TAHVIEHSAM
Cooling System Solutions

EUROKLIMAT®
Give life to building, bring us back to nature

SUPER COMPACT HIGH EFFICIENCY
EKAC Series Environmentally-Friendly Refrigerant-Type
Modular Air-Cooled Heat Pump Unit

EKAC Series Environmentally-Friendly Refrigerant-Type Modular Air-Cooled Heat Pump Unit

Model of basic unit: EKAC460BR1 / EKAC350BR1LH
Nominal cooling capacity: 134~2144 kW
Refrigerant: R410A

www.euroklimat.com

EUROKLIMAT Air Conditioner, Environmental & Energy-saving Technology from Europe.

EUROKLIMAT (EK) was established in 1963 in Italy. For the past half a century, it has become famous as an energy-saving air-conditioning manufacturer in Italy and globally. Continuous innovation, new product development and top manufacturing quality are the driving force behind this growth.

EUROKLIMAT (EK) pursues the ideals of protecting the environment, providing physical comfort and adopting energy-saving into the whole process of product R&D, manufacturing and service. Our products covering residential, commercial and close control air-conditioner are manufactured according to the global generally accepted standards.

Berlin - Allianz Assurance

ISO9001: 2008
corporate certification

ISO14001: 2004
Environmental management system certification

Product Manufacturing License
(XK06-015-00361)

CNAS L5123
State-certified Lab

BMW Central Data Center, Munich

Helsinki- Nokia R&D centers worldwide headquarters

EK Italia Headquarters

3M Central office, UK

DHL Central Data Center

ZTE Central Office, Shenzen

EK China Factory

EK China Factory

Canon Factory

Apple Central Shopping, Shanghai

Renault Automotive Factory

Coca Cola Factory

EKAC Series
Environmentally-Friendly Refrigerant-Type Air-Cooled Heat Pump Unit

EKAC series environmentally-friendly refrigerant-type air-cooled heat pump units combine the essence of Euroklimat accumulated over 40-year air-cooled heat pump design experience with the demand in the modular unit market of China, to fully satisfy customers' requirements on efficiency, environmental friendliness, comfort, safety, and smartness to the greatest extent. These units are applicable to places such as hotels, restaurants, recreational centers, hospitals, dining halls, offices, cinemas, factories, and supermarkets, especially to those rising high requirement on noise reduction and ambient environment and where water is lacking or cooling water tanks are inapplicable.

Featuring flexibility in installation, quickness in construction, and simplicity in pipelining, these units allow phase-based and moderate investment and have no requirement on the chilled water system, therefore becoming one of the best choices for users.

Nomenclature

EKAC	460	B	R	1	M -	F	AA
1	2	3	4	5	6	7	8

1.	EKAC	EK modular air-cooled chilling water (heat pump) unit
2.	460	Code of refrigerating capacity
3.	B	Design SN
4.	R	Function form: R indicates refrigerating and heating type; refrigerating-type unit by default
5.	1	Code of refrigerant: 1 indicates R410A; R22 by default
6.	M	M: master; S: slave
7.	F	Power feature: F indicates 380 V/3N~/50 Hz
8.	AA	Specific descriptions on changes in product specification

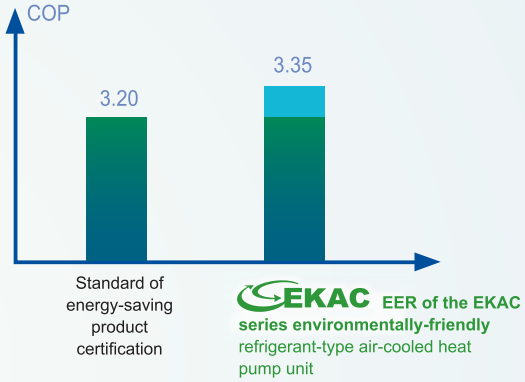
Applicable scenarios




Energy-Saving Certificate

The innovative EK air conditioner adopts the leading air-cooled heat pump design in Europe which enables an energy efficiency ratio (EER) in full load mode exceeding Chinese energy-saving product certification standard (higher than COP3.2). Each unitary module is equipped with 2-level energy adjustment; when multiple units are combined, multi-level energy adjustment is available. Comprehensively-improved system selection and match ensures that the unit is kept in the optimal energy-saving state. In the partial load mode, the EER is increased by 4%.

EER of the product in full load



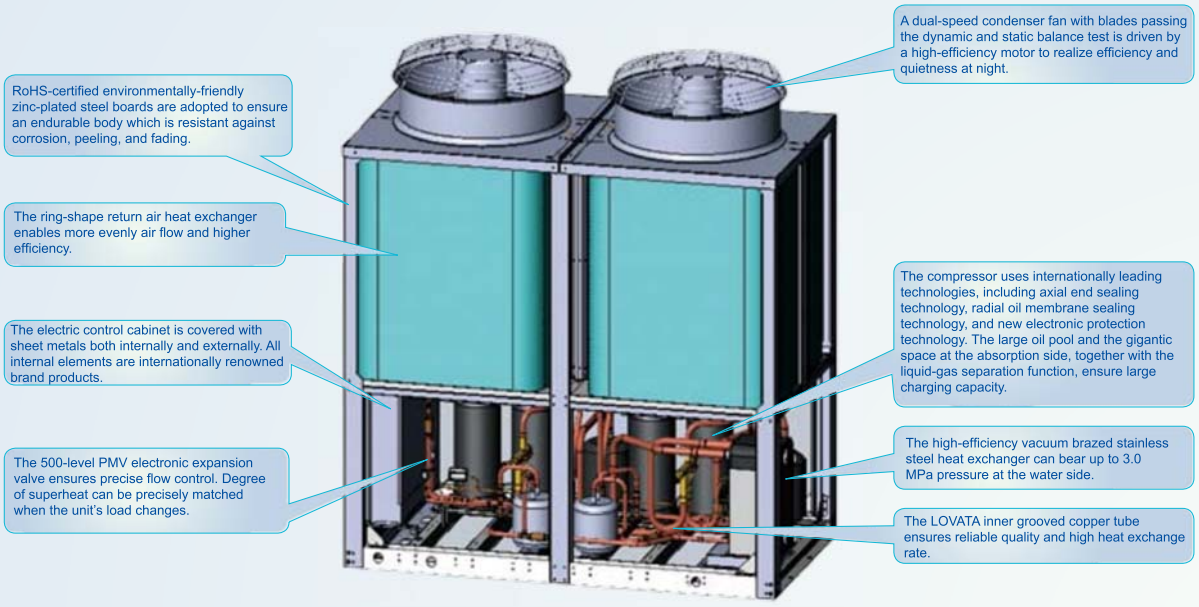
Environmentally-Friendly Refrigerant

EKAC460BR1 / EKAC350BR1LH series air-cooled modular unit adopts R410A. Compared with the conventional refrigerant R22, R410A does not contain chlorine and therefore has no adverse impact on the ozonosphere. It serves as a medium- and long-term substitute of R22. The amount of usage of R22 got controlled since 2013 and it will be further reduced. In 2003, China set a limit to the production of R22 to 74,700 tons and it will be phased out in 2030.

Name of Refrigerant	ODP	Temperature Glide (°C)	Volumetric Refrigerating Capacity	Efficiency
R410A	0	< 0.5	141%	100%
R407C	0	4.4	95%	98%
R22	0.05	0	100%	100%

Note: ODP (ozone depletion potential) indicates a relative value when R11 is taken as 1; Volumetric Refrigerating Capacity and Efficiency are relative values when R22 is taken as 1.

Parts Description

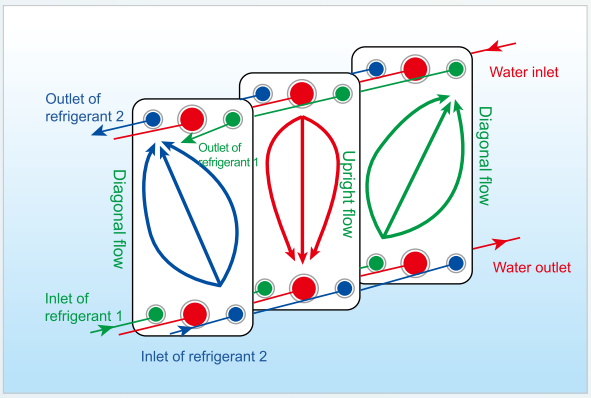


Air-Side Heat Exchanger

The ring-shape finned heat exchanger ensures more evenly air speed and higher heat exchange rate. Compared with a bare tube, the heat exchange surface of the LOVATA inner grooved copper tube is increased by 68% per unit length. The ripple aluminum fin enables high heat exchange efficiency and rarely requires cleaning.

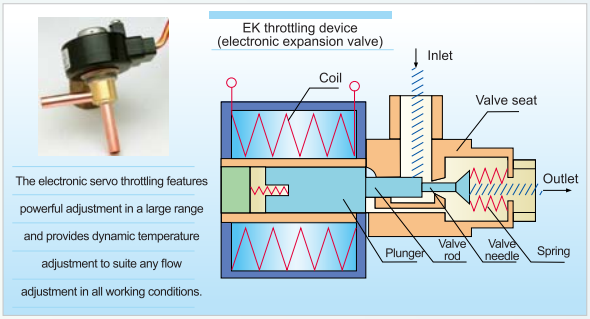
Vacuum Brazed Plate Heat Exchanger

The dual-system plate heat exchanger can bear up to 3.0 MPa pressure at the water side, applicable to water systems of super-high buildings. Compared with a shell and tube heat exchanger, the brazed heat exchanger has higher exchange rate (even higher if it is compared with a conventional back-to-back heat exchanger) and inner cleanness. If the unit is partially loaded, the exchanger shows better antifreeze capability and higher heat exchange rate. The SC differential water pressure switch allows real-time control on water flow; besides, it is configured with a precise antifreeze control.



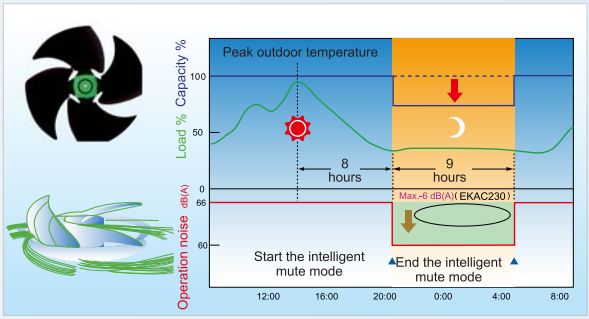
Precise Temperature Control to Ensure Indoor Comfort

The EK air-cooled modular unit uses imported 500-level PMV electronic expansion valves to realize precise control of PID, which is different from the conventional air-cooled modular unit using thermostatic expansion valves for temperature control. The system automatically implements real-time match and precise control on water temperature. The performance of internal parts gets optimized. The unit can stably run under any load and adapt to varying environmental temperature, addressing the problem of oscillation in refrigerating systems. Temperature output becomes more stable and indoor temperature becomes more even. In this way, degree of comfort is improved.



Quiet and Low-Noise

- The unit adopts anti-vibration design and multi-level noise reduction. The brand quiet full-hermetic scroll compressor; dual-speed quiet motor; blades passing the dynamic and static balance test ensures industry leading noise reduction grade and anti-vibration degree.
- Lower-part hermetic structure: The lower part of the unit is covered with sheet metals to insulate noise of a running compressor.
- An innovative smart silence mode is adopted. The fan speed (high/low gear) can be automatically adjusted based on unit's running state and ambient temperature to allow a unit to work in quiet and low-noise mode. The noise at night is reduced by 6 dB (A).

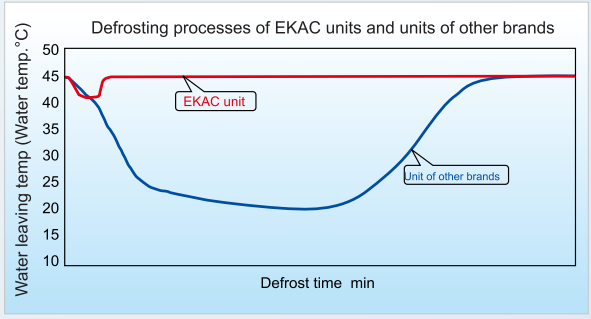


Reliable Performance

The EK test center has been approved by the China National Accreditation Service for Conformity Assessment (CNAS). By national-level test (with respect to corrosion, fatigue, frequent startup, etc), the modular unit is highly reliable.
Each unit experiences 100% online test before delivery to guarantee quality. With the SC filter and differential water pressure switch, users can stop the units in water shortage or cutoff situation.

Smart Defrosting

- Defrosting conditions are automatically to save energy. Defrosting capability varies depending on the amount of frost, to maximize normal heating time and minimize temperature change caused by defrosting.
- Defrosting process monitoring is implemented based on temperature change, refrigerant pressure, and defrosting time.
- The unit adapts to various climatic environments. Defrosting conditions will be set with consideration of defrosting situation of previous periods, to realize efficient use of energy.



Environmentally-Friendly Refrigerant-Type
Modular Air-Cooled Heat Pump Unit

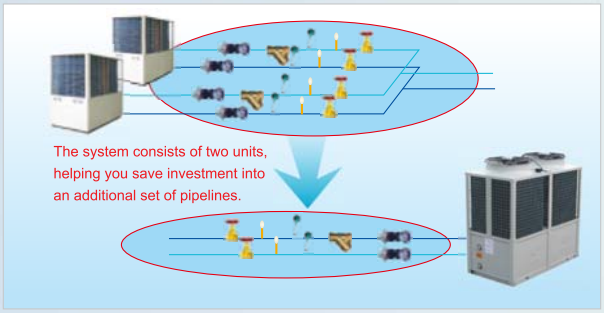
High Compatibility

Conventional air conditioners use a fixed unit as the master module of the system; when the master module fails, the entire system fails to work. The EK system can be composed of up to 16 modules. Any slave module of the system can take over works of a faulty master module, posing no adverse impact on the entire system. Besides, a part of load of the EK system is born alternately to balance load of the compressor.

A next module automatically takes over work of the faulty master module

Saving CAPEX

The unit helps you save investment into water system. A modular unit is equivalent to two conventional modular units, helping you save investment into an additional set of pipelines and accessories.

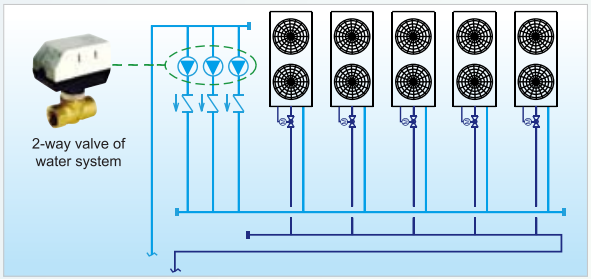


Saving Space

A modular unit is equivalent to two conventional modular units, saving up to 40% installation space.

Variable Primary Flow System

- Compared with a conventional variable secondary flow system, the variable primary flow system has its refrigerant and load varied. Besides, the system shares the same inverter pumping unit whose flow changes according to air conditioner load in inverse proportion, saving expense on running of chiller pumps significantly.
- The unit can output a signal to instruct the 2-way valve so as to close the corresponding chilled water valve. When working with the inverter, the unit will automatically adjust pump flow, realizing variable primary flow.
- The unit can be applicable to projects requiring changing chilling load and long load running time.
- Compared with a conventional variable secondary flow system, the variable primary flow system helps users save not only CAPEX on chiller pumps, pipelines, and power distribution systems but also equipment room space.

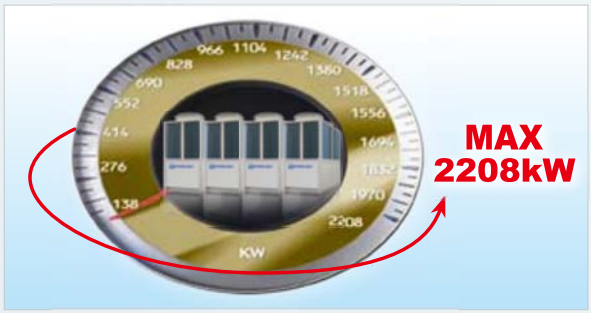


Powerful Protection Function

The unit provides 13 powerful in-built protection functions, including: High-low pressure protection, inverse phase or lack-of-phase protection, frequent start protection, overcurrent protection, discharge temperature protection, overheat protection, sensor fault protection, chiller antifreeze protection, water system antifreeze protection, low water flow protection, and ambient temperature protection

Maximum Number of Modules for a Modular Unit

The modular combined unit can be increased up to 16 modules to expand its capacity from 100 kW to 2208 kW.

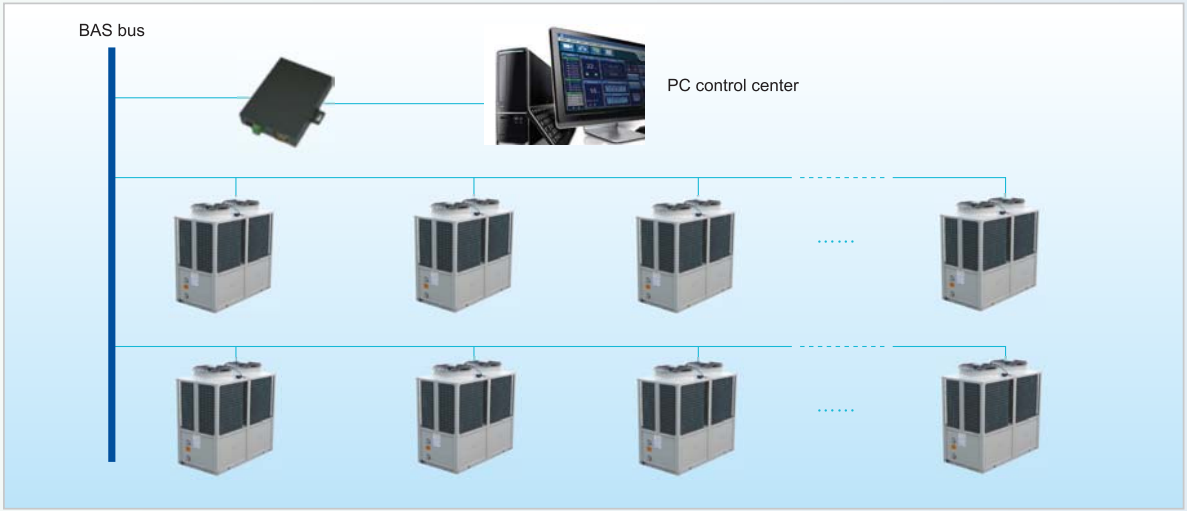


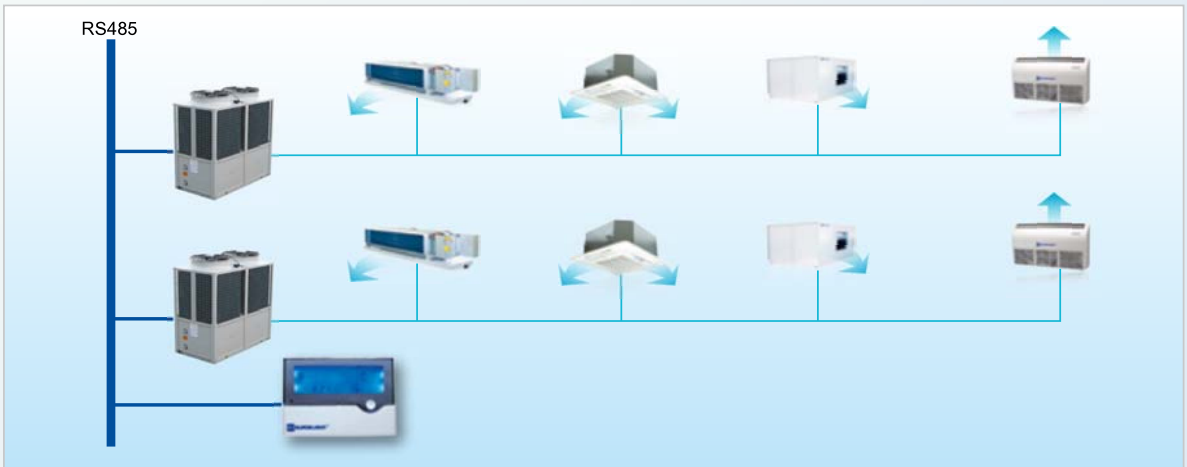
Microcomputer Control System

The unit adopts a microcomputer control system and a large LCD to facilitate operation. A single control system can control up to 16 units and monitor their running state in real time. The optional RS485 COM interface is embedded with the Modbus protocol to realize group control.

- Switch between refrigerating mode and heating mode
- Parameters: real time monitor, refrigerating/heating water inlet/outlet temperature, antifreeze temperature, defrosting temperature, etc
- Auto/manual defrosting
- Weekly timing ON/OFF function
- Automatic diagnosis function
- Remote ON/OFF function (≤ 1000 m)
- Start/stop control for chilled water pump
- Pump protection feedback

- Auxiliary electric heating control
- Load balancing for compressor and timing startup for module
- Memorization function in power outage case
- Fault query
- 2-way valve control of water system
- Interlock control on end-side 2-way valve





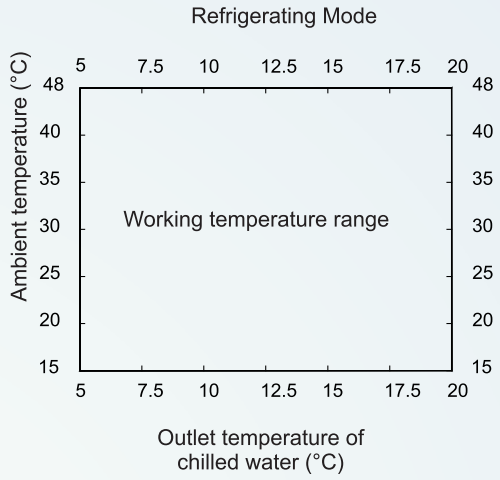
Specifications of Combined Unit with a basic module of EKAC460B(R)1 (Partial Parameters)

Model			EKAC460B1	EKAC460BR1	EKAC920B1	EKAC920BR1	EKAC1380B1	EKAC1380BR1	EKAC1840B1	EKAC1840BR1	EKAC2300B1	EKAC2300BR1
Combination method		Master	EKAC460B1M	EKAC460BR1M	EKAC460B1M	EKAC460BR1M	EKAC460B1M	EKAC460BR1M	EKAC460B1M	EKAC460BR1M	EKAC460B1M	EKAC460BR1M
		Slave	--	--	EKAC460B1S	EKAC460BR1S	2EKAC460B1S	2EKAC460BR1S	3EKAC460B1S	3EKAC460BR1S	4EKAC460B1S	4EKAC460BR1S
Nominal cooling capacity		kW	134	134	268	268	402	402	536	536	670	670
		x10^4 kcal/h										
		x10^4 Btu/h										
Nominal heating capacity		kW	--	142	-	284	-	426	-	568	-	710
		x10 ^{4}kcal/h										
		x10^4 Btu/h										
Total power consumption under nominal refrigerating capacity		kW	40	40	80	80	120	120	160	160	200	200
Total power consumption under nominal heating capacity		kW	--	41.0	--	82.0	--	123.0	--	164.0	--	205.0
Power supply			380 V/3N~/50 Hz									
Refrigerant	Type		R410A									
	Control		Electronic expansion valve									
Compressor	Type		Full hermetic scroll compressor									
	Lubricant		Lipid oil (POE-160SZ)									
	Qty.	Piece	2	2	4	4	6	6	8	8	10	10
Fan	Type		Axial large-blade low-noise fan									
	Qty.	Piece	2	2	4	4	6	6	8	8	10	10
Water-side heat exchanger	Type		High-efficiency vacuum brazed heat exchanger									
	Refrigerating water flow rate	m^3/h	23.1	23.1	46.2	46.2	69.3	69.3	92.4	92.4	115.5	115.5
	Heating water flow rate	m^3/h	24.4	24.4	48.8	48.8	73.2	73.2	97.6	97.6	122.0	122.0
	Water resistance	kPa	42	42	42	42	42	42	42	42	42	42
Recommended length of inlet/outlet water pipe		inch	≥3	≥3	≥4	≥4	≥5	≥5	≥6	≥6	≥6	≥6
Power wire	Cross-sectional area of main wires	mm^2	35	35	95	95	185	185	240	240	185	185
	Qty. of main wires		3								6	
	Cross-sectional area of neutral wire	mm^2	6				10					
	Qty. of neutral wires		1									
	Cross-sectional area of ground wire	mm^2	16	16	50	50	95	95	120	120	185	185
	Qty. of ground wires		1									
Dimensions	L x H	mm	2200×2260									
	W	mm	1150	1150	2900	2900	4650	4650	6400	6400	8510	8510
Weight of unit	Net weight	kg	990	1020	1980	2040	2970	3060	3960	4080	4950	5100
	Weight of unit during running	kg	1005	1035	2010	2070	3015	3105	4020	4140	5025	5175

Notes:

- Working conditions of the unit for testing the nominal refrigerating capacity: Outlet temperature: 7°C; water flow rate: 0.172 m3/(h•kW); outdoor temperature: 35°C
- Working conditions of the unit for testing the nominal heating capacity: Outlet temperature: 45°C; water flow rate: 0.172 m3/(h•kW); outdoor psychrometric difference: 7°C or 6°C
- Water resistance includes differential water pressure of the unit and that of the affiliated Y-shape filter.
- For combined units, the manufacturer does not offer general water pipes and they must be prepared and installed on site. Diameter of the pipes should comply with design standards.
- A modular unit can be combined by same or different modules based on actual requirements; up to 16 modules can be built into a modular unit. The parameters listed in the table above are for commonly combined units.

Working Temperature Range of Units



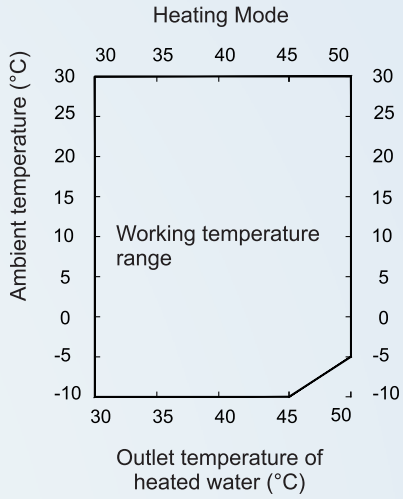


Table of Units' Refrigerating Capability

Model	Water outlet temperature (°C)	Ambient Temperature (°C)															
		48°C		45°C		40°C		35°C		30°C		25°C		20°C		15°C	
		Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW	Refrig-erating capacity kW	Power kW
EKAC460B(R)1	5°C	108.0	49.8	113.0	46.3	122.2	42.3	131.0	38.9	136.4	35.7	141.6	32.5	140.8	33.5	144.4	30.7
	7°C	119.4	50.5	121.4	47.5	131.4	43.3	134.0	40.0	143.8	37.7	148.8	33.7	149.2	35.3	154.4	31.5
	9°C	122.8	51.7	131.0	48.1	139.0	44.5	144.6	41.3	151.8	37.9	158.4	33.3	160.0	35.3	163.2	32.1
	12°C	136.0	52.3	142.0	49.3	152.0	45.7	161.4	41.9	169.0	38.3	169.4	34.3	174.0	37.1	177.4	33.7
	15°C	148.0	53.1	153.0	50.7	163.6	47.5	171.0	42.9	173.0	39.3	173.6	34.7	178.4	34.9	185.4	34.7

Table of Units' Heating Capability

Model	Water outlet temperature (°C)	Ambient Temperature (°C)													
		-10°C		-5°C		0°C		7°C		10°C		15°C		21°C	
		Heating capacity kW	Power kW	Heating capacity kW	Power kW	Heating capacity kW	Power kW	Heating capacity kW	Power kW	Heating capacity kW	Power kW	Heating capacity kW	Power kW	Heating capacity kW	Power kW
EKAC460B(R)1	35°C	94.0	34.6	111.0	34.8	125.0	35.4	153.2	36.4	156.0	36.6	160.0	37.0	160.8	37.6
	40°C	91.2	37.4	106.8	38.0	124.0	38.6	150.4	39.0	154.6	39.2	156.6	40.0	161.0	40.4
	45°C	85.2	41.0	105.2	41.4	121.6	42.2	142.0	42.5	151.0	43.2	152.0	43.6	159.2	44.6
	50°C	—	—	102.8	43.6	116.6	46.0	146.6	47.0	148.0	47.6	148.6	47.8	58.0	49.6

Note: Values of the preceding parameters are obtained through test that is performed under rated water flow.

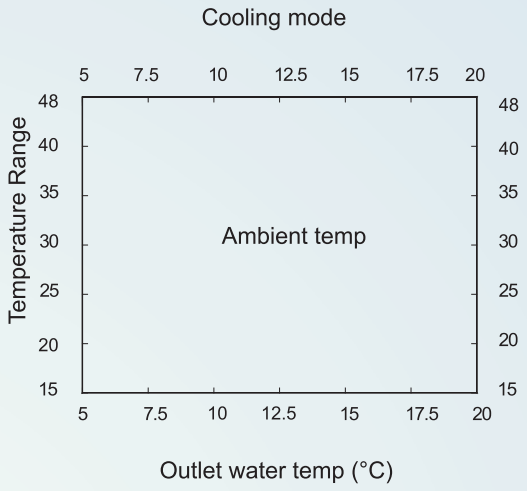
Specifications of Combined Unit with a basic module of EKAC350BR1 (Partial Parameters)

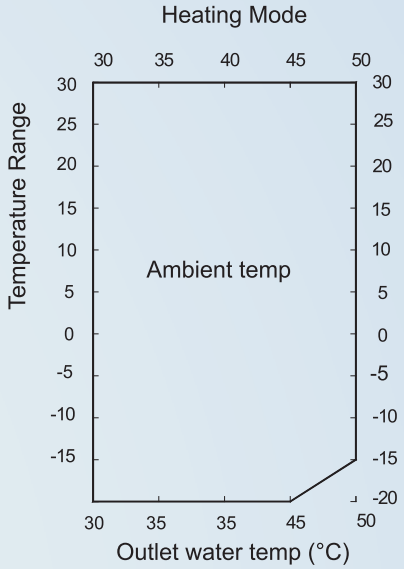
Model			EKAC350BR1LH	EKAC700BR1LH	EKAC1050BR1LH	EKAC1400BR1LH	EKAC1750BR1LH
Combination method		Master	EKAC350BR1LHM	EKAC350BR1LHM	EKAC350BR1LHM	EKAC350BR1LHM	EKAC350BR1LHM
		Slave	--	EKAC350BR1LHS	2EKAC350BR1LHS	3EKAC350BR1LHS	4EKAC350BR1LHS
Nominal refrigerating capacity		kW	100	200	300	400	500
		USRT	28.43	56.87	85.30	113.73	142.2
		$x10^4$ kcal/h	8.61	17.23	25.84	34.46	43.07
		$x10^4$ Btu/h	34.12	68.24	102.36	136.48	170.60
Nominal heating capacity		kW	103	206	309	412	515
		USRT	29.29	58.57	87.86	117.15	146.43
		$x10^4$ kcal/h	8.86	17.72	26.59	35.45	44.31
		$x10^4$ Btu/h	35.14	70.29	105.43	140.57	175.72
Total power consumption under nominal refrigerating capacity		kW	29	58	87	116	145
Total power consumption under nominal heating capacity		kW	29.8	59.60	89.40	119.20	149.00
Power supply			380 V/3N~/50 Hz				
Refrigerant	Type		R410A				
	Control		Electronic expansion valve				
Compressor	Type		Full hermetic scroll compressor				
	Lubricant		Lipid oil (POE-160SZ)				
	Qty.	Piece	2	4	6	8	10
Fan	Type		Axial large-blade low-noise fan				
	Qty.	Piece	2	4	6	8	10
Water-side heat exchanger	Type		High-efficiency vacuum brazed heat exchanger				
	Refrigerating water flow rate	m^3/h	16.7	33.4	50.1	66.8	83.5
	Heating water flow rate	m^3/h	18.1	36.2	54.3	72.4	90.5
	Water resistance	kPa	35	35	35	35	35
Recommended length of inlet/outlet water pipe		inch	≥2.5	≥4	≥5	≥5	≥6
Power wire	Cross-sectional area of main wires	mm^2	25	70	150	240	120
	Qty. of main wires		3				6
	Cross-sectional area of neutral wire	mm^2	6		10		
	Qty. of neutral wires		1				
	Cross-sectional area of ground wire	mm^2	16	35	70	120	120
	Qty. of ground wires		1				
Dimensions	L x H	mm	2215×2260				
	W	mm	1150	2900	4650	6400	8510
Weight of unit	Net weight	kg	780	1560	2340	3120	3900
	Weight of unit during running	kg	819	1638	2457	3276	4095

Notes:

- Working conditions of the unit for testing the nominal refrigerating capacity: Outlet temperature: 7°C; water flow rate: 0.172 m3/(h•kW); outdoor temperature: 35°C
- Working conditions of the unit for testing the nominal heating capacity: Outlet temperature: 45°C; water flow rate: 0.172 m3/(h•kW); outdoor psychrometric difference: 7°C or 6°C
- Water resistance includes differential water pressure of the unit and that of the affiliated Y-shape filter.
- For combined units, the manufacturer does not offer general water pipes and they must be prepared and installed on site. Diameter of the pipes should comply with design standards.
- A modular unit can be combined by same or different modules based on actual requirements; up to 16 modules can be built into a modular unit. The parameters listed in the table above are for commonly combined units.
- Power distribution and wiring are subject to unit nameplates or installation guide.

Operating Temperature Range
EKAC350BR1 (Partial Parameters)





EKAC350BR1 Heating Capacity Variation Table

Model			Ambient temp.																	
			-20°C		-15°C		-10°C		-5°C		0°C		7°C		10°C		15°C		20°C	
			Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)	Quantity of heat (kW)	Power (kW)
EKAC350BR1	Outlet water temp (°C)	35°C	55.9	23.2	68.6	23.7	74.8	24.1	83.9	24.6	99.4	25.1	111.6	26.0	119.2	26.5	129.7	28.1	135.3	28.9
		40°C	53.8	25.4	65.9	25.8	72.4	26.2	80.6	26.6	93.9	26.9	107.8	27.8	115.3	28.4	126.0	29.5	133.7	30.2
		45°C	51.6	27.8	63.7	28.1	70.6	28.4	78.3	28.7	89.2	29.1	103.0	29.8	111.4	30.6	122.3	32.4	132.1	33.7
		50°C	—	—	61.0	30.1	68.5	30.4	75.8	30.8	84.6	31.3	101.2	32.1	107.5	33.2	118.6	34.7	130.5	36.6

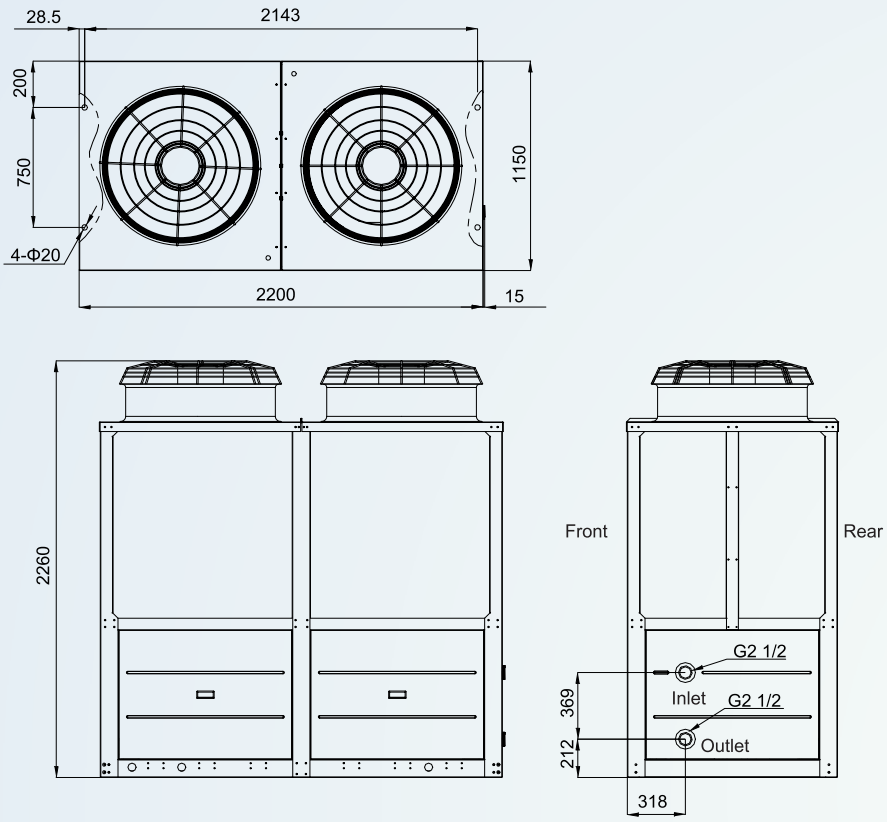
EKAC350BR1 Cooling Capacity Variation Table

Model			Ambient temp.															
			48°C		45°C		40°C		35°C		30°C		25°C		20°C		15°C	
			Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)	Cooling capacity (kW)	Power (kW)
EKAC350BR1	Outlet water temp (°C)	5°C	77.3	37.1	81.5	34.2	86.4	30.5	93.1	28.2	95.7	26.3	98.4	23.5	101.3	22.3	104.5	21.9
		7°C	80.9	37.5	85.7	35.0	91.6	31.2	100.0	29.0	102.8	26.7	104.8	23.9	107.3	22.8	108.7	22.3
		9°C	90.5	37.9	93.4	35.6	98.2	31.9	102.5	29.9	105.9	27.1	108.2	24.3	111.3	23.3	113.2	22.7
		12°C	97.6	38.4	101.2	36.1	106.5	32.6	108.3	30.4	111.5	27.9	114.6	25.5	116.3	24.4	118.1	23.6
		15°C	102.3	39.3	105.4	36.7	110.5	33.8	112.1	30.9	114.1	28.2	117.4	26.3	120.3	25.1	122.6	24.3

Note: parameters in the above table are measured when the unit operates at the rated water flow.

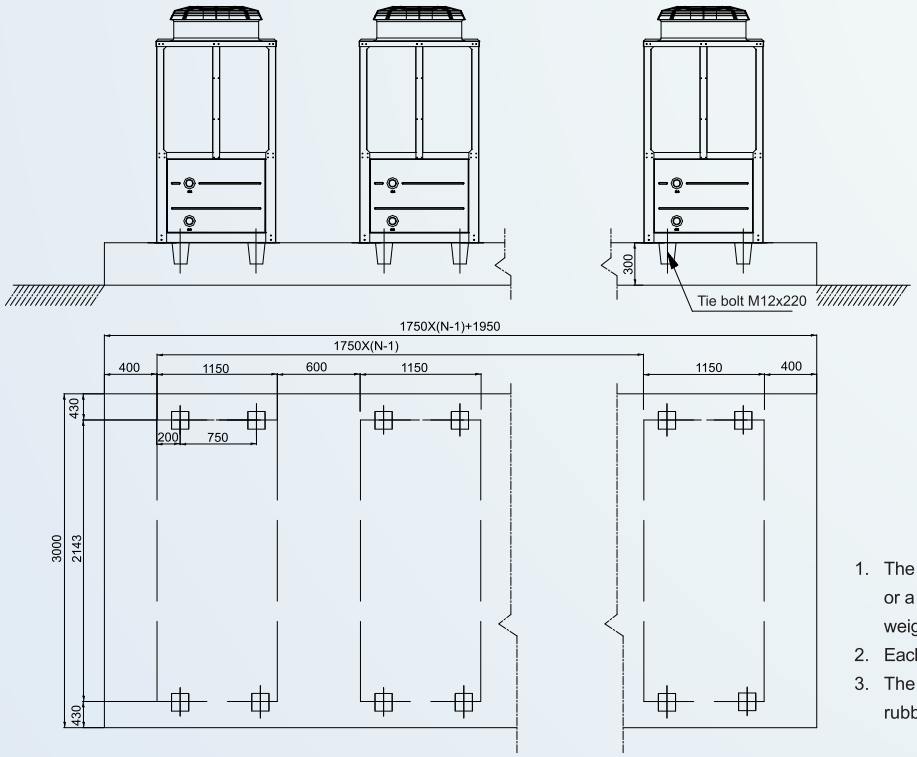
Dimensions (EKAC460BR1, EKAC350BR1)

Unit: mm



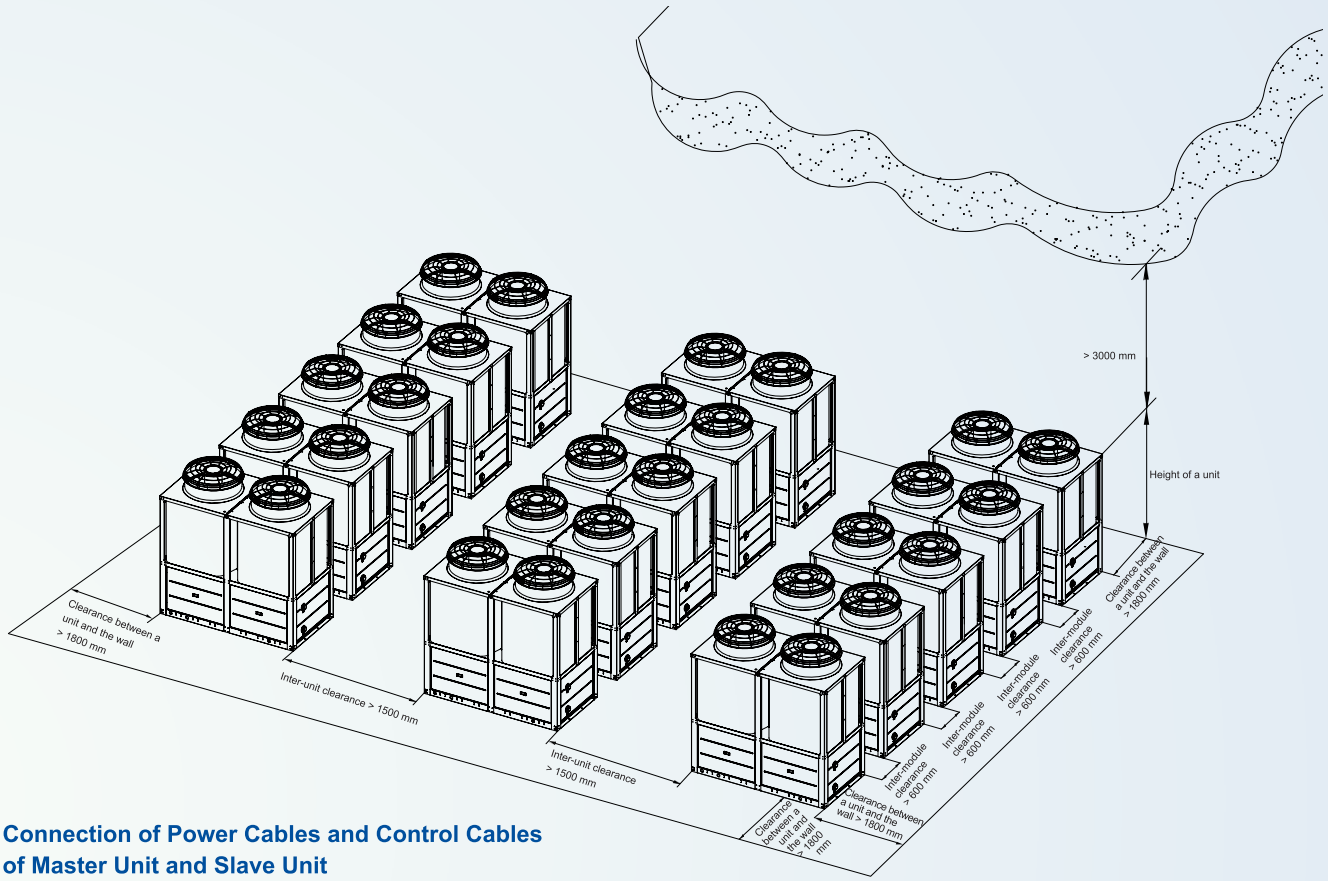
Installation Diagram

Unit: mm

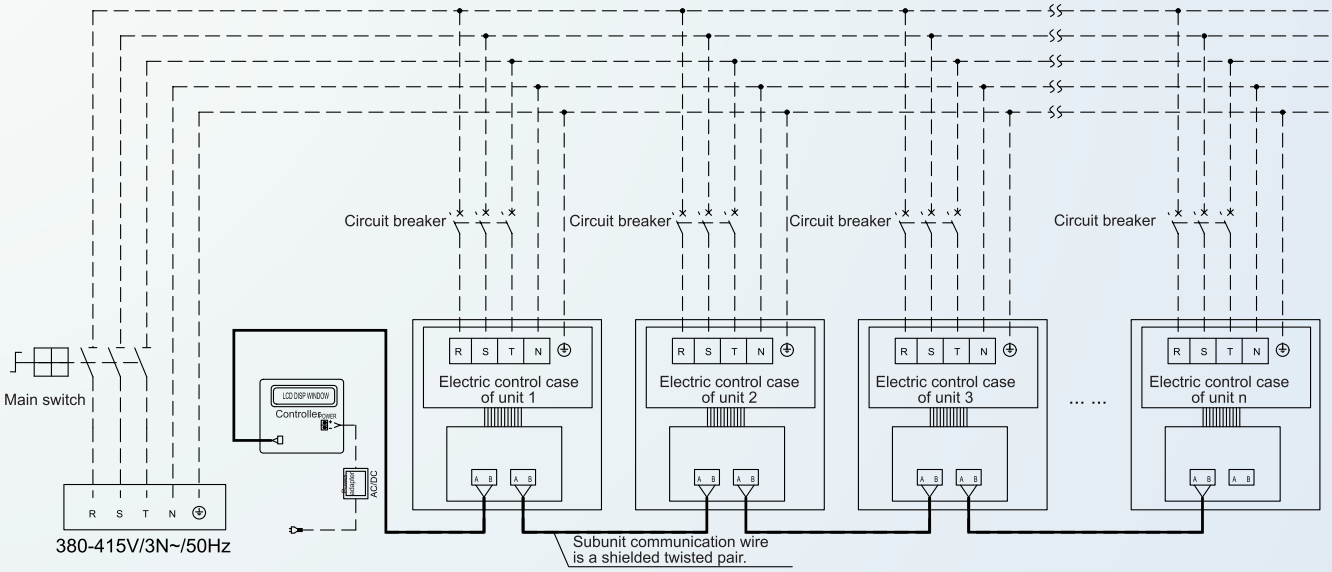


1. The foundation is a concrete structure or a channel steel bracket, bearable to weight of a running unit.
2. Each unit is fixed with four M12 bolts.
3. The base is cushioned with a 20 mm rubber pad.

Requirements on Clearance



Connection of Power Cables and Control Cables of Master Unit and Slave Unit

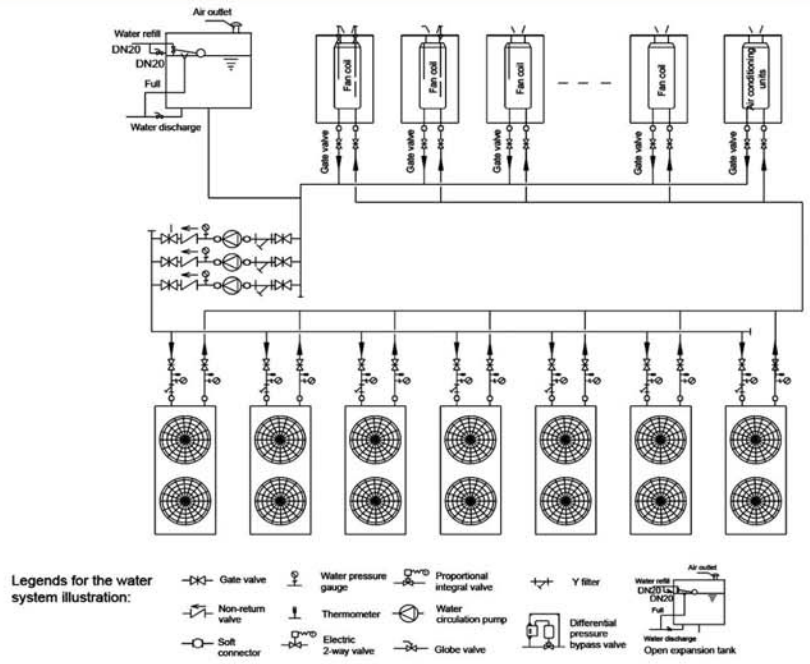


Notes:

- The main switch, circuit breakers, and wires (dotted lines in the preceding figure) are not delivered with the products. Customers should prepare by themselves.
- The master unit is equipped with a wired controller but the slave unit is not.
- Length of the communication wire connecting the master unit with the wired controller is 40 m and that for the slave unit is 5 m.

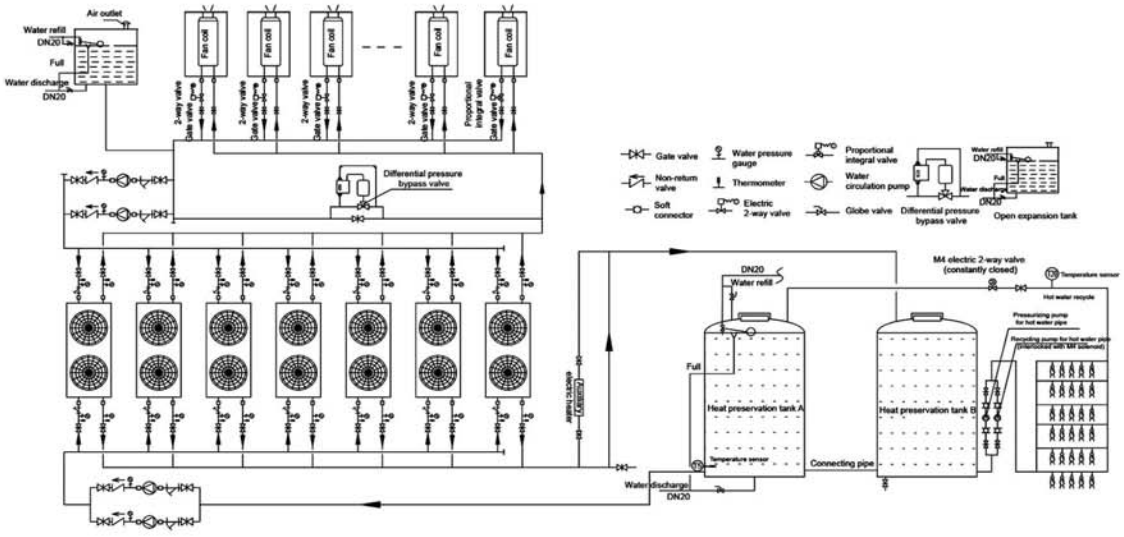
Installation

Illustration for constant flow rate water system which adjusts indoor temperature by adjusting terminal air rate



Water system installation diagram for total heat recovery modular units (simple dual water tanks)

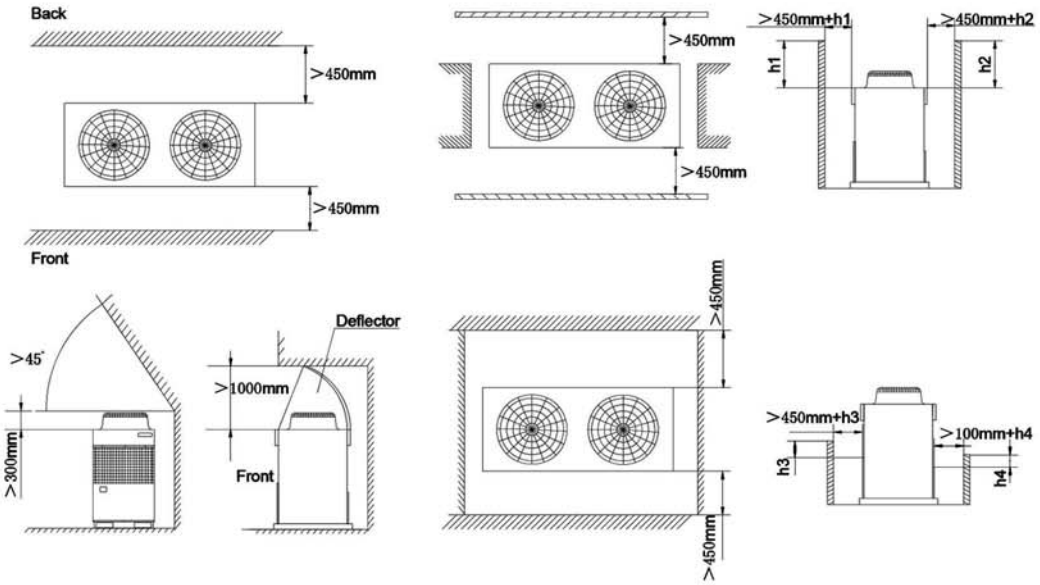
Illustration for variable flow rate water system which adjusts indoor temperature by adjusting flow rate of chilled water (total heat recovery with simple dual water tanks)



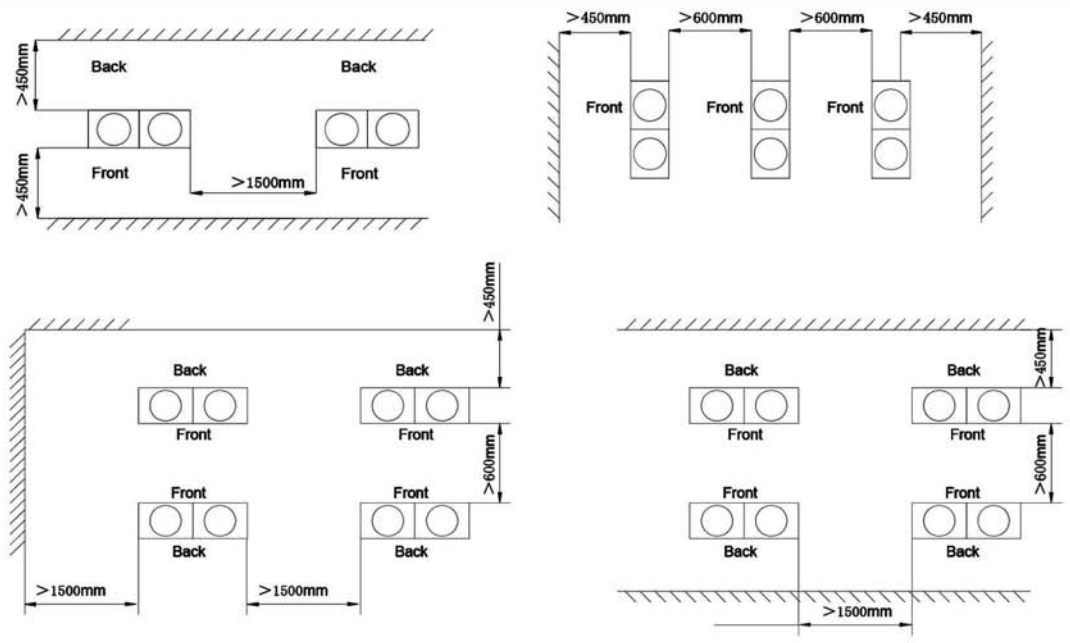
Note: auxiliary heaters are recommended when outdoor temperature drops below -5°C.

Installation

Space allocated for a single chilled water unit



Space allotted for an array of water chillers



Air Conditioning Parameters for Various Buildings

Building		Cooling Load (W/m²)		Stayer (m²/person)	Lighting (W/m²)	Air Supply L/(s.m²)	Allowed Noise dB(A)
		Sensible Cooling Load	Total Cooling Load				
Office	Middle area	65	95	10	60	5	35-50
	Periphery	110	160	10	60	6	35-55
	Private office	160	240	15	60	8	30-45
	Conference room	185	270	3	60	9	40-60
School	Classroom	130	190	2.5	40	9	35-40
	Library	130	190	6	30	9	35-40
	Cafeteria	150	260	1.5	30	10	40-45
Apartment	High floors, southward	110	160	10	20	10	35-40
	Low floors, northward	80	130	10	20	9	35-40
Theater, hall		110	260	1	20	12	40-45
Laboratory		150	230	10	50	10	35-40
Library, museum		95	150	10	40	8	35-40
Hospital	Operating room	110	380	6	20	8	30-40
	Public place	50	150	10	30	8	35-40
Clinic		130	200	10	40	10	35-40
Barber shop, beauty salon		110	200	4	50	10	35-40
Department store	Underground floors	150	250	1.5	40	12	35-45
	Middle floors	130	225	2	601	10	35-45
	High floors	110	200	3	40	8	35-45
Pharmacy		110	210	3	30	10	35-40
Retail store		110	160	2.5	40	10	35-45
Boutique		110	160	5	30	10	35-40
PC room		100	200	8	40	5.5	35-40
Gym		180	320	1	30	6	35-45
Theater		130	220	1	20	7	30-35
Single-bed room		90	120	10	60	15	30-35
Twin-bed room		100	150	10	60	15	30-35
Ballroom (disco)		280	400	1	100	8	30-35
Bar		130	260	2	15	10	35-40
Chinese restaurant		220	400	2	60	10	35-40
Western restaurant, and cafe		160	320	2	60	10	35-40
Hotels	Room	80	130	10	15	7	30-40
	Public places	110	160	10	15	8	35-45
Factory	Assembly room	150	260	3.5	45	9	45-55
	Light industry area	160	260	15	30	10	40-50
Stadium	Drawing room	160	240	6	20	8	35-40
	General competition	110	220	5	40	12	35-45
	Open competition	110	240	3	80	12	40-50

Unit Conversion Table

Length	M	mm	in	ft	mile
	1	$1x10^{3}$	39.37	3.281	$6.214x10^{-4}$
	0.3048	304.8	12	1	$1.578x10^{-5}$
	$1x10^{-3}$	1	0.0394	$3.281x10^{-3}$	$6.214x10^{-7}$
	0.0254	25.4	1	0.08333	$1.578x10^{-5}$
	$1.609x10^{3}$	$1.609x10^{6}$	$6.336x10^{4}$	5280	1
Area	m^2	hm^2	in^2	ft^2	$milk^2$
	1	$1x10^{-4}$	$1.55x10^{3}$	10.76	$3.861x10^{-7}$
	0.0929	$9.29x10^{-6}$	144	1	$3.587x10^{-8}$
	$2.59x10^{6}$	258.9	$4.0145x10^{9}$	$2.7878x10^{7}$	1
Volume	m^3	L	US gal	UK gal	ft^3
	1	1000	264.17	219.97	35.315
	$1x10^{-3}$	1	0.2642	0.22	0.0353
	$3.785x10^{-3}$	3.7854	1	0.8327	0.1337
	$4.546x10^{-3}$	4.546	1.20095	1	0.1605
	$2.832x10^{-2}$	28.316	7.481	6.229	1
Weight	g	kg	T	lb	oz
	1	$1x10^{-3}$	$1x10^{-6}$	$2.205x10^{-3}$	0.0353
	$1x10^{3}$	1	$1x10^{-3}$	2.205	35.274
	$1x10^{6}$	$1x10^{3}$	1	$2.205x10^{3}$	$3.527x10^{4}$
	453.592	0.4536	$4.536x10^{-4}$	1	16
	28.35	0.0283	$2.83x10^{-5}$	0.0625	1
Pressure	Pa	mmH_20	atm	lb/in^2	in.Hg
	1	0.102	$9.8692x10^{-6}$	$1.4504x10^{-4}$	$2.953x10^{-4}$
	9.807	1	$9.678x10^{-5}$	$1.422x10^{-3}$	$2.89x10^{-3}$
	101325	10332	1	14.696	29.921
	6894.8	703.06	0.068	1	2.036
	3386.39	345.32	0.0334	0.4911	1
Energy	J	kJ	kW*h	kcal	Btu
	1	$1x10^{-3}$	$2.778x10^{-7}$	$2.389x10^{-4}$	$9.478x10^{-4}$
	$1x10^{3}$	1	$2.778x10^{-4}$	0.2389	0.9478
	$3.6x10^{6}$	3600	1	860.1	3411
	4186.8	4.1868	$1.163x10^{-3}$	1	3.968
	1055.1	1.0551	$2.93x10^{-4}$	0.252	1
Power	W	kW	kcal/h	Btu/h	RT(US)
	1	$1x10^{-3}$	0.8604	3.412	$2.843x10^{-4}$
	$1x10^{3}$	1	860.4	3412	0.2843
	1.163	$1.1622x10^{-3}$	1	3.9657	$3.30x10^{-4}$
	0.293	$2.93x10^{-4}$	0.2522	1	$8.33x10^{-5}$
	3517	3.517	3024	12000	1
Rate of flow	L/s	m^3/s	m^3/h	ft^3/s	UK gal/s
	1	$1x10^{-3}$	3.6	0.0353	0.22
	$1x10^{3}$	1	3600	35.3147	219.97
	0.2778	$2.778x10^{-4}$	1	$9.81x10^{-3}$	0.611
	28.317	0.0283	101.941	1	6.2288
	4546	$4.546x10^{-3}$	16.416	0.1605	1

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