

**MITSUBISHI  
ELECTRIC**

*Changes for the Better*

HOT WATER HEAT PUMP **R454C**

**CAHV-R450YA-HPB**

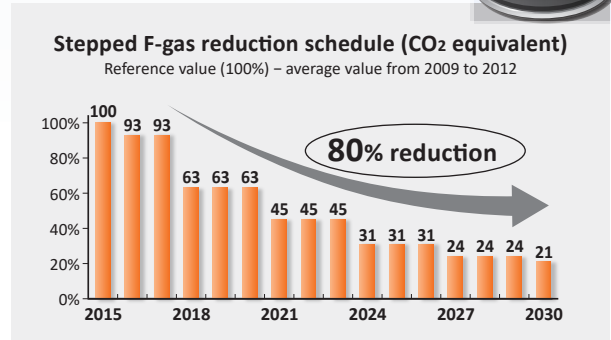


# Features

## 1. Low-GWP refrigerant R454C

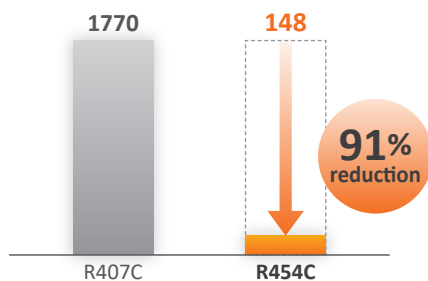
In Europe, the F-gas Regulation is implemented to prevent global warming and unwanted climate changes. The current target is to reduce the total amount of F-gases (CO<sub>2</sub> equivalent) by about 80% across Europe by 2030 compared to 2015.

Mitsubishi Electric offers more environmentally friendly hot water heat pumps that use the low Global Warming Potential (GWP) refrigerant R454C.



\*Estimates based on the version of the F-gas Regulation issued in January 2015.

Comparison of CO<sub>2</sub> equivalent (GWP)



The GWP of R454C refrigerant is 148. It is approximately 91% lower than the R407C refrigerant which is used in the conventional model (CAHV-P500YB-HPB)\*.

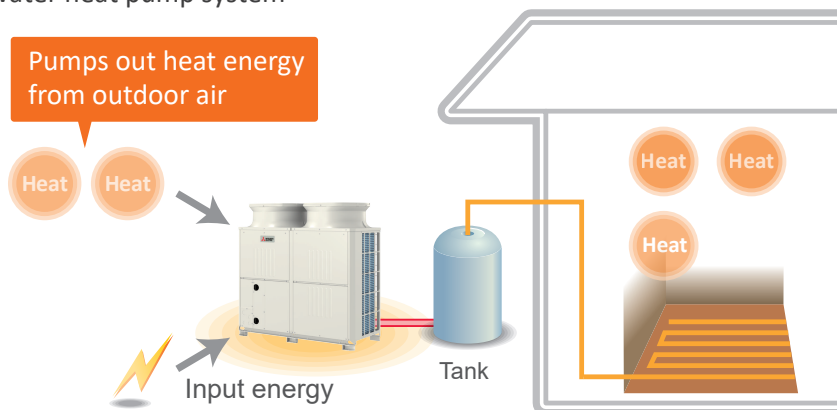
\*Source: IPCC 4th assessment report.

## 2. Low running costs & wide operating temperature range

Hot water heat pumps absorb energy from the surrounding outdoor air and transfer it into refrigerant. Heat energy absorbed from air heats up the incoming water via the heat exchanger. The Seasonal Coefficient of Performance (SCOP) of the new CAHV is 3.57 (low temperature conditions) / 3.24 (medium temperature conditions)\*, which means it can extract more than three times the input electric energy.

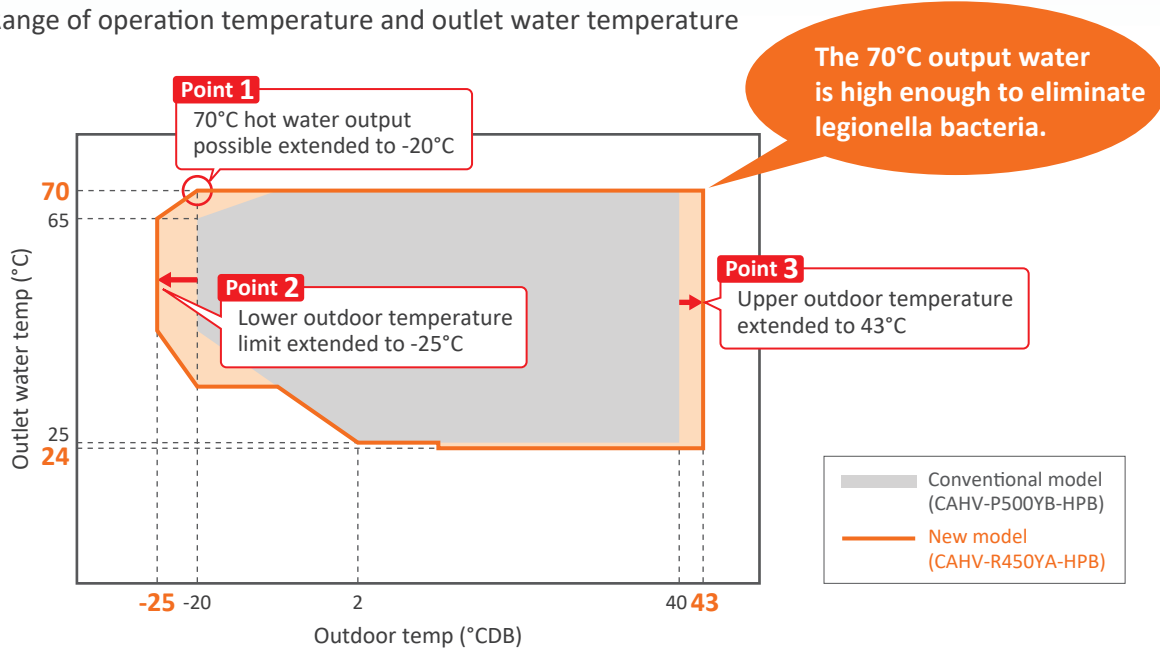
\* Above values are based on Regulation (EU) No.811/2013.

Hot water heat pump system



The lower outdoor temperature limit for 70°C hot water output has been extended from -10°C in the conventional model to -20°C in the new model. The operating temperature range has also been improved from "-20°C to 40°C" to "-25°C to 43°C". It is suitable for heating and heat-retention operations.

Range of operation temperature and outlet water temperature



## Various applications

### Community heating

For heating applications such as radiators and underfloor heating in housing complexes.



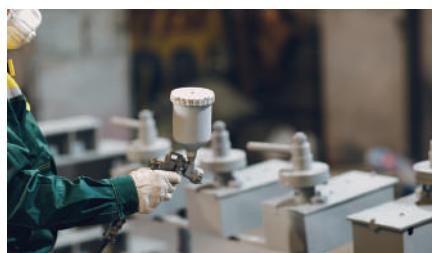
### Hotels & health center

For heating and thermal applications such as showers and swimming pools in hotels and health centers.



### Factory

For applications with high heat-retention loads, such as parts washing and painting lines. The CAHV can also meet high horsepower demands by combining several units.



### 3. Low maintenance & design flexibility

#### Clean and safe

The hot water heat pump system runs on electricity only. It does not require the safety measures and periodic inspections required for gas and other combustion appliance-mounted systems, and does not generate toxic substance such as NOx.

#### Rotation function

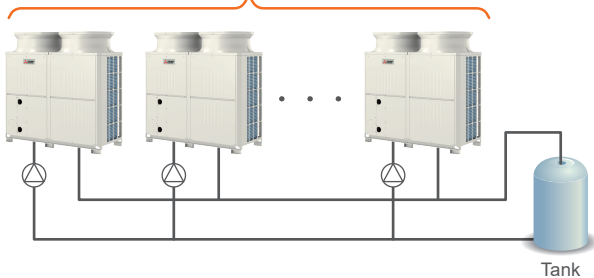
When two or more units are in the system, the unit runs alternately, ensuring an optimum product lifecycle for both component units.



#### Multi-unit installation

The number of outdoor units can be adjusted from 1 to 16 according to the tank storage capacity.

Up to 16 units can be connected to one tank.



#### Wide variety of external input / output

Various system configurations are available.

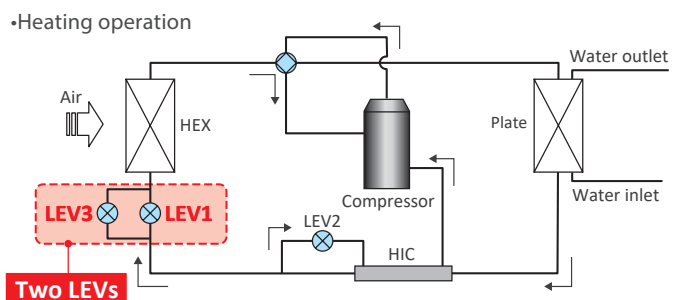
- Two external output for backup heater
  - Analog input to control capacity
  - Defrost signal
- \* Refer to the Data Book for other functions.

## Key technologies

### Refrigerant circulation and pressure control with two LEVs

The R454C refrigerant is a lower pressure refrigerant than R407C, which is used in the conventional model, and R410A, which is commonly used in air conditioners. Because low-pressure refrigerants have a low refrigerant density, securing circulation volume can be challenging especially when the refrigerant circuit pressure drops due to low outdoor temperatures or other conditions.

Linear expansion valves (LEVs) before heat exchanger (HEX) were increased from one to two and placed in parallel. The opening of LEV1, which focuses on securing the refrigerant circulation volume, and LEV3, which focuses on controlling the refrigerant pressure, are controlled respectively to control the refrigerant circulation.



## New compressor has been developed

### Highlights of the new compressor

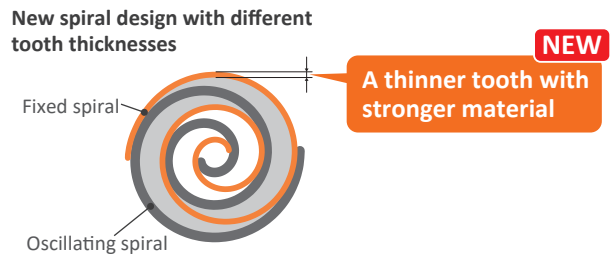
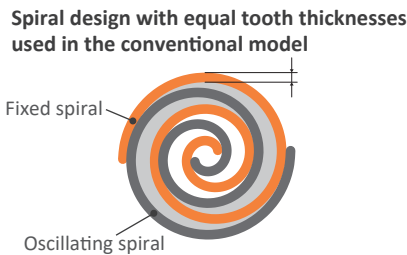
- ✓ New spiral structure
- ✓ Flash injection circuit
- ✓ Expanded inverter frequency control lower limit

Compatible with R454C refrigerant



### New spiral structure

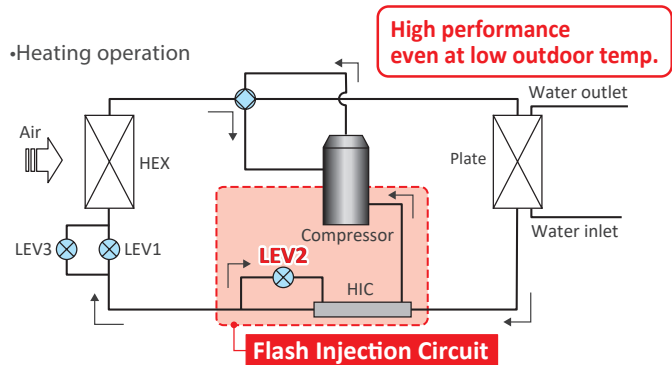
The low density of R454C refrigerant requires an increased amount of refrigerant to be discharged from the discharge section. The new compressor uses a new material for the fixed spiral section, which enables the tooth to be thinner while maintaining their strength. The height of the teeth has also been lengthened. This synergistic effect has resulted in a 15% increase in the extrusion volume from the discharge section compared to the conventional model (assuming the scroll section of the old and new compressors has the same volume).



### Flash injection circuit

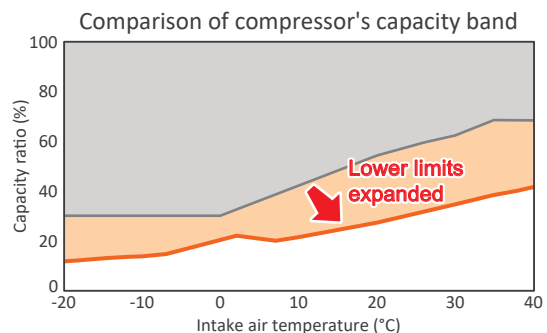
The flash injection circuit is a Mitsubishi Electric technology used in air conditioner for cold climates. The CAHV also adopts this circuit to help units produce high-temperature water even at low outdoor temperatures.

Liquid refrigerant, whose pressure is reduced by the LEV2, exchanges heat in the HIC circuit and becomes gas-liquid two-phase refrigerant. This two-phase refrigerant flows into the injection port in the compressor for controlling the increase of the discharge temperature. Therefore the optimal amount of refrigerant can be provided to the system via the compressor.



### Expanded inverter frequency control lower limit

The new compressor has an expanded lower limit of the frequency control range compared to the conventional model. This expanded lower-limit control helps minimize thermo ON/OFF frequency during low-load operations, such as in intermediate seasons, and improves energy efficiency.



— Lower limit of the conventional model (CAHV-P500YB-HPB)  
 — Lower limit of the new model (CAHV-R450YA-HPB)  
 \* The upper limit for Efficiency Priority Mode is set to 100%.

# Controller

## Individual remote controller

- PAR-W31MAA

PAR-W31MAA offers an easy-to-see full-dot and backlit LCD display. Basic operations, such as ON/OFF, mode switching, water temperature setting and schedule setting, can be performed. Up to 16 units can be controlled with one remote controller.



### Major functions

Operation/ setting	ON/OFF
	Hot water/Heating/HeatingECO/Anti-freeze
	Snow/regular
	Demand
	Scheduled operation (daily/weekly)
Display	Operation mode
	Current water temperature
	Error code

## Centralized remote controller

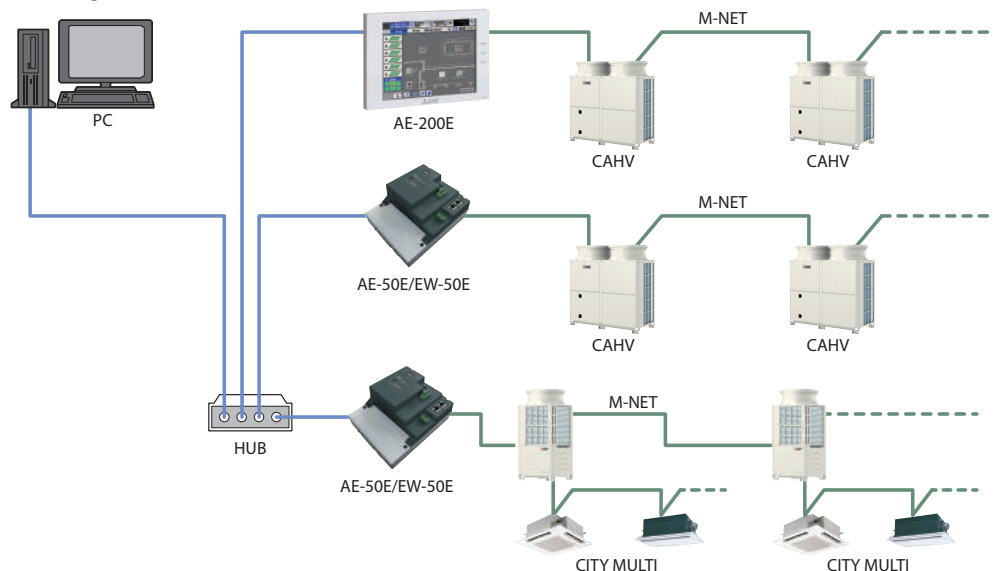
- AE-200E / AE-50E / EW-50E

The CAHV-R450YA-HPB(-BS) is connectable to the AE-200E that centrally controls up to 50 units or 50 systems connected via M-NET.

### Major functions

Operation/ setting	ON/OFF
	Hot water/Heating/HeatingECO/Anti-freeze
	Snow/regular
	Scheduled operation (daily/weekly/annual)
Display	Operation mode
	Current water temperature
	Error code

System configuration



## Optional parts

Description	Model
Y type STRAINER 40A	YS-40A
Representative water temperature sensor	TW-TH16-E

# Specifications

Model		CAHV-R450YA-HPB (-BS)	
Power source		3-phase 4-wire 380-400-415V 50/60Hz	
Capacity(EN14511) *1		kW	40.0
		kcal/h	34,400
		Btu/h	136,480
	Power input	kW	14.03
	Current input	A	23.7-22.5-21.7
	COP (kW/kW)		2.85
Capacity(EN14511) *2		kW	35.0
		kcal/h	30,100
		Btu/h	119,420
	Power input	kW	20.13
	Current input	A	34.0-32.3-31.1
	COP (kW/kW)		1.74
Maximum current input		A	44.0-41.8-40.3
Water pressure drop *1			10.2kPa (1.47 psi)
Temperature range *5	Outlet water temperature		24-70°C 75.2-158°F
	Outdoor temperature	D.B.	-25-43°C -13-109.4°F
Circulating water volume range *6			1.5m³/h-15.0m³/h
Sound pressure level (measured 1 m below the unit in an anechoic room) *1 *4		dB (A)	64
Sound pressure level (measured 1 m below the unit in an anechoic room) *3 *4		dB (A)	72
Water pipe diameter and type	Inlet	mm (in)	38.1(Rc1 1/2"),housing type joint
	Outlet	mm (in)	38.1(Rc1 1/2"),housing type joint
External finish		Acrylic painted steel sheet <Munsell 5Y 8/1 or similar>	
External dimensions H × W × D		mm	1710 x 1750 x 740
Net weight		kg (lb)	359 (791)
Design pressure	R454C	MPa	3.85
	Water	MPa	1.0
Drawing number	Wiring		KW94C870
	External appearance		KW94C397
Heat exchanger	Water-side		Copper brazed stainless steel sheet
	Air-side		Plate fins and copper tubes
Compressor	Type		Inverter scroll hermetic compressor
	Manufacturer		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	12.1
	Lubricant		FVC32EA
	Fan	Air flow rate	m³/min L/s cfm
HIC (Heat inter-changer) circuit	External static pressure		10 Pa (1 mm H2O)
	Type and quantity		Propeller fan x 2
	Control and driving mechanism		Inverter control, direct driven by motor
	Motor output	kW	0.92 x 2
			Copper pipe
Protection devices	High pressure		High-pressure sensor and switch set at 3.85 MPa (643 psi)
	Inverter circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan motor		Thermal switch
Defrosting method		Auto-defrost mode (Reversed refrigerant cycle)	
Refrigerant	Type and factory charge	kg	R454C, 9.0 kg
	Flow and temperature control		LEV and HIC circuit

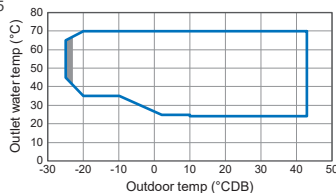
\*1 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB), the outlet water temperature of 45°C (113°F), and the inlet water temperature of 40°C (104°F)

\*2 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB) and the outlet water temperature of 70°C (158°F)

\*3 Under normal heating conditions at the outdoor temperature of 7°CDB/6°CWB (44.6°FDB/42.8°FWB) when the unit is set to the "Capacity Priority" mode through the dry NC-contact

\*4 The sound pressure level is a value measured in an anechoic room in accordance with the conventional method in JRA 4060.

\*5



Outdoor temp. -25°CDB/Outlet water temp. 45 to 65°C  
(Outdoor temp. -13°FDB/Outlet water temp. 113 to 149°F)  
Outdoor temp. -20°CDB/Outlet water temp. 35 to 70°C  
(Outdoor temp. -4°FDB/Outlet water temp. 95 to 158°F)  
Outdoor temp. 43°CDB/Outlet water temp. 24 to 70°C  
(Outdoor temp. -109°FDB/Outlet water temp. 75.2 to 158°F)

\*Do not start up the unit at or below the outdoor temperature of -23°C

\*6 4.0-15.0m³/h under the following conditions.

- When the outdoor temperature is below 0°C.
- When the outlet water temperature is 30°C or below AND the outdoor temperature is 6°C or below.

## Fluorinated Greenhouse Gases Information

Model Name	Refrigerant		Factory charged	
	type	GWP	Weight [kg]	CO <sub>2</sub> equivalent [t]*
CAHV-R450YA-HPB(-BS)	R454C	148	9.0	1332

\* Above values are based on Regulation (EU) No.517/2014.

FOR  
HEALTH  
CLUBS

FOR  
HOTELS

FOR  
SHOPPING  
MALLS

FOR  
FACTORIES

# HOT WATER HEAT PUMP

Air Source Heat Pump



Model

QAHV-N560YA-HPB(-BS)



# MITSUBISHI ELECTRIC'S HOT WATER HEAT PUMP SERIES, QAHV,

Our solution to hot water supply for commercial & industrial applications

As a leading manufacture of air-to-water heat pumps, we have developed QAHV, the latest innovation in Mitsubishi Electric's comprehensive lineup of Hot Water Heat Pump products. QAHV has been specifically designed to produce high volume hot water and is suitable for commercial and industrial application where hot water demand is high. By adopting the Mitsubishi Electric's unique technology, QAHV can ensure highly reliable performance as well as high heating capacity even at low outdoor temperatures.

90°C  
High  
temperature

## Main features of QAHV

- 1) Utilizes natural refrigerant (CO<sub>2</sub>)
- 2) High efficiency (Achieved COP 3.88 \*1)
- 3) Supplies high temp. hot water of up to 90°C \*2
- 4) Operable even at low outdoor temp of -25°C

\*1 Under normal heating conditions at outdoor temp:16°CDB/12°CWB,  
inlet water temp 17°C, outlet water temp 65°C

\*2 Maximum outlet hot water temp on secondary side is 80°C.



CO<sub>2</sub>  
refrigerant

## Why is CO<sub>2</sub> (R744) used?

QAHV adopts CO<sub>2</sub> (R744) as a refrigerant, environment-friendly natural refrigerant, which does not destroy the ozone layer (ODP=0) and has significantly low global warming potential (GWP=1). With the natural refrigerant, QAHV can contribute to the reduction of CO<sub>2</sub> emissions.

\*ODP: Ozone Depletion Potential, GWP: Global Warming Potential

High  
efficiency

## High energy saving with our unique technology

QAHV utilizes a twisted & spiral gas cooler which is Mitsubishi Electric's unique technology. The 3 connected refrigerant pipes are wound around the twisted water pipe, which maximizes heat transfer. The continuous spiral grooves in the twisted pipe accelerates the turbulence effect of water and also helps to reduce pressure loss within the heat exchanger which contribute to enhance efficiency.

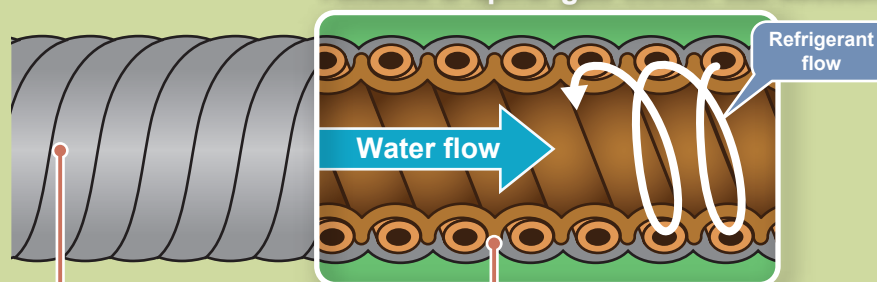
Equipped with the latest inverter scroll compressor, QAHV can significantly increase the annual efficiency which fixed speed systems can not match.

### ► Twisted & spiral gas cooler

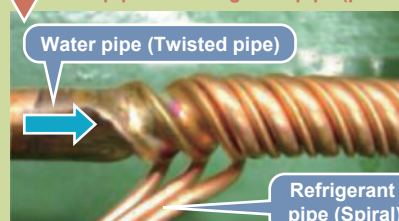
Patented  
technology

Using twist pipes as water pipes and running the refrigerant pipes along their grooves help increasing the heat-conductive area, allowing for better heat transfer.

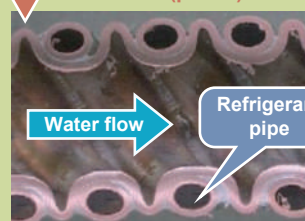
#### Twisted & spiral gas cooler cut section



Water pipe and refrigerant pipe (photo)



Cut section (photo)



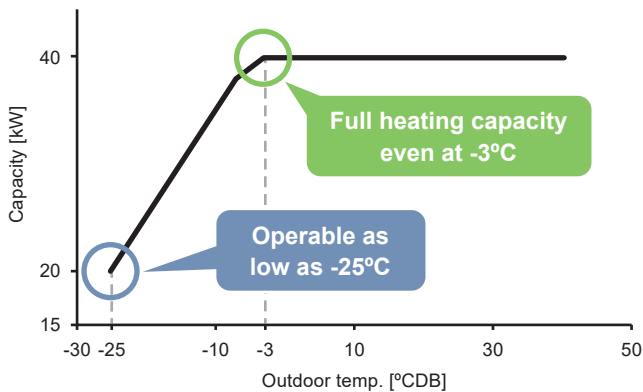
Operable even at **-25°C**

# Bringing a year round hyper heating capacity to extreme climate

QAHV is able to provide full heating capacity even at ambient temperatures of -3°C. Furthermore, the unit is operable and can supply 90°C\*1 hot water in ambient temperatures as low as -25°C. The technology behind this is an injection circuit which provides optimum amount of refrigerant to the system via a compressor through a specially designed injection port to ensure a particularly stable operation.

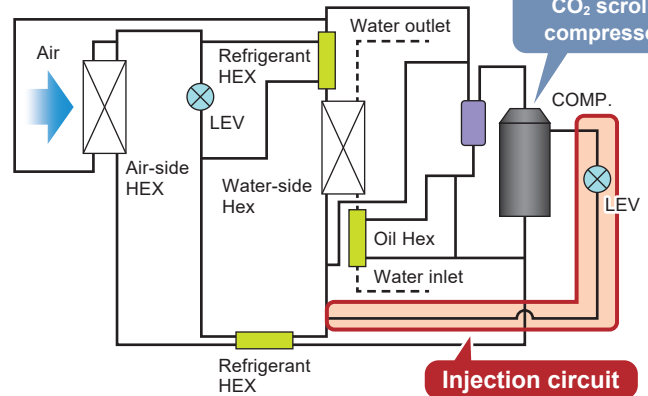
\*1 Maximum outlet hot water temp on secondary side is 80°C.

## ▶ Stable Heating Capacity even at low temperature

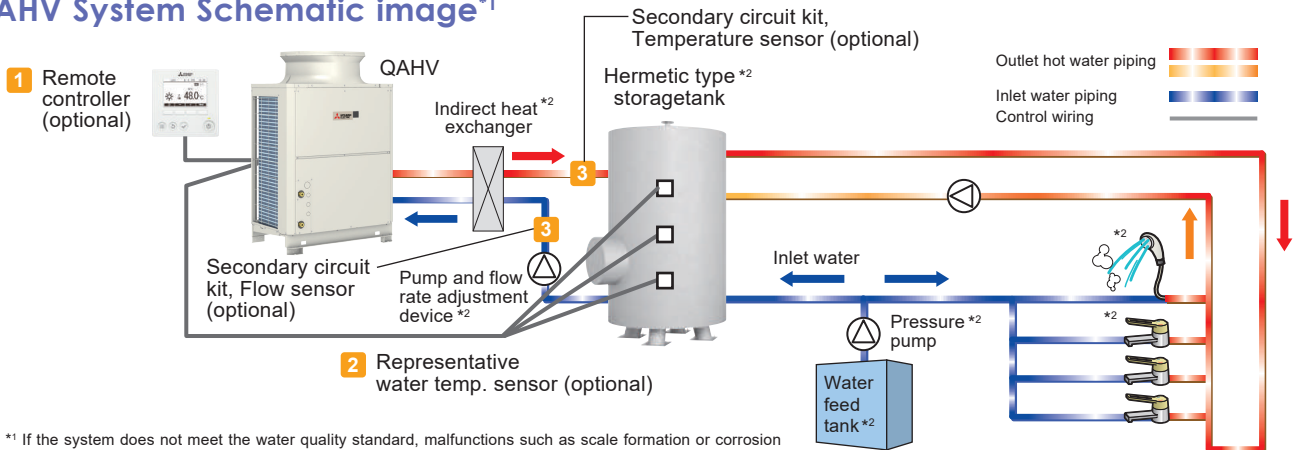


High performance even at low outdoor temp.

Highly efficient inverter-driven CO<sub>2</sub> scroll compressor



## ▶ QAHV System Schematic image\*1



\*1 If the system does not meet the water quality standard, malfunctions such as scale formation or corrosion may occur. Such water cannot be used in a system in which water is directly supplied to the unit.

\*2 Must be procured locally.

## ▶ Optional Parts for QAHV

### ▶ Optional Parts

Description	Image	Model name
1 Remote Controller		PAR-W31MAA-J
2 Representative water temperature sensor		TW-TH16-E
3 Secondary circuit kit *1 (Temperature sensor, Flow sensor)		Q-1SCK

By incorporating the secondary circuit control to the QAHV, the need to assemble a pump control on site is eliminated. This has simplified the system configuration in which the amount of water used exceeds the Water Quality Standards for QAHV.

\*1 For more detailed information, please refer to DATA BOOK. The pump control system on the load side needs to be installed on site.

## ► Specifications

Model			QAHV-N560YA-HPB(-BS)
Power Source			3-phase 4-wire 380-400-415V 50Hz
Capacity *1	kW		40
	kcal/h		34400
	Btu/h		136480
	Power input	kW	10.31
	Current input	A	17.8-16.9-16.3
COP (kW/kW)			3.88
Capacity *2	kW		40
	kcal/h		34400
	Btu/h		136480
	Power input	kW	10.97
	Current input	A	20.0-19.0-18.3
COP (kW/kW)			3.65
Capacity *3	kW		40
	kcal/h		34400
	Btu/h		136480
	Power input	kW	11.60
	Current input	A	20.4-19.4-18.7
COP (kW/kW)			3.44
Maximum current input			A
Allowable external pump head			77kPa
Temperature range	Inlet water temp		5~63°C 41~145.4°F
	Outlet water temp		55~90°C (Secondary side control enabled: 55 to 80°C) 131~194°F (Secondary side control enabled: 131 to 176°F)
	Outdoor temp	D.B.	-25~43°C -13~109.4°F
Sound Pressure level (measured 1m below the unit in an anechoic room) *1			dB (A)
Water pipe diameter and type			mm (in.)
External finish			Acrylic painted steel plate <MUNSELL 5Y 8/1 or similar>
External dimension H x W x D			mm in.
Net weight			kg (lbs)
Design Pressure	R744	MPa	14
	Water	MPa	0.5
Heat exchanger	Water-side		Copper tube coil
	Air-side		Plate fin and copper tube
Compressor	Type		Inverter scroll hermetic compressor
	Maker		MITSUBISHI ELECTRIC CORPORATION
	Starting method		Inverter
	Motor output	kW	11.0
	Case heater	kW	0.045
Lubricant			PAG
FAN	Air flow rate		m <sup>3</sup> /min L/s cfm
	Type x Quantity		Propeller fan
	Control, Driving mechanism		Inverter-control, Direct-driven by motor
	Motor output	kW	0.92
	HIC (HIC: Heat inter-changer) circuit		
Protection	High pressure protection		High pres.Sensor & High pres.Switch at 14MPa (643psi)
	Inverter circuit		Overheat and overcurrent protection
	Compressor		Overheat protection
	Fan motor		Thermal switch
Defrosting method			Auto-defrost mode (Hot gas)
Refrigerant	Type x original charge		R744 x 6.5
	Flow and temperature control		LEV

### Notes:

\*1.Under Normal heating conditions at the outdoor temp, 16° CDB/12° CWB (60.8° FDB/53.6° FWB), the outlet water temperature 65° C (149° F), and the inlet water temperature 17° C (62.6° F)

\*2.Under Normal heating conditions at the outdoor temp, 7° CDB/6° CWB (44.6° FDB/42.8° FWB), the outlet water temperature 65° C (149° F), and the inlet water temperature 9° C (48.2° F)

\*3.Under Normal heating conditions at the outdoor temp, 7° CDB/6° CWB(44.6° FDB/42.8° FWB), the outlet water temperature 65° C(149° F), and the inlet water temperature 15° C(59.0° F)

\*Due to continuing improvements, specifications may be subject to change without notice

\*Do not use steel pipes as water pipes.

\*Keep the water circulated at all times. Blow the water out of the pipes if the unit will not be used for an extended period time.

\*Do not use ground water or well water

\*Do not install the unit in an environment where the wet bulb temperature exceeds 32° C

\*The water circuit must use the closed circuit

\*There is a possibility that the unit may abnormally stop when it operates outside its operating range. Provide backup (ex.boiler start with error display output signal (blue CN511 1-3)) for abnormal stop.

### Unit converter

kcal/h = kW x 860  
BTU/h = kW x 3,412  
cfm = m<sup>3</sup>/min x 35.31  
lbs = kg/0.4536



เลือกซื้อผลิตภัณฑ์มีตซูบิชิ อีเล็กทริก  
ได้ที่ร้านตัวแทนจำหน่ายมีตซูบิชิ อีเล็กทริกทั่วประเทศ

**HOTLINE SERVICE 1325**

สายด่วนไปรษณีย์ทุกวัน  
จ.ศ. เวลา 7.30 - 24.00 น.  
ส.ศ. และวันหยุดนักขัตฤกษ์ เวลา 8.00 - 22.00 น.

**บริษัท มีตซูบิชิ อีเล็กทริก กันยงวัตนา จำกัด**  
**MITSUBISHI ELECTRIC KANG YONG WATANA CO.,LTD.**  
28 ถนนกรุงเทพกรีฑา แขวงหัวหมาก เขตบางกะปิ กรุงเทพฯ 10240  
โทร 0-2763-7000 โทรสาร 0-2379-4759-62  
โทรสาร ศูนย์บริการ 0-2379-4757, 0-2379-4763  
[www.mitsubishi-ykw.co.th](http://www.mitsubishi-ykw.co.th)



ศูนย์บริการ MITSUBISHI ELECTRIC  
ได้รับการรับรองมาตรฐานสากลระบบคุณภาพ ISO 9001