MITSUBISHI HEAVY INDUSTRIES, LTD.

Our Technologies, Your Tomorrow

Ecological energy
Recovering heat energy from the air

Q-ton Air to Water

Commercial use
CO_2 for
Air to water heat pump

ESA30E

50 Hz

16HM01E-A-1

Free energy from the air
Overwhelming high performance and high efficiency

"Our technology, Your tomorrow"

Air to Water Q-ton 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°C➡90°C

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

-7°C➡100%

Keeping 100% capacity down to -7°C

Efficiency

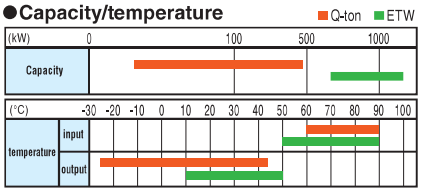
COP 4.3!

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

The most ecological way for supplying hot water

Our Heat Pump series

●Capacity/temperature ■Q-ton ■ETW



Natural refrigerant CO_2
Air to Water Heat Pump
30kW ~ 480kW (for commercial use)

Air to Water Q-ton ESA30E

Water to Water System
Heat recovery type
627kW ~ 3135kW (for industrial use)

ETW

※Please refer to the other catalogue.

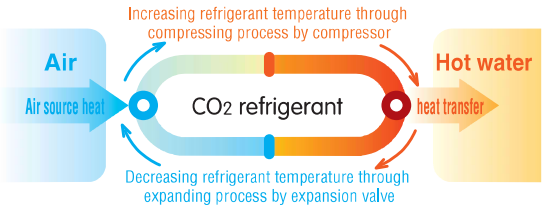
P03 Heat Pump Technology system
P05 Q-ton's unique advantages
P08 Hot water supply system
P10 Installation samples
P12 Specifications and dimensions
P14 Installation work

Heat Pump technology system

What is a Heat Pump ?

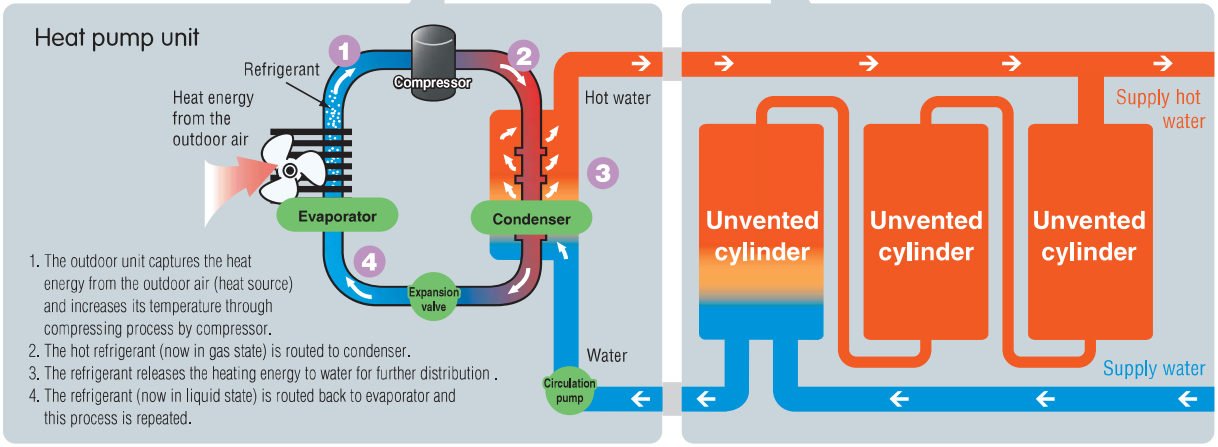
Heat energy is absorbed from the outside air when it passes through the outdoor unit; the energy is transported to the indoor unit in the refrigerant [in this case CO_2] within the piping system. This eliminates the need to bore holes or bury coils of pipes in the ground as used in conventional ground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

Heat pump refrigerant cycle



Recovering heat from the air

Transferring the heat to water and supplying hot water



Offering efficient energy saving is the greatest merit

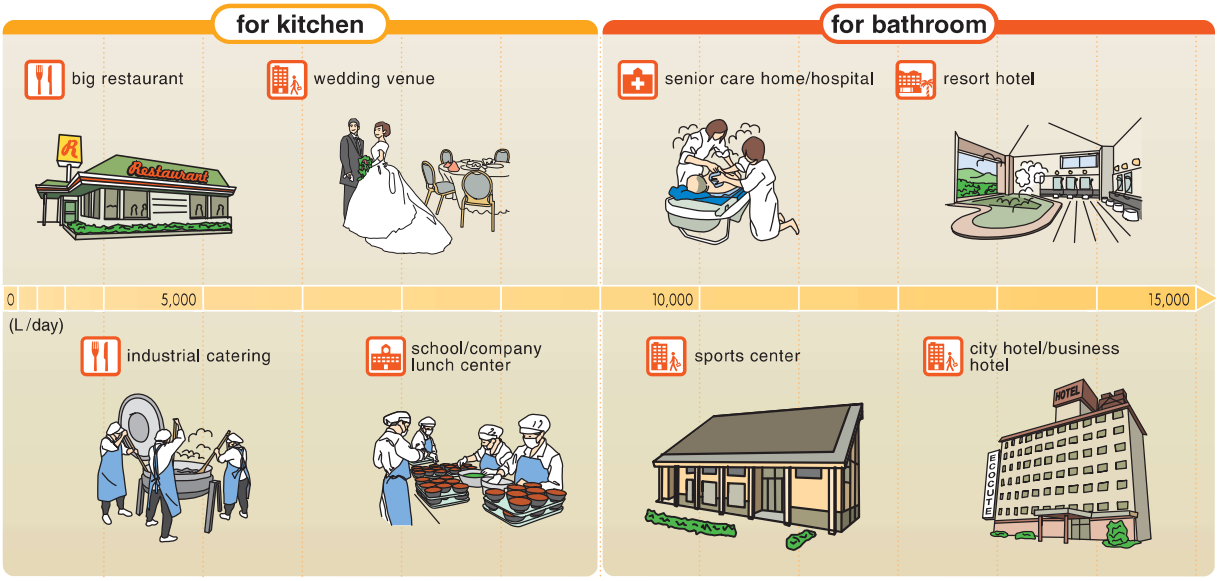
Typically less than 1kW of output heat energy can be produced by conventional oil or gas boilers.
Heat pump technology is capable of producing up to 4.3kW of heat energy from 1kW of energy input making the system 4.3 times more efficient than traditional means.
Furthermore using natural refrigerant can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

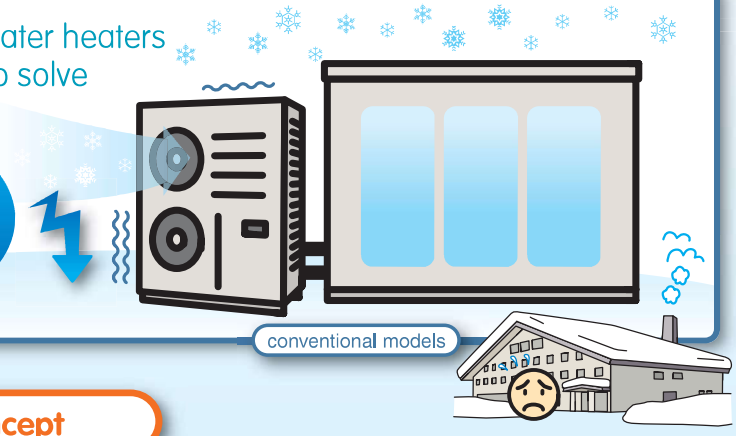
Heat Pump technology system

~Recommendable usage or customer~



Conventional heat pump water heaters have performance issues to solve

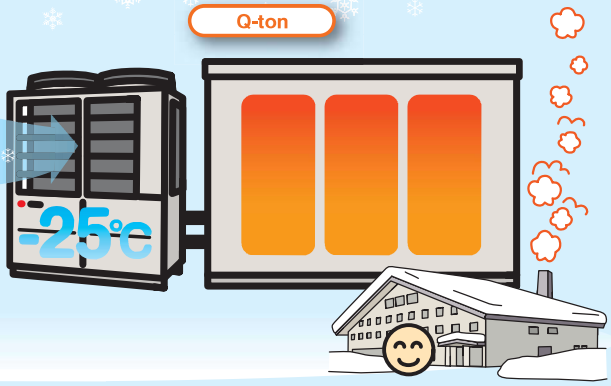
In the operation under low outdoor temperature, heating capacity and heating efficiency decrease significantly.



Our development concept

Keeping high capacity and high efficiency in cold conditions

Air to Water Q-ton 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°C under extreme low outdoor temperature → **90°C** hot water supply

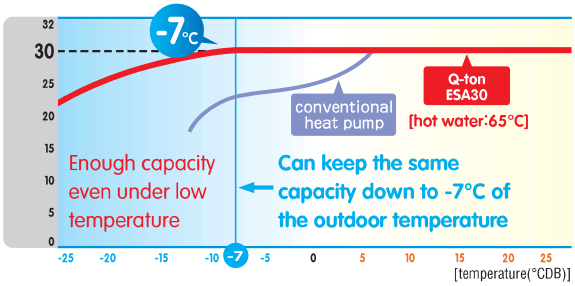
-7°C down to -7°C → **100%** can keep 100% capacity

Efficiency

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

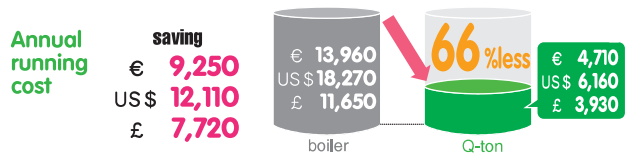
The first introduction of 30kW inverter type, Achieving the industry's top level COP4.3. Keeping high efficiency and saving energy operation throughout the year.

[heating capacity (kW)]



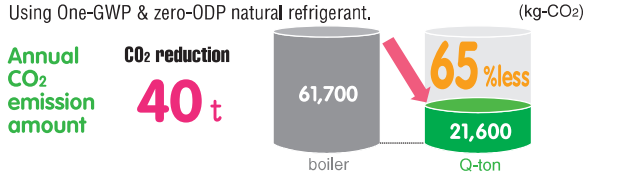
Advanced energy saving operation and low running cost

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



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.



[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 daytime:€0.12, us$0.16, £0.10/kWh, night:€0.06, us$0.08, £0.05/kWh
● Boiler/heavy oil rate:€0.61, us$0.80, £0.51/L
④ CO_2 emission amount : ■Q-ton/electric: 0.423-CO_2/kWh
● Boiler/heavy oil: 2.71kW-CO_2/L
(€1=¥106 us$1=¥ 81 £1=¥127)


Activation of Q-ton in the extreme cold region.

Reason for high efficiency

● Scroll + rotary compressor

Two-stage compressor

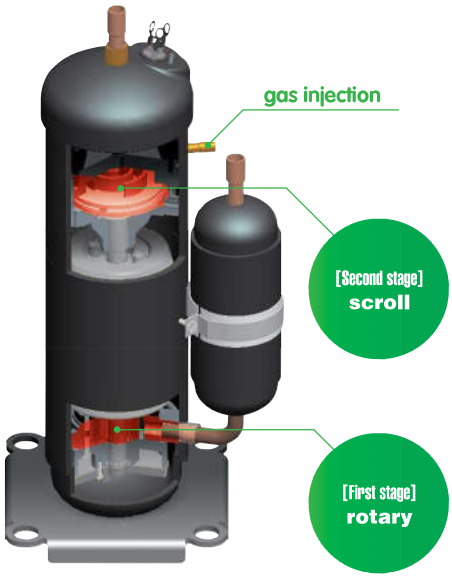
By combination of two systems, high efficiency has been achieved in all operation conditions.

The first in the world

Scroll system advanced at high pressure ratio

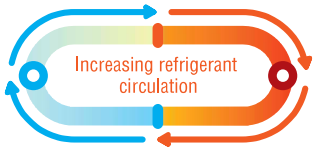
×

Rotary system advanced at low pressure ratio



● Intermediate pressure gas injection configuration

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



Advantages unique to Q-ton

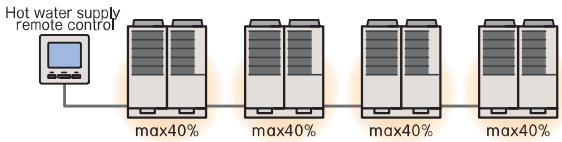
Advantage 2 A Wide Variety of System and Energy Controls

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

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

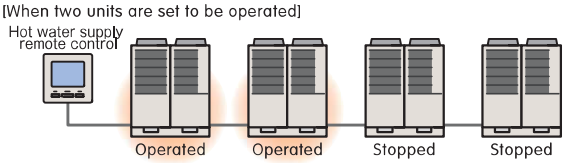
[When 40% is set for demand control]



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.

2 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.

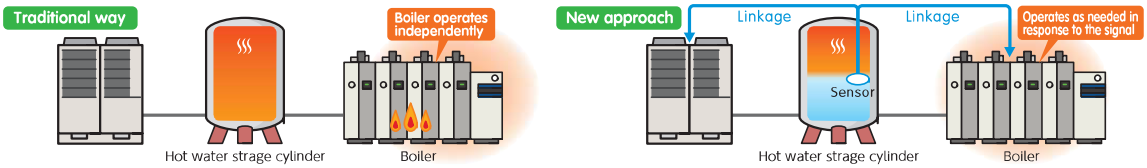
[When two units are set to be operated]



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.

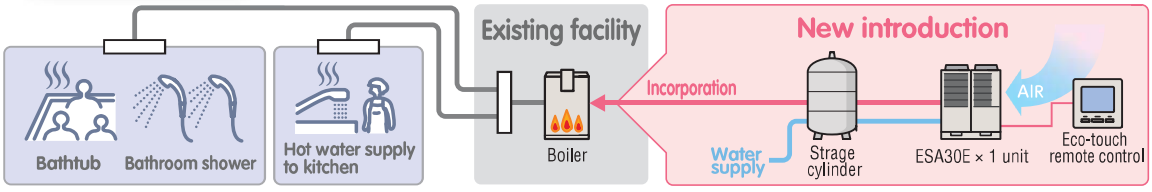


You can set a control condition such as "Operating the boiler while maintaining the volume of hot water at a level of 40% or less". Hybrid operation of Q-ton and the boiler helps you save energy.

Advantage 3 Introduction of Hybrid Concept to Existing System

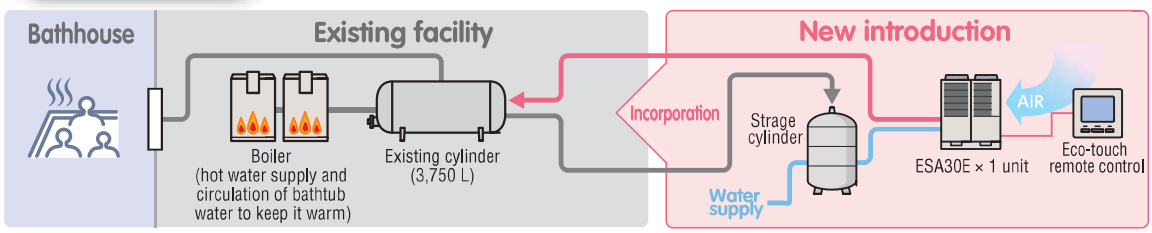
Series Hybrid

100% utilisation of Q-ton's hot water



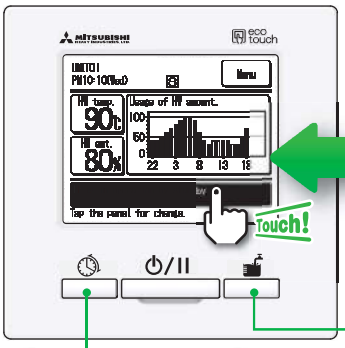
Parallel hybrid

Maximum Utilisation of Cost-Saving System at Large Facilities



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

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

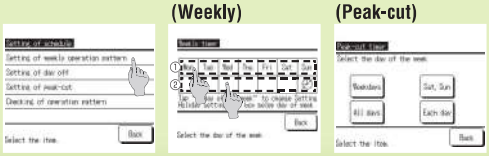
- Big LCD with 3.8 inch full dot display
- Back light function

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

RC-Q1E

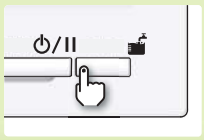
Schedule setting

(Weekly) (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.

operation to fill up

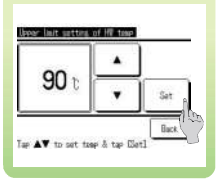


Irrespective of any setting operation, this operation will keep on filling up hot water in a tank (100%).

Select the language to be displayed on the R/C

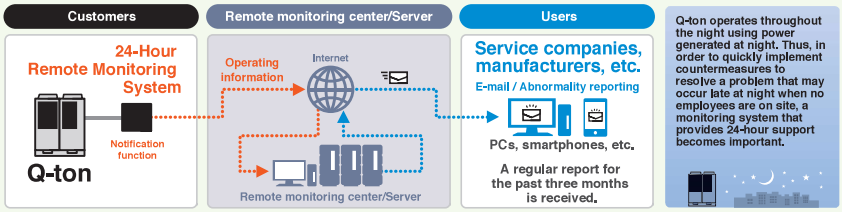
English / Français / 한국어

Setting temp to top up



Unique to Q-ton 24-Hour Remote Monitoring System Option

- Mitsubishi Heavy Industries' unique monitoring system monitors the operation status of customers' equipment 24 hours a day, 365 days a year.
- Should a problem occur on the equipment, this system enables you to immediately understand the operation status and quickly implement countermeasures.



Note) The 24-hour remote monitoring system does not support the following two functions depending on the area. Please contact our person in charge.
·Activation of abnormality alarms ·Abnormality prediction function

Customers' benefits

1. Customers can receive support for energy-saving operations.

Customers can receive proposals on an optimum hot water storage schedule to eliminate excess and deficiency, and also receive periodic reports on power consumption and the equivalent monetary value of energy-saving effects.

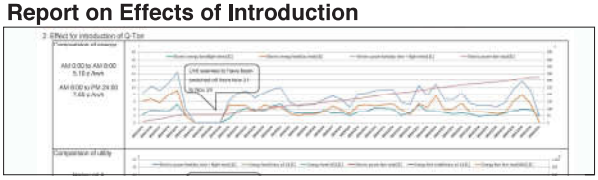
2. Customers can receive proposals about failure prevention measures and maintenance of the equipment based on the data obtained from 24-hour monitoring.

We make proposals on maintenance as needed based on the equipment's operation status data that is collected on a continual basis by the monitoring system.	The monitoring system monitors the discontinuance of system protection functions and the presence/absence of the protection and control functions.	The system monitors the operation status and whether any problems have occurred on elemental components such as compressor, water pump and fan motor.	The system monitors the water heat exchange performance.

3. E-mail warnings and provision of operating data enable you to make appropriate responses faster.

The system monitors the operation status on an ongoing basis and, if any abnormalities are detected, activates an alarm over the Internet. Understanding the operation status beforehand enables you to carry out restorative steps sooner.

Report on Effects of Introduction



- Table showing changes in electricity charges
- Comparative table of fuel and light expenses
- Comparative table of CO_2 emissions
- Table of operating time and period
- Trends in electricity bills and economic effects
- Trends in CO_2 emissions and effects of reduction
- Trends in electricity usage
- Trends in heating volume, etc.

Note) As described above customer benefits will be supported by distributor.

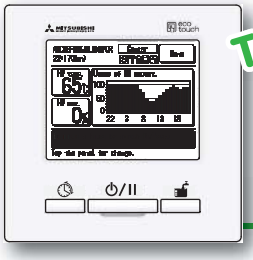
An Example of Abnormality Reporting

E-mail / Abnormality reporting

Customer name: MHI Heat Pump Solution Sales Section System No.: 01
Customer address: Japan (detail info is needed)
Urgent Contact: MHI Q-ton 001810367164880
Malfunction Unit No.: 0
Alarmed time: 2015-09-01 07:47:04
Alarm No.: E54
Compressor running time: 192 hours
Water pump running time: 195 hours
This is an automated message from MHI.
Please do not reply to this email.

If a problem is detected, we will promptly determine the cause and propose necessary countermeasures to prevent equipment failures.

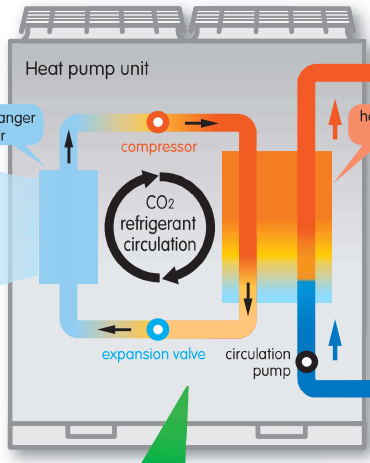
Hot water supply system

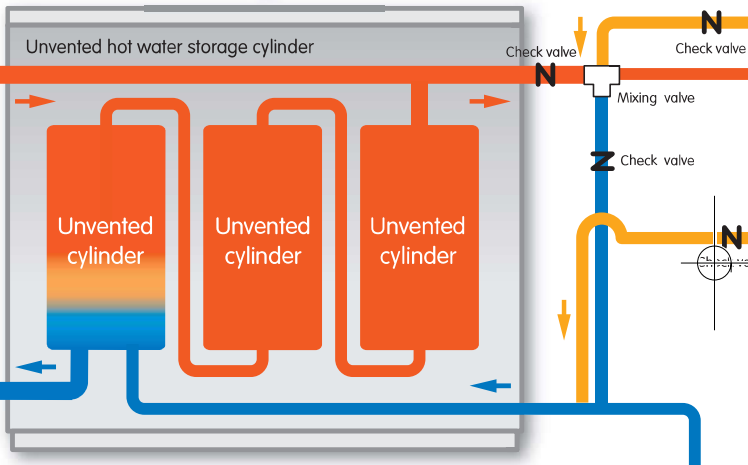


Touch! Efficency and comfortable hot water supply system

Starting an operation by a simple tap on button

Recovering heat energy from the air





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

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

TOTAL ENERGY SOLUTION

Present the best solution

1. Select the best system configuration
2. Saving energy
3. Reducing CO_2 emission

1. Research
Listening to user's requirements in detail

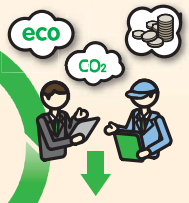
2 .Measurement and diagnosis
Checking installation place and conditions correctly

3. Plan and checking
Make the plan for hot water supply

High efficiency heat pump equipment


Q-ton ESA30E

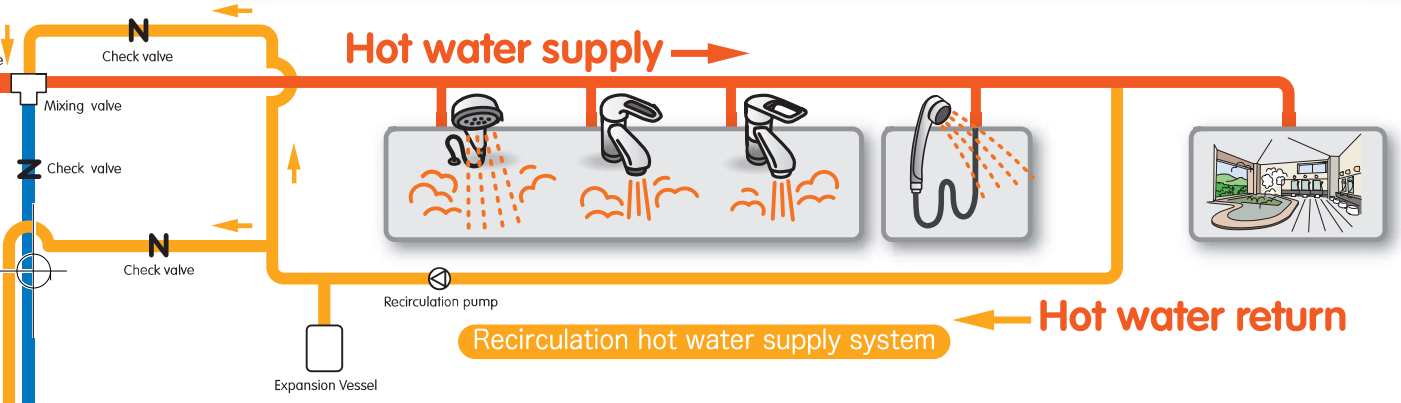

ECO Turbo ETW



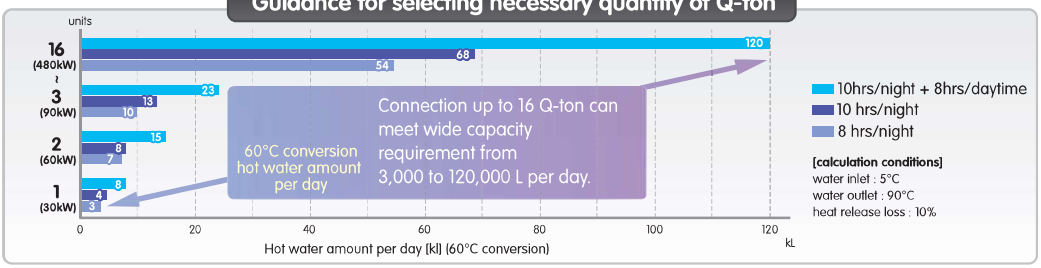
4. Present the plan to the user
Present the best total optimization plan to the user

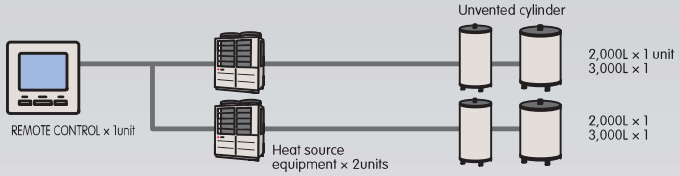
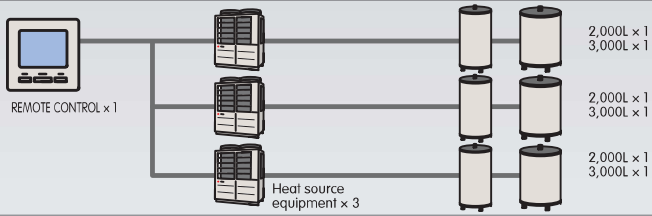
5. Design and construction
Planning to meet user's requirement with reliable design and construction for hot water supply

6. After-sale services
Present various service menu for regular maintenance



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	

Installation samples

MAP

Europe

UK

Case Study 01 — Watford

Medical Centre

Colne House

ESA30E-25×1 Tank(1,000L)×1

Case Study 02 — London

Guest Rooms

Lancaster Hall Hotel

ESA30E-25×2 Tank(2,000L)×2

Europe

SPAIN

Case Study 03 — Cádiz

Sport Center

Activa Club Sport Centre

ESA30E-25×2 Tank(4,000L)×3

Case Study 04 — Las Palmas

Hotel

Alisios Canteras Hotel

ESA30E-25×1 Tank(3,000L)×1,(1,000L)×1

East Asia

KOREA

Case Study 05 — Jecheon

Dorm Building
Semyung University
ESA30E-25×1　Tank(1,000L)×1,(10,000L)×1

Case Study 06 — Changwon

Office Building
Doosan Heavy Industries
ESA30E-25×1　Tank(8,000L)×1

Case Study 07 — Busan

Guest Rooms
Busan Business Hotel
ESA30E-25×1　Tank(30,000L)×1

Case Study 08 — Pohang

Dorm Building
Handong Global University
(Kukje)ESA30E-25×2　Tank(4,000L)×2
(Lothem)ESA30E-25×4　Tank(8,000L)×2

East Asia

JAPAN

Case Study 09 — Kamishihoro

Dairy Farming
DreamHill
ESA30-25×1　Tank(500L)×5

East Asia

CHINA

TEST CASE

Case Study 10 — Qingdao

Office Building
MHI-Haier (Qingdao) Air-Conditioners Co., Ltd.
ESA30E-25×1　Tank(8,000L)×1,(3,000L)×1

Specifications and dimensions

SPECIFICATIONS

Item \ Model			ESA30E-25
Power supply			3-phase 380V±5%, 400V±5%, 415V±5% 50Hz
Operation to top up (In intermediate season)*1	Heating capacity	kW	30
	Water amount	Liter/min	8.97
	Power consumption	kW	6.98
	COP	—	4.3
Operation to top up (In cold region)*2	Heating capacity	kW	30
	Water amount	Liter/min	5.06
	Power consumption	kW	10.73
	COP	—	2.8
Sound Power level*3		dB(A)	58
Sound Pressure level*3			70
Outside dimension	Height	mm	1,690
	Width	mm	1,350
	Depth	mm	720 + 35 (Water pipe connection)
Current	Max	A	21
	Starting	A	5
Unit weight		kg	375 (During operation 385)
Color			Stucco white (4.2Y7.5/1.1 approx.)
Compressor	Type x Pcs		Hermetic inverter compressor × 1
	Nominal output	kW	6.4
Refrigerant	Type		R744 (CO2)
	Charged amount	kg	8.5
Refrigerant oil	Type		MA68
	Charged volume	cc	1200
Crankcase heater		W	20
Anti-freezing heater	for water pipe	W	48 × 3
	for drain pan	W	40 × 2
	for drain hose	W	40 × 2 + 48
Heat exchanger, Air side			Copper pipe straight fin type
Heat exchanger, Water side (Gas cooler)			Copper pipe coil type
Fan	Type		Axial flow type (direct coupled motor) × 2
	Output x Pcs	W	386 × 2
	Air volume	m^3/min	260
	External static pressure	Pa	50
Water pump	Type x output		Non-self-suction spiral type inverter pump × 100W
	Materials contacting to water		Bronze, SCS13
	Actual pump head	m (kPa)	5m (49kPa) @17Liter/min
Usage temp range	Outdoor air temp	°C	-25 to +43
	Feed water inlet temp	°C	Top up: 5-35, Warm up: 35-65
	Hot water outlet temp	°C	60-90
Water pressure range		kPa	500 or lower (Keep water pressure more than 0kPa at the inlet of the heat pump unit)
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)
	Drain water outlet		Rc3/4 (Copper 20A)
Electric wiring	Earth leakage breaker		30A, 30mA, 0.1sec
	Power cable size		□14 × 4 (Length 40m)
	Molded-case circuit breaker		Rated current: 30A, switch capacity: 30A
	Grounding wire size		M6
	Remote controller wire size		0.3mm^2 × 2 cores shielding wire (MVVS)
Design pressure		MPa	High pressure : 14.0, Low pressure : 8.5
IP code			IP24

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

Fixing heat pump unit

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

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

"COMMISSION REGULATION (EU) No.814/2013 of 2 August 2013 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks"

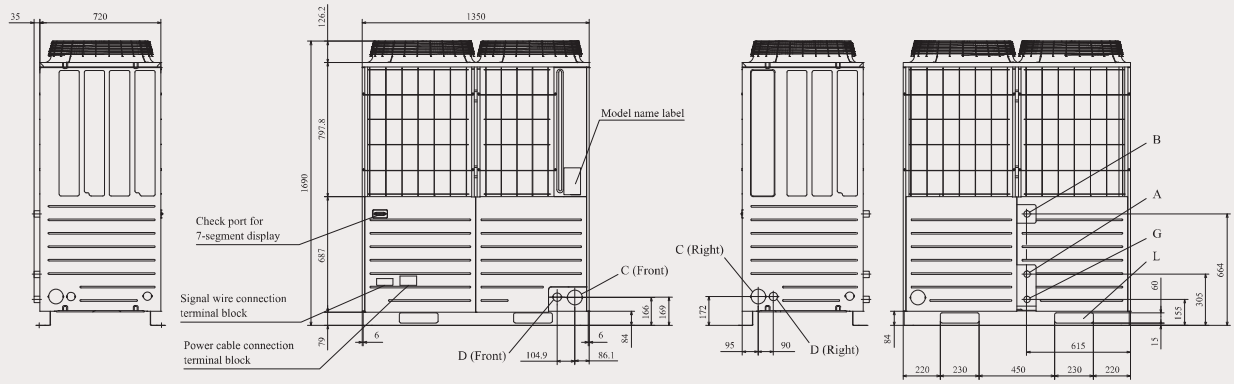
"COMMISSION DELEGATED REGULATION (EU) No. 812/2013 of 18 February 2013 supplementing Directive 2010/30/EU of the European Parliament and of the Council with regard to the energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device"

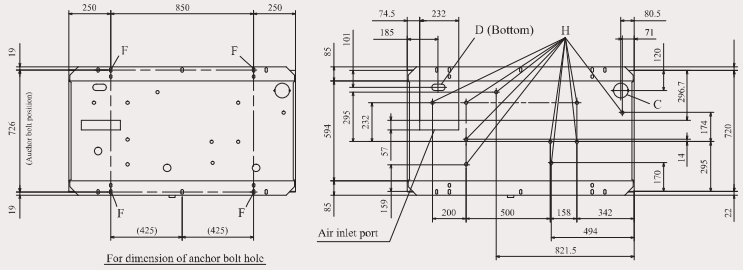
Specification table

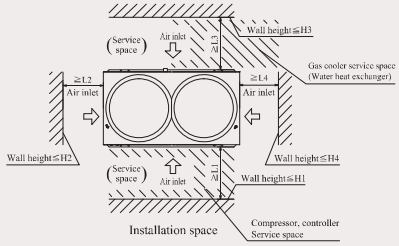
	ESA30E-25
Water Heating Energy Efficiency Class	A
Water Heating Energy Efficiency, %	114
Applied load profile	XXL

(Average climate condition)
Model
Heat Pump water Heater ESA30E-25
Hot Water Storage Tank GX-1000-RB

Dimensions







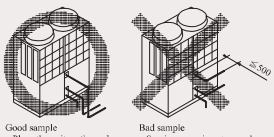
(Unit: mm)

Installation example / Dimension	I	II
L1	800	800
L2	10	10
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.

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 water heater-cylinder 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

Notes
(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.
(4) The holes for power cable inlet, and connection wire outlet from heat pump water heater to cylinder 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 snow
① Place the unit on the rack in order to make the bottom of unit higher than the snow surface.
② Install a snow prevention hood (locally prepared according to the drawing provided by MHI) on the outlet port of the unit.
③ Install the unit at the space under the eaves or the snow prevention roof (locally prepared)
(7) If ambient temp becomes below 0°C, it may cause break of water pipes and damage on the unit due to freezing
Be sure to apply anti-freezing heater to feed water piping , hot water piping, 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

1. Before installation

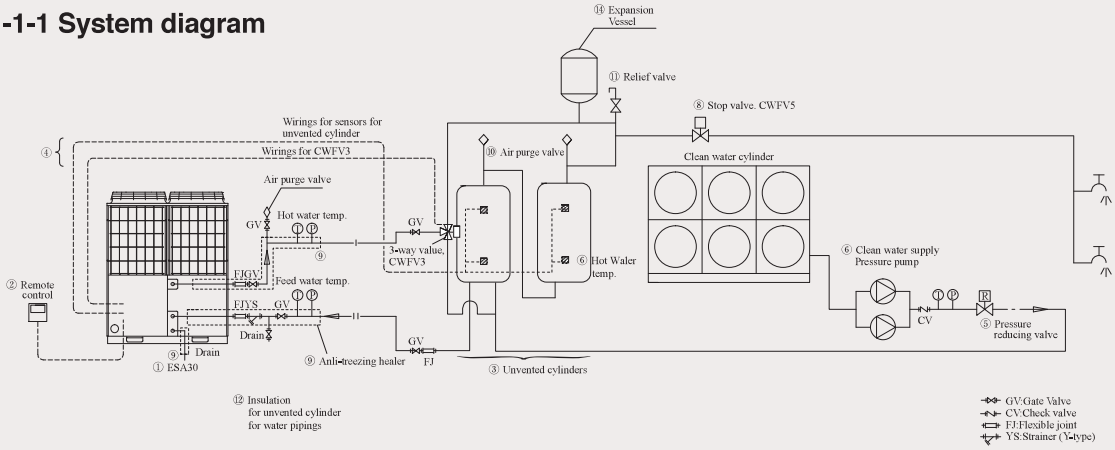
(Check the model, electrical specifications, piping, necessary option parts and etc, and install properly.)

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.

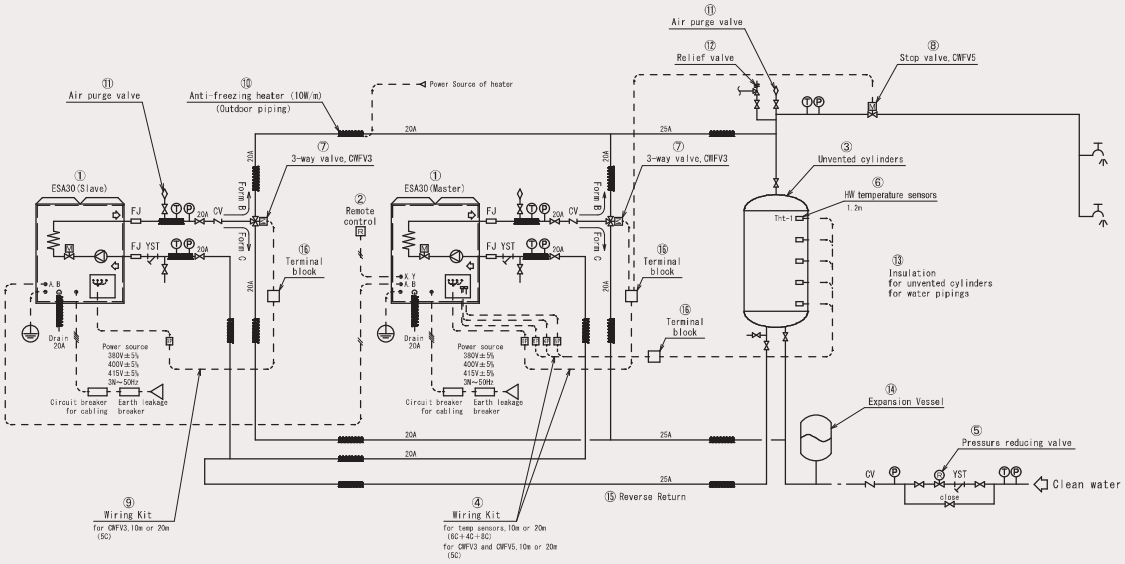
1-1 One way hot water supply system diagram and component list

1-1-1 System diagram



1-1-2 Component list

	Part name	Model	General description
①	Heat pump unit	ESA30E-25	For outdoor air temperature -25°C
②	Remote control for heat pump water heater (Option part)	RC-Q1E	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 heat pump water heater with unvented cylinder ・Connect to the water temperature sensor of unvented cylinder ・Connect to the 3-way valve for switching to anti-freezing circuit and control it
⑤	Pressure reducing valve (Locally procured)	–	Connecting pipe size≧32A Setting pressure is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve (especially lower side)
⑥	Hot water temperature sensor (Option part)	MTH-Q3E	Mounting or pasting on the unvented cylinder for detecting hot water temperature in the cylinder. 1.25m length x 9
⑦	3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit (wiring length 0.7m, AC200V, 50mA)
⑧	Stop valve of hot water supply, CWFV5 (Option part)	MTH-Q5E	If the multiple heat pump water heaters are connected, it is necessary to use at the hot water supply line. (wiring length 0.7m, AC200V, 50mA)
⑨	Anti-freezing water heater (Locally procured)	–	When outdoor air temperature becomes below 0°C, be sure to install this heater on the water pipe (10W/m)
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 is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve
⑫	Insulation (Locally procured)	–	Heat resistance≧120°C ・For the cylinder shell: 50mm or thicker glass wool whose density is 16kg/m^3. ・For the cylinder end plate: 50mm or thicker glass wool whose density is 24kg/m^3. ・For the water piping: 30mm or thicker glass wool whose density is 48kg/m^3.
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)	–	–



Component list of hot water supply system (for unvented cylinder and configuration of master - slave units)

	Part name	Model	General description
①	Heat pump water heater	ESA30E-25	For outdoor air temperature -25°C
②	Remote control for heat pump water heater (Option part)	RC-Q1E	For setting hot water amount and setting hot water temperature.
③	Unvented cylinder (Locally procured)	–	Refer to the specifications of unvented cylinder mentioned in instlation manual.
④	Wiring kit for unvented cylinder (Option part)	MTH-Q1E (20m length of wire) or MTH-Q2E (10m length of wire)	For connecting heat pump water heater with unvented cylinder ・Connect to the water temperature sensor of unvented cylinder ・Connect to the 3-way valve for switching to anti-freezing circuit and control it
⑤	Pressure reducing valve (Locally procured)	–	Connecting pipe size≧32A Setting pressure is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve (especially lower side)
⑥	Hot water temperature sensor (Option part)	MTH-Q3E	Mounting or pasting on the unvented cylinder for detecting hot water temperature in the cylinder. 1.25m length x 9
⑦	3-way valve, CWFV3 (Option part)	MTH-Q4E	For switching to anti-freezing circuit (wiring length 0.7m, AC200V, 50mA)
⑧	Stop valve of hot water supply, CWFV5 (Option part)	MTH-Q5E	If the multiple heat pump water heaters are connected, it is necessary to use at the hot water supply line. (wiring length 0.7m, AC200V, 50mA)
⑨	Wiring kit for CWFV3	MTH-Q6E (20m length of wire) MTH-Q7E (10m length of wire)	MTH-Q1E or –Q2E has only one set of relay wiring for CWFV3 (MTH-Q4E). For the master-slave connection, provide an MTH-Q6E or MTH-Q7E for each slave unit.
⑩	Anti-freezing water heater (Locally procured)	–	When outdoor air temperature becomes below 0°C, be sure to install this heater on the water pipe (10W/m)
⑪	Air purge valve (Locally procured)	–	For purging the air in the hot water system which is generated during heating up the water in the unit or is mixed in the system when feeding water. Each valve is required for each cylinder.
⑫	Relief valve (Locally procured)	–	For preventing from increasing pressure in the system during heating up the water. Working pressure is to be set lower than 500kPa at the inlet of the heat pump water heater and lower than the design pressure of the cylinders. Also please be considered that the head difference of the heat pump water heater and the cylinders and the tolerance of the relief valve
⑬	Insulation (Locally procured)	–	Heat resistance≧120°C ・For the cylinder shell: 50mm or thicker glass wool whose density is 16kg/m^3. ・For the cylinder end plate: 50mm or thicker glass wool whose density is 24kg/m^3. ・For the water piping: 30mm or thicker glass wool whose density is 48kg/m^3.
⑭	Expansion Vessel (Locally procured)	–	–
⑮	Recerse return (Locally procured)	–	When two more master units are connected to a tank, employ the reverse return circuit at the water supply side, in order to reduce the difference in pressure losses among respective heat source unit systems.
⑯	Terminal block (Locally procured)	–	–

1-3 Specifications of unvented hot water storage cylinder for connecting to ESA30E

Please arrange and procure a new unvented cylinder with following specifications for connecting to ESA30E.
*If connecting ESA30 to the existing cylinder, the hot water 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 cylinder.
- The minimum capacity is 500liter. If increasing capacity, please use bigger size cylinder or several cylinders in parallel.
- The maximum capacity is 4000liter. (only as a guide)
  The cylinder capacity may vary according to feed water inlet 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 ESA30E is 0.5MPa. Even if the design pressure of the cylinder is 0.5MPa or higher, the maximum water pressure applied to the cylinder actually shall be less than 0.5MPa. And please decide the usage pressure in consideration of allowance and setting value of relief valve.
  Even if the actual pressure applied to the cylinder is 0.5MPa, the cylinder can be used, but the minimum pressure shall be 0.1 to 0.2MPa or higher. If the pressure becomes lower than the minimum pressure, water volume becomes decreasing.
- Pipe connection port
  Cylinder has one or more pipe connection ports at the top. The size of port shall be 32A or bigger.
  If it is smaller than 32A, it is difficult to detect the hot water 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.
  * 32A=DN32=32mm=1-1/4in
    20A=DN20=20mm=3/4in
- Specifications of inner cylinder
  In order to ensure the thermal boundary layer as minimum as possible when hot water and feed water flow into the cylinder, the cylinder shall have buffer plates built-in. Please consult with our distributor.
- Material
  SUS444 or SUS316 (with consideration for stress corrosion cracking resistance)
  If using the other material than the specified one, hot water temperature and hot water amount in the cylinder may not be detected correctly. Please consult with our distributor.
- Heat resisting temperature
  90°C
  The maximum hot water outlet temperature of ESA30E 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 temp is 90°C or higher.
  If mounting the temperature sensors, the insertion holes with ø7mm or bigger in size and 20mm or deeper in depth are required on the cylinder.
  MHI's genuine temperature sensor, MTH-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 water heater 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 water heater 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 page ×× and 95 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. Please refer to page ×× "7-1 Applying method of hot water temperature sensors on the cylinder" for details.

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

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

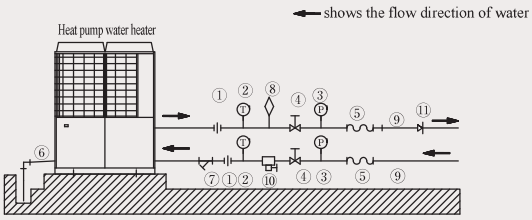
*1 Recommendable number of sensors is 9pcs.
If the number of sensors is less than 9pcs, the hot water amount cannot be detected correctly
When applying Anti-legionnaires' diseace control, please refer to "(9) Anti-legionnaires' diseace control".

- 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



Structure of water piping

(i) Key consideration for water piping

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

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

(ii) Caution for corrosion

① Water quality

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

Be sure to use cyclic water and makeup water whose qualities are within the range of water quality criteria mentioned in Page 78.

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

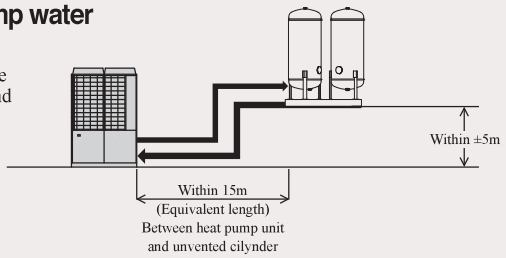
2-2.1 Limitation of piping length between the heat pump water heater and the unvented cylinder

Be sure to install the heat pump water heater 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 (equivalent length for pipe size 20A)

ii) Height difference: Within ±5m



[Water quality criteria]

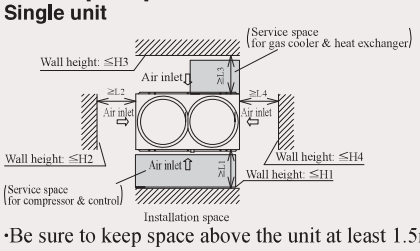
Makeup water and cyclic water shall be the water within the range of water quality criteria mentioned below.

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

Item			Makeup water
Standard items	pH (25°C)	—	7.0—8.0
	Electric conductivity (25°C)	mS/m	≦30
	Chloride ion	mgCl^-/L	≦30
	Sulphate ion	mgSO_3^{2-}/L	≦30
	Acid consumption (pH4.8)	mg$CaCO_3$/L	≦50
	Sulphide ion/Acid consumption	—	≦0.5
	Total hardness	mg$CaCO_3$/L	≦70
	Calcium hardness	mg$CaCO_3$/L	≦50
	Ionic silica	mgSiO_2/L	≦20

2-2.1 Heat pump water heater installation space (Service space)

1) Single unit



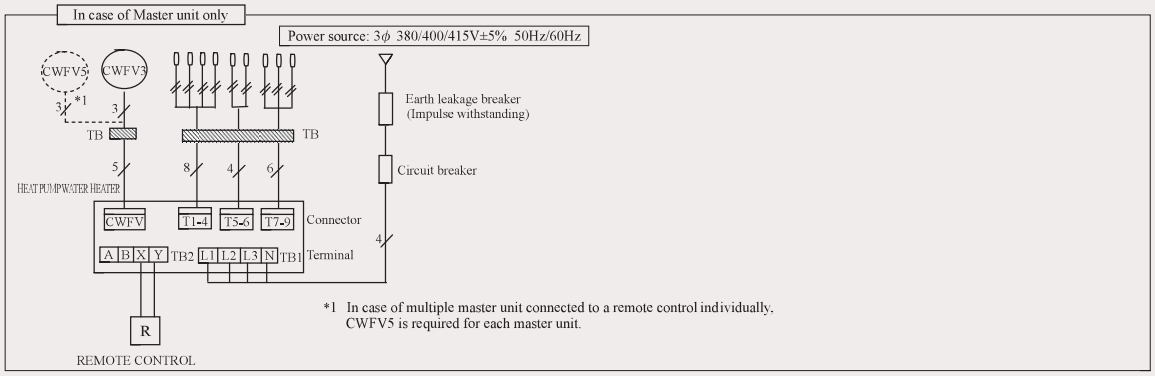
Dimension \ Installation example	1	2
L1	800	800
L2	10	10
L3	800	800
L4	100	500
H1	1500	1500
H2	No limit	No limit
H3	1000	1000
H4	No limit	No limit

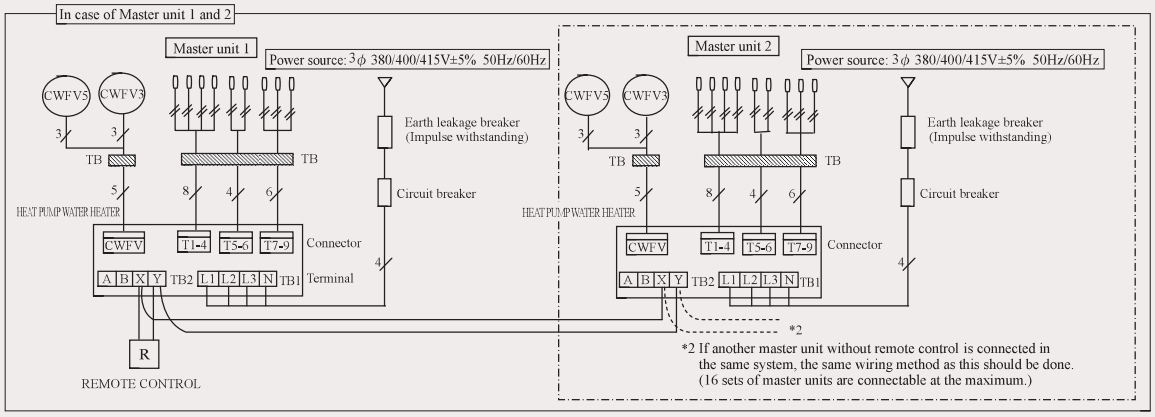
·Be sure to keep space above the unit at least 1.5m.

3. Electrical wiring work for the heat pump water heater

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.





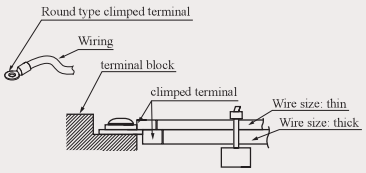
3-1 Connecting method of power cable

(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 (ϕ50 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.



Tightening torque (N·m)		
M4	Signal line terminal block	0.68-0.82
M6	Grounding wire	2.50-3.00
M12	Power cable terminal block	22.05-26.46

- 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.

(c) Heat pump water heater power source specifications: 3 phase 380V/400V/415V±5% 50/60Hz

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
8	70	30A, 30mA, 0.1sec or shorter	8	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.

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)

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ISO9001
Our Air-Conditioning & Refrigeration Division is an ISO9001 approved factory for residential air conditioners and commercial-use air conditioners (including heat pumps).

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HB91-16HM01E-A-1 Feb. 2016(1B)F