MAKE AIR TREATMENT MORE HEALTHY AND ENERGY SAVING

HOLTOP

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* Data is subject to changes without notification due to product improvement

HOLTOP

HFM SERIES

AIR-COOLED MODULAR CHILLER (HEAT PUMP)

HFW Series Air-Cooled Chiller(Heat Pump)

HFW-L Series Air Source Chiller(Heat Pump)

HFW-R Series Total Heat Recovery Air-Cooled Chiller(Heat Pump)

MAKE AIR TREATMENT MORE HEALTHY AND ENERGY SAVING HOLTOP

Everyone needs to breathe **25,000** times per day

- Clean and fresh air is essential
- HOLTOP keeps working on providing you with integrated fresh, clean, comfortable and intelligent air solutions.
- HOLTOP delivers fresh and clean air, just for your healthy breathing!

ABOUT HOLTOP

2002 HOLTOP WAS FOUND

200000+ Units Production Capacity

70000+ m^2 Area

100+ Countries Exportation

30+ Sales Organizations

ISO Certifications

Dozens of National Patents Owner

Industrial Standards Participated

World Leading Manufacturer

Zhongguancun&National High-tech Enterprise

Equipment Supplier for Beijing Olympics and The Shanghai World Expo

Contents

MAKE AIR TREATMENT MORE HEALTHY AND ENERGY SAVING HOLTOP

HFM SERIES

Modular Air Cooled Chiller (Heat Pump)

Holtop HFW series modular air cooled chiller (heat pump) is sophisticated design with fine and elegant configuration, flexible modularized structure. It can be adopted to all kinds of FCU, AHU indifferent specification.
HFW series chiller (heat pump) own itsfeature of high efficiency, low noise, friendly HMI operation, stable and safe running, easy installation and maintenance. The unit canbe widely used for large or small-sized industrial and civil air conditioning project, like factories, station, hotels, villas, office building, high-end apartments etc.

Model marking

HFW - 130 HA1 - L

Model code: **L: Low-temperature air source heat pump**
R:Total heat recovery air cooledheat pump
None: Modular air cooledchiller(heat pump)

Design number

Rated cooling capacity, specification, unit

Holtop air cooled chiller(heat pump) unit

Total heat recovery Heat pump unit

- HFW-130HA1-R
- HFW-65HA1-R

Modular chiller(heat pump) Low-temperature heat pump

- HFW-130HA1
- HFW-130HA1-L
- HFW-150HA1-L

Modular chiller(heat pump) Low-temperature heat pump

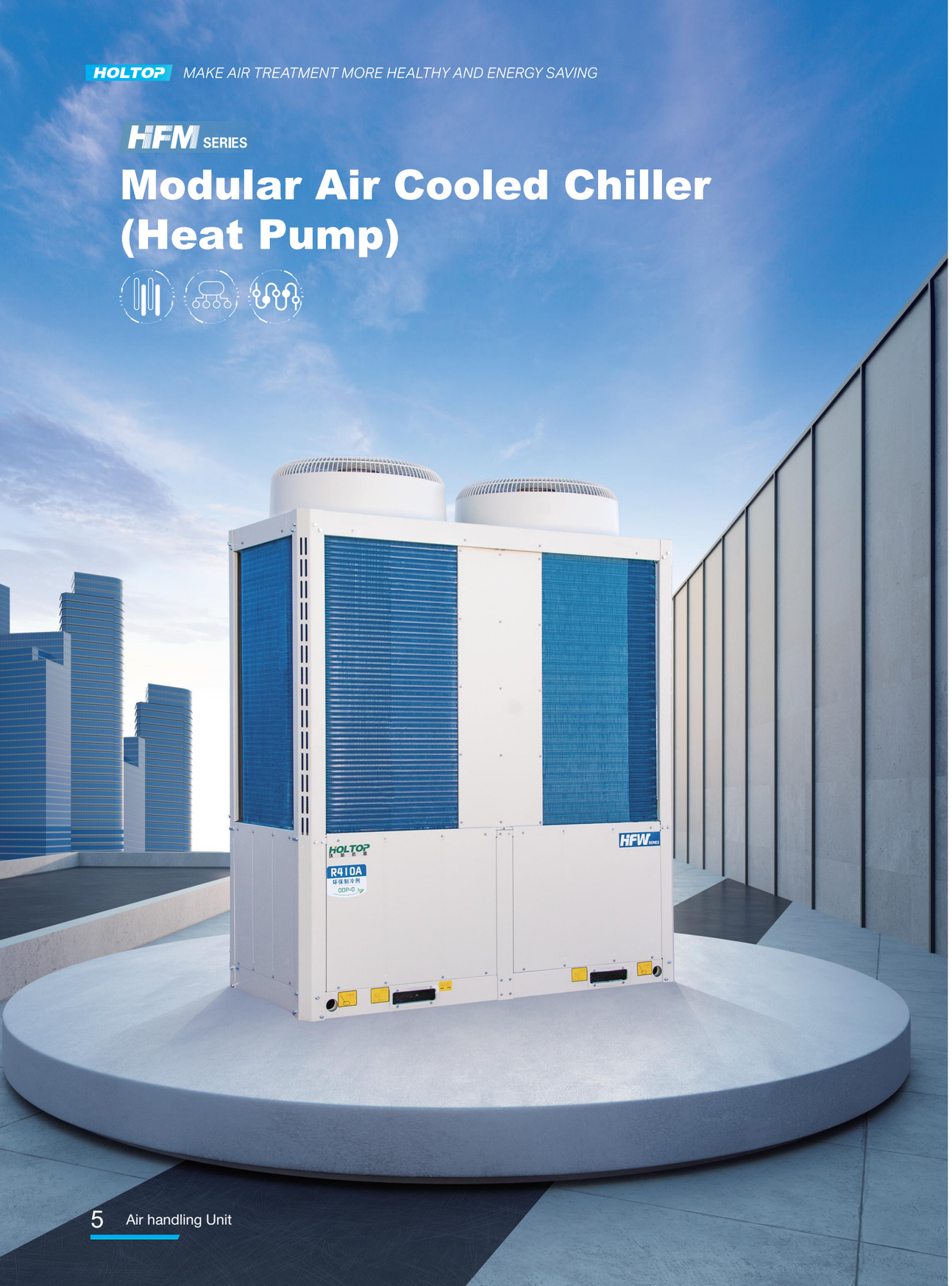
- HFW-65HA1
- HFW-65HA1-L

Low-temperature heat pump unit

- HFW-300HA1-L

HFM SERIES

Modular Air Cooled Chiller (Heat Pump)



Sophisticated design

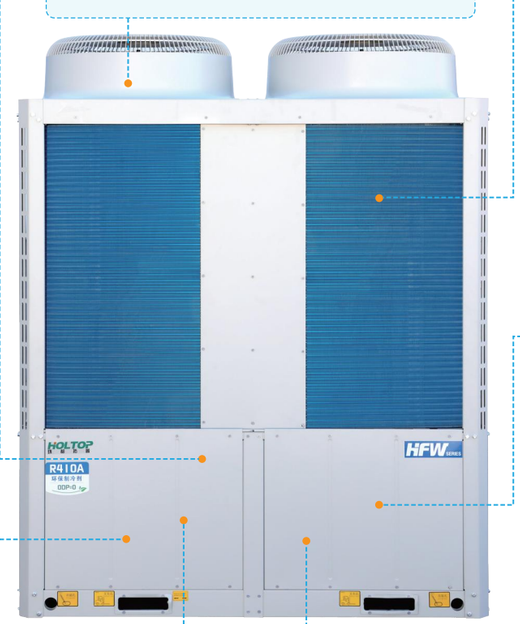
Holtop has accumulated years of tech nical experience in modular air cooled units, and has continuously launched new products of high efficiency and environmental , thus to build an energy-saving society. The modular air cooled chiller (heat pump) has reached the national second-level energy efficiency certification and obtained the national energy-saving product certificate.

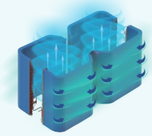
PCB control board

The low-temperature module PCB control board jointly developed by manufacturer of Holtop. compressor, valves and controller. Its has feature of stable operation, advanced control logic and multiple protection

Fan & Motor

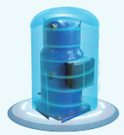
Adopt large air volume, low noise fan impeller with low rotation speed and high efficiency motor.





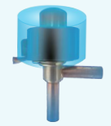
Air side heat exchanger

The design of ring type air inlet heat exchanger makes the air distribution more uniform and the heat exchange more adequate.



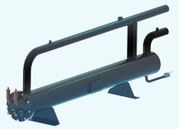
Compressor

The international advanced intermediate exhaust valve IDV technology is adopted to improve the energy efficiency of part load.



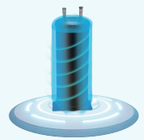
Electronic expansion valve

Precise throttling control of the 480-step electronic expansion valve to keep the unit running at the optimal energy efficiency.



Water side heat exchanger

Shell and tube heat exchanger with new spiral baffle technology is about toincrease efficiencyof 10%



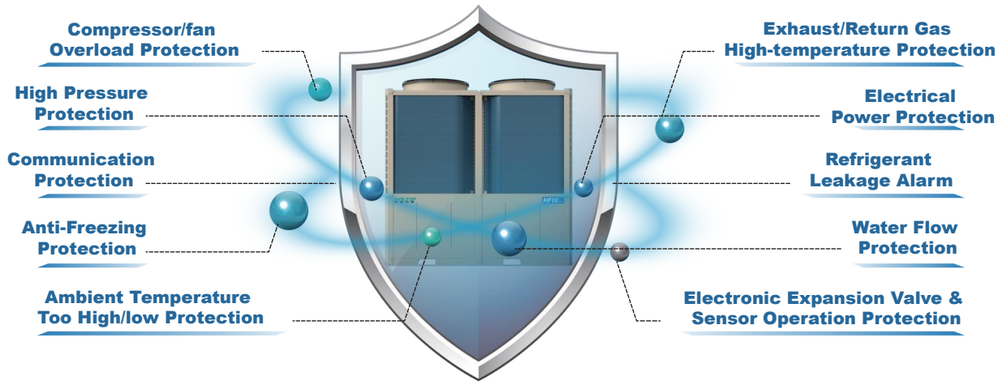
Liquid storage tank

Large volume and low pressure loss liquid storage tank to ensure the system runs more reliably.

Reliable operation

Integrated Protection

Integratedprotectionby more than10 protectionmeasures. and viamulti-variable monitoring of intelligent controller, toguarantee the stableand highefficiencyoperation



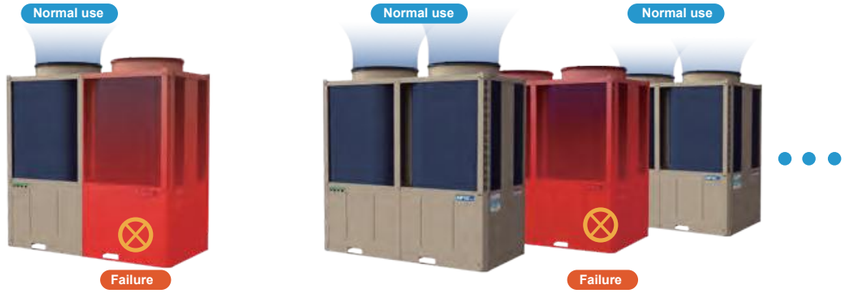
Double Anti-freezing protection

Water pump running anti-freezing: In standby mode, if the system water temperature is too low, the unit will start the water pump for anti-freezing cycle;

Unit heating and anti-freezing: When the water temperature exceeds the safety parameter, the unit starts the heating and anti-freezing cycle until the water temperature rises to the preset safe value.

Failure backup

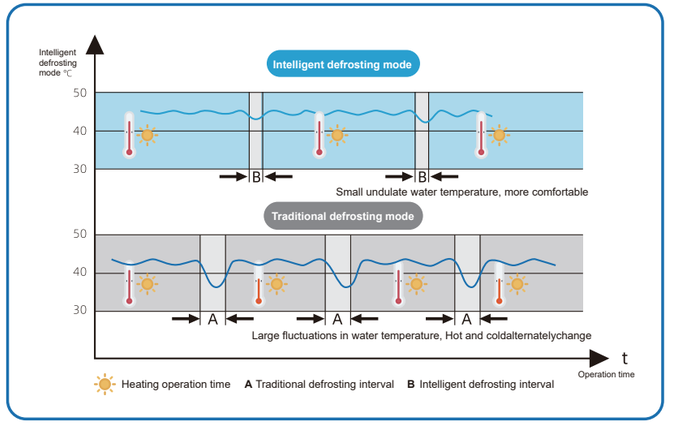
One unit adopts a multi-compressor design. When one of the compressors fails, the rest of the compressors in the system can still operate normally without affecting the normal use of the entire system.



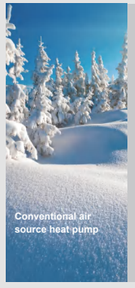
Module combination

Module intelligent defrosting

Holtop air cooled heat pump, unit accurately judges the frosting situation through multi-variable parameters and enter the defrosting mode intelligently, concentrate the heat of the system to melt the frost layer to the maximum extent, and shorten the defrosting time. Avoid problems such as insufficient defrosting or frequent defrosting. When heating in severe low temperature environment, manual forced defrosting can be set.
The unit adopts a multi-compressor system, which can realize alternate defrosting; when multiple units are combined, the units are mutually backed up, and the units are defrosted at intervals. The number of defrosting systems does not exceed half of the total number of systems to ensure that the water temperature is stable to meet heating needs. Eliminate the phenomenon of indoor side blowing cold wind, to ensure the comfort of use.



Shortness of conventional heat pump defrosting



· Frequent defrosting

25% heat loss in one cycle, more energy consumption

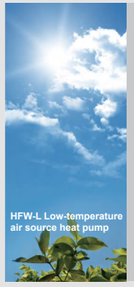
· Large fluctuations in water temperature

Around 10℃, alternately hot and cold

· Cold air blew

Cold air blows indoors due to defrosting, making it uncomfortable.

Advantages of Holtop intelligent defrosting



Longer heating cycle

Shorter defrost times

More comfortable inheating mode

More stablehot water supply

Modular combination

Modular design, and there is no need to distinguish between master and slave units when combining modules, which is convenient for installation. The unit can control the main machine through the wire controller, and can expand up to 15set slave machines, which can meet the load requirements of different buildings, and different series of models can be combined for joint control.

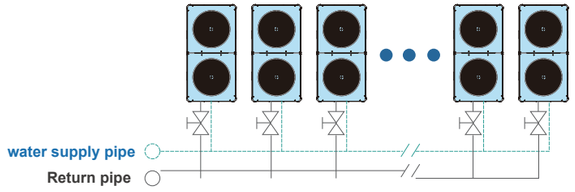
Flexible application

Investment Flexible for further extension, lower investment ininitial project stage

Transportation The unit is small in size and can be transported independently without large hoisting equipment.

Installation Just install it in a well-ventilated place, no special machine room and cooling water system are required. The water inlet and outlet design at the end of the unit is more conducive to reducing the installation space on site.

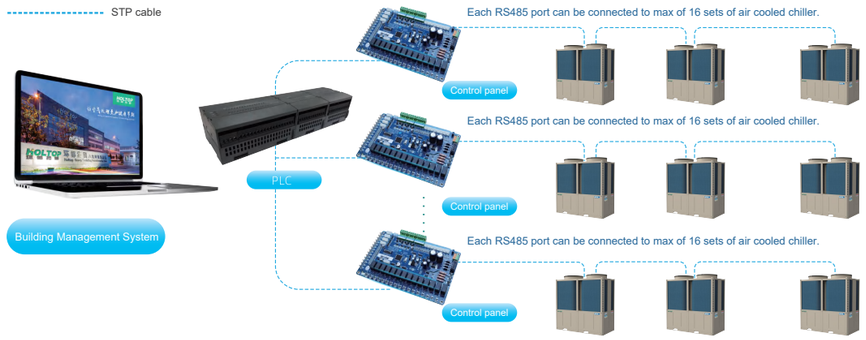
System In addition to the traditional constant water flow system, the terminal circulation system can also be designed as a primary pump variable water flow system.



Intelligent control

Optional PLC control system

The PLC control system combines the simplicity and convenience of the wired control system and the advantages of centralized group control system to achieve chiller group centralized control. One PLC control system can manage 1 to 8 groups of air cooled chiller, each group can control 1 to 16 pieces of modular chillers, that is, 128 modular chillers at most. The control system can deliver group mode switching, temperature adjustment, on/off control, etc., with rich functions, flexible and convenient application.



Intelligent Combination Control Function

Terminal interlock control:
Chiller will automatically start/stop in accordance with the terminal unit(AHU, FCU) status.

Remote switch control:
Unit start/stop can be realized by the remote switch.

Chilled water pump interlock control:
Chiller will automatically start/stop the water pump when it is not working synchronously with the terminal unit, to avoid any damage to the whole system.

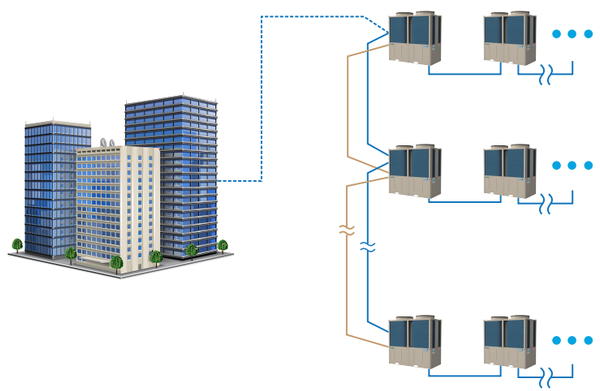
System auxiliary heat source interlock control:
The starting conditions of the auxiliary heat source are determined by the multi-variable system. The start/stop of the auxiliary heat source are controlled intelligently.

Fault alarm:
The control system can connect to the audio and video alarm system or other prompts, to inform user for any failure.

Running status:
The system can output unit operation status feedback signal to user side for easy checking at any time.

Free Access to Building Management System

Standard RS485 building communication interface comes with open source ModBus standard communication protocol. The device can be easily connected to the building management system(BMS) for centralized control, easy to achieve intelligent control, avoid unnecessary energy waste, and save air-conditioning operating costs.



Modular air cooled chiller(heat pump) parameter

Model/Specification		HFW-65HA1	HFW-130HA1
Nominal cooling capacity KW		65.0	130.0
Nominal heating capacity KW		71.0	142.0
Nominal cooling total input power KW		19.2	38.5
Nominal heating total input power KW		20.2	40.4
Power		380V/3N~/50Hz	
Throttle parts		Electrical expansion valve	
Compressor	Type	Hermetic scroll compressor	
	QTY	2	
Fan	Type	Axial low noise fan	
	Power kW	0.9x2	1.5x2
	Air volume m^3/h	14000x2	19500x2
Air side heat exchanger	Type	High-efficient finned heat exchanger	
Air side heat exchanger	Type	High-efficient shell&tube heat exchanger(Designed pressure 1.0Mpa)	
	Nominal water flow m^3/h	11.2	22.5
Water pressure drop kPa		30	40
Water inlet/outlet connection pipe		R2 ” male adapter	R2-1/2 ” male adapter
Refrigerant	Type	R410A	
	Charge volume kg	5.0x2	12.0x2
Dimensions(L x W x H) mm		1810x960x2280	2180x1100x2250
Net weight kg		580	1000

Remark:
1.Nominal cooling condition: water flow rate: 0.172m^3/(h·kw); outlet temperature 7˚C; Ambient temperature 35˚C.
2.Nominal heating condition: water flow rate: 0.172m^3/(hkw); outlet temperature 45˚C; Ambient DB/WB temperature:7˚C/6˚C.
3.Water pipe for modular chiller combination should be fabricated and installed at project site, not provided by factory. Pipe diameter and construction should conform to design standards.
4.Module units can be combined on the basis of the same or different model according to needs for specific project. The number of combined units ranges from 1 to 16 pcs. The above table is the parameters of a single unit.
5.Control accessories need to be ordered separately. Control accessories include wire controller,instruction manual, controller connection cable and other accessories.

HFM SERIES

Low Temperature Type Air Source Chiller(Heat Pump)

EXQUISITE DESIGN

The low-temperature air source heat pump chiller is a central heating unit with air as the thermal energy source, water as the heat transfer medium. It uses clean energy for heating to replace traditional coal-fired boilers, which can realize cooling in summer and heating in winter. Based on the modular air-cooled heat pump chiller, Holtop low-temperature series adopts the EVI technology to further expand the operating range and energy efficiency of the unit. HFW-65HA1-L and HFW-130HA1-L can reach the national energy efficiency grade I, the HFW-150HA1-L can reach the national energy efficiency grade II, and obtained energy-saving certification.

PCB Control Panel

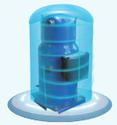
The low-temperature modular PCB control panel, which is developed under the collaboration of HOLTOP, and supplier of compressor /electronic valve /controller, its feature of advanced control logic, stable operation, and multi-protection, which guarantee the performance of the whole system.

Fan and Motor

The fan is with large air volume and low noise level, and the motor is with strong torque and high efficiency. Both are allowing the unit to operate at high efficiency and low noise.

Air-Side Heat Exchanger

The circling air inlet heat exchanger creates a uniform air distribution to get the optimal heat exchange.

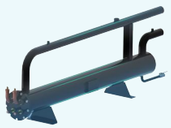


Compressor

With the help of the world-class EVI (Enhanced Vapor Injection) compressor, the heating performance at low-temperature working conditions increases over 18%.

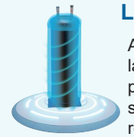
Electronic Expansion Valve

Precise refrigerant flow control is available from a 480-step electronic expansion valve, to keep the unit running at the most efficient level.



Water-Side Heat Exchanger

The new helical baffles technology of shell & tube heat exchanger, which helps to increase about 10% of the heat exchange efficiency.



Liquid Storage Tank

A liquid storage tank with large-volume and less pressure loss, to make the system operation more reliable.

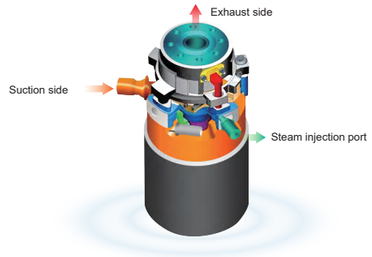
Heat exchanger

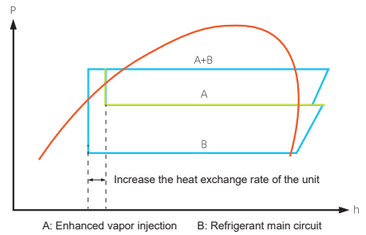
Stainless steel brazed plate heat exchanger to ensure effective supercooling of refrigerant.

Low Temperature Type Air Source Chiller (Heat Pump) Characteristics

Using EVI compressor

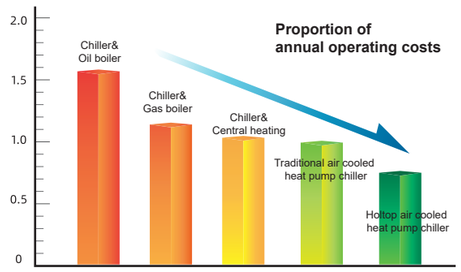
The unit adopts EVI (Enhanced Vapor Injection) high-efficiency compressor with air injection and enthalpy increase. Compared with conventional compressors, EVI compressor has one more air return port, through which part of the medium-pressure gas can be introduced to achieve secondary compression in one compressor. Due to the introduction of medium-pressure gas supplementary air, the suction capacity of the compressor is increased, the system refrigerant circulation volume and outdoor heat exchange heat capacity are greatly improved, and the cooling and heating capacity is increased by about 10-20% compared with ordinary compressor units. Especially in the low temperature environment place, the heating capacity is excellent, and it can be used as the latest choice for winter heating, with lower operating costs.





Excellent Energy Efficiency Ratio (EER)

Holtop low-temperature air source heat pump unit is designed for ultra-efficient and low-temperature operation in cold regions. The unit has excellent operating performance, with heating COP as high as 3.64 and cooling COP as high as 3.48. The heating and cooling performance of the unit has been comprehensively improved, reaching the national first-class energy efficiency , and obtained energy-saving certification. And the unit is matched with advanced high-efficiency heat exchanger and parallel control technology, which can make the unit's comprehensive partial load performance coefficient IPLV as high as 4.12, saving more operating costs for users.

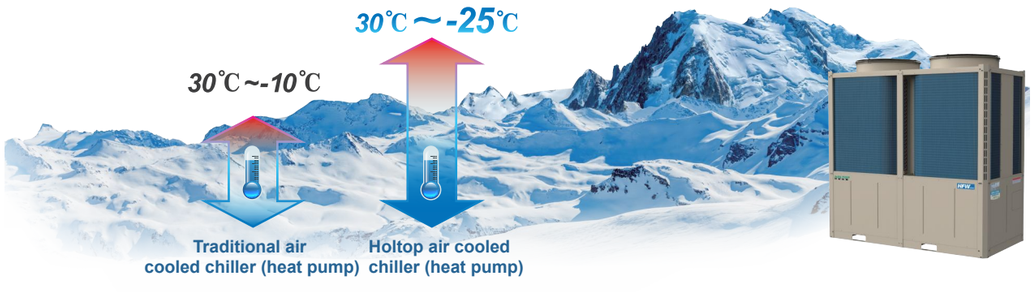


Proportion of annual operating costs	Chiller& Oil boiler	Chiller& Gas boiler	Chiller& Central heating	Traditional air cooled chiller(heat pump)	Holtop air cooled chiller(heat pump)
	1.72	1.29	1.18	1.17	1

Noted: This data is based on the analysis of the operating costs of different air-conditioning methods for a 5-story office building in a Chinese northern city, with a total area of 6,000 square meters.

Wide Temperature Range in Operation

The lowest operation temperature of traditional air-cooled chiller(heat pump) is -10°C. But the low temperature air source heat pump chiller based on the EVI technology would still have good heating performance in the low outdoor temperature environment of -10°C. The temperature of the heating operation environment is extended from -10°C to -25°C of the conventional unit, greatly expanding the application area and range of the air cooled heat pump. This low temperature series of units can be combined with conventional units, which can make the choice of air conditioning solutions more flexible.



Low Temperature Type Air Source Chiller (Heat Pump) Parameter

Model/Specification		HFW-65HA1-L	HFW-130HA1-L	HFW-150HA1-L	HFW-300HA1-L
Nominal cooling capacity KW		65.0	130.0	150.0	300.0
Nominal heating capacity KW		71.0	141.0	155.0	314.0
Nominal cooling total input power KW		18.7	37.7	44.2	93.8
Nominal heating total input power KW		19.5	38.8	45.4	90.2
Nominal heating capacity in low temp KW		52.0	100.0	106.0	202.0
Nominal heating total input power in low temp KW		18.6	37.0	42.4	81.0
Power		380V/3N~/50Hz			
Throttle parts		Electrical expansion valve			
Compressor	Type	Hermetic scroll compressor			
	QTY	2			4
Fan	Type	Axial low noise fan			
	Power kW	0.9x2	1.5x2	1.8x2	1.8x4
	Air volume m³/h	14000x2	19500x2	23500x2	23500x4
Air side heat exchanger	Type	High-efficient finned heat exchanger			
Air side heat exchanger	Type	High-efficient shell&tube heat exchanger(Designed pressure 1.0Mpa)			
	Nominal water flow m³/h	11.5	22.5	25.8	51.6
Water pressure drop kPa		30	40	55	45
Water inlet/outlet connection pipe		R2 ” male adapter	R2-1/2 ” male adapter		R3 ” male adapter
Refrigerant	Type	R410A			
	Charge volume kg	6.5x2	12.0x2	13.5x2	14.0x2
Dimensions(L x W x H) mm		1810x960x2280	2180x1100x2250		2200x2200x2250
Net weight kg		600	1050	1100	1900

Noted:
1.Nominal cooling condition: water flow rate: 0.172m³/(h·kw); Water outlet temperature: 7˚C; Ambient temperature: 35˚C.
2.Nominal heating condition: water flow rate: 0.172m³/(h·kw); Water outlet temperature: 45˚C; Ambient temperature DB/WB: 7˚C/6˚C.
3.Nominal heating in low temperature condition: water flow rate: 0.172m³/(h·kw); Water outlet temperature: 41˚C; Ambient temperature DB/WB: -12˚C/-14˚C.
4.Water pipe for modular chiller combination should be fabricated and installed at project site, not provided by factory. Pipe diameter and construction should conform to design standards.
5.Module units can be combined on the basis of the same or different model according to the needs for specific project. The number of combined units ranges from 1 to 16 sets. The above table sheet is the parameters of a single unit.
6.Control accessories need to be ordered separately. Control accessories include wire controller, instruction manual, controller connection cable and other accessories. The manufacturer reserves the right to change the configuration. Please refer to the factory configuration when purchasing.

HFM SERIES

Total Heat Recovery Type Air Cooled Chiller (Heat Pump)

EXQUISITE DESIGN

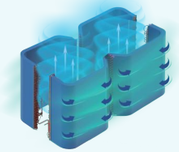
Holtop total heat recovery air-cooled heat pump chiller adds casing heat recovery heat exchanger on the basis of modular air-cooled (heat pump) chiller development, and adopts double four-way valve + diaphragm check valve + double electronic expansion for control Valve + multi-solenoid valve control technology, ensures the stable and efficient operation of the 5 modes with almost no attenuation, and the IPLV is as high as 7.4.

PCB Control Panel

The total heat recovery modular PCB control panel, which is developed under the collaboration of HOLTOP, and supplier of compressor /electronic valve /controller, its feature of advanced control logic, multiple modes stable operation, and multi-protection, which guarantee the performance of the whole system.

Fan and Motor

The fan is with large air volume and low noise level, and the motor is with strong torque and high efficiency. Both are allowing the unit to operate at high efficiency and low noise.



Air-Side Heat Exchanger

The circling air inlet heat exchanger creates a uniform air distribution to get the optimal heat exchange.

Compressor

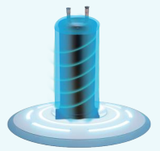
Adopt international advanced intermediate exhaust valve IDV technology to improve energy efficiency of part load.

Electronic Expansion Valve

Precise refrigerant flow control is available from a 480-step electronic expansion valve, to keep the unit running at the most efficient level.

Heat Recovery Heat Exchanger

The casing heat exchanger adopts a unique spiral structure, which is highly efficient in heat exchange, stronger in corrosion resistance, and has the best antifreeze and antifouling capabilities.



Liquid Storage Tank

A liquid storage tank with large-volume and less pressure loss, to make the system operation more reliable.

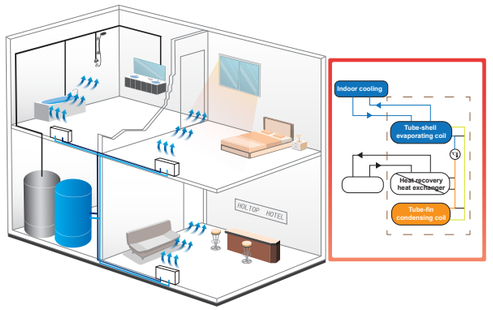
Water-Side Heat Exchanger

The waterside heat exchanger is adopted with the new helical baffles technology of shell &tube heat exchanger, which helps increase10% of the heat exchange efficiency

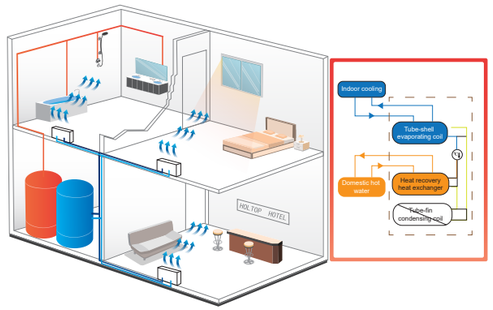
Total Heat Recovery Type Air Cooled Chiller (Heat Pump)

Refrigeration total heat recovery is to use 100% of the heat released during the condensation and exothermic process of the refrigerant in refrigeration cycle to prepare hot water, which realizes the reuse of waste heat, reduces condensing heat pollution to the environment, and reduces the cooling fan power consumption and noise of the unit;
In addition, compared with some heat recovery units, total heat recovery module unit can run the heat pump hot water heating mode alone in winter, and can meet the demand for hot water in winter without adding other hot water equipment, which greatly reduces the initial investment of engineering equipment, and perfectly adapts to the year-round changing demand for air conditioning and hot water in different places.

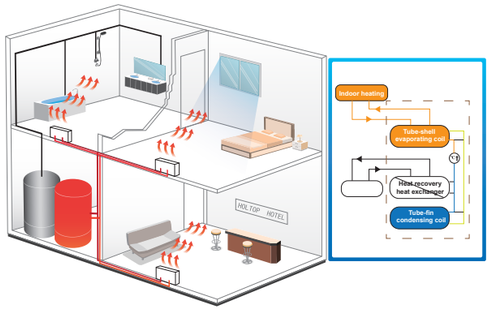
Working principle diagram of cooling mode



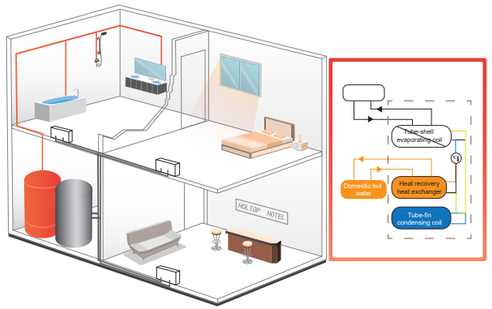
Working principle diagram of cooling&hot water mode



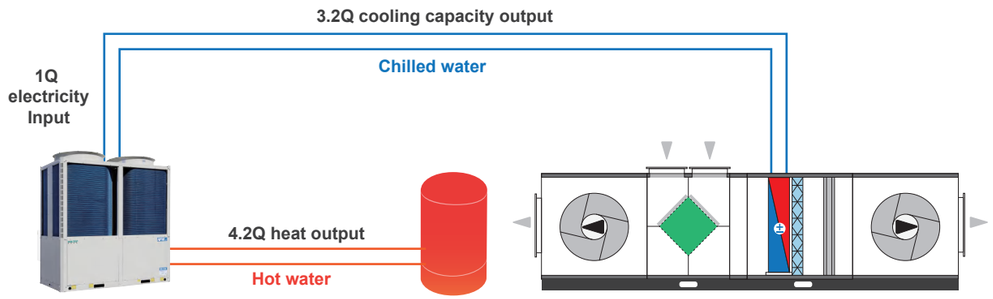
Working principle diagram of heating mode



Working principle diagram of hot water mode



High efficiency and energy saving

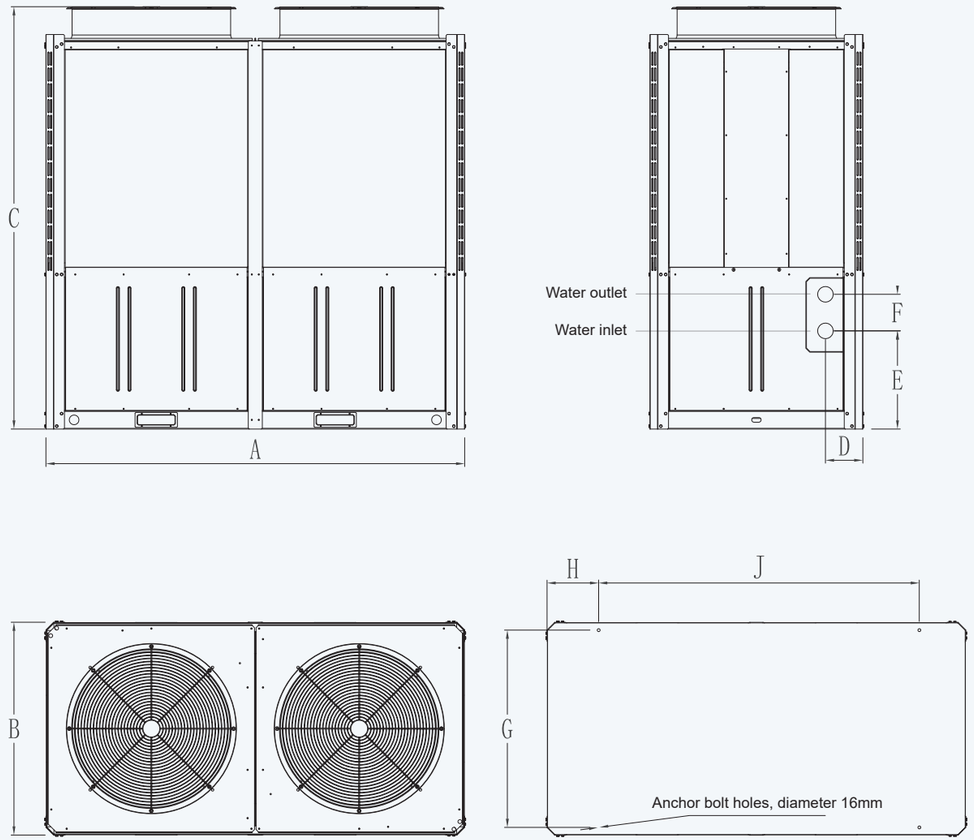


Total Heat Recovery Type Air Cooled Chiller (Heat Pump) Parameter

Model/Specification		HFW-65HA1-R	HFW-130HA1-R
AHU mode	Nominal cooling capacity KW	64.0	128.0
	Nominal heating capacity KW	68.0	134.0
	Nominal cooling total input power KW	20.5	40.9
	Nominal heating total input power KW	20.8	42.6
Hot water mode	Nominal cooling capacity in low temp KW	81.0	158.0
	Nominal heating input power in low temp KW	21.0	40.7
Heat recovery mode	Cooling capacity KW	62.0	120.0
	Heat recovery KW	80.0	156.0
	Heat recovery input total power KW	19.5	37.5
Water flow	Air conditioning side water flow m^3/h	11.0	22.0
	Hot water side water flow m^3/h	13.9	27.2
Power		380V/3N~/50Hz	
Throttle parts		Electrical expansion valve	
Compressor	Type	Hermetic scroll compressor	
	QTY	2	
Fan	Type	Axial low noise fan	
	Power kW	0.9x2	1.5x2
	Air volume m^3/h	14000x2	19500x2
Water side heat exchanger	Air conditioner side	Shell and tube heat exchanger	
	Hot water side	Tube heat exchanger	
Water pressure drop kPa	Air conditioner side	52	50
	Hot water side	60	70
connection pipe	Water inlet connection pipe	R2” External threaded connector	R2-1/2” External threaded connector
	Water outlet connection pipe	R3” External threaded connector	R2-1/2” External threaded connector
Refrigerant	Type	R410A	
	Charge volume kg	6.0x2	14.0x2
Dimensions(L x W x H) mm		1810x960x2440	2180x1100x2400
Net weight kg		650	1150

Noted:
1.Nominal cooling condition: water flow rate: 0.172m^3/(h·kw); Water outlet temperature: 7˚C; Ambient temperature: 35˚C.
2.Nominal heating condition: water flow rate: 0.172m^3/(h·kw); Water outlet temperature: 45˚C; Ambient temperature DB/WB: 7˚C/6˚C.
3. The hot water mode test conditions are: hot water inlet/outlet temperature 40/45*C, outdoor environment dry/wet bulb temperature 20/15;
4. The heat recovery mode test working conditions are: chilled water inlet/outlet temperature 12/7C, hot water inlet/outlet temperature 40/45C, and air ambient temperature 35%C;
5.Water pipe for modular chiller combination should be fabricated and installed at project site, not provided by factory. Pipe diameter and construction should conform to design standards.
6.Module units can be combined on the basis of the same or different model according to the needs for specific project. The number of combined units ranges from 1 to 16 sets. The above table sheet is the parameters of a single unit.
7.Control accessories need to be ordered separately. Control accessories include wire controller, instruction manual, controller connection cable and other accessories. The manufacturer reserves the right to change the configuration. Please refer to the factory configuration when purchasing.

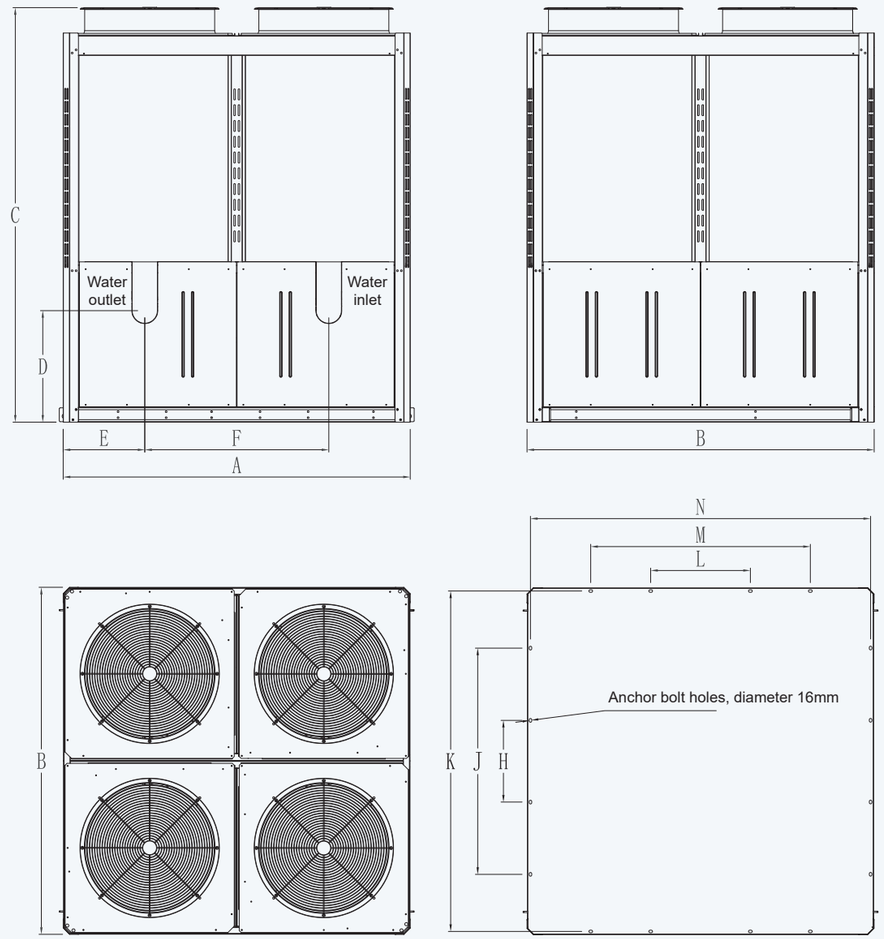
Modular air-cooled chiller (heat pump) dimension table



Modular air-cooled chiller (heat pump) dimension table

Model	A	B	C	D	E	F	G	H	J
HFW-65 series	1810	960	2280	480	420	170	900	390	940
HFW-130&150 series	2180	1100	2250	200	515	170	1020	570	930

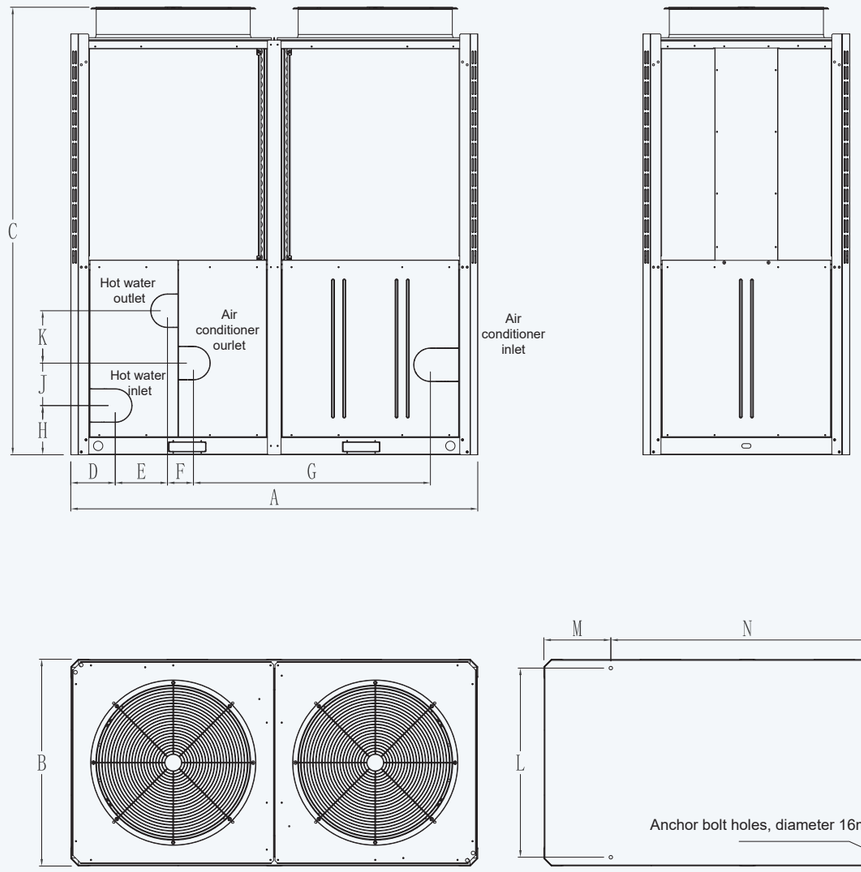
Low temperature air cooled chiller (heat pump) dimension drawing



Low temperature air cooled chiller (heat pump) dimension table

Model	A	B	C	D	E	F	H	J	K	L	M	N
HFW-300HA1-L	2200	2200	2550	710	520	1170	520	1340	2160	630	1390	2160

Total heat recovery air cooled chiller (heat pump) dimension drawing



Total heat recovery air cooled chiller (heat pump) dimension table

Model	A	B	C	D	E	F	G	H	J	K	L	M	N
HFW-65HA1-R	1810	960	2440	252	200	132	928	253	247	52	885	388	940
HFW-130HA1-R	2180	1100	2400	238	280	140	1250	264	226	281	1025	673	930

Variable working condition parameter table

Refrigeration working condition variable working condition parameter table

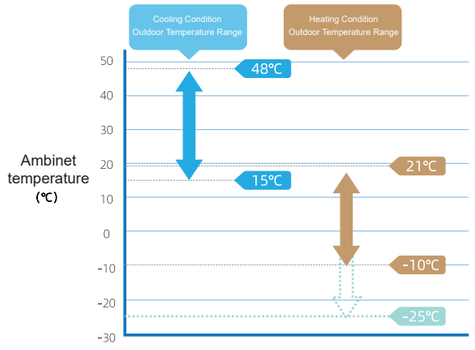
Water outlet temperature ℃	Ambinet temperature ℃				
	25	30	35	40	45
5	1.07	1.00	0.94	0.84	0.81
6	1.10	1.03	0.97	0.87	0.83
7	1.14	1.07	1.00	0.91	0.86
8	1.17	1.10	10.3	0.94	0.88
9	1.20	1.13	1.06	0.98	0.91
10	1.23	1.16	1.09	1.01	0.93
11	1.27	1.19	1.12	1.04	0.96
12	1.31	1.23	1.15	1.07	0.99
13	1.34	1.26	1.17	1.09	1.01
14	1.37	1.29	1.20	1.12	1.03
15	1.41	1.32	1.23	1.14	1.06

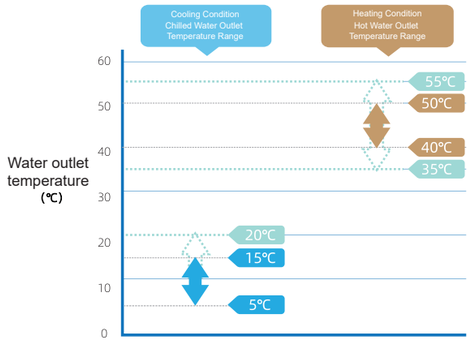
Heating working condition variable working condition parameter table

Water outlet temperature ℃	Ambinet temperature ℃							
	15	10	7	5	-5	-10	-15	-20
30	1.23	1.10	1.03	0.99	0.81	0.73	0.58	0.57
35	1.21	1.09	1.02	0.98	0.79	0.70	0.55	0.54
40	1.20	1.08	1.01	0.96	0.77	0.67	0.53	0.52
45	1.19	1.07	1.00	0.95	0.75	0.65	0.50	0.49
50	1.17	1.05	0.98	0.94	0.74	0.64	/	/

Wide Temperature Range of Application, Worry-free of Operation

Chiller unit is suitable for operation in a wide outdoor temperature range, from -20˚C~48˚C.





Note: The solid colour marks are the operating range of normal temperature type equipment. The dotted line marks are the extended operating range of low-temperature type equipment.