MITSUBISHI HEAVY INDUSTRIES

Commercial use CO_2 for air to water heat pump

50/60Hz

Q-ton Air to Water

MOVE THE WORLD FORWARD MITSUBISHI HEAVY INDUSTRIES GROUP

Free energy from the air

Overwhelming high performance and high efficiency

Q-ton Air to Water is born

Next generation Heat pump developed to combat global warming improve impact on environment

The world's first

CO_2 two-stage compressor with the combination of rotary and scroll compression cycles

High Performance

-25℃➡90℃

Even in the extremely cold regions with outdoor temperature as low as -25°C, 90°C water supply is possible

-7℃➡100%

Keeping 100% capacity down to -7°C

Efficiency

COP 4.3!

The industry's highest COP level COP4.3 (In intermediate season)

New

1. **Add space heating function corresponding to Lot 1.**
2. **Strengthening cooperation with external control devices through Modbus communication.**

Q-ton Air to Water ESA30EH2-25

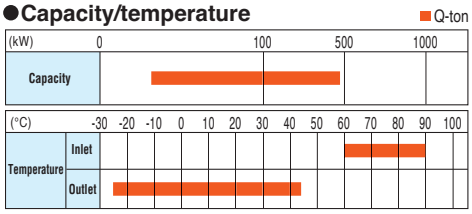
Natural refrigerant CO_2 Air to Water Heat Pump

30kW ~ 480kW (for commercial use)

The most ecological way for supplying hot water

Our Heat Pump series

●Capacity/temperature ■Q-ton

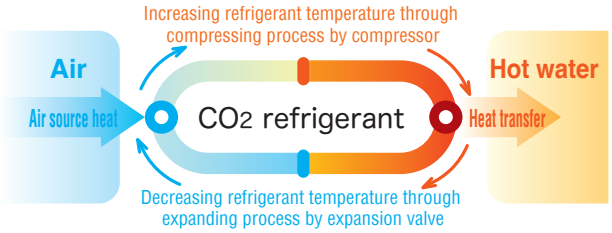


Heat Pump technology system

What is a Heat Pump ?

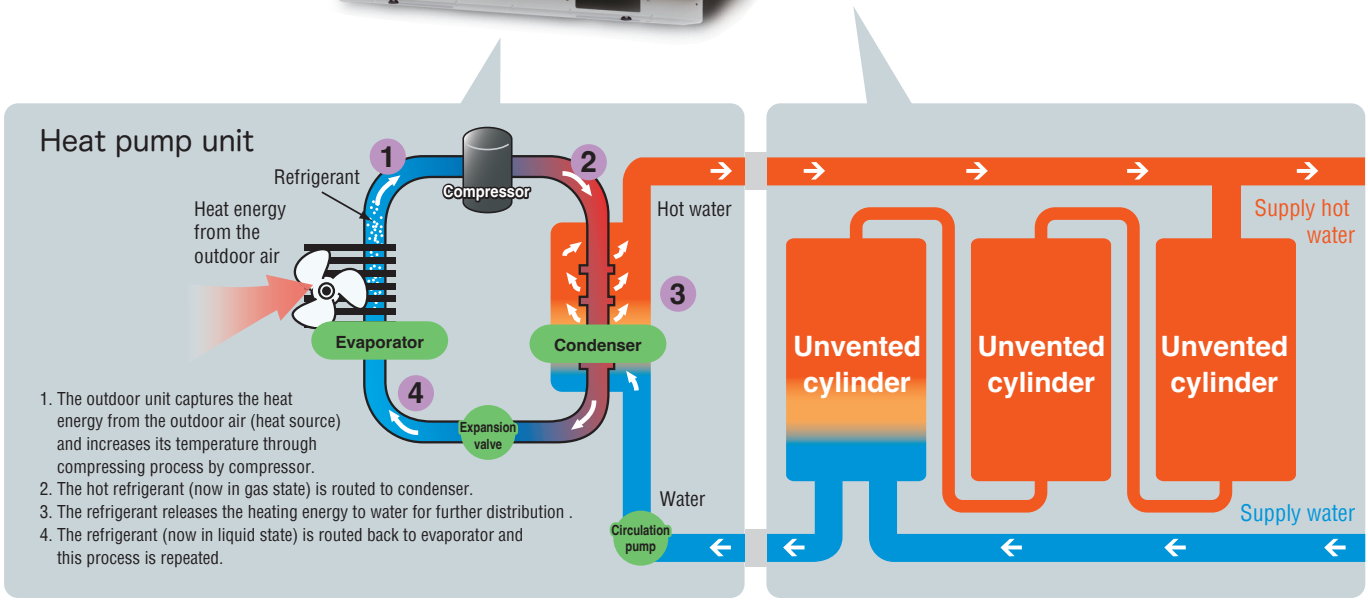
Heat energy is absorbed from the outside air when it passes through the outdoor unit; the energy is transported to the indoor unit in the refrigerant [in this case CO_2] within the piping system. This eliminates the need to bore holes or bury coils of pipes in the ground as used in conventional ground source systems.

Heat pump refrigerant cycle



Recovering heat from the air

Transferring the heat to water and supplying hot water



1. The outdoor unit captures the heat energy from the outdoor air (heat source) and increases its temperature through compressing process by compressor.
2. The hot refrigerant (now in gas state) is routed to condenser.
3. The refrigerant releases the heating energy to water for further distribution .
4. The refrigerant (now in liquid state) is routed back to evaporator and this process is repeated.

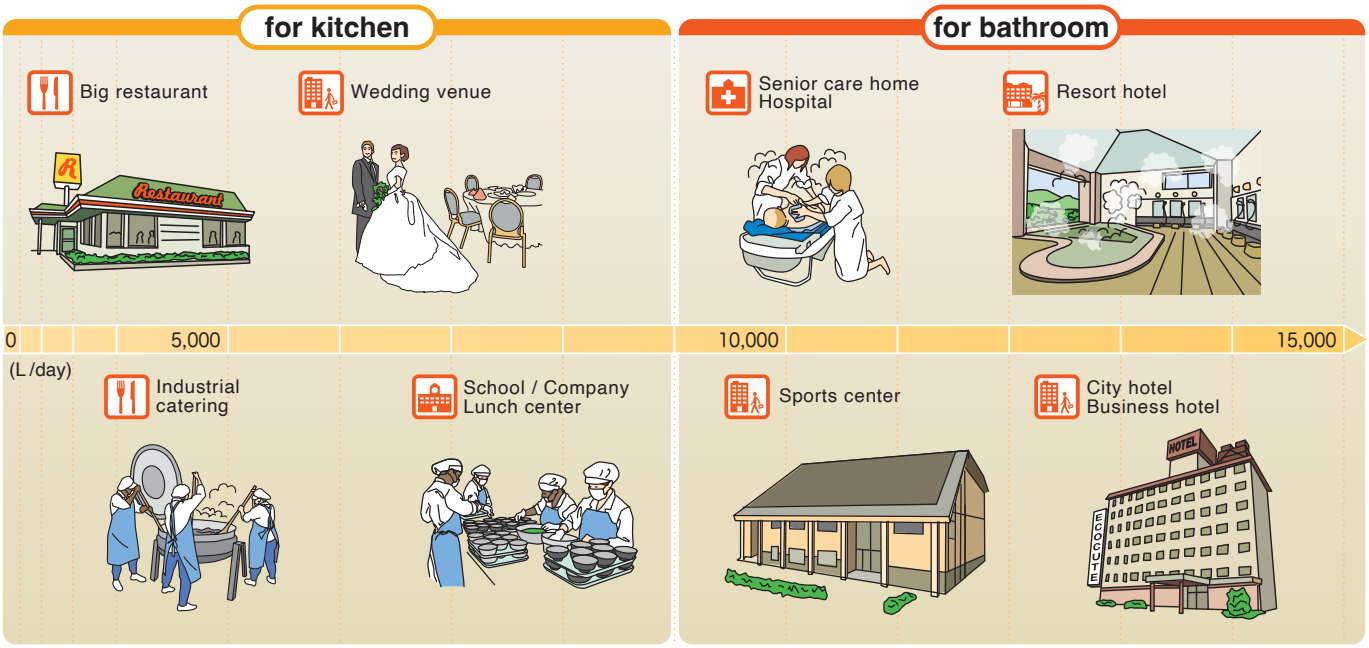
Offering efficient energy saving is the greatest merit

Typically less than 1kW of output heat energy can be produced by conventional oil or gas boilers.
Heat pump technology is capable of producing up to 4.3kW of heat energy from 1kW of energy input making the system 4.3 times more efficient than traditional means.
Furthermore using natural refrigerant can provide comprehensive solution for realization of low-carbon society.

Technology for Eco

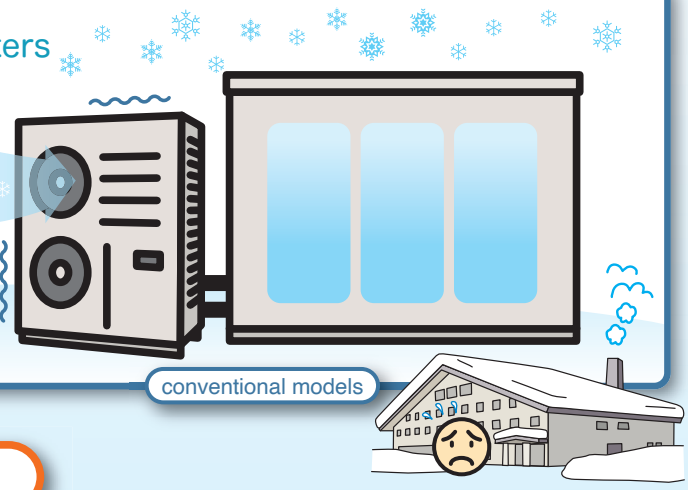
1. Dramatically reducing power consumption
2. Increasing Low Carbon initiative
3. GWP(Global Warming Potential): 1
   (R410 refrigerant:2090)
4. ODP(Ozone Depletion Potential): zero

~Recommendable usage or customer~



Conventional heat pump water heaters have performance issues to solve

In the operation under low outdoor temperature, heating capacity and heating efficiency decrease significantly.



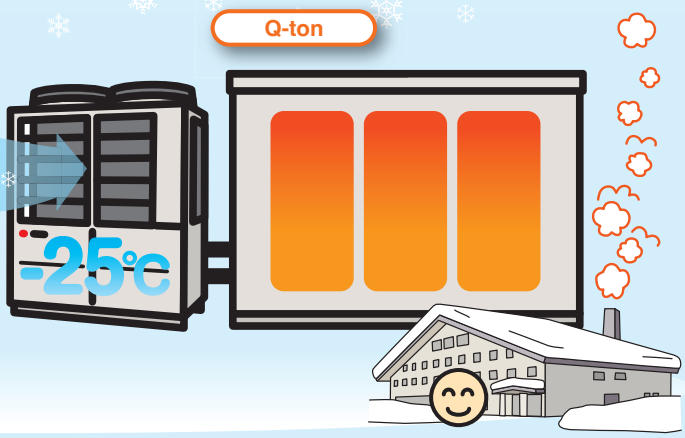
Our development concept

Keeping high capacity and high efficiency in cold conditions

Q-ton Air to Water is born

Overwhelming high performance and high efficiency

- Supplying 90°C hot water at ambient temperatures down to -25°C
- Achieving the industry's top level COP "4.3"(in intermediate season)



Q-ton's unique advantages

Advantage 1

Overwhelming high capacity and high efficiency

High Performance

-25℃ under extreme low outdoor temperature → **90℃** hot water supply

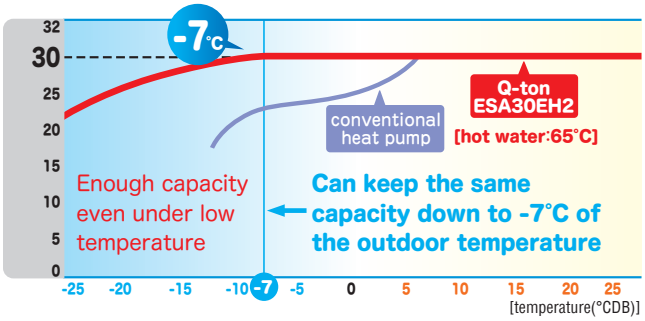
-7℃ down to -7°C → **100%** can keep 100% capacity

Efficiency

COP : 4.3!
COP = Capacity (kW) / Power consumption (kW)
the industry's top level

The first introduction of 30kW inverter type, Achieving the industry's top level COP4.3. Keeping high efficiency and saving energy operation throughout the year.

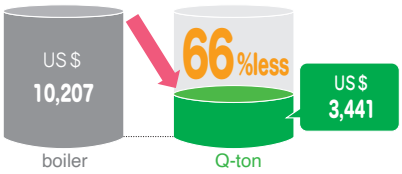
[heating capacity (kW)]



Advanced energy saving operation and low running cost

High efficiency heat pump water heaters can save running cost compared with traditional oil or gas boilers.

Annual running cost **saving** US$ **6,766**

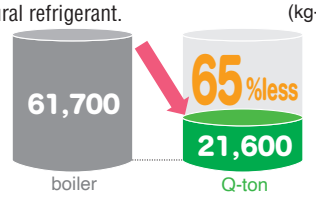


Giving consideration to global environment by use of CO_2 refrigerant

High efficiency can minimize CO_2 emission.
Using One-GWP & zero-ODP natural refrigerant.

Annual CO_2 emission amount **CO_2 reduction** **40 t**

(kg-CO_2)



[Calculation conditions]
① Operation conditions : Senior care home/resident : 50 persons, purpose of use:bath, shower, wash stand (8000L/day, 60°C conversion)
② System : ■Q-ton 30kW, tank 3000L (10hrs/night + 10hrs/daytime)
●Heavy oil boiler:110kW
③ Price rate : ■Q-ton/electric rate dayline: US$ 0.09/kWh, night: US$ 0.046/kWh
●Boiler/heavy oil rate: US$ 0.45/L
④ CO_2 emission amount : ■Q-ton/electric: 0.423-CO_2/kWh
●Boiler/heavy oil: 2.71kW-CO_2/L
(US$ 1=¥145)

Reason for high efficiency

● Scroll + rotary compressor

Two-stage compressor
By combination of two systems, high efficiency has been achieved in all operation conditions.

The first in the world

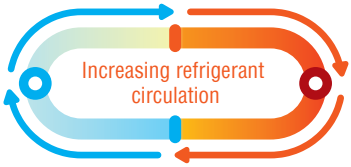
Scroll system advanced at high pressure ratio

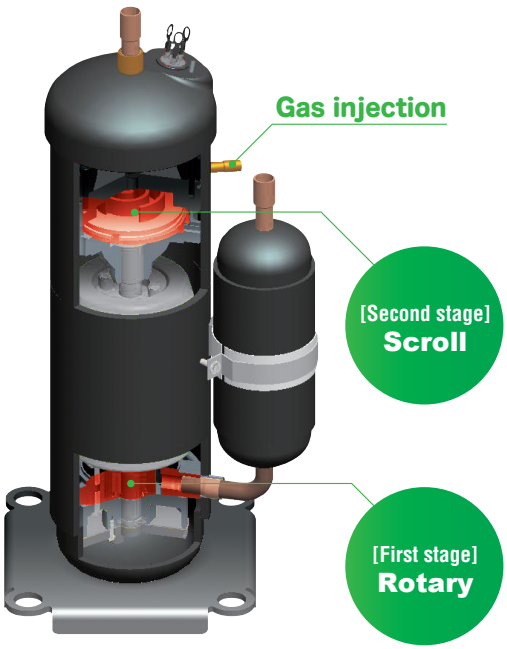
×

Rotary system advanced at low pressure ratio

● Intermediate pressure gas injection configuration

By increasing refrigerant circulation, high efficiency in low temperature can be achieved.





Advantage 2 A Wide Variety of System and Energy Controls

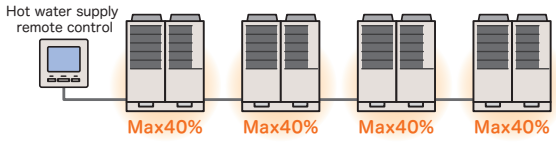
Power-Saving Measures Based on Two Types of Demand Control

Q-ton supports as-needed energy control (helps reduce electricity usage) with two types of demand setting.

* In the case of a multiple-unit coupling system

❶ You can restrict electricity usage as necessary by setting the demand time and control rate on each unit of heat source equipment.

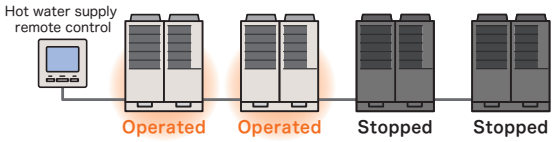
[When 40% is set for demand control]



You can select one of four rates: 0%, 40%, 60% and 80%. If you select 40%, you can reduce power consumption of all Q-ton systems during the set time period.

❷ In the case of a parent-child system, you can restrict energy usage by setting the number of units of heat source equipment to be operated during the given time slot.

[When two units are set to be operated]

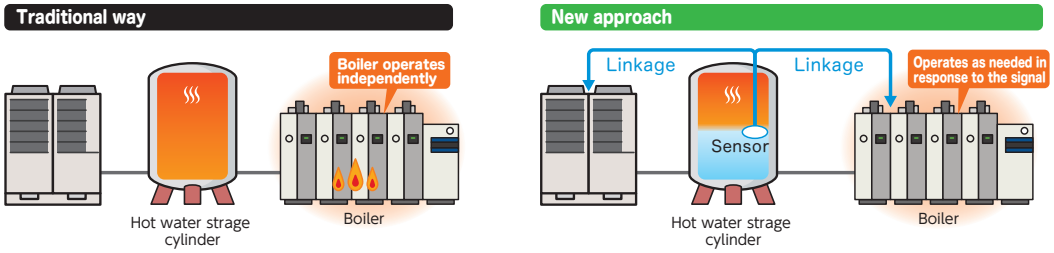


You can also reduce power consumption by varying the number of units to operate, for example, having two units operating and two stopped, three units operating and one stopped, and so on.

System Control Item

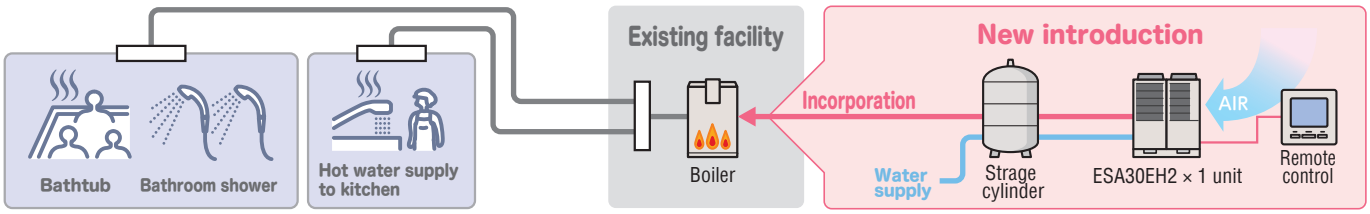
You can establish optimum operation control with other hybrid equipment in the same system by outputting your arbitrary setting of the hot water reservoir level to the external output terminal.

You can set a control condition such as "Operating the boiler while maintaining the volume of hot water at a level of 40% or less". Hybrid operation of Q-ton and the boiler helps you save energy.

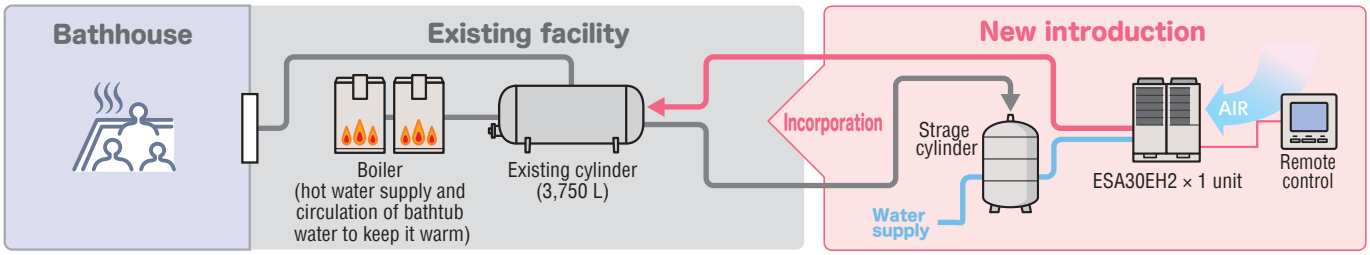


Advantage 3 Introduction of Hybrid Concept to Existing System

Series Hybrid 100% utilisation of Q-ton's hot water



Parallel hybrid Maximum Utilisation of Cost-Saving System at Large Facilities



We propose an optimum system for each of the various existing systems.

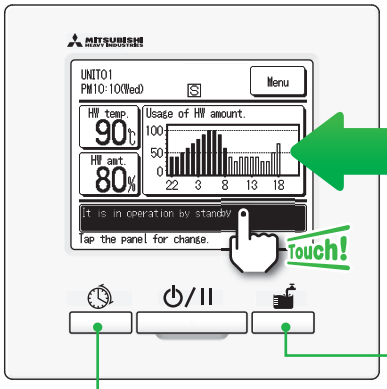
RC-Q1EH2 REMOTE CONTROL

User friendly

•LCD panel with light tap operation introduced as the industry's first
•Simple interface with only three buttons

High level of visibility

•Big LCD with 3.8 inch full dot display
•Back light function



You can check transition of hot water storage amount at a glance.

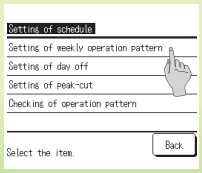
Operation to fill up

Select the language to be displayed on the R/C

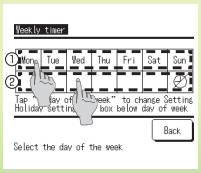
English / French / Korean / Spanish / Italian / German / Dutch / Russian

Schedule setting

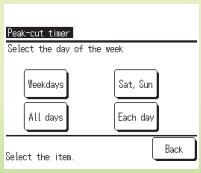
Select the item



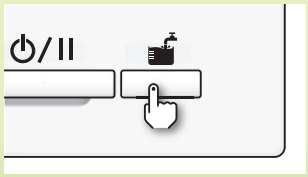
Setting of Weekly



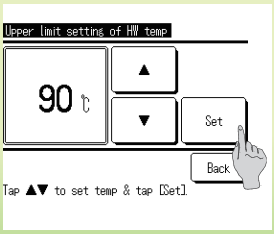
Setting of Peak-cut



Setting of schedule such as weekly operation pattern, day off (for a Maximum one year) and peak-cut timer can be set easily.



Irrespective of any setting operation, this operation will keep on filling up hot water in a tank (100%).



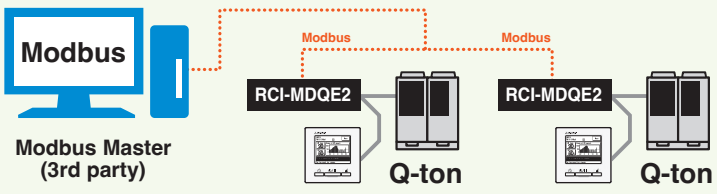
Setting temp to top up

Cooperation with BMS

Modbus interface (RCI-MDQE2)

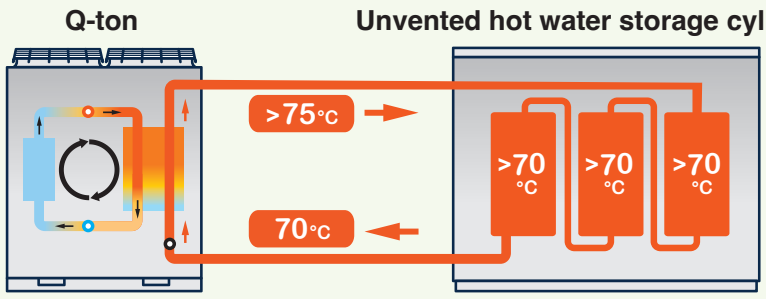
Option

- Various operation parameters and data can be controlled or obtained from the outside via the Modbus interface.
- By connecting the BMS via Modbus communication, advanced integrated control with external devices such as changing the hot water storage amount and monitoring the hot water supply temperature is possible.

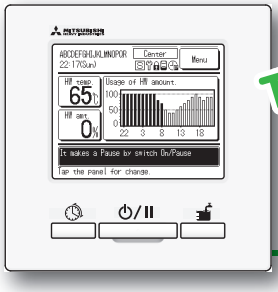


Legionella setting

- Legionella function keeps heating up the tanks until the Q-ton inlet temperature is 70°C
- The ON/OFF timer can be set with the remote controller



Hot water supply system

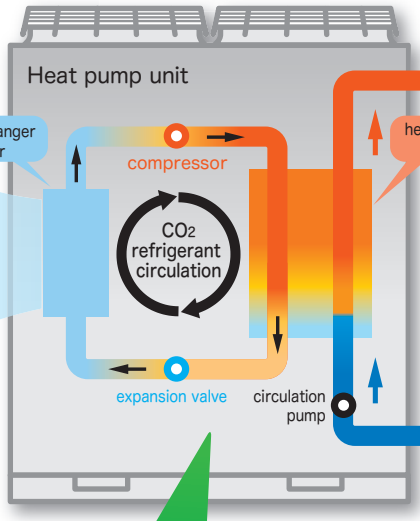


REMOTE CONTROL

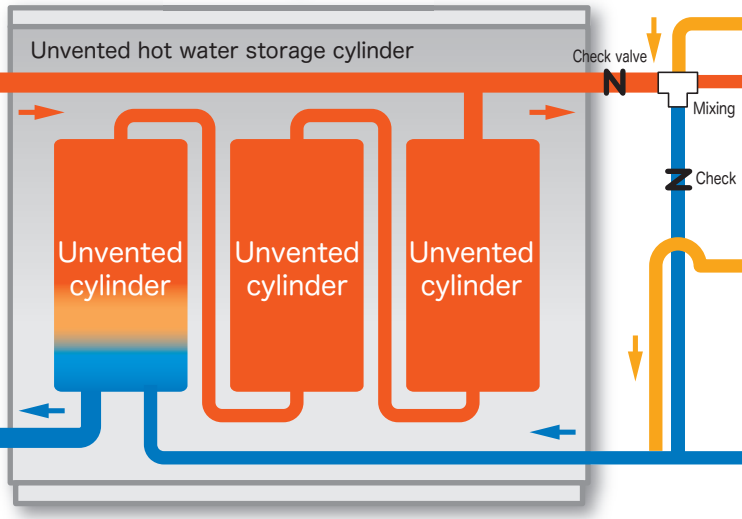
Efficency and comfortable hot water supply system

Starting an operation by a simple tap on button

Unvented cylinder



Recovering heat energy from the air



The world's first two-stage compressor
Scroll + Rotary compressor
High efficiency operation

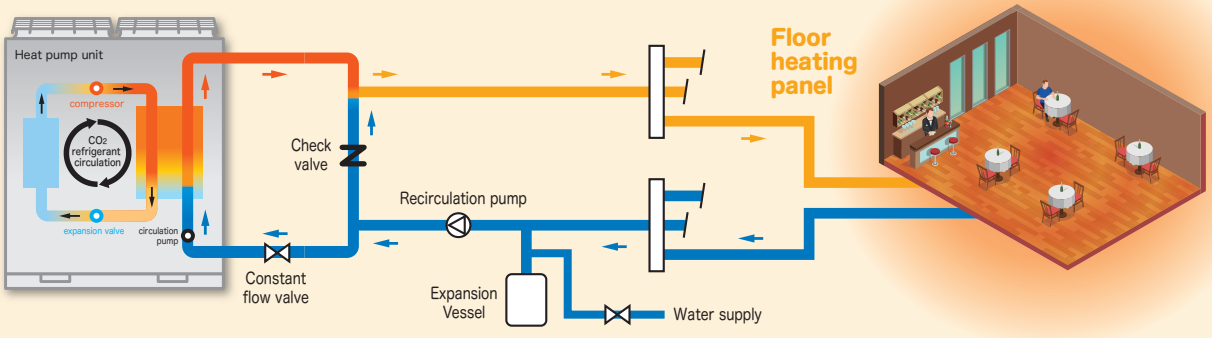
Water supply

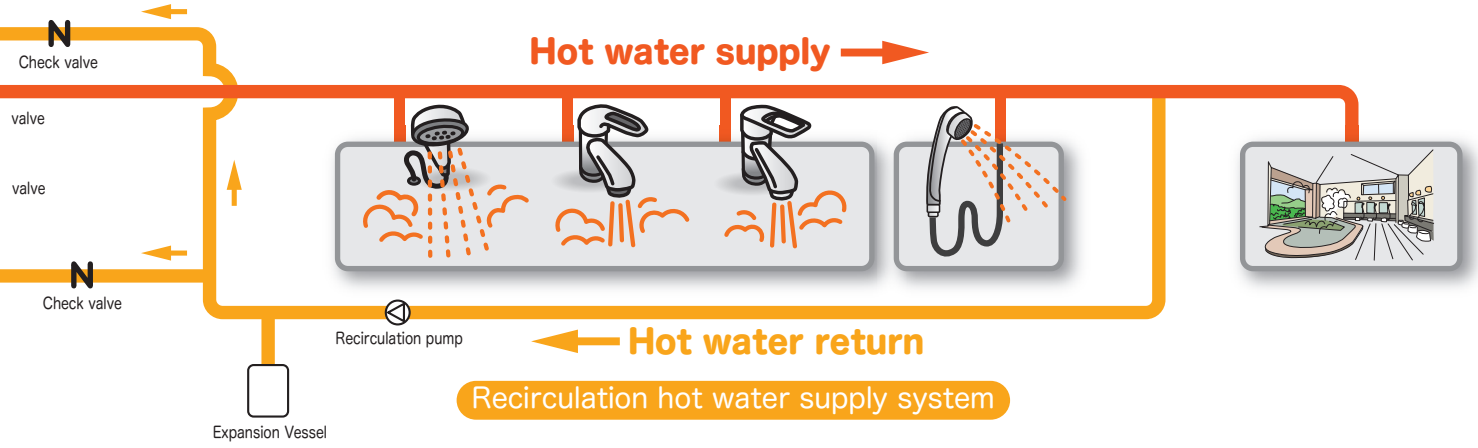
System configuration guide

Hot water amount	Place	Recommendable system configuration sample
3,000 L/day	Big restaurant	REMOTE CONTROL × 1unit / Heat source equipment × 1unit / Unvented cylinder 3,000L × 1 unit
4,000 L/day	Industrial catering	REMOTE CONTROL × 1 / Heat source equipment × 1 / 2,000L × 2
5,000 L/day	Wedding venue	REMOTE CONTROL × 1 / Heat source equipment × 1 / 2,000L × 1, 3,000L × 1
6,000 L/day	School/company lunch center	REMOTE CONTROL × 1 / Heat source equipment × 1 / 3,000L × 2

Perfect for floor heating system!

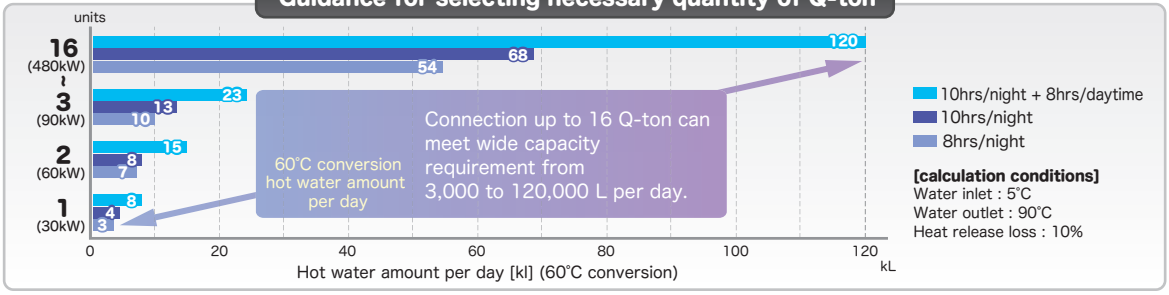
Supply hot water of suitable temperature to floor heating panel without hot water storage cylinder.
Recirculation circuit is available by using a constant flow valve and a variable speed pump.

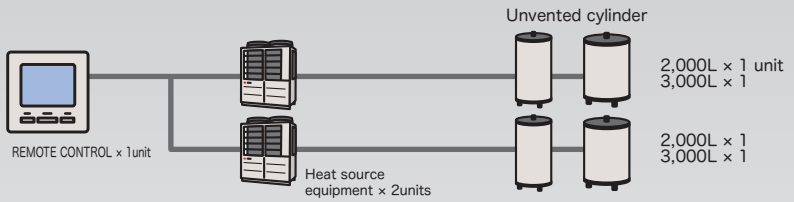
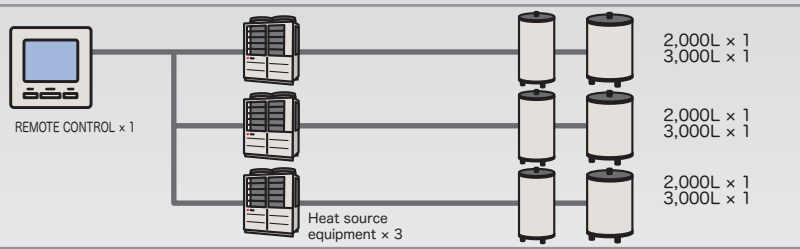




Recirculation hot water supply system

Guidance for selecting necessary quantity of Q-ton



Hot water amount	Place	Recommendable system configuration sample
10,000 L/day	Hospital, Senior care home, Sports center	
15,000 L/day	Resort hotel, City hotel, Business hotel	

Specifications and dimensions

SPECIFICATIONS

Item		Model	ESA30EH2-25
Power source		—	3 Phase 380V±5%, 400V±5%, 415V±5%, 50/60Hz
Operation to top up (In intermediate season)*1	Heating capacity	kW	30.0
	(Water amount)	L/min	8.97
	(Power consumption)	kW	6.98
	COP	—	4.30
Operation to top up (In cold season)*2	Heating capacity	kW	30.0
	(Water amount)	L/min	5.06
	(Power consumption)	kW	10.73
	COP	—	2.80
Operating sound pressure (In intermediate season)*1,3		dB(A)	58
Operating sound power (In intermediate season)*1		dB(A)	70
Exterior dimensions	Height	mm	1690
	Width	mm	1350
	Depth	mm	720＋35 (Water pipe connection)
Current	Max.	A	21
	Starting	A	5
Unit weight		kg	375 (During operation 385)
Color			Stucco white (4.2Y 7.5/1.1approx.)
Compressor	Type×Pcs.		Hermetic inverter compressor×1
	Nominal output	kW	6.4
Refrigerant	Type		R744 (CO_2)
	Charged amount	kg	8.5
Refrigerant oil	Type		MA68
	Charged volume	cc	1200
Crankcase heater		W	20
Anti-freezing heater	for water pipe	W	21×3
	for drain pan	W	40×2
	for drain hose	W	16×3
Heat exchanger ,Air side			Copper pipe straight fin type
Heat exchanger ,Water side (Gas cooler)	Type		Copper pipe coil, indirect heat exchanger
	Possession quantity of water	kg	10
Fan	Type		Axial flow type (direct coupled motor)×2
	Output×Pcs.	W	386×2
	Air volume	m^3/min	260
	External static pressure	Pa	50
Water pump	Type×Output		Non-self-suction spiral type inverter pump×95W
	Materials contacting to water		PPS, SUS 301
	Actual pump head	m (kPa)	5m(49kPa) @17L/min
Usage temperature range	Outdoor air temperature	°C	-25 to+43
	Feed water inlet temperature	°C	Top up 5-35,Warm up 35-63
	Hot water outlet temperature	°C	60-90
Water pressure range		kPa	500 or lower (Keep water pressure more than 0kPa at the inlet of heat pump water heater)
Defrost			Hot gas type
Vibration and sound proofing devices			Compressor ;placed on anti-vibration rubber and wrapped with sound insulation
Protection devices			High pressure switch, over current protection,power transistor overheat protection and anomalous high pressure protection
Pipe connection	Feed water inlet		Rc3/4 (Copper 20A)*4
	Hot water outlet		Rc3/4 (Copper 20A)*4
	Drain water outlet		Rc3/4 (Copper 20A)*4
Electric wiring	Earth leakage breaker		30A, 30mA, 0.1sec.
	Power cable size		□8mm^2×4 (Length70m)
	Molded-case circuit breaker		Rated current 30A, switch capacity 30A
	Grounding wire size		M6
	Remote control wire size		0.3mm^2 ×2 cores shielding wire (MVVS)
Design pressure		MPa	High pressure; 14.0 Low pressure; 8.5
IP code			IP24

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

Based on European regulations listed below, please refer to the following specification table.

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

"COMMISSION DELEGATED REGULATION (EU) No. 813/2013 of 2 August 2013" Implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for space heaters and combination heaters

Specification table

		ESA30EH2-25
Seasonal space heating energy efficiency class		A+
Water heating energy efficiency class		A
Water heating energy efficiency	Average	114%
Water heater load profile		XXL

Target model

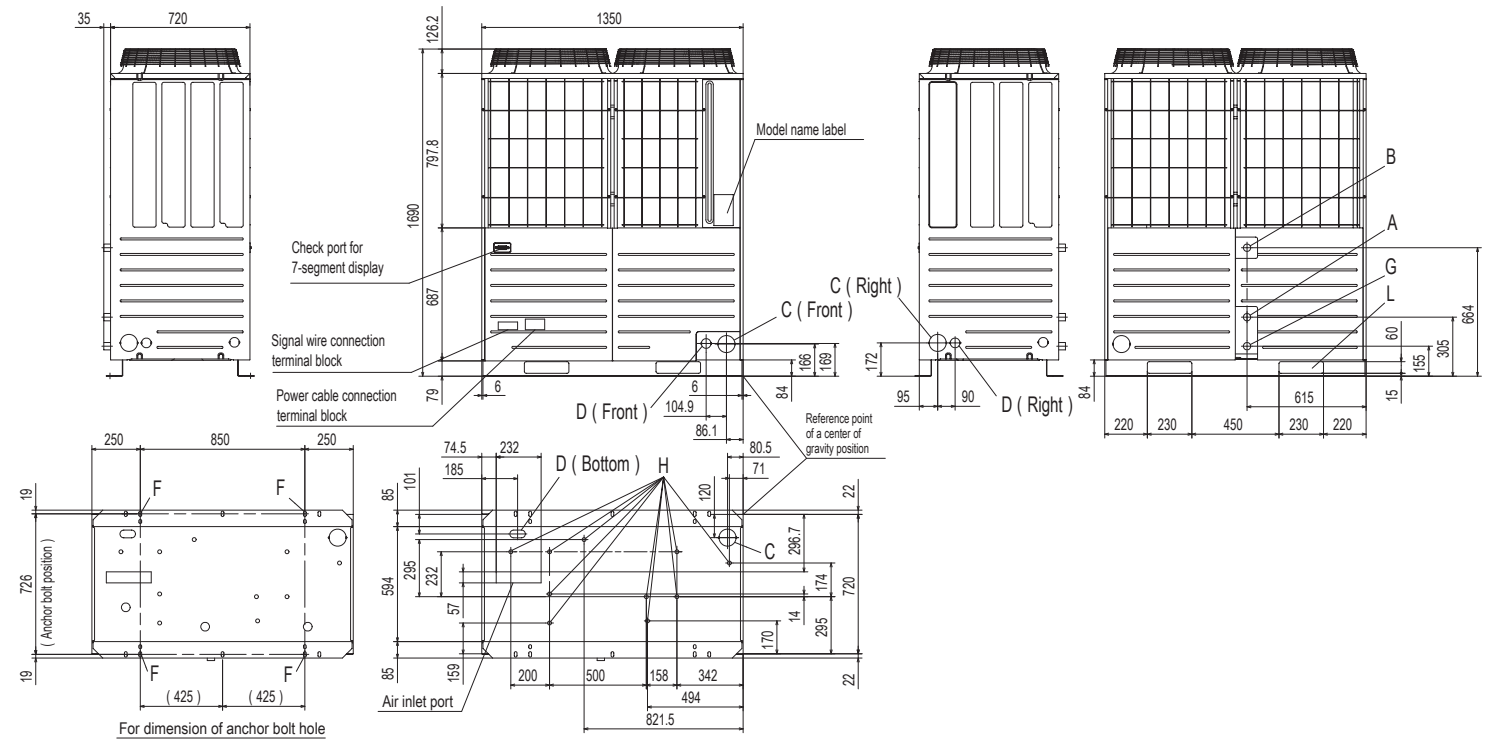
Heat Pump Combination Heater	ESA30EH2-25
Hot Water Storage Tank	GX-1000-RB

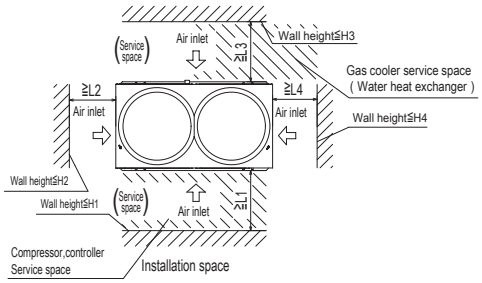
Fixing heat pump unit

Anchor bolt	M10×4

According to the installation conditions, please take a measure to prevent from falling, cross wind and heavy snow.

Dimensions





(Unit:mm)

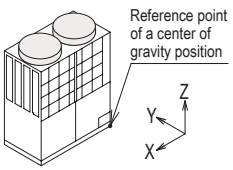
Dimension \ Installation example	Ⅰ	Ⅱ
Note (8) L1	800	800
L2	10	10
Note (8) L3	800	500
L4	100 (*)	500
H1	1500	1500
H2	Not limited	Not limited
H3	1000	1000
H4	Not limited	Not limited

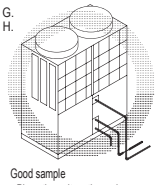
(*) Be sure to keep more than 100mm spaces when the unit contacts with a wall.
If the unit installed in succession, 10mm spaces is enough.

Center of gravity position (mm)		
X	Y	Z
608	342	620

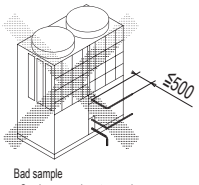
Symbol	Contents	
A	Feed water inlet port	Rc3 / 4 (Copper tube 20A)
B	Hot water outlet port	Rc3 / 4 (Copper tube 20A)
C	Heat pump unit-Tank unit connecting wire outlet port	Ø88 (or Ø100)
D	Power cable inlet port	Ø50 (right, front) Long hole 40 × 80 (bottom)
F	Anchor bolt hole	M10 × 4pcs
G	Drain water pipe outlet port (Atmosphere opening)	Rc3 / 4 (Copper tube 20A)
H	Drain hole	Ø20 × 10
L	Hole for carrying in or hanging	230 × 60

Note
(1) Be sure to fix the unit with anchor bolts.
(2) Be sure to keep space above the unit at least 2m.
(3) The connection of water pipes (Feed water inlet, Hot water outlet, Drain water outlet) should be done on site locally.
The heat insulator thickness of the water plumbing assumes it 30mm, And the racking covers are less than 100mm outside diameter, and, please do it with circumference 315mm or less.
When they are more than circumference 315mm, Racking cover dimensions cannot remove a service panel after racking construction more than 100mm outside diameter.
In addition,the drain outlet port assumes it atmosphere opening, and, Please do not let me occlude at valves.
(4) The holes for power cable inlet and, connection wire outlet from heat pump unit to tank unit are half-blanked.
Therefore please punch out the hole by cutting the residual portion and use it.
(5) For fixing the unit, the hole (Symbol F) for anchor bolts (M10 x 4) can be used.
(6) In heavy snow region, please take following measures in order for the air inlet/outlet port and the bottom part of unit not to be covered with show.
① Place the unit on the rack in order to make the bottom of unit higher than the snow surface.
② Install a snow prevention hood (Locally prepared according to the drawing provided by MTH) on the outlet port of the unit.
③ Install the unit at the space under the eaves or the snow prevention roof (Locally prepared) .
(7) If ambient temp becomes below 0°C, it may cause break of water pipes and damage on the unit due to freezing.
Be sure to apply anti-freezing heater to feed water piping, hot water piping, drain water piping and drainage course in order to prevent from freezing.
(8) Be sure to keep enough service spaces of more than 800mm in front of the unit service panel for easy inspection of the unit and replacement of components.
When piping work is done, be sure not to interfere the pipes with the unit service space.
If the service space cannot be kept, please install the piping below the unit by placing the unit on the rack.
(Refer to following sample)
(9) The drain water is drained away from symbol H as well as symbol G.
Please secure a drainage course about the drainage from symbol H.





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



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

Installation work ··· Hot Water

1. Before installation

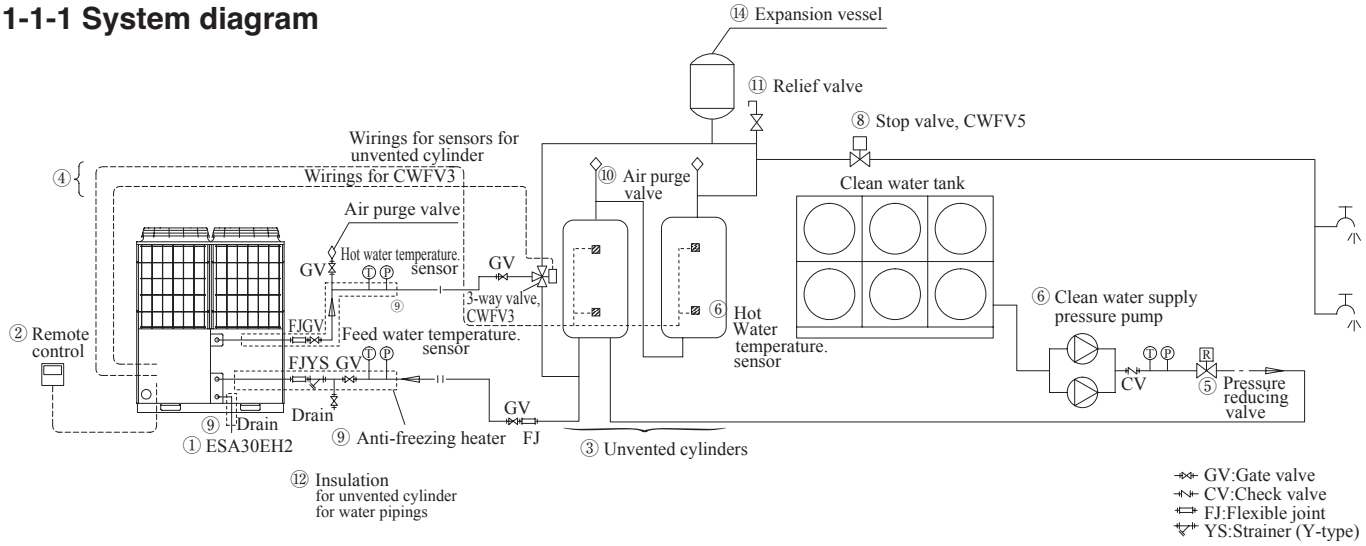
Check the model, electrical specifications, piping, necessary option parts and etc, and install properly.

⚠ 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 install the earth leakage breaker. (it should be impulse withstanding type.)
- If operating unit by keeping discharge pipe temperature sensor, suction pipe temperature sensor and pressure sensors removed, compressor may be broken. Be sure to avoid such operation.

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

1-1-1 System diagram



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 (20m length of wire) or MTH-Q2E (10m length of wire)	For connecting with unvented cylinder • Connect to the water temperature sensor of unvented cylinder. • Connect to the 3-way valve for switching to anti-freezing circuit and control it.
⑤	Pressure reducing valve (Locally procured)	—	Setting pressure ≦ 400kPa Connecting pipe size ≧ 32A If the feed water pressure exceeds 400kPa, be sure to mount it.
⑥	Hot water temperature sensor (Option part)	MTH-Q3E	Mounting or pasting on the unvented cylinder for detecting hot water temperature in the cylinder. 1.25m length × 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±30kPa or lower.
⑫	Insulation (Locally procured)	—	Heat resistance ≧ 120°C 3 • For the cylinder shell: 50mm or thicker glass wool whose density is 16kg/m . 3 • For the cylinder end plate: 50mm or thicker glass wool whose density is 24kg/m . • For the water piping: 30mm or thicker glass wool whose density is 48kg/m3.
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 (20m length wire) or MTH-Q7E (10m length wire)	For connecting heat pump [Sub unit only]. • Connect to the 3-way valve, CWFV3, switching to anti-freezing circuit and control it.

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

Please arrange and procure a new unvented cylinder with following specifications for connecting to ESA30EH2.
*If connecting ESA30EH2 to the existing cylinder, the hot water temperature and amount in the cylinder cannot be detected correctly.
In such case, please consult with our distributor.
In some case, preliminary survey on site may be required before installation.

Specifications of unvented cylinder

- For commercial use
  The cylinder is installed indoors, not outdoors.
- It should be unvented hot water storage cylinder, not open tank.
- The minimum capacity is 500liter. If increasing capacity, please use bigger size cylinder or several cylinders in series.
- The maximum capacity is 4000liter. (only as a guide)
  The cylinder capacity may vary according to feed water inlet temperature, hot water outlet temperature and operation hours in the night. 25837 x Operation hour in the night/ (Hot water outlet temperature- feed water inlet temperature) =available hot water supply volume (Liter).
  However, there is dead volume, where the cold water is always filled in, at the bottom of cylinder to which the feed water line is connected. Therefore please select the cylinder volume in consideration of available hot water supply volume and dead volume.
- Design pressure
  Design pressure is 0.5MPa or higher.
  The design pressure of ESA30EH2 is 0.5MPa. Even if the design pressure of the cylinder is 0.5MPa or higher, the maximum water pressure applied to the cylinder actually shall be less than 0.5MPa. And please decide the usage pressure in consideration of allowance and setting value of relief valve.
  Even if the actual pressure applied to the cylinder is 0.5MPa, the cylinder can be used, but the minimum pressure shall be 0.1 to 0.2MPa or higher. If the pressure becomes lower than the minimum pressure, water volume becomes decreasing.
- Pipe connection port
  Cylinder has one or more pipe connection ports at the top. The size of port shall be 32A or bigger.
  If it is smaller than 32A, it is difficult to detect the hot water temperature and hot water amount in the cylinder properly. And when discharging the hot water from the cylinder, the outlet flow volume may be restricted.
  Cylinder has 2 or more pipe connection ports at the bottom. The size of one port shall be 32A and the other port shall be 20A.
- Specifications of inner cylinder
  In order to ensure the temperature boundary layer as minimum as possible when hot water and feed water flow into the cylinder, the cylinder shall have buffer plates built-in.
- Material
  SUS444 or SUS316 (with consideration for stress corrosion cracking resistance)
  If using the other material than the specified one, hot water temperature and hot water amoount 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 φ7mm or bigger in size and 20mm or deeper in depth are required on the cylinder. MHI's genuine temperature sensor, MHT-Q3E (option part), shall be used.
  3 to 9 sets of temperature sensors shall be applied to the cylinder.
  In order to detect the hot water amount by 10% intervals, 9 sets of temperature sensors shall be applied to the cylinder. If reducing the number of temperature sensor, the hot water amount cannot be detected properly.

Ex) In case of applying 3 sensors, heat pump unit can detect only 20%, 60% and 100% of HW amount. (Please refer to following table.)
Therefore, even though 80% of HW amount is set with schedule setting, the HP unit cannot stop at storing 80% of HW amount and it still keeps on operating until storing 100% of HW amount.
And if 30% of HW amount is set for the operating to top up, HP unit cannot start operation to top up until HW amount decreases to 20%. Accordingly, we recommend to apply 9 sensors to the cylinder for precise control.
The positions to apply the temperature sensors on the cylinder are depended on the number of sensors and sensors should be applied to the designated positions on the cylinder. (See technical data(ESA30EH2-25 for hot water supply use) for details.)
According to the following table, please check the number of sensor and apply each sensor to the designated position of hot water amount% according to the sensor No.

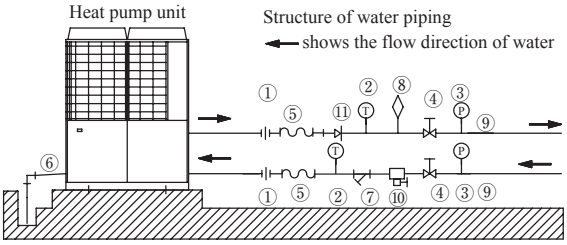
The position to apply temperature sensor according to the hot water amount %

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

*1 Recommendable number of sensors is 9 pcs.
If the number of sensors is less than 9 pcs., the hot water amount cannot be detected correctly.
*2 The sensor which detects 100% of HW amount shall be applied to the position within the range of sensitive volume with consideration of dead volume which is 10% of total volume of cylinder.

- Insulation
  Insulation must be required in order to keep hot water temperature stored in the cylinder.
  - Shell Material: Glass wool
    Density: 16kg/m^3
    Thickness: 50mm or more
  - End plate Material: Glass wool
    Density: 24kg/m^3
    Thickness: 50mm or more

- Carry in, Installation and Service & maintenance space
  It depends on the installation manual of the cylinder procured.



2. Water piping work

2-1 General description

2-1.1 Outline of water piping

(i) Key consideration for water piping

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

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

(ii) Caution for corrosion

① Water quality

It is important to check in advance whether the feed water and hot water have good quality.

Be sure to use cyclic water and makeup water whose qualities are within the range of water quality criteria mentioned in page 17.

② Foreign matter in water

If solid matter such as sand and small stone and/or floating suspended solid such as corrosion product exist in water, the heat-transfer surface of heat exchanger is directly attacked by water flow, and corrosion may be created locally.

In order to avoid such corrosion by these foreign matters, be sure to fit a cleanable strainer (60 mesh or higher) at the water inlet port of the unit to remove foreign matters.

③ Contact of different metal

Depending on the type of metal, if different metals contact directly, corrosion may be generated at contact part.

Refer to followings and in case of the combination of different metals to generate corrosion, take a measure not to generate corrosion by inserting a non-conductive material (non-metallic insulation flange and etc) between the metals or by other method

The combination not to generate corrosion by contact of metals
- ① Stainless steel (SUS304, SUS316)
- ② Bronze
- ③ Copper

④ Others

1) Water pipe shall have no water leak and no air intrusion. Especially if air intrudes at suction side of pump, pump performance becomes decreasing and it may cause generation of noise

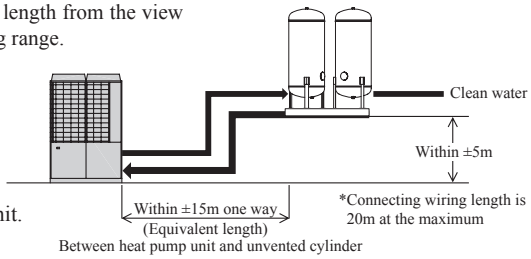
2) Be sure to take into consideration for water pipe not to freeze at stopping operation in winter

2-2 Water piping work

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

2-2.1 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)

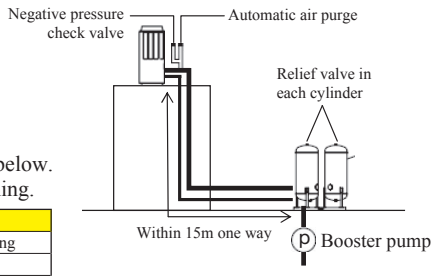
ii) Height difference: Within ±5m

●When the heat pump unit is installed bellow 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.



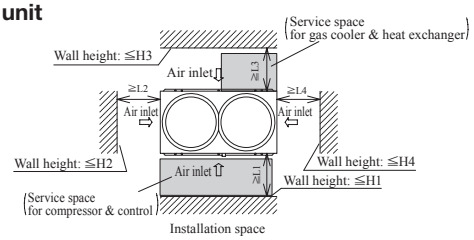
Water quality criteria

Makeup water and primary water shall be within the range of water quality criteria mentioned below.
If water quality is outside this range, there is the possibility of scaling and corrosion to be foaming.

	Item	unit	Tolerated value		Risk	
			Cyclic water	Make up water	Corrosion	Scale-forming
Standard items	pH at 25°C	u.pH	7.0-8.0	7.0-8.0	✓	✓
	Electric conductivity (20°C)	mS/m	≦27	≦27	✓	✓
	Electric conductivity (25°C)	mS/m	≦30	≦30		
	Chloride ion	$mgCl^-/L$	≦30	≦30	✓	
	Sulphate ion	$mgSO_4^{2-}/L$	≦30	≦30	✓	
	Acid consumption (pH4,8)	$mgCaCO_3/L$	≦50	≦50		✓
	Sulphate ion ÷Acid consumption		≦0.5	≦0.5		✓
	Total Hardness	$mgCaCO_3/L$	≦70	≦70		✓
	Calcium Hardness	$mgCaCO_3/L$	≦50	≦50		✓
	Ionic Silica	$mgSiO_2/L$	≦20	≦20		✓
	Residual Chlorine	mgCl/L	≦0.1	≦0.3	✓	

2-3 Heat pump unit installation space (Service space)

1) Single unit

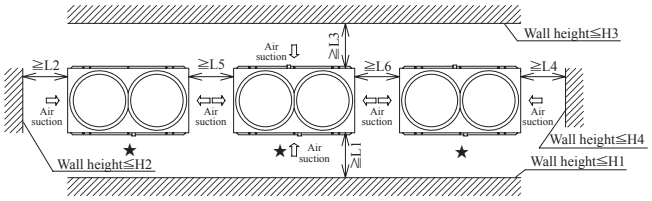


Dimension \ Installation example	1	2
L1	800	800
L2	10	10
L3	800	500
L4	100	500
H1	1500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

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

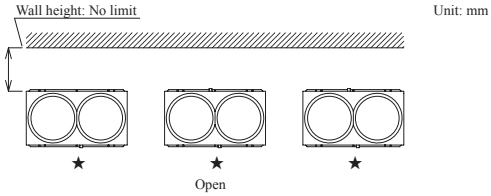
① Installation example for 3 units in a row



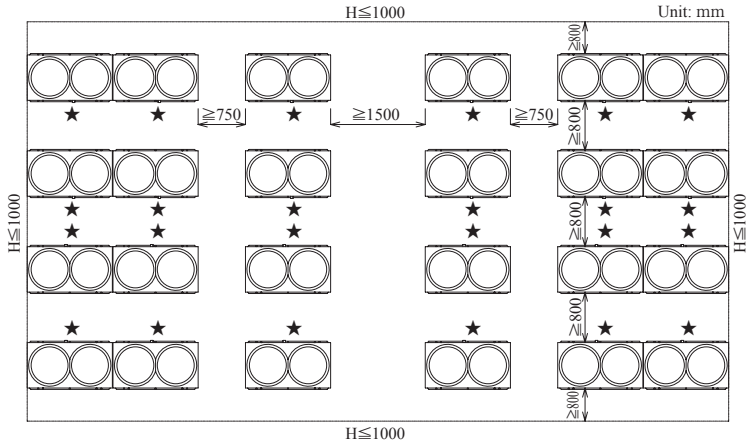
Dimension \ Installation example	1	2
L1	800	800
L2	10	10
L3	800	500
L4	100	500
L5	10*	500
L6	10*	500
H1	1500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

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

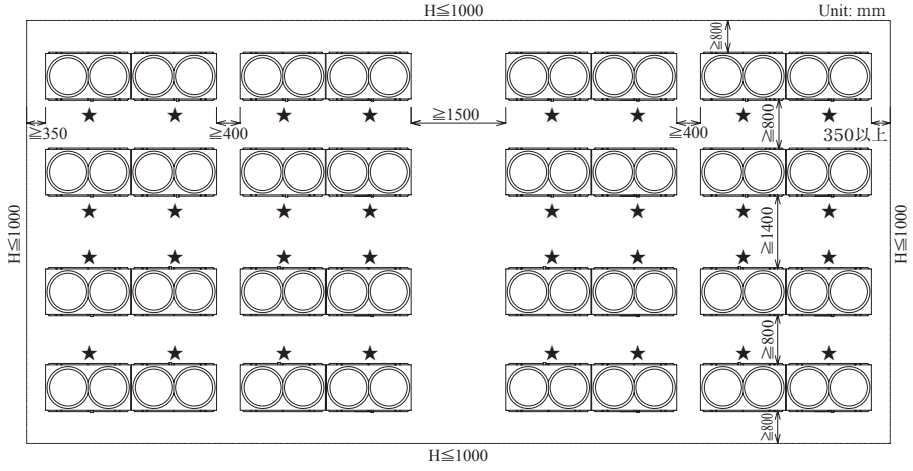
② Installation example for 3 units in a row (In case of high wall on the back)
Please keep 10mm or more space between the units with consideration for the installation space.



③ Installation example for 6 units horizontally and 4 units l ongitudinally



④ Installation example for 8 units horizontally and 4 units l ongitudinally

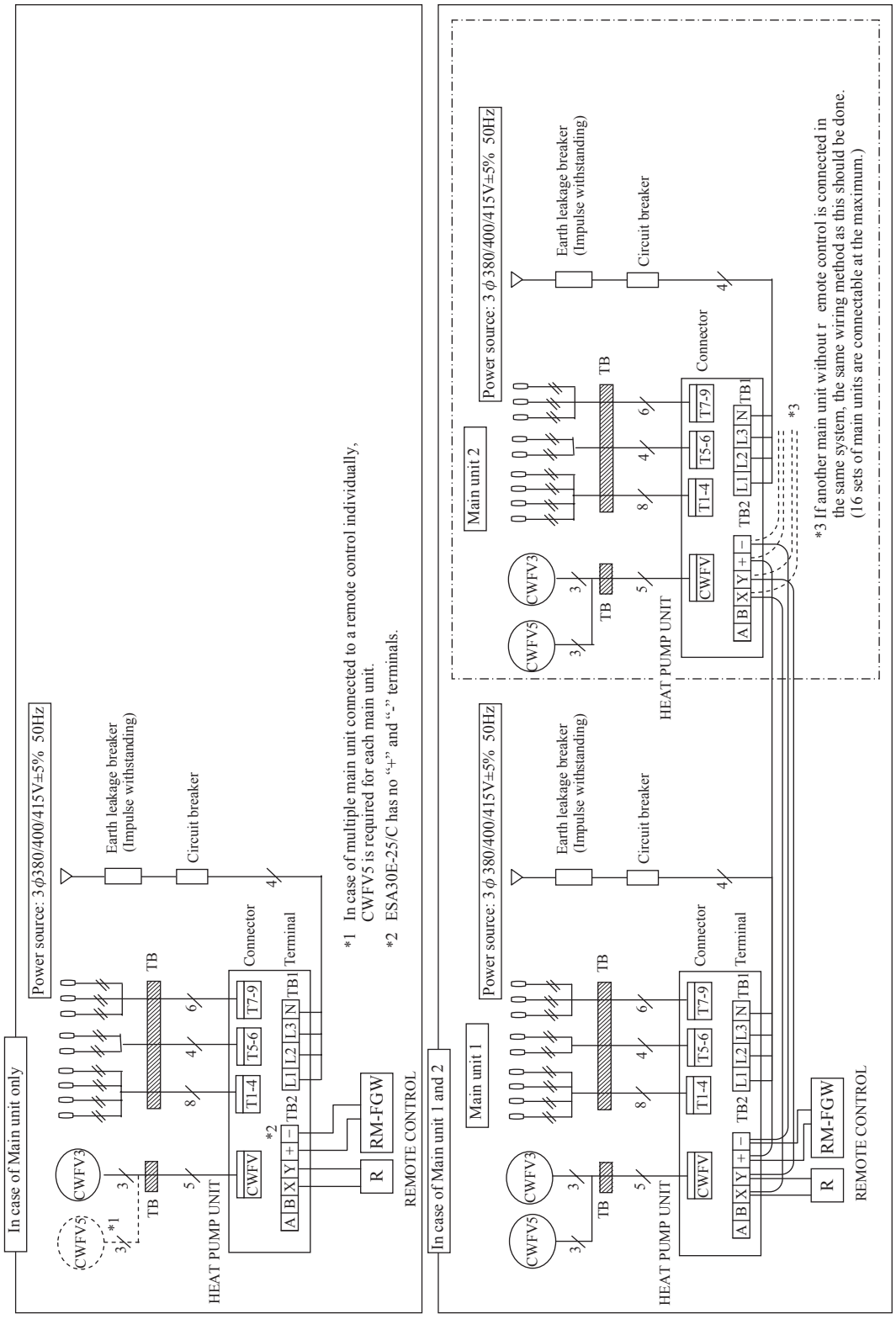


3. Electrical wiring work for the heat pump unit

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

⚠ **Please install an earth leakage breaker without fail.** The installation of an earth leakage breaker is compulsory in order to prevent electric shocks or fire accidents.
(Since this heat pump water heater employs inverter control, please **use an impulse withstanding type one** to prevent the earth leakage breaker from false activation.

Wiring system diagram



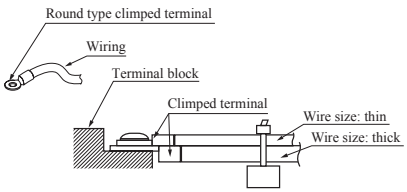
3-1 Connecting method of power cable

(a) Method for leading out cables

- Cables can be led out through the front, right, left panel and bottom plate.
- In wiring on installation site, cut off a half-blank(ϕ 50 or elongate hole 40x80) cover for penetration of cables with nipper.
- In case of a collective drain piping, please use the hole to lead out cables or pipe other than the hole on bottom plate.
  If the hole on bottom plate is used, be careful to apply adequate seal in order not to leak drain.

(b) Notabilia in connecting power cables

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



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

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

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

Please note

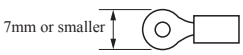
① Wiring procedure is determined by JEAC8001.(lease adapt it to the regulations in effect in each country.)
② The wire length and cable size in above table show that within 2% of voltage drop. If the wire length exceeds the value shown in the above table, review the cable size according to the regulations 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.

3-2 Connecting method of signal wire

- **The signal line is DC5V so that please do not connect single phase 220V/230V/240V of power cable to the signal line. In case to connect power cable, the fuse on the control PCB is blown.**
  ① Please check that power cable is not connected to the signal line.
  ② Before turning on power source, be sure to check resistance on the terminal block of signal line.
  If the measured resistance is 100Ω or lower, power line may touch to signal line.
  ・Standard signal wire size is 0.75mm^2 x 2 cores shielding wire (MVVS)
  ・The both end of shielding wire shall be grounded.

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

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



1. Before installation

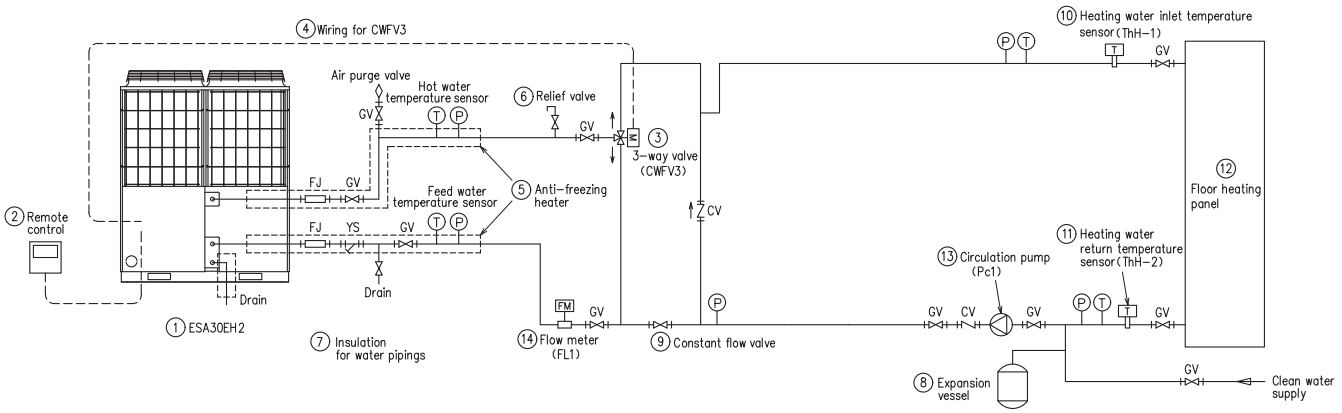
Check the model, electrical specifications, piping, necessary option parts and etc, and install properly.

> **⚠ 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 a high risk for the compressor be broken. Be sure to avoid such operation.

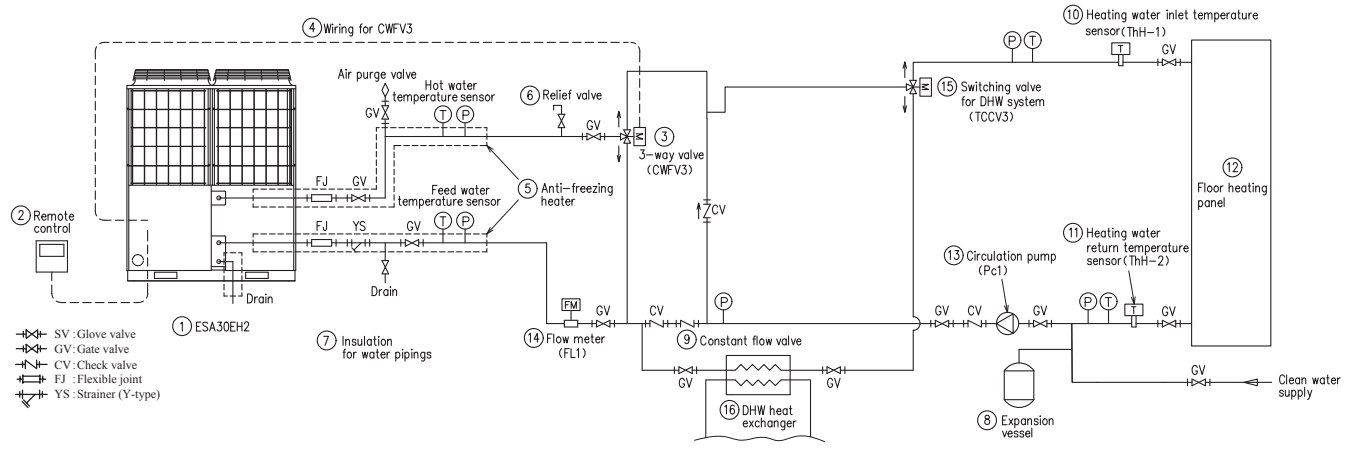
1-1 Standard space heating system diagram and component list

1-1-1 System diagram

(1) For the purpose of space heating only



(2) For the purpose of combination system with space heating and DHW



1-2 Component list

	Part name	Model	General description
①	Heat pump unit	ESA30EH2-25	For outdoor temperature -25°C.
②	Remote control for heat pump water heater (Option part)	RC-Q1EH2	For setting hot water temperature.
③	3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit. (wiring length 0.7m, AC200V, 50mA) IP56 (Indoor specifications)
④	Wiring kit for CWFV3 (Option part)	MTH-Q6E (20m length wire) or MTH-Q7E (10m length wire)	For connecting heat pump. (Connect to the 3-way valve, CWFV3, switching to anti-freezing circuit and control it).

Locally procured parts

	Part name	Model	General description
⑤	Anti-freezing water heater	—	When outdoor air temperature becomes below 0℃, please install the trace heating on the water pipe. (10W/m)
⑥	Relief valve	—	For preventing from increasing pressure in the system during heating up the water. (Working pressure: 450±30kPa or lower.)
⑦	Insulation	—	Heat resistance≧120℃ (30mm or thicker glass wool whose density is 48kg/m^3)
⑧	Expansion vessel	—	—
⑨	Constant flow valve	—	To keep the flow rate to the heat pump unit constant. Set flow rate : 16 L/min Example: CALEFFI FLOWMATIC©(PICV) 145 series
⑩	Heating water inlet temperature sensor	—	The type required by the smart pump used.
⑪	Heating water return temperature sensor	—	The type required by the smart pump used.
⑫	Floor heating panel	—	—
⑬	Circulation pump, Pc1	—	Smart pump (inverter pump with external control) for space heating. Flow rate : 5,160L/h or more, Head : More than pressure loss between floor heating panel and temperature control circuit It must have temperature difference constant control (delta T constant) Example: Wilo Stratos MAXO series. Please confirm that sensor ThH-1 and ThH-2 are supplied with the smart pump.
⑭	Flow meter, FL1	—	To monitor and control the flow rate to the heat pump unit. With upper alarm output. Set flow rate alarm: 17L/min Piping size: 20A
⑮	Switching valve, TCCV3	—	For switching between space heating and DHW.
⑯	DHW heat exchanger	—	This is only used for the combination system with space heating and DHW.

2. Water piping work

Please refer to the technical manual.

3. Electrical wiring work

Please refer to the technical manual.

Certified ISO 9001

JQA-0709

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