



BROAD CENTRAL AIR CONDITIONING

BROAD PACKAGED POWER-EFFICIENT CHILLER

MODEL SELECTION & DESIGN MANUAL



Application

- Provide chilled / heating water for central air conditioning system
- Produce chilled water over 3°C and heating water below 60°C

Cooling capacity

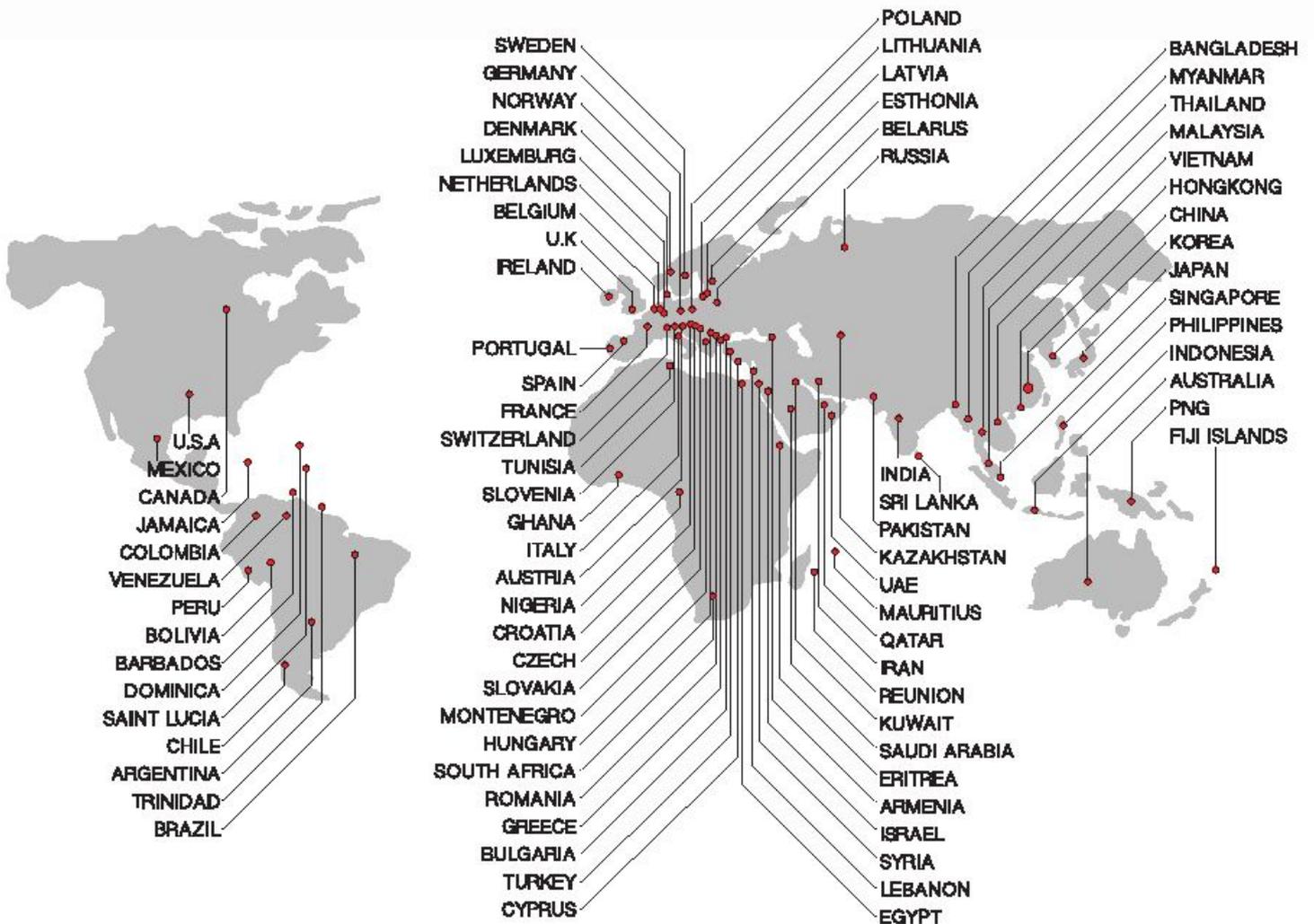
420 ~ 4,650kW
(120 ~ 1,329RT)



[CY90 Packaged Chiller]



Global internet monitoring system for BROAD users since 1996



AS THE GLOBAL LEADER OF NON-ELECTRIC CHILLER, WHY BROAD ALSO MAKES ELECTRIC CHILLER?

The BROAD non-electric chiller is the world's most efficient method to produce chilled water when evaluating original source "primary energy fuels". A BROAD Direct Fired Absorption Chiller/Heater is able to generate chilled, heating and domestic hot water simultaneously. These three outputs from a single absorption unit is the most reliable system when looking at potential points of failure. The BROAD XI Generation Absorption Chiller provides the longest life span and the quietest operation available in the market today.

With the emergence of growing CHP, wind and solar PV power systems we are now manufacturing the power-efficient chiller.

Markets for the new power-efficient chiller are as follows:

1. Locations of the developing world where there is no access to natural gas or waste energy sources
2. Applications for small cooling only requirements
3. Site specific locations powered by only wind, hydro or solar PV has great potential to reduce CO₂ emissions
4. A BROAD Power-efficient Chiller is more efficient than traditional electric chillers
5. A BROAD Packaged Water Distribution System is more efficient than traditional distribution systems
6. A BROAD Power-efficient Chiller can be combined with a BROAD CHP system, which has higher efficiency and energy flexibility than a non-hybrid or single energy source plant

VALUES OF BROAD POWER-EFFICIENT CHILLER

ENERGY SAVING

The Integrated Part Load Value (IPLV) of the chiller can reach 11. This high IPLV can reduce energy consumption by 40% when compared to traditional electric chillers

A BROAD Packaged Water Distribution System can reduce electricity consumption up to 76% when compared to conventional field-built systems

ADDITIONAL COST SAVINGS

The magnetic oil free and zero friction technology can save up to 40% energy cost and 90% of maintenance cost when compared with traditional electric chillers

BROAD PLC "Smart anti-surge control" module insures the chiller always operate in a safe range

The Integrated design of the BROAD chiller, water distribution system and stainless steel metal enclosure reduce design cost and field installation costs for customers

SPACE SAVING

Compared with the traditional electric chillers, A BROAD chiller package reduces volume by 30-50% and the weight by 30%

BROAD Packaged Water Distribution System and stainless steel metal enclosures can be installed outside which reduces mechanical room footprint requirements

WORRY-FREE

BROAD Packaged Water Distribution System and stainless steel metal enclosure eliminate risk and reduce system design, procurement and installation errors

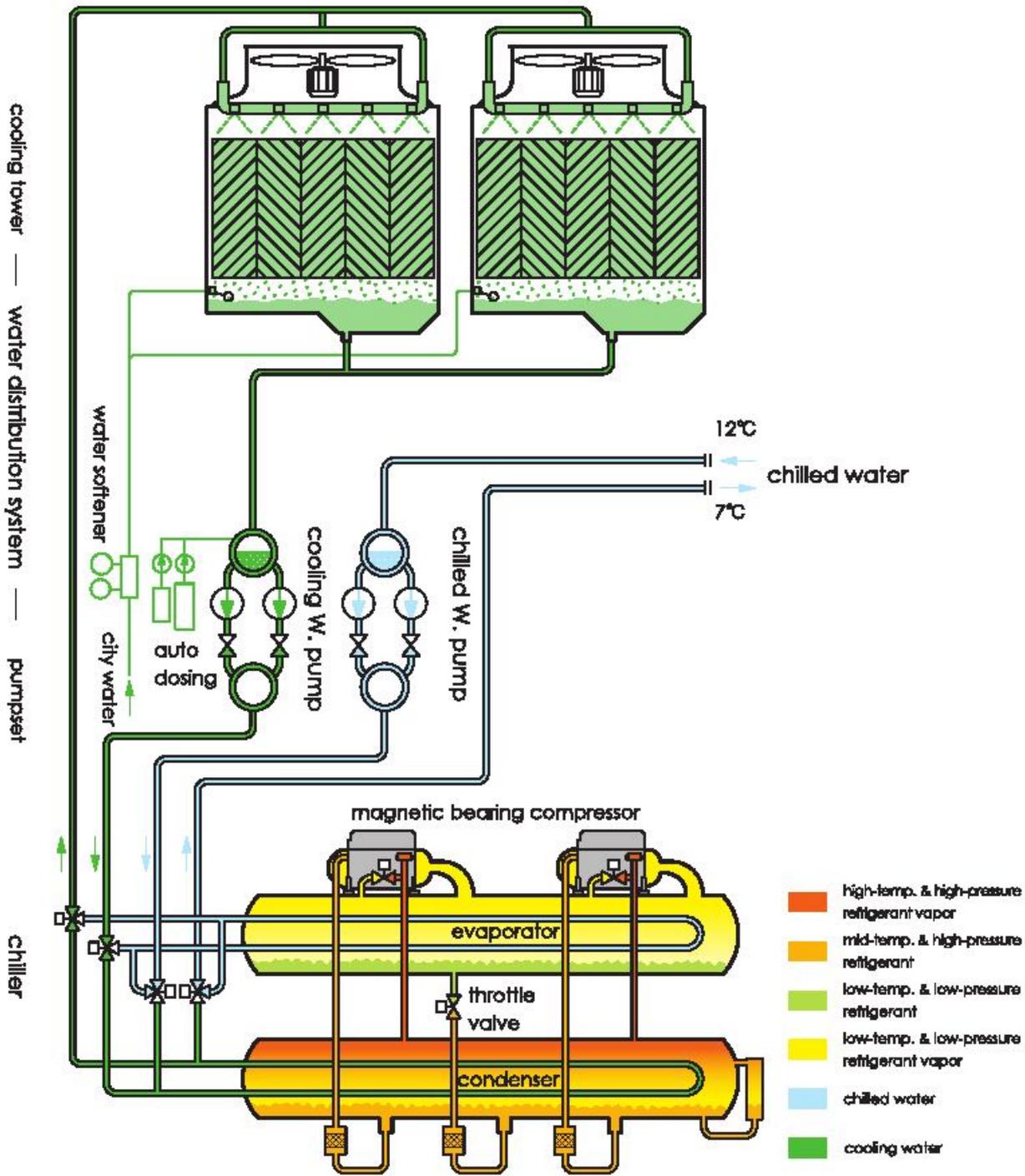
BROAD Intelligent Control System (ICS) can be automated for operator free operation of the chiller and water distribution system

BROAD Global Internet Monitoring System provides customers with 24/7/365 fault prediction, analysis and energy-saving management tools

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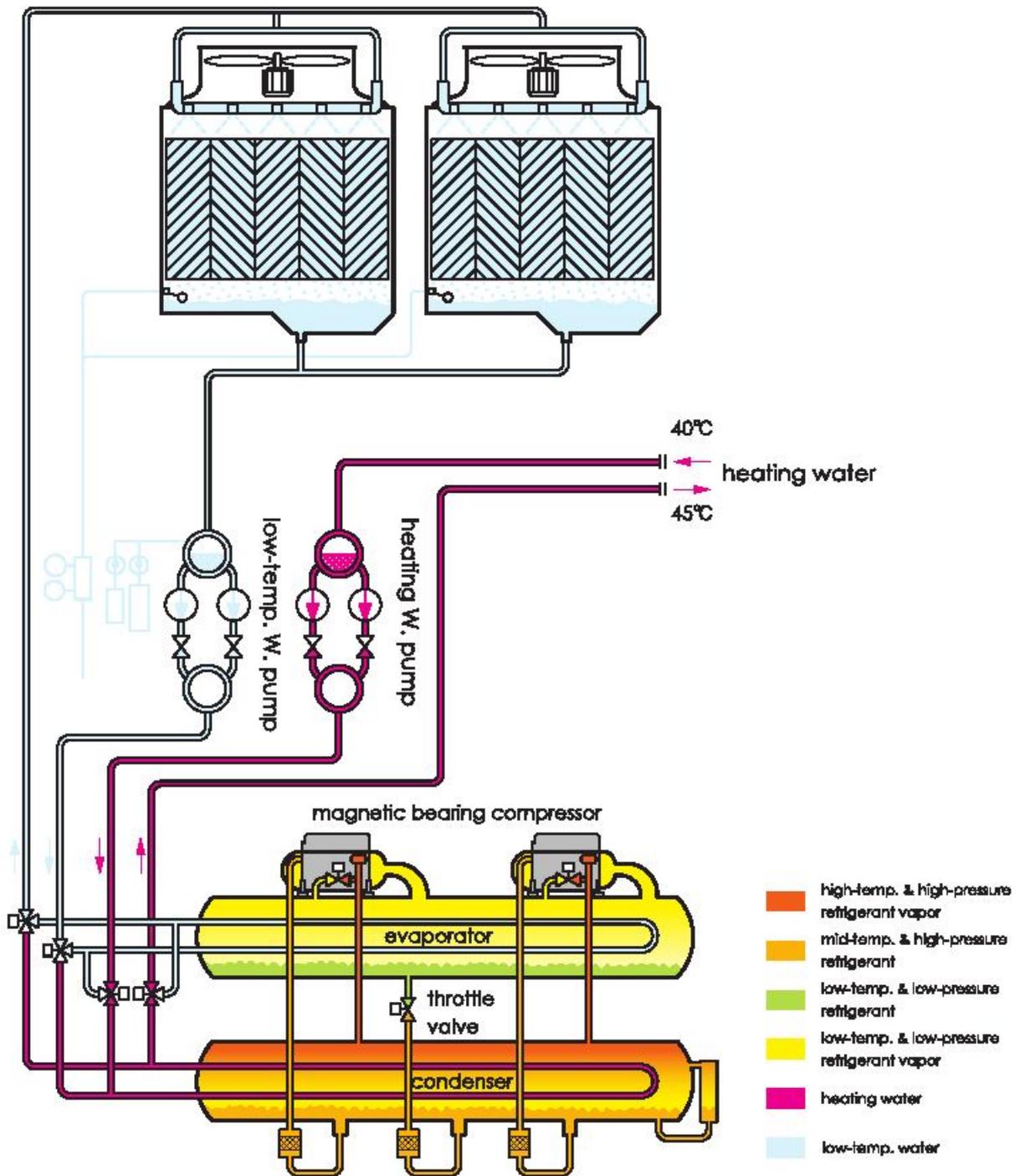
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BROAD Packaged Power-efficient Chiller



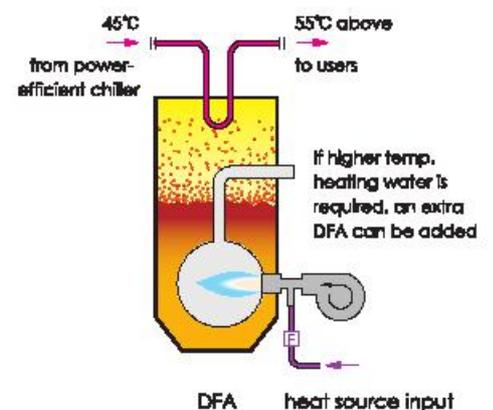
The cooling principle

The compressor compresses 7°C low-temp. & low-pressure refrigerant vapor to 45°C high temp. & high pressure vapor then flows into condenser. In condenser cooling water absorbs the heat from refrigerant vapor condensation process and its temperature raises from 30°C to 35°C. Then the heat will be discharged to air through cooling tower. After condensation, 33°C refrigerant becomes into 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 sucked into compressor. Then next cycle begins



Heating principle

The compressor compresses 4°C low-temp. & low-pressure refrigerant vapor to 55°C high temp. and high pressure vapor then flows into condenser. In condenser heating water is heated from 40°C to 45°C, then provided to users. After condensation, 43°C refrigerant becomes into 3°C low-temp. & low-pressure liquid after throttle valve. The refrigerant enters evaporator and evaporates immediately. It absorbs heat from the low-temp. water and makes low-temp. water drop from 10°C to 5°C. After evaporation, the refrigerant becomes into low temp. & low-pressure vapor and sucked to compressor. Then next cycle begins



Power-efficient Chiller Cooling Performance Data

Mode	C	35	90	180	400
Cooling capacity	kW	420	1045	2090	4650
	10 ⁴ kcal/h	36	90	180	400
	RT	120	300	600	1329
Power demand	kW	74	169	327	720
Rated COP		5.70	6.20	6.40	6.46
COP (IPLV)		9.32	10.6	10.7	11.5
Starting current	A	2	4	8	8
Maximum operation current	A	160	360	740	1500
Evaporator					
Flow rate	m ³ /h	72	180	360	800
Pressure drop	kPa	40	65	65	75
Connection diameter	DN	150	200	250	350
Condenser					
Flow rate	m ³ /h	90	225	450	1000
Pressure drop	kPa	30	60	60	70
Connection diameter	DN	150	200	300	400
Refrigerant wt.	kg	260	550	1100	2000
Shipment wt.	kg	2800	4800	9600	16500
Operation wt.	kg	3200	5400	10800	18500

General Conditions

1. Rated chilled W. outlet/inlet temp: 7/12°C
2. Rated cooling W. outlet/inlet temp: 35/30°C
3. Lowest permitted outlet temp. for chilled water: 3°C
4. Lowest permitted inlet temp. for cooling water: 10°C
5. Adjustable chilled water flowrate: 30 ~ 120%
6. Adjustable cooling water flowrate: 20 ~ 140%
7. Pressure limit for chilled W. and cooling W.: ≤1.0MPa (high pressure model available)
8. Adjustable load: 10 ~ 100%
9. Fouling factor for chilled W: 0.018m²·K/kW
Fouling factor for cooling W: 0.044m²·K/kW
10. Refrigerant: R134a
11. Machine room ambient temperature: 5 ~ 43°C, humidity ≤85%
12. Life design: 30 years
13. Operation noise: ≤65dB (A)
14. Operation vibration: ≤0.30mm

Packaged Power-efficient Chiller Performance Data

Mode	CY	35	90	180	400	
Cooling capacity	kW	420	1045	2090	4650	
Pump set	Chilled water pump					
	External head	mH ₂ O	18	20	20	20
	Power demand	kW	8	22	44	90
	Cooling water pump					
	External head	mH ₂ O	10	9	9	9
	Power demand	kW	6	15	37	60
	Total power demand	kW	14	37	81	150
	Shipment wt.	kg	2000	2600	5400	8000
	Operation wt.	kg	3000	3900	7000	10000
	Power demand	kW	5.5	11	15	37
	Operation wt.	kg	2960	7600	14300	28700

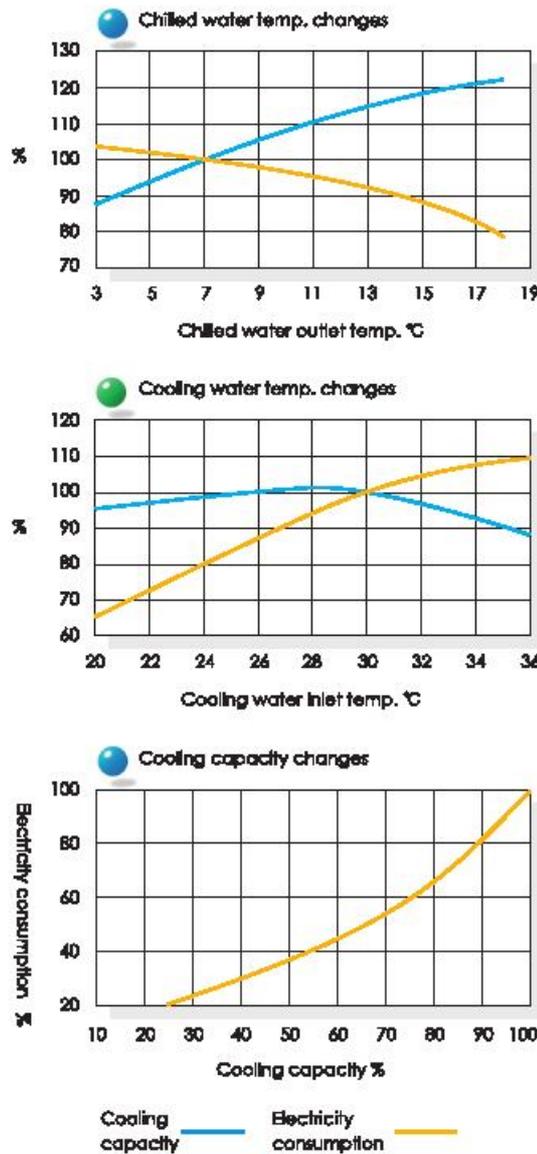
Power-efficient Heat Pump Performance Data

Model	C35-R
Heating capacity	628kW
Power demand	110kW
Rated COP	5.71
Starting current	2A
Maximum operation current	190A
Maximum input power	115kW
Evaporator	
Flow rate	72m ³ /h
Pressure drop	40kPa
Connection diameter	DN150
Condenser	
Flow rate	108m ³ /h
Pressure drop	40kPa
Connection diameter	DN150
Refrigerant	260kg

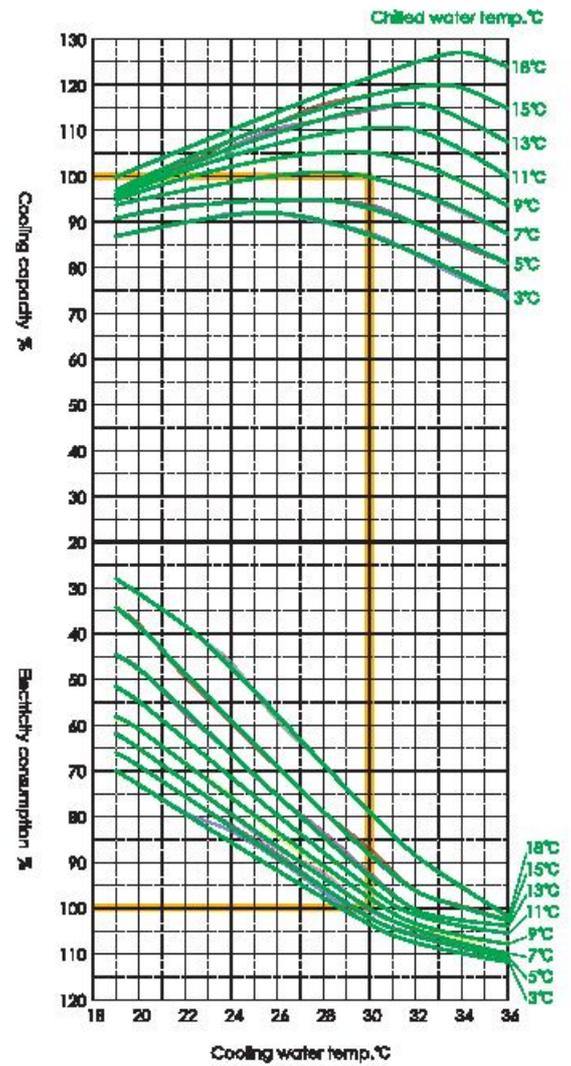
Notes:

1. Rated low temp. heating W. outlet/inlet temp: 15/20°C
2. Rated A/C heating W. outlet/inlet temp.: 45/40°C
(Highest permitted outlet temp. 60°C)
3. Please contact BROAD for solution for non-rated conditions

Performance Curves



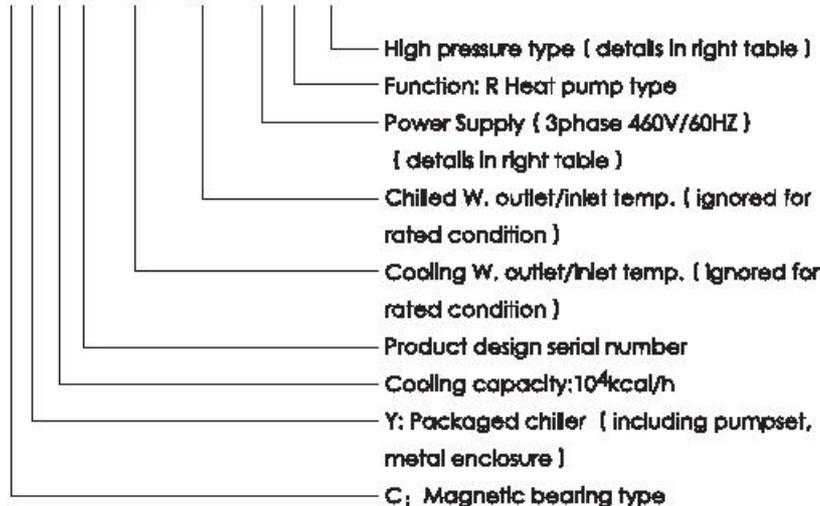
Model Selection Curves



Notes: Calculation method of COP
 $COP = \text{cooling capacity} \% / \text{electricity consumption} \% = \text{rated COP}$
 e.g. C90 rated COP is 6.2, chilled water temp. is 7°C, cooling water temp. is 26°C, then cooling capacity is 100%, electricity consumption is 87%, $COP = 100\% / 87\% \times 6.2 = 7.12$

Nomenclature

C Y 35 A - 35/29 - 6/14 - B3 - R - Fb



Codes 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

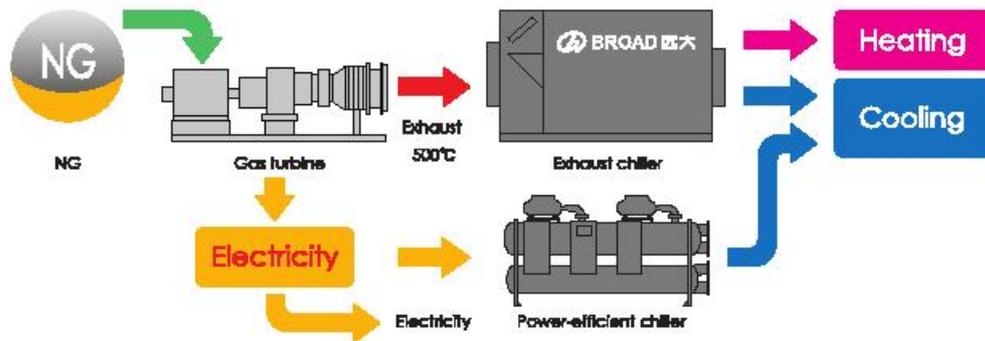
Codes for power supply:

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

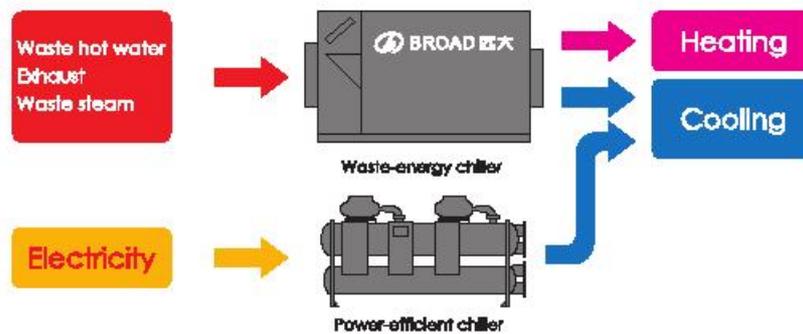
Combination of CHP and power-efficient chiller

Energy self-sufficient system



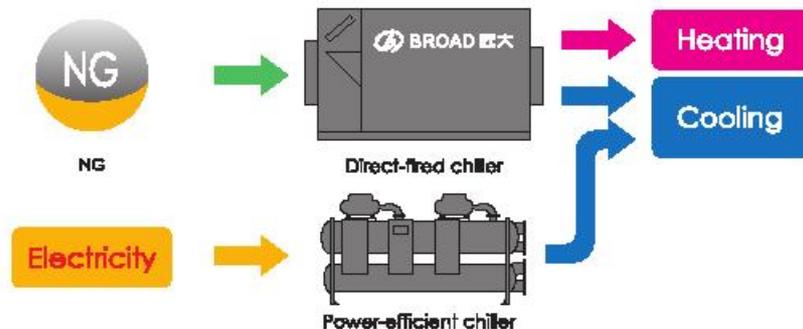
Combination of waste heat chiller and power-efficient chiller

Waste heat is priority
power-efficient chiller used
as supplementary



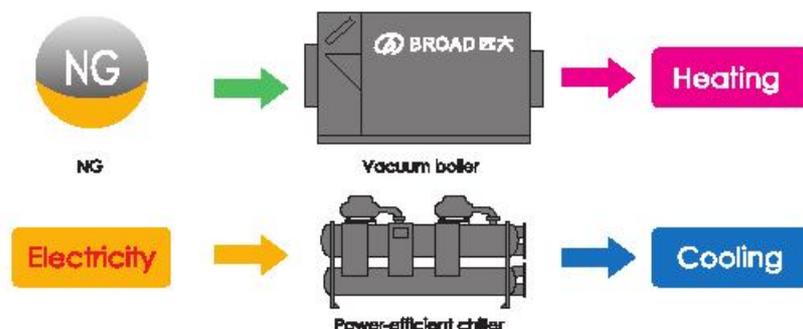
Combination of direct-fired chiller and power-efficient chiller

Daily shift or seasonal shift
according to different
energy prices



Combination of vacuum boiler and power-efficient chiller

Most applicable to places
with huge heating and
cooling load difference



Model Selection & Ordering

Function selection

- Cooling only type
- Heat pump type
- Combination of CHP and power-efficient chiller, Combination of waste heat chiller and power-efficient chiller, Combination of direct-fired chiller and power-efficient chiller, Combination of vacuum boiler and power-efficient chiller

Load selection

- Any building cooling load cannot be estimated according to 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

Flowrate selection

- BROAD designs the distribution system head according to its profound experiences
- BROAD is open for special head design

Pressure selection

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

Control

- BROAD power-efficient chillers are equipped with complete control function including internet monitoring
- If users 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 whole building)

Machine room location

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

Packaged selection

- Packaged power-efficient chiller includes chiller, water distribution system, metal enclosure as machine room, etc.
- If the packaged system is installed in the building, metal enclosure can be selected as an option
- Cooling tower is an option for International

Lead time

- ≤CY90: 4 months
- ≥CY180: 6 months

Warranty

Free warranty is to cover 12 months from commissioning or 18 months from shipment, whichever comes earlier

Technical specification is based upon

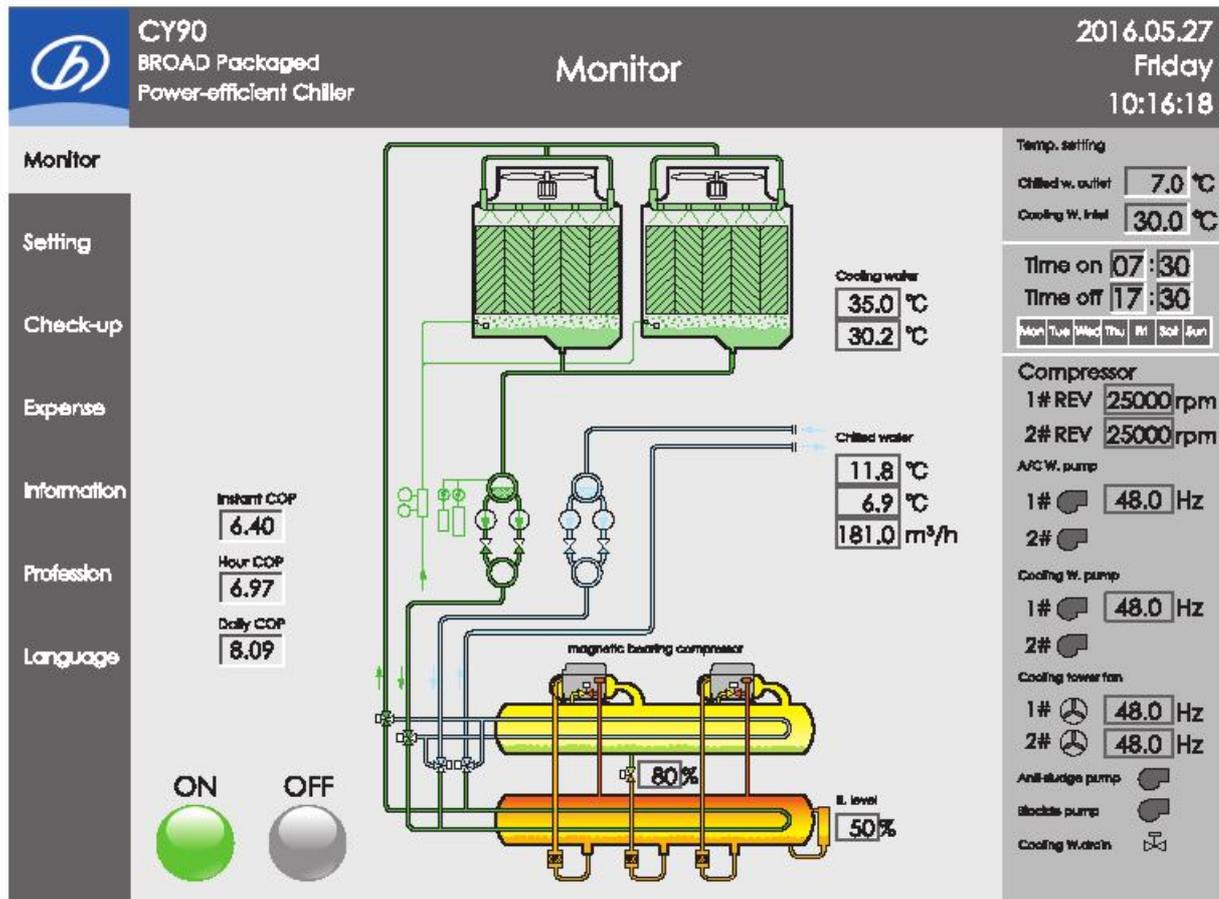
- GB 25131 Safety Requirements For Water Chillers (Heat Pump) Using The Vapor Compression Cycle
- GB 19577 Minimum Allowable Values Of Energy Efficiency And Energy Efficiency Grades For Water Chillers
- ANSI/AHRI 551-591 (SI) with Addendum Performance Rating of Water-Chilling and Heat Pump Water-Heating 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/T19409 Water-Source (Ground-Source) Heat Pumps

Supply Scope

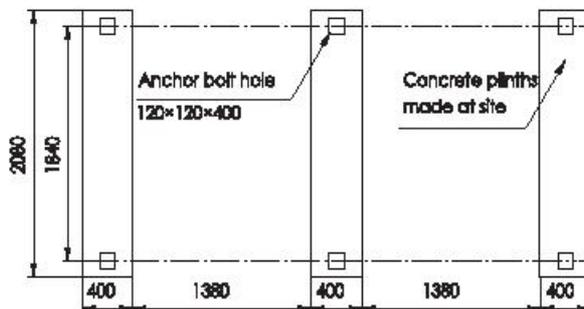
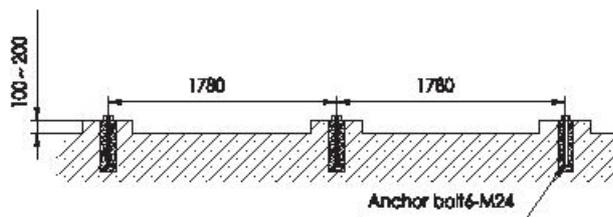
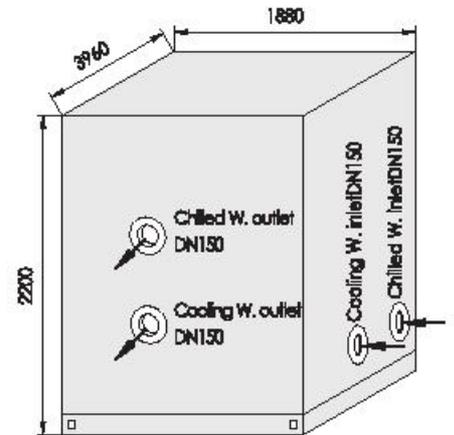
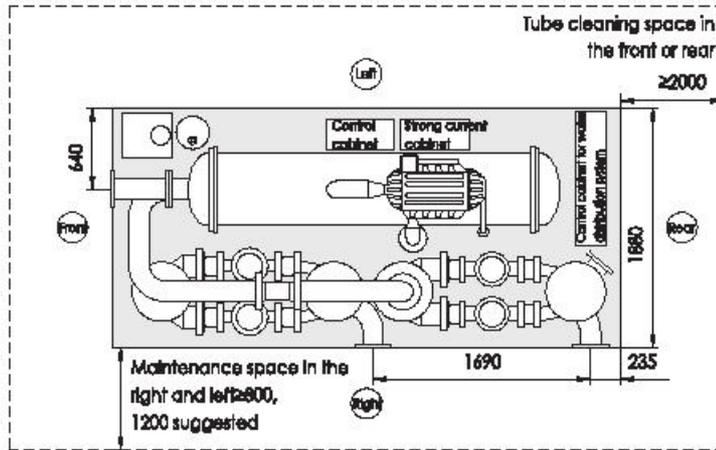
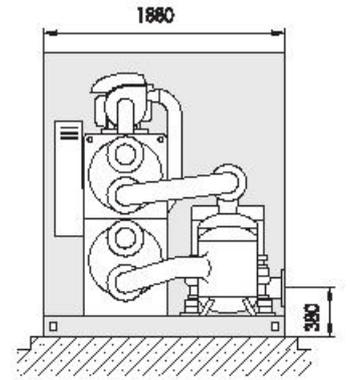
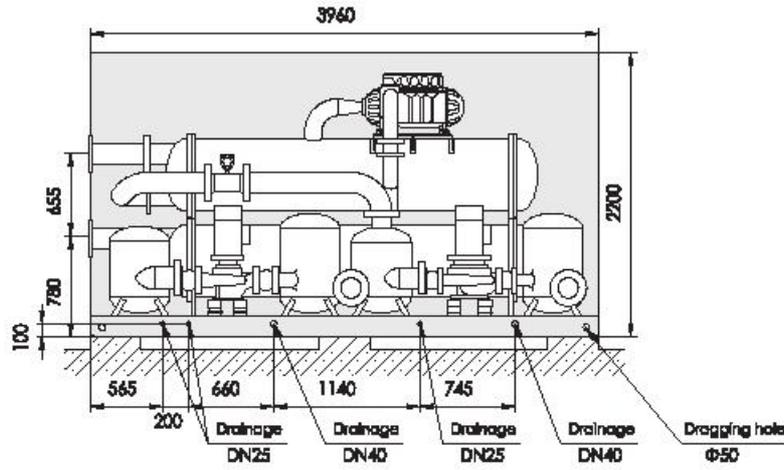
Products	Category	Item	Remarks
Chiller	Chiller	Heat exchanger	Include condenser, evaporator (cold insulation included)
		Compressor	Magnetic bearing, VFD centrifugal type ,oil free operation
		Throttling valve set	Include electronic expansion valve, drying filter, shut-off valve, regulating valve
		Check valve	Prevent refrigerant vapor flow-back to protect compressor
		Motor cooling device	Include drying filter, control valve set etc
	Control system	Low voltage control cabinet	Include low voltage electric parts, control board, PLC, etc
		Power control cabinet	Includes switch gear, instant, reactor etc
		Touch screen	For operation
		External control elements	Include temperature & pressure sensors, flow switches, solution level probes and actuators
		BMS Interface (optional)	Connect to BMS system through dry contact or serial communication
	Refrigerant	R134a	Used for cooling or heating
Pumpset system	Pumpset	A/C water pump	Two units
		Cooling water pump	Two units
		Accessories	Include zero resistance filter, check valve, soft connectors, valves and vibration isolator etc
		Piping *	Include all piping between pumpset and chiller
		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 in winter to avoid freeze
		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 (option)	Cooling tower	Include auto water makeup device, spraying device, anti-drifting device, fillings, water makeup and draining pipe /valve	
	Cooling tower fan	Cooling fan cable & control wiring not included	
Option	Enclosure	Enclosure	Include stainless steel panel, roof cover, structural frame, baseframe, as well as accessories

Notes: 1. * only for standard size. Special offer is available

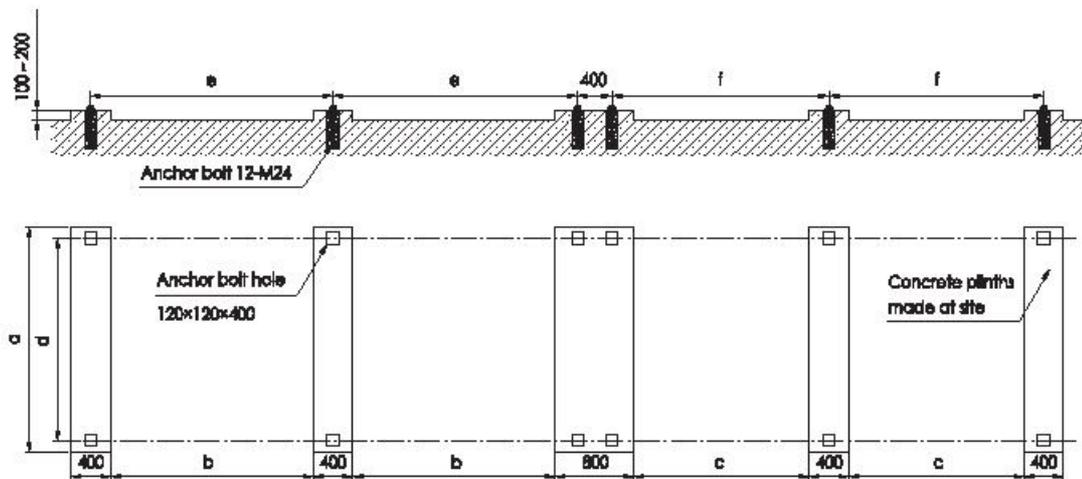
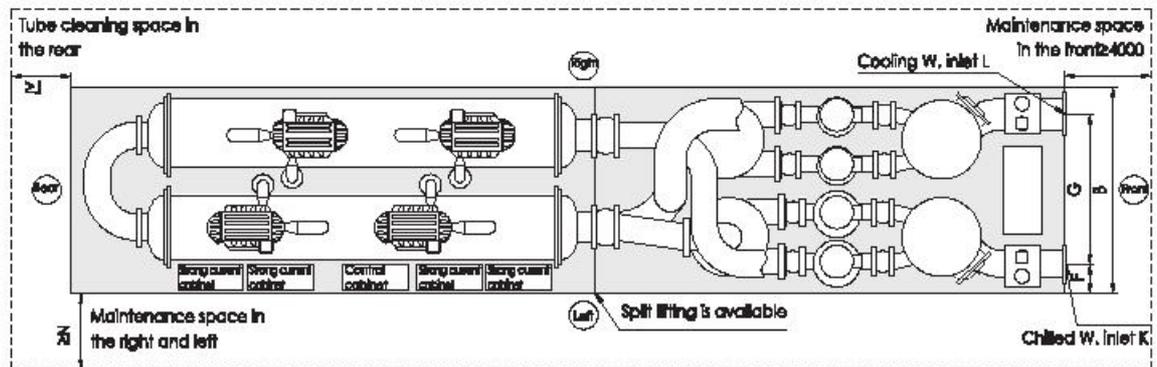
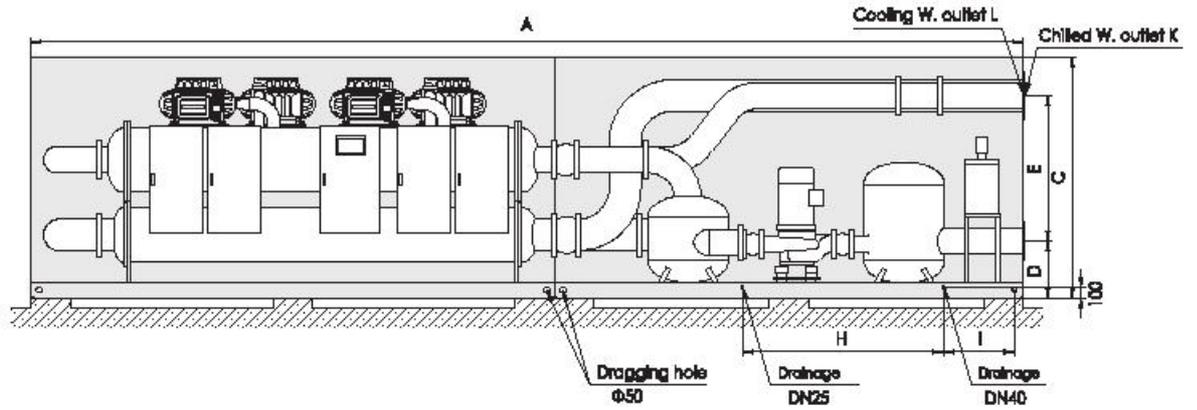
2. If the customer does not order cooling tower, a control signal linkage to cooling fan will be provided



CY35 Dimensions

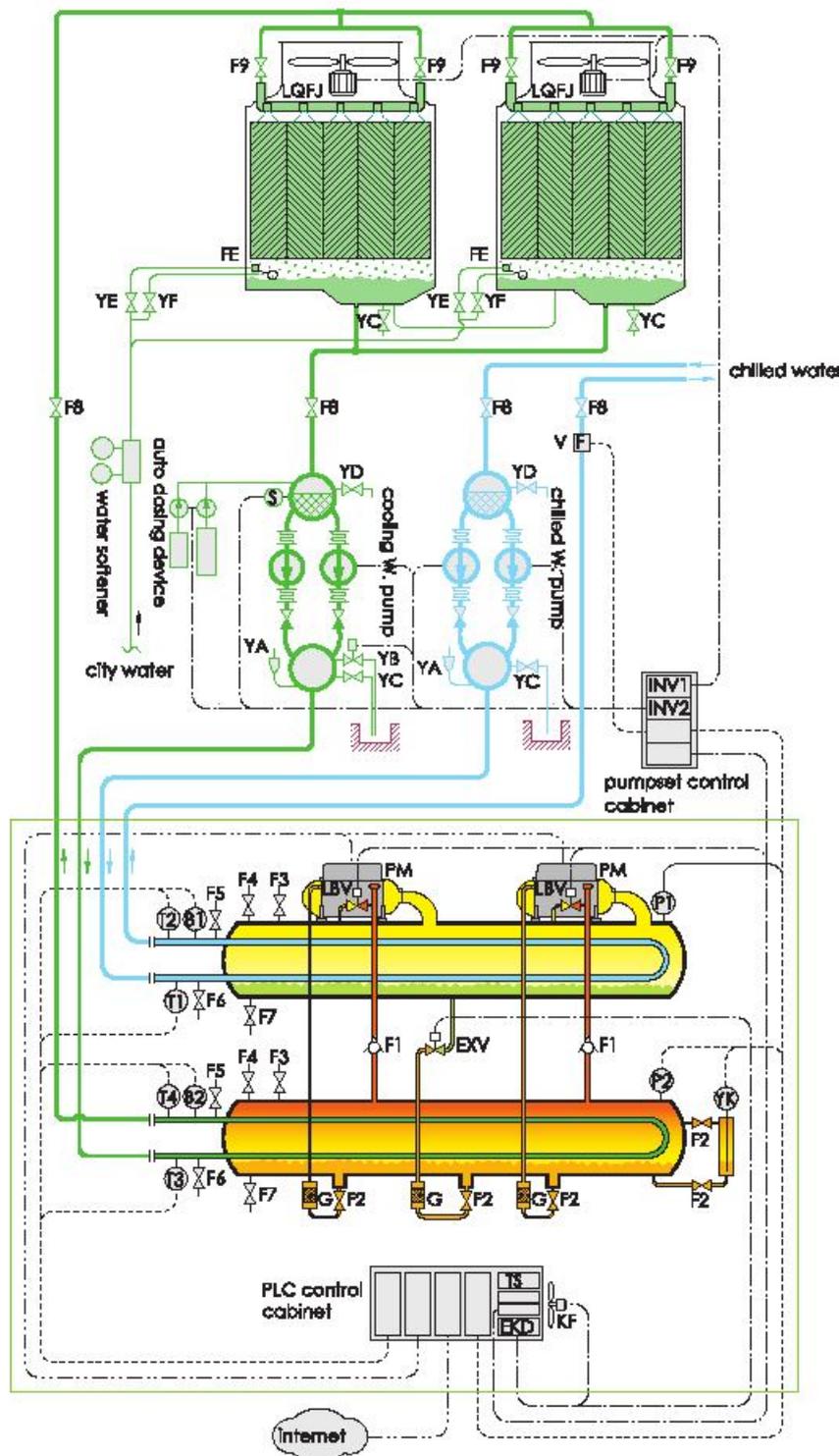


CY180、CY400Dimensions



Mode	A	B	C	D	E	F	G	H	I	J
CY180	10210	2130	2500	590	1510	300	1545	2885	820	4000
CY400	11410	2140	3000	625	1975	600	1000	2280	1095	5000
Mode	K	L	M	N	a	b	c	d	e	f
CY180	DN250	DN300	1600	1200	2330	2090	1765	2090	2490	2165
CY400	DN350	DN400	2000	1200	2360	2480	2025	2100	2880	2425

P&I Diagram



Control devices:

- EVD electronic throttle valve controller
- INV1 cooling tower fan inverter
- INV2 cooling water pump inverter
- PLC Programmable Logic Controller
- TS TS touch screen

Controlled objects:

- EXV electronic throttle valve
- KF control cabinet fan
- LBV load balancing valve
- LQFJ cooling tower fan
- PM compressor
- YB motor drain 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
- B1 chilled W. flow switch
- B2 cooling W. flow switch
- P1 evaporation pressure sensor
- P2 condensation pressure sensor
- S conductivity sensor
- V A/C W. flowmeter

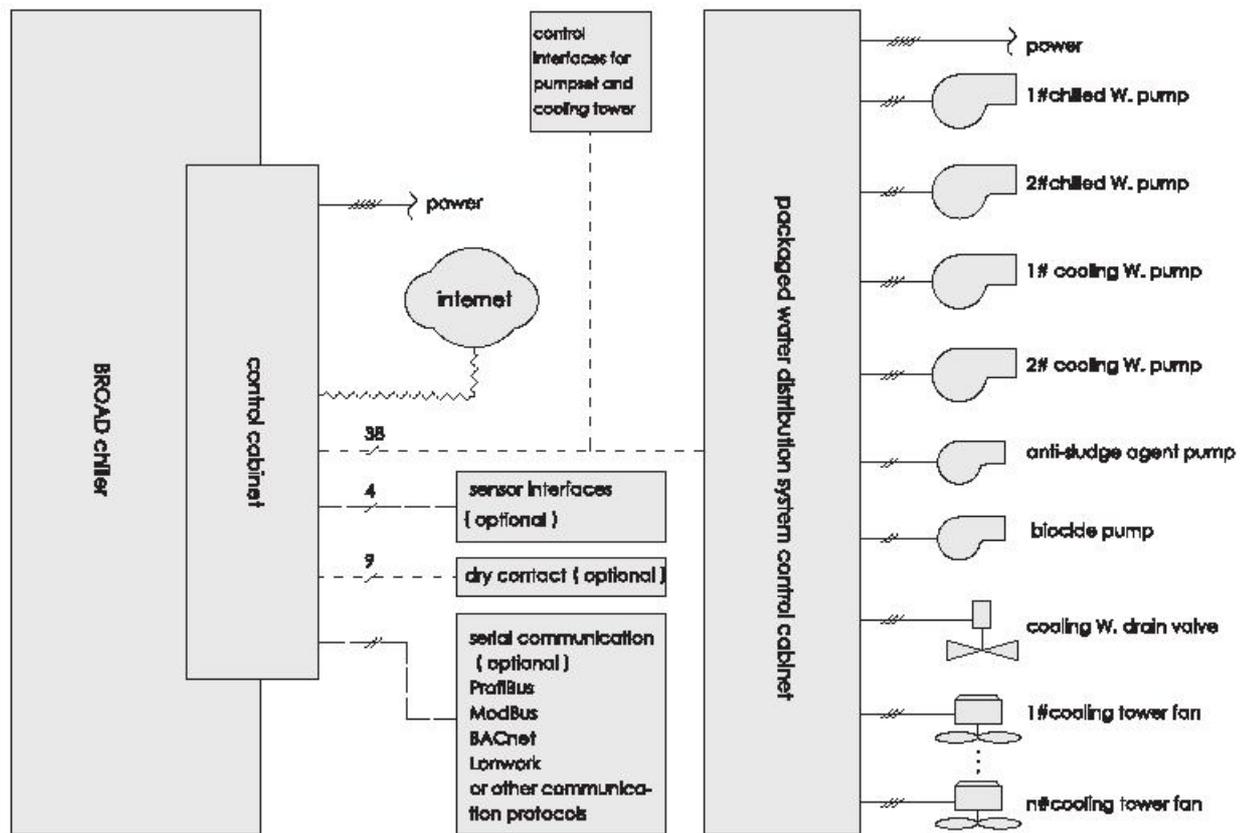
Others:

- F1 check valve
- F2 shutoff valve
- F3 safety valve
- F4 purge valve
- F5 vent valve
- F6 drain valve
- F7 refrigerant discharge valve
- F8 shutoff valve
- F9 balance 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
- YK level probe
- G dry filter

Notes:

- 1. Chiller scope
- 2. Line type:
 - actuator signal output
 - sensor signal input
 - communication

Control System

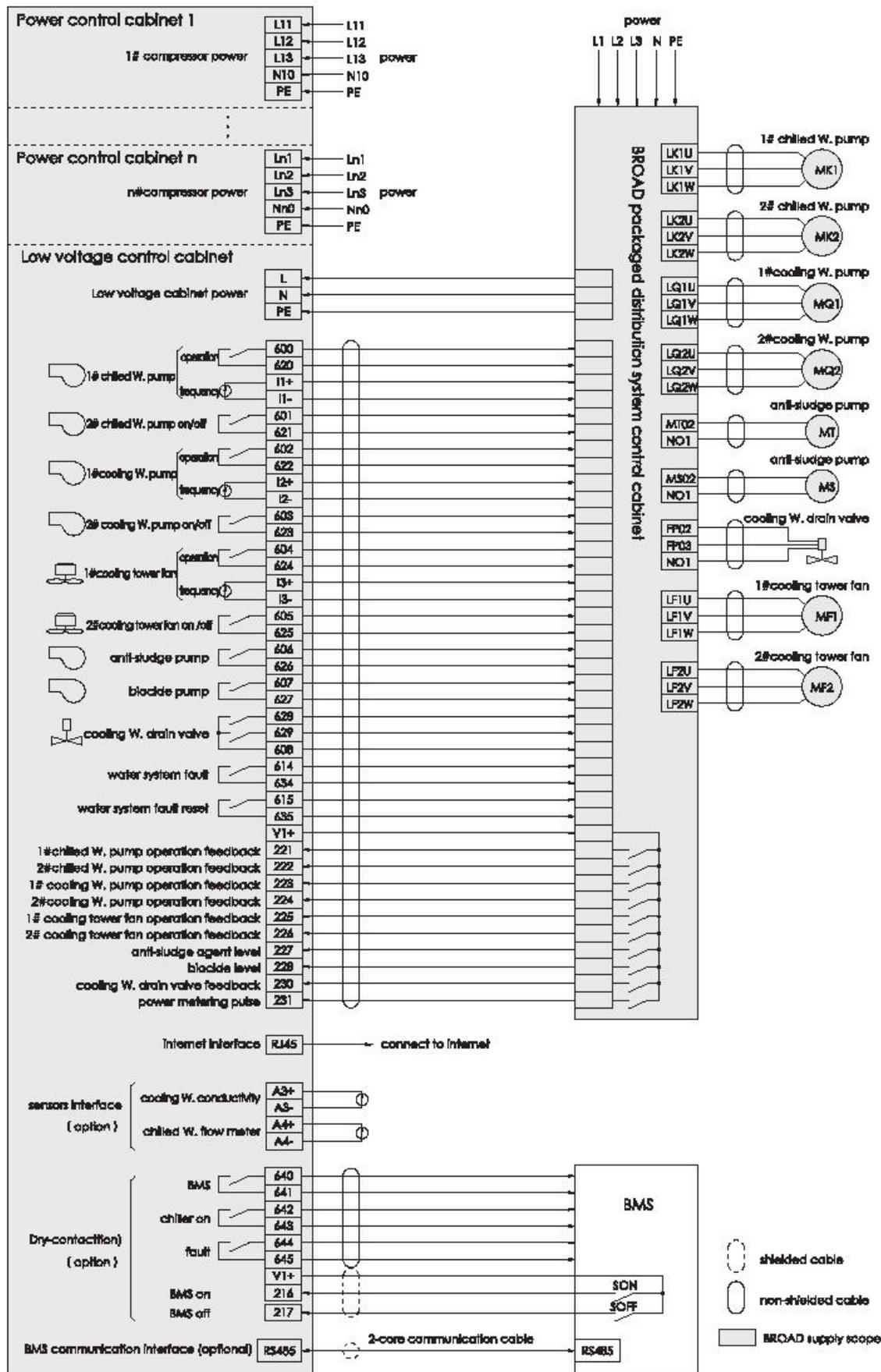


cable:
 power cable —————
 control wire - - - - -
 communication cable ·····
 internet connection ~~~~~

Notes:

1. BROAD packaged chiller control system includes interfaces for chiller, pumpset, cooling tower fan, internet, BMS etc
2. Pumpset and cooling tower control interface and water distribution system control cabinet are supplied with pumpset
3. BMS control interface includes serial communication and dry contact options. Serial communication interface can be ModBus, Profibus, BACnet or Lonwork
4. Only control interfaces will be provided to customers who only order chiller without pumpset and cooling tower

Exterior Wiring Diagram



- Notes:
1. Instead of a control cabinet, only control interfaces will be provided to customers who only order chiller without pumpset and cooling tower
 2. DC4-20mA signal is provided for frequency control and sensors

List of Control System Installation

Item	Object	Installation position and requirement	Material	Source	BROAD scope	Customer scope
chiller	Chiller power	Chiller control cabinet and water system	5-core cable	Customer	/	Cable installation and wiring inside chiller control cabinet
	Touch screen	Built-in	/	BROAD	/	/
	Ambient temperature sensor	Ventilation and avoid direct sunlight	3-core shielded cable(10m standard supply)	BROAD	Wiring inside chiller control cabinet	Temperature sensor installation and cable installation
	Network monitor	Built-in	Network cable	Customer	Wiring inside chiller control cabinet	Cable installation Wiring at building side
	BMS Interface(optional)	Chiller control cabinet	Communication 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	Customer	/	Grounding setup and wiring
pumpset	Main power supply connection	Water distribution system control cabinet	5-core cable	Customer	Wiring inside chiller control cabinet	Cable installation
	Wire between chiller and water distribution system cabinet	Between chiller and water distribution system cabinet	Cable supply as per package chiller	BROAD	Installation and wiring inside chiller control cabinet	/

Scope of Supply/Work

Category	Item	BROAD	Customer	Remarks
Transportation & Location	Factory to port		√	BROAD can arrange transportation upon request
	Jobsite settlement (eg. erection)		√	BROAD provides free guidance
Electric engineering	Power supply to enclosure		√	3 phase, 4 wires
	Internet connection	√		Network cable to the enclosure is to be provided by customer
	Grounding		√	
Construction & Installation	Foundation		√	
	Pipe connection between chiller and pumpset for order with pumpset	√		A crane must be provided by customer
	External piping installation		√	Include chilled water pipes, water make-up and drain pipes
	Chiller insulation and chilled water pumps insulation	√		Factory-mounted
	Piping insulation in enclosure	√		For order with pumpset
	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
Operation & Maintenance	Operator training on site	√		BROAD provides free professional site training; the customer pays the accommodations and transportation for BROAD engineer
	Regular maintenance	√		Service contract can be signed after the warranty period

Machine Room Construction

Machine Room

BROAD Packaged Power-efficient Chiller can be placed outdoor directly, no additional construction of machine room. Make the foundation in accordance with the drawings

Foundation

- Please refer to dimension drawings for plinth dimensions
- Load capacity:
 - ①The machine room foundation load is recommended as 1.5 times of the operation weight
 - ②Make sure that the foundation is level without sinking or overload (for rooftop installation)
 - ③Chiller load should be evenly distributed on the contact surface between the frame base rolling steel and the plinth
- Anchor bolts:
 - ①Anchor bolts must be pre-installed in foundation per dimension drawings
 - ②Place the chiller on the foundation directly and fix it with anchor bolts

Machine room built by customer

- Ventilation: poor ventilation leads to high humidity in the machine room, which may erode the unit. Please ventilate 3 times machine rooms every hour
- Drainage:
 - ①Chiller foundation must be on a high level in the machine room
 - ②All discharge pipes and drainpipes must be visible above the drainage
 - ③Machine room in basement must be built above a water ditch, which is equipped with an auto level-controlled submerged pump
- Temperature: machine room temperature must be controlled 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 machine room
- Humidity: machine room humidity must be lower than 85%. Higher humidity may impair insulation of electrical components

Transportation Tips

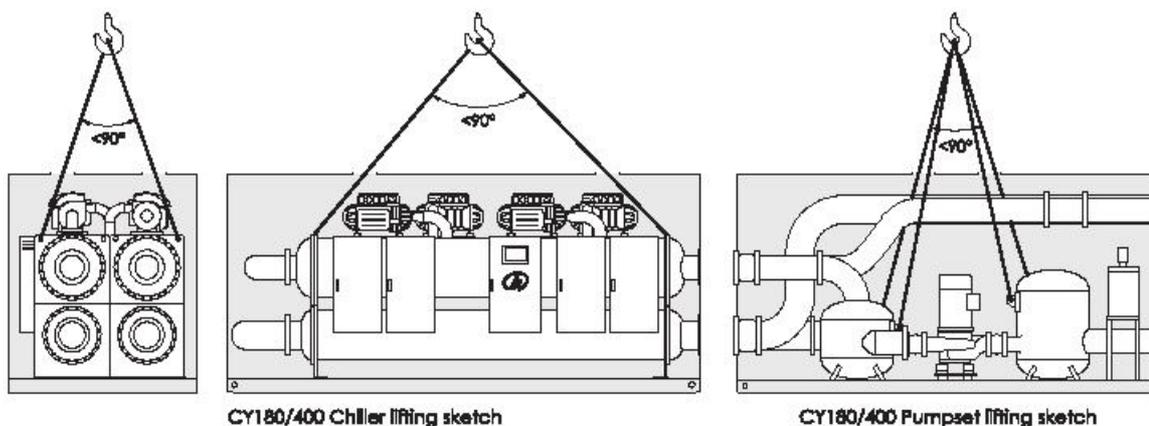
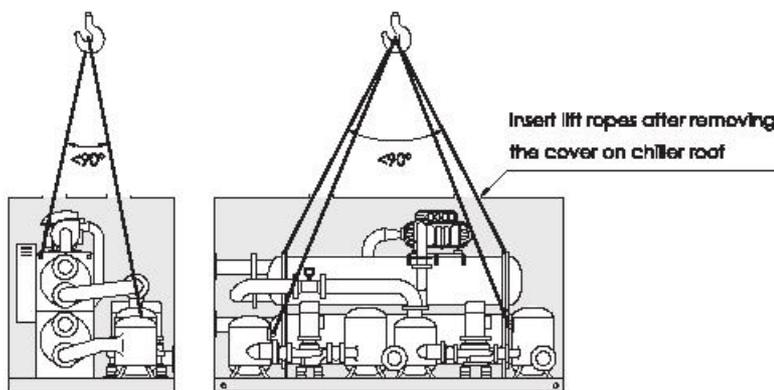
Shipping Status

- CY35 & CY90 are to be shipped in one piece, while CY180 & CY400 in two pieces
- All equipment can be containerized as per *Container Arrangement Reference*
- BROAD can arrange transportation and insurance on behalf of customers. If customers manage it by themselves, please refer to BROAD Chiller Packing & Transportation Regulations for container arrangement in advance, so as to make sure safety transportation

Lifting & Leveling Tips

1. Before the chiller is positioned, concrete foundation plinths must be molded and leveled. The level degree is $<1.5\%$, height of foundation is 100–200mm. Then fix the chiller with anchor bolts on the foundation
 2. Lifting must be done by qualified lifting companies that are properly insured
 3. The crane must be supported by crossies and firm foundation to avoid sinking. Check the crane steel ropes and hoods 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, it should be kept for a little while. Lift the chiller slowly if everything is fine
 4. If limited by loading height, loading angle or machine room access, the professional lifting company must make special plan with BROAD team together to avoid any risk
 5. The landing of the chiller must be with care. Crash landing is strictly forbidden
 6. When moving the chiller, only round steels or thick steel tubes can be used as rollers instead of wooden sticks.
- Only drag the dragging hole on the rolling steel. Do not place forces on other part of the chiller. Lift the unit first with jacks under the rolling steel before rigging
7. After chiller positioning, please adjust leveling and lay thin steel plate where it is uneven to guarantee compact contact between the chiller and base. Take tube sheet as the leveling point and make front/rear and left/right leveling (check level height of every part by acrylic tube). It should be leveled within 1% both lengthwise and sidewise. Leveling must be done within 2 hours after locating the chiller; otherwise the chiller base will be damaged
 8. The chiller must be located levelly and its steel frame bases must match the plinth, the weight of the chiller must be evenly balanced on the plinth
 9. The chiller should be protected by full time personnel during transportation & installation. No access allowed for unauthorized persons. Valves of the chiller are forbidden to be screwed. If the machine room is still under construction, precautions are essential to avoid chiller get damaged or dirty. No scraping the paint or insulation layer

Sketch of lifting





BROAD power-efficient chillers and packaged water distribution system are ISO, CE, ETL, ASME certified



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

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