

### 3. APPLICATION DATA

#### 3.1 Installation work for air to water heat pump water heater

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

### SAFETY PRECAUTIONS

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

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

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

### WARNING



- The appliance shall be installed in accordance with national wiring regulations.
- Installation should be performed by your dealer or the specialist.  
Improper installation made by yourself may cause water leak, electric shocks, fire or injury by dropping the unit.
- Installation should be performed properly according to this installation manual.  
Improper installation may cause water leak, electric shocks, fire or injury due to overturn of the unit.
- Use the genuine accessories and the specified parts for installation.  
Using unspecified parts may cause falling or turnover of the unit, water leak, fire, electric shocks, refrigerant leak, insufficient capacity, improper controlling or injury.
- Consider measures not to exceed the critical concentration of refrigerant in the event of leakage especially when it is installed in a small room.  
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.  
(The concentration of CO<sub>2</sub> in nature is 0.03-0.04%. If the concentration of CO<sub>2</sub> exceeds 0.1%, it may affect the human body.)
- Ventilate the working area well in case the refrigerant leaks during installation.  
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.
- Check no leakage of refrigerant after installation.  
If the refrigerant leaks and exceeds the critical concentration, it may cause oxygen deficiency accident.
- When carrying the unit in, hoist the unit with slings for haulage by putting it through the holes at the anchor leg of the unit.  
And in order to keep its balance, be sure to support it at 4 points securely. Do not use a fork lift to lift unit using lifting points.  
If supporting the unit at 3 points or applying wrong method for carrying in, it may cause death or severe injury.
- The hoisting work shall be done by the qualified worker for slinging work.  
Improper hoisting may cause an accident resulting in injury or death by dropping the unit.
- During hoisting, any person shall not enter under the unit slinging.  
If the unit falls, it may cause death or severe injury. Be sure not to enter under the unit slinging.
- Do not carry the unit, whose weight exceeds 20kg, by oneself without any other supporters.
- Install the unit properly on a place to be able to withstand the heavy weight when filled with water fully.  
Improper installation or insufficient strength may cause falling or turnover of the unit that leads to injury.
- Install the remote control on a place to be able to hold its weight.  
Improper installation or insufficient strength may cause falling of R/C.
- Install the unit properly and fix it with anchor bolts in order to be able to withstand strong winds such as typhoon, and earthquakes.  
Improper installation may cause an accident due to turnover of the unit.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.  
Insufficient capacity of power source, improper work may cause electric shocks or fire.
- Shut OFF the main power source before electrical wiring.  
Without shutting OFF the power, it may cause electric shocks, breakdown or malfunction.
- Be sure to use the specified wire for electrical wiring conformed to the standard and the current capacity.  
Using improper electrical wires may cause electric leak, heat generation or fire.
- Be sure to use the specified wire for electrical wiring, to fasten the wiring to the terminal securely and hold the cable securely in order not to apply unexpected stress on the terminal.  
Loose connection and improper hold may cause heat generation or fire.
- Arrange the electrical wires in the control box properly to prevent them from rising the terminal cover.  
Improper arrangement may cause heat generation at the terminal, fire or electric shocks.
- Do not perform brazing work in a sealed room.  
It may cause oxygen deficiency accident.
- Do not put the drain pipe directly into the ditch where toxic gas such as sulfide gas is generated.  
Toxic gas would flow into the unit and it may cause poisoning or deficiency of oxygen.  
And it may cause corrosion of the inside unit that leads malfunction of the unit or refrigerant leak.
- Be sure to use the breaker [Earth leakage breaker, circuit breaker (breaker + B type fuse)] with proper capacity to shut off all poles.  
Using improper breaker may cause malfunction or fire.
- Use the genuine optional parts.  
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 ground line to gas pipe, water pipe, etc.  
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.



- Do not install the unit in a location where the high pressure steam is emitted into the refrigerant circuit.
- Do not connect the power with the voltage other than 380/400V.  
If connecting the power not specified, it may cause abnormal heating of electrical components and catching fire.
- Do not connect the AC power to the remote control. The connectable voltage to the R/C is DC18V at the maximum.  
If connecting AC power, it may cause breakage, catching fire or fire.
- Fit the service panel and the control lid securely.  
Improper fitting may cause fire or electric shocks due to intrusion of dust or water into the control box.
- Be sure to install an earth leakage breaker and check its operation.  
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 are not removed after unpacking, it may cause an accident of oxygen deficiency for the child who are playing with it.
- Dispose the packing materials properly after unpacking.  
If disposing packing material without removing nails and metal pins, it may cause an accident of oxygen deficiency for the child who are playing with it.
- If disposing plastic covers without tearing, it may cause an accident of oxygen deficiency for the child who are playing with it.
- Do not use this unit with combustion appliance, be sure to ventilate.

**⚠ 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 disposing packing material without removing nails and metal pins, it may cause an accident of oxygen deficiency for the child who are playing with it.
- 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.  
If the piping is not insulated, the hot water temperature on the surface of the piping will be high, and it may cause scalding.
- Check the refrigerant gas leak by performing air tightness test after the unit is installed.  
If refrigerant gas leaks in a small room and exceeds the critical concentration, it might cause oxygen deficiency accident.
- For the piping work, use the straps and hold the piping with a support.  
If the piping is not supported, it may cause vibration and noise during test run and operation.
- Do not touch the piping at the inlet and outlet pipes.  
Operating the unit with the valves closed may cause failure.
- Always stop the unit when using the remote control.  
Do not use the remote control when the unit is operating.
- Dispose the refrigerant solution and glycol solution properly according to the local regulations.  
If dispose them illegally, it might cause not only to violate the law, but also to have adverse effects on health and environment.
- Make sure the water quality conforms to the water quality criteria of drinking water.  
If the water quality is poor, it may cause malfunction of the unit.
- 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 the unit.  
If supplying power between the units, it might cause fire.
- Be sure to take measure for anti-freezing.  
If the unit is not used in winter, it might cause freezing of the piping.
- 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 of hot water from the hot water storage unit and water piping.
- Do not touch the high temperature section of the hot water piping.  
If touching, it might cause scald.
- 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 ladder and hand rail at the edge, and install fence and ladder around the unit. If not, it might cause injury due to falling from the installation place.
- Do not install and use the unit near the hospital and telecommunication facility where equipment generate electromagnetic wave and/or high frequency wave. It might cause malfunction or failure of the unit due to the effect of inverter equipment, private power generators, high frequency medical equipment or radio communication equipment, or may cause harmful effects such as interfering with medical activity or visual and noise disturbance of video communication due to the influence from the industrial equipment and communication equipment.
- Do not install in a place that may become a nesting site. 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 install in a place where installing unit which is corroded. 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 the unit could be generated much (in a kitchen)
  - Where the equipment, which generates high frequency wave, is
  - Highly salted area such as beach
  - Heavy snow area (When installing the unit in such a sea, 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 sources
  - Where air circulation is not good
  - Where there is obstacles at air inlet/outlet port of the unit
  - Where the circuit of air could happen, in case of installation
  - 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 unit could be affected by the cold air from the unit could bother nearby
  - 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 affect the environment and might be cause of the claim.
- Do not install high remote control at a place where it is exposed. It might cause malfunction or discoloration of the R/C.
- Do not install the R/C remote control at a place where water could flow into the R/C. It might cause electric shocks.
- Do not install in a place where the temperature is -25 to +43°C and the storage temperature is -5 to +55°C. If the unit is used in a place where the temperature is below -25°C or above +43°C, be sure to install the unit at a high place not to be buried under the snow.

### Feature of CO<sub>2</sub> refrigerant

- The operating pressure of CO<sub>2</sub> refrigerant is generally 12-15MPa at the normal temperature, which is about 1.5 times higher than R410A. Consideration for safety to high pressure is required more than R410A. Please be careful not to break the piping of refrigerant circuit of the heat pump unit during service work.
- When purging CO<sub>2</sub> refrigerant, please purge a small amount to a place where the risk of opening service valve is light.
- CO<sub>2</sub> refrigerant is non-inflammable and non-poisonous, but under the high concentration, it may affect the human body. At more than 3% of concentration it affects the physiological function, at 7% to more than 9% it causes disturbance of consciousness, and at 25% to more than 30% it causes death. CO<sub>2</sub> refrigerant is heavier than the air and accumulate easily at lower place. Therefore, if there is a risk of refrigerant leak or when purging refrigerant, please take measure to prevent CO<sub>2</sub> refrigerant from accumulating by ventilating the air at the surface of floor.

### First aid under high concentration of CO<sub>2</sub> gas

- (a) When breathing a high concentration of CO<sub>2</sub> gas  
Move the sufferer immediately to a place where fresh air can be breathed and ensure the person can relax and kept rested. If he is unconscious, call for an ambulance immediately, loosen his clothing, ensure the respiratory airway is clear and perform artificial respiration.
- (b) When the high concentration of CO<sub>2</sub> gas makes contact with the skin  
If it is a mild frostbite, only rubbing that section is OK. But in case of severe frostbite, warm that section with lukewarm water and wrap lightly with gauze, and then consult a physician immediately.
- (c) When the high concentration of CO<sub>2</sub> gas gets into the eye  
Rinse the eye with fresh water and consult a physician immediately.

### Legal formalities

- Responding to the Water Law  
When connecting the H<sub>2</sub>O storage unit with clean water pipe  
Consult with the Waterworks Bureau under the jurisdiction of the local government.



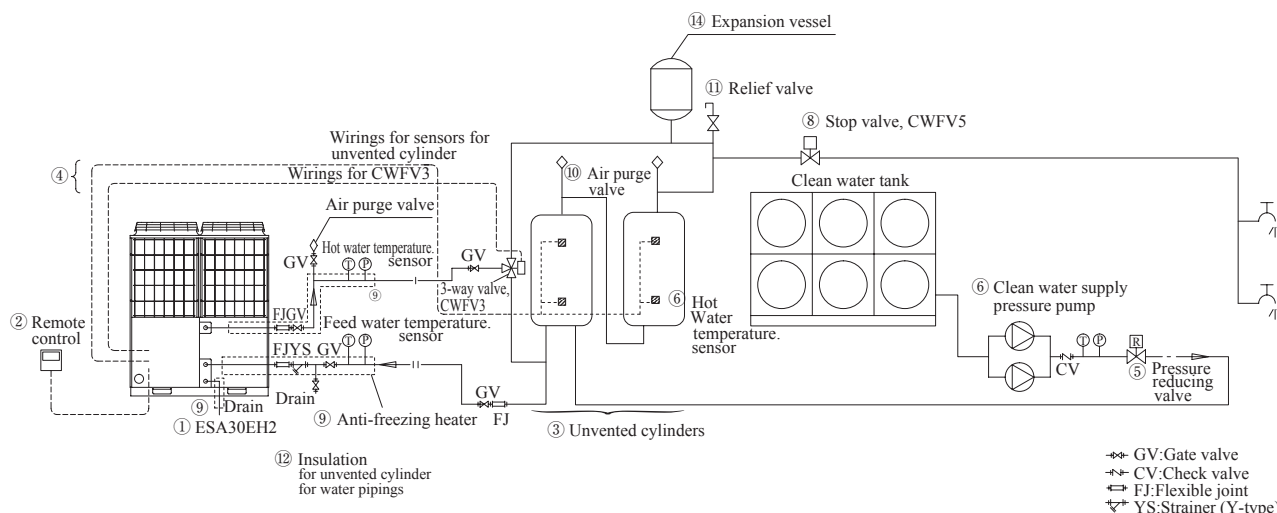
## **(1) Before installation**

(Check the model, electrical specifications, piping, necessary option parts and etc, and install properly.)

### Caution

- Read this manual before starting installation work and proceed installation work properly according to this manual.
- For the piping work, option parts are required, please refer to the catalog and etc for this unit.
- Be sure to install the earth leakage breaker. (It should be impulse withstanding type.)
- If you run the unit by keeping without the discharge pipe temperature sensor, the suction pipe temperature sensor and the pressure sensors, there is high risk for the compressor be broken. Be sure to avoid such operation.

### 1-1 Standard hot water supply system diagram (for unvented cylinder)



### 1-2 Component list of hot water supply system (for unvented cylinder)

|   | Part name                                               | Model                                                                    | General description                                                                                                                                                                                                                                                                                                                     |
|---|---------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ① | Heat pump unit                                          | ESA30EH2                                                                 | For outdoor air temperature -25°C                                                                                                                                                                                                                                                                                                       |
| ② | Remote control for heat pump water heater (Option part) | RC-Q1EH2                                                                 | For setting hot water amount and setting hot water temperature.                                                                                                                                                                                                                                                                         |
| ③ | Unvented cylinder (Locally procured)                    | —                                                                        | Refer to the specifications of unvented cylinder mentioned on next page.                                                                                                                                                                                                                                                                |
| ④ | Wiring kit for unvented cylinder (Option part)          | MTH-Q1E<br>(20m length of wire)<br>or<br>MTH-Q2E<br>(10m length of wire) | For connecting with unvented cylinder<br>• Connect to the water temperature sensor of unvented cylinder.<br>• Connect to the 3-way valve for switching to anti-freezing circuit and control it.                                                                                                                                         |
| ⑤ | Pressure reducing valve (Locally procured )             | —                                                                        | Setting pressure $\leq 400\text{kPa}$<br>Connecting pipe size $\geq 32\text{A}$<br>If the feed water pressure exceeds 400kPa, be sure to mount it.                                                                                                                                                                                      |
| ⑥ | Hot water temp sensor (Option part)                     | MTH-Q3E                                                                  | Mounting or pasting on the unvented cylinder for detecting hot water temperature in the cylinder. 1.25m length $\times$ 9                                                                                                                                                                                                               |
| ⑦ | 3-way valve, CWFV3 (Option part)                        | MTH-Q4E                                                                  | For switching to anti-freezing circuit. (wiring length 0.7m, AC200V, 50mA) IP56 (Indoor specifications)                                                                                                                                                                                                                                 |
| ⑧ | Stop valve of hot water supply, CWFV5 (Option part)     | MTH-Q5E                                                                  | If the multiple heat pump water heaters are connected, it is necessary to use at the hot water supply line. (wiring length 0.7m, AC200V, 50mA) IP56 (Outdoor use allowed)                                                                                                                                                               |
| ⑨ | Anti-freezing water heater (Locally procured)           | —                                                                        | When outdoor air temperature becomes below 0°C, be sure to install the trace heating on the water pipe (10W/m).                                                                                                                                                                                                                         |
| ⑩ | Air purge valve (Locally procured)                      | —                                                                        | For purging the air in the hot water system which is generated during heating up the water in the unit or is mixed in the system when feeding water. Each valve is required for each cylinder.                                                                                                                                          |
| ⑪ | Relief valve (Locally procured)                         | —                                                                        | For preventing from increasing pressure in the system during heating up the water. Working pressure: 450 $\pm$ 30kPa or lower.                                                                                                                                                                                                          |
| ⑫ | Insulation (Locally procured)                           | —                                                                        | Heat resistance $\geq 120^\circ\text{C}$<br>• For the cylinder shell: 50mm or thicker glass wool whose density is 16kg/m <sup>3</sup> .<br>• For the cylinder end plate: 50mm or thicker glass wool whose density is 24kg/m <sup>3</sup> .<br>• For the water piping: 30mm or thicker glass wool whose density is 48kg/m <sup>3</sup> . |
| ⑬ | Clean water supply pressure pump (Locally procured)     | —                                                                        | Apply pressure to the primary side of the pressure reducing valve, which is more than a valve of the secondary side.                                                                                                                                                                                                                    |
| ⑭ | Expansion vessel (Locally procured)                     | —                                                                        | —                                                                                                                                                                                                                                                                                                                                       |
| ⑮ | Wiring kit for CWFV3                                    | MTH-Q6E<br>(20m length wire)<br>or<br>MTH-Q7E<br>(10m length wire)       | For connecting heat pump [Slave unit only].<br>• Connect to the 3-way valve, CWFV3, switching to anti-freezing circuit and control it.                                                                                                                                                                                                  |

### 3-3 Specifications of unvented hot water storage cylinder connecting to ESA30EH

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

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

In such case, please consult with our distributor.

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

#### Specifications of unvented cylinder

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

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

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

\*1 Recommendable number of sensors is 9 pcs.

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

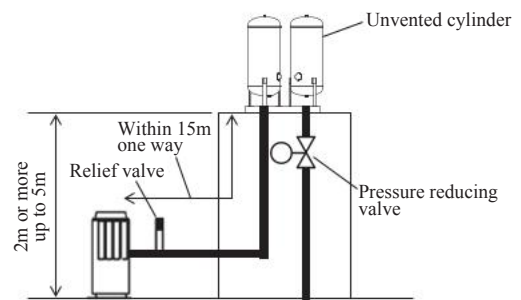
\*2 The sensor which detects 100% of H amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.

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

## 1-4 Notabilia for designing hot water supply system

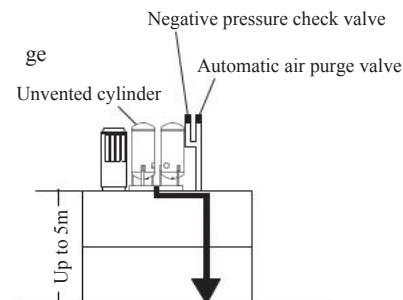
### Water piping limitation between the heat pump unit and the unvented cylinder .

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



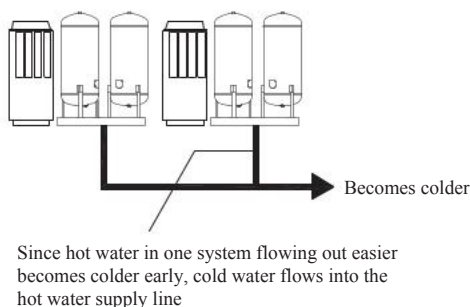
### (1) Supply hot water to downstairs

Unvented cylinder can be used to supply hot water up to 5m below the cylinder to install a negative pressure check valve and flow regulator.

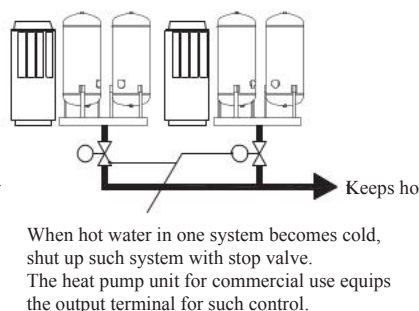


### (2) Drift and parallel control

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

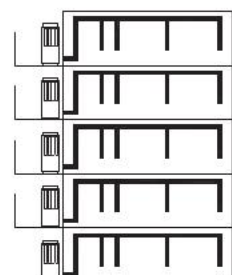


- ② Please install the stop valve at each outlet port. Even if drift happens, it can prevent the cold water flow into the hot water supply line.



### (3) Hot water supply system

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



## ALL TION AOC NO

tain pp roba om the customer when se èct ng the installation a ea)

### 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 discha ged
- ☐ Where noise and hot air will not bother neighboring residents
- ☐ Where no snow will accumulate
- ☐ Where no V set or radio receiver is placed within 5m
- ☐ (If the place is still be interfered by electrical interference, seek a
- ☐ Do not run the signal wire bet een heat pump unit and HW sto age unit nea the device gene ating elect omagnetic wave and/o 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 discha ge in a snowy area.)
- d) Do not install the unit in area where inflammable gas is generated.
- e) If installing the unit in the following special area, it may ca
  - Where corrosive gas is generated (Hot spring area and etc.)
  - Where sea wind directly blows to the unit
  - Where oil mist is filled
  - Where there are equipments generating electromagnetic wave
- f) If ambient temperature decreases below 0°C, it is a risk to break water pipes and the unit due to freezing.  
Be sure to apply anti-freezing heater to feed water piping, hot water piping and drain water piping locally installed

#### Caution

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

Water quality criteria]

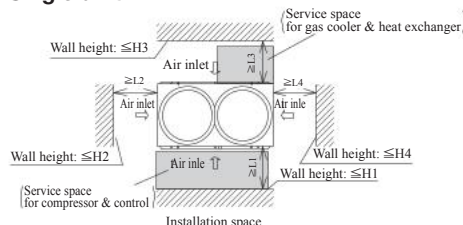
Makeup water quality criteria must be the water within the ra

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

| Item            |                               |                                    | Cyclic water<br>(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 <sup>-</sup> /L               | ≤30                            | ≤30          |
|                 | Sulphate ion                  | mgSO <sub>4</sub> <sup>2-</sup> /L | ≤30                            | ≤30          |
|                 | Acid consumption (pH4.8)      | mgCaCO <sub>3</sub> /L             | ≤50                            | ≤50          |
|                 | Sulphide ion/Acid consumption | —                                  | ≤0.5                           | ≤0.5         |
|                 | Total hardness                | mgCaCO <sub>3</sub> /L             | ≤70                            | ≤70          |
|                 | Calcium hardness              | mgCaCO <sub>3</sub> /L             | ≤50                            | ≤50          |
| Reference items | Ionic silica                  | mgSiO <sub>2</sub> /L              | ≤20                            | ≤20          |
|                 | Iron                          | mgFe/L                             | ≤1.0                           | ≤0.3         |
|                 | Copper                        | mgCu/L                             | ≤1.0                           | ≤0.1         |
|                 | Sulphide ion                  | mgS <sup>2-</sup> /L               | Not detected                   | Not detected |
|                 | Ammonium ion                  | mgNH <sub>4</sub> <sup>+</sup> /L  | ≤0.1                           | ≤0.1         |
|                 | Residual chlorine             | mgCl /L                            | ≤0.1                           | ≤0.3         |
|                 | Free carbon dioxide           | mgCO <sub>2</sub> /L               | ≤0.4                           | ≤4.0         |
|                 | Stability index               |                                    | —                              | —            |

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

#### 1) Single unit



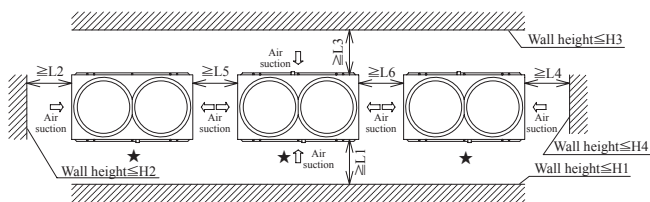
| Dimension | Installation example |          |
|-----------|----------------------|----------|
|           | 1                    | 2        |
| L1        | 800                  | 800      |
| L2        | 10                   | 10       |
| L3        | 800                  | 500      |
| L4        |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

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

## 2) In case that multiple heat pump units are installed

★ shows the front side of the unit

### ① Installation example for 3 units in a row

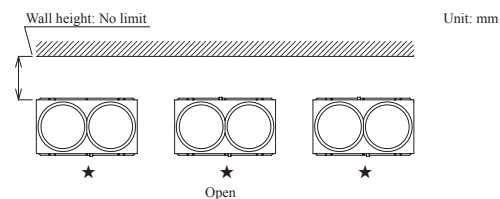


| Dimension | Installation example | 1        | 2        |
|-----------|----------------------|----------|----------|
| L1        |                      | 800      | 800      |
| L2        |                      | 10       | 10       |
| L3        |                      | 800      | 500      |
| L4 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

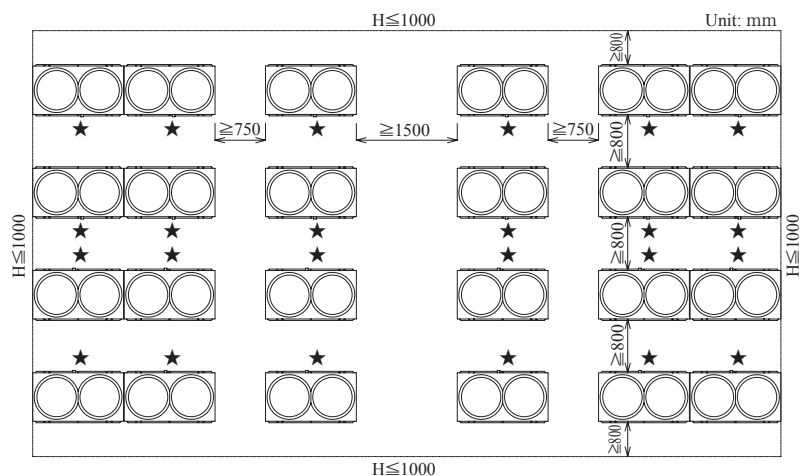
\*Units can be installed continuously at intervals of 10mm.

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

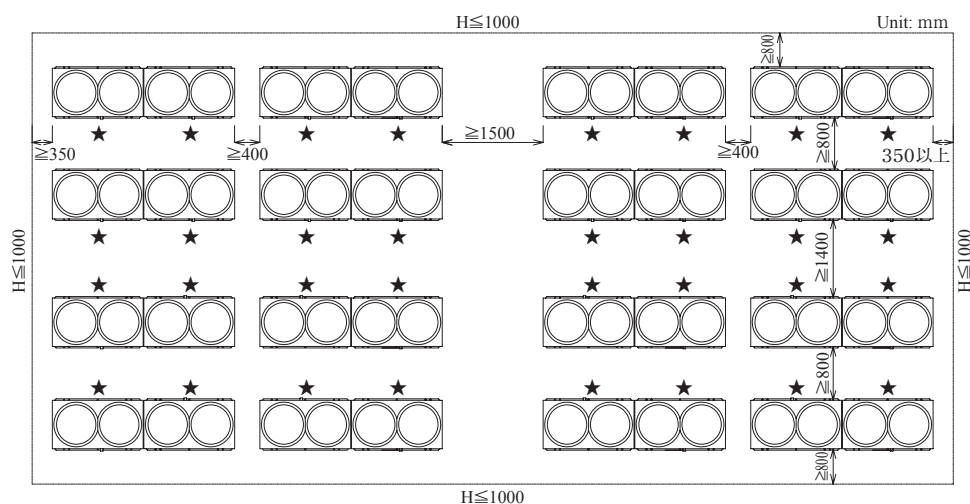
Please keep 10mm or more space between the units with consideration for the installation space.



### ③ Installation example for 6 units horizontally and 4 units longitudinally



### ④ Installation example for 8 units horizontally and 4 units longitudinally



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

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



### (3) Carrying in and installation of unit

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

#### 3-1 Carrying in

- Define a carry-in route, and carry in the entire package containing a unit to the installation point
- ~~Shipping and handling protection is applied to the bolts with plates~~ to prevent from damage

##### Please note

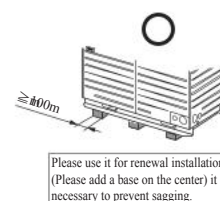
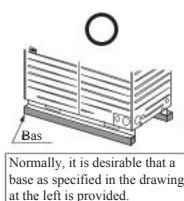
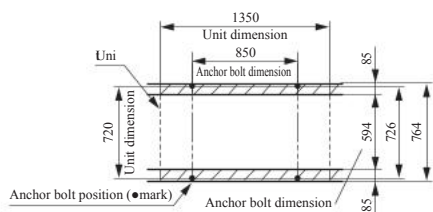
- ~~Place do not~~ to put belts through the rectangular hole
- ~~Apply cloth pads~~ between a canvas belt and a unit in order to p



#### 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

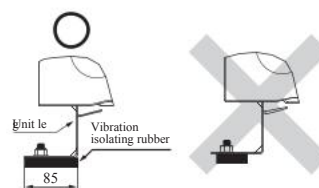
- Please install a heat pump unit after ascertaining that the bases were made to have sufficient strength and level for ensuring the unit shown in the above figure.
- Please construct a base which has larger area than the shadowed area (the entire bottom area of the heat pump unit's anchor legs) shown 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.
- ~~By sea, air, truck, etc.~~ wind solidly not to be fallen down

##### (c) Vibration isolation rubber

- The vibration isolating rubber must support the heat pump unit 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.



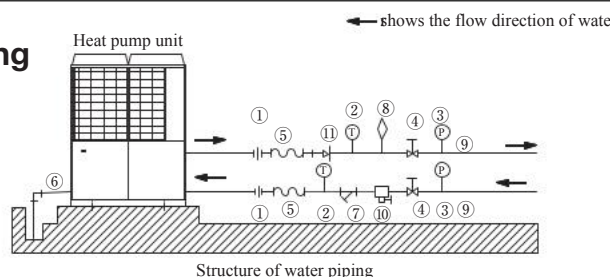
#### 3-3 Notabilia for installation of unvented cylinder

According to the installation manual attached to the cylinder p

## Water piping work

### 4-1 General description

#### 4-1.1 Outline of water piping



##### (i) Key consideration for water piping

Be sure to consider the following point when designing and installing

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 it discharge as far as possible and make the distance of it horizontal as shorter as possible in order to prevent the drain water from freezing.

Moreover, in cold region, be sure to take a measure for preventing drain water by equipping drain heater or like that.

⑦ Strainer

Be sure to fit a strainer (60 mesh or more) at the inlet port of the unit to avoid intrusion of foreign matter into the unit.

⑧ Air purge valve

Be sure to equip it to the place where air may accumulate in order to purge air in the water pipe.

⑨ Water piping

Water piping work shall be done by considering to purge air in the water pipe easily. Insulation work shall be done sufficiently.

Depending on the set temperature, the unit may temporarily supply hot water above 90°C. Piping should be selected by paying attention to heat resistant temperature.

Be sure to equip it in order to drain off the water from the system at servicing.

Be sure to equip it in order to operate the multiple heat pump water

⑩ Drain valve

⑪ Check valve

##### (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 check the quality of water and hot water whose quality is poor.

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 stop piping operation consideration for water pipe not to freeze

#### 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 drain pipe, joints and valves at water inlet/outlet

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.

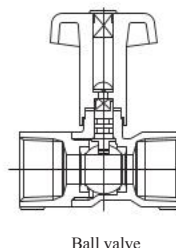
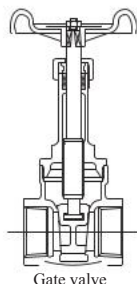
##### (ii) Piping to H storage unit

Be sure to install an air purge valve at the inlet/outlet ports of unit for easy servicing

##### (iii) Selection of valves and joints

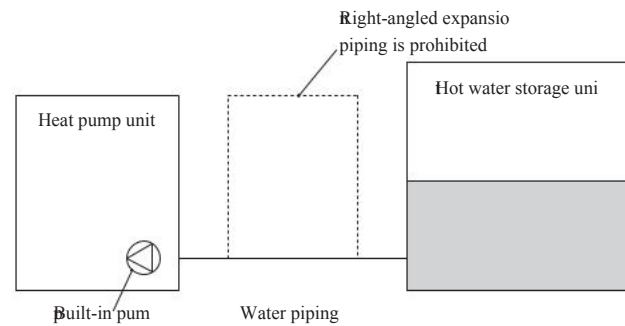
① It is better to use a gate valve for main pipe, because the gate valve has less resistance at full opening position.

② For air purging or draining, ball valve shall be used. Be sure to install ball valve to be horizontal axis in order to drain bubble to be able to pass easily.



- (iv) Right-angled expansion piping is prohibited. (Return piping from tank)

Before recommending such a right-angled expansion piping like



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

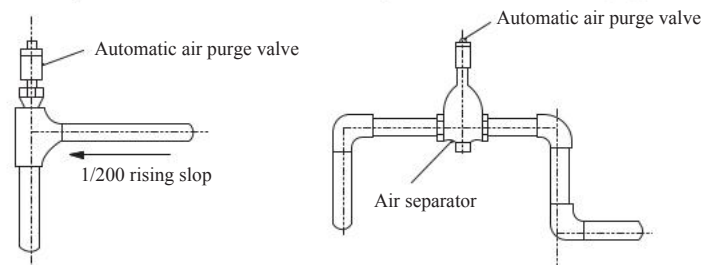
- (v) Piping slope and air purge valve (Hot water piping)

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

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

Therefore if there is descending slope in the hot water circuit, it is necessary to install 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 temperature variation is large, the pipe will expand or contract, however, the expansion and contraction will be small, 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, there is a risk that a serious leak may occur from the faulty joint and/or connection part of pipes.

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

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

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

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

Supporting interval of pipe support (m)

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

### 4-1.3 Drain piping work

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

## 4-2 Water piping work

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

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

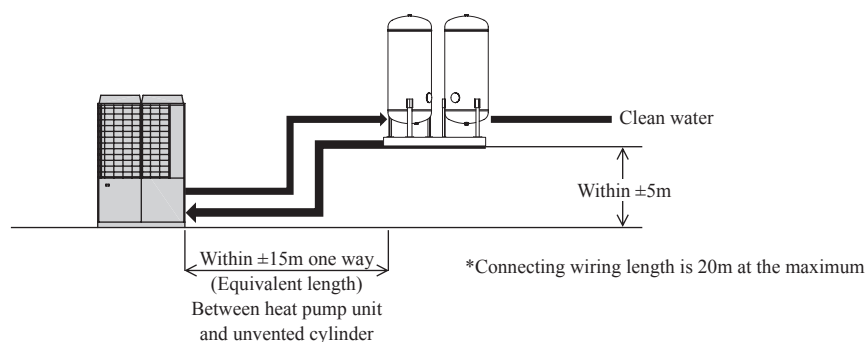
Be sure to install the heat pump unit and the unvented cylinder in the shortest piping length from the view point of saving energy. Piping length and height difference shall be within a following range.

Limitation of piping length

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

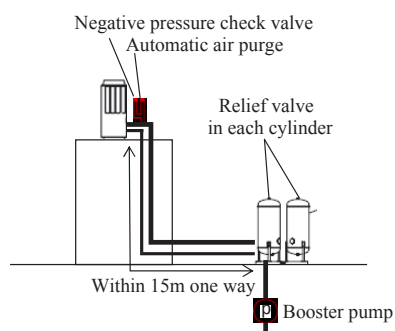
ii) Height difference: Within  $\pm 5\text{m}$

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



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

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



### 4-2.2 Pressure loss of the pipe and joint

① Pressure loss of pipe

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

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

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

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

③ Pressure loss of option part.

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



### 4-3 System diagram

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

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

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

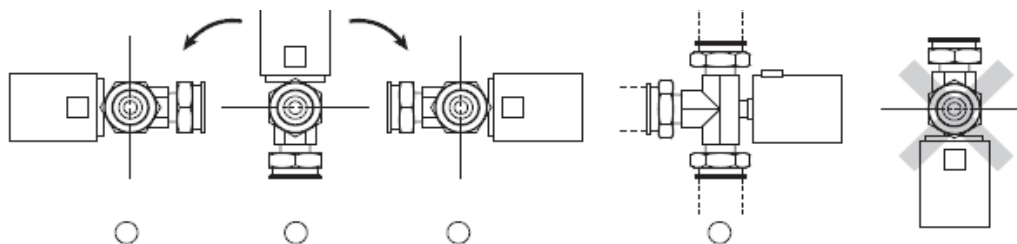
If you want to select other combination than these, please consult with our distributor.

The notabilia for system structure

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

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

\* Hot water stop valve is aw well.



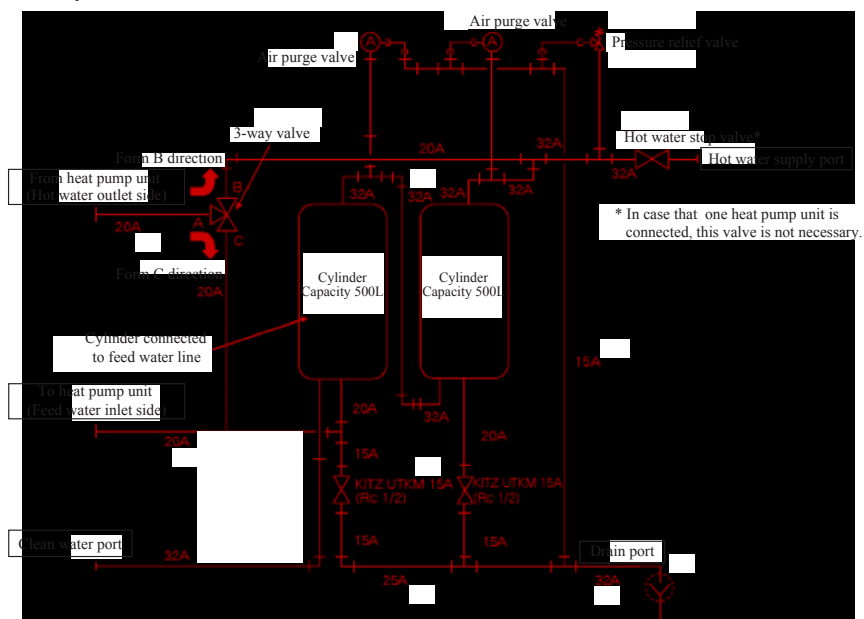
- ⑥ The drain cock for the cylinder connecting the feed water pipe shall be install at the position mentioned in the system diagram.
- ⑦ Be sure to insulate water piping and cylinders.
- ⑧ Please apply anti-freeze pipe heater to the water pipe as necessary.
- ⑨ The limitation of one way piping length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

Other points to be noted

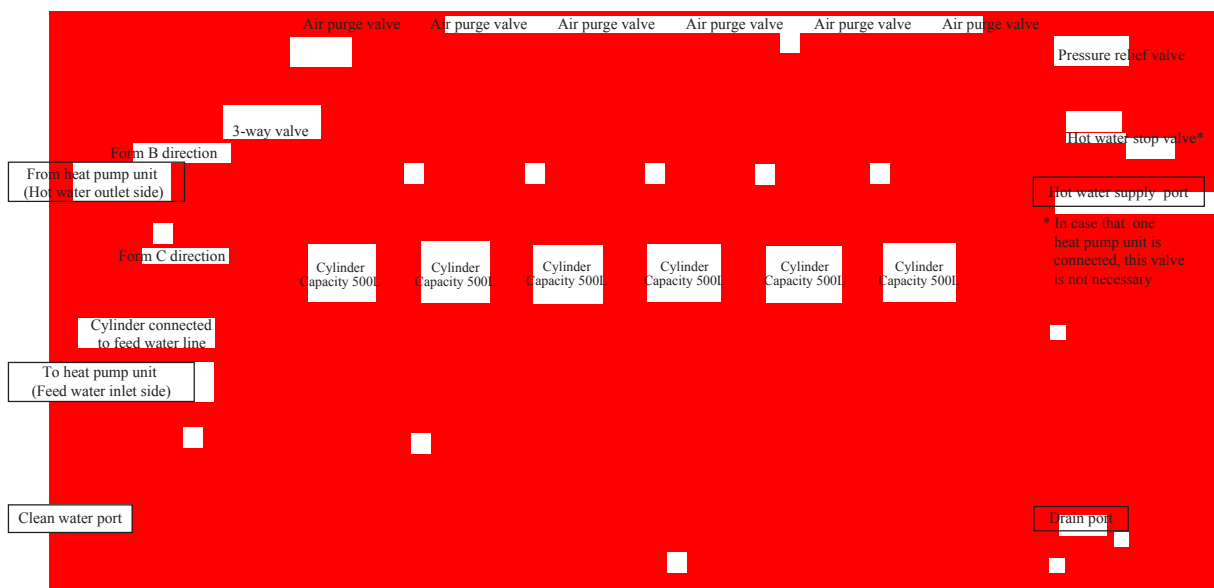
- Do not do brazing work near the cylinder.  
The corrosive material included in the brazing material may give damage (Pin-hole) on the cylinder and it may cause water leak. Accordingly, regarding the piping work near the cylinder, please proceed screw connection by using union as possible as you can.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

## Installation example

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



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



## (5) Insulation work and water proofing work

### 5-1 Insulation work

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

Insulation work shall be done to satisfy the following specifications.

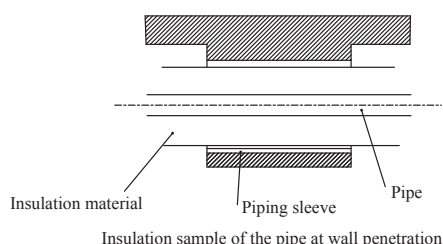
- Cylinder shell: Glass wool (Density is 16kg/m<sup>3</sup>) with 50mm or thicker
- Cylinder end plate: Glass wool (Density is 24kg/m<sup>3</sup>) with 50mm or thicker
- Water piping: Glass wool (Density is 48kg/m<sup>3</sup>) with thickness shown in following table or thicker

(Unit:mm)

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

Piping at wall penetration

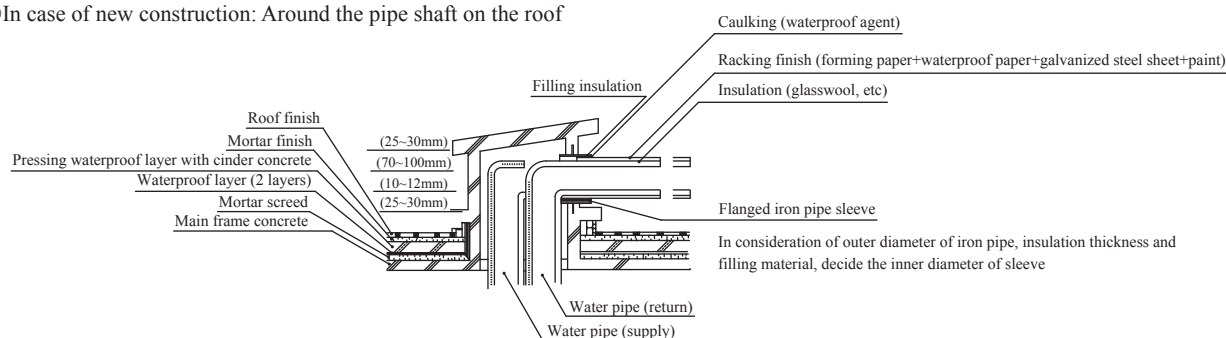
A part of wall penetration (following figure) and inlet/outlet port of water pipe at unit side shall be insulated.



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

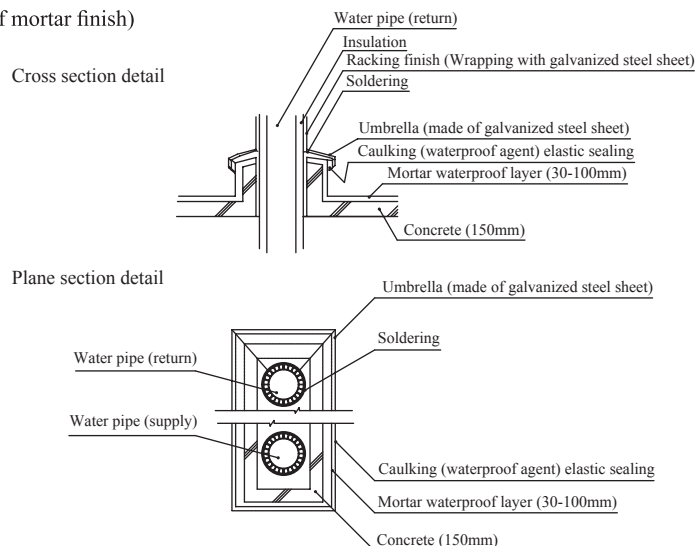
When connecting pipe to the hot water storage unit installed on the roof, if waterproof layer of the roof is cut with pipe or sleeve, It may cause rain leaking through the roof. Therefore please ask constructor to prepare the pipe penetration port mentioned below as construction work.

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



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

- Roof penetration (in case of mortar finish)



## (6) Electrical wiring work for the heat pump unit

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

Additional standards and other regulations applicable to the electrical installation work 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.

• ~~Shielded cord~~ (Cord designation 60245 IEC 51), if allowed in the

• ~~Binary tough rubber sheathed cord~~ (Cord designation 60245 IEC

• Flat twin tinsel cord (Cord designation 60227 IEC 41)

• ~~Cord 60227 IEC 51~~ vinyl chloride sheathed cord (Cord designation

• ~~Flat twin cord~~ (Cord designation 60245 IEC 51) from the

b) A grounding wire must be connected before connecting the power cable. Provide a grounding wire longer than the power cable.

c) ~~Light the unit.~~ Do not connect the ground wire to a gas pipe

If improperly grounded, an electric shock or malfunction may result.

~~Never connect the gas pipe to the gas pipe because if gas~~

d) **The installation of an impulse withstanding type earth leakage breaker is necessary.** A failure to install an earth leakage breaker can result in an accident such as an electric shock or fire. Do not turn on the power until the electrical work is completed. Be sure to turn off the power when servicing.

e) Please do not use a phase advance capacitor for power factor improvement under any circumstances. (It does not improve power factor, while it can cause an anomalous overheat accident.)

f) For power source cables, use conduits.

g) ~~Please do not lay cables in the same way as the other cables.~~ **the unit.**

Laying them together can result in malfunction or failure of the unit due to electric noise.

h) ~~Do not use the cable as a ground wire.~~ **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

component in the control box. ~~Do not attach the cable to the control box.~~ (The power attachment can result in malfunction or a failure of the unit, if water penetrates into the control box.)

k) ~~Make sure to use proper breakers.~~ (earth leakage breaker and circuit

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

The circuit breaker should isolate all poles under over current.

l) Install an isolator or a cut-off switch on the power source line in accordance with the local codes and regulations. The isolator shall be locked to keep the power source line in OFF state in conformity with EN60204-1.

m) After maintenance service, be sure to restore all wiring, bundling wire and wiring route to their original state in order for them not to touch to the metal parts.





**CAUTION**

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

- a) ~~Each cable power cable, signal cable, wire, signal wire and r~~  
 ly Each wiring shall be connected to the terminal block securely.  
 Power cable and grounding wire should be fixed with band.

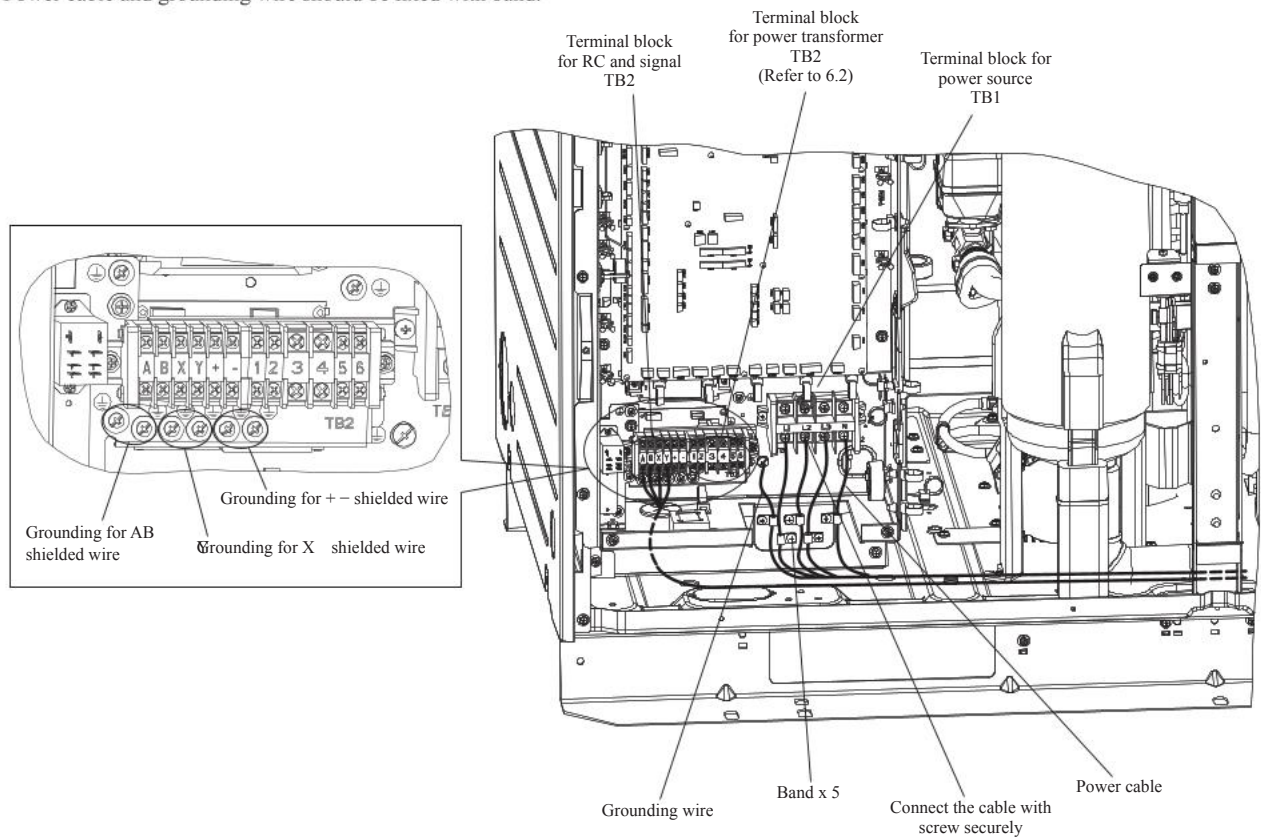


Figure-a

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

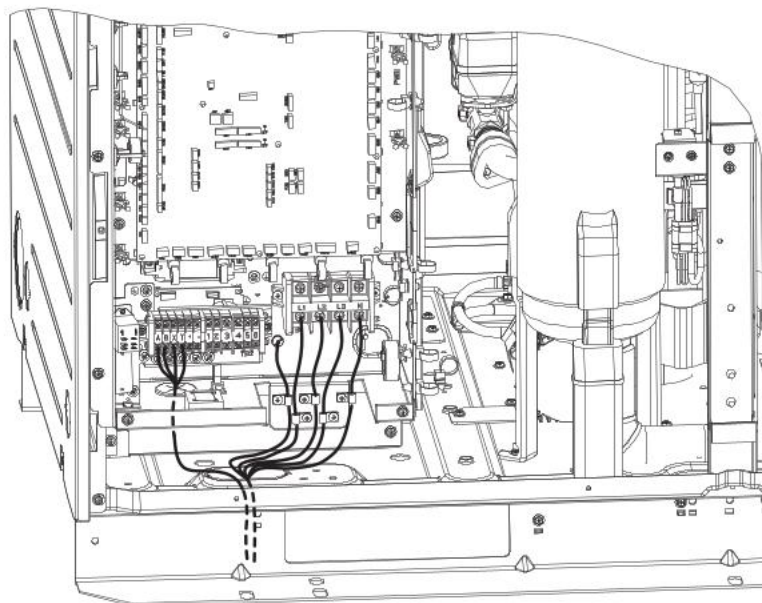


Figure-b

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.



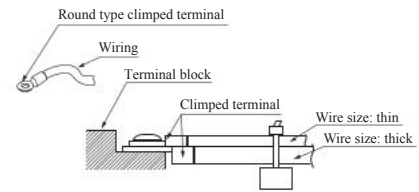
## 6-3 Connecting method of power cable

### (a) Method for leading out cables

- Cable is leaded out through the front, right, left panel a
- In wiring on installation site, cut off a half-blank (of type longate hole 40x80) cover for penetration of cables with
- In case cables of pipe or drain piping, please use bottom plate to le
- 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 cable must always be connected to the power cable terminal block and clamped them outside the control box.
- In order to the power cable terminal blocks a round-type impedance terminal
- If 2 cable connect to one terminal block, be sure to put the crimped terminal to back connection.
- And in such a case please place a thin battery 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 block are not subjected to external force
- In tightening a screw of terminal block, be sure to use a correct
- Tightening a screw of terminal block with excessive torque force may break the screw.
- For the tightening torque of terminals, refer to the table shown at right.
- When electrical installation work is completed, make sure that all electrical components in the control box have no loose connector coupling or no loose terminal connection.



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

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

| Cable size for power source (mm <sup>2</sup> ) | Wire length (m) | Earth leakage breaker (Grounding fault, overload, short-circuit protection) | Earth wire              |            |
|------------------------------------------------|-----------------|-----------------------------------------------------------------------------|-------------------------|------------|
|                                                |                 |                                                                             | Size (mm <sup>2</sup> ) | 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 signal line phase wire of power cable to the signal line. In case to connect power cable, the fuse on the control PCB is blown.

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

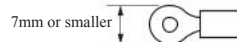
If the measured resistance is 100Ω or lower, power line may touch to signal line.

- Standard signal wire size is 0.75mm<sup>2</sup> 2 cores shielding wire. (MVVS)
- The both end of shielding wire shall be grounded.

#### • Remote control wiring

- Standard remote control wire size is 0.3mm<sup>2</sup> 2 cores shielding wire. (MVVS)
- The both end of shielding wire shall be grounded.
- If using longer wire, please use the wire size shown in

| Length (m)  | Wire size                                 |
|-------------|-------------------------------------------|
| 100 ≤ < 200 | 0.5mm <sup>2</sup> shielding wire (MVVS)  |
| 200 ≤ < 300 | 0.75mm <sup>2</sup> shielding wire (MVVS) |
| 300 ≤ < 400 | 1.25mm <sup>2</sup> shielding wire (MVVS) |
| 400 ≤ < 600 | 2.0mm <sup>2</sup> shielding wire (MVVS)  |



## (7) Electrical wiring work for the unvented cylinder

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

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

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

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

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

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

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

### Please note

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

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

Please apply temperature sensors on the position mentioned in following figure according to the following table.

Temperature sensor should be applied to the position of hot water inlet port on the cylinder in the order of Th1, Th2, Th3...

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

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

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

| Number of sensors to apply |        |        |        |        |        |        |          |
|----------------------------|--------|--------|--------|--------|--------|--------|----------|
| Sensor No.                 | 3 pcs. | 4 pcs. | 5 pcs. | 6 pcs. | 7 pcs. | 8 pcs. | 9 pcs.*1 |
| Th1                        | 20%    | 20%    | 20%    | 10%    | 20%    | 10%    | 10%      |
| Th2                        | 60%    | 50%    | 40%    | 30%    | 30%    | 20%    | 20%      |
| Th3                        | 100%*2 | 75%    | 60%    | 40%    | 40%    | 30%    | 30%      |
| Th4                        |        | 100%*2 | 80%    | 60%    | 50%    | 50%    | 40%      |
| Th5                        |        |        | 100%*2 | 70%    | 65%    | 60%    | 50%      |
| Th6                        |        |        |        | 100%*2 | 80%    | 70%    | 60%      |
| Th7                        |        |        |        |        | 100%*2 | 80%    | 70%      |
| Th8                        |        |        |        |        |        | 100%*2 | 80%      |
| Th9                        |        |        |        |        |        |        | 100%*2   |

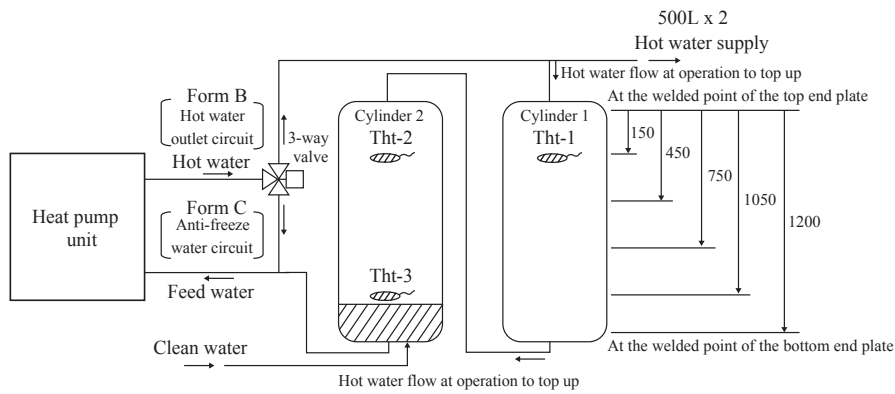
\*1 Recommendable number of sensors is 9 pcs.

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

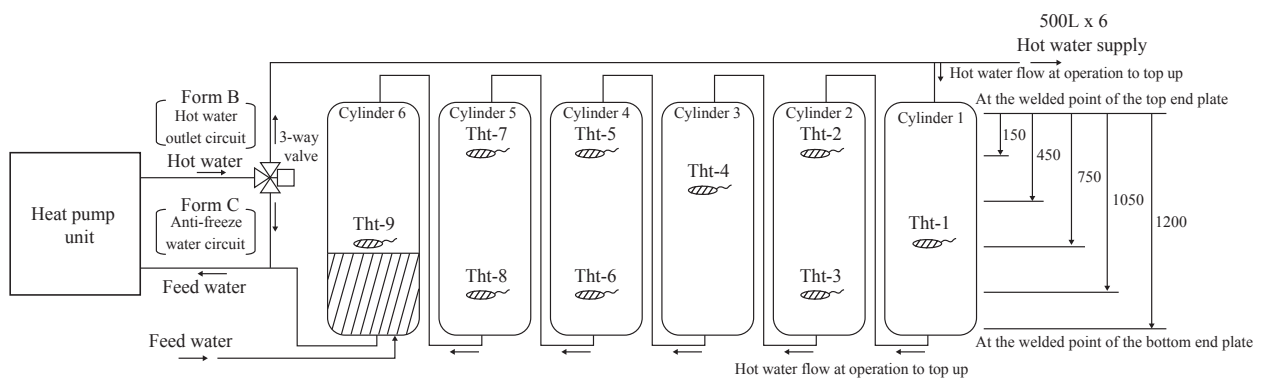
\*2 The sensor which detects 100% of W amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.



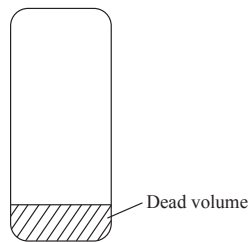
(i) In case that 2 sets of cylinders are installed



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



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



## 7-2 Wire connecting method

### Please note

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

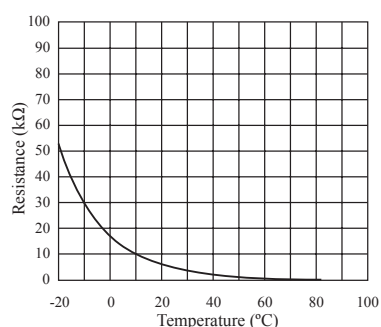
| Tightening torque |                                           |           |
|-------------------|-------------------------------------------|-----------|
| M3.5              | Terminal block for power and signal wires | 0.68-0.82 |

### (i) Connecting method of temperature sensor

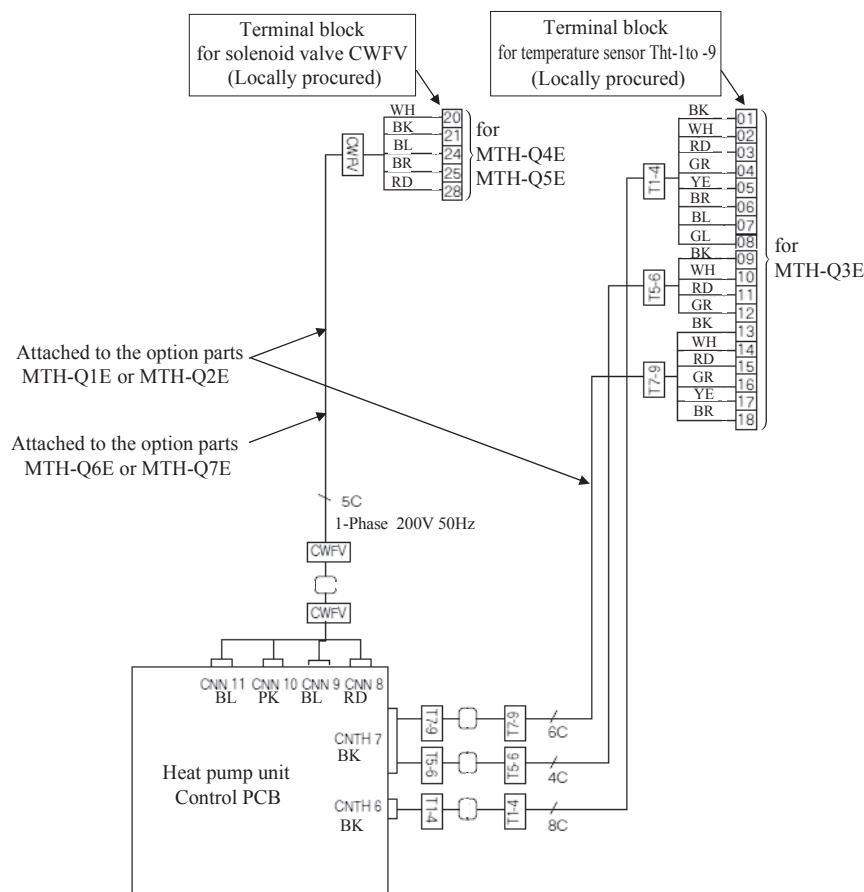
- Connect the lead wires of temperature sensors applied on the cylinder to the specified position on the terminal block. (for M3.5, with 18 terminals for 6 and 8 cylinders/4 terminals for 2 cylinders) (Refer to the figure on next page.)  
Connect the lead wires to the terminal block by using round type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

### Electric characteristics of temperature sensor

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



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

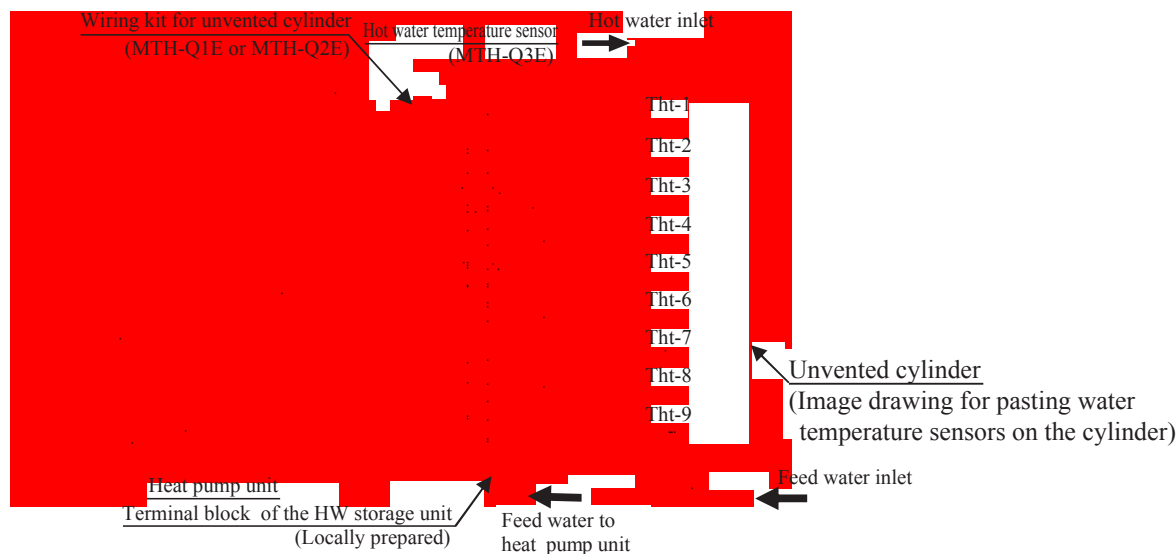


### 7-3 Connection of signal wire

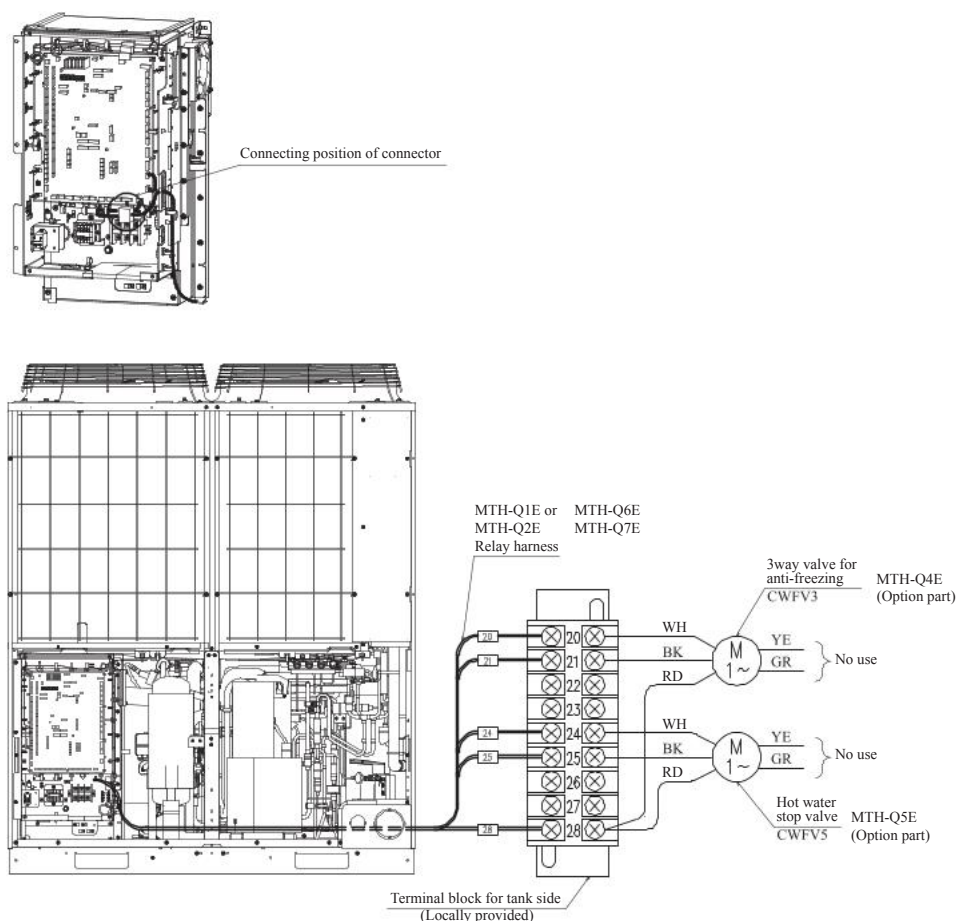
- 1) The temperature sensor wiring connectors (They are connected to the CNTH6 and CNTH7 on the control PCB in the control box of the heat pump unit at the factory) and the temperature sensor terminal block in the control box of the HW storage unit are interconnected with sensor wires. Please connect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

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

Therefore please check the continuity with tester after wiring connection.



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



## 7-4 Control setting when unvented cylinder is connected.

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

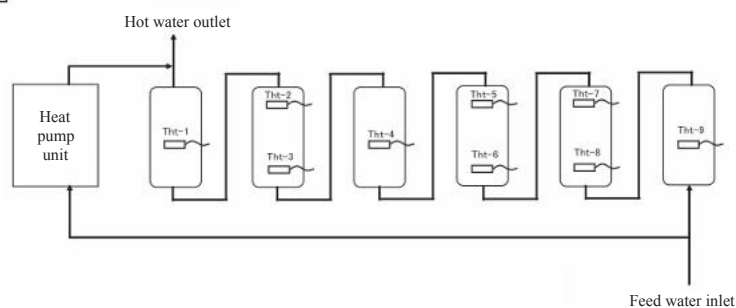
- DIP switch setting  
Be sure to set SW3-3 OFF

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

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

Example

For 3000Liter (6 x 500Liter) cylinder



## 7-5 Anti-freezing water circuit for unvented cylinder

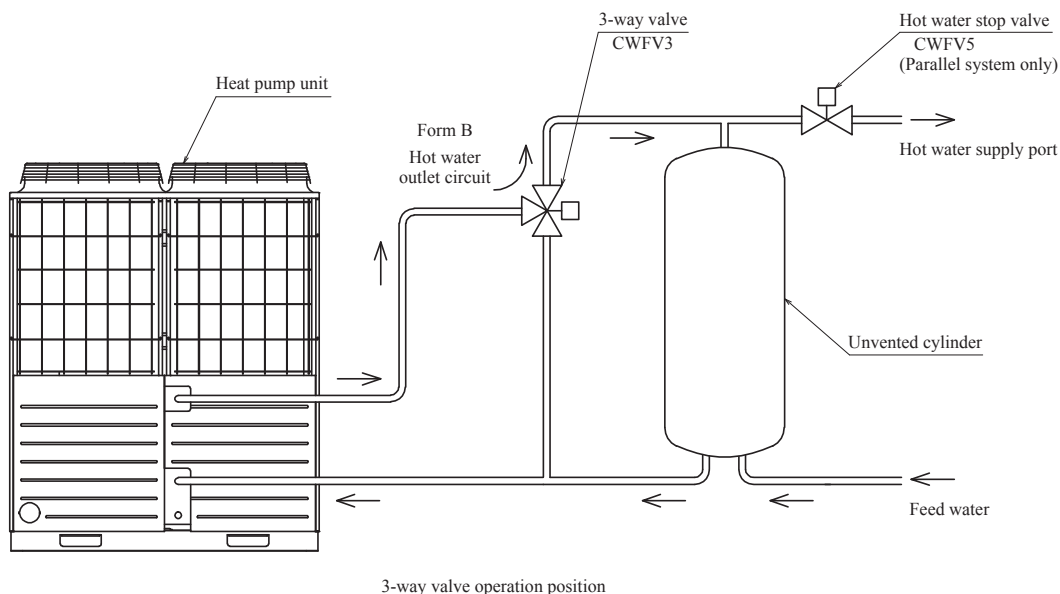
In case that the water in the pipe may be frozen due to decreasing the water temp below 0°C in winter season during the long term stop or anomaly stop of heat pump unit, the water pump is forcibly operated in order to prevent water in the pipe from freezing. The water flow is changed to ② anti-freezing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

[Water circuit]

### ① Normal operation (Just reference)

Compressor: ON

Gas cooler inlet water temperature > 3°C



### ② Anti-freezing water operation

[Starting condition]

- Compressor: OFF
- Following condition is satisfied

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

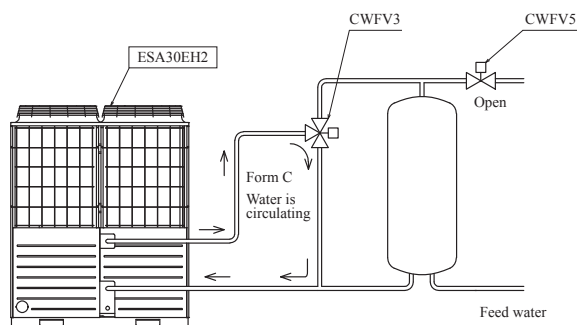
[Ending condition]

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

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

[Control conditions]

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





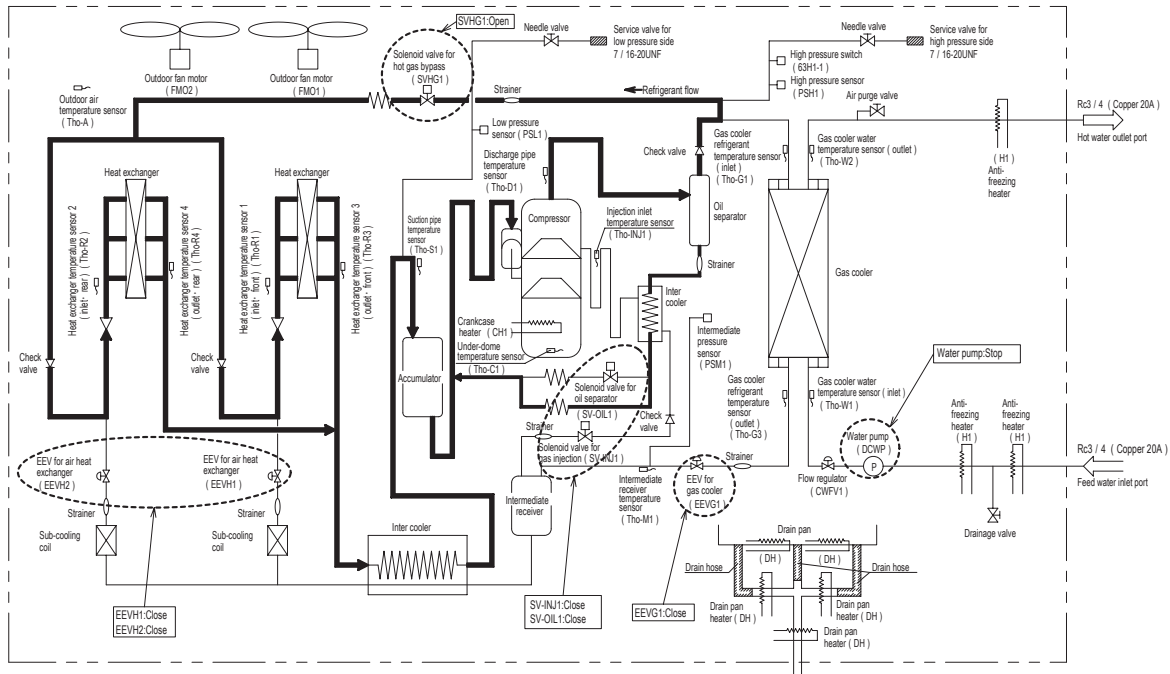
## 7-6 Defrost operation for unvented cylinder

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

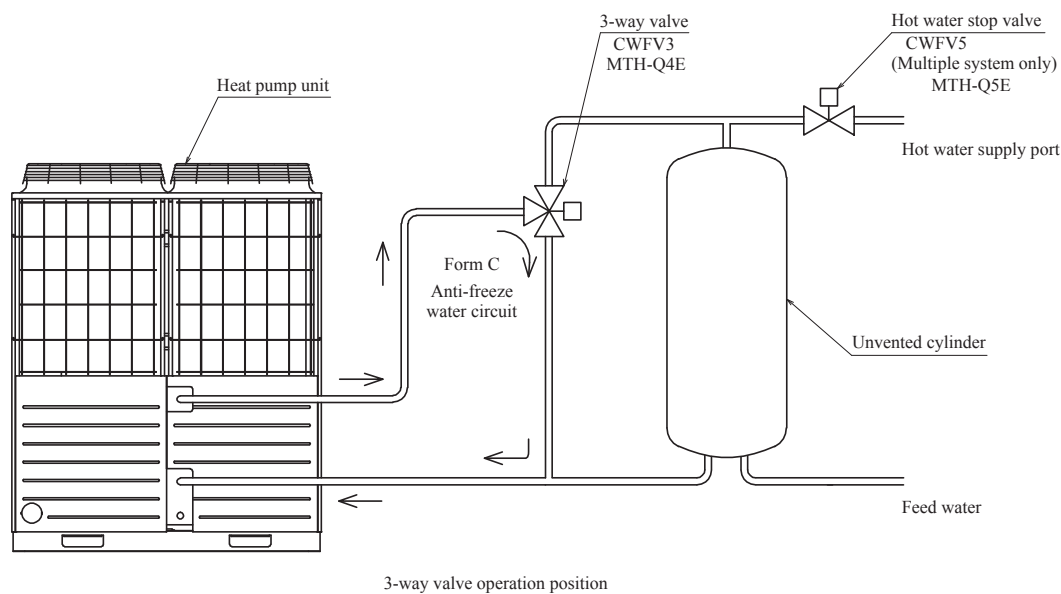
When the defrost starting condition is satisfied, defrost operation is started and the frost on the heat exchanger is defrosted by opening the hot gas bypass valve (SVHG1) to flow the discharge gas into the air heat exchanger.

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

[Refrigerant circuit]



[Water circuit at defrost operation]



## (8) Control setting

### 8.1 Unit address setting

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

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

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

• Address No. setting

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

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

• Address No. setting method

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

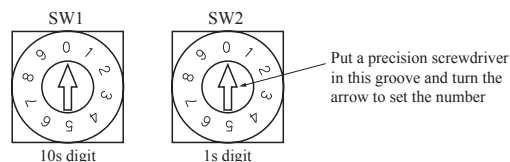
Do not set other than the number listed on this table.  
It may cause error.

|                    |
|--------------------|
| How to set address |
|--------------------|

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

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

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



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

### 8.2 Switching control

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

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

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

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

### 8.3 Check DIP switch setting

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

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

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

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

## 8.4 Software switch setting

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

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

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

### (a) Unvented cylinder

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

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

### (b) Setting procedure of 7-segment display

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

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

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

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

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

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

The identification alphabets of code display are following 2.

"C" : [C00] - [C99]

"P" : [P00] - [P99]

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

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

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

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

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

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

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

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

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

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

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

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

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

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

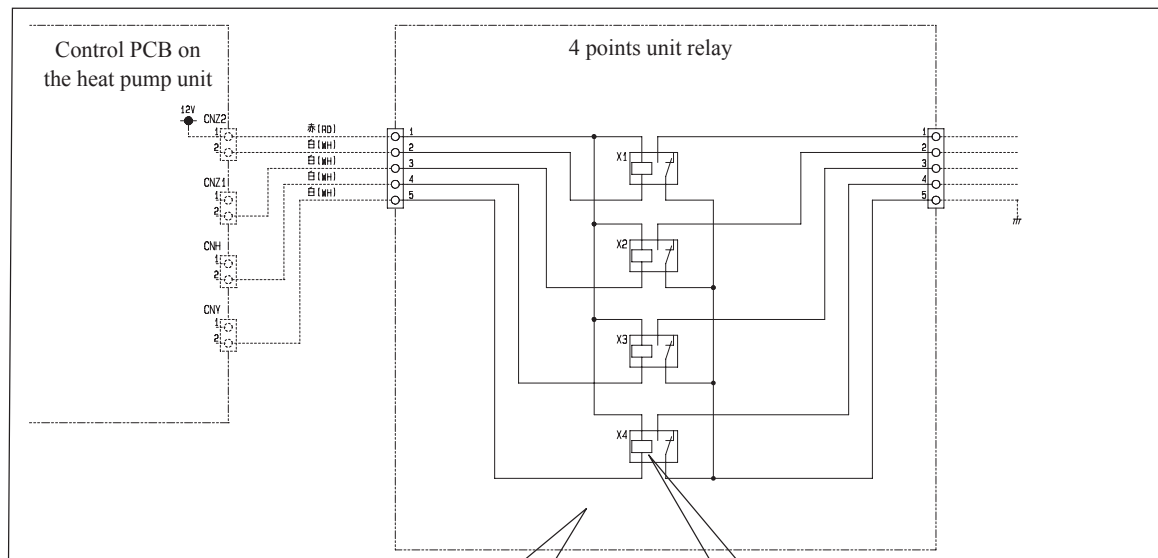
- When holding down SW7 for 3 seconds, 2 lights up 2 of [P][0][2] lights up.

With that, the setting is completed.

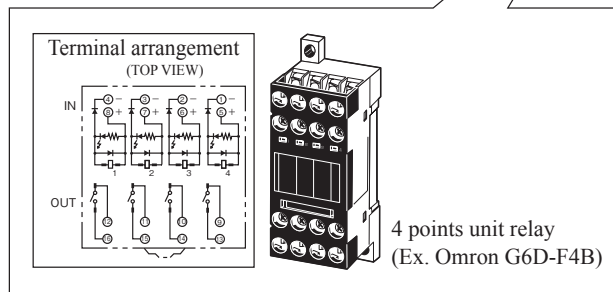
## 8.5 Specifications of external input terminal

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

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



Example of use



Coil resistance  
720Ω or more

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



## (9) Commissioning and handover

### 9.1 Before test run

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

### 9.2 Test run

#### (a) Test run procedure

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

**Please proceed test operation according to following procedure.**

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

#### [Complement]

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

#### [Caution]

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

#### (b) Contents of primary setting operation

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

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

## (10) Inspection report

### 10.1 Project information

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

### 10.2 Check list for installation

○: OK    △: shall be revised    — : No item

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

## 10.3 Check list for commissioning

○: OK △: shall be revised — : No item

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

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

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

## (11) Notabilia for servicing (for CO<sub>2</sub> heat pump unit)

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

## External input harness installation manual

This harness is used to control the operation of the CO<sub>2</sub> water heater from an external control panel.

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

### Warning

- Installation should be performed by a professional contractor.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.
- Shut off the main power source of the CO<sub>2</sub> water heater and external control panel before installing.
- Observe all warnings and cautions, stated or implied, in the CO<sub>2</sub> water heater installation manual.

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

BROWN:Snow prevention fan control input (CNS3)



BLUE:Start operation input (CNG1)



WHITE:Pause input (CNG2)



### Installation procedure

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

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

2. Connect the connector to the PCB of the CO<sub>2</sub> water heater.

### Specifications of external input

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

The external input is a no voltage contact input.

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

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

#### 【 Procedure for changing the external input function 】

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

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

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

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

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

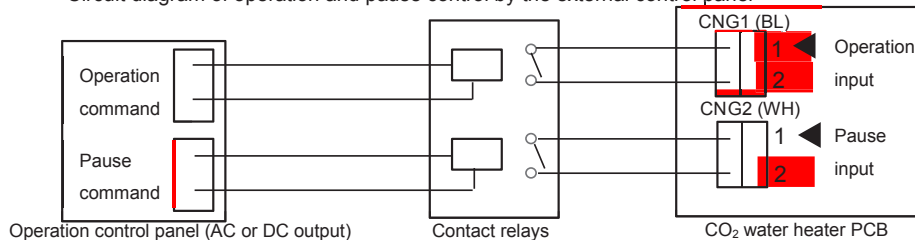
| Set value | Function                                           | Open    | Short     |
|-----------|----------------------------------------------------|---------|-----------|
| 0         | All system stop input (master)                     | Stop    | Normal    |
| 1         | Demand input (master)*1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

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

#### 【 In case that operation control by external control panel 】

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

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



## External output harness installation manual

This harness is used for carrying out the removal of the operation and abnormal signal from the CO<sub>2</sub> heat pump water heater.

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

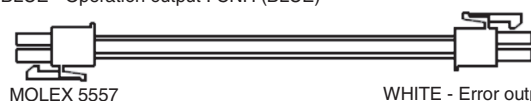
### ⚠ WARNING

- Installation should be performed by a professional contractor.
- The electrical wiring work shall be done by a qualified electrical installer, and the exclusive circuit shall be used.
- Shut off the main power source before installation work.
- Do not connect the connectors to the control board without connecting to the unit relays.
- Observe all warnings and cautions, stated or implied, in the CO<sub>2</sub> water heater installation manual.

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

BLUE - Operation output : CNH (BLUE)

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



WHITE - Error output : CNY (WHITE)

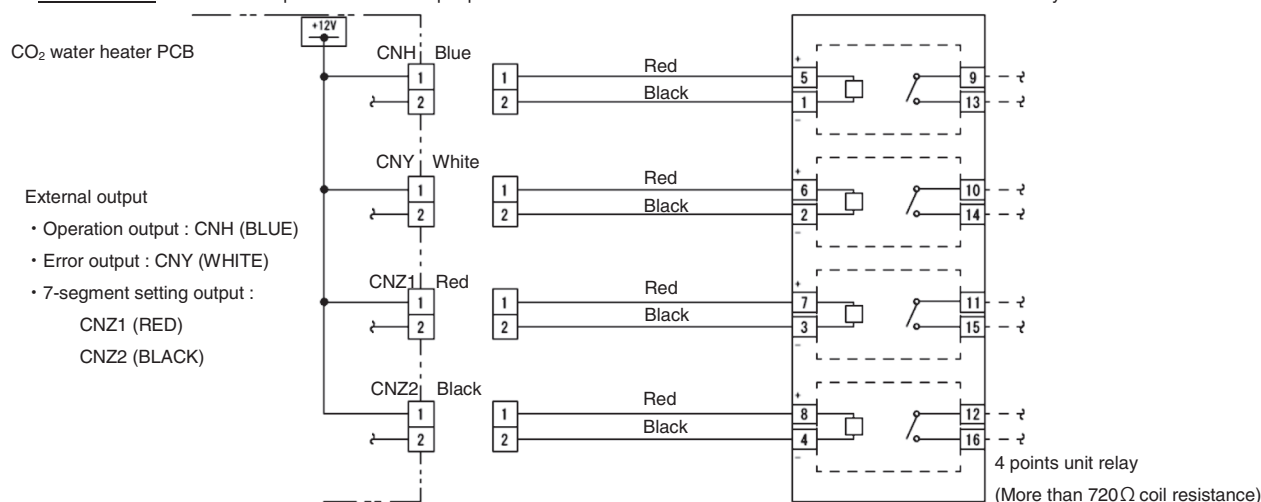
BLACK - 7-segment setting output: CNZ2 (BLACK)

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

### Installation procedure

1. Cut the cables in the middle of the harness to divide into two connectors.
2. Connect them to the unit relays.
3. Connect the connectors to the CO<sub>2</sub> water heater PCB.

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



<Setting method of CNZ1 and CNZ2>

Address of 7-segment LED

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

Set value of P23, P24

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

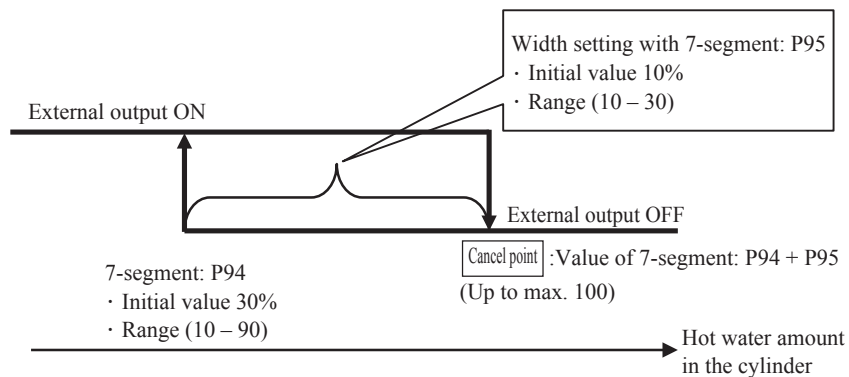
Note  
Operation signal is also output during anti-freezing operation.



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

In case of 15: Hot water amount output

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



[Setting value]

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

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

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

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

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

### Commissioning

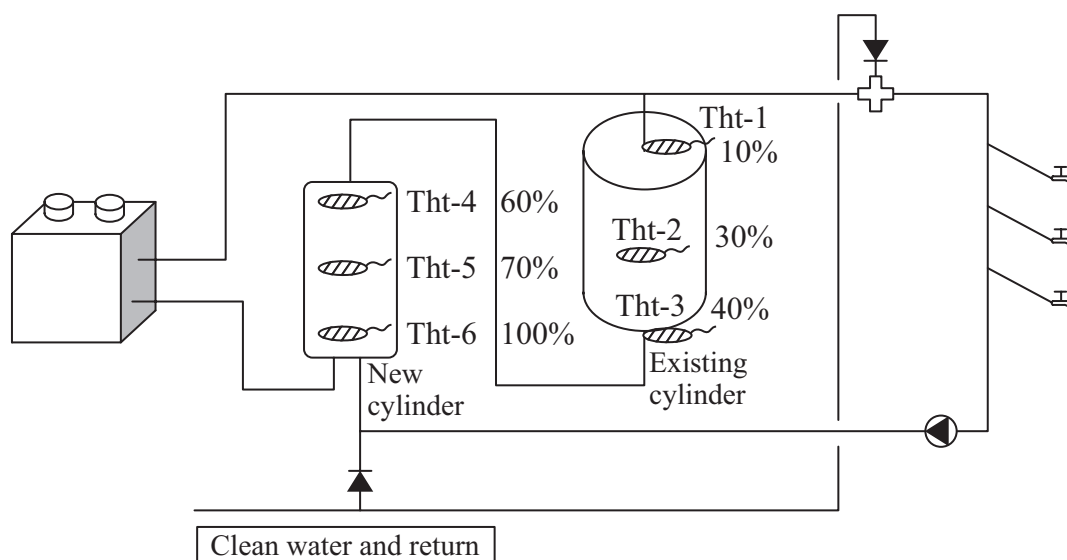
Check the normal operation by conducting a test run after installation of the external output harness.

## (12) Connection to existing cylinder

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

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

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



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

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

## (13) The behavior after power recovery

- \* The behavior after power reset (earth leakage breaker turns ON) is same as the behavior after power recovery.
- \* The behavior after CPU reset, and initializing is described as well.

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

[Remarks]

\*1 Power failure backup function

\*2 Time setting

\*3 CPU reset

\*4 Initializing

\*5 Pause

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

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

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

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

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

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## (14) Recirculation hot water supply system

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### 14.1 Features

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

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

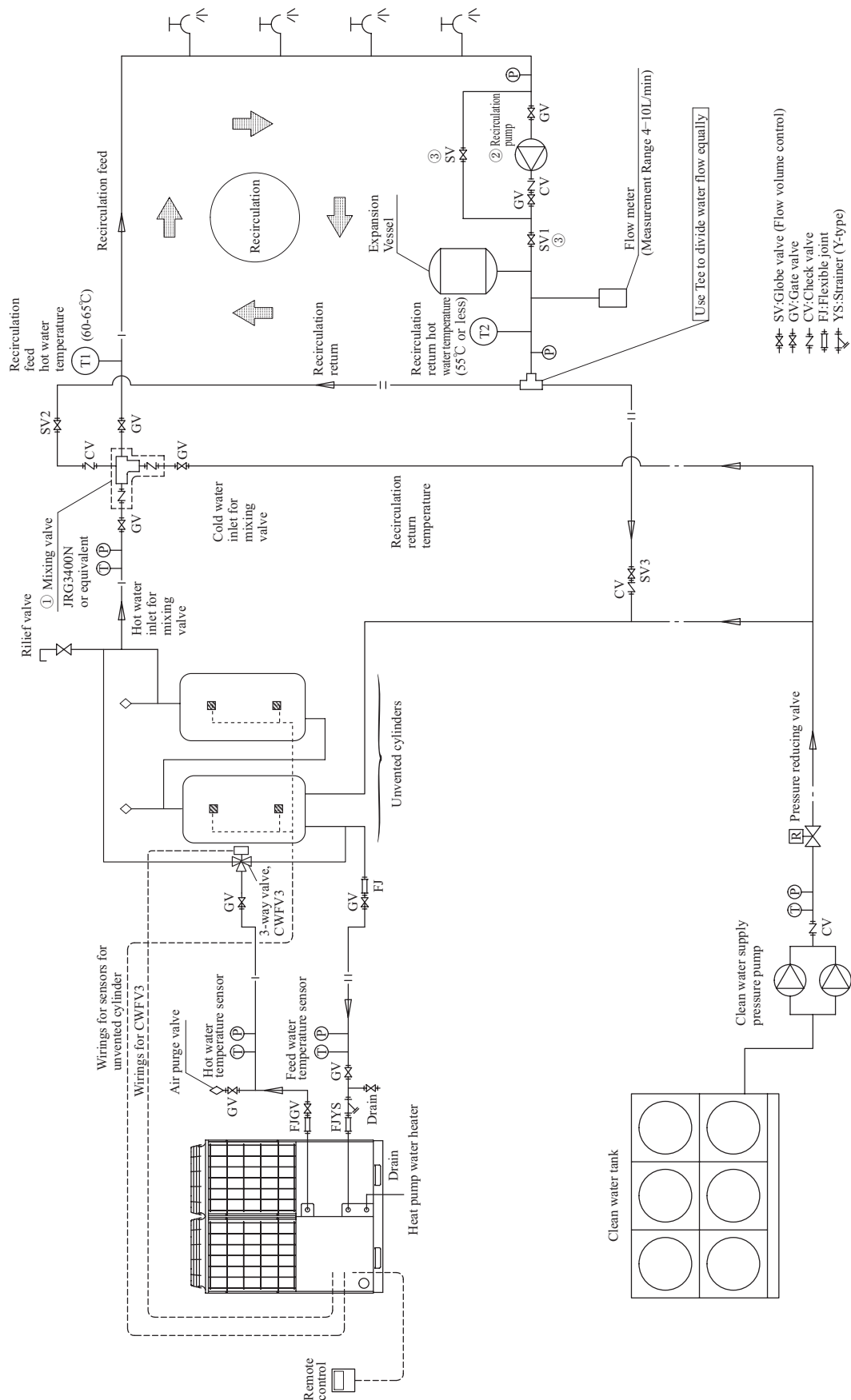
\*2: Take note that if anticipated balance is lost between the recirculation load and the hot water supply load, the supply of hot water becomes likely to exhaust.

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

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

## 14.2 Recirculation hot water supply system diagram and component list

### 1) System diagram



## 2) Component list

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

Others: please prepare parts shown in the installation manual.



### 14.3 Example of calculation for recirculation load

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

Heat loss from piping (W)

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

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

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

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

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

[Example 1]

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

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

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

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

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

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

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

Heat required for recirculation = 1,365 W  $\times$  24 H  $\times$  3,600  
= 1.18  $\times$  10<sup>8</sup> J

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

Hot water volume for recirculation = 1.18  $\times$  10<sup>8</sup>/(4.18  $\times$  (80  $-$  55)  $\times$  1,000)  
= 1,128 kg  $\approx$  1,128 L

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

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

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

## [Example 2]

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

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

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

## [Example 3]

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

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

## [Example 4]

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

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

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

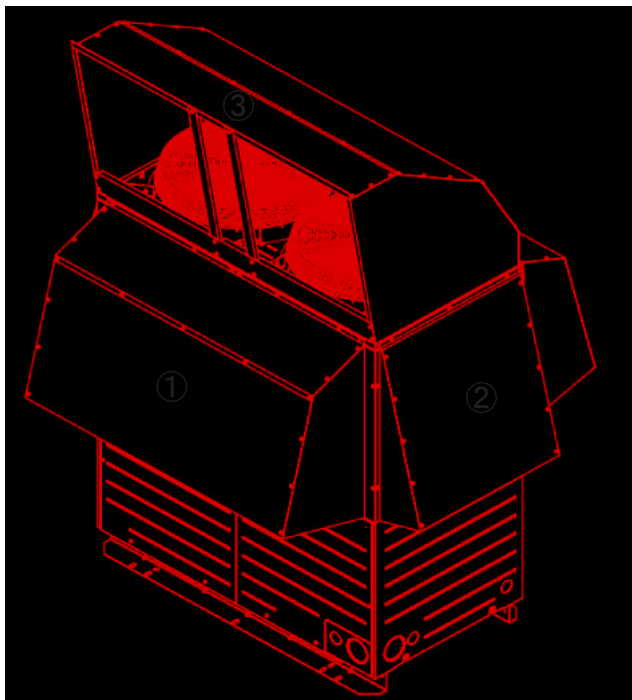
Since the flow volume of recirculation water quantity was fixed at 3.9 (L/min) utilizing the difference of 5 deg (= 60 – 55), it becomes 5 deg/1350 × 795 = 3 deg so that temperature difference in summer and winter becomes 2 deg. Therefore, provided the recirculation return hot water temperature is 53°C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

## (15) Snow prevention hood

### Snow hood

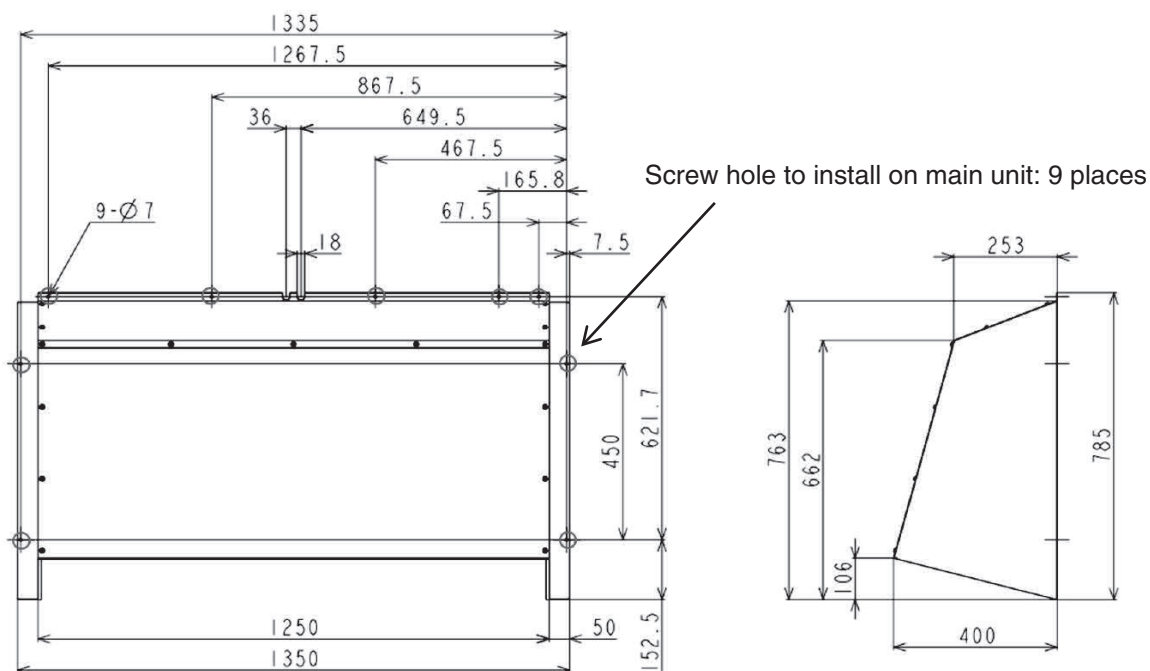
When installing the equipment in a snowy district, it is necessary to produce a snow hood at site, in order to protect the heat source unit from accumulating snow.

#### 1) Outline of snow hood

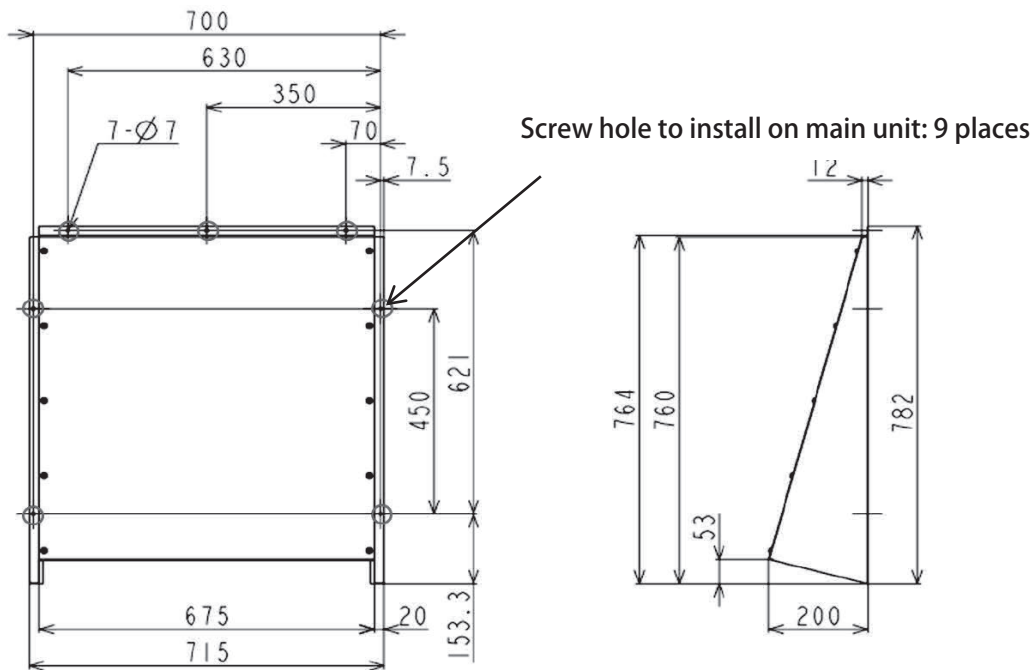


Installation of snow hood

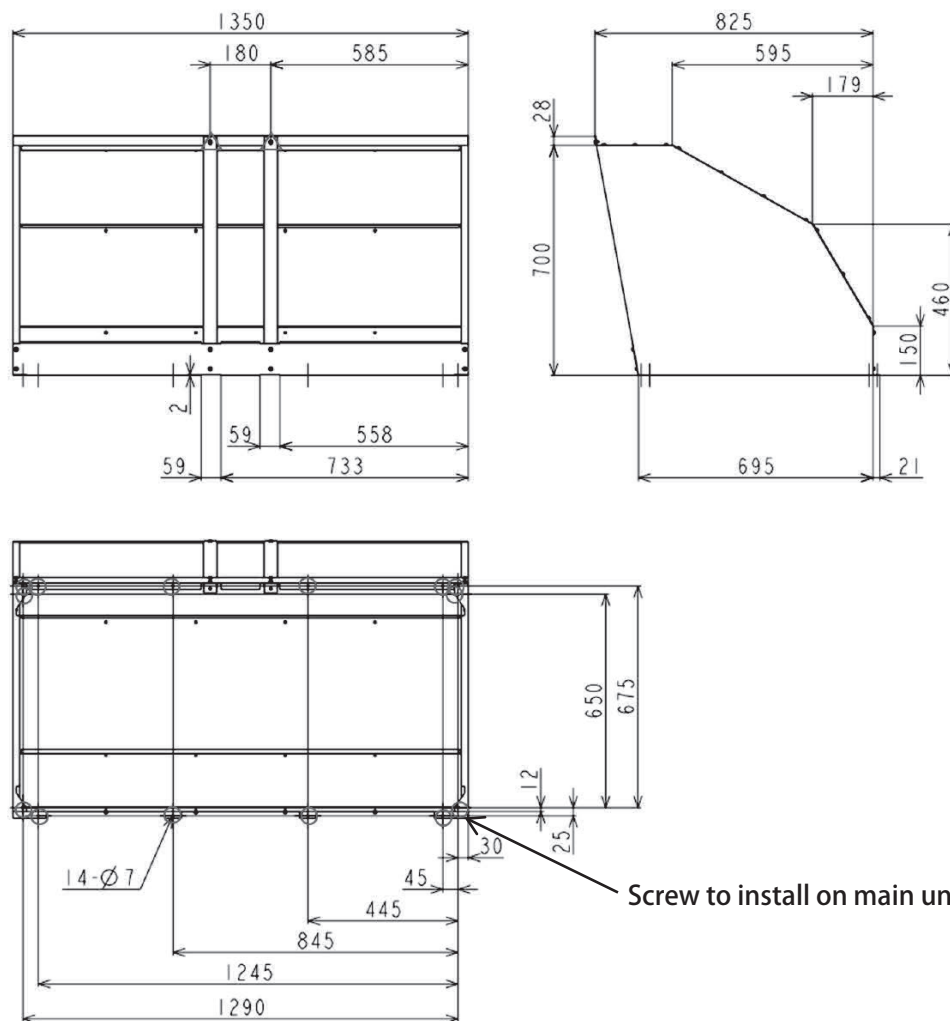
#### ① Suction side (for front, rear) x 2



② Suction side (for right, left) x 2

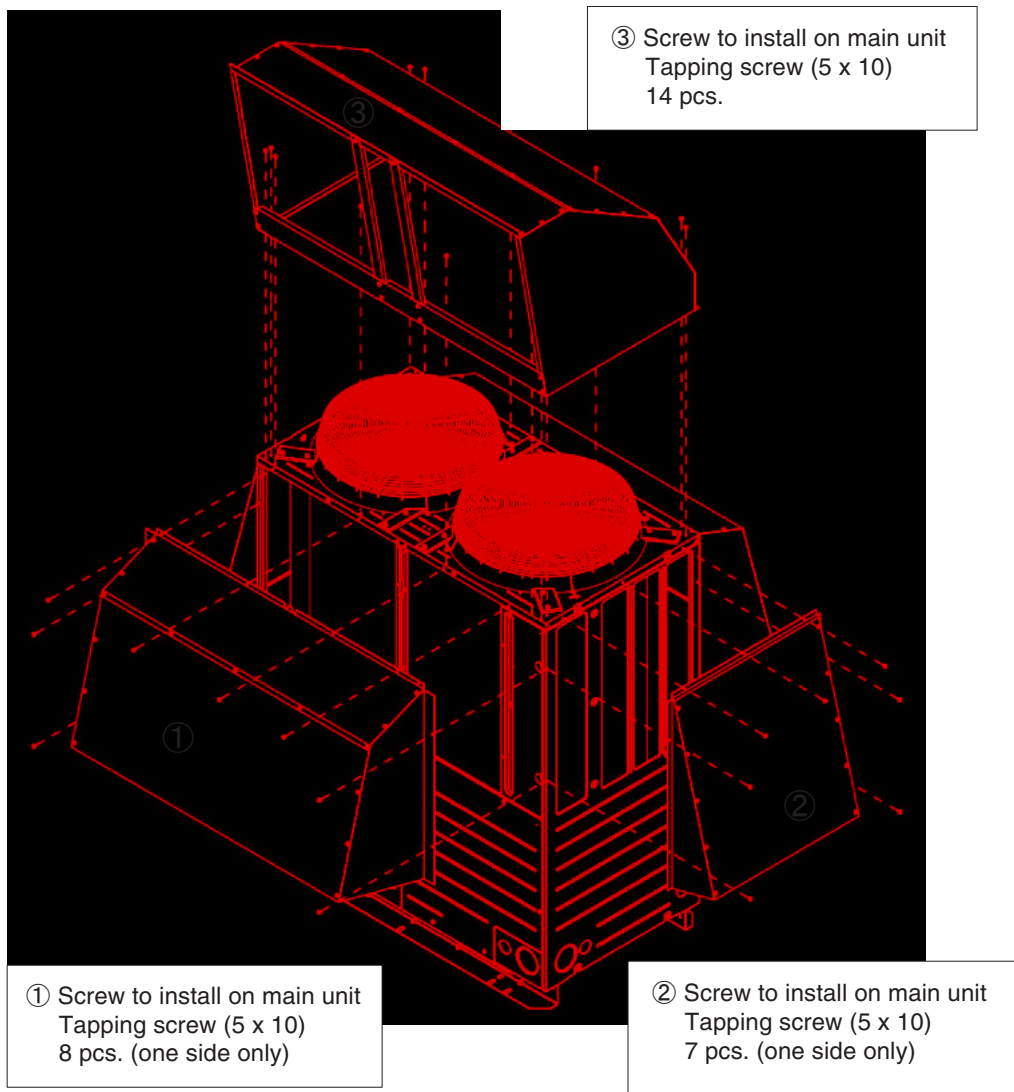


③ Outlet side x 1



## 2) Installation

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



### < Caution >

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