



BROAD CENTRAL AIR CONDITIONING & WATER DISTRIBUTION SYSTEM

BROAD THREE FUNCTION DUAL ENERGY CHILLER/HEATER

MODEL SELECTION & DESIGN MANUAL



Application

- Provide chilled/heating water for central air conditioning system
- Produce chilled water over 3 °C and heating water below 90 °C

Cooling capacity

520~4,200kW
(150~1,200Rt)

Heating capacity

465~3,722kW

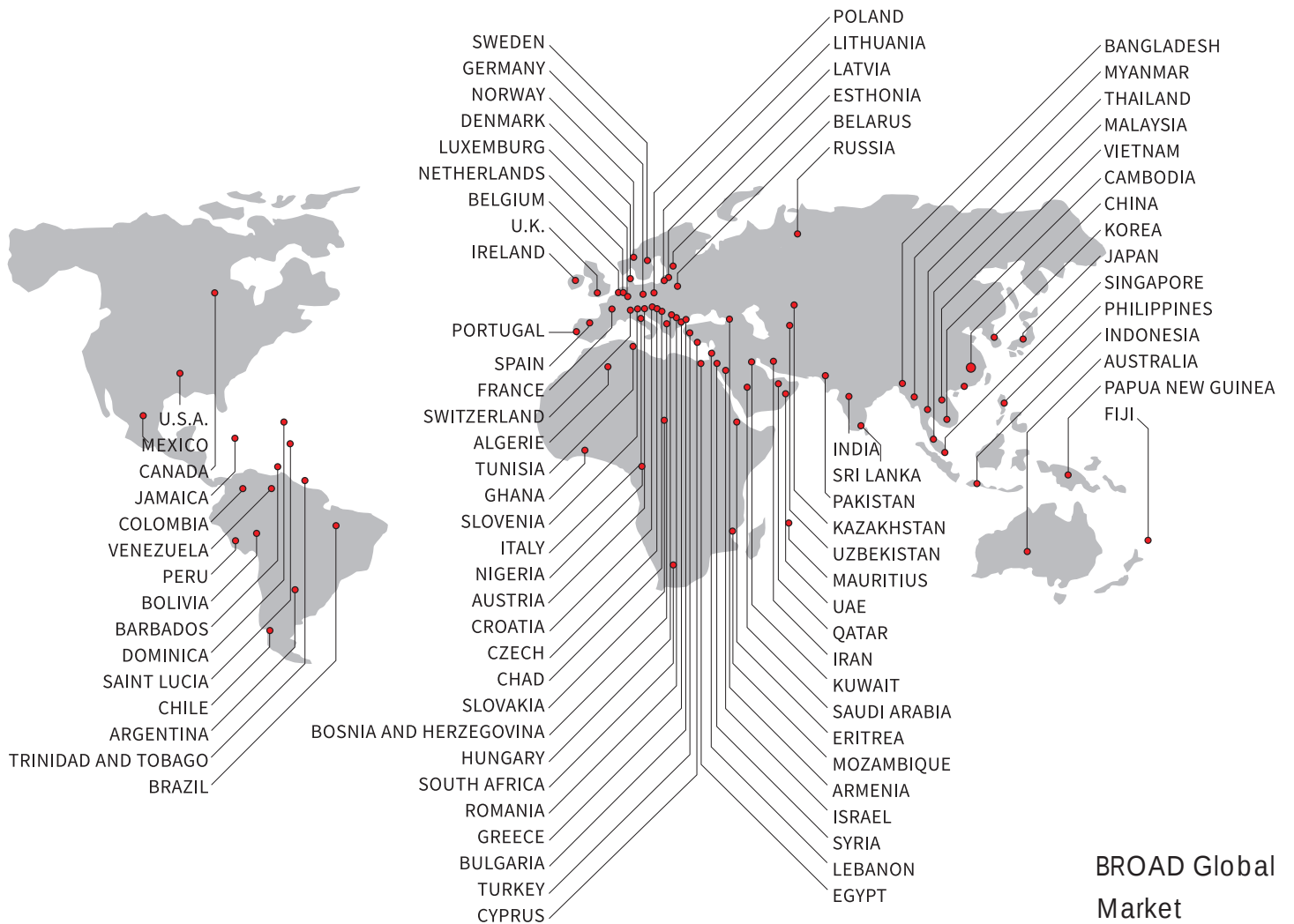


(BCRY90 Packaged Chiller/Heater)



Global Internet Monitoring Center for BROAD central air conditioning

It has been operating since 1996, known as the originator of "internet +"



WHY DOES BROAD MAKE A THREE FUNCTION DUAL ENERGY CHILLER/HEATER?

In 1989, BROAD invented Pressure-free Heating Boiler, tackling the problem of boiler explosion hazards

In 1992, BROAD invented non-electric air conditioning, tackling the problem of ozone layer depletion caused by CFCs

In 1996, BROAD invented global internet monitoring system, which was a forerunner of "internet +"

In 2004, BROAD invented the zero-resistance central air conditioning water distribution system, achieving an energy saving by maximum 76%

In 2015, BROAD launched anti-corrosion direct-fired heater, tackling the problem of heating safety

In 2015, BROAD launched magnetic bearing power efficient chiller, achieving the highest power efficiency in the world

Today, BROAD integrated decades of experiences, and invented three function (cooling, heating and hot water) dual energy (fuel or electricity) chiller/heater, which achieves:

- Higher efficiency cooling/heating unit
- Higher efficiency water distribution system
- Higher integrated energy efficiency
- Greater energy flexibility

VALUES OF BROAD THREE FUNCTION DUAL ENERGY CHILLER/HEATER

ENERGY SAVING

- The Integrated Part Load Value (IPLV) for cooling is 10. This high IPLV can reduce energy consumption by 40% compared to traditional electric chillers
- The heating efficiency is 94% (can reach 103% with an optional economizer, can reach 108% with an optional heat pump)
- BROAD Packaged Water Distribution System can reduce electricity consumption by up to 76% compared to conventional systems

ADDITIONAL COST SAVING

- The magnetic oil free with zero friction technology can save up to 40% energy cost and 90% maintenance cost compared with traditional electric chillers
- BROAD PLC "Smart anti-surge control" module ensures the chiller always operate in a safe range
- The integrated design of BROAD chiller, water distribution system and stainless steel enclosure reduces the design cost and field installation cost for customers

SPACE SAVING

- Compared with the traditional system, BROAD chiller size has been reduced by 50%, weight by 40% and mechanical room footprint by 50%
- BROAD Packaged Water Distribution System and stainless steel enclosure can be installed outdoor or on the roof top which reduces mechanical room footprint

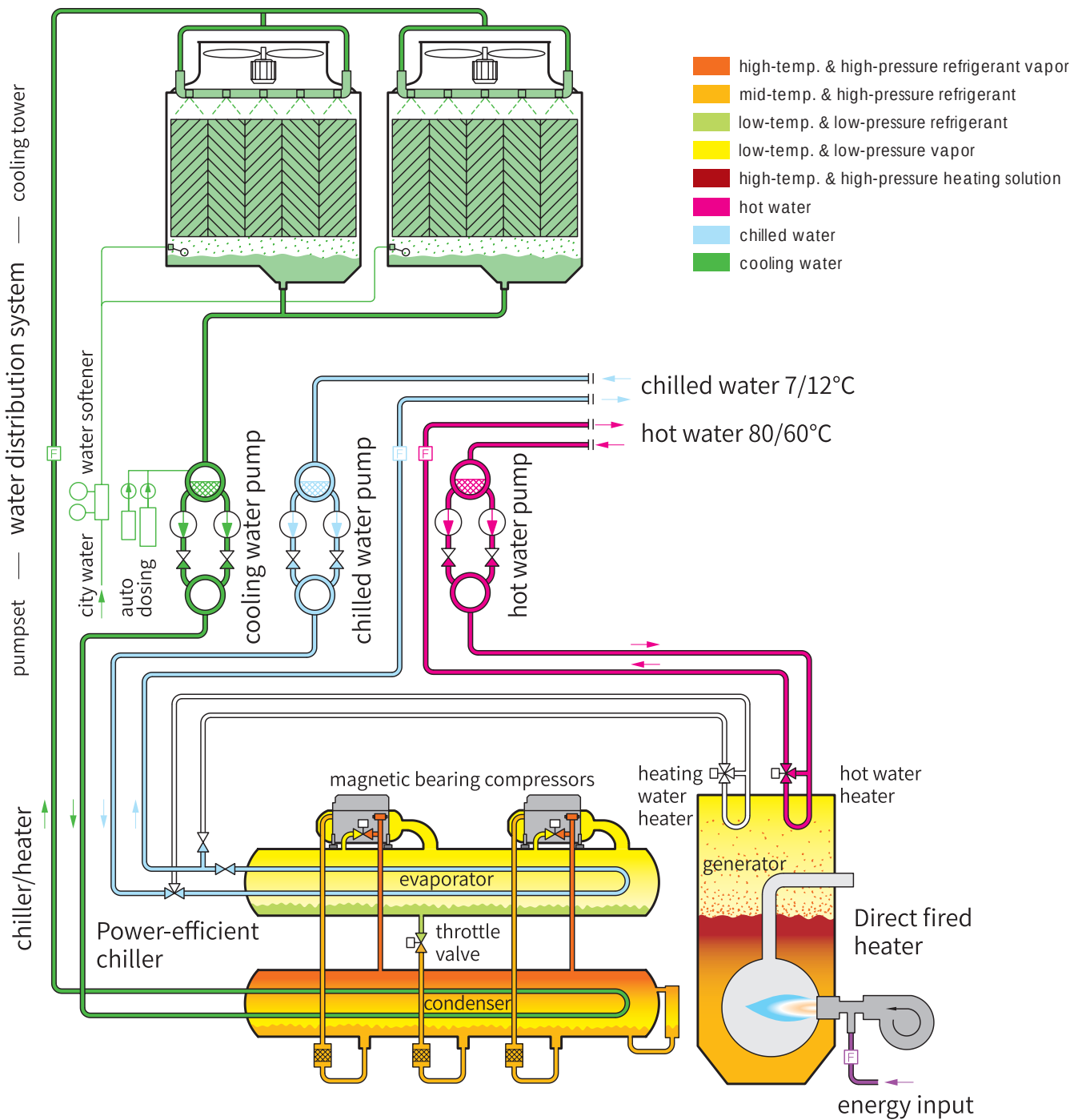
WORRY-FREE

- Unit works under vacuum condition when providing heating, with 8-level anti-explosion technologies which eliminate any explosion risks in any cases
- BROAD Packaged Water Distribution System and stainless steel enclosure eliminate troubles from design, procurement, installation and service for customers
- BROAD Intelligent Control System (ICS) realizes an operator-free system for chiller/heater and water distribution system
- BROAD Global Internet Monitoring System provides customers with 24/7/365 fault prediction, analysis and energy-saving management

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THREE FUNCTION DUAL ENERGY CHILLER/HEATER

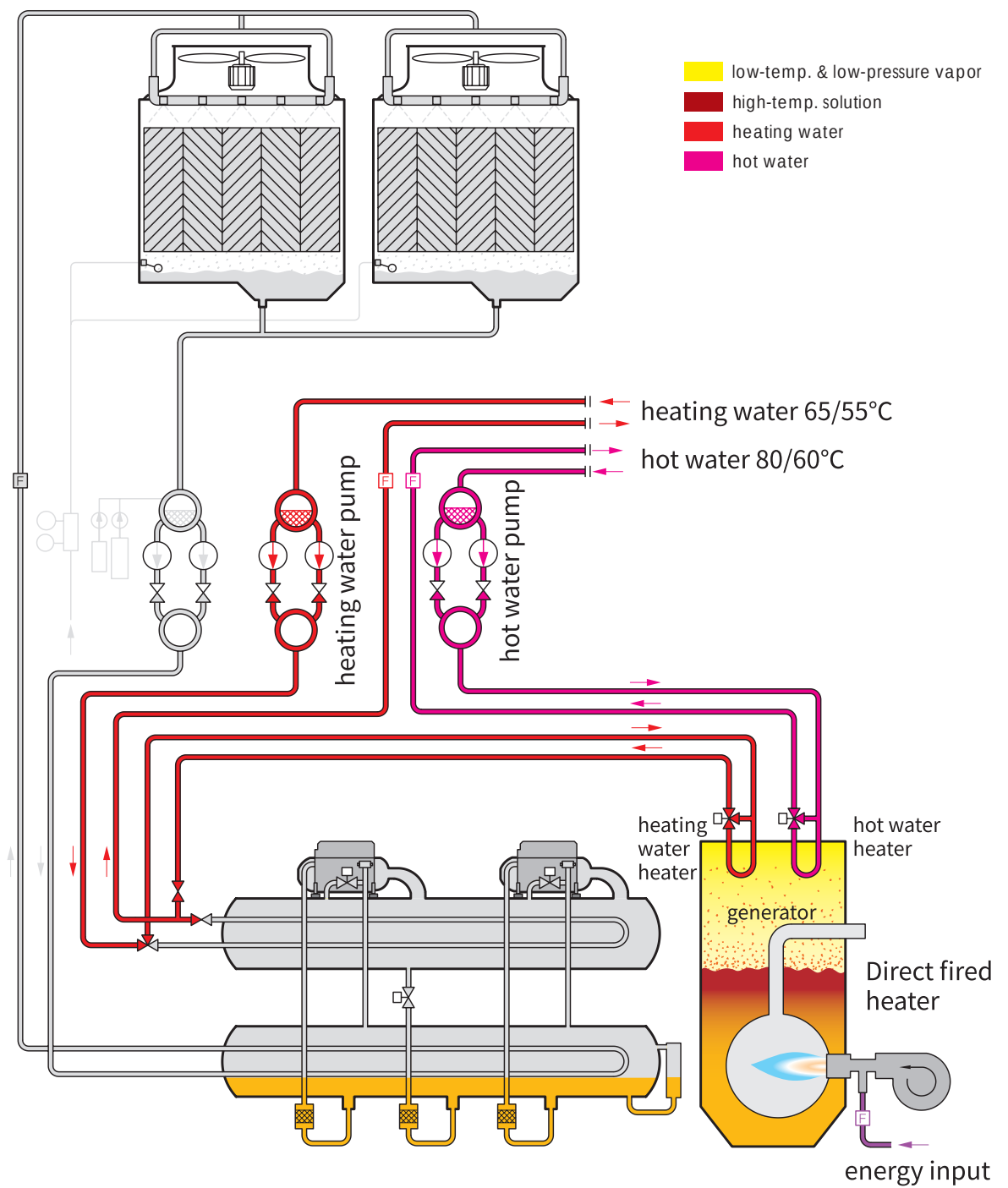


The cooling principle

The compressor compresses 7 °C low-temp. & low-pressure refrigerant vapor to 45°C high temp. & high pressure vapor, then the vapor flows into the condenser. In the condenser cooling water absorbs the heat from refrigerant vapor condensation process and its temperature rises from 30°C to 35°C. Then the heat will be discharged to air through cooling tower. After condensation, 33°C refrigerant transforms to 6°C low-temp. & low-pressure liquid after throttle valve. The refrigerant enters evaporator and evaporates immediately. It absorbs heat from the chilled water and makes chilled water drop from 12°C to 7°C. After evaporation, the refrigerant gasifies into 7°C vapor and is sucked into compressor. Then the next cycle begins

The hot water principle

The energy input heats the solution in generator, the vapor generated from the solution then heats the hot water in tubes, while condensate returns to the solution to be heated and the cycle repeats



The heating principle

Similar to the hot water principle, the energy input heats the solution in generator, the vapor generated from the solution then heats the heating water in tubes, while condensate returns to the solution to be heated and the cycle repeats. The heater can provide heating water and hot water separately or simultaneously

Three Function Dual Energy Chiller/Heater Rated Parameters

Model		BCR	45	60	90	120	180	240	360
Cooling capacity		kW	520	700	1045	1400	2090	2800	4200
		10 ⁴ kcal/h	45	60	90	120	180	240	360
		RT	150	200	300	400	600	800	1200
Heating capacity		kW	465	698	930	1163	1861	2326	3722
Hot W. capacity		kW	200	300	400	500	800	1000	1600
Power-efficient Chiller	Cooling input power	kW	89.5	115.5	171.3	224.7	339.3	432.1	650.2
	Cooling rated COP		5.81	6.06	6.10	6.23	6.16	6.48	6.46
	IPLV	(AHRI)	9.90	9.69	10.15	10.05	10.02	10.56	10.60
	Compressor quantity		1	1	2	2	3	4	6
	Cooling starting current	A	2	2	2	2	2	2	2
	Cooling maximum operation current	A	180	230	360	460	690	920	1380
	Cooling power demand	kW	105	130	200	260	380	520	750
	Evaporator								
	Flow rate	m ³ /h	90	120	180	240	360	480	720
	Pressure drop	kPa	35	40	70	70	70	70	80
	Condenser								
	Flow rate	m ³ /h	112	150	225	300	450	600	900
	Pressure drop	kPa	35	45	75	75	60	75	75
Direct-fired Heater	Heating W. heater								
	Flow rate	m ³ /h	40	60	80	100	160	200	320
	Pressure drop	kPa	25	25	25	25	35	35	45
	NG consumption	Nm ³ /h	49.5	74	99	124	198	247	396
	Hot W. heater								
	Flow rate	m ³ /h	8.6	12.9	17.2	21.5	34.4	43	64
	Pressure drop	kPa	20	20	20	20	30	30	40
	NG consumption	Nm ³ /h	21.3	32	43	53	85	106	170
	Electricity consumption	kW	1.5	1.5	2.7	2.7	6.6	7.6	12.1
Total power demand		kW	106.5	131.5	202.7	262.7	386.6	527.6	762.1
Refrigerant wt.		kg	190	280	380	480	775	960	1550
Heating solution wt.		kg	900	1200	1300	1500	2000	2500	3500
Shipment wt.		t	5.8(2.5)	7.2(3.2)	9.1(4.1)	11.4(5.6)	17.4(8.5)	21.9(11.4)	32(17.2)
Operation wt.		t	6.5(2.9)	8.3(3.8)	10.5(4.9)	13(6.6)	19.4(9.7)	24.7(13.4)	35.2(19.6)

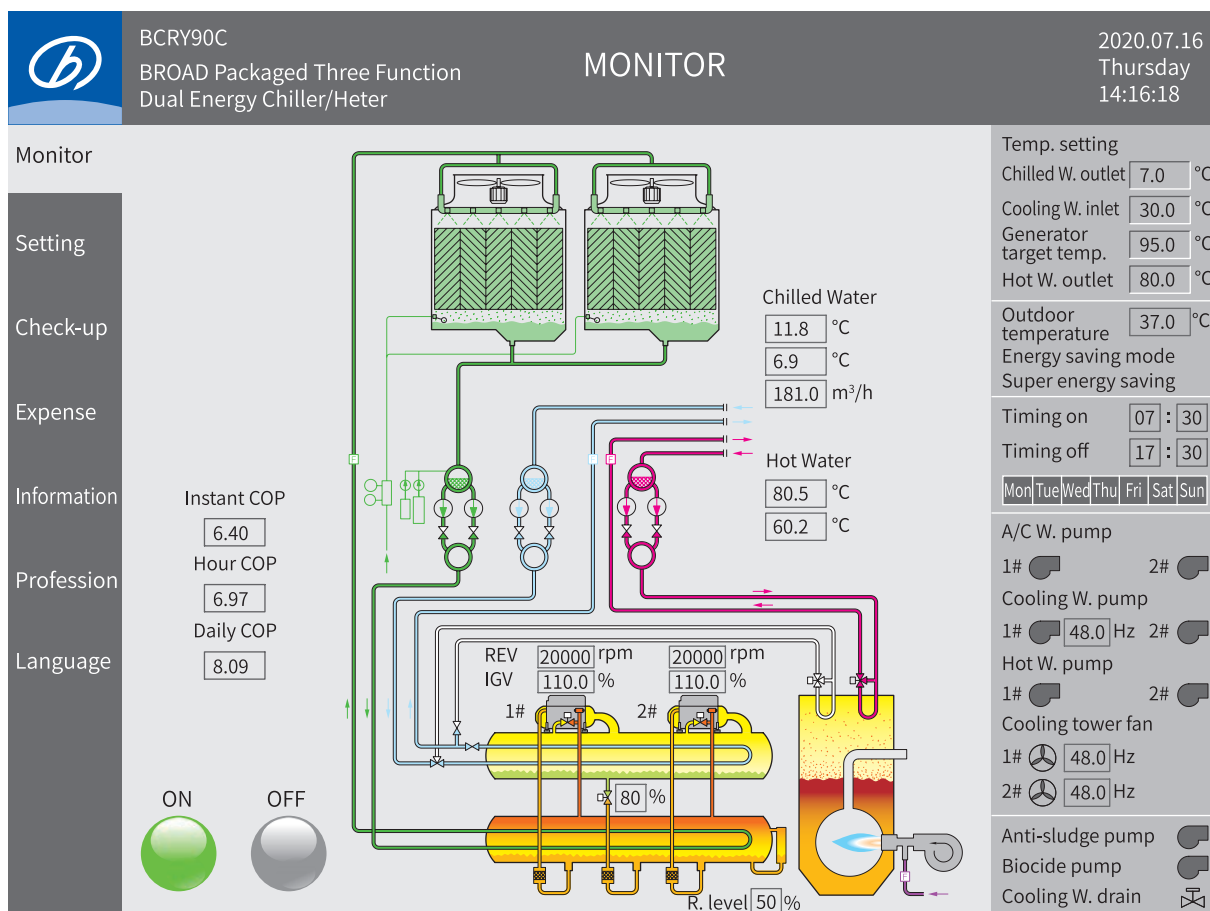
Note: the data in brackets is the weight of power-efficient chiller

Packaged Three Function Dual Energy Chiller Rated Parameters

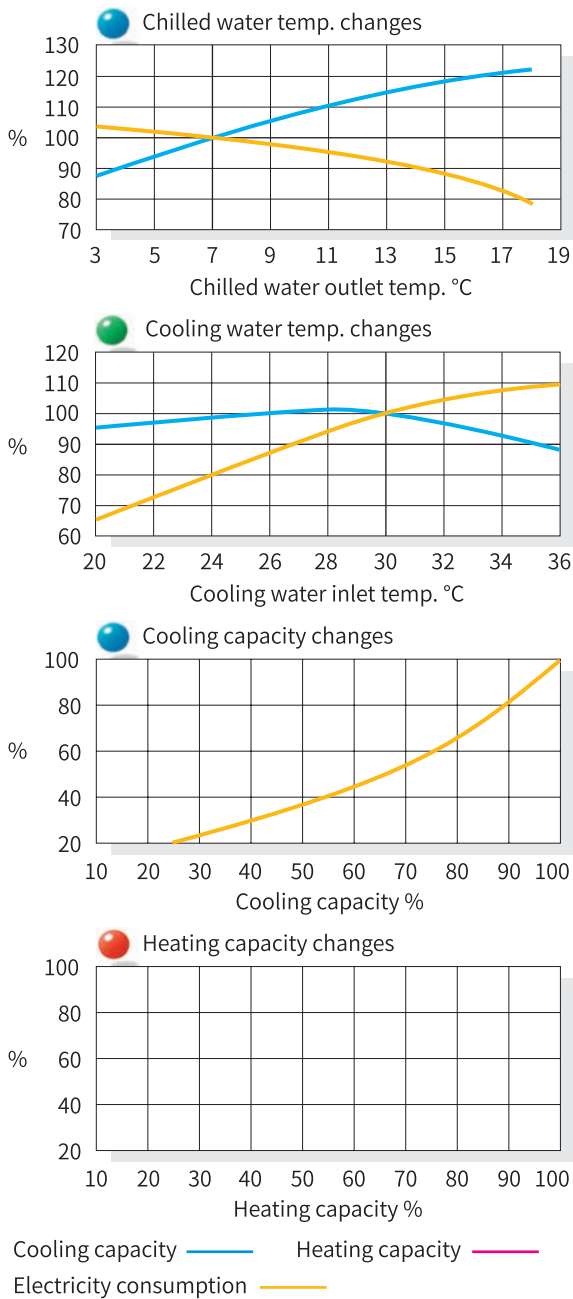
Model		BCRY	45	60	90	120	180	240	360
Pumpset	Chilled water pump								
	Pump head	mH ₂ O	23	22	27	28	28	28	27
	Power demand	kW	11	15	22	37	44	60	90
	Cooling water pump								
	Pump head	mH ₂ O	15	17	19	22	16	19	19
	Power demand	kW	8	11	22	30	37	44	74
	Hot water pump								
	Pump head	mH ₂ O	15	15	15	15	15	15	15
	Power demand	kW	1.5	2.2	3	3	4.4	4.4	6
	Total power demand	kW	20.5	28.2	47	70	85.4	108.4	170
Cooling Tower	Shipment wt.	kg	1400	1700	2100	2400	3500	4600	5200
	Operation wt.	kg	2650	3250	3850	4200	6600	7200	8800
	Cooling tower								
Cooling fan power demand		kW	5.5	7.5	11	15	15	22	37
Shipment wt.		kg	3170	3815	6335	7630	14320	19000	23120

General Conditions

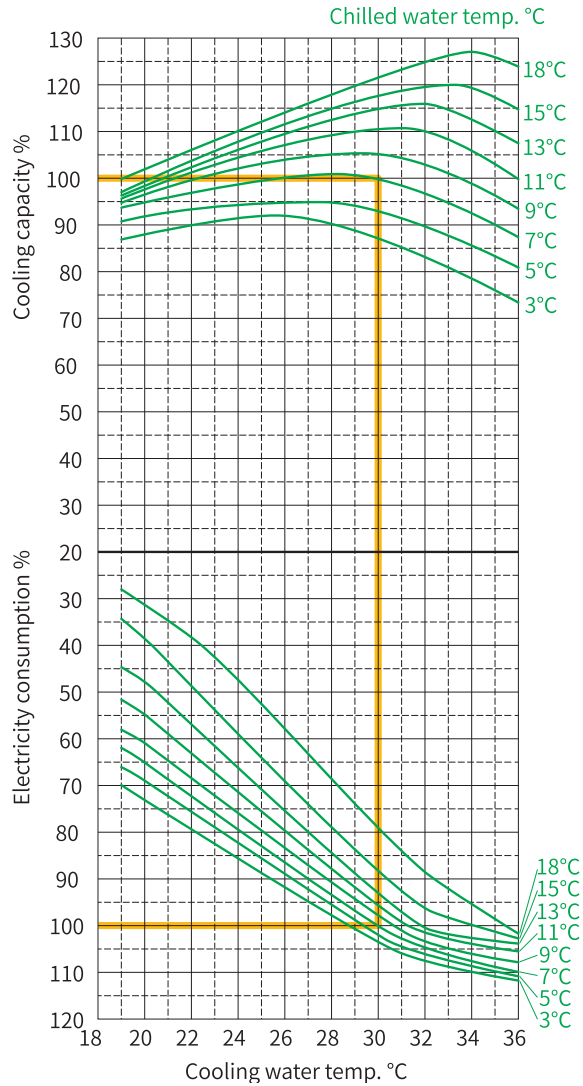
- Rated chilled W.outlet temp:7°C, flow rate: 0.172m³/(h•kW)
- Rated Cooling W. inlet temp: 30°C, flow rate: 0.215m³/(h•kW)
- Rated heating W. outlet/inlet temp: 65/55°C
- Hot W. outlet/inlet temp: 80/60°C
- Lowest permitted outlet temp. for chilled water: 3°C
- Highest permitted outlet temp. for heating/hot water: 90°C
- Lowest permitted inlet temp. for cooling water: 10°C
- Adjustable chilled water flowrate: 50~120%
Adjustable heating/hot water flowrate: 65~120%
Adjustable cooling water flowrate: 20~130%
- Static pressure limit for chilled W. and cooling W.: ≤1.0MPa
Static pressure limit for heating W., hot W.: ≤1.0 MPa (except special order)
- Fouling factor for chilled W./heating W./hot W.: 0.018m²•K/kW, for cooling W. : 0.044m²•K/kW
- Adjustable load: 10~100% (BCR45, BCR60≥30%)
- Refrigerant: R134a
Heating solution: specified
- Natural gas heating value calculation: 10kWh/Nm³ (8600kcal/Nm³)
- Standard natural gas dynamic pressure is 16~35kPa, static pressure is < 50kPa, requirements for lower or higher pressure can be accommodated by special orders
- Heating efficiency: 94% (optional exhaust plate heat exchanger heating efficiency: 98%, preheating hot water supplement water heating efficiency: 103%)
- Heating capacity and hot water capacity refer to the capacity in separate operation, which is adjustable within this range
- Machine room temperature: 5~43°C, relative humidity≤ 85%
- Power: 380V/3 phase, 50/60Hz
- Power-efficient chiller designed lifespan: 30 years
Direct-fired heater designed lifespan: 60 years
- Operation noise: ≤65dB (A)
- Operation vibration: ≤0.30mm



Performance Curves



Model Selection Curves



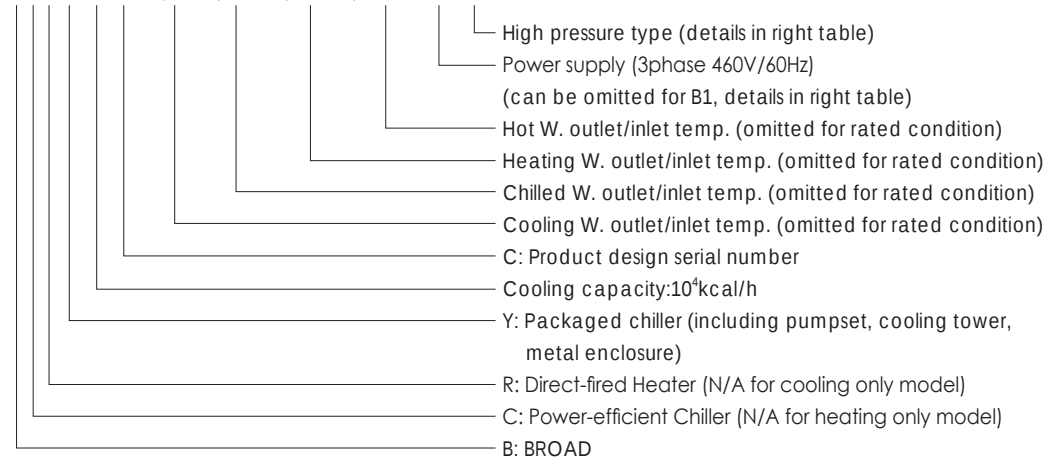
Notes: Calculation method of COP

$COP = \frac{\text{cooling capacity \%}}{\text{electricity consumption \%} \times \text{rated COP}}$

e.g. BC90 rated COP is 6.10, chilled water temp. is 7 °C, cooling water temp. is 26 °C, then cooling capacity is 100%, electricity consumption is 87%,
 $COP = 100\% \div 87\% \times 6.10 = 7.01$

Nomenclature

BCR Y 45 C-34/29-6/11-60/50-80/70-B3-Fb



Code for high pressure type:

Pressure limit MPa	Chilled W.	Cooling W.
1.01~1.60	Fb	Mb
1.61~2.00	Fc	Mc
2.01~2.40	Fd	Md

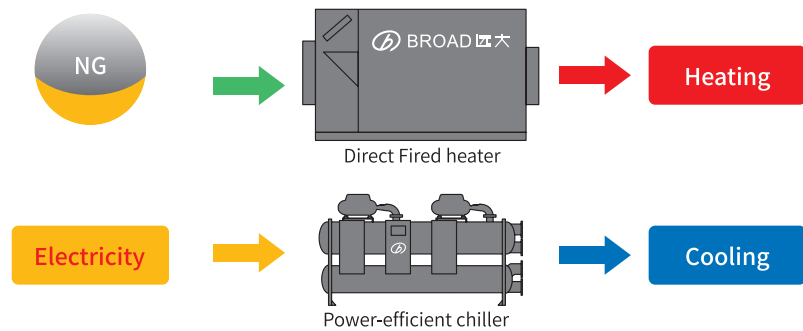
Codes for power supply:

Power supply	Voltage	Frequency
B1	380V	50Hz
B2	400~415V	
B3	460V	60Hz
B5	380V	
B6	400~415V	
B7	575V	

Combination of Non-electric Chiller and Power-efficient Chiller

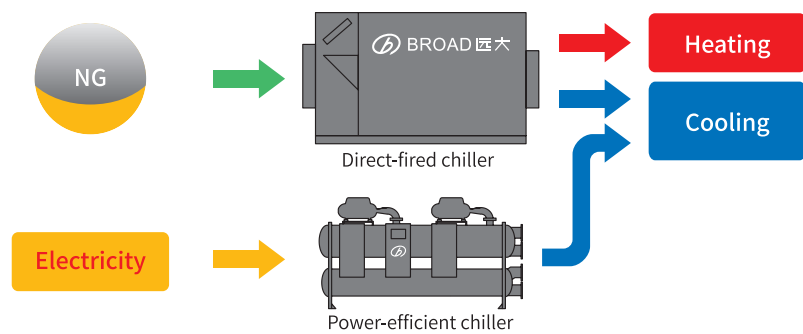
Combination of direct fired heater and power-efficient chiller

Most applicable
to places with
huge heating
and cooling
load differences



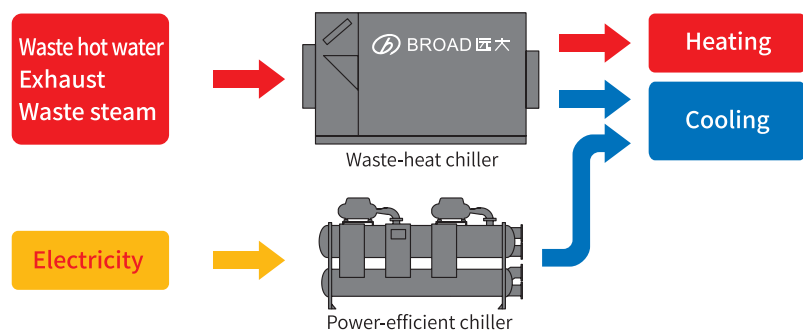
Combination of direct-fired chiller and power-efficient chiller

Daily shift or
seasonal shift
according to
different energy
prices



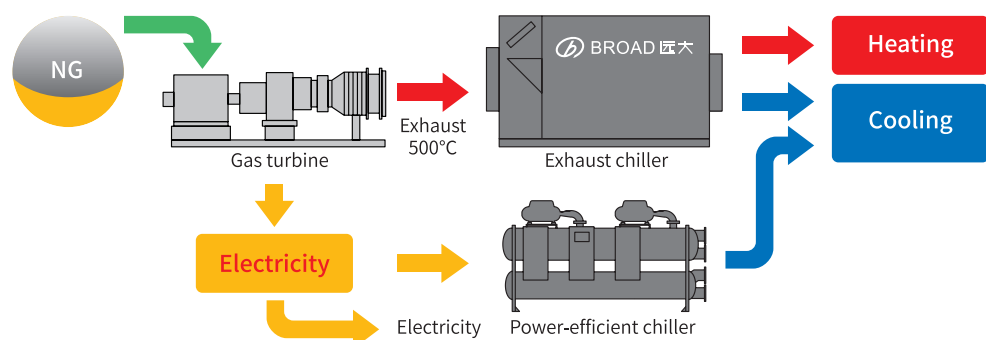
Combination of waste heat chiller and power-efficient chiller

Use of waste
heat is the
priority
power-efficient
chiller used as
supplementary



Combination of CCHP system and power-efficient chiller

Energy self-sufficient system



Model Selection & Ordering

Function selection

- Standard type (cooling-heating-hot water)
- A/C type (cooling-heating)
- Cooling only/heating only type (cooling or heating)

Load selection

- Any building cooling load cannot be estimated solely by the building area, as it is more closely related to building insulation and room function
- 30~50W/m² is recommended for energy-efficiency building, 60~90W/m² for normal building, 100~150W/m² for high occupancy and high space building
- When the heating load is not enough, direct fired heater capacity can be enlarged

Power efficient chiller selection

- Adjustable load for chiller with single compressor (BC45, BC60) is 30~100%, load less than 30% should be specially ordered
- Cooling water inlet temperature at 32°C for high-temperature and high-humidity area
- The lowest cooling water inlet temperature for stable operation is 18°C, otherwise a bypass motor valve should be added on the pipe

Flowrate & pump head selection

- BROAD's pump head design is based on our extensive experience
- BROAD can accommodate special head design

Static pressure selection

- The standard pressure limit for chilled/heating/cooling water is 1.0MPa. For information about high pressure type please see Code for high pressure type at P5
- >2.0MPa system: secondary heat exchange recommended

Emissions

- Concentration of NO_x ≤60ppm (about 123mg/m³, O₂=3.5%)
- Special orders for low NO_x (≤80mg/m³) or ultra low NO_x (≤30mg/m³)
- Latent recovery technology in cold areas can eliminate "white smoke"

Control

- BROAD Three Function Dual Energy Chiller/Heater is equipped with complete control function including internet monitoring
- If customers have a building management system (BMS), the BMS control interface can be selected as an optional supply. If the BMS interface is not ordered along with the chiller, it can be purchased later
- BROAD BMS is recommended to customers (for the entire building)

Machine room location

- On the ground or on building rooftop
- Machine can also be installed in the basement
- Cooling tower should be installed on the ground, on stilt or on building rooftop

Packaged selection

- Three Function Dual Energy Chiller/Heater includes chiller/heater, water distribution system, metal enclosure, etc.
- If the packaged system is installed inside the building, metal enclosure is not needed
- For overseas customers, cooling tower is optional

Lead time

- ≤ BCRY120: 3~6 months
- ≥ BCRY180: 6~9 months

Warranty

- Factory warranty covers 24 months from commissioning or 30 months from shipment, whichever comes earlier
- BROAD provides service throughout the lifespan. Service price list is available upon request

Technical specifications are based upon

- ANSI/AHRI 551-591 (SI) with addendum performance rating of water-chilling and heat pump water-heating packages using the vapor compression cycle
- GB/T18430 water chilling (heat pump) packages using the vapor compression cycle. Part 1: water chilling (Heat pump) packages for industrial & commercial and similar application
- GB 25131 safety requirements for water chillers (Heat pump) using the vapor compression cycle
- GB 19577 minimum allowable values of energy efficiency and energy efficiency grades for water chillers
- GB/T 18361 safety requirements for lithium bromide absorption chilling (heating) water units
- GB/T 18362 direct-fired lithium bromide absorption chilling (heating) water unit

Supply Scope

Products	Category	Item	Remarks
Chiller	Power efficient chiller	Compressor	Include magnetic bearing, VFD centrifugal type, oil free operation
		Heat exchanger	Include condenser, evaporator (cold insulation included)
		Throttling valve set	Include electronic expansion valve, drying filter, shut-off valve, regulating valve
		Check valve	Prevent refrigerant vapor flow-back to protect compressor
		Motor cooling device	Include drying filter, control valve set etc.
		Load balancing valve (optional)	For stable operation under low load ($\leq 30\%$)
	Direct Fired Heater	Direct Fired Heater	Include heater body, front flue chamber, rear flue chamber, base frame, enclosure, etc.
		Water heater	For heating & hot water
		Thermostatic valve	2 pieces, used for thermostatic control of heating water and hot water respectively. Only available in standard 3 function model.
		Burner	Include gas valve trains, filter, safety devices, muffler, etc.
		Gas flow meter (optional)	For accurate measuring of the gas consumption
	Control system	Low voltage control cabinet	Include low voltage electric parts, control board, PLC, etc.
		Power control cabinet	Include switch gear, fuse, reactor etc.
		Touch screen	For operation
		External control elements	Include temperature & pressure sensors, flow switches, level probes and actuators
		BMS interface (optional)	Connect to BMS system through dry contact or serial communication
	Refrigerant	R134a	For cooling
	Heating medium	Specified	For heating by direct fired heater
Pumpset system	Pumpset	A/C water pump	2 units
		Cooling water pump	2 units
		hot water pump	2 units, N/A for cooling only and cooling-heating types
		Accessories	Include zero resistance filter, check valve, soft connectors, valves and vibration isolator etc.
		Piping *	Include all piping between pumpset and chiller/heater
		Piping accessories	Include flow switches, auto air vent & its socket, soft connectors
		Motor drain valve	When water quality becomes poor, this valve automatically drains the cooling water. It also drains cooling water automatically to prevent water from freezing in winter
		A/C W. flowmeter	For precise management of chiller load and efficiency
		Water softener	Improve A/C water and cooling water quality
		Auto dosing device	Automatically charge biocide corrosion inhibitor and anti-sludge to the cooling water
		Pumpset control cabinet	Include inverters for A/C W. pump, cooling W. pump, cooling fan soft starter, low voltage electric parts, etc.
		Electric wiring *	Include wires, cables, cable conduit, cable supporters, etc.
	Cooling tower	Cooling tower	Including automatic water refill device, spray device, anti-drift device, packing, filling drain pipe and valve, etc.
		Cooling fan	Fan control system
Option	Machine room	Enclosure	Include stainless steel panel, roof cover, structural frame, base frame, as well as accessories
		Base frame	Fix and support the integrated computer room and main machine

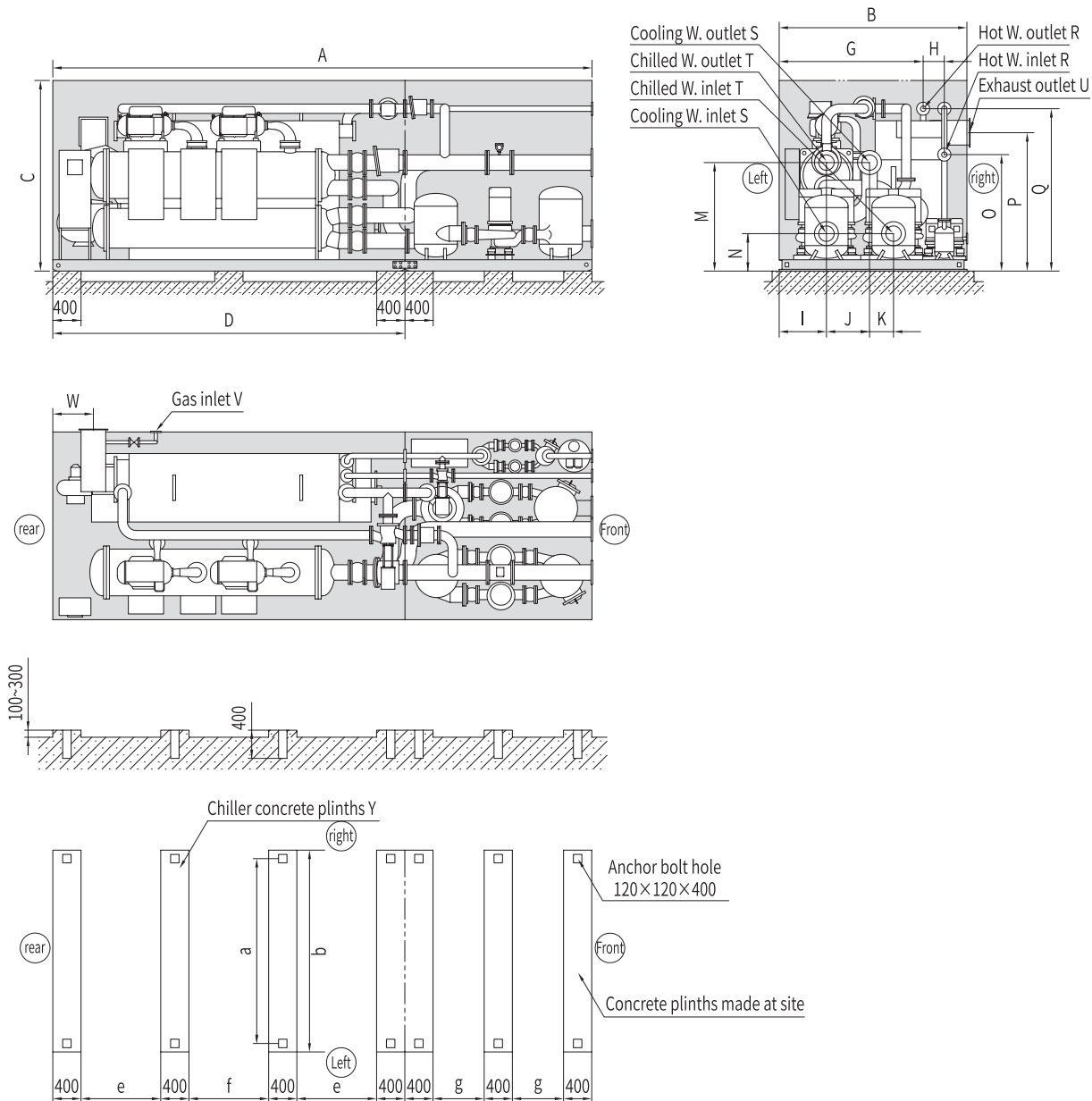
Notes: 1. * Only for standard size. Non-standard sizes are available by order

2. If cooling tower is not ordered, a control signal linkage to cooling fan will be provided

DESIGN & CONSTRUCTION TIPS

Dimensions

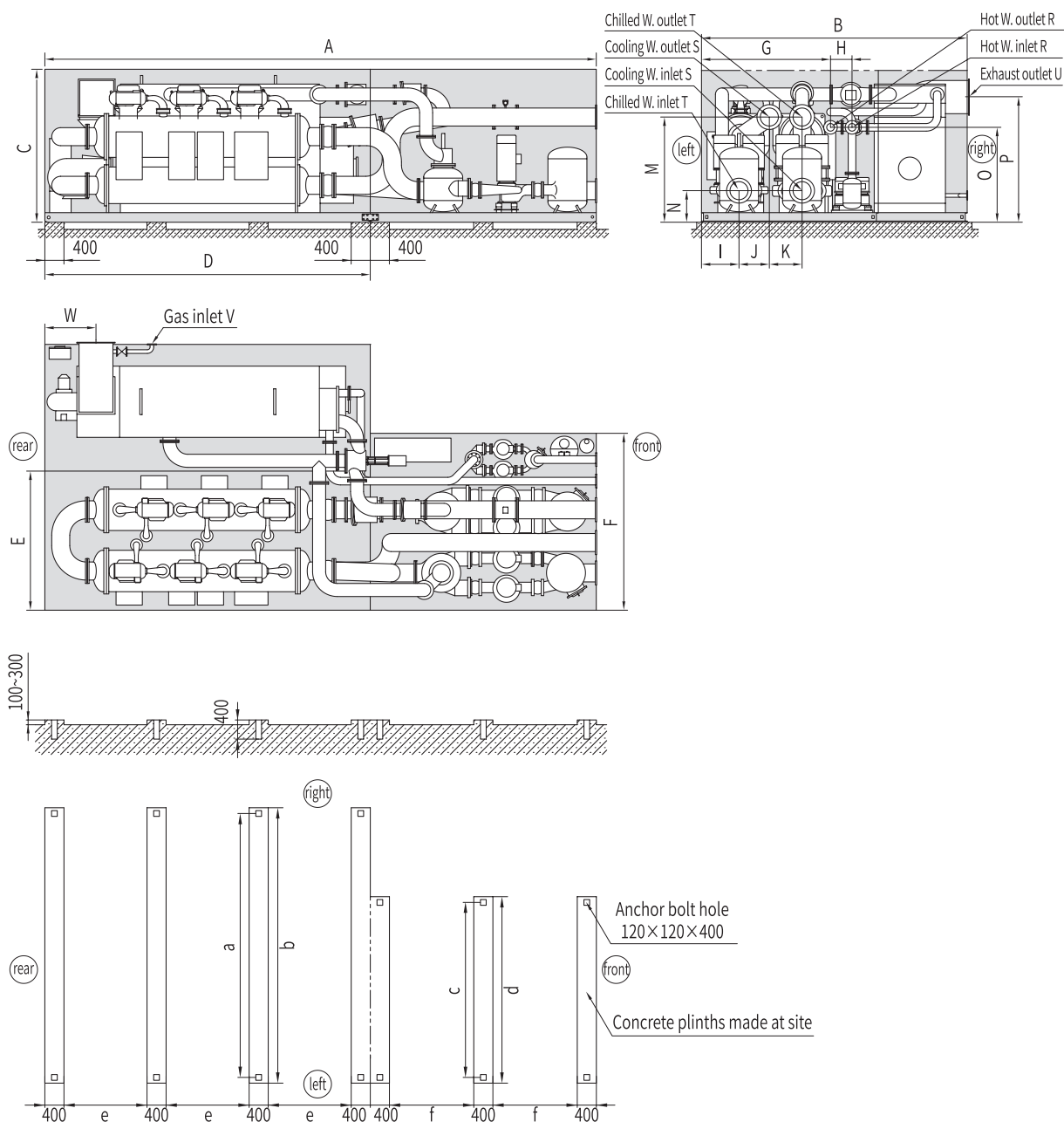
BCRY45, BCRY60, BCRY90, BCRY120, BCRY180



Model	A	B	C	D	G	H	I	J	K	M	N	O	P
BCRY45	6860	2140	2400	4470	1610	160	400	460	260	1395	450	1650	1670
BCRY60	7380	2530	2700	4990	1720	280	450	460	340	1510	450	1650	1920
BCRY90	7640	2660	2700	4990	2040	280	670	610	300	1540	530	1650	1960
BCRY120	8550	2790	2700	5510	2065	345	550	610	415	1610	530	1650	1875
BCRY180	9980	3180	3200	6030	2310	450	665	760	395	2010	670	2000	2270
Model	Q	R	S	T	U	V	W	Y	a	b	e	f	g
BCRY45	2100	DN50	DN150	DN150	250×250	DN25	385	3	2100	2340	1635	/	595
BCRY60	2300	DN65	DN150	DN150	320×320	DN25	640	3	2490	2730	1895	/	595
BCRY90	2300	DN65	DN200	DN200	350×350	DN40	575	3	2620	2860	1895	/	725
BCRY120	2350	DN80	DN200	DN200	400×400	DN40	740	3	2750	2990	2155	/	920
BCRY180	2760	DN125	DN250	DN250	560×560	DN50	1010	4	3140	3380	1477	1477	1375

Note: BCRY45 and BCRY60 have a single compressor, BCRY90 and BCRY120 with two compressors, and BCRY180 with three compressors

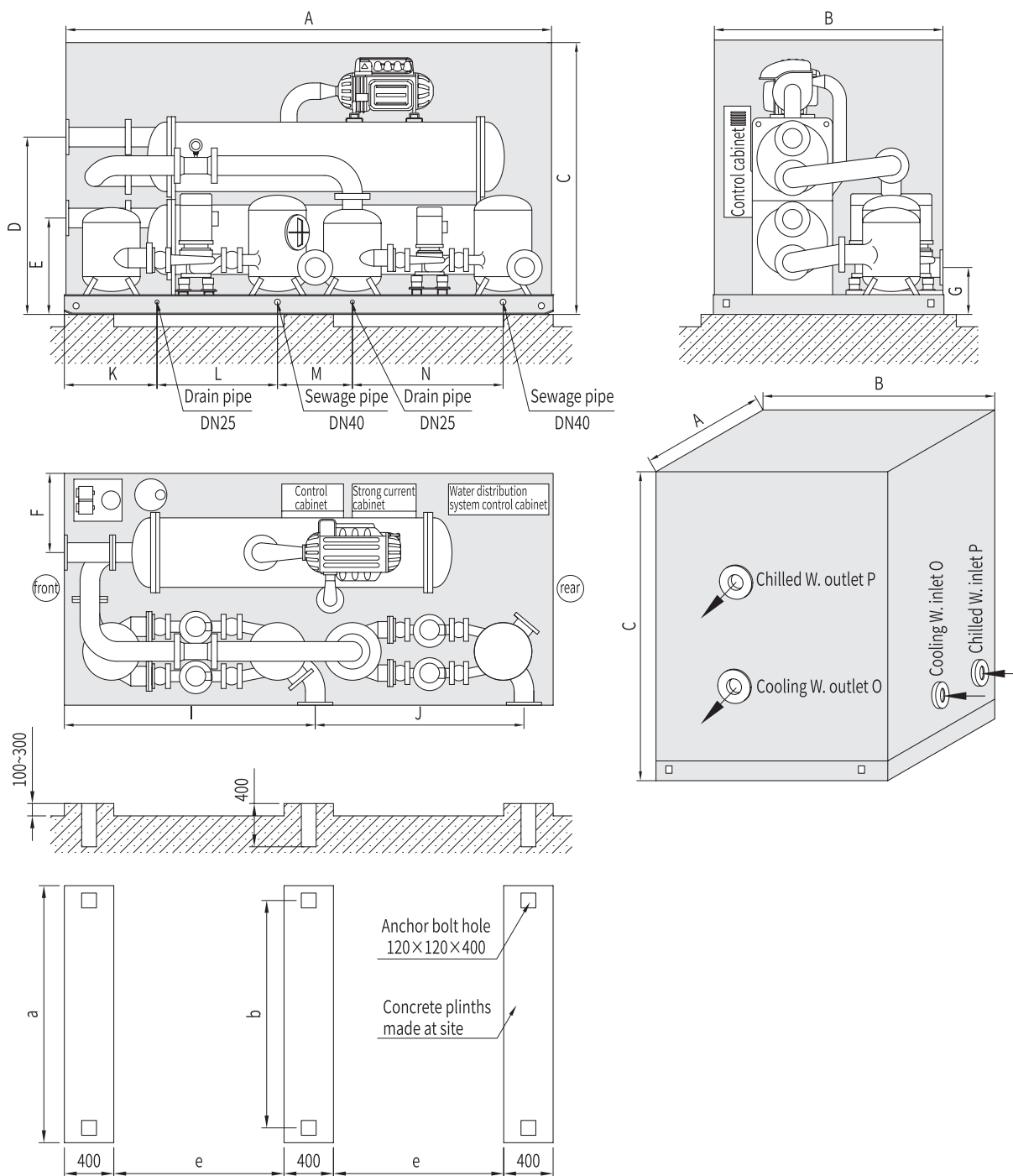
BCRY240, BCRY360



Model	A	B	C	D	E	F	G	H	I	J	K	M	N	O
BCRY240	11280	4910	3200	6810	2650	3180	2330	480	710	620	520	2350	660	2340
BCRY360	11540	5560	3200	6810	2910	3700	2700	450	785	635	685	2200	660	1985
Model	P	R	S	T	U	V	W	a	b	c	d	e	f	
BCRY240	2277	DN125	DN300	DN300	560×560	DN50	1010	4870	5110	3140	3380	1737	1635	
BCRY360	2625	DN150	DN350	DN350	710×710	DN65	1070	5520	5760	3660	3900	1737	1765	

Note: BCRY240 has four compressors, BCRY360 has six compressors

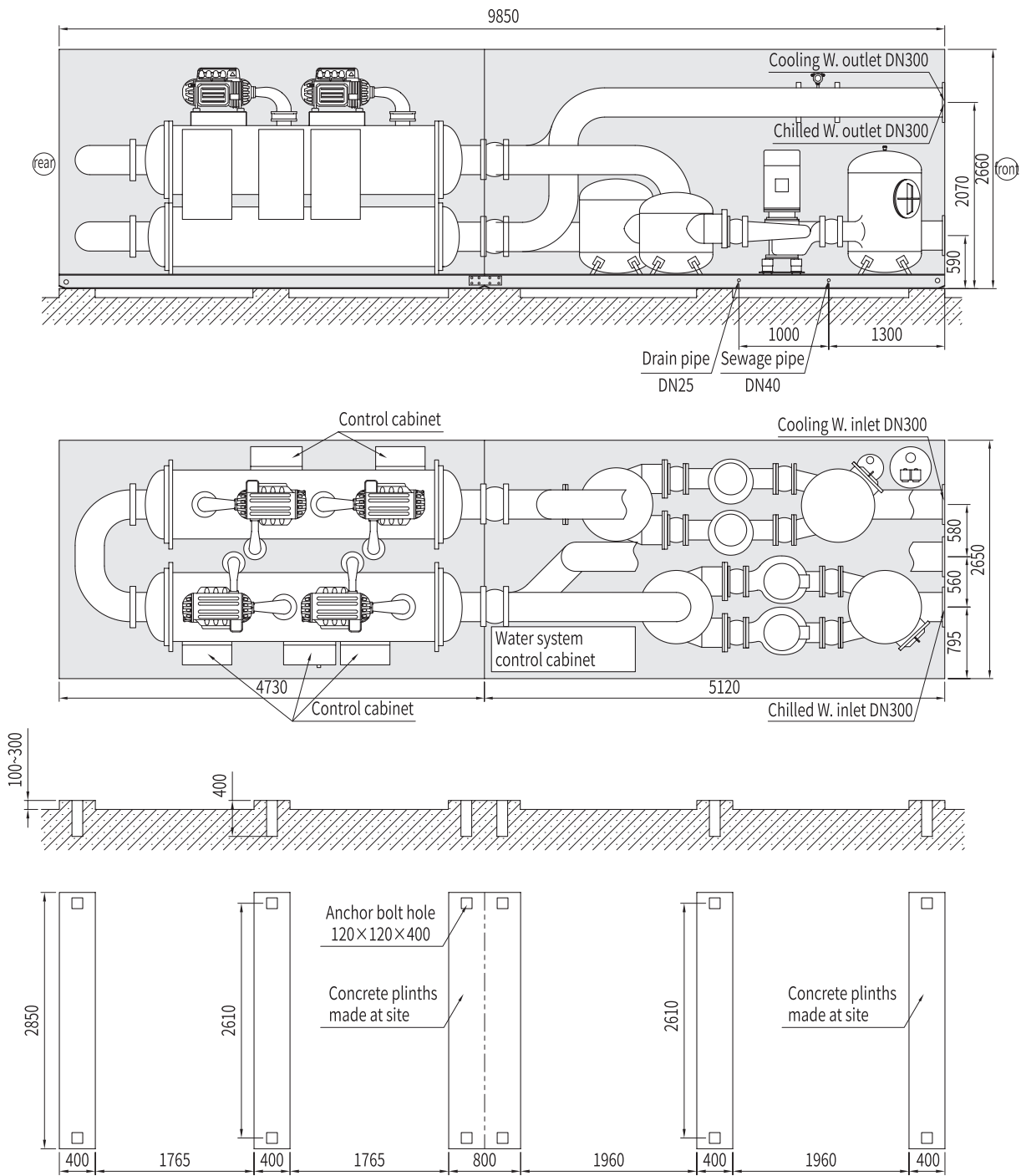
BCY45, BCY60



Model	A	B	C	D	E	F	G	I	J
BCY45	3960	1880	2360	1395	740	640	380	1825	1920
BCY60	4220	2130	2660	1510	760	710	420	1885	2050
Model	K	L	M	N	O	P	a	b	e
BCY45	765	645	1090	800	DN150	DN150	2080	1840	1380
BCY60	800	645	1340	800	DN150	DN150	2330	2090	1510

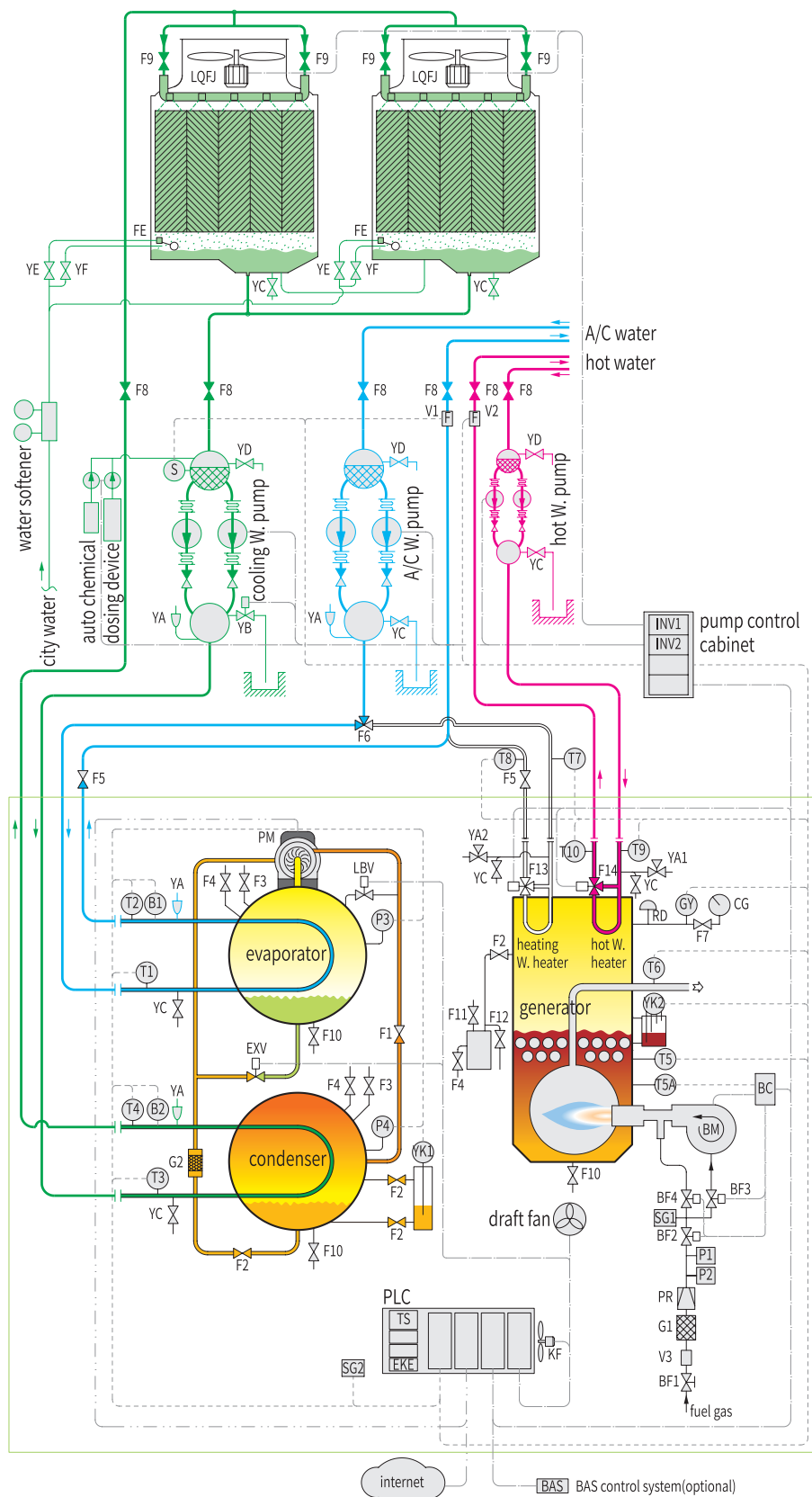
Note : BCY90, BCY120 have two compressors, BCY180 has three compressors

BCY240



The technical drawings illustrate the dimensions and components of the cooling system unit. The top view shows the front elevation with a total width of 11020 and a total height of 3040. It includes labels for 'Cooling W. outlet DN350', 'Chilled W. outlet DN350', 'Drain pipe DN25', and 'Sewage pipe DN40'. The side view shows the unit's profile with a width of 5770 and a height of 2910. It includes labels for 'Control cabinet', 'Water system control cabinet', 'Cooling W. inlet DN350', and 'Chilled W. inlet DN350'. The foundation view shows the unit's base with dimensions for the concrete plinths and anchor bolt holes. The plinths are 400 wide and 2810 high, with a 120x120x400 anchor bolt hole. The foundation is made of concrete and is 3050 high. The unit is supported by four concrete plinths, with dimensions of 2285 between the first two, 2285 between the last two, and 800 between the middle two. The total width of the foundation is 5770. The unit is 5250 wide. The foundation is 100-300 high. The unit is 100-300 high. The unit is 100-300 high.

P&I Diagram



Notes:

- Chiller/heater scope
- Parts marked with "***" are not applicable to cooling/heating type
- Line type:
 - actuator signal output
 - sensor signal input
 - communication

Control devices:

EKE	electronic throttle valve controller
INV1	cooling tower fan inverter
INV2	cooling water pump inverter
PLC	programmable logic controller
TS	touch screen
BC	burner control

Controlled objects:

EXV	electronic throttle valve
KF	control cabinet fan
LBV	load balancing valve (optional)
LQFJ	cooling tower fan
PM	compressor
BM	burner
YB	motor drain valve
F13	heating W. thermostatic valve
F14	hot W. thermostatic valve **
BF2	fuel gas main solenoid valve
BF3	fuel gas work solenoid valve
BF4	fuel gas ignition solenoid valve

Sensors:

T1	chilled W. inlet temp. sensor
T2	chilled W. outlet temp. sensor
T3	cooling W. inlet temp. sensor
T4	cooling W. outlet temp. sensor
T5	generator temp. sensor (to PLC)
T5A	generator temp. control (to burner)
T6	exhaust temp. sensor
T7	heating W. inlet temp. sensor
T8	heating W. outlet temp. sensor
T9	hot W. inlet temp. sensor **
T10	hot W. outlet temp. sensor **
B1	chilled W. flow switch
B2	cooling W. flow switch
P3	evaporation pressure sensor
P4	condensation pressure sensor
S	conductivity sensor
V1	A/C W. flowmeter
V2	hot W. flowmeter
V3	gas flowmeter(optional)
GY	pressure control
SG1	burner gas leakage sensor
SG2	machine room gas leakage sensor

Others:

F1	check valve
F2	shutoff valve
F3	safety valve
F4	purge valve
F5	chilled W. check valve
F6	chilled W. switch valve
F7	pressure detecting valve
F8	water system shutoff valve
F9	balance valve
F10	refrigerant discharge valve
F11	sampling purge valve
F12	direct vent valve
YA1	hot W. drain valve **
YA2	heating W. pressure release valve
FE	auto water makeup valve
YA	auto vent valve
YC	manual drain valve
YD	pollution discharge valve
YE	water makeup valve
YF	manual water makeup valve
YK1	condenser solution level probe
YK2	generator solution level probe
G1	gas filter
G2	dry filter
BF1	fuel gas ball valve
P1	lower limit pressure switch
P2	upper limit pressure switch
PR	fuel gas pressure regulator
RD	rupture disc
CG	generator compound gauge

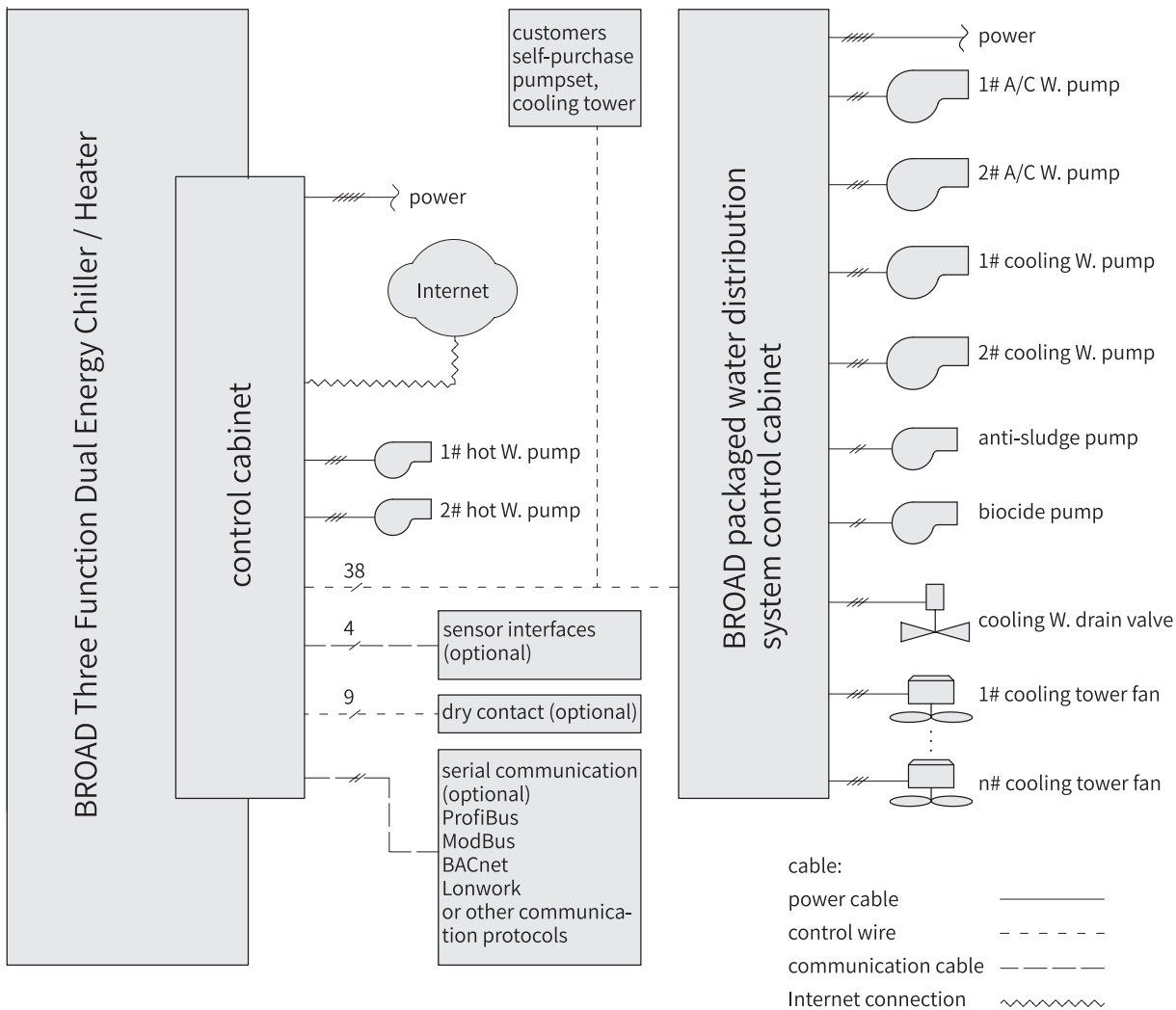
Scope of Supply/Work

Category	Item	BROAD	Customer	Remarks
Transportation and positioning	Factory to port		√	BROAD can arrange transportation upon request
	Jobsite handling (chiller, pumpset)		√	BROAD provides guidance
	Joint (for split shipment)	√		Customer to provide necessary assistance like welding machine, nitrogen
Electric engineering	Power supply to enclosure		√	3 phase, 4 wires
	Internet connection	√		Network cable to the enclosure is to be provided by customer
	Grounding		√	Place special grounding terminal with grounding resistance $\leq 4\Omega$ near water system control cabinet
Construction & installation	Foundation		√	
	Installation of metal enclosure	√		
	Water softener installation		√	
	Pipe connection between chiller/heater and pump *		√	A crane must be provided by customer
	Pipe connection between pumpset and cooling tower Δ		√	
	External piping installation		√	Includes chilled water pipes, hot water pipes, water make-up and drain pipes, energy source pipes
	Chiller cold insulation, chilled water pumps cold insulation and hot water pumps insulation	√		Factory-mounted
	Piping insulation in enclosure *	√		
	Pipeline insulation		√	
	Anti freezing		√	Water anti-freeze treatment is recommended when the ambient temp is below 0 °C
Commissioning	Jobsite chiller commissioning	√		Customer provides energy and air conditioning load. Chiller commissioning is a paid service
Operation & maintenance	Operator training on site	√		BROAD provides professional training free of charge, the customer pays for the accommodations and transportation of BROAD engineers
	Regular maintenance	√		Service contract can be signed after the warranty period

Notes:

1. * When packaged system is ordered
2. Δ When cooling tower is ordered

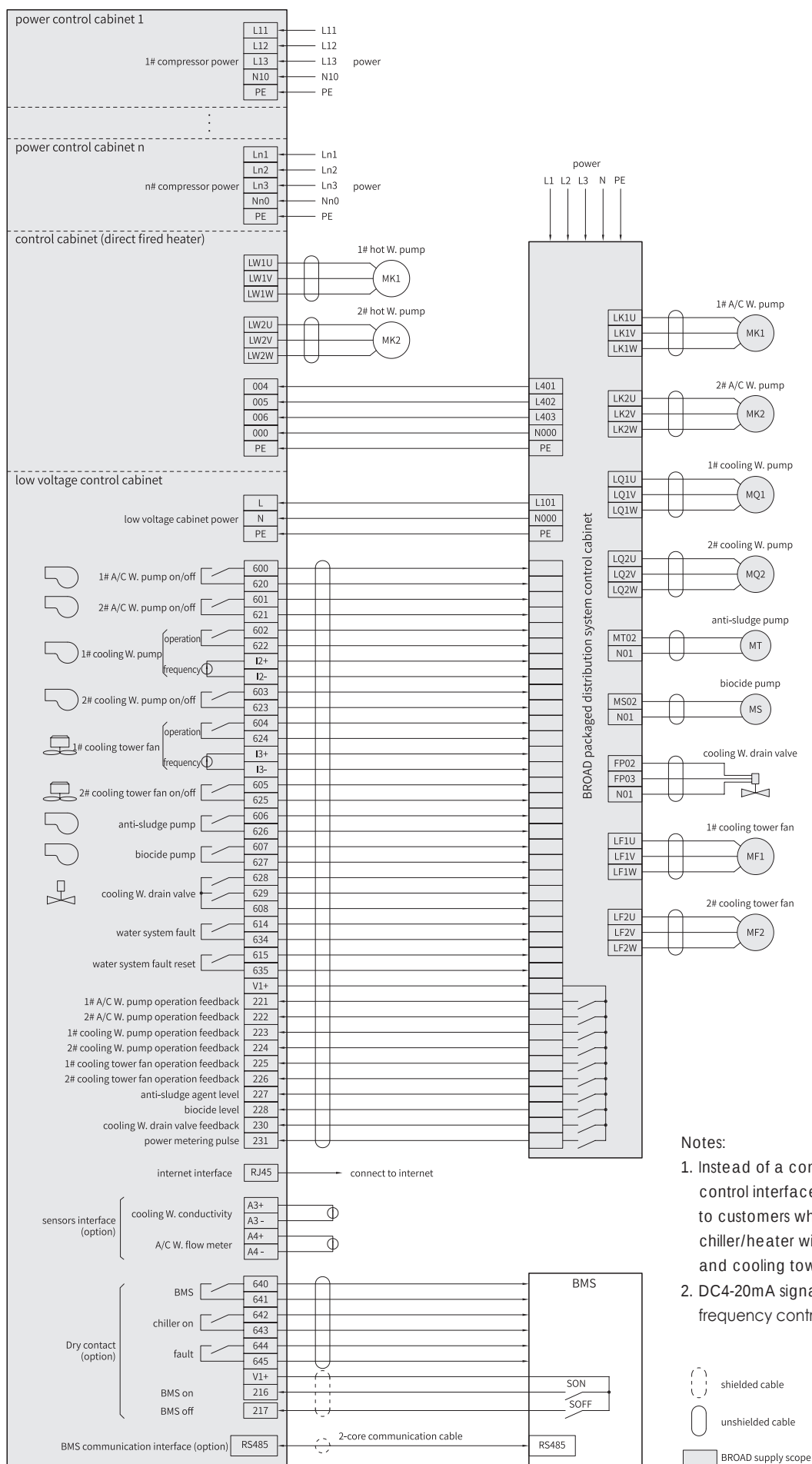
Control System



Notes:

1. BROAD Three Function Dual Energy chiller/heater control system includes interfaces for power-efficient chiller/direct fired heater/pumpset/cooling tower fan/internet/BMS etc.
2. Water distribution system control cabinet supplied with pumpset
3. BMS control interface includes Serial Communication and Dry Contact. Serial Communication interface can be ModBus/ProfiBus/BACnet or Lonwork
4. Control interfaces will be provided to customers who purchase pumpset and cooling tower by themselves

Exterior Wiring Diagram



Machine Room Construction Tips

Packaged Machine Room

BROAD Packaged Three Function Dual Energy Chiller/Heater can be placed outdoor directly. It is unnecessary to build a separate machine room. The foundation can be built as per drawing provided in previous pages

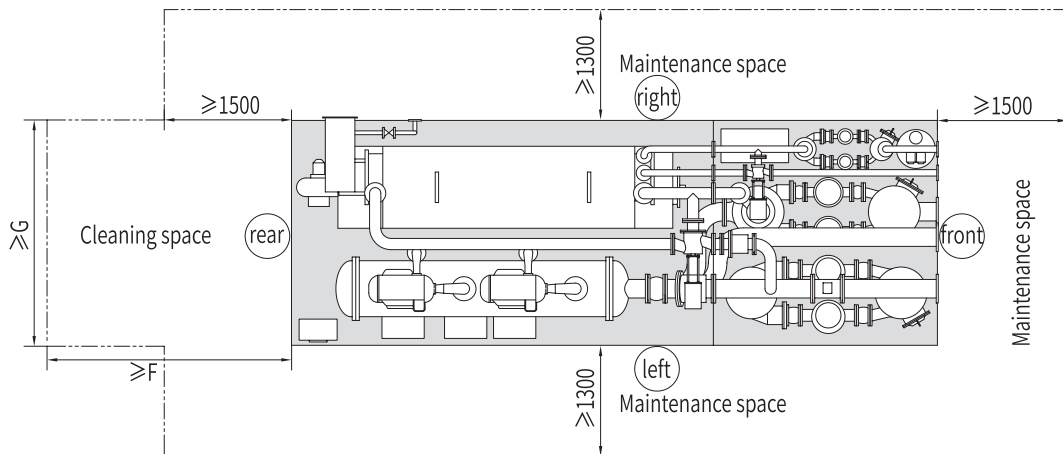
Foundation

- Refer to plinth dimensions
 - Load capacity
- 1) The machine room foundation load is recommended as 1.5 times the operation weight
 - 2) Make sure that the foundation is level (levelness <1.5‰) without sinking or overload (for rooftop installation)
 - 3) Chiller load should be evenly distributed on the contact surface between the frame base rolling steel and the plinth
- Anchor bolts:
- 1) Anchor bolts must be pre-installed as per dimension drawing
 - 2) Place the chiller on the foundation directly and fix it with anchor bolts
 - 3) Shock absorption spring should be equipped for chiller installed on non-ground floors, or in space with strong vibration source

Customer-built Machine Room

- Ventilation:
Poor ventilation leads to high humidity in the machine room, which may corrode the unit. Please ventilate the machine room more than 3 times per hour
- Drainage:
 - 1) Unit foundation must be on a high level in the machine room
 - 2) All discharge pipes and drain pipes must be visible above the drainage
 - 3) Machine room in the basement must be built above a water ditch, which is equipped with an auto level-controlled submerged pump
- Temperature:
Machine room temperature must be maintained within 5-43 °C. Lower temperature may crack heat exchange tubes and water box when the chiller is shut off; higher temperature may damage electrical components. Thermometer and over temperature alarm must be installed in the machine room
- Humidity:
The relative humidity in the machine room must be less than 85%. Higher humidity may impair insulation of electrical components

Unit Maintenance Space



Model	BCRY45	BCRY60	BCRY90	BCRY120	BCRY180	BCRY240	BCRY360
F	2200	2200	3000	3000	4000	3000	4000
G	2000	2500	2500	3000	3000	4500	5500

Note:

1. F and G is the space for tube cleaning. It could be the space of water pumps, doors or windows, and also can be shared by two chillers
2. If the machine room is smaller than above size, please contact BROAD for solution
3. It is recommended that the height of the machine room is 500mm higher than chiller/heater

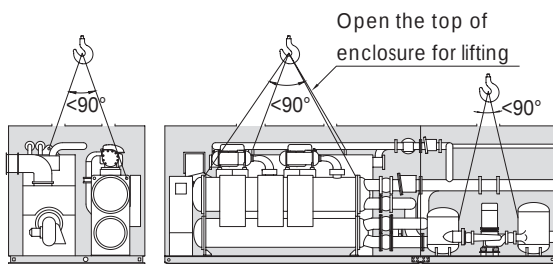
List of Control System Installation

Item	Object	Installation position and requirement	Material	Source	BROAD scope	Customer scope
Chiller	Chiller power	Control cabinet of chiller and water system	13-core cable, 2-core shielded cable (30m standard supply)	BROAD	Wiring inside chiller control cabinet	/
	Ambient temperature sensor	Good ventilation, no direct sunlight	3-core shielded cable (10m standard supply)	BROAD	Wiring inside chiller control cabinet	Temperature sensor and cable installation
	Internet monitoring	Chiller control cabinet	Network cable	Customer	Wiring inside chiller control cabinet	Cable installation, and wiring
	Fire protection	Comply with fire protection regulations	2-core cable fire protection detector	Customer	Wiring inside chiller control cabinet	Cable installation, and fire protection detector setup
	BMS interface (Optional)	Chiller control cabinet	2-core shielded cable (for serial communication), 11-core cable (for dry contact)	Customer	Wiring inside chiller control cabinet	Cable installation, wiring at building side
	Chiller and pumpset grounding	Grounding resistance $\leq 4\Omega$	Grounding wire and Grounding electrode	Customer	/	Grounding electrode installation and wiring
Pump set	Main power supply connection	Water distribution system control cabinet	5-core cable	Customer	Wiring inside chiller control cabinet	Cable & control cabinet installation
	Wiring between chiller and water distribution system control cabinet	Between chiller and water distribution system control cabinet	Cable supply according to the standard configuration of packaged chiller/heater	BROAD	Wiring inside chiller control cabinet	Cable installation
	Wiring between pumpset and water distribution system control cabinet	Between pumpset and water distribution system control cabinet	Cable supply according to the standard configuration of packaged chiller/heater	BROAD	Wiring inside chiller control cabinet	/
	Wiring between cooling tower and water distribution system control cabinet	Between cooling tower and water distribution system control cabinet	Cable supply according to the standard configuration of packaged chiller/heater	BROAD	Wiring inside chiller control cabinet	Cable installation

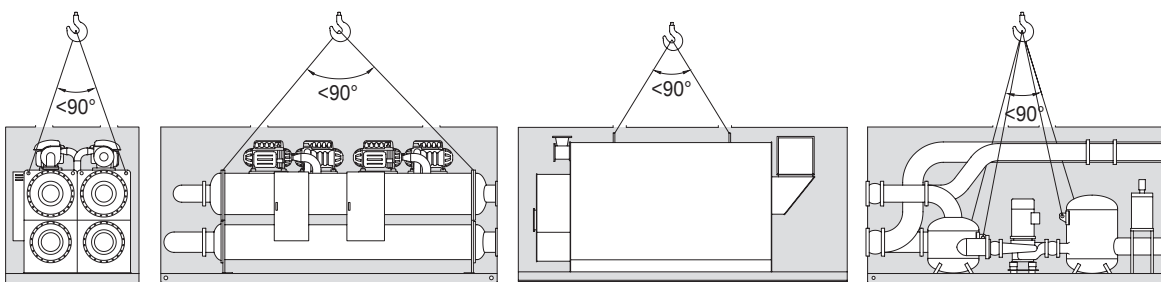
Lifting & Leveling Tips

1. Before unit arrival, concrete foundation plinths must be molded and leveled. The level degree is $<1.5\%$, height of foundation is 100~300mm. Place the chiller right on the foundation, fix with anchor bolts
2. Lifting must be done by qualified and insured lifting companies
3. The crane must be supported by cross-ties and firm foundation to prevent sinking. Check the crane steel ropes and hooks before lifting to prevent any accident. The lifting intersection angle must be less than 90° . It is strictly prohibited to lift the chiller with a single steel rope. When the chiller is lifted 20mm above the carriage or the ground, hold for a while, then lift the chiller slowly if everything is ok
4. If limited by loading height, loading angle or machine room access, lifting company must make special plan with BROAD team together to avoid any risk
5. Land the unit carefully, to avoid impact
6. Use the round steel or thick steel tubes for moving. No wooden sticks. Only drag the dragging hole on the rolling steel, do not apply forces on the other part of the chiller. Lift the unit first with jacks under the rolling steel before rigging
7. The level calibration should be carried out within 2 hours after the unit is in place. The deviation shall be less than 1% . The machine may be damaged if pad is not placed immediately
8. The unit base frame should touch plinth evenly
9. The chiller should be protected by full time personnel during transportation & installation. No access for unauthorized persons. It is essential to avoid touching the chiller valves. If the machine room is still under construction, precautions are essential to prevent unit from getting damaged or dirty. Don't scrape the paint or insulation layer

Sketch of leveling



Lifting sketch of BCRY45/60/90/120/180



Chiller lifting sketch of BCRY240/360

Pumpset lifting sketch of BCRY240/360

ABOUT THE BROAD GROUP

The BROAD Group is a private manufacturing enterprise dedicated to original innovation. Since its inception in 1988, BROAD has never copied any technology of its peers. All technologies developed by BROAD are focused on energy efficiency, material conservation, cleanliness, durability and intelligence, and all its products have reached an unparalleled level that is unmatched in the industry. Headquartered in Changsha, China, BROAD has over 3,000 employees worldwide, and has sold its products in more than 80 countries. BROAD wholly owns the following subsidiaries:

BROAD Air Conditioning Co. Ltd., founded in 1988, supplies non-electric central air conditioning systems under built-in vacuum condition with packaged water distribution system, and powered by natural gas or waste heat. It is world-renowned for super energy efficiency

BROAD Clean Air Technology Co. Ltd., set up in 2005, supplies the Clean Fresh Air Machine that recovers 80% heat and filters PM2.5 by 99.9%, and also air purification products that can kill pathogens and clear allergens

BROAD Energy Service Co. Ltd., established in 2007, provides equipment, investment, design, construction and operation of district cooling and heating and power (CHP) projects, using market mechanism to actualize maximum energy conservation

BROAD Sustainable Building Co. Ltd., ("BSB"), was founded in 2009. BSB provides a revolutionary stainless steel structural material for the construction and transportation industries called "B-CORE Slab", and stainless steel modular buildings. BSB is committed to achieve a sustainable development path for human beings



BROAD Town — BROAD central air conditioning R&D and production base (Changsha, Hunan)



BROAD Three Function Dual Energy Chiller/Heater and packaged water distribution system are ISO, CE, ETL, ASME, AHRI certified



To protect forest & water sources, please imitate us to adopt compact layout & thin paper printing