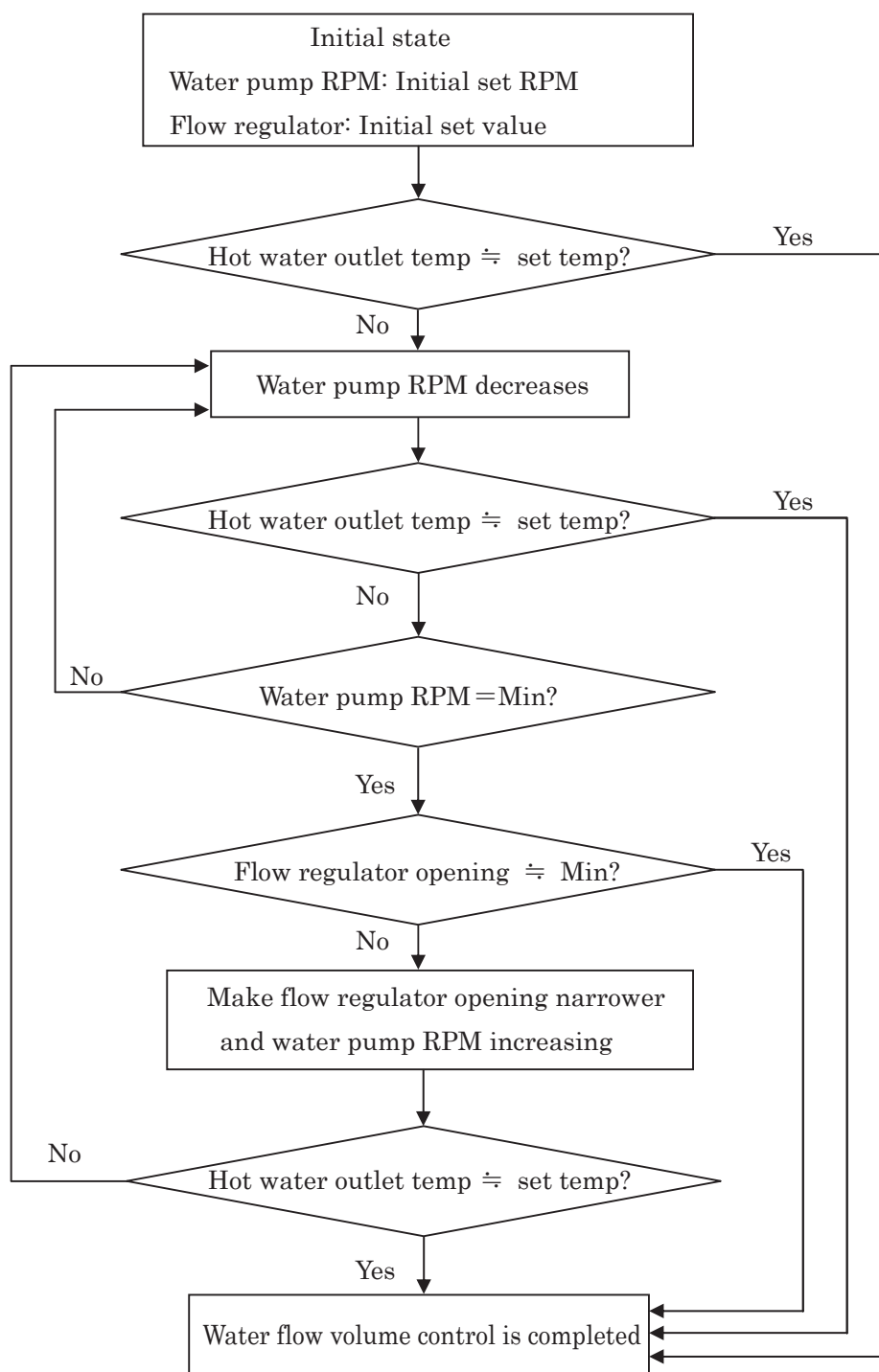
(4)-2 Water flow volume control

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

[Set temp < Actual outlet temp of hot water]



[Set temp > Actual hot water temp]



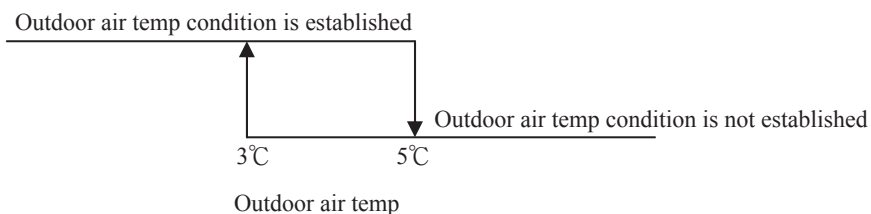
(4)-3 Water pump operation for anti-freezing

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.

(1) Start condition

If all of the following conditions are established;

- (a) Operation mode of heat pump unit 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 temp of the gas cooler $\leq 3^{\circ}\text{C}$

(2) End condition**① End condition A**

- (a) The start condition (a) is not established or the start condition (b) is not established.
- (b) Inlet water temp 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.

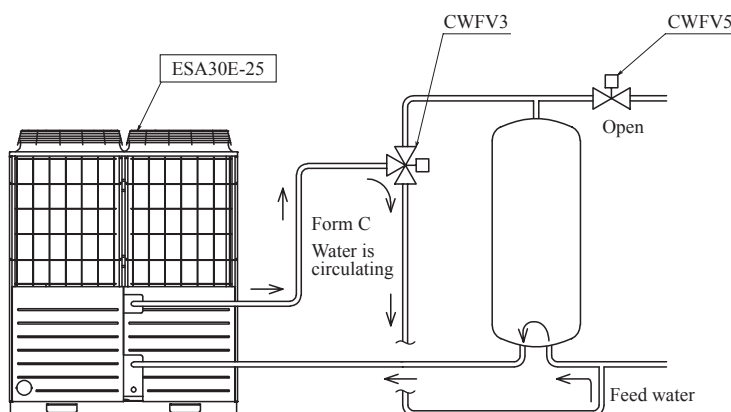
② End condition B

- (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 temp sensor on the cylinder.

3. APPLICATION DATA

PCM012D010

3.1 Installation work for 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 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 concerned 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 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
 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.
 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 controller 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 supply, 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 controller. 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 slop 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.
- 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 equipments generate electromagnetic wave and/or high frequency wave.
It might cause malfunction or failure of the unit due to the effect of inverter equipments, private power generators, high frequency medical equipments or radio communication equipments, 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 equipments and/or communication equipments.
- Do not install the unit at a place that could be a nest 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 hot 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 controller 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 controller 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 noninflammable and nonpoisonous, 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 sucking the high concentration of CO2 gas
Move the sufferer immediately to a place where fresh air can be intake and make his body relaxed and keep him rest
If he is unconscious, loosen his clothing, ensure the respiratory airway and perform artificial respiration, and then consult a physician immediately.
- (b) When the high concentration of CO2 gas adhere to 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 get 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 ESA30E

Please arrange and procure a new unvented cylinder with following specifications for connecting to ESA30E.

*If connecting ESA30 to the existing cylinder, the hot water temp 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 parallel.
- The maximum capacity is 4000liter. (only as a guide)
The cylinder capacity may vary according to feed water inlet temp, hot water outlet temp and operation hours in the night.
 $25837 \times \text{Operation hour in the night} / (\text{Hot water outlet temp} - \text{feed water inlet temp}) = \text{available hot water supply volume (Liter)}$. 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 ESA30E 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 temp 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 temp 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 temp 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 temp of ESA30E is 90°C. If the heat resisting temp of the cylinder is lower than 90°C. Be sure to reduce the hot water outlet setting temp in order to meet the specifications of the cylinder.
If using the cylinder at the higher water outlet temp than the heat resisting temp of the cylinder, it may have break of the cylinder or leakage of hot water.
- Applying hot water temp sensors on the cylinder
In order to judge the hot water temp and amount in the cylinder, the temp sensors shall be mounted or pasted on the cylinder.
If pasting the temp sensors, they shall be pasted with aluminum adhesive tape whose heat resisting temp is 90°C or higher.
If mounting the temp sensors, the insertion holes with $\phi 7\text{mm}$ or bigger in size and 20mm or deeper in depth are required on the cylinder.
MHI's genuine temp sensor, MTH-Q3E (optional part), shall be used.
3 to 9 sets of temp sensors shall be applied to the cylinder.
In order to detect the hot water amount by 10% intervals, 9 sets of temp sensors shall be applied to the cylinder. If reducing the number of temp 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 temp sensors on the cylinder are depended on the number of sensors and sensors should be applied to the designated positions on the cylinder. (See page 68 and 69 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 temp sensor according to the hot water amount %

Sensor No.	Number of sensors to apply							Recommendable
	3pcs	4pcs	5pcs	6pcs	7pcs	8pcs	9pcs*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 9pcs.

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

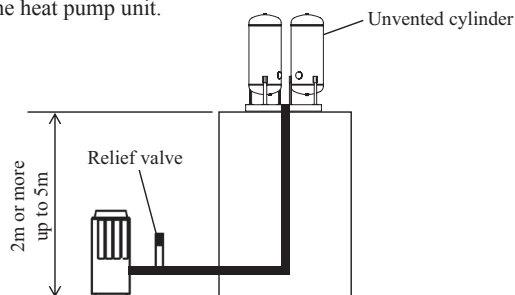
*2 The sensor which detects 100% of HW amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.

- Insulation
Insulation must be required in order to keep hot water temp 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

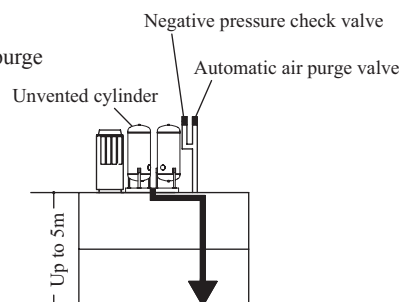
Water piping limitation between the heat pump unit and the unvented cylinder.

- The water piping limitation in length between the heat pump unit and the unvented cylinder is within 15m of equivalent length with pipe size 20A.
- If the equivalent piping length exceeds 15m, 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 temp from the heat pump unit to the cylinder becomes decreasing.
(Ex. If pipe size 25A is used instead of 20A, the hot water temp 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 450kPa of the pressure in 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 $\pm 5\text{m}$.
However 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: 450kPa) in the vicinity of the hot water outlet port of the heat pump unit.



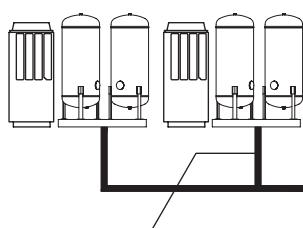
(1) Supply hot water to downstairs

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.



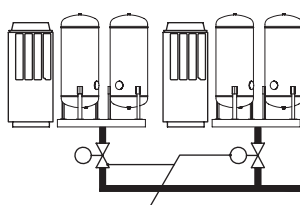
(2) Drift and parallel control

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



Since hot water in one system flowing out easier becomes colder early, cold water flows into the hot water supply line.

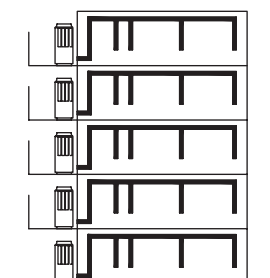
② Please install the stop valve at each outlet port. Even if drift happens, it can prevent the cold water flow into the hot water supply line.



When hot water in one system becomes cold, shut up such system with stop valve. The heat pump unit for commercial use equips the output terminal for such control.

(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 temp 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 eclectic component failure may occur

[Water quality criteria]

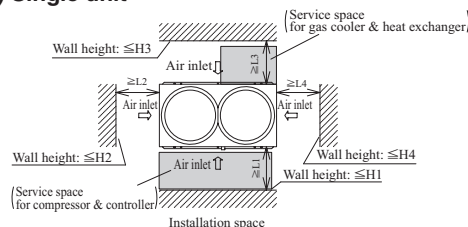
Makeup water and cyclic water shall be the water within the range of water quality criteria mentioned below.

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 ⁻ /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	mgCO ₂ /L	≤ 0.4	≤ 4.0
Stability index			—	—

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

1) Single unit

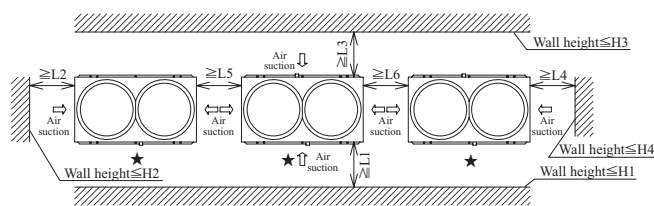


Dimension	Installation example	
L1	1	2
L2	800	800
L3	10	10
L4	800	800
H1	100	500
H2	1500	1500
H3	No limit	No limit
H4	1000	1000
	No limit	No limit

2) In case that multiple heat pump units are installed

★ shows the front side of the unit

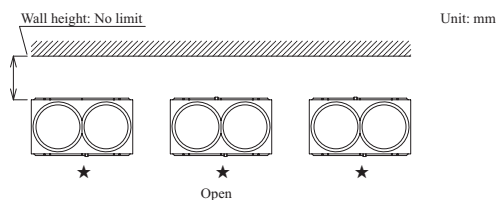
① Installation example for 3 units in a row



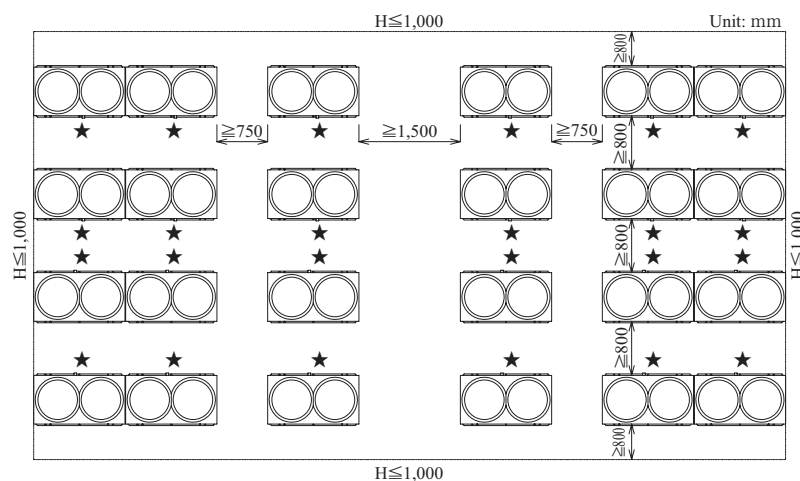
Dimension	Installation example	
L1	1	2
L2	800	800
L3	10	10
L4	800	500
L5	100	500
L6	100	500
H1	500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

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

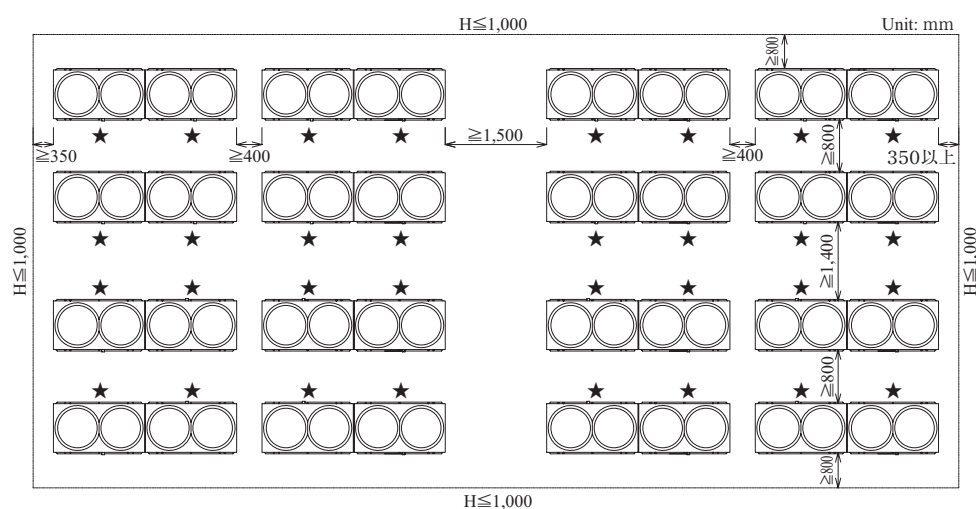
Please keep 10mm or more space between the units with consideration for the installation space.



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

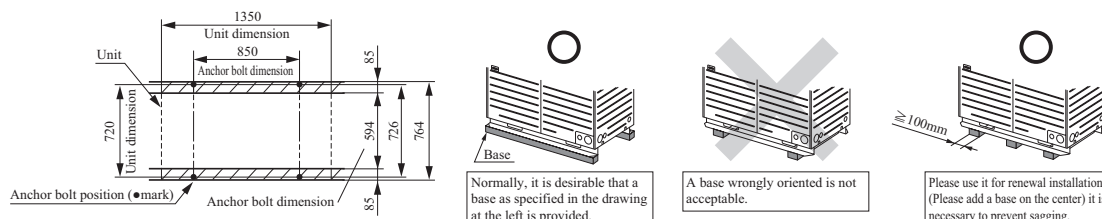
- Please do not fail to put belts through the rectangular holes of units anchor legs.
- Apply cloth pads between a canvas belt and a unit in order to prevent from damage.



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

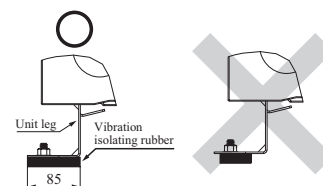
- Please install a heat pump unit after ascertaining that the bases were made to have sufficient strength and level for ensuring the unit shown in the above figure.
- Please construct a base which has larger area than the shadowed area (the entire bottom area of the heat pump unit's anchor legs) shown 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.



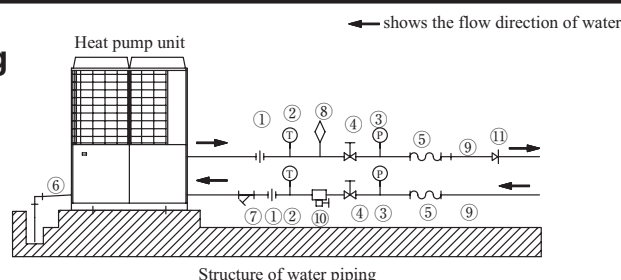
3-3 Notabilia for installation of unvented cylinder

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. |
| 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 prevent hot water from flowing back from the existing system connected or from other heat pump water heaters connected in multiple system. |

(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 20.

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

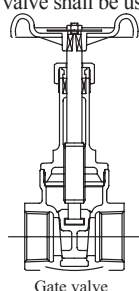
- ① Be careful not to make the water pipe connection to the inlet/outlet ports of unit being reversed by referring the exterior dimensional drawing.
- ② Be sure to install union joints and valves at water inlet/outlet ports of unit for easy maintenance.
- ③ In order to prevent from transmitting the unit 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

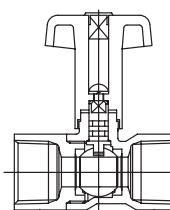
Install valves at water inlet/outlet ports of unit for easy servicing at periodical cleaning and etc.

(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.



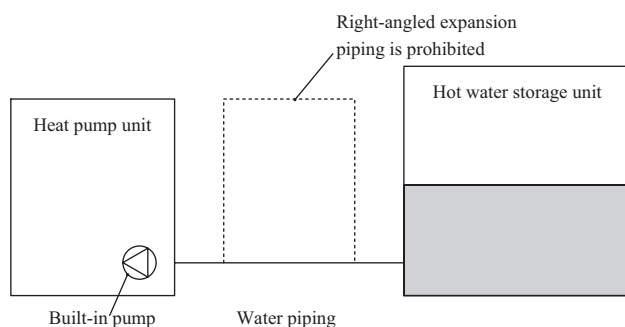
Gate valve



Ball valve

(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.

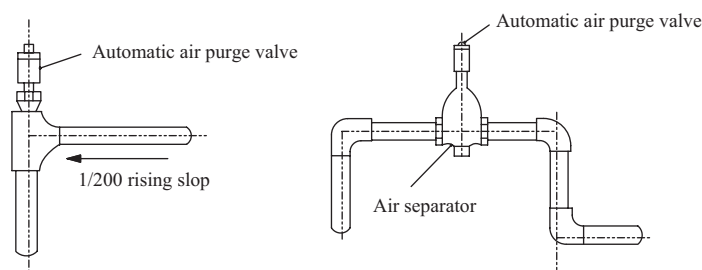
(v) Piping slope and air purge valve (Hot water piping)

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 temp 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 an 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 temp 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

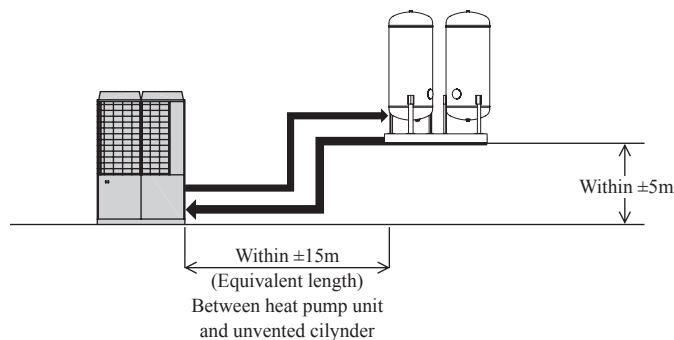
- When doing piping work between the heat pump unit and the unvented cylinder, be sure not to interfere the service space of the heat pump unit. Regarding the service space, please refer to chapter 2

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

- Piping length: Within 15m (equivalent length for pipe size 20A)
- Height difference: Within $\pm 5\text{m}$



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

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 ESA30E should be 2, 6 or 8.

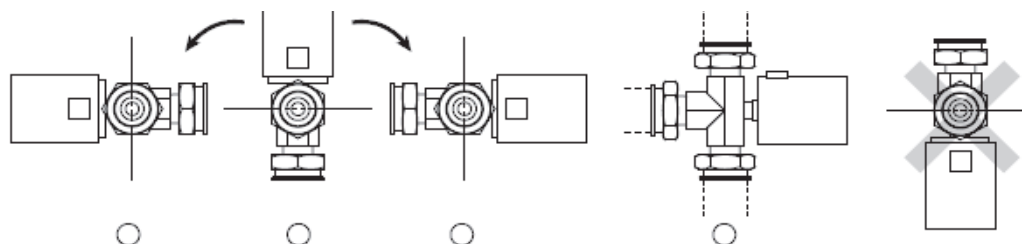
If you want to select other combination than these, please consult with our distributor.

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 temp 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.



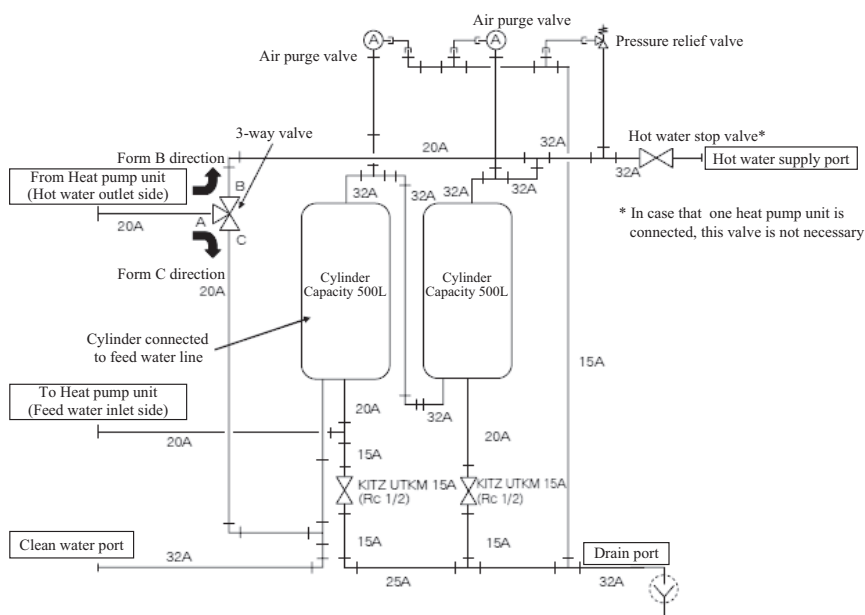
- ⑥ The drain cock for the cylinder connecting the feed water pipe shall be install at the position mentioned in the system diagram.
- ⑦ Be sure to insulate water piping and cylinders.
- ⑧ Please apply anti-freeze pipe heater to the water pipe as necessary.
- ⑨ The limitation of one way piping length 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 optional 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

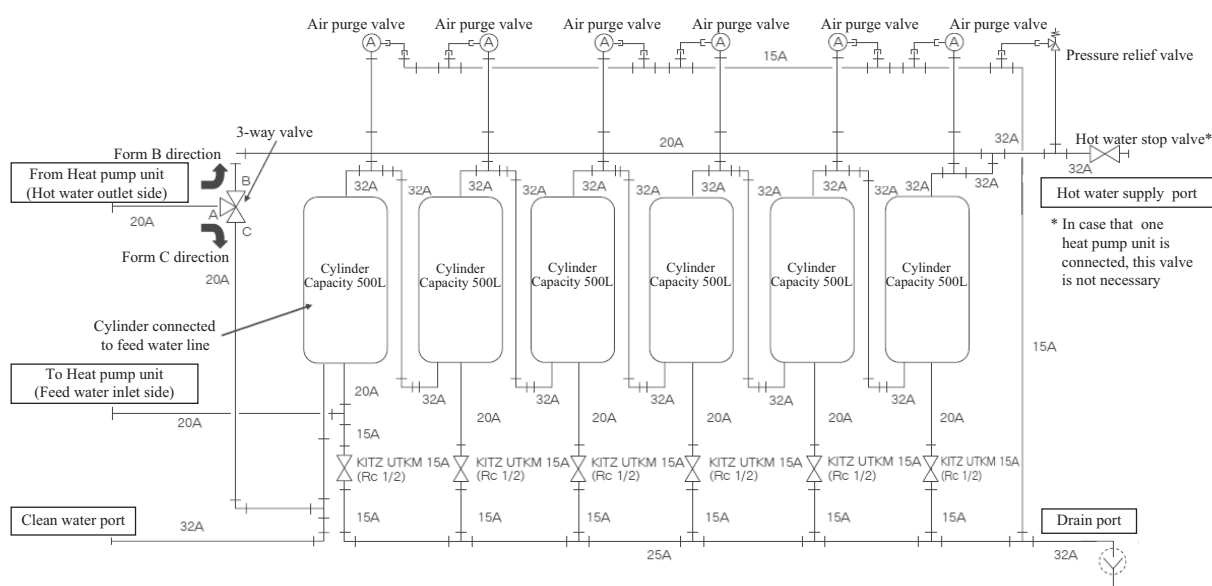
- Do not do brazing work near the cylinder
The corrosive material included in the brazing material may give damage (Pin-hole) on the cylinder and it may cause water leak. Accordingly, regarding the piping work near the cylinder, please proceed screw connection by using union as possible as you can.
If 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 N2 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 N2 gas before filling water in the system.

Installation example

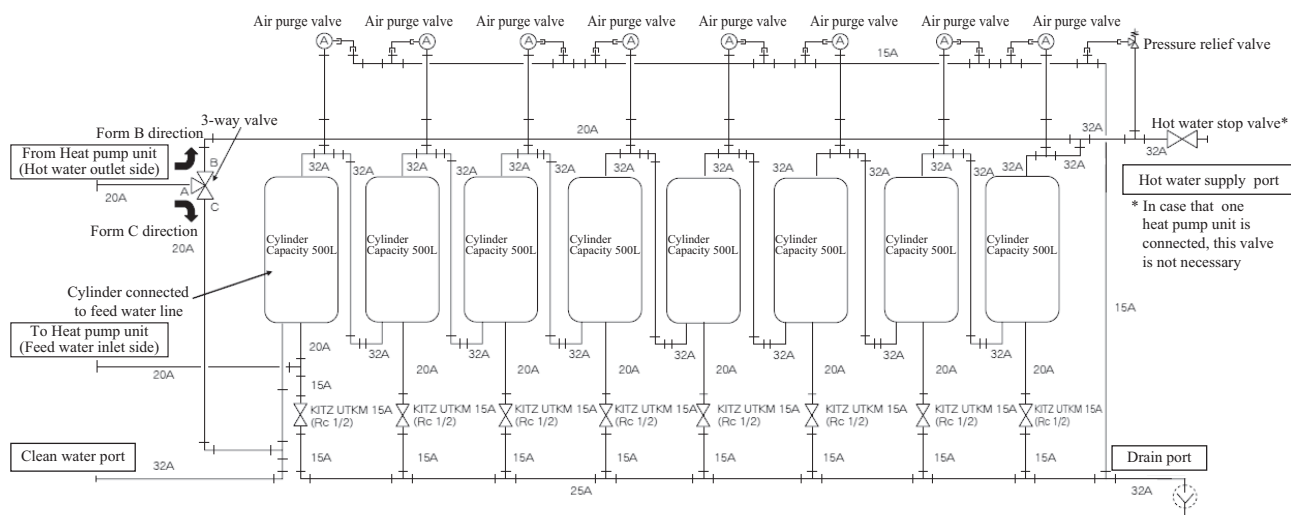
(i) In case that 2 sets of cylinders are installed



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



(iii) In case that 8 sets of cylinders are installed



5. Insulation work

- Temp 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.

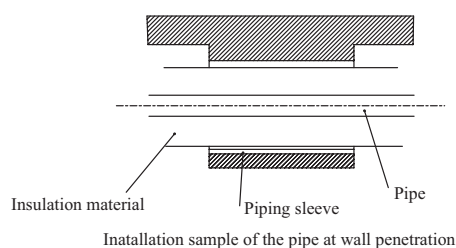
- Cylinder shell: Glass wool (Density is 16kg/m³) with 50mm or thicker
- Cylinder end plate: Glass wool (Density is 24kg/m³) with 50mm or thicker
- Water piping: Glass wool (Density is 48kg/m³) with thickness shown in following table or thicker

(Unit:mm)

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

Piping at wall penetration

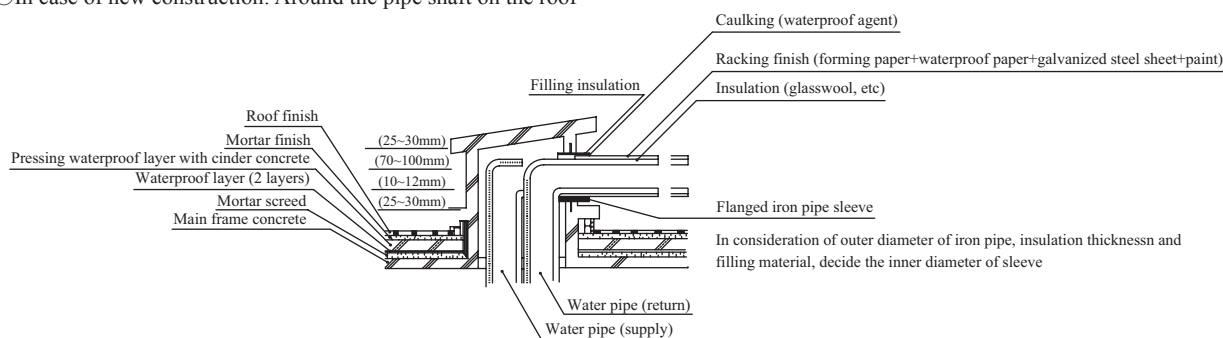
A part of wall penetration (following figure) and inlet/outlet port of water pipe at unit side shall be insulated.



5-1 Waterproofing work at the place where water pipe is passing through

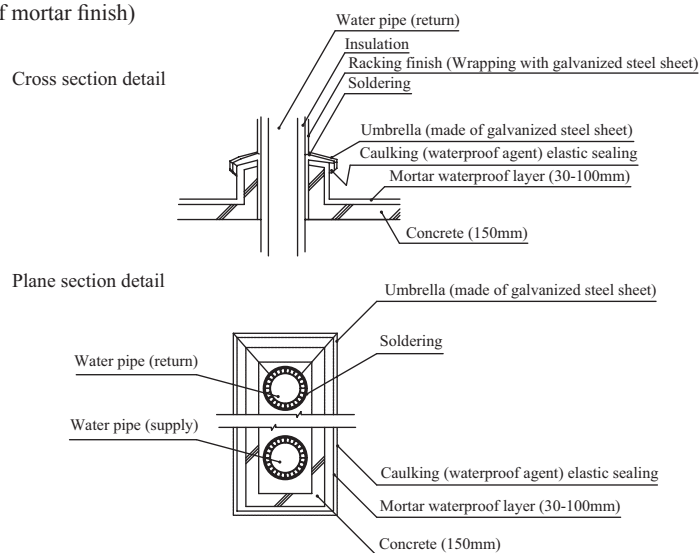
When connecting pipe to the hot water storage unit installed on the roof, if waterproof layer of the roof is cut with pipe or sleeve, It may cause rain leaking through the roof. Therefore please ask constructor to prepare the pipe penetration port mentioned below as construction work.

- 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)



5-2 In case of connecting unvented cylinder

5-2.1 Allowable external head and piping resistance

The distance between heat pump unit and hot water storage unit should be as shorter as possible from a view point of energy saving. Piping length and bend should be within following range in principle. If out of range, 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 unit mentioned below.

Regarding the limitation of piping length, please refer item 5-2.2.

(i) Allowable external head

Between the heat pump unit (ESA30E series) and the unvented cylinder: Allowable external head is within $\pm 5\text{m}$ at 17 liter/min.

(ii) 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.

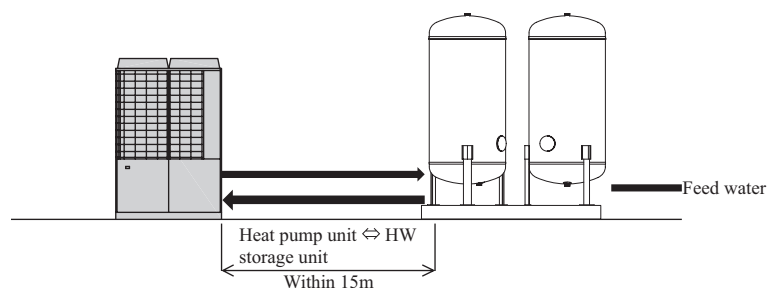
Nominal diameter	Equivalent pipe length (m)			
	Elbow	Gate valve	Check valve (Swing type)	Y-type strainer
20A	0.75	0.15	1.6	2.18
25A	0.9	0.18	2.0	3.00
32A	1.2	0.24	2.5	4.62
40A	1.5	0.30	3.1	5.47
50A	2.1	0.39	4.0	8.00
60A	2.4	0.48	4.6	11.50

5-2.2 Limitation of distance between the heat pump unit and the unvented cylinder

The distance between the heat pump unit and the unvented cylinder should be as shorter as possible from a view point of energy saving. Piping length and bend is within following range in principle.

(i) Hot water piping

① Standard limitation of piping length



* Connecting wiring length is 20m at the maximum

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 supply 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.

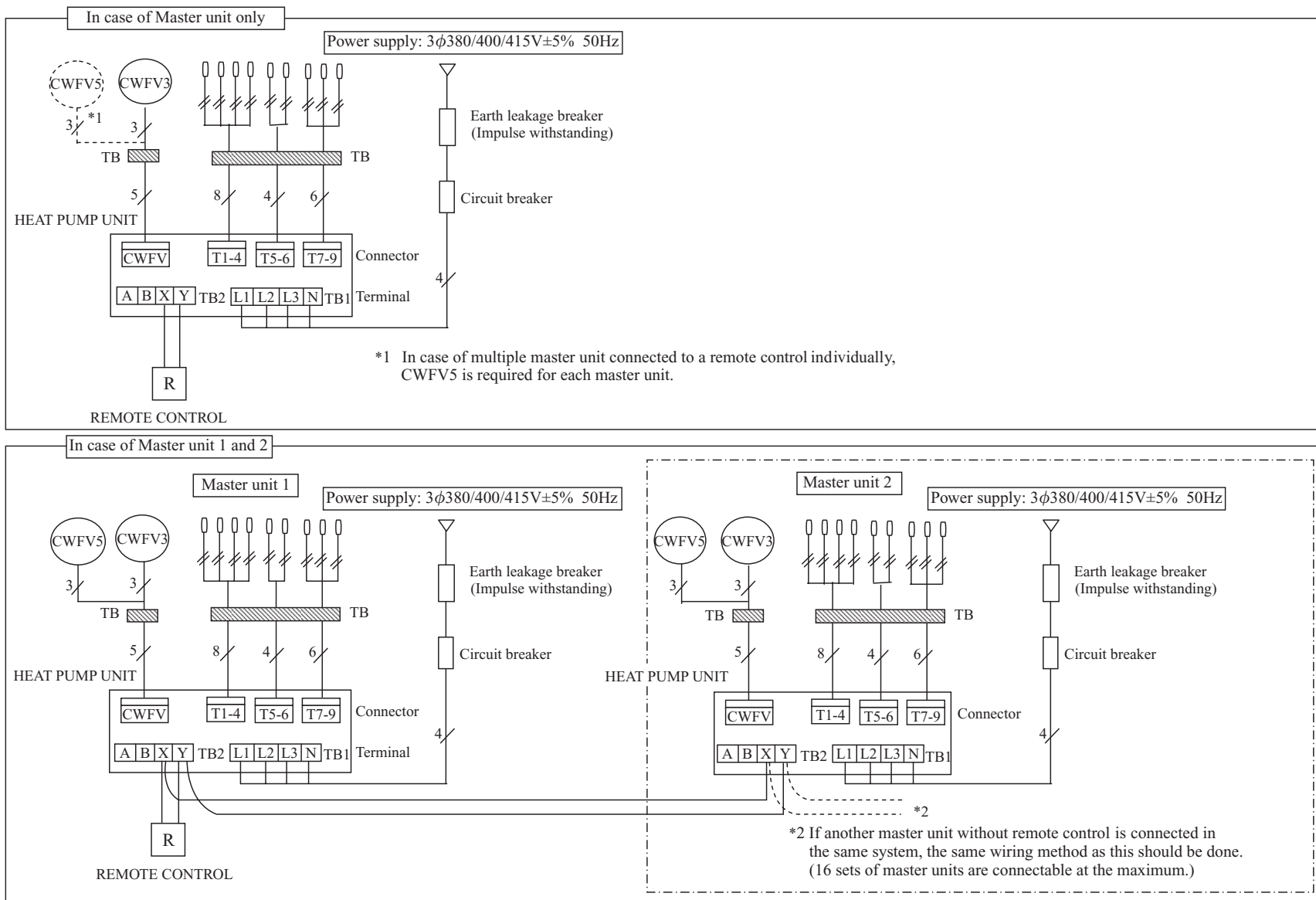
Use of breakers of larger capacity could result in trouble on components or fire accident.

The circuit breaker should isolate all poles under over current.

l) Install an isolator or a cut-off switch on the power supply line in accordance with the local codes and regulations. The isolator shall be locked to keep the power supply 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.

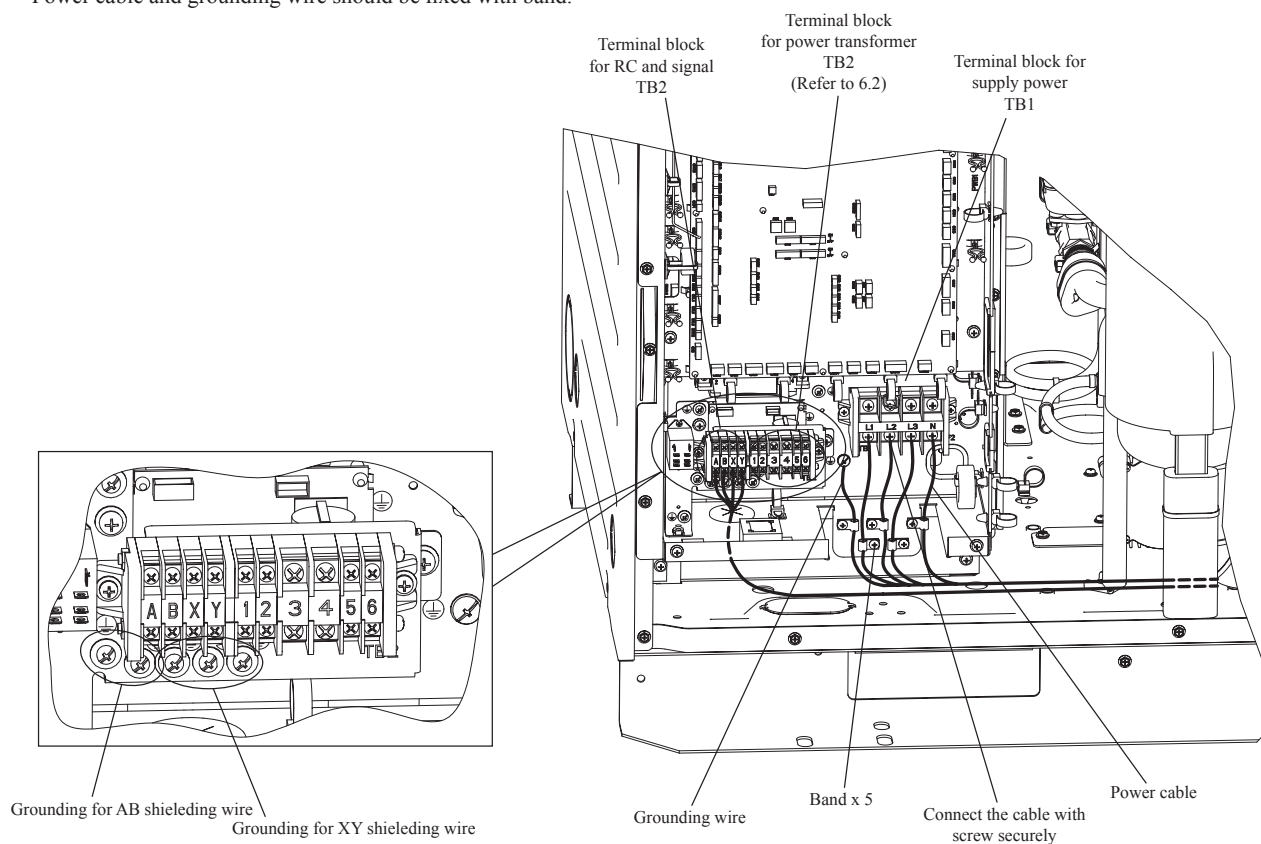


Figure-a

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

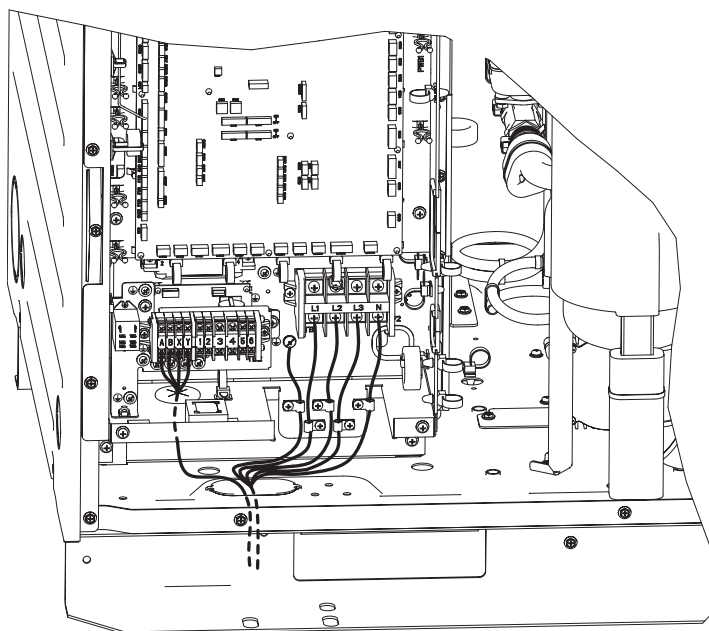


Figure-b

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 voltage for control line, it is necessary to change connection of wire on the terminal block (TB2) in the control box according to the supply power voltage to be used.

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

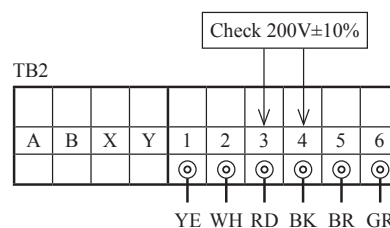
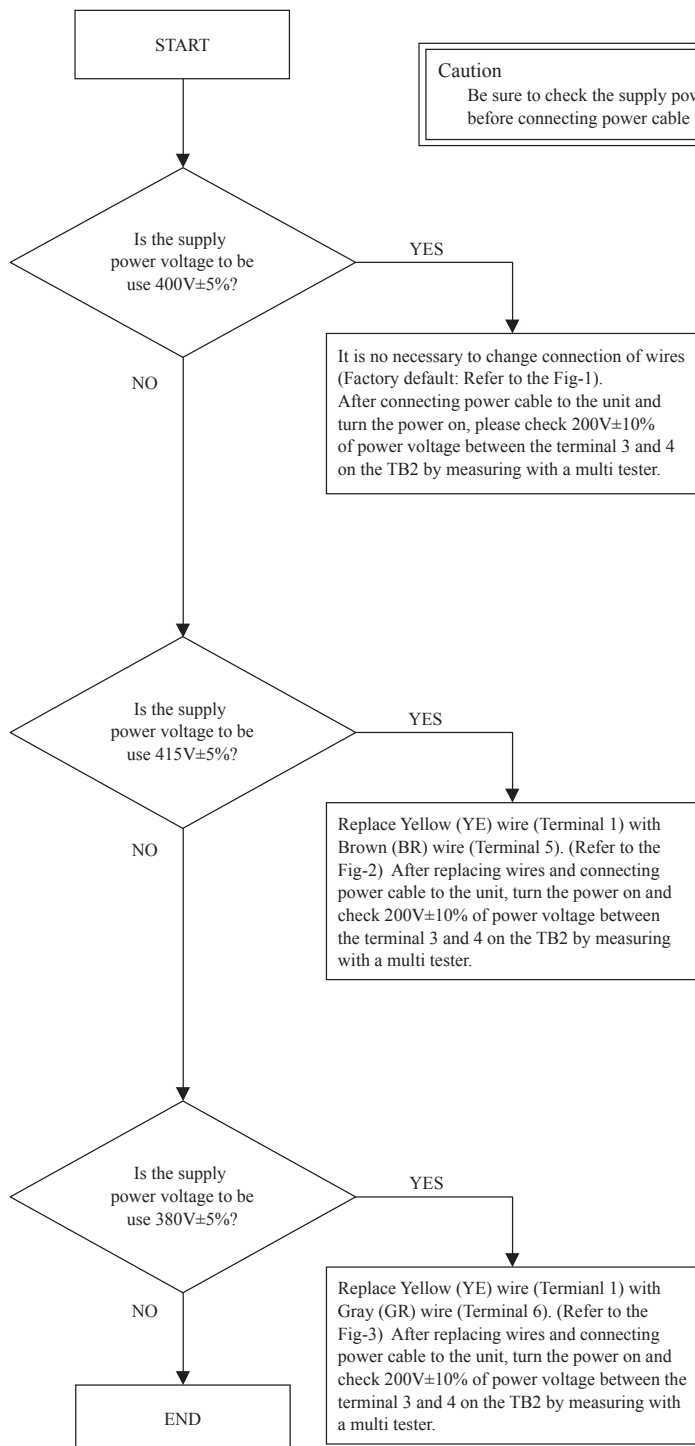


Fig-1 Wiring method for $400V \pm 5\%$ (Factory default)

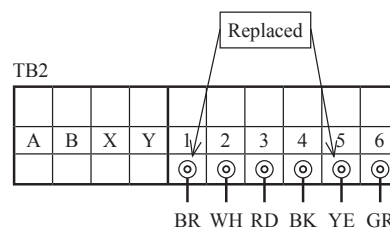


Fig-2 Replaced wires for $415V \pm 5\%$ from factory default

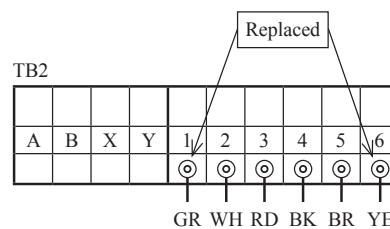


Fig-3 Replaced wires for $380V \pm 5\%$ from factory default

[Caution]

If the supply power voltage is out of the limitation range, it may cause malfunction of compressor, water pump, fan motor, PCBs and electric functional parts and it may result in ignition and fire at worst.

6-3 Connecting method of power cable

(a) Method for leading out cables

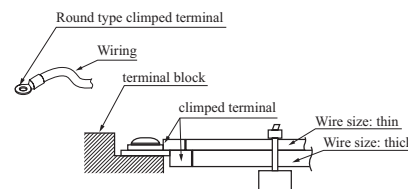
- Cables can be led out through the front, right, left panel and bottom plate.
- In wiring on installation site, cut off a half-blank ($\phi 50$ or elongate hole 40x80) cover for penetration of cables with nipper.
- In case of a collective drain piping, please use the hole to lead out cables or pipe 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
M12	Power cable terminal block	22.05-26.46

(c) Heat pump unit power supply specifications: 3-phase 380V/400V/415V±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

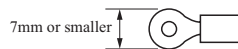
- The signal line is DC5V so that please do not connect single phase 220V/230V/240V of power cable to the signal line.
In case to connect power cable, the fuse on the control PCB is blown.

- ① Please check that power cable is not connected to the signal line.
 - ② Before turning on power supply, be sure to check resistance on the terminal block of signal line.
If the measured resistance is 100Ω 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 ≤ < 200	0.5mm ² x 2 cores shielding wire (MVVS)
200 ≤ < 300	0.75mm ² x 2 cores shielding wire (MVVS)
300 ≤ < 400	1.25mm ² x 2 cores shielding wire (MVVS)
400 ≤ < 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 temp 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

- a) 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.

- b) A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.
- c) 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.
- d) **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.
- 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 supply cables, be sure to use conduits
- g) 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.
- 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 with 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 supply line in accordance with the local codes and regulations. The isolator shall be locked to keep the power supply 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.

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

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

Temp 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 temp 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 temp.

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

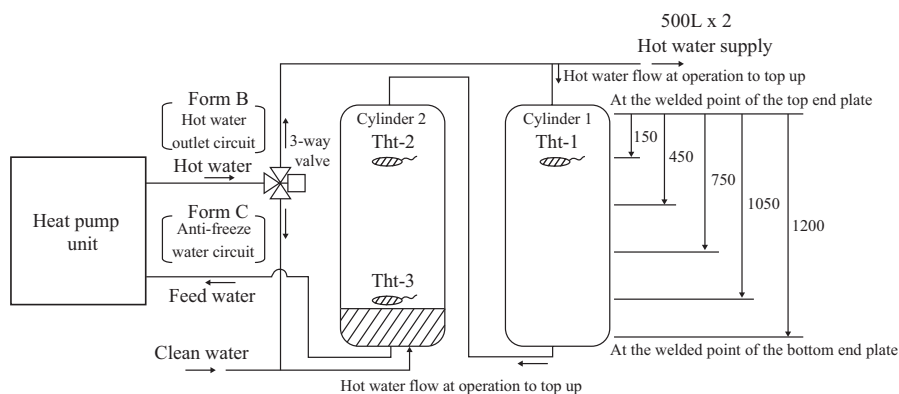
Number of sensors to apply							
Sensor No.	3pcs	4pcs	5pcs	6pcs	7pcs	8pcs	9pcs*1
Tht-1	20%	20%	20%	10%	20%	10%	10%
Tht-2	60%	50%	40%	30%	30%	20%	20%
Tht-3	100%*2	75%	60%	40%	40%	30%	30%
Tht-4		100%*2	80%	60%	50%	50%	40%
Tht-5			100%*2	70%	65%	60%	50%
Tht-6				100%*2	80%	70%	60%
Tht-7					100%*2	80%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

*1 Recommendable number of sensors is 9pcs.

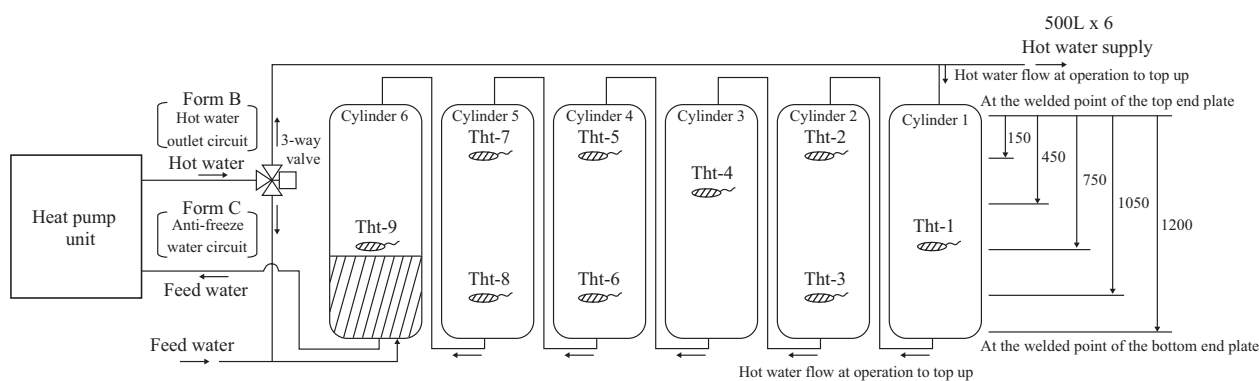
If the number of sensors is less than 9pcs, the hot water amount cannot be detected correctly.

*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.

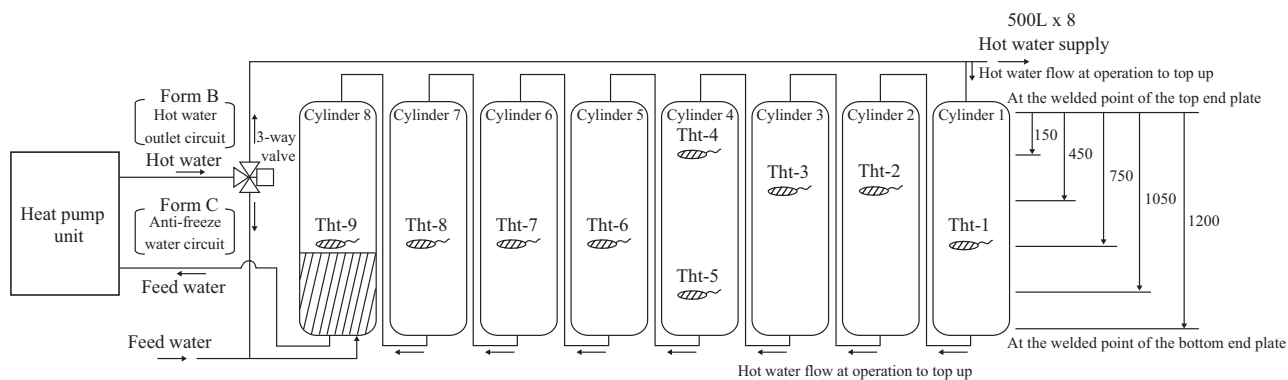
(i) In case that 2 sets of cylinders are installed



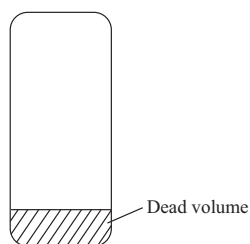
(ii) In case that 6 sets of cylinders are installed



(iii) In case that 8 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 screw driver.
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.

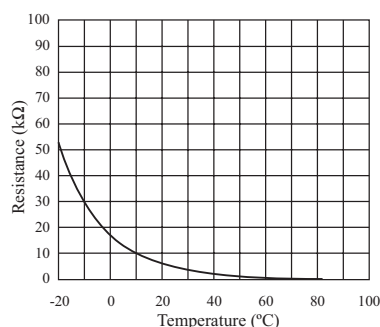
Tightening torque		
M3.5	Terminal block for power and signal wires	0.68-0.82

(i) Connecting method of temp sensor

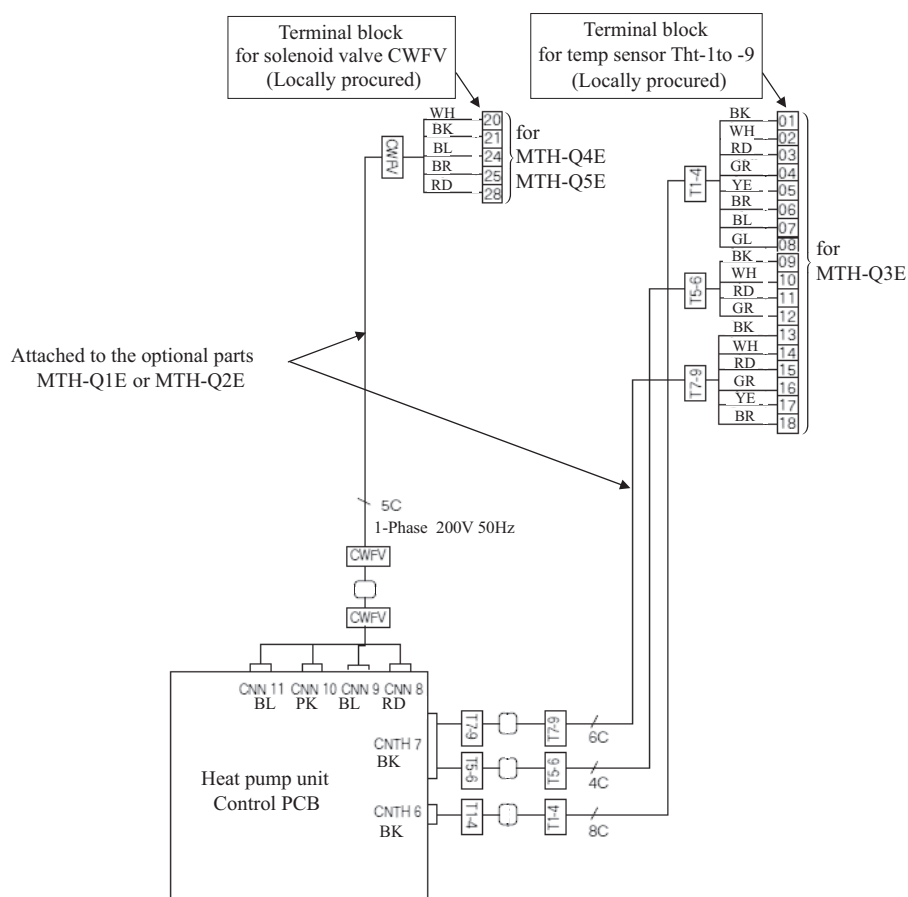
- Connect the lead wires of temp sensors applied on the cylinder to the specified position on the terminal block (for M3.5, with 18 terminals for 6 and 8 cylinders/4 terminals for 2 cylinders) (Refer to the figure on next page)
Connect the lead wires to the terminal block by using round type crimped 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 temp 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 temp 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 temp 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 temp sensor

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



- By using temp sensors of the wiring kit MTH-Q3E, connect the heat pump unit and terminal block
There are totally 3 sets of temp 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 temp 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

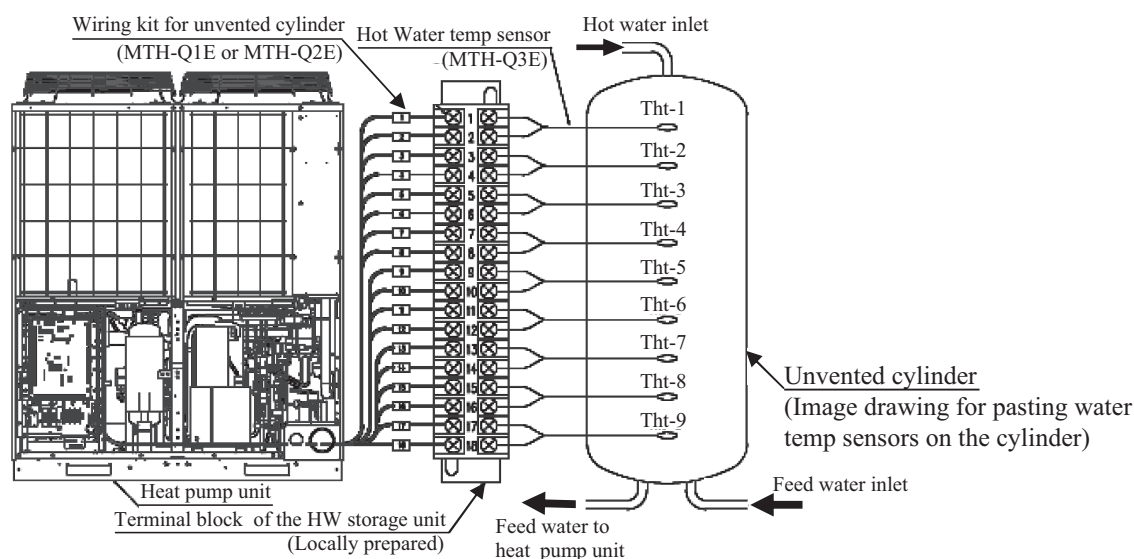


7-3 Connection of signal wire

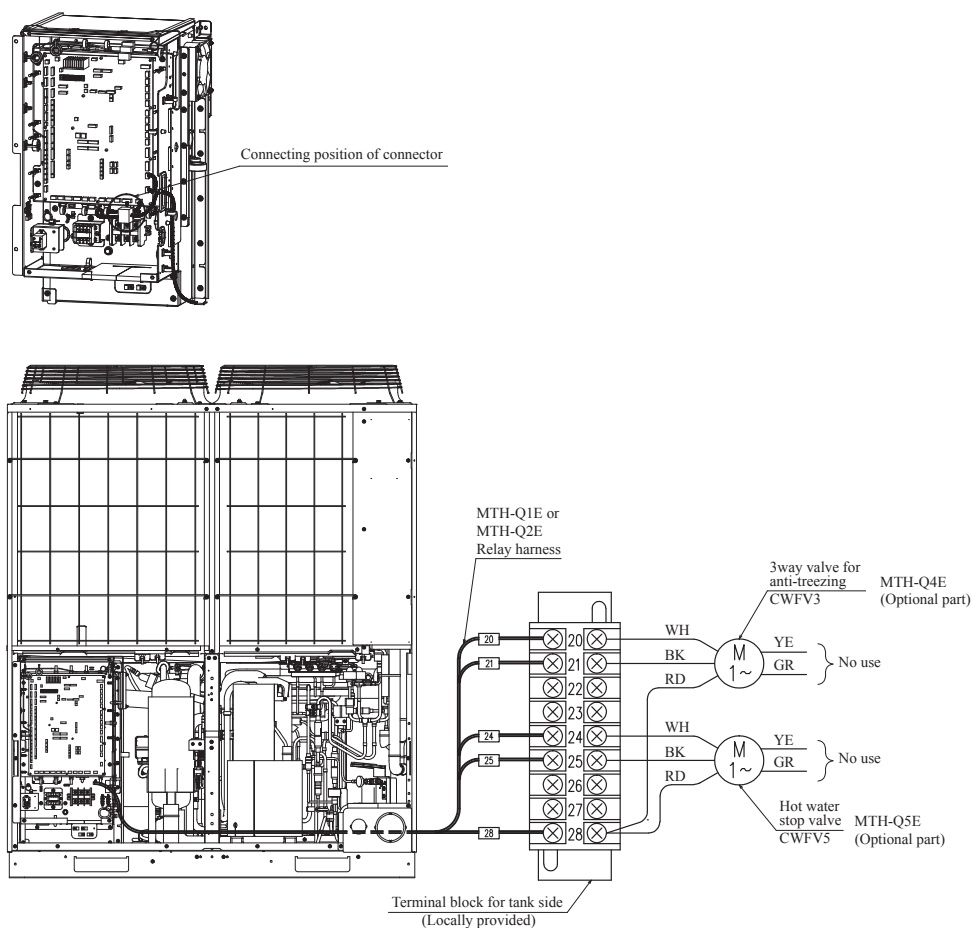
- 1) The temp sensor wiring connectors (They are connected to the CNTH6 and CNTH7 on the control PCB in the control box of the heat pump unit at the factory) and the temp sensor terminal block in the control box of the HW storage unit are interconnected with sensor wires. Please connect the sensor wires crimped round-type terminals to the temp 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 Controller setting when unvented cylinder is connected.

Please implement the controller setting according to the instruction mentioned in page 30-31

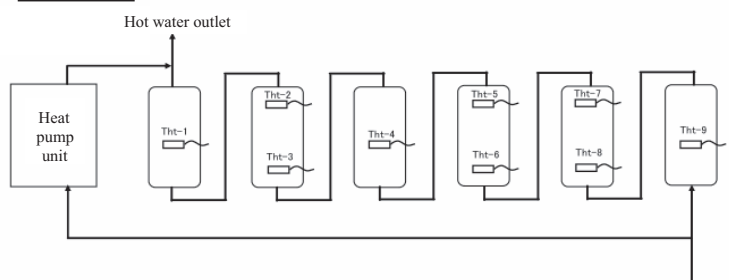
- Dip switch setting
Be sure to set SW3-3 OFF

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

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

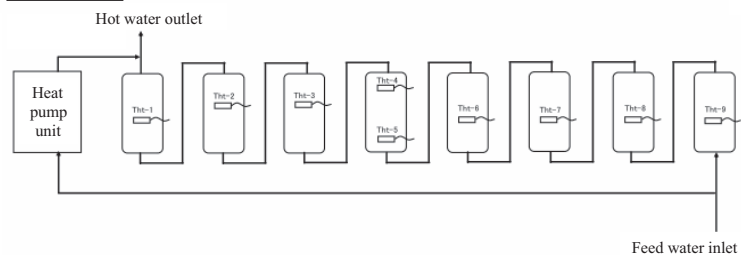
Example 1

For 3000Liter (6 x 500Liter) cylinder



Example 2

For 4000Liter (8 x 500Liter) cylinder



7-5 Anti-freezing water circuit for unvented cylinder

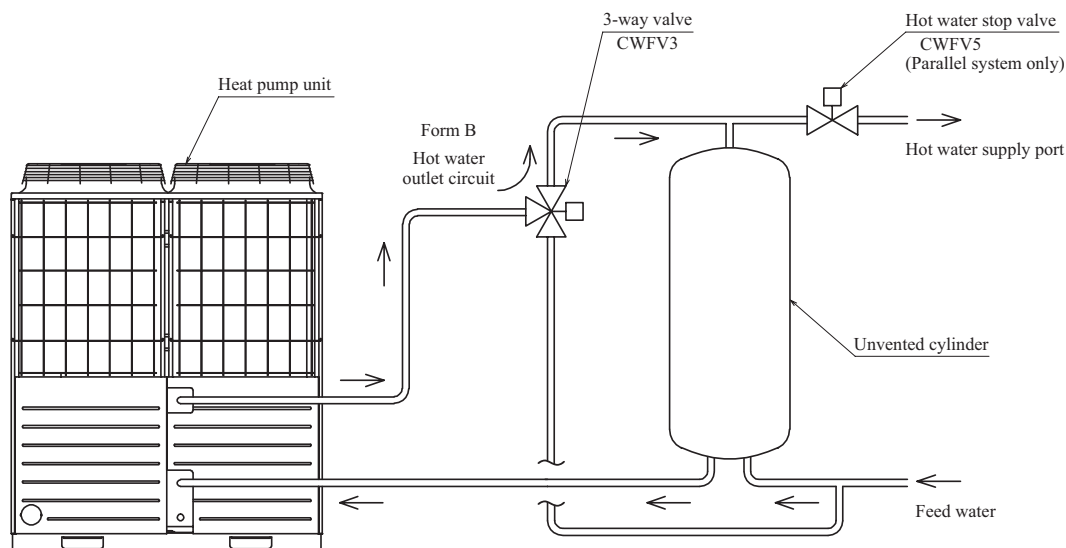
In case that the water in the pipe may be frozen due to decreasing the water temp below 0°C in winter season during the long term stop or anomaly stop of heat pump unit, the water pump is forcibly operated in order to prevent water in the pipe from freezing. The water flow is changed to ② anti-freezing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

[Water circuit]

① Normal operation (Just reference)

Compressor: ON

Gas cooler inlet water temp > 3°C



3-way valve operation position

② Anti-freezing water operation

[Start condition]

- Compressor: OFF
- Following condition is established

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

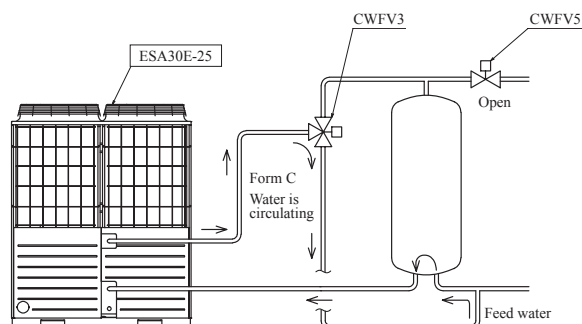
[End condition]

- Compressor start condition is established.
- Following condition is established

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

[Control conditions]

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



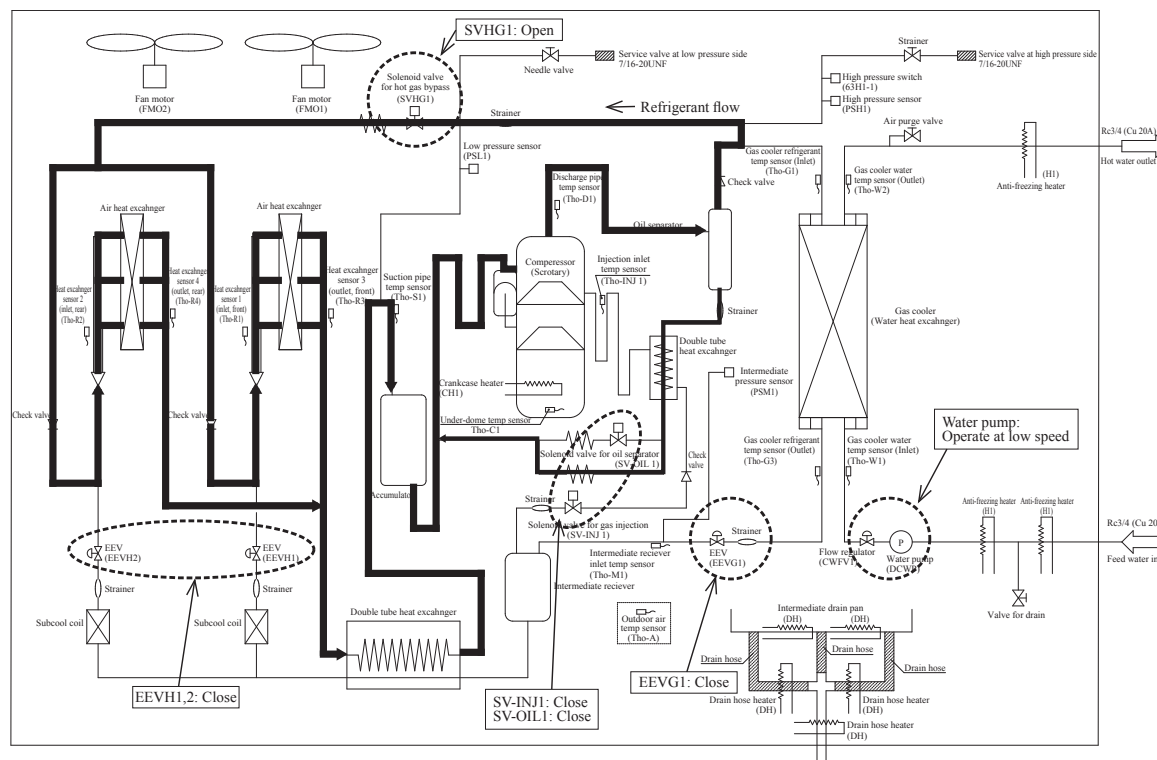
7-6 Defrost operation for unvented cylinder

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.

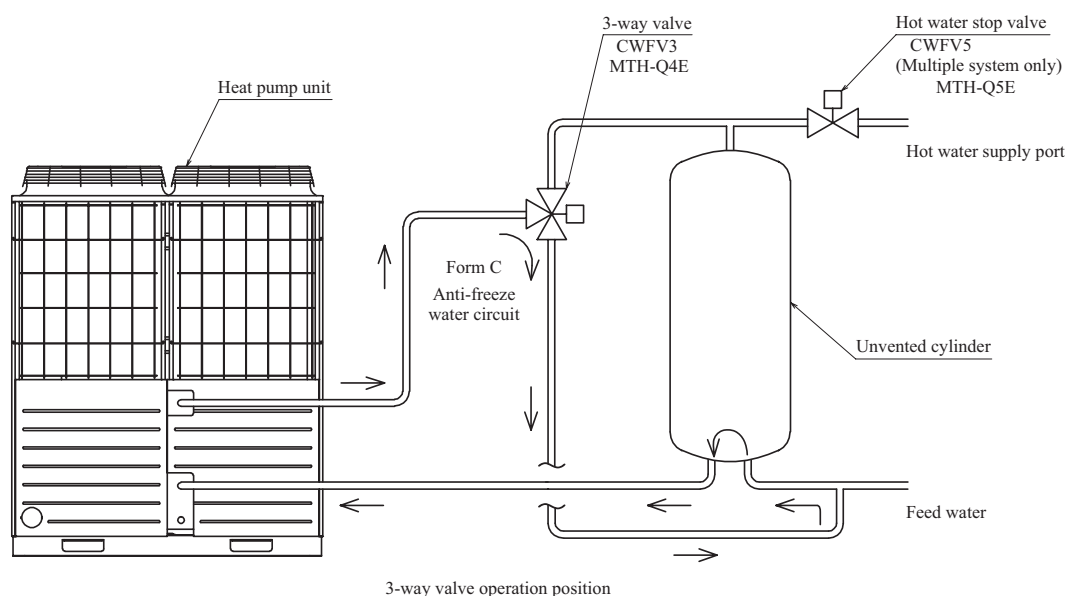
When the defrost start condition is established, defrost operation is started and the frost on the heat exchanger is defrosted by opening the hot gas bypass valve (SVHG1) to flow the discharge gas into the air heat exchanger.

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

[Refrigerant circuit]



[Water circuit at defrosting]



8. Controller setting

(1) Unit address setting

This control system controls the communication among the controllers 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.

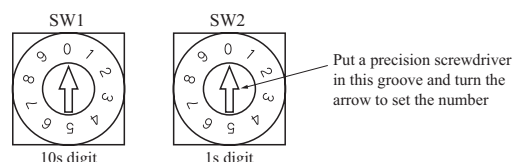
How to set address

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

(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 contents
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

(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		SW5-7	For air tightness test & etc. EEVH&EEVG normal ★/fully open	
SW3-2		Check SW kept "OFF"	SW5-8	For air tightness test & etc. EEVH&EEVG normal ★/EEVH fully open & EEVG close	
SW3-3*1	Type of tank Unvented ★/Open	Check SW kept "OFF"	SW6-1		Check SW kept "OFF"
SW3-4		Check SW kept "OFF"	SW6-2		Check SW kept "OFF"
SW3-5	Anti-freezing start condition setting OA temp ≤ 3℃ ★/OA and Water temp ≤ 3℃	Check SW kept "OFF"	SW6-3		Check SW kept "OFF"
SW3-6		Check SW kept "OFF"	SW6-4		Check SW kept "OFF"
SW3-7	Reset cumulative operation hours after the previous checking Normal ★/Reset		SW6-5		Check SW kept "OFF"
SW3-8		Check SW kept "OFF"	SW6-6	Operation to fill up OFF ★/ON	
SW5-1	Primary setting of operation Normal ★/Start test run		SW6-7		Check SW kept "OFF"
SW5-2	Water pump test run Normal ★/Start test run		SW6-8		Check SW kept "OFF"
SW5-3	Valve open/close test Normal ★/Forced operation		J10	Superlink terminal spare Spare/Normal ★	
SW5-4		Check SW kept "OFF"	J13	External input signal type Pulse/Level ★	
SW5-5		Check SW kept "OFF"	J14		Check J14 kept "Short"
SW5-6		Check SW kept "OFF"	J15	Defrost starting temp. Cold region/Normal ★	
			J16		Check J16 kept "Short"

(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 temp sensors for unvented cylinder are less than 8 pieces, this setting is required. Refer to item (b)

Code No.	Data display		Minimum unit
	Contents	Display range	
P01	No. of tank water temp 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.

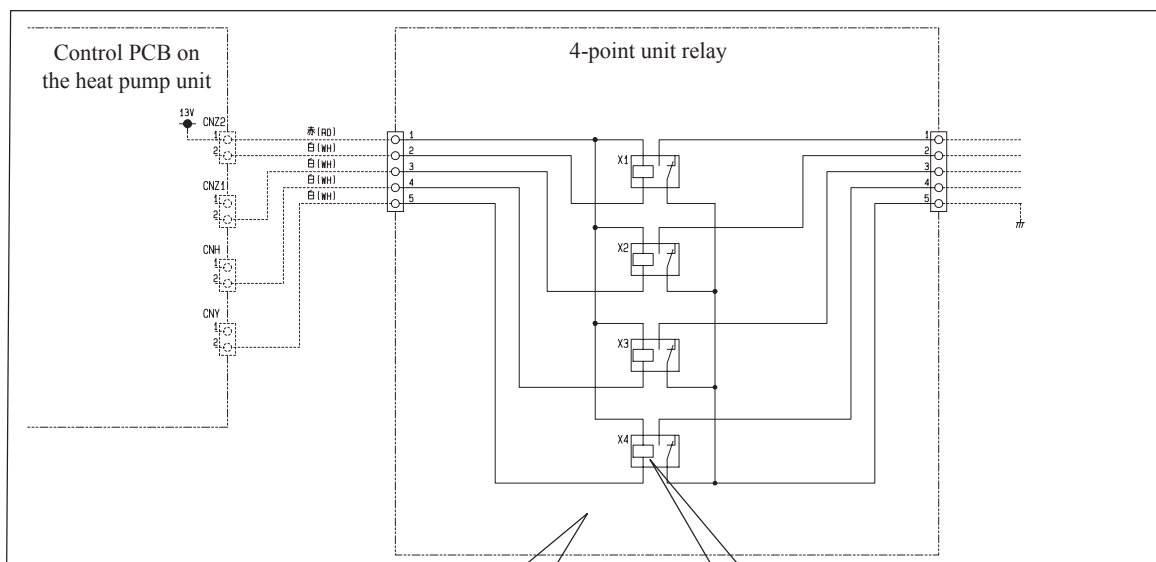
⑩ Even if resetting the power, the unit is controlled to operate according to this control contents which is changed and memorized.

Ex. "P01" In case of change the No. of cylinder water temp sensor. (from 9 to 2 pieces)
<ul style="list-style-type: none"> ● Display "P01" at 7-segment LED by SW8 and SW9. Display [P01] ● When holding down SW7 for 3 seconds, 9 of [P01] blinks. ● Press SW8 (for 1s digit) to change from 9 to 2 of [P01] blinks. * In case of change setting of 10s digit, use SW9. ● When holding down SW7 for 3 seconds, 2 lights up 2 of [P01] lights up.
With that, the setting is completed

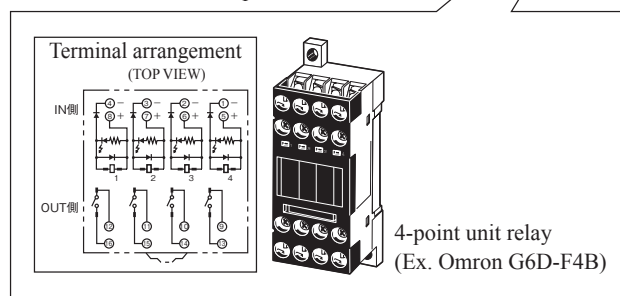
(5) Specifications of external input terminal

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		(Molex:5557-2R, 5556T should be locally procured)
	CNZ2 Set with 7-segment control (*1)		

(*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 () 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

(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 supply power to the crankcase heater**.
- (d) Be sure to check **the bottom of the compressor becomes warm**. (Outdoor air temp + 5°C or higher)

(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 MentePC 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 temp automatically.
In this case, it may be operated with different temp from the hot water temp 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

(1) Project information

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

(2) Check list for installation

○: OK △: shall be revised — : No item

	Check items	Standard	Checked result			Remarks
			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 tech. 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 tech. manual (Drain)				
	Are enough service spaces for the heat pump unit and the HW storage unit secured?	Check tech. 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 tech. 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 tech. manual (Quality of material)				
	Are there any problem on connection, length and route of the piping	Check tech. manual (Water piping)				
	Is the insulation work done properly?	Check tech. 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 tech. manual (Eclectic work)				
	Are wires connected properly without any looseness?	Check tightening				
	Is grounding work done surely?	Check tech. 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				

(2) Check list for commissioning

○: OK △: shall be revised — : No item

	Check items	Standard	Checked result			Remarks
			①	②	③	
Before start commissioning (Before power supply)	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 controller connected to X and Y terminals on TB2?	X and Y terminals (No polarity)				See 6-1 for details
	Is the supply power 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 supply 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 (①YE②WH③RD④BK ⑤BR⑥GR) 415V: ①BR, ⑤YE				
Heat pump unit	Does the hot water supply temp conform with the set temp by remote control?	Same as set temp				
	Are high pressure, intermediate pressure and low pressure within the normal range?	HP: 7-12MPa IP: 2-6MPa LP: 1.5-5MPa				
	Is discharge temp within the normal range?	70-120℃				
	Is suction superheat within the normal range?	3-30℃				
	Is under-dome temp 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 temp is 3℃ or lower.				
	Are operation and display of remote control normal?	Check operation				
	Did you check and explain the setting contents of remote control to the customer?	Explain the setting contents				
Water circuit and hot water storage tank	Is the cylinder filled with hot water?	Check water level sensor				
	Are the sensed values of water temp and etc normal?	Check each sensed value				
	Does the control of anti-freezing circuit actuate normally?	When outdoor air temp 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 MentePC data) [Date of data acquisition :]

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

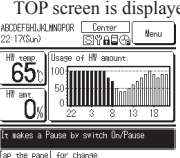

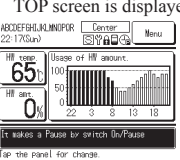
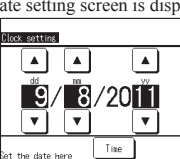
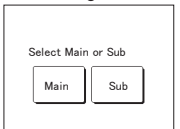
11. Notabilia for servicing (for CO2 heat pump unit)

- (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.

12. 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..						○: Setting is memorized, ×: Setting is not memorized							
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 temp 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	 TOP screen is displayed	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 unit 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 unit 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 unit 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 units 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 units can be restarted.

R/C and all heat pump units can be initialized. All settings of R/C and heat pump units are back to the factory default except the [date and time] setting.

[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.

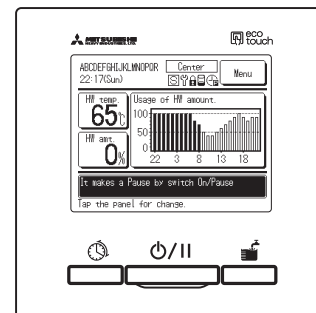
3.2 Installation work for remote control

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 optional equipment. Please read this manual carefully before starting the installation work to install the unit properly.

PJZ012D084

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. If the unit is used at places where air contains dense oil mist, steam, organic solvent vapor, corrosive gas (ammonium, sulfuric compound, acid, etc) or where acidic or alkaline solution, special spray, etc are used, It could cause electric shocks, break-down, smoke or fire as a result of significant deterioration of its performance or corrosion. ⓘ
- 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 (ϕ 3.5 x 16) 2pcs, User's Manual, Installation Manual (in CD-R)
-------------	--

Parts prepared on site

Item name	Q'ty	Remarks
Switch box For 1 piece or 2 pieces (JISC8340)	1pc	There are not necessary when installing R/C directly on a wall
Thin steel conduit tube (JIS C8305)	As required	
Lock nut, bushing (JIS C8330)	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 (0.3mm ² x 2-core) 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 0.5mm².

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	0.5mm ² x 2-core shielding wire (MVVS)
< 300m	0.75mm ² x 2-core shielding wire (MVVS)
< 400m	1.25mm ² x 2-core shielding wire (MVVS)
< 600m	2.0mm ² x 2-core shielding wire (MVVS)

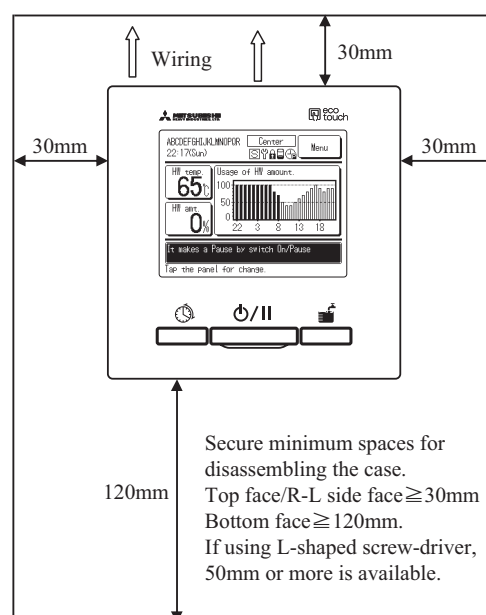
3. Installation place

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.

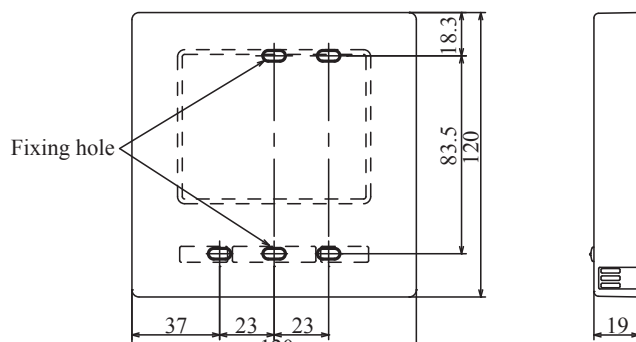


Request

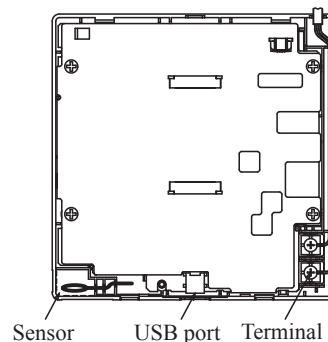
Do not install the R/C at a place where it is exposed to direct sunlight or surrounding air temp exceeds 40°C or drop below 0°C.
It could cause discoloration, deformation, malfunction or break-down.

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



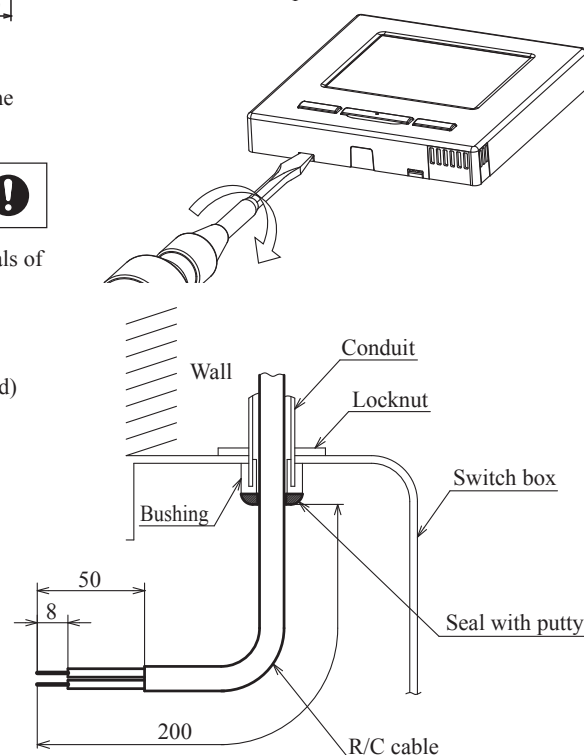
- ② Connect the wires from X and Y terminals of R/C to X and Y terminals of heat pump unit.
There is no polarity of R/C wiring (X and Y).

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

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

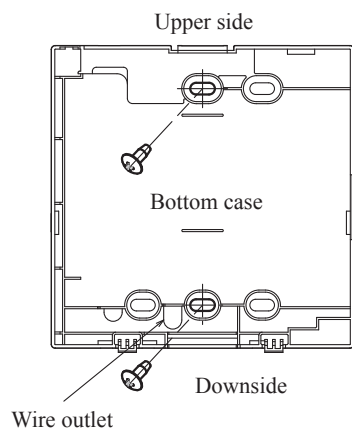
Seal the inlet hole for the R/C wiring with putty.

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

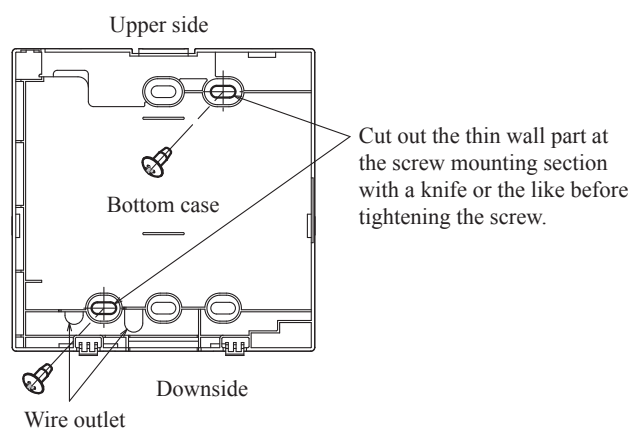


- ④ When wires are passed through the bottom case, fix the bottom case on the switch box at 2 places.

Switch box for 1

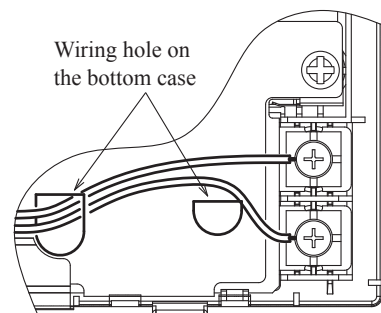


Switch box for 2



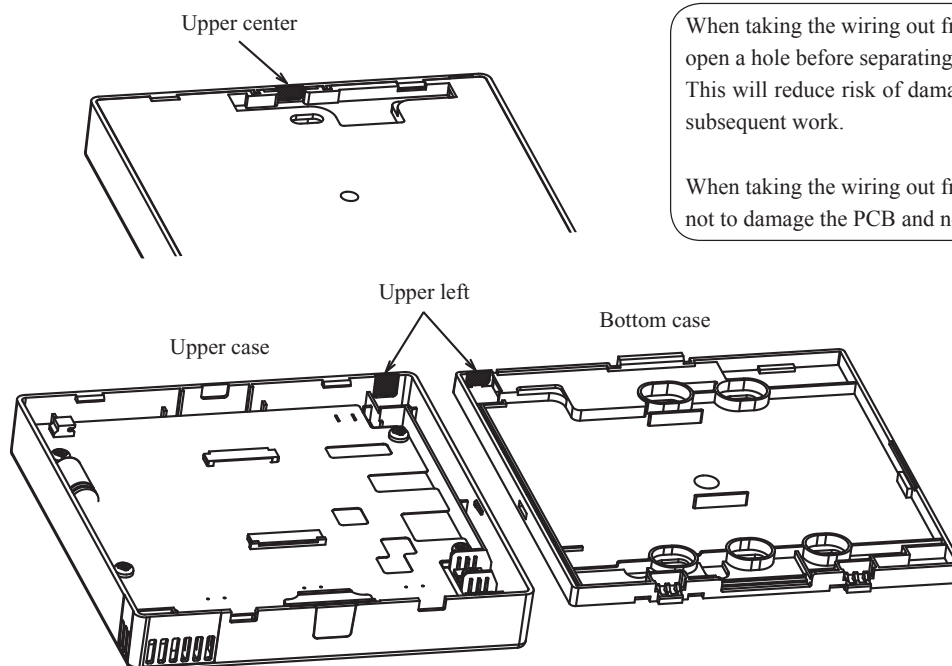
4. Installation and wiring work (Continue)

- 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.

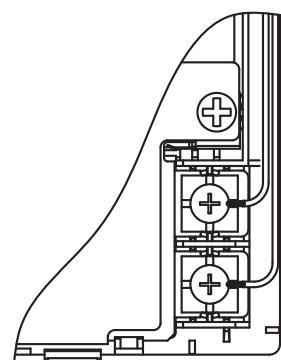
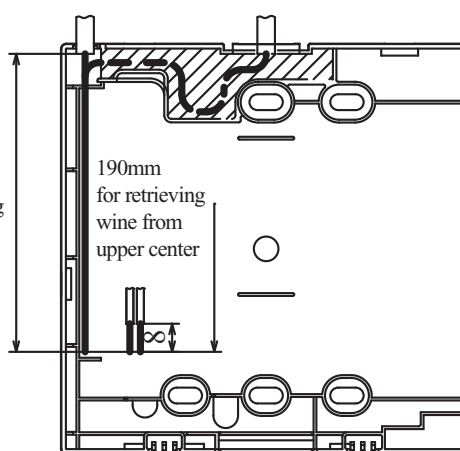
When taking the wiring out from the upper left, take care not to damage the PCB and not to leave any chips inside.

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
wine from
upper left

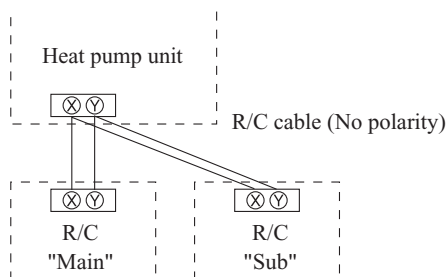


5. Main/Sub setting when more than one remote controls are used.

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	<input type="radio"/>	<input type="radio"/>
Setting of hot water temp	<input type="radio"/>	-
Setting of hot water amount	<input type="radio"/>	-
Usage of hot water amount	<input type="radio"/>	<input type="radio"/>
Schedule setting	<input type="radio"/>	-
Operation to fill up	<input type="radio"/>	<input type="radio"/>
Test run	<input type="radio"/>	-
Error history display	<input type="radio"/>	<input type="radio"/>
R/C function setting	<input type="radio"/>	-

Note: Connection to personal computer

It can be set from a personal computer via the USB connector (mini-B)

Connect the USB connector after removing the cover for USB port located on the upper case.

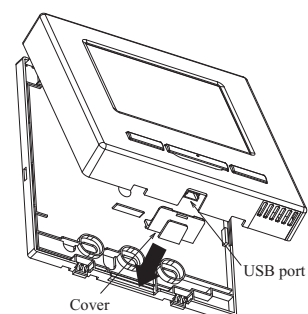
Replace the cover after use.

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



Special software is required for the setting with PC through this USB port.

For details, view the web site or refer to the technical manual.



Do not connect a personal computer to the USB port without using the special software.

Do not connect a personal computer to this USB port simultaneously with other USB devices.

It could cause malfunction or break-down of R/C or personal computer.



Note: Initializing of password

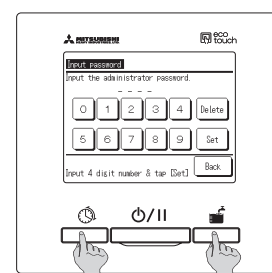
Administrator password (for daily setting items) and service password (for installation, test run and maintenance) are used

- 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 supply and initial setting

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

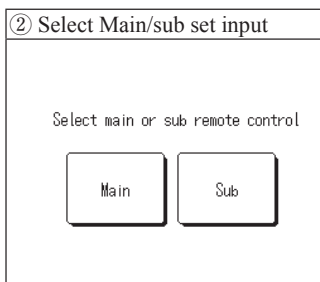
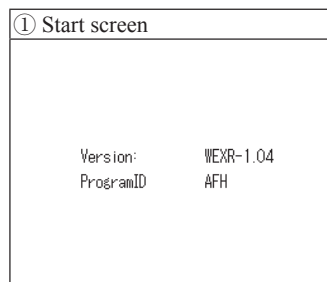
- (1) If the main and sub are not set yet, [Select Main/sub set input] screen is displayed. (Screen ②)

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 ⑧)

- (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.



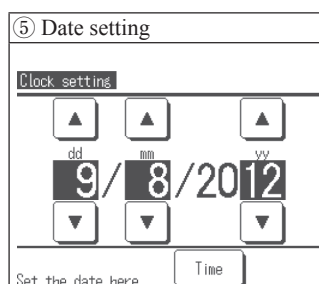
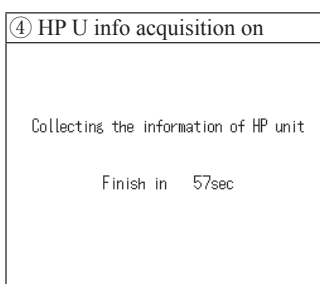
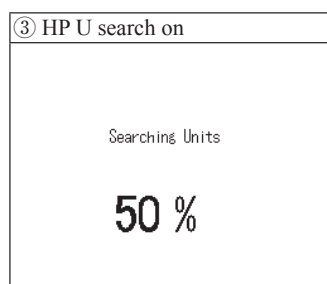
[Main] ⇒ ③ ⇒ ④ ⇒ ⑤ ⇒ ⑥ ⇒ ⑦

[Sub] ⇒ ⑩ ⇒ ⑤ ⇒ ⑥ ⇒ ⑦

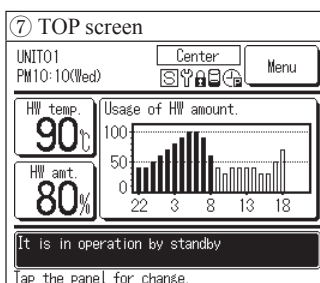
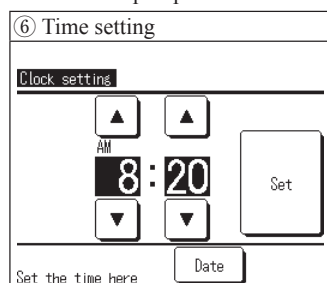
Caution

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.

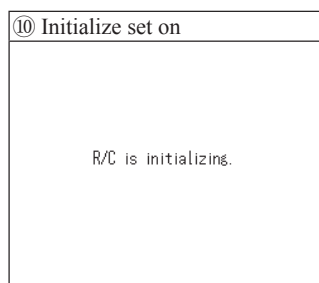
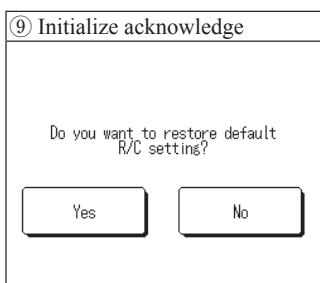
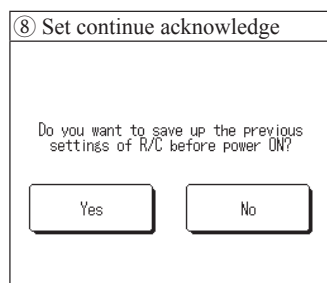


*HP U: Heat pump unit



The mode of operation at the power on is [Pause].

(In Pause, the operation to top up does not start)



[Yes] Continue ⇒ ⑩ ⇒ ⑤ ⇒ ⑥ ⇒ ⑦

[No] Change ⇒ ⑨

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] ⇒ ⑧

If initializing, it restore to the factory default

7. Installation settings and Test run

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

① TOP screen

UNIT01 Center Menu

PM10:10(Wed)

HW temp. 90°

HW amt. 80%

Usage of HW amount.

It is in operation by standby

Tap the panel for change.

② Menu screen (1)

Menu

Initial settings

Administrator settings

Installation settings

R/C function settings

More information

Next Back

Select the item.

② Menu screen (2)

Menu

Service & maintenance

Contact company

Check of R/C setting

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

Service password is "9999".

④ Installation settings

Installation settings

Installation date 5

Company information 6

Test run 9

Back

Select the item.

⑤ Installation date

Installation date

dd mm yy

1/1/2012

Set the date here

Set Back

Set with [▲] [▼] buttons.

Tap [Set] to save.

⑥ Company information

Company information

Company 7

Phone No. 8

Select the item.

Back

Set the Contact for the customer to ask servicing

⑦ Enter the contact

Company Set

MITSUBISHI

Alphabet Number

A B C D E F G H I

J K L M N O P Q R

Delete Next Back

Input the name and tap [Set].

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

Phone No.

000-000-0000

0 1 2 3 4 Delete

5 6 7 8 9 Set

Input Telephone No.

Back

Enter the contact phone No. with up to 13x 1-byte letters

Tap [Set] to save.

⑨ Test run

Test run

Primary settings of operation 11

Water pump test run 10

Compressor Hz fixed operation

Select the item.

Back

Move to the screen of a selected menu

⑩ Water pump test run

Water pump test run

Start

When tapping [Start], test run starts.
By pushing [On/Pause] button, water pump test run will finish.

Back

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

⑪ Primary setting of operation

Primary setting of operation

Start

Tap [Start] makes primary operation start
After 120 minutes, or by touching <On/Pause> button, the primary operation ends

Back

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 SW 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 SW 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.

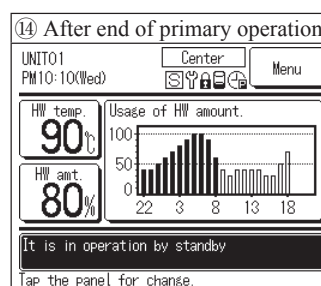
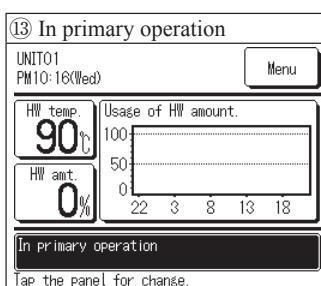
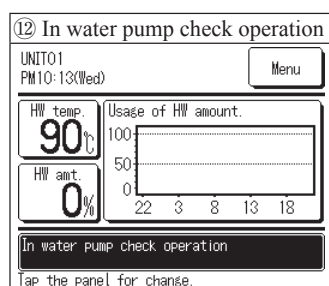
(7) After the end of the [Primary setting of operation], The heat pump unit is paused and the message "In primary operation" is disappeared and the message "It is in operation by standby" is displayed. (Screen ⑭)

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 starting 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)

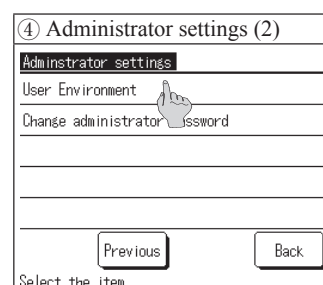
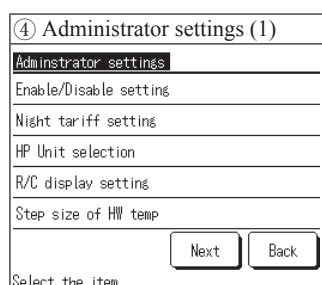
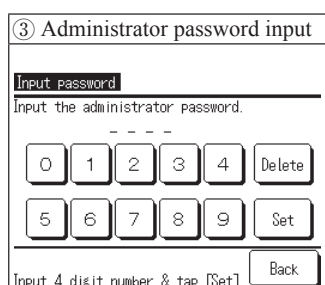
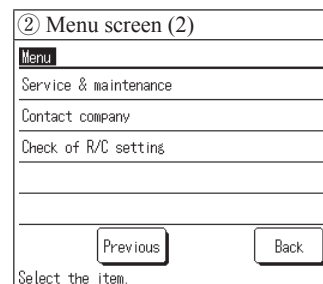
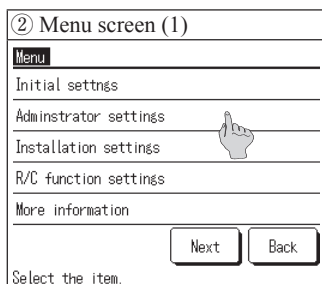
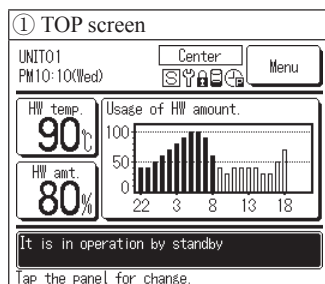
This heat pump unit is operated to top up hot water according to the target hot water amount set at each time zone.

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

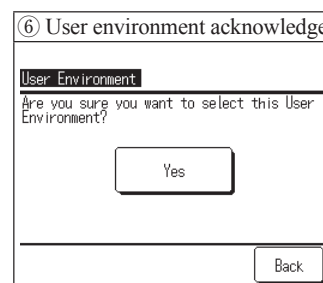
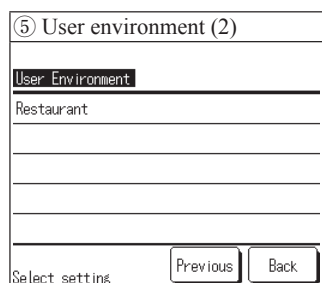
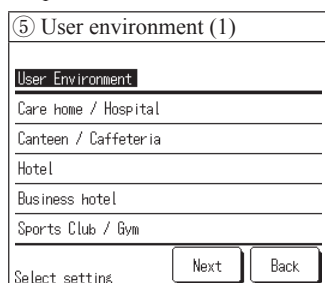
- (1) [② Menu] ⇒ [③ Administrator password (Service password "9999")] ⇒ [④ Admin settings] ⇒ [⑤ User environment]

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.

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/caffeateria	Restaurant	Hotel	Business hotel	Sports Club/gym
22:00	100%	60%	60%	60%	40%	40%	40%
0:00	100%	100%	100%	100%	100%	100%	100%
4:00	100%	100%	100%	100%	100%	100%	100%
8:00	30%	80%	80%	80%	80%	40%	100%
10:00	30%	50%	60%	80%	70%	40%	80%
13:00	30%	30%	40%	60%	60%	100%	60%
16:00	30%	30%	20%	40%	50%	100%	40%
19:00	30%	30%	20%	30%	40%	40%	30%

9. R/C function settings

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

① TOP screen

UNIT01 Center Menu

PM10-10(Wed)

HW temp. 90℃

HW amt. 80%

Usage of HW amount.

It is in operation by standby

Tap the panel for change.

② Menu screen (1)

Menu

Initial settings

Administrator settings

Installation settings

R/C function settings

More information

Next Back

Select the item.

② Menu screen (2)

Menu

Service & maintenance

Contact company

Check of R/C settings

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

External input

Individual

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 and Controller sound.

• Schedule setting

Setting of weekly operation pattern, Setting of day off, Setting of peak-cut and Changing of operation pattern.

• Administrator settings

Enable/Disable setting, Step size of HW temp, R/C display setting, Night tariff setting, HW unit selection, User environment and Change administrator password.

10. Service & Maintenance

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

① TOP screen

UNIT01 Center Menu

PM10:10(Wed)

HW temp. 90°C

Usage of HW amount.

HW amt. 80%

It is in operation by standby

Tap the panel for change.

② Menu screen (1)

Menu

Initial settings

Administrator settings

Installation settings

R/C function settings

More information

Next Back

Select the item.

② Menu screen (2)

Menu

Service & maintenance

Contact company

Check of R/C setting

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

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

④ Service & maintenance (1)

Service & maintenance

No. Display of unit 5

Next service date 6

Error display 8

Save HP Unit settings 9

Special settings 14

Next Back

Select the item.

Move to the screen of a selected menu.

④ Service & maintenance (2)

Service & maintenance

System off 15

Previous Back

Select the item.

⑤ Heat pump unit address

No. Display of unit

HP unit No.	HP/U name
007	
008	ABCDEFGH
009	
010	
011	
012	
013	

Previous Next Back

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

⑥ Next service date

Next service date

dd mm yy

1 / 1 / 2012

Cancel Set Back

Set the date here

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

Usage time 1year0month

Next check 1/2020

Company MITSUBISHI

Phone No. 000-000-0000

⑧ Display error history

Error history Delete

Time	HP unit	Error
06/01/2012 PM 6:22	002	E02
06/01/2012 PM 6:22	003	E09
06/01/2012 PM 6:22	000	E07
06/01/2012 PM 6:22	001	E07
11/01/2011 PM10:27	006	E82
11/01/2011 PM10:27	007	E52
11/01/2011 PM10:27	004	E05

Previous Next Back

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

If the [Delete] button is tapped,
the error histories are deleted.

⑨ Save HP Unit setting

Save HP Unit setting

Save setting 10

Automatic saving 11

Transfer the saved data 12

Back

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 controller 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.

10. Service & Maintenance (Continue)

⑩ Save HP Unit setting acknowledge

Save settings

Do you want to save the settings?

Yes

Back

If yes, tap [Yes].

When tapping [Yes], the setting of the heat pump unit connected is saved.

⑪ Automatic saving

Automatic saving

Saving automatically at the set time.

AM 0:00

Set

Cancel Back

Tap ▲▼ to set time, and tap [Set].

After setting the time and tapping [Set], the time to save automatically can be set.

⑫ Select heat pump unit

Select heat pump unit

000	001 ROOM01	002	003
004	005	006	007

Next Back

Select the number of heat pumps

If several heat pump units are connected, the unit to be sent the saved data can be selected.

⑬ Transfer the saved data acknowledge

Transfer the saved data

Approve the transfer of saved data to R/C?

Yes

Back

If yes, tap [Yes].

When tapping [Yes], the following data is transferred to the heat pump unit selected

- Hot water set temp
- Cumulative operation hours of compressor
- Cumulative operation hours of water pump

⑭ Special setting

Special settings

CPU reset

Restore of default setting

Touch panel calibration 15

Back

Select the item.

Move to the screen of a selected menu

[CPU reset]

The microcomputer of the heat pump unit connected is reset
(Like a state of recovery after power fail)

[Restore of default setting]

The setting of the R/C and the HP unit connected are restored to the factory setting

[Touch panel calibration]

Adjust the position if the display and the touch position are unmatched.

⑮ Touch panel calibration 1

Touch panel calibration

Start

Back

If Yes, tap [Start].

Adjust the position if the display and the touch position are unmatched.

⑯ Touch panel calibration 2

+

Tap [+] on the upper left.

According to the prompt displayed on the screen, tap the center of [+].

[Cancel] ⇒ The display returns to the screen ⑮

[Redo] ⇒ Retry the calibration from the screen ⑯

[Confirm] ⇒ The calibration is completed

⑰ Touch panel calibration 3

+

+

Tap center of [+] & check screen position.

Cancel Redo Confirm

⑱ System OFF

System off

All connected HP units will stop
Is it okay to stop?

Yes

Back

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.

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 SW5-2 on the PCB of the heat pump unit	① Switch OFF the Dip SW5-2 on the PCB of the heat pump unit ② Pause operation by pushing the [Run/Pause] 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 3000rpm 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 temp 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 temp 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 SW5-1 on the PCB of the heat pump unit	① Switch OFF the Dip SW5-1 on the PCB of the heat pump unit	Pause	Despite the "primary setting of operation" does not end (In case of end condition ① – ④), it moves to normal operation * If the supply hot water temp 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 [Run/Pause] 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	
	③ Start operation to top up, to warm up or to fill up without the primary setting of operation	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	⑥ After the end of test run, start normal operation without pausing	Operation to top up or to fill up	It is possible to check that [Primary setting of operation] is unfinished, interrupted or completed with mentePC
		① Pause operation by pushing the [Run/Pause] switch of R/C	Pause	Even if the operation starts by pushing [Run/Pause] 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 unit, and can be end with both the R/C and the PCB of the heat pump unit (Ex. To start with the R/C and to end with the PCB of heat pump unit is also available.)

Note 2. [Water pump test run] and [Primary setting of operation] can be set from the master heat pump unit 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.

(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.

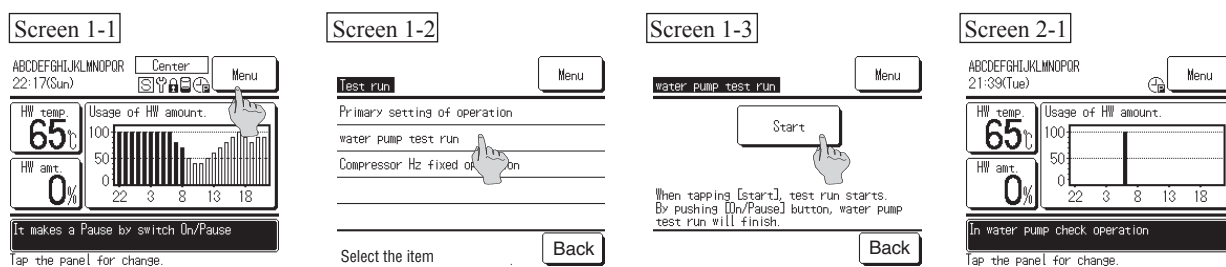
- b. Implement water pump test run

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)

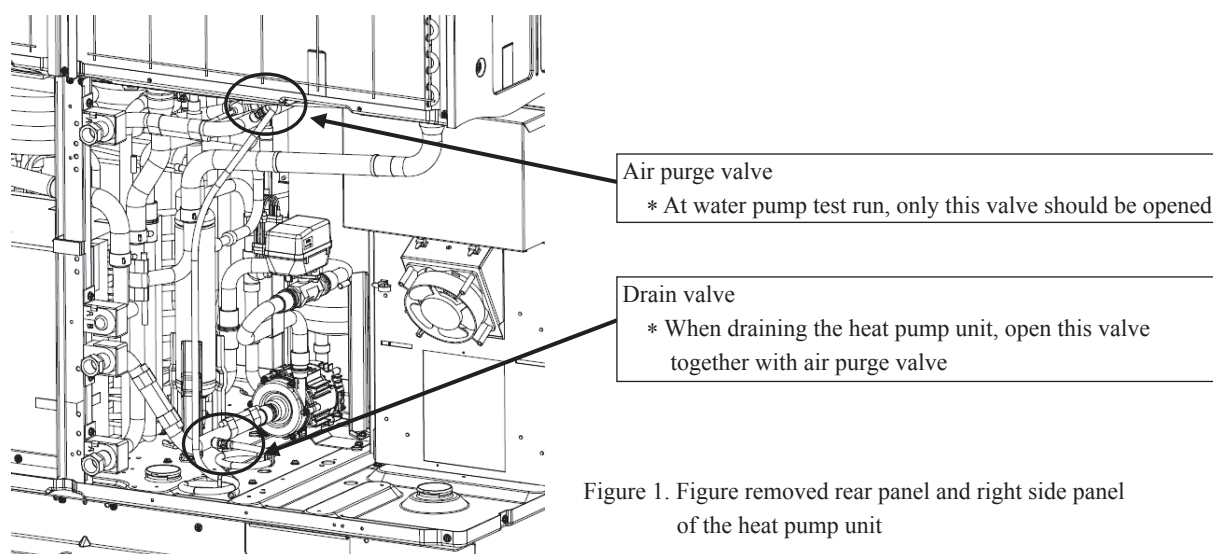
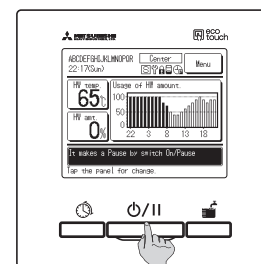


Figure 1. Figure removed rear panel and right side panel of the heat pump unit

- d. After the end of water pump test run, **switch OFF the SW5-2 on the PCB of the heat pump unit** and stop operation of water pump test run.

If stopping this operation with R/C, push **Run/Pause** switch at the TOP screen (Screen 3-1)

Screen 3-1



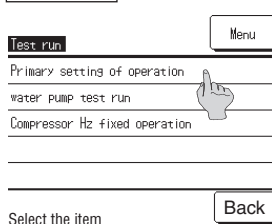
- e. Please start [Primary setting of operation]

[Primary setting of operation] can be done by **switching ON the SW5-1 on the PCB of the heat pump unit.**

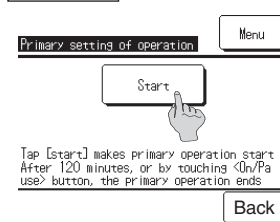
If starting this operation with R/C, it can be done according to the following procedure.

[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

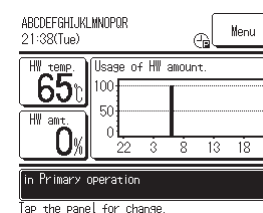


- f. When the heat pump unit starts operation of [Primary setting of operation], the message of "In Primary operation" is displayed on the TOP screen (Screen 5-1).

When the operation is completed, the heat pump unit 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 unit.**

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 unit 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 MentePC 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 unit starts operation, the message of " In operation to fill up" is displayed (Screen 6-3)

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.

- h. Check the operation status of the heat pump unit with MentePC and check each function is working properly.

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.

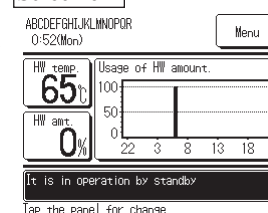
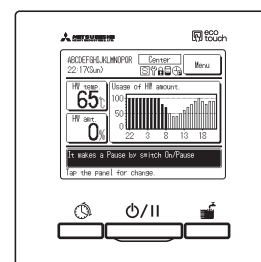
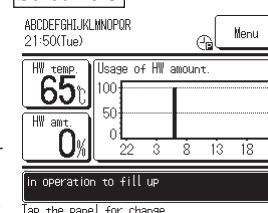
Furthermore, please check no problem such as leak and etc on the hot water supply system according to the inspection report of CO2 heat pump water heater.

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 On/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.**

Screen 6-1**Screen 6-2****Screen 6-3**

C Standard operation data

	Air condition		Water temp		Operating state								<Reference>	
	DB	WB	Inlet temp	Outlet temp	Comp speed	HP	MP	LP	EEVG opening	EEVH opening	Tho-D	Tho-S	Water pump	CWFV1 opening
	℃	℃	℃	℃	rps	MPaG	MPaG	MPaG	Pulse	Pulse	℃	℃	rpm	%
Operation to top up in summer	25	21	24	65	83	10.35	5.81	4.45	260	310	86	17	2400	65
Operation to top up in intermediary season	16	12	17	65	80	9.89	5.37	4.16	190	380	85	12	2300	65
Operation to top up in winter	7	6	9	90	88	11.65	4.60	3.46	170	230	114	6	2500	35
Operation to top up at frosting	2	1	5	90	104	11.44	4.05	3.04	130	170	125	-2	2300	35
Operation to top up in winter at cold region	-7	-8	5	90	104	10.68	3.59	2.28	130	120	125	-12	2800	60
Operation to top up in winter at cold region ①	-15	-	5	90	104	9.95	3.37	1.83	150	90	121	-19	2500	30
Operation to top up in winter at cold region ②	-25	-	5	90	100	9.66	2.73	1.35	160	80	121	-28	3800	25
Operation to top up at overload	43	26	29	90	96	11.47	5.22	4.04	340	280	103	11	2400	35

(2) Method to purge CO2 refrigerant

- (a) Turn the power ON at the state that SW5-7 on the PCB of the heat pump unit 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) Remove the cap of service valve and connect charge hose
- (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 unit, 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 unit.

(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 N3 gas, for this air tightness test.
- (b) Turn the power ON at the state that SW5-7 on the PCB of the heat pump unit 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 unit.
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 unit.

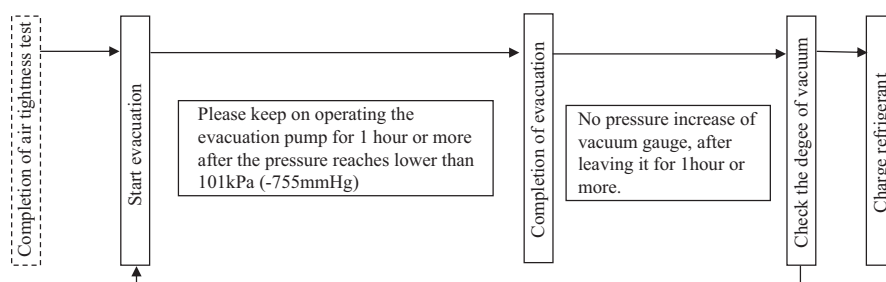
(4) Method of charging refrigerant

- (a) Turn the power ON at the state that SW5-7 on the PCB of the heat pump unit 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) Remove the cap of service valve and connect a gauge manifold and implement evacuation.

[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°C .)
- (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 MentePC 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 unit.

(5) Draining

- (a) Turn the power OFF
- (b) Close the gate valve for the heat pump unit. (Gate valve shall be equipped on site)
- (c) Open the service panel of heat pump unit and open the drain valve (lower side) and air purge valve (upper side) located in the heat pump unit.
- (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 unit. (Water flow into the heat pump unit)
- (d) Open the air purge valve located in the heat pump unit 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]

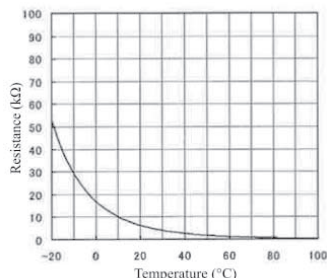
4.2 Error code list

Remote control Error code	LED on heat pump unit		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 controller and heat pump unit
E10	Keep flashing	Stay off	Normal	Excessive connected number of heat pump units to the remote control
E31	Keep flashing	1-time flash	E31	Duplicated address No. of heat pump unit Address setting error of heat pump unit
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 temp. sensor 1 fault (Tho-R1)
		2-time flash	E37-2	Heat exchanger temp. sensor 2 fault (Tho-R2)
		3-time flash	E37-3	Heat exchanger temp. sensor 3 fault (Tho-R3)
		4-time flash	E37-4	Heat exchanger temp. sensor 4 fault (Tho-R4)
		5-time flash	E37-5	Fault of inlet water temp. sensor 1 on gas cooler (Tho-W1)
		6-time flash	E37-6	Fault of outlet water temp. sensor 2 on gas cooler (Tho-W2)
		Keep flashing	E37-7	Fault of inlet gas temp. sensor 1 on gas cooler (Tho-G1)
			E37-9	Fault of outlet gas temp. sensor 3 on gas cooler (Tho-G3)
E38	Keep flashing	1-time flash	E38	Outdoor air temp. sensor fault (Tho-A)
E39	Keep flashing	1-time flash	E39-1	Discharge pipe temp. sensor fault (Tho-D1)
		3-time flash	E39-3	Fault of inlet temp. 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)
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 temp. sensor 1 on unvented cylinder (Th1-1)
		2-time flash	E52-2	Fault of hot water temp. sensor 2 on unvented cylinder (Th1-2)
		3-time flash	E52-3	Fault of hot water temp. sensor 3 on unvented cylinder (Th1-3)
		4-time flash	E52-4	Fault of hot water temp. sensor 4 on unvented cylinder (Th1-4)
		5-time flash	E52-5	Fault of hot water temp. sensor 5 on unvented cylinder (Th1-5)
		6-time flash	E52-6	Fault of hot water temp. sensor 6 on unvented cylinder (Th1-6)
		Keep flashing	E52-7	Fault of hot water temp. sensor 7 on unvented cylinder (Th1-7)
			E52-8	Fault of hot water temp. sensor 8 on unvented cylinder (Th1-8)
			E52-9	Fault of hot water temp. sensor 9 on unvented cylinder (Th1-9)
E53	Keep flashing	1-time flash	E53-1	Suction pipe temp. sensor 1 fault (Tho-S1)
		3-time flash	E53-3	Injection inlet temp 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 temp. sensor 1 fault (Tho-C1)
E56	Keep flashing	1-time flash	E56-1	Power transistor temp. 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)
E60	Keep flashing	1-time flash	E60-1	Rotor position detection failure (CM1)

Remote control Error code	LED on heat source unit		7-segment display	Contents of inspection
	Green	Red		
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)	Keeps flashing	Stays off	Normally	See troubleshooting (Page 92)
No hot water comes out (2)	Keeps flashing	Stays off	Normally	See troubleshooting (Page 93)
No hot water comes out (3)	Keeps flashing	Stays off	Normally	See troubleshooting (Page 94)
Anomalous sound and vibration (1)	Keeps flashing	Stays off	Normally	See troubleshooting (Page 95)
Anomalous sound and vibration (2)	Keeps flashing	Stays off	Normally	See troubleshooting (Page 96)

Maintenance code

Maintenance code is the signal to prompt service and maintenance, not to show anomaly.

7-segment display	RC display	Items	Remarks
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 tank	Check setting of SW3-3 is OFF for sealed tank
oPE-21	M21	Setting error of heat pump unit 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 tank water temp sensor	
oPE-34	M34	Detection of suspension of water supply	
oPE-35	M35	Detection of water pump error	
oPE-40	M40	<div>· Message of [disconnection of cylinder temp sensor] Hot water temp sensor on the cylinder (Tht-1 to Tht-9) may be disconnected.</div> <div>Characteristics of HW temp sensor</div> <div></div>	<div>· Check the connection and the characteristics of all hot water temp sensors on the cylinder and if there is a problem, connect it securely or replace it.</div> <div>· If no problem on sensors, replace control PCB.</div>

4.3 Troubleshooting

Error code	LED	Green	Red	Content
Remote control: No error code	Heat pump unit	Keeps flashing	Stays off	Power supply anomaly (Power supply 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 unit 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	<ul style="list-style-type: none"> • 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 unit	Stays off	Stays off	No display on the remote control

1.Applicable model	5.Troubleshooting				
All models (In case of no display on the remote control)	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>No display on the remote control after the power is supplied</p> <p>NO</p> <p>Is there DC10V or higher voltage on the connecting terminal of remote control?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>Is the connecting wire between the remote control and the heat pump unit connected properly?</p> <p>YES → Connecting wire disconnection</p> <p>NO</p> <p>Is there DC15V or higher voltage between X and Y terminals of heat pump unit?</p> <p>YES → Replace remote control</p> <p>NO</p> <p>Is the voltage between ① and ② of CN18V on the control PCB DC18V?</p> <p>NO → Replace power PCB</p> <p>YES → Replace control PCB</p> </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>No display on the remote control after the power is supplied</p> <p>NO</p> <p>Is there DC10V or higher voltage on the connecting terminal of remote control?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>Is the connecting wire between the remote control and the heat pump unit connected properly?</p> <p>YES → Connecting wire disconnection</p> <p>NO</p> <p>Is there DC15V or higher voltage between X and Y terminals of heat pump unit?</p> <p>YES → Replace remote control</p> <p>NO</p> <p>Is the voltage between ① and ② of CN18V on the control PCB DC18V?</p> <p>NO → Replace power PCB</p> <p>YES → Replace control PCB</p>	
Diagnosis	Countermeasure				
<p>No display on the remote control after the power is supplied</p> <p>NO</p> <p>Is there DC10V or higher voltage on the connecting terminal of remote control?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>After disconnecting the remote control, can DC10V or higher voltage be detected on the R/C wiring?</p> <p>YES → Remote control anomaly</p> <p>NO</p> <p>Is the connecting wire between the remote control and the heat pump unit connected properly?</p> <p>YES → Connecting wire disconnection</p> <p>NO</p> <p>Is there DC15V or higher voltage between X and Y terminals of heat pump unit?</p> <p>YES → Replace remote control</p> <p>NO</p> <p>Is the voltage between ① and ② of CN18V on the control PCB DC18V?</p> <p>NO → Replace power PCB</p> <p>YES → Replace control PCB</p>					
2.Error detection method					
3. Condition of Error displayed					
4.Presumable cause					
<ul style="list-style-type: none"> • 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 unit	Keeps flashing	Stays off	Communication error between remote control and heat pump unit

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 unit is normal)] C -- NO --> E[Replace control PCB Or replace remote control] </pre> <p>* Check whether the message of "It is in operation by standby" is still displayed on the remote control, after 3minutes or more have elapsed.</p>	
3. Condition of Error displayed		
Same as above		
4.Presumable cause		
<ul style="list-style-type: none"> Anomaly of communication circuit between remote control and heat pump unit Noise 		

Note: If the heat pump unit cannot communicate with remote control normally for 180 seconds, the PCB of the heat pump unit automatically resets and starts

Error code	LED	Green	Red	Content
	Heat pump unit	Keeps flashing	Stays off	
Remote control: E10				
Excessive No. of heat pump units connected to one remote control				

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
	<div>Are more than 17 sets of heat pump units connected to one remote control?</div> <div>NO</div> <div>YES</div>	<div>Remote control anomaly →Replace remote control</div> <div>Reduce connecting No. of units to 16 sets or less</div>
2.Error detection method		
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		
<div><div>Excessive No. of units are connected</div><div>Remote control anomaly</div></div>		

Note:

Error code	LED	Green	Red	Content
Remote control: E31 7-segment display: E31	Heat pump unit	Keeps flashing	One time flash	Duplicated address No. of heat pump unit Address setting error of heat pump unit

1. Applicable model	5. Troubleshooting			
All models	Diagnosis		Countermeasure	
2. Error detection method	<p>Save the MentePC data of 30 minutes before stopping</p> <p>Reset the power and start operation again.</p> <p>* Caution The addresses are not confirmed without resetting the power</p> <p>Does the same error reccur? Is E31 diplayed?</p> <p>YES</p> <p>Check the address No. of heat pump units in the same system.</p> <p>Are there any duplicated address No.?</p> <p>YES</p> <p>NO</p>		<ul style="list-style-type: none"> Check the operation status and record it. Check it occurs soon after power ON or during operation. Check current status of connection and address <p>Start test run Take no action to correct. Because it is judged that the power resetting was not done after changing address No.</p> <p>Correct the address No.</p> <p>Replace control PCB of heat pump unit.*</p> <p>* 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.</p>	
3. Condition of Error displayed				
When the duplicated address No. is detected in the same system				
4. Presumable cause				
<ul style="list-style-type: none"> Mistake of setting address on heat pump unit More than 17 units of heat pump unit 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 unit	Keeps flashing	1-time flash	Open phase of power line

1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
2.Error detection method	<div>Save the MentePC data of 30 minutes before stopping</div> <div>Is the primary side of power voltage between phases OK?</div> <div>YES</div> <div>Reset the power and restart</div> <div>Is E32 displayed?</div>	<div>• Check the operation status and record it.</div> <div>• Check it occurs soon after power ON or during operation or during stopping.</div> <div>(When asking the customer to make rectification, it is much easier to explain the situation with this data.</div> <div>Ask the customer to make rectification</div> <div>Check it under the operating conditions 30 minutes before error occurred as possible as you can.</div> <div>Replace control PCB</div> <div>Check operation without any rectifications.</div>
3. Condition of Error displayed		
If the power voltage between L3 and L1 phases or L3 and L2 phases becomes 0V.		
4.Presumable cause		
<div>• Power voltage failure on primary side.</div> <div>• Control PCB anomaly</div>		

Note:

Error code	LED	Green	Red	Content	Discharge pipe temperature anomaly
Remote control: E36 7-segment display: E36	Heat pump unit	Keeps flashing	1 time flash		

1.Applicable model	5.Troubleshooting		
All models	Diagnosis	Countermeasure	
2.Error detection method	<div>Is there any leak of refrigerant?</div> <div>YES</div> <div>NO</div>		
	Specify the leak point and rectify it		
If discharge pipe temp sensor detects anomalous high temp.	<div>Is the refrigerant amount charged properly?</div> <div>NO</div> <div>YES</div>		
	Check the refrigerant amount and charge additionally		
3. Condition of Error displayed	<div>Is the sensor connector inserted to the connector on control PCB properly?</div> <div>NO</div> <div>YES</div>		
	Check the connector and wiring harness and rectify it.		
If discharge pipe temp sensor detects 115℃ or higher for 2 seconds or compressor stops 5 times within 60 minutes.	<div>Is there any anomaly of discharge pipe temp sensor?</div> <div>YES</div> <div>NO</div>		
	Check the output and replace the sensor		
4.Presumable cause	<div>Does the valve of gas injection circuit (SVINJ1) activate normally?</div> <div>NO</div> <div>YES</div>		
	Check the coil of solenoid valve or the sensor and replace it		
• Discharge pipe temp 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.	<div>Do EEVH1 and EEVH2 activate normally?</div> <div>NO</div> <div>YES</div>		
	Check the body of EEV and the coil activation and the sensor and then replace it.		
	<div>Is water circuit normal? (Is high pressure normal?)</div> <div>NO</div> <div>YES</div>		
	Rectify the water circuit		
	It might be compressor failure. Please correct the data and ask further investigation to MHI		

Note:

Error code	LED	Green	Red	Content
Remote control: E37 *1 7-segment display: E37-1 to -9	Heat pump unit	Keeps flashing	*2	Outdoor heat exchanger sensor (Tho-R1, 2, 3, 4) anomaly Gas-cooler temp sensor (Tho-G1, 3, Tho-W1, 2) anomaly

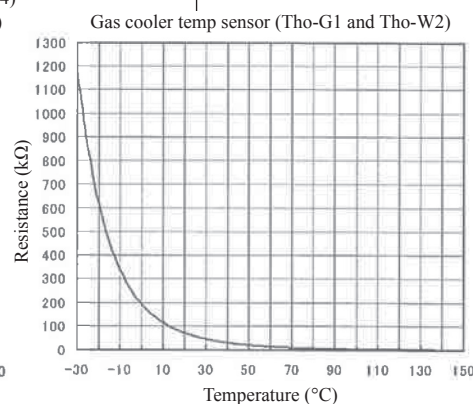
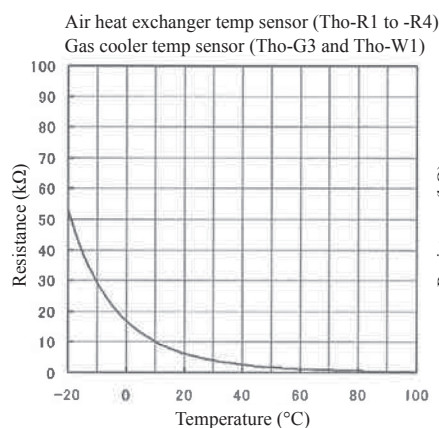
*1 E37-1 to -4: Tho-R1 to -R4, E37-5, -6: Tho-W1, -W2, E37-7, -9: Tho-G1, -G3

*2 According to the kinds of sensors, from 1 to 6 time flash or keeps flashing

1. Applicable model	5. Troubleshooting				
All models					
2. Error detection method	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the MentePC data of 30 minutes before stopping</div> <div style="text-align: center;"> <pre> graph TD A[Save the MentePC 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 temp sensor] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> </div> </td><td> <ul style="list-style-type: none"> • 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 temp shown in mentePC data to the actual temp measured with thermometer. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the MentePC data of 30 minutes before stopping</div> <div style="text-align: center;"> <pre> graph TD A[Save the MentePC 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 temp sensor] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> </div>	<ul style="list-style-type: none"> • 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 temp shown in mentePC data to the actual temp measured with thermometer.
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3. Condition of Error displayed	<p>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.</p>				
4. Presumable cause	<ul style="list-style-type: none"> • 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 				

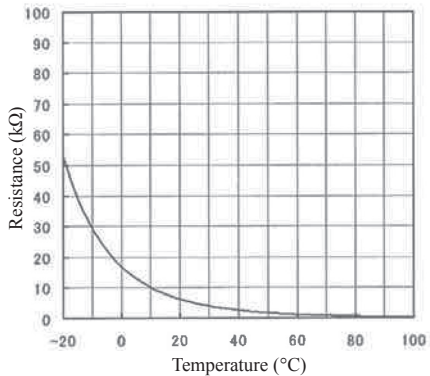
*3 Check several times to prove any poor connection

[Sensor temperature-resistance characteristics]



Note:

Error code	LED	Green	Red	Content
Remote control: E38 7-segment display: E38	Heat pump unit	Keeps flashing	1 time flash	Outdoor air temp sensor (Tho-A) anomaly

1. Applicable model	5. Troubleshooting			
All models	Diagnosis		Countermeasure	
2. Error detection method	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the data 30 minutes before stopping into the MentePC</div> <pre> graph TD A[Save the data 30 minutes before stopping into the MentePC] --> 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 temp sensor (Tho-A)] D -- YES --> F[Replace the control PCB of heat pump unit] </pre>		<ul style="list-style-type: none"> • 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 temp shown in mentePC data to the actual temp measured with thermometer. 	
3. Condition of Error displayed				
4. Presumable cause	<p>*1 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Outdoor air temp sensor (Tho-A)</p> 			

Note:

Error code	LED	Green	Red	Content
Remote control: E39 *1 7-segment display: E39-1, 3	Heat pump unit	Keeps flashing	*2	Discharge pipe temp sensor (Tho-D1) anomaly Intermediate receiver inlet temp sensor (Tho-M1) anomaly

*1 E39-1: Tho-D1, E39-3: Tho-M1

*2 E39-1: One time flash, E39-3: 3 time flash

1. Applicable model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;">Save the MentePC data of 30 minutes before stopping</div> <pre> graph TD A[Save the MentePC 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 temp sensor (Tho-D1 and/or Tho-M1)] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> <p>*3 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Discharge pipe temp sensor (Tho-D1)</p> </div> <div style="text-align: center;"> <p>Intermediate receiver inlet temp sensor (Tho-M1)</p> </div> </div>	
3. Condition of Error displayed	<p>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.</p>	
4. Presumable cause	<ul style="list-style-type: none"> 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 unit	Keeps flashing	1 time flash	High pressure anomaly (63H1-1 activated)

1. Applicable model	5. Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is 63H1-1 activated at 14MPa or higher?</p> <p>NO</p> <p>Is the fuse F2 blown?</p> <p>YES</p> <p>NO</p> <p>Does the sensing value of high pressure sensor show 14MPa? (Is 63H1-1 normal?)</p> <p>NO</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>NO</p> <p>YES</p> <p>Is 63H1-1 normal? Are the connector and the wiring harness of 63H1-1 OK?</p> <p>NO</p> <p>YES</p> <p>7-segment : Check C40</p> <p>Does the unit stop, when the high pressure increases to 14MPa?</p> <p>NO</p> <p>YES</p> <p>Is the feed water OK?</p> <p>• Is the feed water pressure 100kPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO</p> <p>YES</p> <p>Does the refrigerant circuit get clogged?</p> <p>YES</p> <p>NO</p> </td><td> <ul style="list-style-type: none"> 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. <p>Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional parts CWFV3 and V5. After checking, replace fuse F2.</p> <p>High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>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.</p> <p>Replace control PCB</p> <p>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</p> <p>Check the disruption of feed water. Secure a supply of feed water.</p> <p>Clear the clog</p> <p>[Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p> </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is 63H1-1 activated at 14MPa or higher?</p> <p>NO</p> <p>Is the fuse F2 blown?</p> <p>YES</p> <p>NO</p> <p>Does the sensing value of high pressure sensor show 14MPa? (Is 63H1-1 normal?)</p> <p>NO</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>NO</p> <p>YES</p> <p>Is 63H1-1 normal? Are the connector and the wiring harness of 63H1-1 OK?</p> <p>NO</p> <p>YES</p> <p>7-segment : Check C40</p> <p>Does the unit stop, when the high pressure increases to 14MPa?</p> <p>NO</p> <p>YES</p> <p>Is the feed water OK?</p> <p>• Is the feed water pressure 100kPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO</p> <p>YES</p> <p>Does the refrigerant circuit get clogged?</p> <p>YES</p> <p>NO</p>	<ul style="list-style-type: none"> 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. <p>Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional parts CWFV3 and V5. After checking, replace fuse F2.</p> <p>High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>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.</p> <p>Replace control PCB</p> <p>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</p> <p>Check the disruption of feed water. Secure a supply of feed water.</p> <p>Clear the clog</p> <p>[Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p>
Diagnosis	Countermeasure				
<p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is 63H1-1 activated at 14MPa or higher?</p> <p>NO</p> <p>Is the fuse F2 blown?</p> <p>YES</p> <p>NO</p> <p>Does the sensing value of high pressure sensor show 14MPa? (Is 63H1-1 normal?)</p> <p>NO</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>NO</p> <p>YES</p> <p>Is 63H1-1 normal? Are the connector and the wiring harness of 63H1-1 OK?</p> <p>NO</p> <p>YES</p> <p>7-segment : Check C40</p> <p>Does the unit stop, when the high pressure increases to 14MPa?</p> <p>NO</p> <p>YES</p> <p>Is the feed water OK?</p> <p>• Is the feed water pressure 100kPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO</p> <p>YES</p> <p>Does the refrigerant circuit get clogged?</p> <p>YES</p> <p>NO</p>	<ul style="list-style-type: none"> 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. <p>Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional parts CWFV3 and V5. After checking, replace fuse F2.</p> <p>High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>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.</p> <p>Replace control PCB</p> <p>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</p> <p>Check the disruption of feed water. Secure a supply of feed water.</p> <p>Clear the clog</p> <p>[Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p>				
2. Error detection method					
When high pressure switch 63H1-1 is activated					
3. Condition of Error displayed					
<ul style="list-style-type: none"> High pressure increases to 14MPa or higher. 63H1-1 is activated 5 times within 60minutes. 63H1-1 is activated for 60minutes continuously. 					
4. Presumable cause					
<ul style="list-style-type: none"> Short-circuit of airflow at air heat exchanger/Disturbance of airflow/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 					

Note: If the same error does not reappear, continue to get data with MentePC.

Error code	LED	Green	Red	Content
Remote control: E41 (E51) 7-segment display: E41 (E51) -1	Heat pump unit	Keeps flashing	1 time flash	Power transistor overheat

1.Applicable model	5.Troubleshooting				
All models	<table> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> <tr> <td> <p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the outdoor fan of heat pump unit rotating?</p> <p>NO →</p> <p>YES →</p> <p>Reset the power and restart operation</p> <p>After restarting operation, does the same error reappear?</p> <p>NO →</p> <p>YES →</p> <p>Is the inverter cooling fan rotating?</p> <p>NO →</p> <p>YES →</p> <p>Is DC15V of power voltage detected at the C19 terminal of inverter PCB?</p> <p>NO →</p> <p>YES →</p> <p>After power OFF</p> <p>Is the connection of power transistor sensor connector OK? (Check short circuit and disconnection of wiring harness)</p> <p>NO →</p> <p>YES →</p> <p>Is the characteristics of power transistor temp sensor OK?*</p> <p>NO →</p> <p>YES →</p> <p>Is the power transistor mounted properly? (Check tightening of screws and application of silicon for radiation)</p> <p>NO →</p> <p>YES →</p> </td><td> <p>• Check the operation status and record it. • Check the power transistor temp • Check the operation of outdoor fan of heat pump unit and the operation of inverter cooling fan</p> <p>Rectify it according to the troubleshooting procedure of E48</p> <p>Restart operation under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Wait and see (If possible, collect the operation data continuously)</p> <p>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.</p> <p>After checking loose connection of connector or disconnection of wiring harness, replace inverter PCB</p> <p>Connect the connector of sensor securely. Or replace the sensor.</p> <p>Replace the power transistor sensor.</p> <p>Apply the silicon for radiation to the power transistor and mount the power transistor on to the radiation fin securely.</p> <p>Replace the power transistor.</p> </td></tr> </table>	Diagnosis	Countermeasure	<p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the outdoor fan of heat pump unit rotating?</p> <p>NO →</p> <p>YES →</p> <p>Reset the power and restart operation</p> <p>After restarting operation, does the same error reappear?</p> <p>NO →</p> <p>YES →</p> <p>Is the inverter cooling fan rotating?</p> <p>NO →</p> <p>YES →</p> <p>Is DC15V of power voltage detected at the C19 terminal of inverter PCB?</p> <p>NO →</p> <p>YES →</p> <p>After power OFF</p> <p>Is the connection of power transistor sensor connector OK? (Check short circuit and disconnection of wiring harness)</p> <p>NO →</p> <p>YES →</p> <p>Is the characteristics of power transistor temp sensor OK?*</p> <p>NO →</p> <p>YES →</p> <p>Is the power transistor mounted properly? (Check tightening of screws and application of silicon for radiation)</p> <p>NO →</p> <p>YES →</p>	<p>• Check the operation status and record it. • Check the power transistor temp • Check the operation of outdoor fan of heat pump unit and the operation of inverter cooling fan</p> <p>Rectify it according to the troubleshooting procedure of E48</p> <p>Restart operation under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Wait and see (If possible, collect the operation data continuously)</p> <p>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.</p> <p>After checking loose connection of connector or disconnection of wiring harness, replace inverter PCB</p> <p>Connect the connector of sensor securely. Or replace the sensor.</p> <p>Replace the power transistor sensor.</p> <p>Apply the silicon for radiation to the power transistor and mount the power transistor on to the radiation fin securely.</p> <p>Replace the power transistor.</p>
Diagnosis	Countermeasure				
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2.Error detection method					
When anomalously high temperature is detected					
3. Condition of Error displayed					
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					
<ul style="list-style-type: none"> Power transistor anomaly Power transistor temp sensor anomaly Anomalous power supply to inverter PCB 					

Note: Inverter cooling fan is operated under the condition mentioned at right.
If the same error does not reappear, continue to get data with MentePC.



Error code	LED	Green	Red	Content
Remote control: E42 7-segment display: E42	Heat pump unit	Keeps 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> <p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the winding wire resistance and the meggar check of motor insulation of compressor OK?</p> <p>NO →</p> <p>YES →</p> <p>Is the fan of heat pump unit rotating?</p> <p>NO →</p> <p>YES →</p> <p>Reset the power and restart operation</p> <p>Does E42 recur?</p> <p>NO →</p> <p>YES →</p> <p>* See checking method on page 140</p> <p>Do you have an inverter checker* for judging inverter PCB anomaly?</p> <p>YES →</p> <p>Is the checked result of inverter PCB OK?</p> <p>NO →</p> <p>YES →</p> <p>NO →</p> <p>** As for how to address the 2nd layer, please refer to PCB replacement procedure</p> <p>Turn the power OFF and check the 2nd layer of the controller **</p> <p>Measure the resistance of power transistor module (Does it short circuited?)</p> <p>Short circuited →</p> <p>Normal →</p> </td><td> <ul style="list-style-type: none"> Check the operation status and record it. Is anomalous pressure detected? Does the fan motor of heat pump unit run? <p>Replace compressor If necessary, replace capillary tube of oil separator and strainer as well.</p> <p>Rectify it according to the troubleshooting procedure of E48</p> <p>Restart operation under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Wait and see (If possible, collect the operation data continuously)</p> <p>Replace power transistor Replace inverter PCB</p> <p>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 140 for details) Replace inverter PCB</p> </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the winding wire resistance and the meggar check of motor insulation of compressor OK?</p> <p>NO →</p> <p>YES →</p> <p>Is the fan of heat pump unit rotating?</p> <p>NO →</p> <p>YES →</p> <p>Reset the power and restart operation</p> <p>Does E42 recur?</p> <p>NO →</p> <p>YES →</p> <p>* See checking method on page 140</p> <p>Do you have an inverter checker* for judging inverter PCB anomaly?</p> <p>YES →</p> <p>Is the checked result of inverter PCB OK?</p> <p>NO →</p> <p>YES →</p> <p>NO →</p> <p>** As for how to address the 2nd layer, please refer to PCB replacement procedure</p> <p>Turn the power OFF and check the 2nd layer of the controller **</p> <p>Measure the resistance of power transistor module (Does it short circuited?)</p> <p>Short circuited →</p> <p>Normal →</p>	<ul style="list-style-type: none"> Check the operation status and record it. Is anomalous pressure detected? Does the fan motor of heat pump unit run? <p>Replace compressor If necessary, replace capillary tube of oil separator and strainer as well.</p> <p>Rectify it according to the troubleshooting procedure of E48</p> <p>Restart operation under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Wait and see (If possible, collect the operation data continuously)</p> <p>Replace power transistor Replace inverter PCB</p> <p>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 140 for details) Replace inverter PCB</p>
Diagnosis	Countermeasure				
<p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the winding wire resistance and the meggar check of motor insulation of compressor OK?</p> <p>NO →</p> <p>YES →</p> <p>Is the fan of heat pump unit rotating?</p> <p>NO →</p> <p>YES →</p> <p>Reset the power and restart operation</p> <p>Does E42 recur?</p> <p>NO →</p> <p>YES →</p> <p>* See checking method on page 140</p> <p>Do you have an inverter checker* for judging inverter PCB anomaly?</p> <p>YES →</p> <p>Is the checked result of inverter PCB OK?</p> <p>NO →</p> <p>YES →</p> <p>NO →</p> <p>** As for how to address the 2nd layer, please refer to PCB replacement procedure</p> <p>Turn the power OFF and check the 2nd layer of the controller **</p> <p>Measure the resistance of power transistor module (Does it short circuited?)</p> <p>Short circuited →</p> <p>Normal →</p>	<ul style="list-style-type: none"> Check the operation status and record it. Is anomalous pressure detected? Does the fan motor of heat pump unit run? <p>Replace compressor If necessary, replace capillary tube of oil separator and strainer as well.</p> <p>Rectify it according to the troubleshooting procedure of E48</p> <p>Restart operation under the operating conditions 30 minutes before error occurred as possible as you can.</p> <p>Wait and see (If possible, collect the operation data continuously)</p> <p>Replace power transistor Replace inverter PCB</p> <p>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 140 for details) Replace inverter PCB</p>				
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					
<ul style="list-style-type: none"> Compressor anomaly Leak of refrigerant Power transistor anomaly Anomalous power votage 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 MentePC.

Error code	LED	Green	Red	Content
Remote control: E45 7-segment display: E45-1	Heat pump unit	Keeps 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	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is the LED 2 on the control PCB flashing?</p> <p>NO → Replace control PCB</p> <p>YES → Is the LED 1 on the inverter PCB flashing?</p> <p>NO → Replace inverter PCB Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional 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. Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Is the fuse F2 blown?</p> <p>YES → Reset the power and restart</p> <p>NO → Reset the power and restart</p> <p>Does E45 recur?</p> <p>NO → Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Does 63H1 activate at the pressure 14MPa or higher?</p> <p>YES → Does the high pressure sensor (PSH1) show 14MPa?</p> <p>NO → High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>YES → Is the feed water OK? • Is the feed water pressure 100KPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO → Check the disruption of feed water. Secure a supply of feed water.</p> <p>YES → Does the refrigerant circuit get clogged?</p> <p>YES → Clear the clog</p> <p>NO → [Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>YES → Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>NO → Go to next page</p> </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is the LED 2 on the control PCB flashing?</p> <p>NO → Replace control PCB</p> <p>YES → Is the LED 1 on the inverter PCB flashing?</p> <p>NO → Replace inverter PCB Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional 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. Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Is the fuse F2 blown?</p> <p>YES → Reset the power and restart</p> <p>NO → Reset the power and restart</p> <p>Does E45 recur?</p> <p>NO → Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Does 63H1 activate at the pressure 14MPa or higher?</p> <p>YES → Does the high pressure sensor (PSH1) show 14MPa?</p> <p>NO → High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>YES → Is the feed water OK? • Is the feed water pressure 100KPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO → Check the disruption of feed water. Secure a supply of feed water.</p> <p>YES → Does the refrigerant circuit get clogged?</p> <p>YES → Clear the clog</p> <p>NO → [Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>YES → Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>NO → Go to next page</p>	
Diagnosis	Countermeasure				
<p>Save the data 30 minutes before stopping into the MentePC</p> <p>Is the LED 2 on the control PCB flashing?</p> <p>NO → Replace control PCB</p> <p>YES → Is the LED 1 on the inverter PCB flashing?</p> <p>NO → Replace inverter PCB Check the cause of F2 blown. Check wiring mistake and short circuit of AC200V line. Especially check wiring mistake of optional 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. Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Is the fuse F2 blown?</p> <p>YES → Reset the power and restart</p> <p>NO → Reset the power and restart</p> <p>Does E45 recur?</p> <p>NO → Wait and see (If possible, collect the operation data continuously)</p> <p>YES → Does 63H1 activate at the pressure 14MPa or higher?</p> <p>YES → Does the high pressure sensor (PSH1) show 14MPa?</p> <p>NO → High pressure sensor anomaly is suspected. After restarting operation, check the high pressure sensor itself. (If the high pressure sensor has anomaly, replace it)</p> <p>YES → Is the feed water OK? • Is the feed water pressure 100KPa or higher? • Was air purge done? • Does water stoppage occur?</p> <p>NO → Check the disruption of feed water. Secure a supply of feed water.</p> <p>YES → Does the refrigerant circuit get clogged?</p> <p>YES → Clear the clog</p> <p>NO → [Check items] Gas cooler, Strainer, Lack of water, Clogging of gas cooler</p> <p>Is there loose connection of 63H1 at the connector on the PCB or disconnection of 63H1 wire?</p> <p>YES → Connect the connector securely. Rectify the disconnection of 63H1 wire.</p> <p>NO → Go to next page</p>					
2. Error detection method					
When the communication between inverter PCB and control PCB of heat pump unit is not established.					
3. Condition of Error displayed					
Same as above					
4. Presumable cause					
<ul style="list-style-type: none"> • 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 MentePC.

Error code Remote control: E45 7-segment display: E45-1	LED Heat pump unit	Green Keeps flashing	Red 1 time flash	Content Communication error between inverter PCB and control PCB High pressure anomaly (63H1-1 activated)
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1.Applicable model	5.Troubleshooting	
All models	Diagnosis	Countermeasure
	<div>From previous page</div> <div>(Check after Power OFF) Is the connection of wiring harness and connector between inverter PCB and control PCB</div> <div>NO</div> <div>YES</div> <div>Is the inrush current suppression resistance</div> <div>YES</div> <div>NO</div> <div>Is the connection of wiring harness between diode module and inverter PCB OK ?</div> <div>YES</div> <div>Is the Dip switch setting of inverter PCB correct?*</div> <div>NO</div> <div>YES</div> <div><div>[Setting of Dip switch on inverter PCB]</div><div><div>JSW10-1 OFF JSW11-1 ON</div><div>-2 OFF -2 OFF</div><div>-3 OFF -3 ON</div><div>-4 OFF -4 OFF</div></div></div>	<div>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.</div> <div>Check the disconnection of wiring harness and loose connection of connector. If there is a problem, correct it</div> <div>Correct the setting of Dip switch</div> <div>Replace inverter PCB</div>
2.Error detection method		
3. Condition of Error displayed		
4.Presumable cause		

Error code	LED	Green	Red	Content
Remote control: E48 7-segment display: E48-1, 2	Heat pump unit	Keeps flashing	*1	Heat pump unit DC fan motor anomaly

*1 E48-1: FMo1 1 time flash

E48-2: FMo2 2 time flash

1.Applicable model	5.Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <div>Save the MentePC data of 30 minutes before stopping</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Does the fan motor of heatpump unit rotate smoothly when turning it by hand?</div> <div>NO → Replace fan motor</div> <div>YES</div> <div>Disconnect the connectors of fan motor & CN15V connector from control PCB</div> <div>Power ON</div> <div>Is DC15V detected* at CN15V connector on harness side?</div> <div>NO → Repalce power PCB</div> <div>YES</div> <div>Reconnect CN15V connector</div> <div>Is DC15V detected* at CN15V connector on the control PCB?</div> <div>NO → Repalce control PCB</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Connect the connector of fan motor</div> <div>Power ON</div> <div>Does E48 recur 10 seconds after starting compressor?</div> <div>NO → Wait and see (If possible, collect the operation data continuously with MentePC) Since other error may occur, rectify according to the troubleshooting procedure of the error occurred</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Switch over the control signal for 2 fan motors by changing over the connectors on control PCB</div> <div>Power ON</div> <div>Does the faulty fan motor switch to the other one?</div> <div>NO → Replace fan motor</div> <div>YES → Replace control PCB</div> </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	<div>Save the MentePC data of 30 minutes before stopping</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Does the fan motor of heatpump unit rotate smoothly when turning it by hand?</div> <div>NO → Replace fan motor</div> <div>YES</div> <div>Disconnect the connectors of fan motor & CN15V connector from control PCB</div> <div>Power ON</div> <div>Is DC15V detected* at CN15V connector on harness side?</div> <div>NO → Repalce power PCB</div> <div>YES</div> <div>Reconnect CN15V connector</div> <div>Is DC15V detected* at CN15V connector on the control PCB?</div> <div>NO → Repalce control PCB</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Connect the connector of fan motor</div> <div>Power ON</div> <div>Does E48 recur 10 seconds after starting compressor?</div> <div>NO → Wait and see (If possible, collect the operation data continuously with MentePC) Since other error may occur, rectify according to the troubleshooting procedure of the error occurred</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Switch over the control signal for 2 fan motors by changing over the connectors on control PCB</div> <div>Power ON</div> <div>Does the faulty fan motor switch to the other one?</div> <div>NO → Replace fan motor</div> <div>YES → Replace control PCB</div>	
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<div>Save the MentePC data of 30 minutes before stopping</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Does the fan motor of heatpump unit rotate smoothly when turning it by hand?</div> <div>NO → Replace fan motor</div> <div>YES</div> <div>Disconnect the connectors of fan motor & CN15V connector from control PCB</div> <div>Power ON</div> <div>Is DC15V detected* at CN15V connector on harness side?</div> <div>NO → Repalce power PCB</div> <div>YES</div> <div>Reconnect CN15V connector</div> <div>Is DC15V detected* at CN15V connector on the control PCB?</div> <div>NO → Repalce control PCB</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Connect the connector of fan motor</div> <div>Power ON</div> <div>Does E48 recur 10 seconds after starting compressor?</div> <div>NO → Wait and see (If possible, collect the operation data continuously with MentePC) Since other error may occur, rectify according to the troubleshooting procedure of the error occurred</div> <div>YES</div> <div>Power OFF (Wait for 3 minutes)</div> <div>Switch over the control signal for 2 fan motors by changing over the connectors on control PCB</div> <div>Power ON</div> <div>Does the faulty fan motor switch to the other one?</div> <div>NO → Replace fan motor</div> <div>YES → Replace control PCB</div>					
2.Error detection method	<ul style="list-style-type: none"> When 400min⁻¹ or lower of fan rotating speed command and the status of over current are detected 10 times continuously. When 100min⁻¹ or lower of actual fan rotating speed is detected for 30 seconds continuously (Fan motor is locked) 				
3. Condition of Error displayed	Same as above				
4.Presumable cause	<ul style="list-style-type: none"> Disconnection of wiring harness or loose connection of connector Fan motor anomaly Control PCB anomaly 				

Note: If the same error does not reappear, continue to get data with MentePC.

Error code	LED	Green	Red	Content
Remote control: E49 7-segment display: E49-1	Heat pump unit	Keeps flashing	1 time flash	Low pressure anomaly

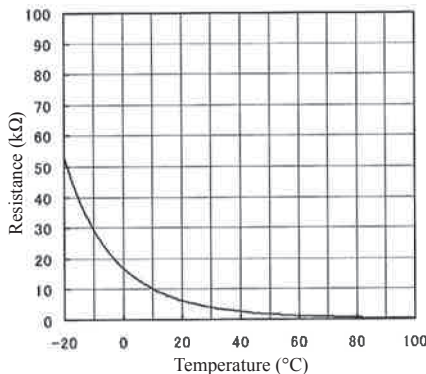
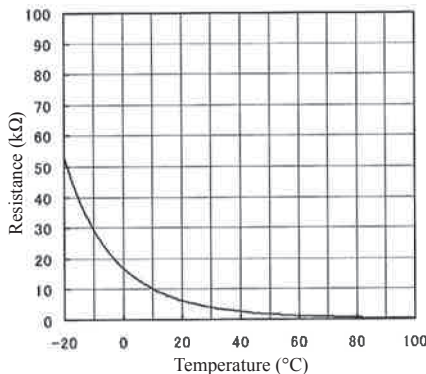
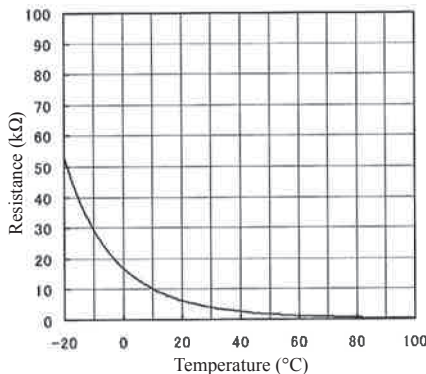
1.Applicable model	5.Troubleshooting				
All models	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Before starting operation, is the power to the heat pump unit turned ON?</p> <p>NO →</p> <p>YES ↓</p> <p>Is the refrigerant amount adequate? (If recharging refrigerant after rectification, check whether the specified refrigerant amount was charged.)</p> <p>NO →</p> <p>YES ↓</p> <p>Is there any leak of refrigerant? Is balancing pressure higher or lower than the pressure of saturated temperature?*</p> <p>YES →</p> <p>NO ↓</p> <p>Reset the power and restart operation</p> <p>Does low pressure become altered after starting operation?</p> <p>NO →</p> <p>YES ↓</p> <p>Does the opening of EEVH1, H2 change?</p> <p>NO →</p> <p>YES ↓</p> <p>Is the EEV coil OK? (Check continuity)</p> <p>NO →</p> <p>YES →</p> </td><td> <p>The refrigerant may be accumulated in the accumulator. After supplying power for more than 6 hours, restart operation</p> <p>Purge refrigerant and recharge refrigerant properly.</p> <p>Refrigerant is leaking. Specify the leak point and after rectifying the leak point, recharge refrigerant properly</p> <p>* In case of 31°C or lower</p> <p>Correct the connection</p> <p>Check the low pressure sensor. If it has a problem, replace the sensor</p> <p>Check connection of connectors and characteristics of sensors of Th-R1, -R2, -R3 and -R4</p> <p>Replace EEV coil</p> <p>Clogging of strainer or anomaly of the EEV body may cause. Check them. If it has a problem, replace it.</p> </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Before starting operation, is the power to the heat pump unit turned ON?</p> <p>NO →</p> <p>YES ↓</p> <p>Is the refrigerant amount adequate? (If recharging refrigerant after rectification, check whether the specified refrigerant amount was charged.)</p> <p>NO →</p> <p>YES ↓</p> <p>Is there any leak of refrigerant? Is balancing pressure higher or lower than the pressure of saturated temperature?*</p> <p>YES →</p> <p>NO ↓</p> <p>Reset the power and restart operation</p> <p>Does low pressure become altered after starting operation?</p> <p>NO →</p> <p>YES ↓</p> <p>Does the opening of EEVH1, H2 change?</p> <p>NO →</p> <p>YES ↓</p> <p>Is the EEV coil OK? (Check continuity)</p> <p>NO →</p> <p>YES →</p>	<p>The refrigerant may be accumulated in the accumulator. After supplying power for more than 6 hours, restart operation</p> <p>Purge refrigerant and recharge refrigerant properly.</p> <p>Refrigerant is leaking. Specify the leak point and after rectifying the leak point, recharge refrigerant properly</p> <p>* In case of 31°C or lower</p> <p>Correct the connection</p> <p>Check the low pressure sensor. If it has a problem, replace the sensor</p> <p>Check connection of connectors and characteristics of sensors of Th-R1, -R2, -R3 and -R4</p> <p>Replace EEV coil</p> <p>Clogging of strainer or anomaly of the EEV body may cause. Check them. If it has a problem, replace it.</p>
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2.Error detection method					
<p>Detection of anomalously low pressure</p> <ul style="list-style-type: none"> • 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					
<ul style="list-style-type: none"> • 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 unit	Keeps flashing	* 2	Anomaly of hot water temp 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: Keeps flashing,

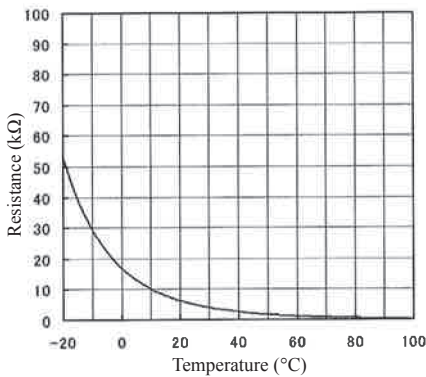
1. Applicable Model	5. Troubleshooting				
All models					
2. Error detection method					
Detection of anomalously low temperature (resistance) of hot water temp sensor for unvented cylinder					
3. Condition of Error displayed					
If the sensor detects anomalously low temp for 20 seconds continuously 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					
<ul style="list-style-type: none"> 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 	<table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the connector of the anomalous sensor connected properly?</p> <p>NO → Insert the connector securely</p> <p>YES</p> <p>Are the characteristics of sensor OK? *3</p> <p>NO → Replace the hot water temp sensor for unvented cylinder (Tht-1 to -9)</p> <p>YES → Replace the control PCB of heat pump unit</p> <p>*3 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Hot water temp sensor for unvented cylinder (Tht-1 to -9)</p>  </td><td> <ul style="list-style-type: none"> 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 temp shown in mentePC data to the actual temp measured with thermometer. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the connector of the anomalous sensor connected properly?</p> <p>NO → Insert the connector securely</p> <p>YES</p> <p>Are the characteristics of sensor OK? *3</p> <p>NO → Replace the hot water temp sensor for unvented cylinder (Tht-1 to -9)</p> <p>YES → Replace the control PCB of heat pump unit</p> <p>*3 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Hot water temp sensor for unvented cylinder (Tht-1 to -9)</p> 	<ul style="list-style-type: none"> 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 temp shown in mentePC data to the actual temp measured with thermometer.
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Note:

Error code	LED	Green	Red	Content
Remote control: E53 * 1 7-segment display: E53-1, -3	Heat pump unit	Keeps flashing	* 2	Suction pipe temp sensor (Tho-S1) anomaly Injection inlet temp sensor (Tho-INJ1) anomaly

* 1 E53-1: Tho-S1, E53-3: Tho-INJ1

* 2 E53-1: 1 time flash, E53-3: 3 time flash

<h3>1. Applicable Model</h3> <p>All models</p>	<h3>5. Troubleshooting</h3> <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the connector of the anomalous sensor connected properly?</p> <p>YES</p> <p>Are the characteristics of sensor OK? *3</p> <p>NO</p> <p>YES</p> </td><td> <ul style="list-style-type: none"> 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 temp shown in mentePC data to the actual temp measured with thermometer. <p>Insert the connector securely</p> <p>Replace temp sensor (Tho-S1, Tho-INJ1)</p> <p>Replace the control PCB of heat pump unit</p> </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the MentePC data of 30 minutes before stopping</p> <p>Is the connector of the anomalous sensor connected properly?</p> <p>YES</p> <p>Are the characteristics of sensor OK? *3</p> <p>NO</p> <p>YES</p>	<ul style="list-style-type: none"> 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 temp shown in mentePC data to the actual temp measured with thermometer. <p>Insert the connector securely</p> <p>Replace temp sensor (Tho-S1, Tho-INJ1)</p> <p>Replace the control PCB of heat pump unit</p>												
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<h3>2. Error detection method</h3> <p>Detection of anomalously low temperature (resistance) of temp sensor. (Tho-S1, Tho-INJ1)</p>																	
<h3>3. Condition of Error displayed</h3> <p>If the sensor detects -50°C or lower temp for 5 seconds continuously</p>																	
<h3>4. Presumable cause</h3> <ul style="list-style-type: none"> 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 	<p>*3 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Suction pipe temp sensor (Tho-S1) Injection inlet temp sensor (Tho-INJ1)</p>  <table border="1"> <caption>Sensor temperature-resistance characteristics (approximate data points)</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
Temperature (°C)	Resistance (kΩ)																
-20	50																
0	20																
20	10																
40	5																
60	2																
80	1																
100	0.5																

Note:

Error code	LED	Green	Red	Content
Remote control: E54 * 1 7-segment display: E54-1, -2, -3	Heat pump unit	Keeps flashing	* 2	High pressure/Intermediate pressure/ Low pressure sensor anomaly (PSH/PSM/PSL)

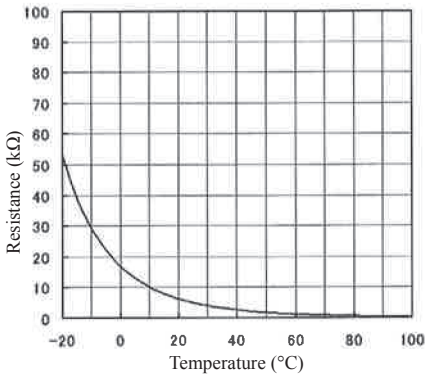
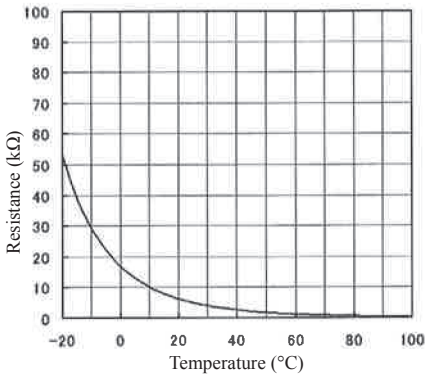
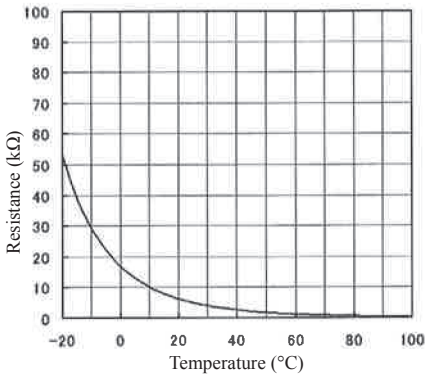
* 1 E54-1: Low pressure sensor, E54-2: High pressure sensor, E54-3: Intermediate pressure sensor

* 2 E54-1: 1 time flash, E54-2: 2 time flash, E54-3: 3 time flash

<h3>1. Applicable Model</h3> <p>All models</p>	<h3>5. Troubleshooting</h3>						
<h3>2. Error detection method</h3> <p>Detection of anomalous pressure (resistance) of PSL/PSM/PSH</p> <table border="1"> <tr> <td>High pressure</td><td>0 - 14MPa</td></tr> <tr> <td>Intermediate pressure</td><td>0 - 10MPa</td></tr> <tr> <td>Low pressure</td><td>0 - 10MPa</td></tr> </table>	High pressure	0 - 14MPa	Intermediate pressure	0 - 10MPa	Low pressure	0 - 10MPa	<h3>Diagnosis</h3> <pre> graph TD A[Save the MentePC data of 30 minutes before stopping] --> B[Check the data of 30 minutes before stopping] B --> C{Does anomalous pressure occur?} C -- YES --> D{Is the connection of connector of the anomalous sensor to the control PCB OK?} D -- NO --> E[Insert the connector of sensor securely and restart operation] D -- YES --> F[Reset the power and restart operation] C -- NO --> F F --> G{Is the pressure value indicated on MentePC same as that measured with pressure gauge? *} G -- YES --> H{Does the same error recur?} H -- YES --> I[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...)] H -- NO --> J[Temporary malfunction by noise. If noise source can be specified, take a measure.] G -- NO --> K[Measure the output voltage of sensor] K --> L{Is the measured output voltage of sensor same as that shown in following characteristics?} L -- YES --> M[Replace control PCB] L -- NO --> N[Replace sensor] </pre> <p>* From the viewpoint of safety, pressure cannot be measured with pressure gauge during operation. Please check pressure during stopping operation</p> <div style="display: flex; justify-content: space-around;"> <div> <p>[Output characteristics of high pressure sensor] (Up to 15MPa)</p> </div> <div> <p>[Output characteristics of intermediate /low pressure sensor] (Up to 10MPa)</p> </div> </div> <p>Pressure sensor output voltage : To measure between Black-White</p> <h3>Countermeasure</h3> <ul style="list-style-type: none"> • Check the operation status and record it. • Check it occurs soon after power ON or during operation or during stopping. • Check sensing value
High pressure	0 - 14MPa						
Intermediate pressure	0 - 10MPa						
Low pressure	0 - 10MPa						
<h3>3. Condition of Error displayed</h3> <p>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.</p>							
<h3>4. Presumable cause</h3> <ul style="list-style-type: none"> • 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 unit	Keeps flashing	1 time flash	Under-dome temp sensor (Tho-C1) anomaly

<h3>1. Applicable Model</h3> <p>All models</p>	<h3>5. Troubleshooting</h3> <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <p>Save the MentePC data of 30 minutes before stopping</p> <pre> graph TD A[Save the MentePC 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 under-dome temp sensor (Tho-C1)] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> <p>*1 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Under-dome temp sensor (Tho-C1)</p>  </td><td> <ul style="list-style-type: none"> • 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 temp shown in mentePC data to the actual temp measured with thermometer. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>Save the MentePC data of 30 minutes before stopping</p> <pre> graph TD A[Save the MentePC 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 under-dome temp sensor (Tho-C1)] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> <p>*1 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Under-dome temp sensor (Tho-C1)</p> 	<ul style="list-style-type: none"> • 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 temp shown in mentePC data to the actual temp measured with thermometer.
Diagnosis	Countermeasure				
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<h3>2. Error detection method</h3> <p>Detection of anomalously low temperature (resistance) of temp sensor. (Tho-C1)</p>					
<h3>3. Condition of Error displayed</h3> <p>If the sensor detects -50°C or lower temp for 5 seconds continuously</p>					
<h3>4. Presumable cause</h3> <ul style="list-style-type: none"> • 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 unit	Keeps flashing	1 time flash	Powe transistor temp sensor (Tho-P1) anomaly

1. Applicable Model	5. Troubleshooting																		
All models																			
2. Error detection method																			
Detection of anomalously low temperature (resistance) of power transistor temp 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																			
<ul style="list-style-type: none"> • 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 																			
	<p>Diagnosis</p> <pre> graph TD A[Save the MentePC 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 temp sensor (Tho-P1)] D -- YES --> F[Replace the control PCB of heat pump unit] </pre> <p>Countermeasure</p> <ul style="list-style-type: none"> • 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 temp shown in mentePC data to the acutal temp measured with thermometer. <p>• Insert the connector securely</p> <p>• Replace power transistor temp sensor (Tho-P1)</p> <p>• Replace the control PCB of heat pump unit</p> <p>*3 Check several times to prove any poor connection</p> <p>[Sensor temperature-resistance characteristics]</p> <p>Power transistor temp sensor (Tho-P1)</p> <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>50</td></tr> <tr><td>60</td><td>25</td></tr> <tr><td>80</td><td>10</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	50	60	25	80	10	100	5	120	2	140	1
Temperature (°C)	Resistance (kΩ)																		
0	180																		
20	100																		
40	50																		
60	25																		
80	10																		
100	5																		
120	2																		
140	1																		

Note:

Error code	LED	Green	Red	Content
Remote control: E58 7-segment display: E58-1	Heat pump unit	Keeps flashing	1-time flash	Compressor anomaly by loss of synchronism

<h3>1. Applicable Model</h3> <p>All models</p>	<h3>5. Troubleshooting</h3> <table border="1"> <thead> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> </thead> <tbody> <tr> <td> <pre> graph TD A[Save the MentePC data of 30 minutes before stopping] --> B[Check the data 30 minutes before stopping] B --> C{Is this the first time to start up within 1 hour after the power ON?} C -- YES --> D[There is a possibility that the liquid refrigerant is migrated in the compressor. Wait for about one hour with keeping the power supplying and then restart operation. (In order to evaporate the liquid refrigerant migrated in the compressor by supplying power to the crankcase heater.)] C -- NO --> E{Are there any maintenance history to replace inverter PCB?} E -- YES --> F[There is a possibility to be done wrong setting of model selection switch. Check the setting of Dip switch] E -- NO --> G[Compressor lock may cause. Replace compressor] </pre> </td><td> <ul style="list-style-type: none"> • Check the operation status and record it. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<pre> graph TD A[Save the MentePC data of 30 minutes before stopping] --> B[Check the data 30 minutes before stopping] B --> C{Is this the first time to start up within 1 hour after the power ON?} C -- YES --> D[There is a possibility that the liquid refrigerant is migrated in the compressor. Wait for about one hour with keeping the power supplying and then restart operation. (In order to evaporate the liquid refrigerant migrated in the compressor by supplying power to the crankcase heater.)] C -- NO --> E{Are there any maintenance history to replace inverter PCB?} E -- YES --> F[There is a possibility to be done wrong setting of model selection switch. Check the setting of Dip switch] E -- NO --> G[Compressor lock may cause. Replace compressor] </pre>	<ul style="list-style-type: none"> • Check the operation status and record it.
Diagnosis	Countermeasure				
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<h3>2. Error detection method</h3> <p>When E58 is displayed on the 7-segment LED display</p>					
<h3>3. Condition of Error displayed</h3> <p>If this anomaly is established 4 times within 15 minutes</p>					
<h3>4. Presumable cause</h3> <ul style="list-style-type: none"> • Insufficient communication hours before start operation. (Start operation without supplying power to the crankcase heater in advance) • Compressor anomaly 					

Note: If the same error does not reappear, continue to get data with MentePC.

Error code	LED	Green	Red	Content
Remote control: E59 7-segment display: E59-1	Heat pump unit	Keeps flashing	1 time flash	Compressor startup failure

1. Applicable Model	5. Troubleshooting				
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Diagnosis	Countermeasure				
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2. Error detection method					
When it fails to change over to the operation for rotor position detection of compressor motor (If the compressor speed cannot increase 11Hz or higher)					
3. Condition of Error displayed					
If the compressor fails to startup 20 times (10 patterns x 2 times) continuously.					
4. Presumable cause					
<ul style="list-style-type: none"> • Anomalous power supply 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 MentePC.

Error code	LED	Green	Red	Content
Remote control: E60 7-segment display: E60-1	Heat pump unit	Keeps 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 mentePC data of 30 minutes before stopping] --> B{Is power supply voltage OK?} B -- NO --> C[Correct it] B -- YES --> D[Reset the power 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> <ul style="list-style-type: none"> • Check the operation status and record it. </td></tr> </tbody> </table>	Diagnosis	Countermeasure	<pre> graph TD A[Save the mentePC data of 30 minutes before stopping] --> B{Is power supply voltage OK?} B -- NO --> C[Correct it] B -- YES --> D[Reset the power 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>	<ul style="list-style-type: none"> • Check the operation status and record it.
Diagnosis	Countermeasure				
<pre> graph TD A[Save the mentePC data of 30 minutes before stopping] --> B{Is power supply voltage OK?} B -- NO --> C[Correct it] B -- YES --> D[Reset the power 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>	<ul style="list-style-type: none"> • 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					
<ul style="list-style-type: none"> • Compressor anomaly • Inverter PCB anomaly • Anomalous power supply voltage • Power transistor anomaly 					

Note: If the same error does not reappear, continue to get data with MentePC.

Error code	LED	Green	Red	Content
Remote control: E63 7-segment display: E63	Heat pump unit	Keeps flashing	1 time flash	Emergency stop

1. Applicable model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	<pre> graph TD A[Save the MentePC data of 30 minutes before stopping] --> B{Is the setting of emergency stop by remote controller 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>	
3. Condition of Error displayed		
Same as above		
4. Presumable cause		
• Occurrence of emergency stop factor		

Note: The heat pump unit 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 unit	Keeps 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> <p>When starting operation after the power ON, does the pump motor run?</p> <p>YES → It is normal.</p> <p>NO →</p> <p>Is AC220-240V\pm5% detected between L1 and N on the TB1?</p> <p>NO → Check the power supply voltage and correct it.</p> <p>YES →</p> <p>Is AC200V\pm10% detected between 3 and 4 on the TB2?</p> <p>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</p> <p>YES →</p> <p>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.</p> <p>Is DC280V\pm10% detected between 4P (Black) and 6P(Red) connector CN1 on the water pump PCB?</p> <p>NO → Replace water pump PCB</p> <p>Is the LED2 on control PCB flashing?</p> <p>NO → Replace control PCB</p> <p>YES →</p> <p>Check DC voltage between 3P of CNPUM1 on the control PCB and C48GND (located just left below the control PCB).</p> <p>DC5V → Is DC5V detected between 4P of CNPUM1 and C48GND on the control PCB?</p> <p>YES → Replace control PCB</p> <p>NO →</p> <p>Is the wiring connected to water pump PCB & control PCB normal?</p> <p>NO → Replace the wiring</p> <p>YES →</p> <p>Replace water pump PCB</p> <p>Is the rotation speed of water pump motor normalized?</p> <p>NO → Replace water pump motor</p> <p>YES → End</p> </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	<p>When starting operation after the power ON, does the pump motor run?</p> <p>YES → It is normal.</p> <p>NO →</p> <p>Is AC220-240V\pm5% detected between L1 and N on the TB1?</p> <p>NO → Check the power supply voltage and correct it.</p> <p>YES →</p> <p>Is AC200V\pm10% detected between 3 and 4 on the TB2?</p> <p>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</p> <p>YES →</p> <p>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.</p> <p>Is DC280V\pm10% detected between 4P (Black) and 6P(Red) connector CN1 on the water pump PCB?</p> <p>NO → Replace water pump PCB</p> <p>Is the LED2 on control PCB flashing?</p> <p>NO → Replace control PCB</p> <p>YES →</p> <p>Check DC voltage between 3P of CNPUM1 on the control PCB and C48GND (located just left below the control PCB).</p> <p>DC5V → Is DC5V detected between 4P of CNPUM1 and C48GND on the control PCB?</p> <p>YES → Replace control PCB</p> <p>NO →</p> <p>Is the wiring connected to water pump PCB & control PCB normal?</p> <p>NO → Replace the wiring</p> <p>YES →</p> <p>Replace water pump PCB</p> <p>Is the rotation speed of water pump motor normalized?</p> <p>NO → Replace water pump motor</p> <p>YES → End</p>	
Diagnosis	Countermeasure				
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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 <ul style="list-style-type: none"> • If the rotation speed difference is 500min⁻¹ or more • If anomalous actual rotation speed is detected for 1 minute continuously. 					
4. Presumable cause <ul style="list-style-type: none"> • Water pump anomaly • Control PCB anomaly • Power supply or power PCB anomaly • Water pump PCB anomaly 					

Note:

Error code	LED	Green	Red	Content
Remote control: E64 7-segment display: E64	Heat pump unit	Keeps flashing	1 time flash	Water pump anomaly (2) In case the motor rotates at anomalously high speed (Disable to control rotation speed or rotate at Max speed)

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 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 PCB] C2 --> D4{Is the rotation speed of water pump motor normalized?} D4 -- YES --> C6[End] D4 -- NO --> C7[Replace water pump motor] </pre> </td><td></td></tr> </tbody> </table>	Diagnosis	Countermeasure	<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 PCB] C2 --> D4{Is the rotation speed of water pump motor normalized?} D4 -- YES --> C6[End] D4 -- NO --> C7[Replace water pump motor] </pre>	
Diagnosis	Countermeasure				
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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 unit	Keeps flashing	1 time flash	Communication error between CPU of control PCBs

1. Applicable Model	5. Troubleshooting				
All models	<table> <tr> <th>Diagnosis</th><th>Countermeasure</th></tr> <tr> <td> <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 --> P1[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 --> C2[IC2 is in software rewriting mode.] Q3 -- NO --> C3[Software program version before rewritten was unmatched.] P1 --> Q4{Does E89 recur?} Q4 -- YES --> C4[Control PCB anomaly → Replace control PCB] Q4 -- NO --> C3 </pre> </td><td> <p>CPU may be malfunctioned by the influence of wiring. Rearrange to keep wiring away from the circumference of CPU</p> <p>IC2 is in software rewriting mode.</p> <p>Software program version before rewritten was unmatched.</p> <p>Control PCB anomaly → Replace control PCB</p> </td></tr> </table>	Diagnosis	Countermeasure	<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 --> P1[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 --> C2[IC2 is in software rewriting mode.] Q3 -- NO --> C3[Software program version before rewritten was unmatched.] P1 --> Q4{Does E89 recur?} Q4 -- YES --> C4[Control PCB anomaly → Replace control PCB] Q4 -- NO --> C3 </pre>	<p>CPU may be malfunctioned by the influence of wiring. Rearrange to keep wiring away from the circumference of CPU</p> <p>IC2 is in software rewriting mode.</p> <p>Software program version before rewritten was unmatched.</p> <p>Control PCB anomaly → Replace control PCB</p>
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2. Error detection method					
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					
<ul style="list-style-type: none"> • 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 unit	Keeps flashing	Stays OFF	It can operate but no hot water comes out (1)

1. Applicable Model	5. Troubleshooting				
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2. Error detection method					
3. Condition of Error displayed					
4. Presumable cause	<ul style="list-style-type: none"> Insufficient capacity of heat pump unit Heating capacity of heat pump unit is not meet to the actual heat load Bad installation of equipments Anomaly of heat pump unit 				

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump unit	Keeps flashing	Stays OFF	It can operate but no hot water comes out (2)

1. Applicable Model	5. Troubleshooting	
All models	Diagnosis	Countermeasure
2. Error detection method	<pre> graph TD Start([Start]) --> Step1[Check availability to operate heat pump unit and the operating condition of heat pump unit Check whether hot water comes out] Step1 --> Step2[Check the hot water amount in the cylinder] Step2 --> Dec1{Is enough hot water amount in the cylinder secured after the operation to fill up in the night time?} Dec1 -- YES --> Step3[Check water pressure and water volume] Dec1 -- NO --> Dec2{Is it available to change setting?} Dec2 -- YES --> Step4[Readjustment of setting contents due to increasing hot water amount] Step4 --> Step5[Check the setting of hot water temp by remote control] Step5 --> Dec1 Dec2 -- NO --> Step6[Usage of hot water amount is too much] Step3 --> Dec3{Is the flow amount of water circuit within the range?} Dec3 -- YES --> Step7[Check water circuit Go to Page 137] Dec3 -- NO --> Step6 </pre>	
3. Condition of Error displayed	<p>Since the usage of hot water amount seems to be very much, the setting contents by remote control shall be readjusted.</p> <p>① Start and/or end time ② Hot water amount and/or the amount to top up</p> <p>Usage of hot water amount is too much</p> <p>Check water circuit Leak, Drain, by-pass, Clogging, operation of pump and actuation of valves</p> <p>Check water circuit Go to Page 137</p>	
4. Presumable cause	<ul style="list-style-type: none"> Anomaly of water circuit between the heat pump unit and HW storage unit. Piping failure in the HW storage unit 	

Note:

Error code	LED	Green	Red	Content
Remote control: No display 7-segment display: No display	Heat pump unit	Keeps flashing	Stays OFF	It can operate but no hot water comes out (3)

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2. Error detection method					
3. Condition of Error displayed					
4. Presumable cause	<ul style="list-style-type: none"> • 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 unit	Keeps flashing	Stays OFF	Anomalous sound and vibration (1)

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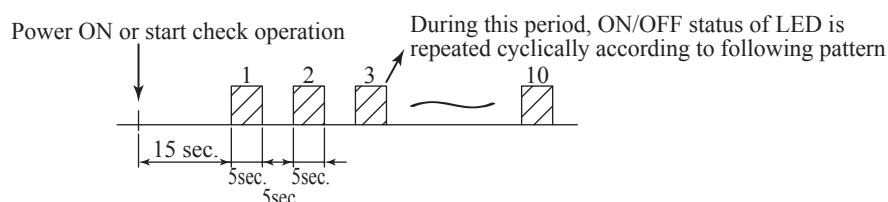
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Note:

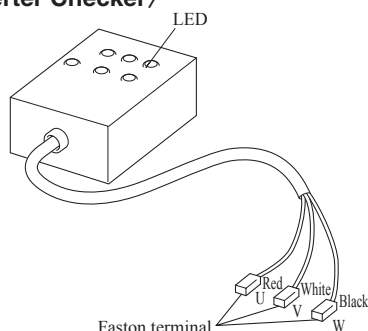
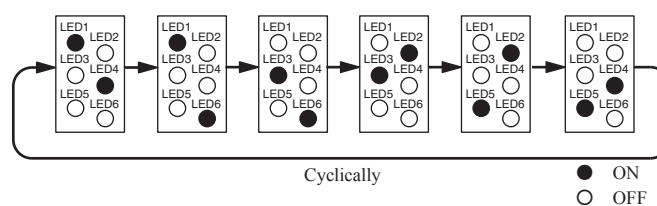
(1) Checking procedure of inverter PCB

- 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>**LED ON/OFF pattern**

Connect to the terminal of the wires which are disconnected from compressor.

(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 controller incorporated.

Tester		Normal values (Ω)
Terminal (+)	Terminal (-)	ESA30E
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 Ω , there is a possibility that the elements are damaged, so replace the power transistor parts.

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	High pressure, intermediate pressure, low pressure, vibration, sound, insulation resistance, loose connection of terminal	1	40,000 hours
	Heat exchanger (Evaporator)	High pressure, intermediate pressure, low pressure, cleanness of fin	1	10 years
	Gas cooler (water heat exchanger)	High pressure, intermediate pressure, low pressure, pressure loss of water, discharge pipe temperature	1*	10 years
	Solenoid valve	Behavior, leak, clogging	1	10 years
	EEV (Electronic expansion valve)	Behavior, leak, clogging	1	10 years
	Strainer	Temp difference between inlet and outlet ports of strainer	1	At heavy service
	Capillary tube	Contact wear, vibration	1	10 years
	Refrigerant pipe	Contact wear, vibration	1	10 years
Components of electrical circuit	Relay	Behavior, contact resistance at contact point, insulation resistance	1	10 years
	Coil and body of solenoid Valve & EEV	Insulation resistance	1	10 years
	Crankcase heater	Insulation resistance	1	20,000 hours
	Anti-freezing heater (Drain pan, Water piping)	Insulation resistance	1	20,000 hours
	Fuse	Apparent condition	1	5 years
	PCB (for Control, Inverter and Water pump)	Apparent condition	1	10 years
	High pressure switch (63H1)	Contact resistance at contact point	1	10 years
	Pressure sensors	Is any rubbing on the capillary tube found?		
	Terminal block	Loose connection of terminal	1	10 years
	Wiring and connector	Disconnection, looseness, deterioration, rubbing	1	10 years
	Capacitor	Leakage of electrolysis solution, deformation	1	25,000 hours
	Cooling fan	Insulation resistance, anomalous sound	1	10 years
Outdoor fan	Magnet contactor (52C)	Contact resistance at contact point, behavior	1	25,000 hours
	Fan propeller	Balance, crack	1	10 years
Components of water circuit	Fan motor	Insulation resistance, anomalous sound, vibration	1	20,000 hours
	Water pump	Behavior, vibration, anomalous sound, insulation resistance, water leakage	1*	5 years
	Flow regulator (CWFV1)	Behavior, vibration, anomalous sound, insulation resistance, water leakage	1*	5 years
	Motor valve (CWFV2 to CWFV5)	Behavior, vibration, anomalous sound, insulation resistance, water leakage	1*	5 years
	Pressure reducing valve	Behavior, anomalous sound, water pressure, water leakage	1*	5 years
	Check valve	Behavior, anomalous sound, water pressure, water leakage	1*	5 years
	Strainer	Clogging, water leakage	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.

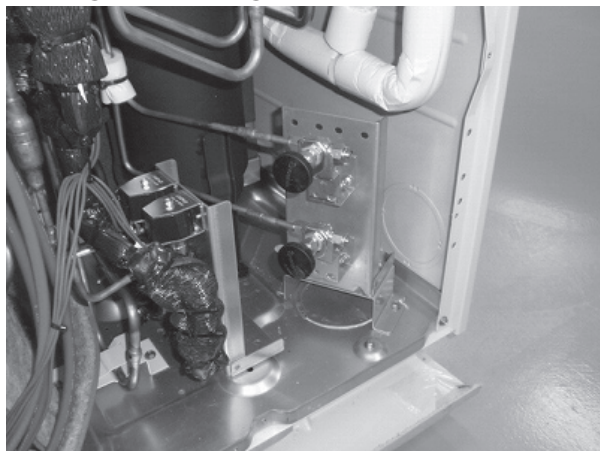
Please ask our distributor for details.

** It is recommendable to inspect at least one time / year.

4.5 Disassemble and reassemble method.

(1) Compressor Replacement Procedure

1. 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.

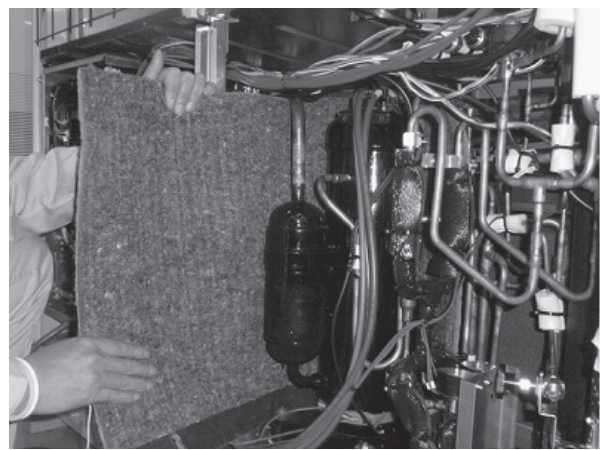
Therefore, be sure to purge the refrigerant through a proper adjustment.

Note 2: Be sure to check EEV fully opened.

*Check procedure: Power Off ⇒ On ⇒ Off

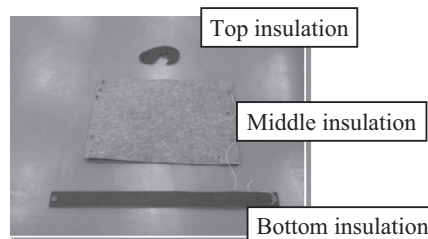
2. Before dismounting compressor

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

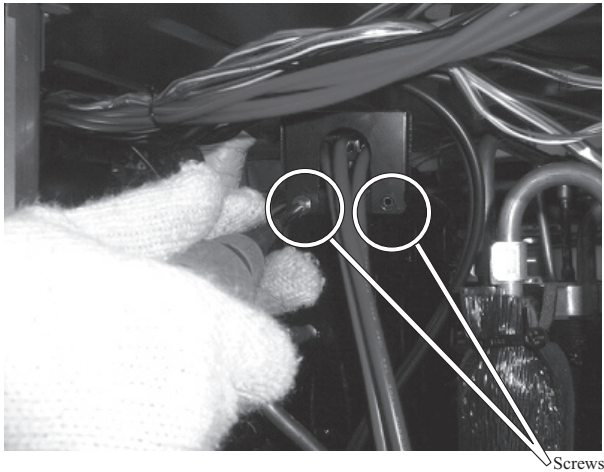


2) Remove the insulation of discharge piping

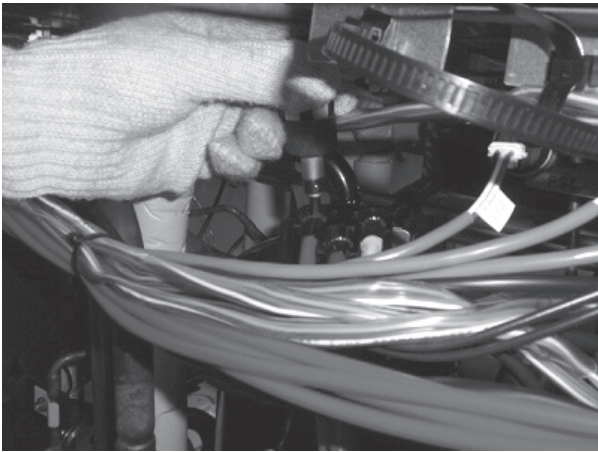


Be sure to remove the insulation neatly with consideration for reuse.
And remove it up to the position not to be burnt by brazing work.

3) Remove the power cables from compressor



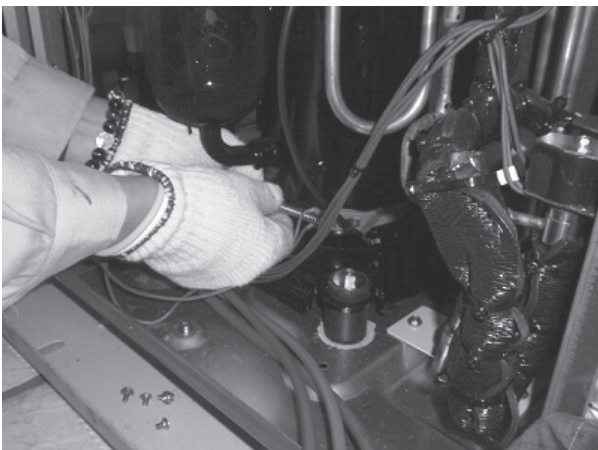
Loosen 2 screws and remove the terminal cover.



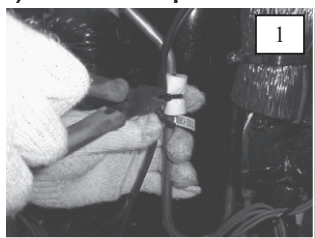
Loosen 3 screws and disconnect the power cables.

Note: Since the terminals are facing upward, it had better to use a stabilizing type screw driver.

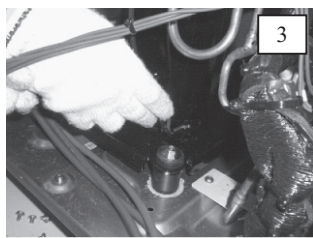
4) Remove the crank case heater



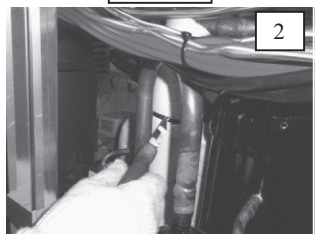
5) Remove temperature sensors



Tho-INJ1



Tho-C1

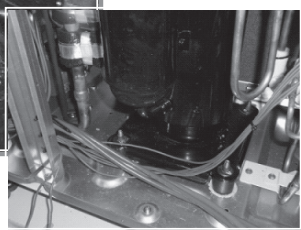
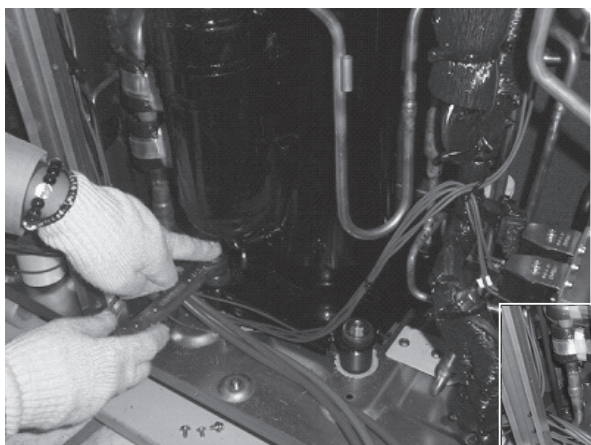


Tho-D1

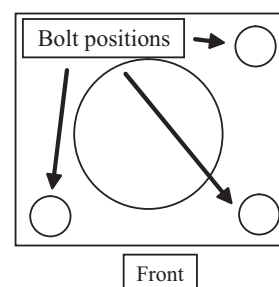
Remove 3 temperature sensors after removing insulations

1. Tho-INJ1 (Injection temp sensor)
2. Tho-D1 (Discharge temp sensor)
3. Tho-C1 (Under-dome temp 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

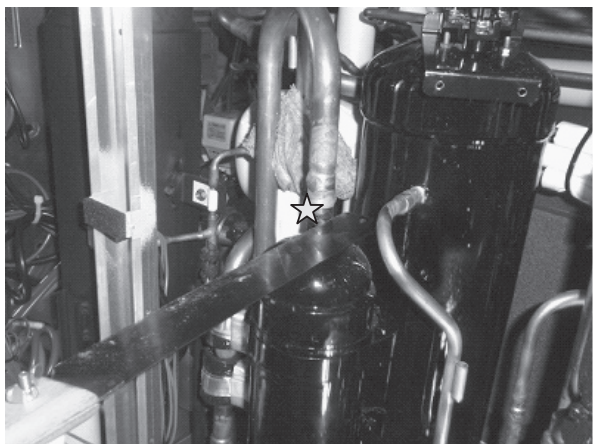


Bind up wires and cables in order not to get in the way of brazing work and replacing work of compressor.

3. 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

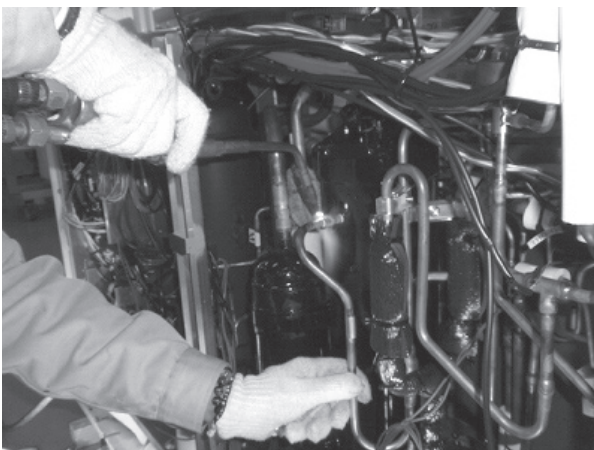


Cut the pipe in the same procedure as that for suction pipe.

☆ Cutting position

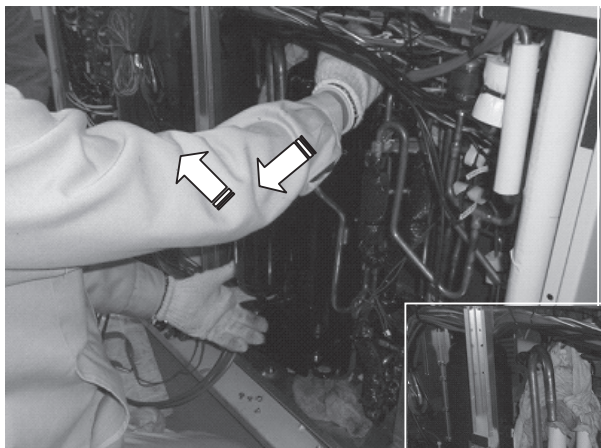
2) Disconnect a pipe by brazing

③ Gas injection pipe



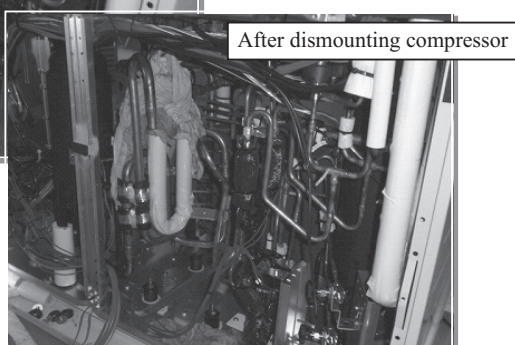
Gas injection pipe can be disconnected first by brazing, because this pipe is thin. However it is easier to disconnect it after cutting suction and discharge pipes.

3) Dismount the compressor

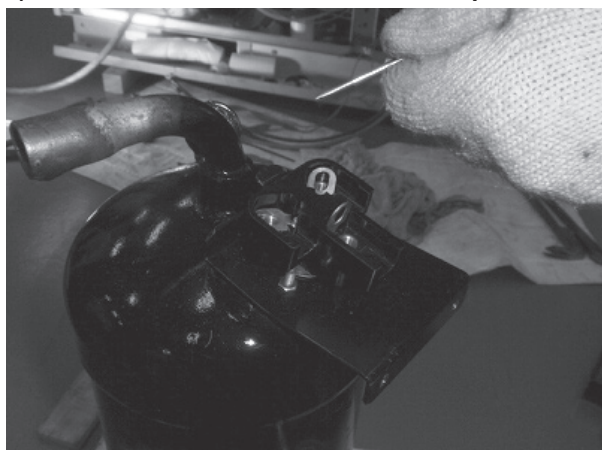


Incline the top of compressor to foreside and take it out obliquely upward.

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.

4. Mounting new compressor

1) Mounting new compressor

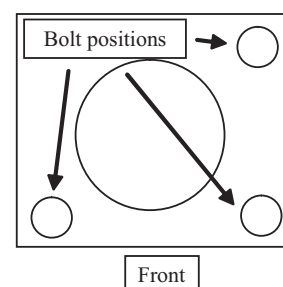


Place the new compressor on to the mounting base without hitting the suction pipe located at the rear lower left side of compressor.

2) Tighten the nuts of compressor mounting bolts

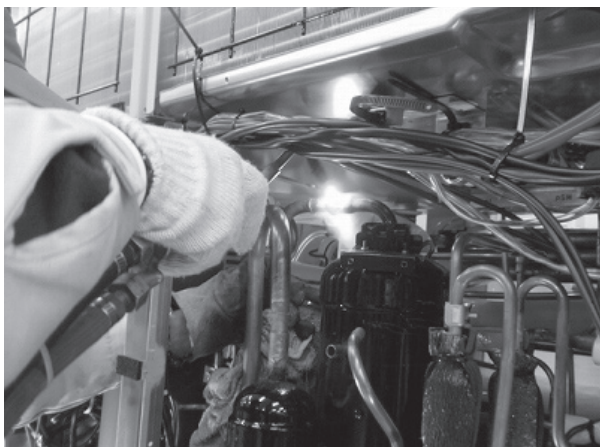


Place the new compressor in right position on the mounting bolts and tighten the nuts



3) Brazing

① Discharge pipe



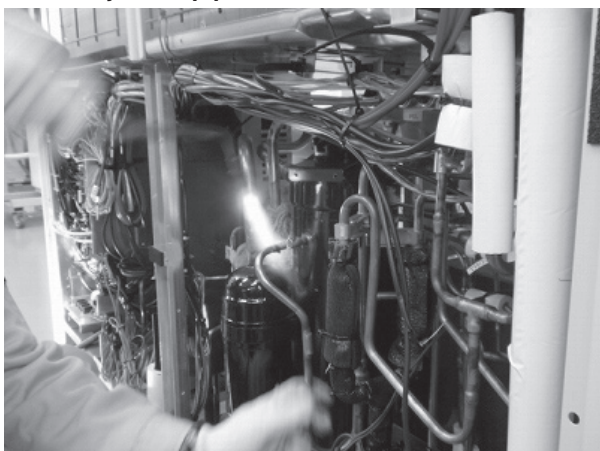
Be sure to do masking around the brazing place.
(The places not only around discharge pipe but also around suction pipe and gas injection pipe)

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

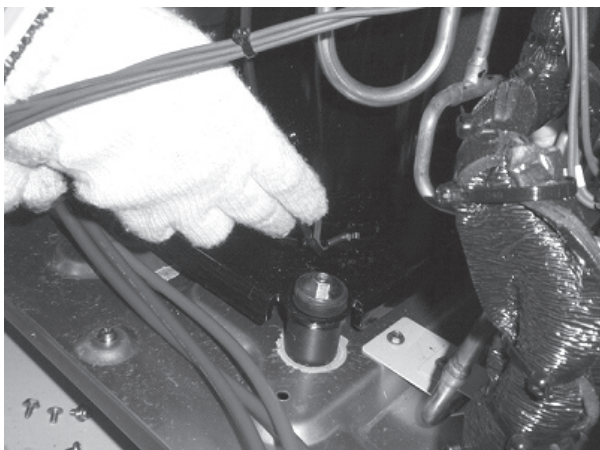


③ Gas injection pipe



4. After mounting new compressor

1) Attaching crank case heater and under-dome temp sensor



Be sure to attach them before wrapping the insulation jacket around the compressor.

2) Wrapping 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.

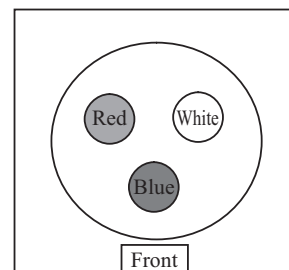
Note: Do not forget to put top insulation cover on the compressor.

3) Attaching discharge pipe temp sensor and gas injection temp sensor



Put them back the way they were.

4) Connecting the power cable to the compressor



5) Attaching 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.

5. Charging refrigerant

- 1) Air tightness test should be done with N₂ gas by pressurizing up to 14MPa
- 2) Evacuate the refrigerant pipes
- 3) Charge CO₂ refrigerant

* About 2 sets of 7m³ bomb are required.

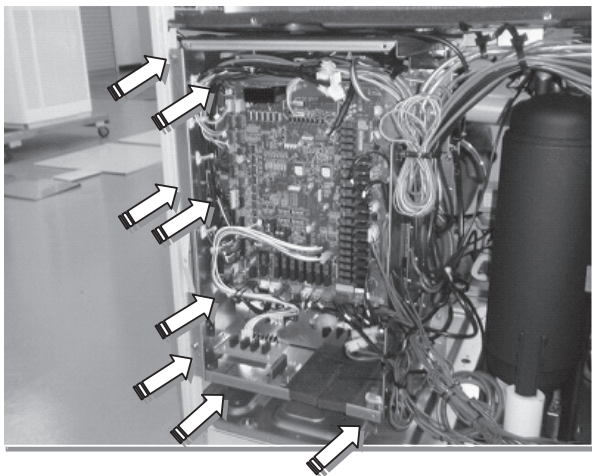
6. Test run

- 1) Check whether the controls and sensors are normal.

(2) Inverter PCB replacement procedure

1. 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.

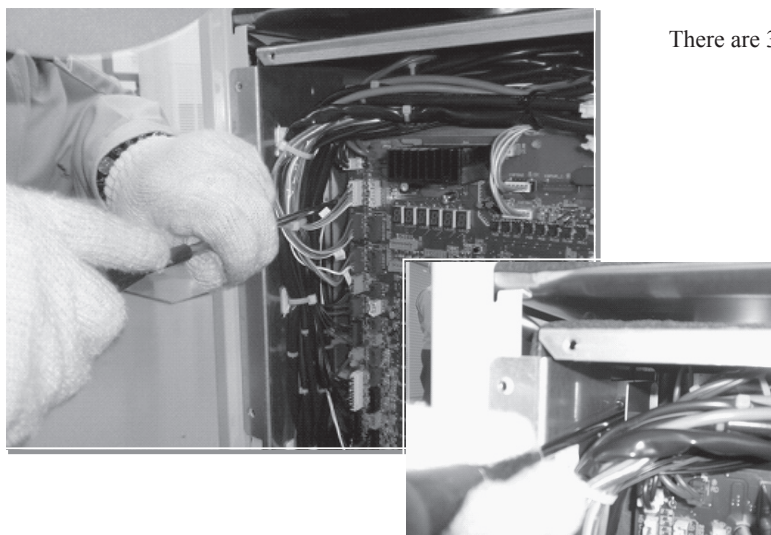
Loosen 8 screws (shown with white arrow)

Left side of control box : 3 screws

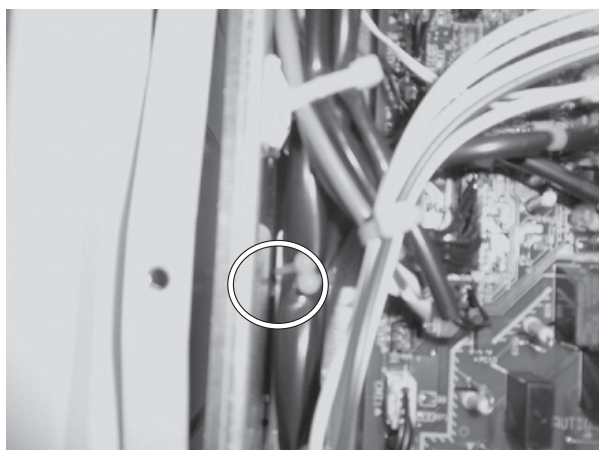
Inner left side of control box : 3 screws

Bottom side of control box : 2 screws

① Inside of control box

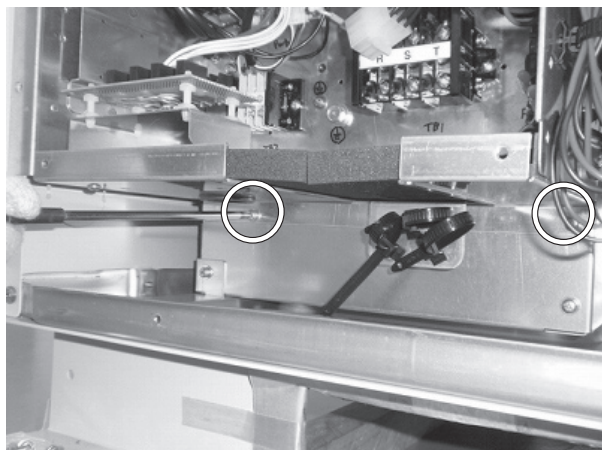


There are 3 screws at inner left side of control box.



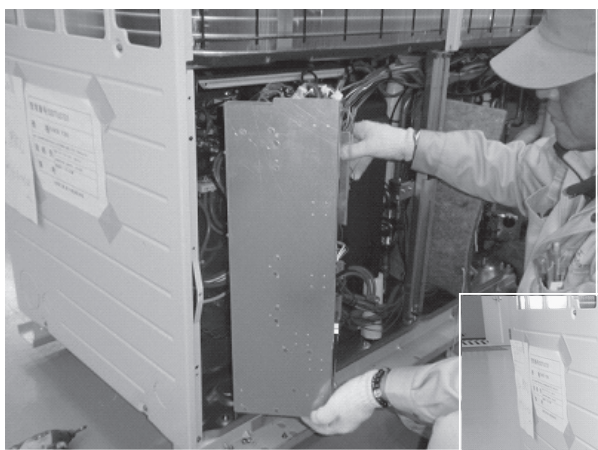
Be careful not to forget to loosen a center screw which is hidden by wiring.

② At the bottom of control box



There are 2 screws at the bottom of the control box.

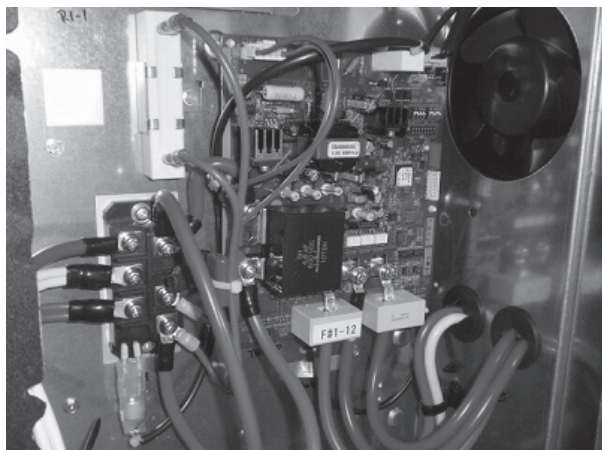
③ Open the mounting board of first and second layer



This mounting board supported at right edge as supporting point can be opened from left side.



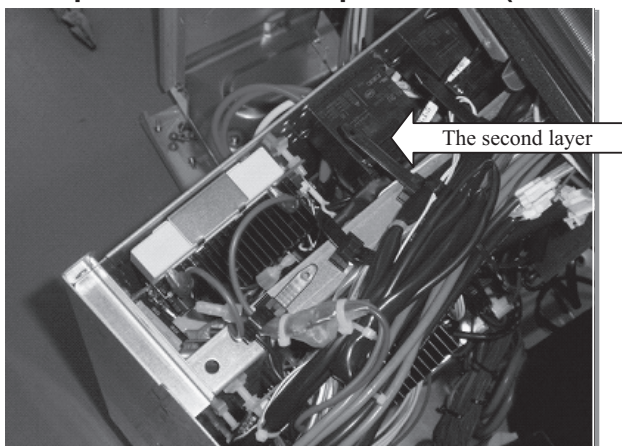
2) Inverter PCB



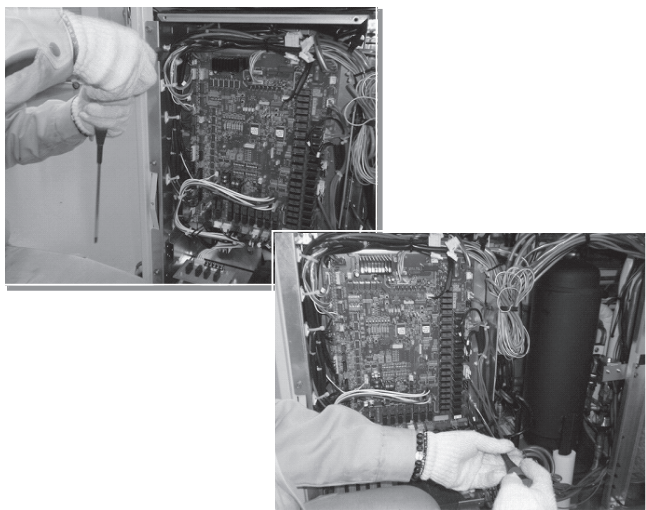
Following the process ① to ③ enables easy access to the inverter PCB without disconnecting wires.

(3) Replacement procedure of power PCB and water pump PCB

2. Replacement work of power PCB (on the second layer)

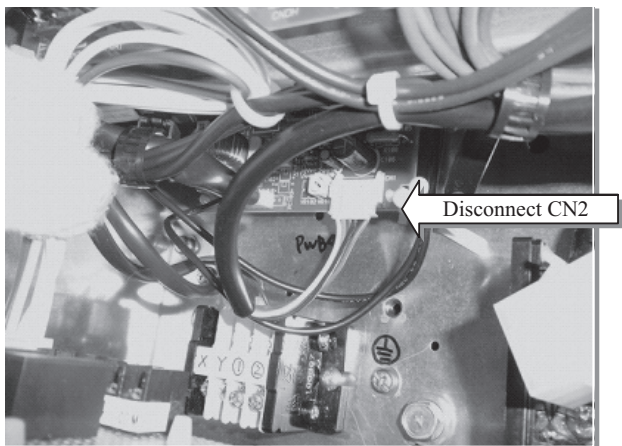


① Loosen 4 screws



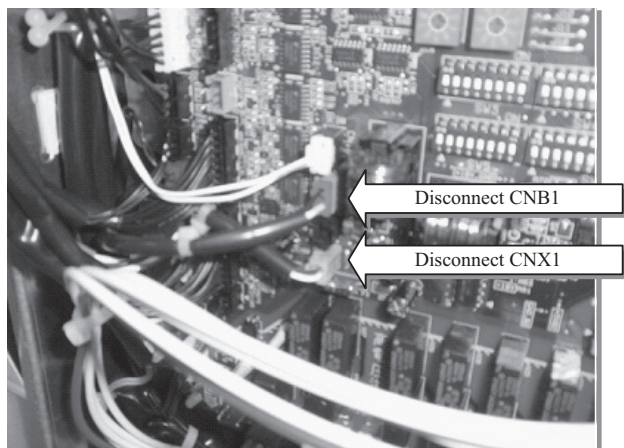
There are 4 screws at all corners of the first layer.

② Disconnect the wire going to the water pump PCB



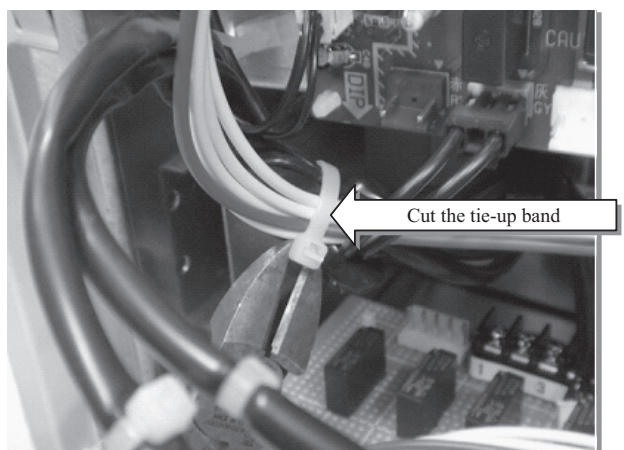
Disconnect CN2 connector on the water pump PCB.

③ Disconnect the wires going to control PCB



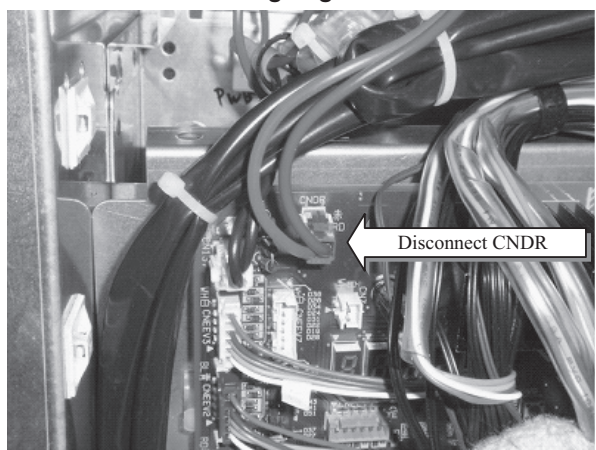
Disconnect CNB1 connector (Green) and CNX1 connector (Yellow) on the control PCB.

④ Cut the tie-up band



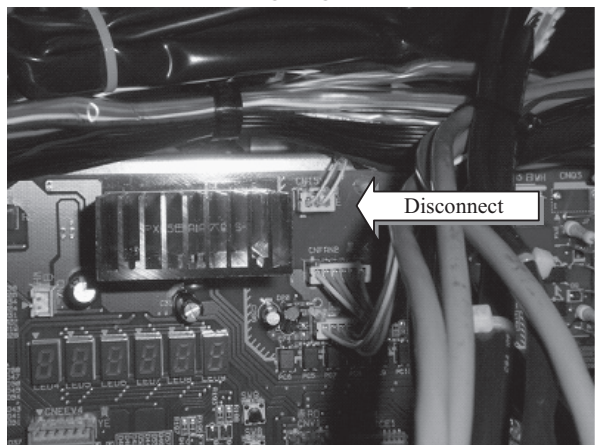
Cut the tie-up band

⑤ Disconnect the wire going to control PCB



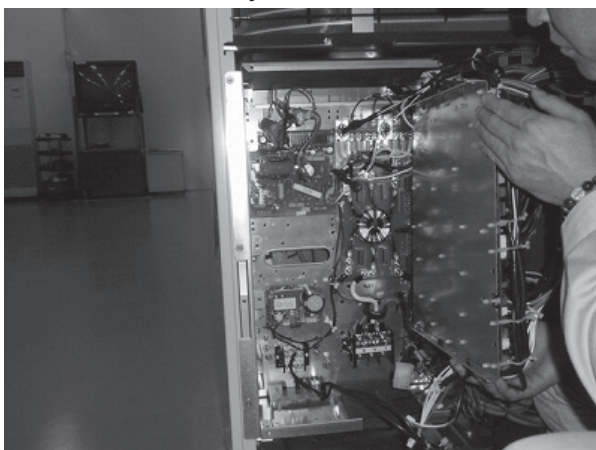
Disconnect CND1 connector (Red) at the upper left part of control PCB

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

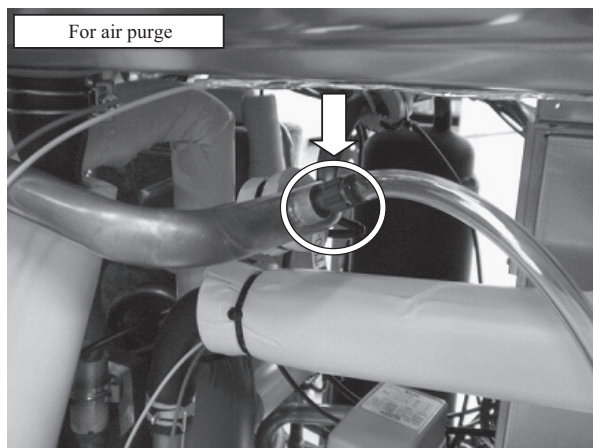


Following the process from ① to ⑦ enables to remove the first layer and to access power PCB.

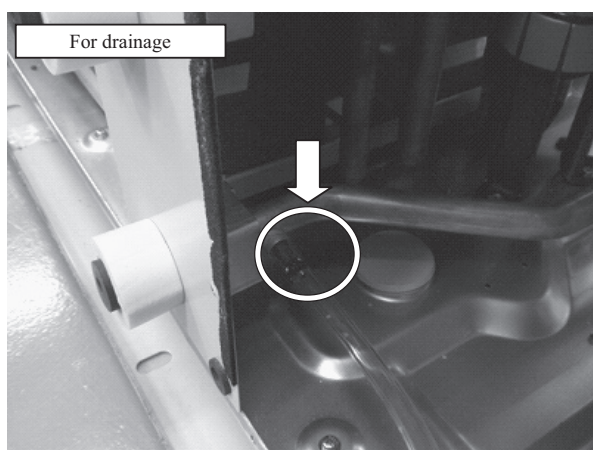
(4) Replacement procedure of water heat exchanger (Gas cooler)

1. 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.

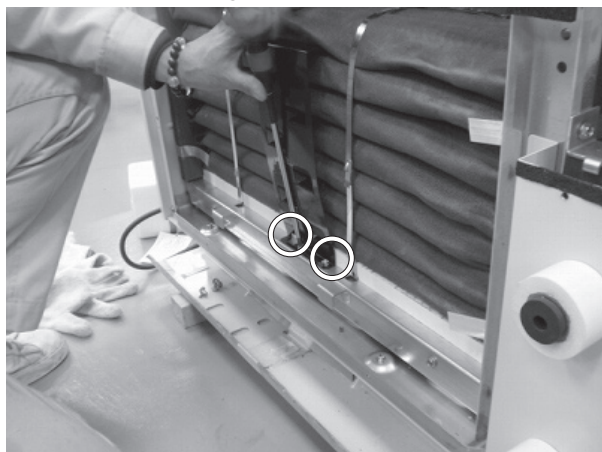
2. Dismounting water heat exchanger

1) Remove the insulation



The insulation will be reused.

2) Remove the fixing bracket



The bracket is fixed to the bottom of the unit with 2 screws.

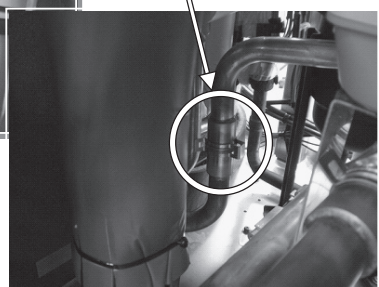
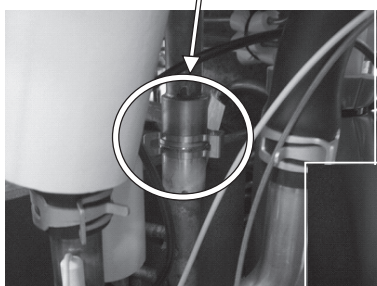
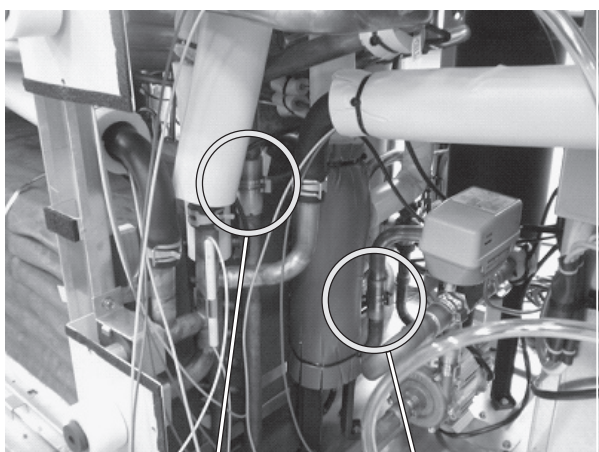
3) Cut the metal bands



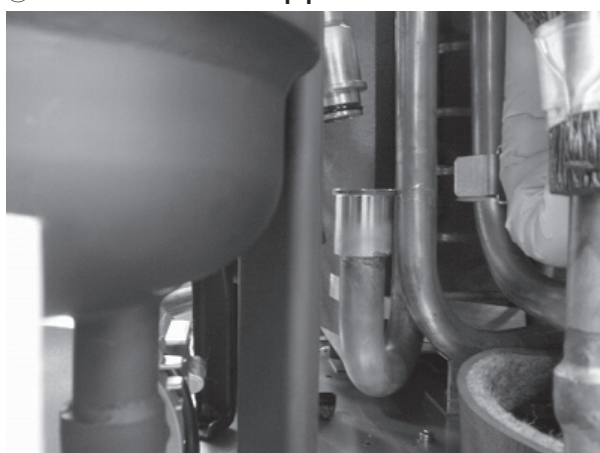
Cut the metal band.
(These are for transportation. No necessary to reuse)

4) Disconnect the water pipes (at 2 positions)

① The positions to disconnect



② Disconnect the water pipes



Extract the quick fastener (female side)

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.

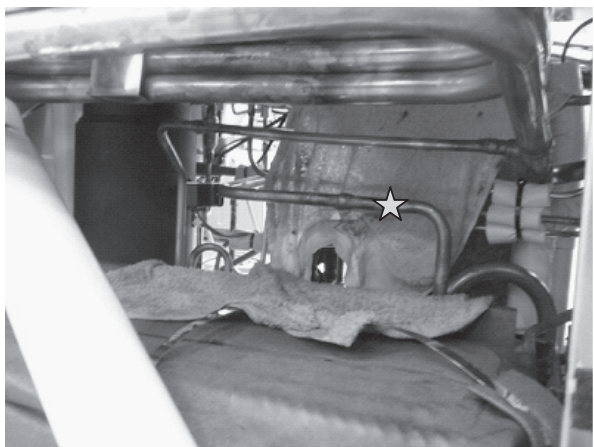
(It is very dangerous to brazing pipe too hastily)

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) Mount new water heat exchanger

① Inlet side of refrigerant pipe



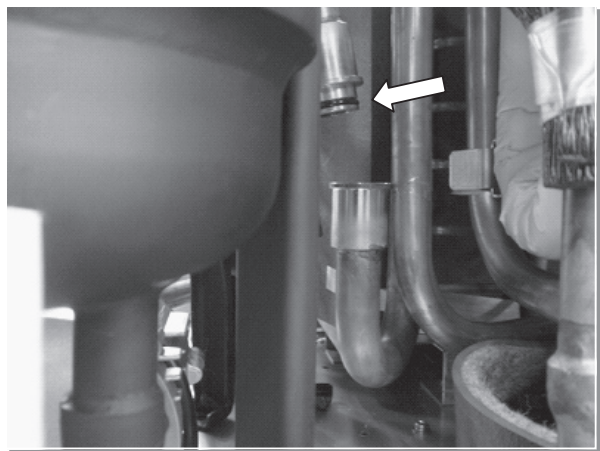
Be sure to do masking around the brazing place.
(The places not only around inlet side of refrigerant pipe but also around outlet side of refrigerant pipe)

Note: Be careful to braze 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



8) Connect the water pipe



When connecting the water pipe, be sure to replace the O-ring to new one.

Heat Pump Water Heater



Air-Conditioning & Refrigeration Systems

16-5, Konan 2-chome, Minato-ku, Tokyo, 108-8215 Japan

<http://www.mhi.co.jp>

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