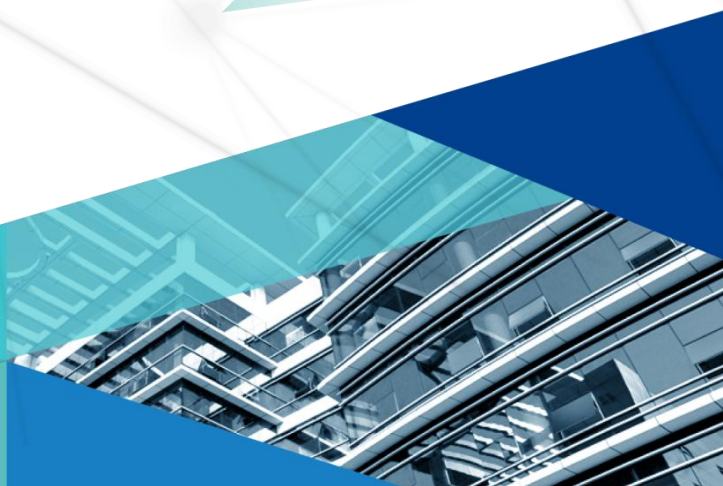
GREE
Change for life

Service Manual

Commercial Air Conditioners

LMP Series Air-Cooled Screw (Heat Pumps) Chiller



Contents

Ⅰ PRODUCT

1. Product

1.1 Product Lineup

■ Heat pump

Product Model	Nominal Capacity(kW/Ton)	Power	Refrigerant	Pictures
LMPA30JD4E/Nb-M	315/90	380V 3Ph 50Hz	R134a	 Picture is for reference and is subject to change without prior
LMPB30JD3E/Nb-M	340/97			
LMPA40JE2E/Nb-M	400/114			
LMPB40JE1E/Nb-M	445/127			
LMPA50LE8E/Nb-M	505/144			
LMPB50LE7E/Nb-M	550/156			
LMPA33LF6E/Nb-M	640/182			
LMPB33LF5E/Nb-M	690/196			
LMPB43LG4E/Nb-M	730/208			
LMPB43LG3E/Nb-M	790/225			
LMPA44LF2E/Nb-M	825/235			
LMPB44LF1E/Nb-M	900/256			
LMPB54NG2E/Nb-M	1000/284			
LMPB50LE750LE7E/Nb-M	1120/318			
LMPB33LF550LE7E/Nb-M	1240/353			
LMPB33LF533LF5E/Nb-M	1380/392			
LMPB33LF543LG3E/Nb-M	1480/421			
LMPB43LG343LG3E/Nb-M	1580/449			

Note:1Ton =12000Btu/h = 3.516Kw

1.2 Nomenclature

①LMPA30JD4E/Nb-M

LM	P	B	3	0	JD4	E	/Nb	-M
1	2	3	4	5	6	7	8	9

NO.	Description	Options
1	Unit series	LM: LM:Screw Air-Cooled Chiller
2	P	P: Heat pump E: Cooling only
3	Condenser type	Condenser Type:A,B,C,D
4、5	Number of Condensers	Number of Condensers
6	Evaporator	Type of Shell Tube Evaporator
7	Economy Function	Default:No Economizer E:With Economizer
8	Refrigerant	Default: R22 Nb:R134a

9	Power Supply	M: 380V 3Ph 50Hz

②LMPB33LF533LF5E/Nb-M

LM	P	B	3	3	LF5	3	3	LF5	E	/Nb	-M
1	2	3	4	5	6	7	8	9	10	11	12

NO.	Description	Options
1	Unit series	LM: LM:Screw Air-Cooled Chiller
2	P	P: Heat pump E: Cooling only
3	Condenser type	Condenser Type:A,B,C,D
4、5、7、8	Number of Condensers	Number of Condensers
6、9	Evaporator	Type of Shell Tube Evaporator
10	Economy Function	Default:No Economizer E:With Economizer
11	Refrigerant	Default: R22 Nb:R134a
12	Power Supply	M: 380V 3Ph 50Hz

1.3 Features

1.3.1 General

GREE modular air-cooled screw (heat pumps) chillers are such equipments which can be integrated together with the air handling units such as air-cooled packaged units and hydronic air handling units etc into various large-sized central air conditioning systems to provide chilled water in summer and hot water in winter.

These air-cooled systems do not require the cooling tower, cooling water pump, and therefore are especially applicable to where there is insufficient water source. They are not restricted to be installed in the machine room but instead at the rooftop and outdoor floor etc. They are widely used for newly or refitted large and small industrial or civil buildings, such as hotels, apartments, restaurants, office buildings, shopping malls, cinemas, theaters, stadiums, hospitals, workshops, and especially where there are high requirements on noise and environment, or it is not allowed for the installation of boilers, or it is inconvenient for the installation of the cooling tower etc.

Composed of the high-efficiency dual-screw compressor, the low-noise axial flow fan, the high-accuracy electronic expansion valve and the advanced control system, GREE modular air-cooled screw (heat pump) chillers are the embodiment of GREE years' design experience and multiple advanced technical achievements.

1.3.2 Features

(1) Modular Design:

Modules of difference model and different cooling capacity can be combined together so as to extent the total cooling capacity. Any module can be taken as the master. That is, when one module fails, other modules will still work normally. Each compressor will operate based on the equilibrium accumulative runtime so as to extend their service life, lower the starting current, and reduce the impact fact upon the electric network. The modular design enables the compact structure, which will facilitate the transportation and field installation.

(2) High Efficiency:

The high-efficiency dual-screw compressors can effectively eliminate leakage, and improve the operation performance. Moreover, these compressors can provide direct linkage with the motor and stepless control of the guide vane. Thanks to the hi-quality system and reliable control, the unit will run in high efficiency no matter at full load or at part load.

The world-known hi-accuracy electronic expansion valves are used to dynamically control the super-heating degree at the outlet of the evaporator, enhance the heat exchange efficiency and realize high-accuracy water temperature control.

The GREE patented defrosting control logics are capable to judge when to perform defrosting and when not. Therefore, it will avoid unnecessary heat loss, and improve the stability of the hot water temperature and heating capacity.

Circulating design of economizer: auxiliary refrigerant of economizer conducts heat exchange with main refrigerant, to improve condenser depression of refrigerant when the main refrigerant returns to the expanding valve inlet, and improve liquid seal effect, ensure refrigerant entering into main throttle valve (electronic expanding valve) is in liquid state; at the same time the auxiliary refrigerant directly gets into compressor after it is gasified, which will increase inspiratory capacity of compressor. Such design can help to increase cooling capacity for 10%.

Flooded shell and tube design: adopt TURBO-BII ultra high efficiency evaporator that the evaporating pipe is soaking in liquid refrigerant for improving heat transfer capacity and cooling efficiency, the evaporating temperature is higher than 5.5^{o}C; chilled water pass through the tube for reducing flowage pressure loss of water side and reduce energy consumption of water pump. This evaporator works with the high-performance and reliable special screw compressor, which can greatly improve cooling capacity and energy efficiency ratio of unit.

V shape condenser design: adopt V shape layout with the best angle and the best air volume for more even distribution of air flow; adopt ripple fenestration aluminous condensing fin for higher heat exchange efficiency.

(3) High Reliability:

As a specialized air conditioner manufacturer, GREE is always dedicated to technical reform and innovation, including: selecting the high-quality parts and components, stringently control each manufacturing procedures, adopting the finite element calculation method, further optimize the key parts and component to prevent pipelines breaking during transport.

Each unit will undergo strict factory tests to guarantee their expected quality and performance. EMC test will ensure each unit is to be of high immunity from interference. Reliable technology for cooling the motor and oil return technology will lead the compressor to run normally and stably.

Oil supply design of oil pump *(optional): the oil pump will conduct auxiliary oil return under low differential pressure, which can effectively prevent faulted oil circulation of compressor when the differential pressure is insufficient, and improve reliability of compressor.

Ejecting oil return design: when the unit operates under bad oil return work condition, the ejector will be automatically started up to ensure reliable oil return of unit, which can solve the oil return problem of

flooded unit.

Ultralow temperature cooling design *(optional): Apply control technology of inverter fan unit to conduct reliable cooling under the ambient temperature of -20^{o}C.

(4) Quiet Operation, Long Service Life:

Compared with other type of compressor under the same cooling load, it has few movable components, smaller rotating torque, lower noise and vibration and higher reliability and efficiency.

The compressor is composed of the high-efficiency double rotary gears designed with a service life of 100,000 hours. The dual shafts adopt the accurate positioning at both the axial and radial directions which will result in fast and stable compressing speed, low pressure fluctuation, low vibration and reliable operation.

Low noise axial fan design: adopt the plastic fan blade made of high-efficiency low noise fiber glass with improvement of 20% and streamline ail foil design that the fan can be driven directly, which has lower noise than general fan units.

Sound insulation and noise reduction design for fan *(optional): sound insulation cover is specially designed for the fan that can further reduce the noise.

Patent technology of sound insulation and noise reduction for compressor *(optional): according to the test and analysis of frequency spectrum for compressor, the sound insulation cover is specially designed for compressor to absorb the noise in different frequency spectrum by adopting multiple sound insulation material and sound insulation board.

(5) Easy Installation, Operation and Maintenance:

Liquid injection is used for the motor of the compressor so that the user is unnecessary to prepare the cooling or ventilating devices in the machine room. The oil cooler is not required as oil is cooled by the refrigerant circuit. Moreover, the unit has been lubricated in the factory and can be put into use only after piping and wiring work are finished.

On-site seamless splice technology: can conduct on-site splicing for over 2 modules according to requirement of users, which can satisfy different requirement of cooling capacity.

Built-in water conservation module *(optional): the unit can set a built-in water conservation module according to requirement of users. The water conservation module has passed the installation test that its mating parts are highly matched with the unit, therefore there is no need to conduct separate design, model selection and purchase for the water pump.

The display control can simplify greatly the operation, show the alarms, and realize the powerful connection (RS485 interface, allow the unit to be integrated into the building management system).

(6) Advanced Control:

The user-friendly control panel can display the operating parameters clearly, which will simplify greatly the operation. Through the press buttons on the control, it is available to view the leaving/entering water temperature, ambient temperature, discharge temperature, suction temperature, high pressure, low pressure, current of the compressor etc.

Three start/stop modes are available, manual, timing and remote control. The control will calculate the load variation based on the water temperature difference and water temperature change rate so as to obtain the highest energy utilization efficiency.

The system has complete protections. The password protection can prevent disoperation. Others

include: high pressure protection, low pressure protection, high discharge protection, compressor overload protection, internal protection of the compressor, compressor over-current protection, phase reverse/loss protection, low oil level protection, water flow switch protection, low flow alarm, system differential pressure protection, high oil pressure difference protection, fan over-current protection, freeze protection, sensor failure protection, low discharge superheating degree protection etc.

Programmed with C++, the control system runs under the Windows operation system with high operation efficiency. The table-structured display mode is used to show the running status of the unit. International RS485 communication is available and each computer port is allowed to connect up to 255 display controls which can control the operation of the unit, including:

Self-check. It helps the servicemen who are not familiar with the unit, the communication protocol and the unit model etc get a quick know of the whole air conditioning system and then realize the monitoring to the unit.

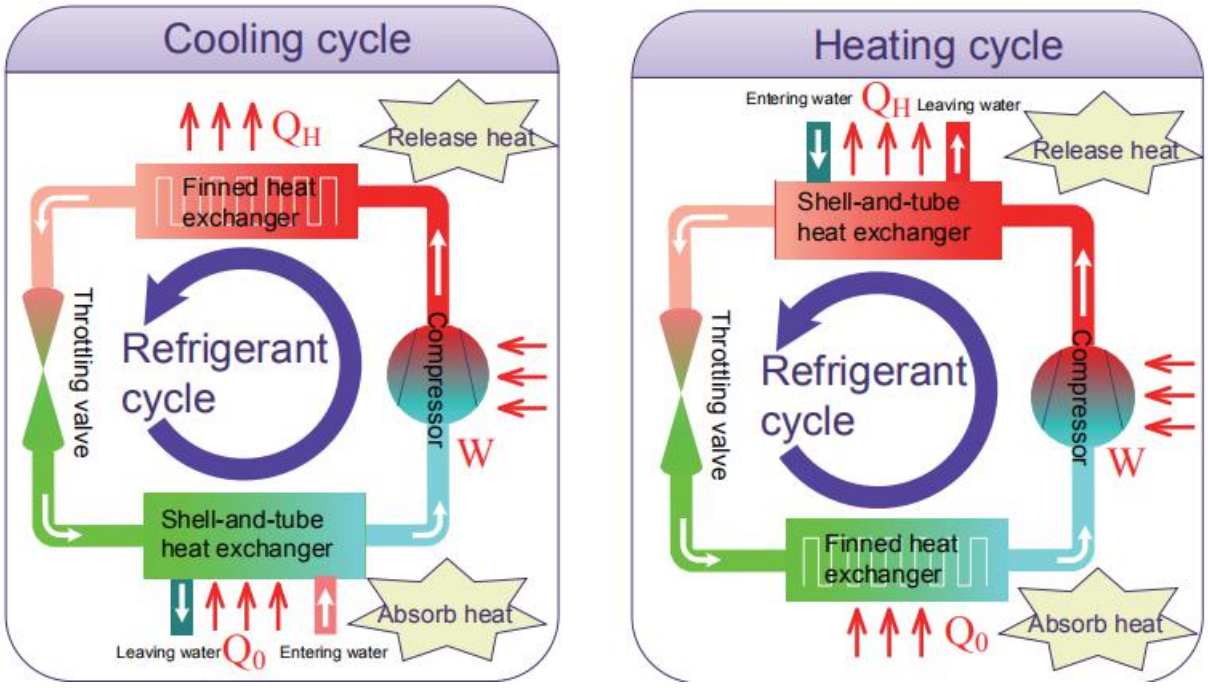
Viewing the running status. The servicemen are allowed to view the current running status and error records which then will be taken as the basis for service and maintenance.

Remote control: setting of the operating parameters of the air conditioning unit is allowed through the remote control but instead staying in the machine room in person at all times.

Timing control. Timing control is allowed through the BMS in accordance with the service time and operating requirements on the air conditioning unit by the user. For instance, if the service period of the air conditioning system is from 8:00-17:00 for an office building, the unit can automatically operate in this expected service period everyday as long as the timing control is set through the remote control software.

1.4 Operation Principles

1.4.1 Flowchart Diagram



1.4.2 Interpretation of the Flowchart

Refrigeration Cycle(Cooling):

Low-pressure, superheated refrigeration vapor in the evaporator is drawn into the compressor where it will be compressed to high-temp and high-pressure superheated vapor. Next, it will go to the condenser (air-cooled heat exchanger) to transfer heat with ambient air and turn to saturated or sub-cooled refrigeration liquid. The condensed liquid will be cooled again via fins and further cooled by the economizer. Then, it will flow to the expansion valve with its pressure to be lowered and then flow back to the evaporator (flood evaporator) where it will transfer heat with the secondary refrigerant-water and turn to refrigerant vapor. After that, it will be drawn back into the compressor and this cycle will be repeated again and again. The resultant chilled water will be sent to the air conditioning unit.

Refrigeration Cycle(Heating):

Low-pressure, superheated refrigeration vapor in the evaporator is drawn into the compressor where it will be compressed to high-temp and high-pressure superheated vapor. Next, it will go to the condenser (flood evaporator) to transfer heat with the secondary refrigerant-water and turn to saturated or sub-cooled refrigeration liquid. The condensed liquid will be further cooled again by the economizer. Then, it will flow to the expansion valve with its pressure to be lowered and then flow back to the evaporator(air-cooled heat exchanger) to transfer heat with ambient air and turn to refrigerant vapor. After that, it will be drawn back into the compressor and this cycle will be repeated again and again. The resultant chilled water will be sent to the air conditioning unit.

1.5 Product Data

1.5.1 Normal Working Conditions

Model			LMPA30JD4E/Nb-M	LMPB30JD3E/Nb-M	LMPA40JE2E/Nb-M	LMPB40JE1E/Nb-M
Cooling capacity		kW	315	340	400	445
		RT	90	97	114	127
Heating capacity		kW	320	335	410	430
		RT	91	95	117	122
Power input	cooling	kW	98	106	124	138
	Heating	kW	99	104	126	134
EER		W/W	3.21	3.21	3.23	3.22
COP		W/W	3.23	3.22	3.25	3.21
Rated power input		kW	127	138	161	179
Capacity steps			50%~100%			
Power supply			380V 3N~ 50Hz			
Operating control			Automatic microcomputer control, operating status display, error alarms			
Safety protection			High pressure protection, low pressure protection, compressor over-load protection, compressor internal protection, compressor over-current protection, phase loss/reversal protection, low oil level protection, water flow switch protection, low flow alarm, differential pressure protection, high oil pressure difference protection, fan over-current protection, freeze protection, sensor protection, low discharge superheating degree protection.			
Compressor	Type	-	Semi-hermetic screw compressor			
	Starting model	-	Star Delta Start			
	Quantity	-	1			
Refrigerant			R134a			
Water side heat exchanger	Water flow	m³/h	55	60.2	72.2	80.8
		GPM	243	265	318	356
	Pressure loss	kPa	≤35	≤35	≤45	≤45
		ft.wg	≤11.7	≤11.7	≤15.1	≤15.1
	Heat exchanger type		Flooded Evaporator			
	Max.bearing	Mpa	1			
	Inlet/outlet tube	mm	DN100	DN100	DN125	DN125
	connection mode		Flanged connection			
Air side heat exchanger	Heat exchanger type		Aluminum Fin-copper Tube			
	Fan rated power	kW	1.5×6	1.8×6	1.5×8	1.8×8

Outline dimensions	Width	mm	3670	3670	4890	4890
	Depth	mm	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550
Package dimensions	Width	mm	3820	3820	5040	5040
	Depth	mm	2330	2330	2330	2330
	Height	mm	2550	2550	2550	2550
Net weight		kg	4570	4600	5435	5500
Gross weight		kg	4610	4640	5475	5540
Operating weight		kg	4661	4692	5544	5610
Loading quantity	40'GP/40'HQ	set	0/1	0/1	0/1	0/1

Model			LMPA50LE8E/Nb-M	LMPB50LE7E/Nb-M	LMPA33LF6E/Nb-M	LMPB33LF5E/Nb-M
Cooling capacity		kW	505	550	640	690
		RT	144	156	182	196
Heating capacity		kW	520	545	645	685
		RT	148	155	183	195
Power input	cooling	kW	157	169	200	215
	Heating	kW	160	169	198	211
EER		W/W	3.22	3.25	3.20	3.21
COP		W/W	3.25	3.22	3.26	3.25
Rated power input		kW	204	220	260	280
Capacity steps			50%~100%		25%~100%	
Power supply			380V 3N~ 50Hz			
Operating control			Automatic microcomputer control, operating status display, error alarms			
Safety protection			High pressure protection, low pressure protection, compressor over-load protection, compressor internal protection, compressor over-current protection, phase loss/reversal protection, low oil level protection, water flow switch protection, low flow alarm, differential pressure protection, high oil pressure difference protection, fan over-current protection, freeze protection, sensor protection, low discharge superheating degree protection.			
Compressor	Type	-	Semi-hermetic screw compressor			
	Starting model	-	Star Delta Start			
	Quantity	-	1		2	
Refrigerant			R134a			
Water side heat exchanger	Water flow	m^3/h	89.4	99.8	111.8	120.4
		GPM	394	440	493	531
	Pressure loss	kPa	≤45	≤45	≤55	≤55
		ft.wg	≤15.1	≤15.1	≤18.4	≤18.4
	Heat exchanger type		Flooded Evaporator			

	Max.bearing	Mpa	1			
	Inlet/outlet tube	mm	DN125	DN125	DN150	DN150
	connection mode		Flanged connection			
Air side heat exchanger	Heat exchanger type		Aluminum Fin-copper Tube			
	Fan rated power	kW	1.5×10	1.8×10	1.5×12	1.8×12
Outline dimensions	Width	mm	6110	6110	7340	7340
	Depth	mm	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550
Package dimensions	Width	mm	6260	6260	7490	7490
	Depth	mm	2330	2330	2330	2330
	Height	mm	2550	2550	2550	2550
Net weight		kg	6455	6590	8550	8410
Gross weight		kg	6495	6630	8590	8450
Operating weight		kg	6584	6722	8721	8578
Loading quantity	40'GP/40'HQ	set	0/1	0/1	0/1	0/1

Model			LMPB43LG4E/Nb-M	LMPB43LG3E/Nb-M	LMPA44LF2E/Nb-M	LMPB44LF1E/Nb-M	LMPB54NG2E/Nb-M
Cooling capacity		kW	730	790	825	900	1000
		RT	208	225	235	256	284
Heating capacity		kW	755	785	815	890	980
		RT	215	223	232	253	279
Power input	cooling	kW	225	245	255	279	308
	Heating	kW	232	243	250	276	303
EER		W/W	3.24	3.22	3.24	3.23	3.25
COP		W/W	3.25	3.23	3.26	3.22	3.23
Rated power input		kW	293	319	332	363	400
Capacity steps			25%~100%				
Power supply			380V 3N~ 50Hz				
Operating control			Automatic microcomputer control, operating status display, error alarms				
Safety protection			High pressure protection, low pressure protection, compressor over-load protection, compressor internal protection, compressor over-current protection, phase loss/reversal protection, low oil level protection, water flow switch protection, low flow alarm, differential pressure protection, high oil pressure difference protection, fan over-current protection, freeze protection, sensor protection, low discharge superheating degree protection.				
Compressor	Type	-	Semi-hermetic screw compressor				
	Starting model	-	Star Delta Start				

	Quantity	-	2				
Refrigerant			R134a				
Water side heat exchanger	Water flow	m³/h	129	141	147.9	163.4	180.6
		GPM	569	622	652	720	796
	Pressure loss	kPa	≤55	≤55	≤65	≤60	≤70
		ft.wg	≤18.4	≤18.4	≤21.7	≤20.1	≤23.4
	Heat exchanger type		Flooded Evaporator				
	Max.bearing	Mpa	1				
	Inlet/outlet tube	mm	DN150	DN150	DN150	DN150	DN200
	connection mode		Flanged connection				
Air side heat exchanger	Heat exchanger type		Aluminum Fin-copper Tube				
	Fan rated power	kW	1.5×14	1.8×14	1.5×16	1.8×16	1.8×18
Outline dimensions	Width	mm	8560	8560	9780	9780	11000
	Depth	mm	2250	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550	2550
Package dimensions	Width	mm	8710	8710	9930	9930	11150
	Depth	mm	2330	2330	2330	2330	2330
	Height	mm	2550	2550	2550	2550	2550
Net weight		kg	9900	10075	10910	11110	12380
Gross weight		kg	9940	10115	10950	11150	12420
Operating weight		kg	10098	10277	11128	11332	12628
Loading quantity	40'GP/40'HQ	set	0/1	0/1	0/1	0/1	0/1

Model			LMPB50LE750LE7E/Nb-M	LMPB33LF550LE7E/Nb-M	LMPB33LF533LF5E/Nb-M	LMPB33LF543LG3E/Nb-M	LMPB43LG343LG3E/Nb-M
Cooling capacity		kW	1120	1240	1380	1480	1580
		RT	318	353	392	421	449
Heating capacity		kW	1075	1230	1370	1470	1570
		RT	306	350	390	418	446
Power input	cooling	kW	346	384	430	460	490
	Heating	kW	334	380	422	454	486
EER		W/W	3.24	3.23	3.21	3.22	3.22
COP		W/W	3.22	3.24	3.25	3.24	3.23
Rated power input		kW	450	499	559	598	637
Capacity steps			25%~100%	16.7%~100%	12.5%~100%		
Power supply			380V 3N~ 50Hz				
Operating control			Automatic microcomputer control, operating status display, error alarms				

Safety protection			High pressure protection, low pressure protection, compressor over-load protection, compressor internal protection, compressor over-current protection, phase loss/reversal protection, low oil level protection, water flow switch protection, low flow alarm, differential pressure protection, high oil pressure difference protection, fan over-current protection, freeze protection, sensor protection, low discharge superheating degree protection.				
Compressor	Type	-	Semi-hermetic screw compressor				
	Starting model	-	Star Delta Start				
	Quantity	-	2	3	4		
Refrigerant			R134a				
Water side heat exchanger	Water flow	m³/h	199.5	220.2	240.8	261.4	283.8
		GPM	880	971	1062	1153	1251
	Pressure loss	kPa	≤55	≤55	≤60	≤60	≤60
		ft.wg	≤18.4	≤18.4	≤20.1	≤20.1	≤20.1
	Heat exchanger type		Flooded Evaporator				
	Max.bearing	Mpa	1				
	Inlet/outlet tube	mm	2×DN125	DN150+DN125	2×DN150	2×DN150	2×DN150
	connection mode		Flanged connection				
Air side heat exchanger	Heat exchanger type		Aluminum Fin-copper Tube				
	Fan rated power	kW	1.8×20	1.8×22	1.8×24	1.8×26	1.8×28
Outline dimensions	Width	mm	12230	13450	14670	15890	17120
	Depth	mm	2250	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550	2550
Package dimensions	Width	mm	12380	13600	14820	16040	17270
	Depth	mm	2330	2330	2330	2330	2330
	Height	mm	2550	2550	2550	2550	2550
Net weight		kg	13160	15000	16820	18485	20150
Gross weight		kg	13200	15040	16860	18525	20190
Operating weight		kg	13423	15300	17156	18855	20553
Loading quantity	40'GP/40'HQ	set	0/0	0/0	0/0	0/0	0/0

Notes:

(a) The unit is designed, manufactured, inspected and tested in accordance with GB/T18430.1-2007.

(b) The cooling capacity is measured under the following conditions:

(c) Outdoor DB temperature: 35℃, Leaving water temperature: 7℃, Flow rate: 0.172m3/(h·kW).

(d) The heating capacity is measured under the following conditions:Outdoor DB temperature: 7℃, WB temperature: 6℃, Leaving water temperature: 45℃, Flow rate: 0.172m3/(h·kW).

(e) Heating capacity and heating power and other heating related parameters are inapplicable to the cooling only unit.

(f) The operating weight is about 102% of the net weight.

(g) The operating power of the air conditioning unit is subject to change as the load and the ambient temperature varies. Therefore, the power cable and the transformer shall be sized as per the Rated Power Input.

(h) This product complies with general noise requirement. When there is higher noise requirement, please select the product treated with special noise reduction measures.

(i) Parameters on the nameplate always take precedence.

1.5.2 Normal Working Temperature

Item	Water Side		Air Side	
	Water Flow Rate	Leaving Water Temp	DB (℃)	WB (℃)
Cooling	0.172	7	35	—
Heating	0.172	45	7	6

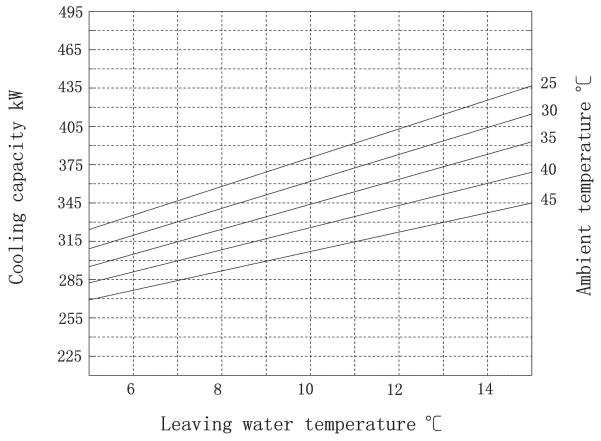
1.5.3 Working Temperature Range

Item	Water Side		Air Side
	Leaving Water Temp (℃)	Entering/leaving water temp	DB Temp (℃)
Cooling	5～15	2.5～8	18～52
Heating	45~50	2.5～8	-15~24

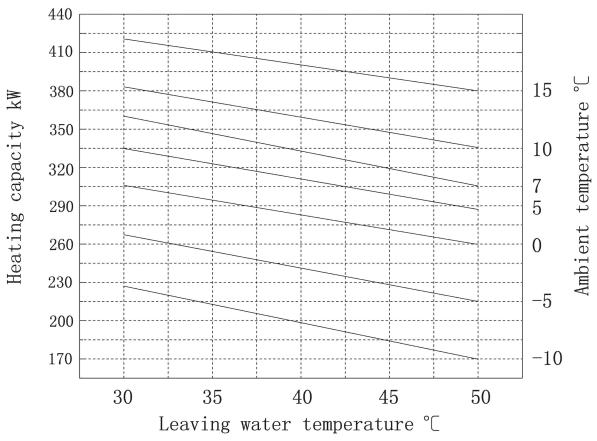
Note: please contact us when the working conditions are out of the range stated in the table above.

1.5.4 Performance Correction

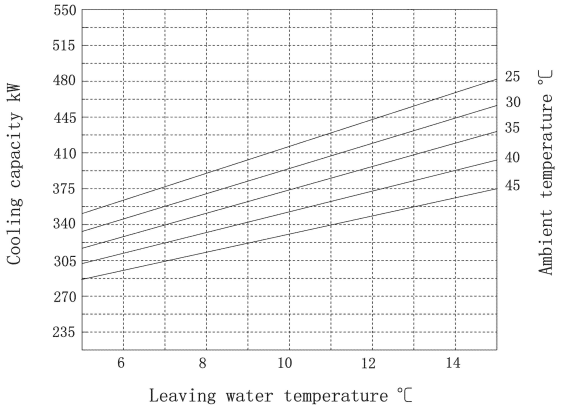
Correction curves for the cooling capacity at difference ambient temperature and leaving chilled water temperature are as shown below.



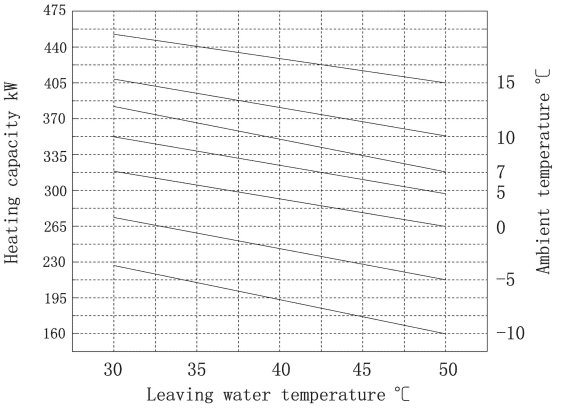
LMPA30JD4E/Nb-M Cooling capacity correction



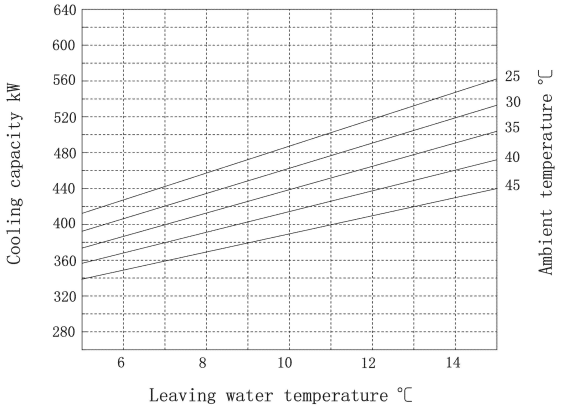
LMPA30JD4E/Nb-M Heating capacity correction



LMPB30JD3E/Nb-M Cooling capacity correction



LMPB30JD3E/Nb-M Heating capacity correction



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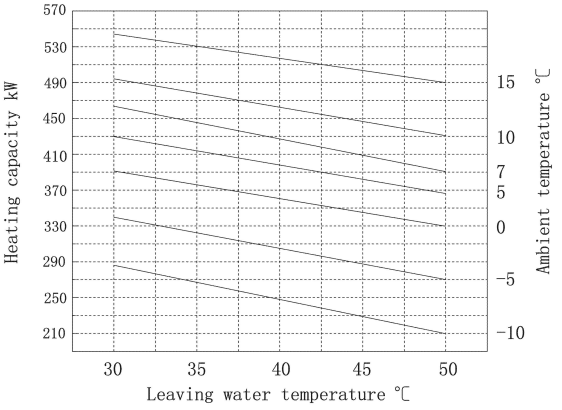

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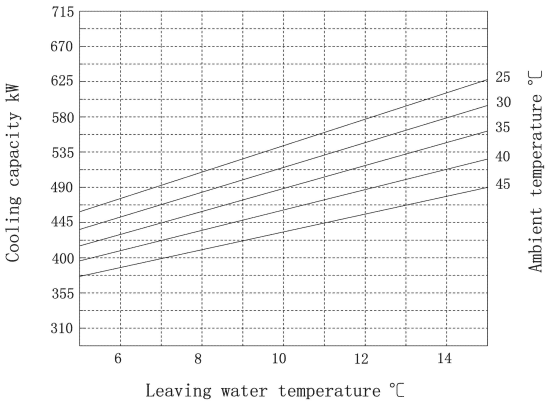

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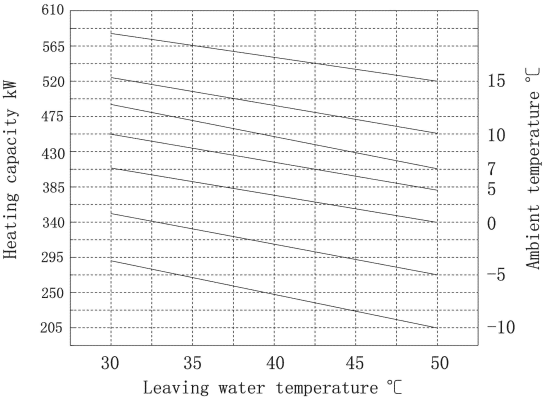

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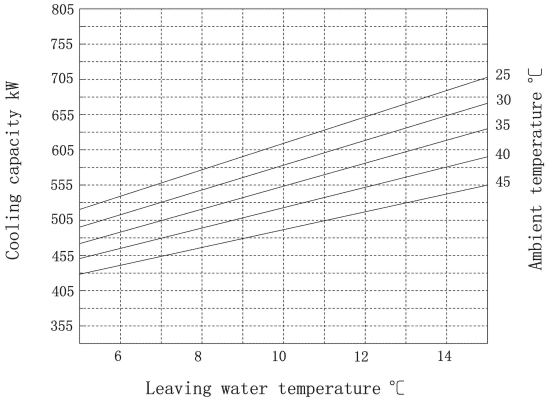

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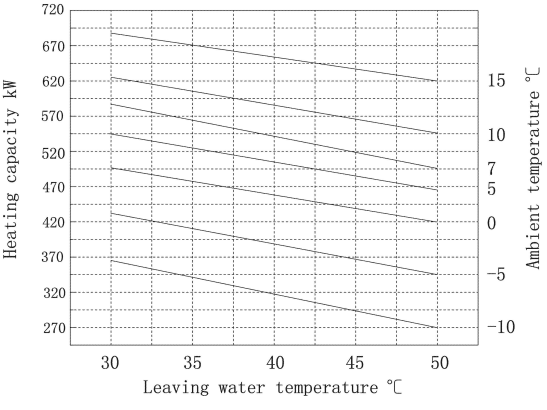

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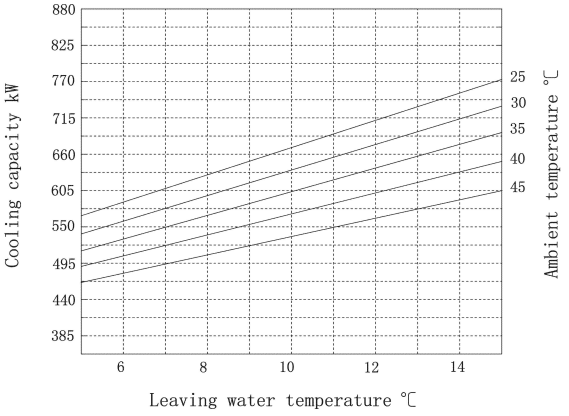

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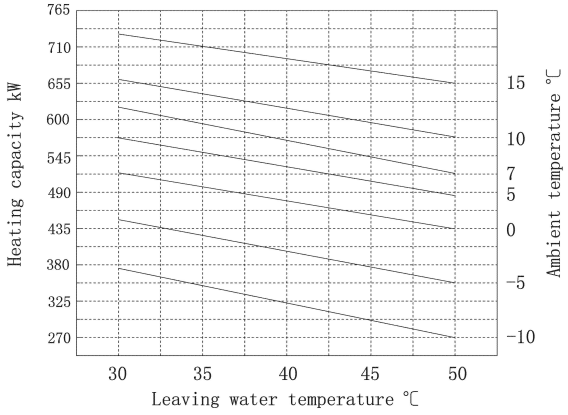

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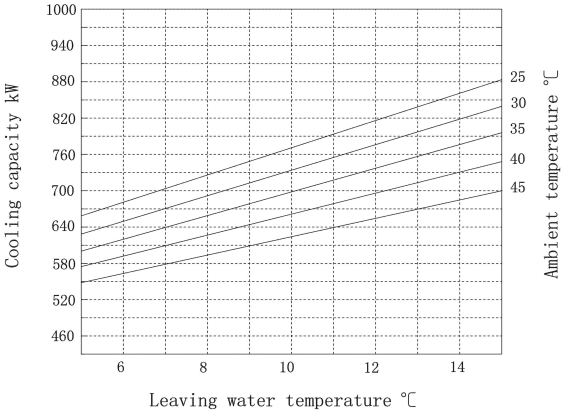

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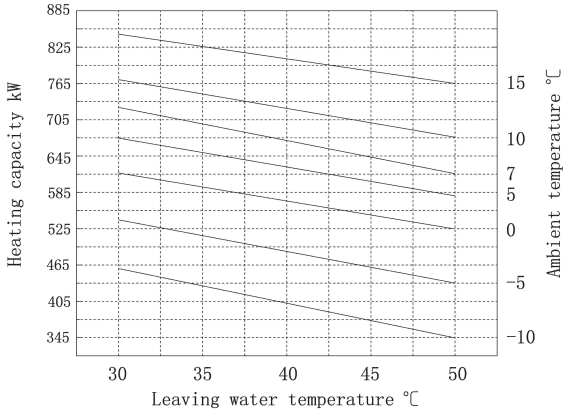

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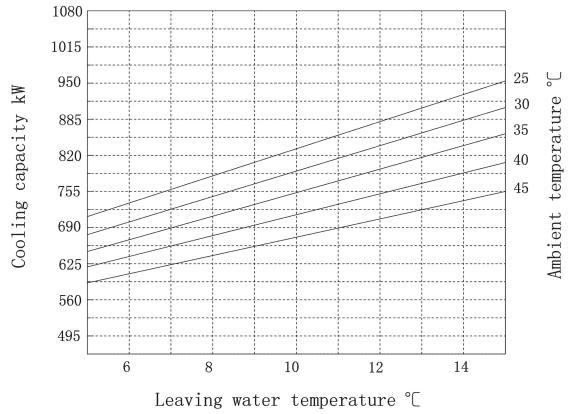

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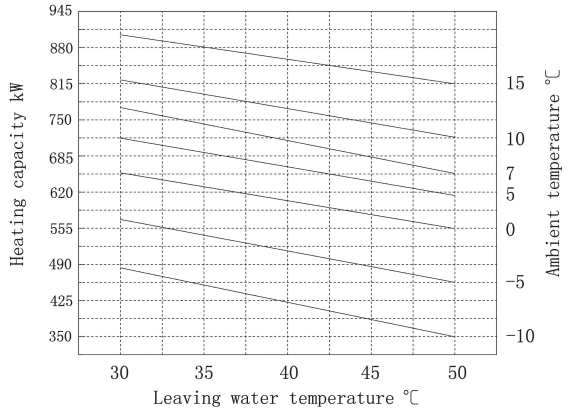

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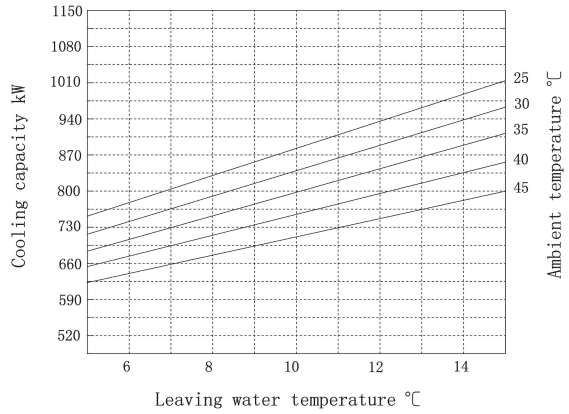

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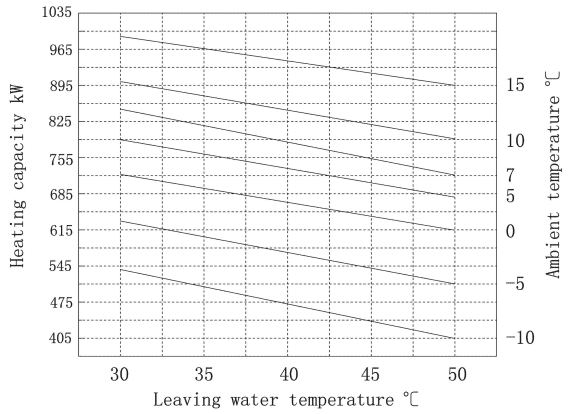

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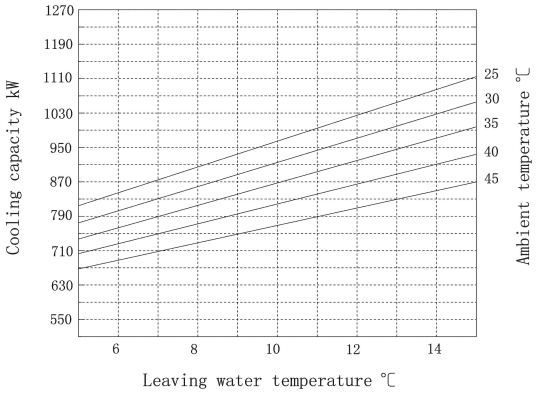

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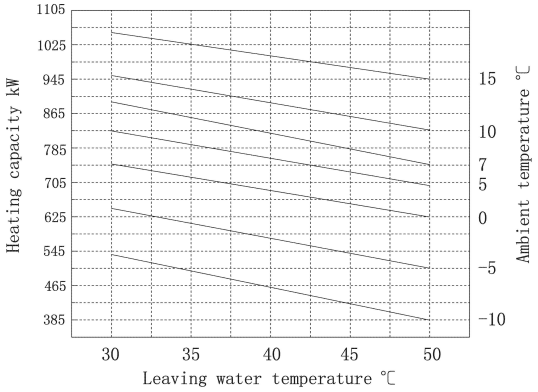

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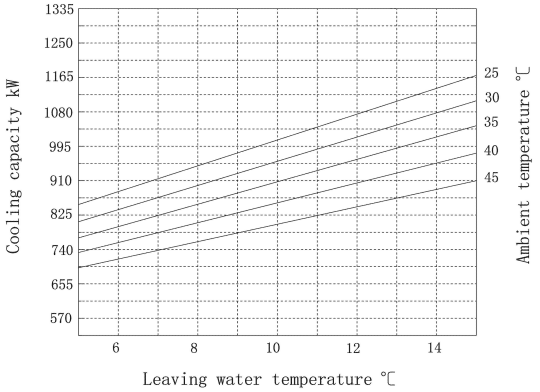

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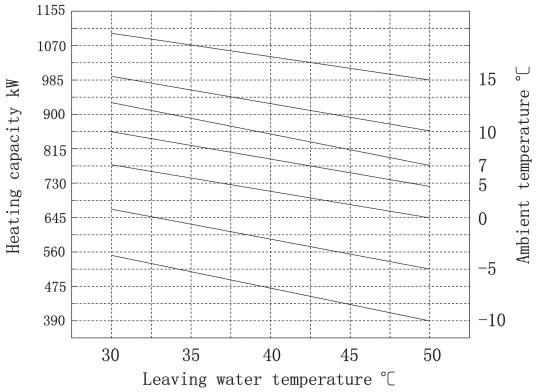

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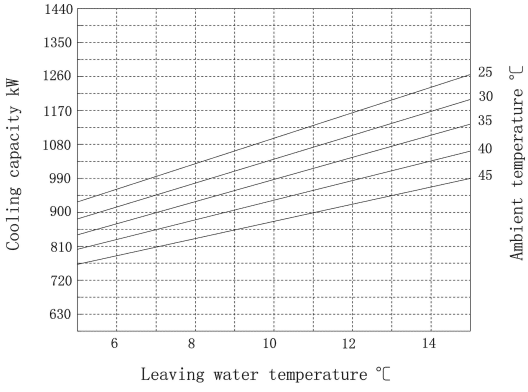

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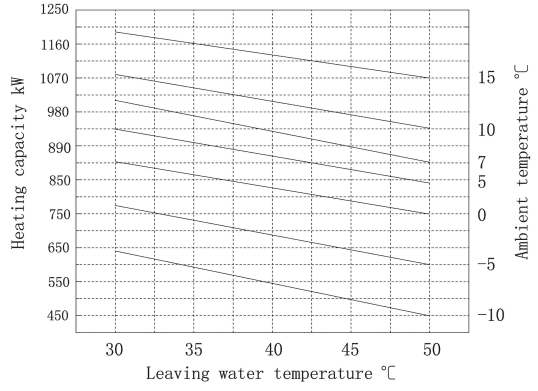

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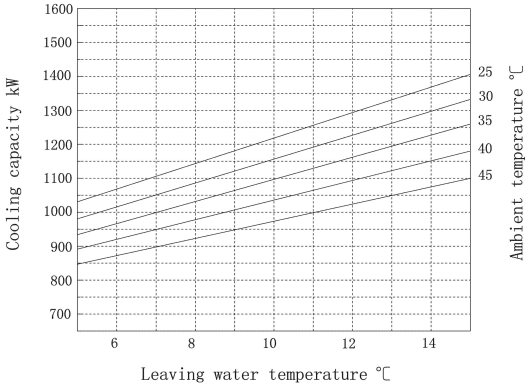

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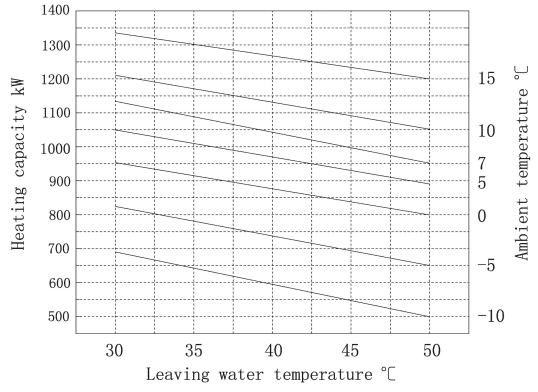

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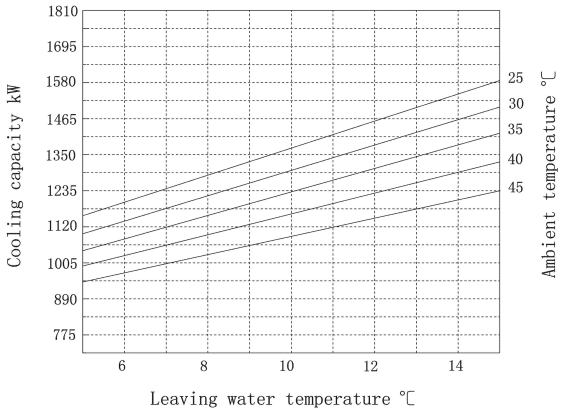

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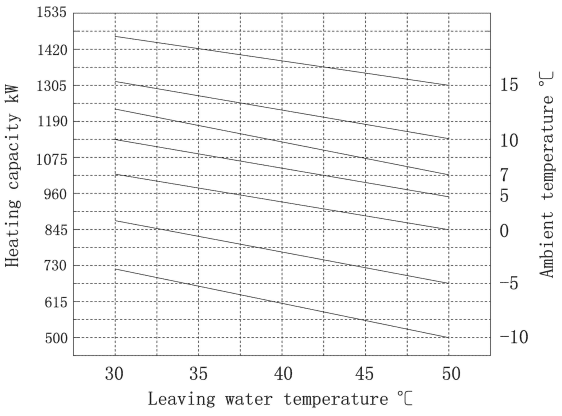

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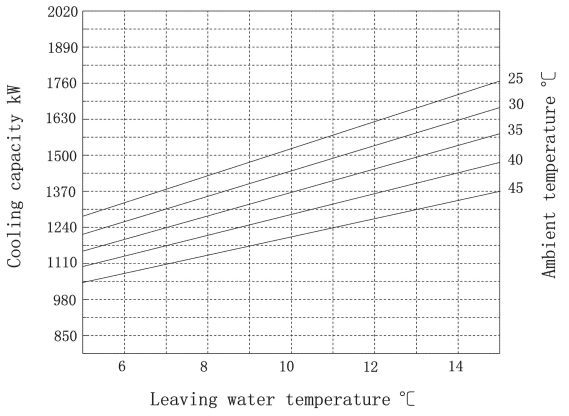

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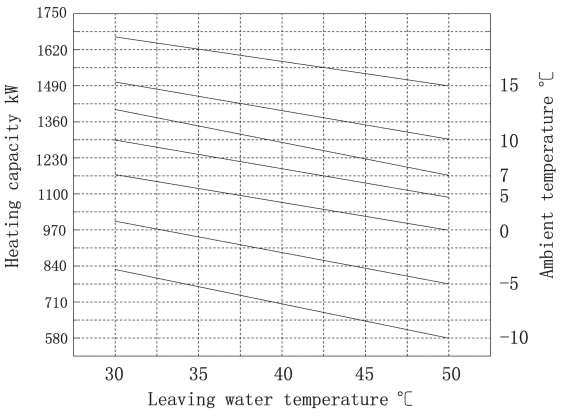

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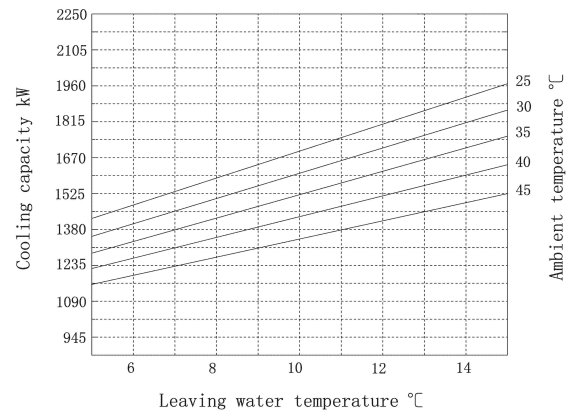

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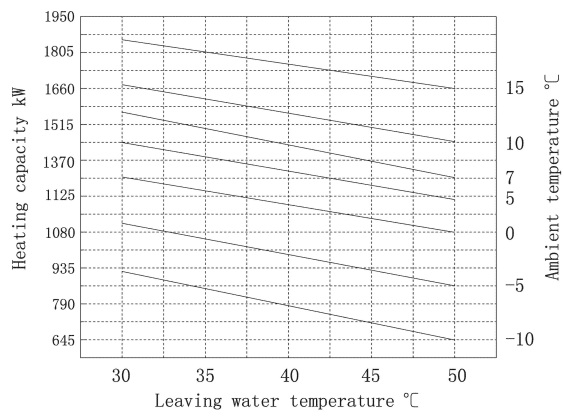

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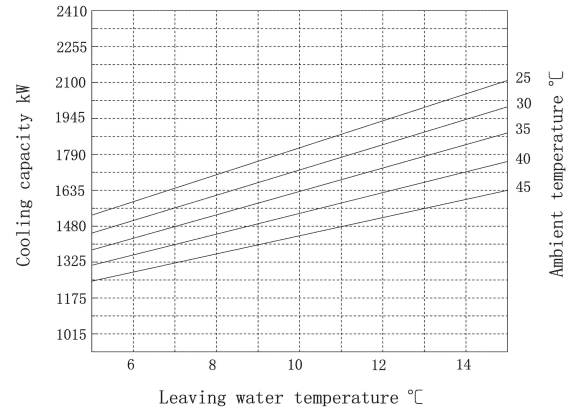

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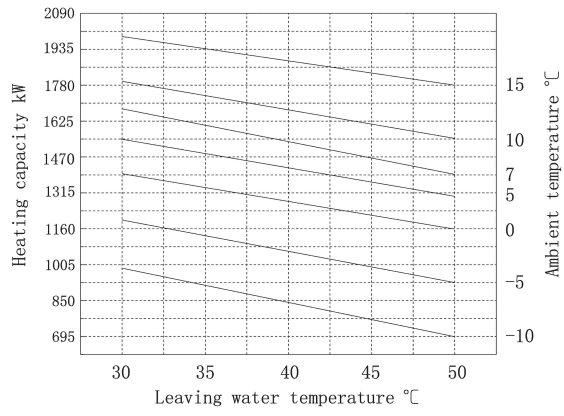

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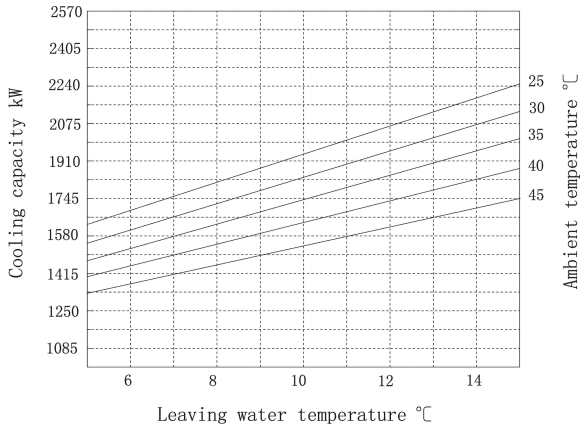

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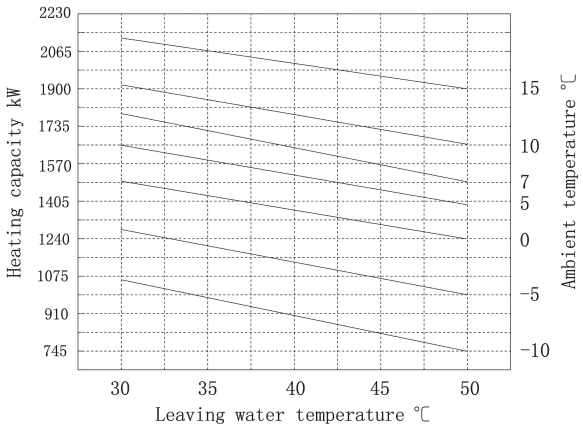


LMPB43LG343LG3E/Nb-M Heating capacity correction

1.6 Noise Correction

Sound levels can be as important as unit cost and efficiency. The inherently quiet scroll compressors used in D series modular air-cooled scroll chillers are coupled with precision engineering for industry-leading sound levels.

The sound data is presented with both sound pressure and sound power levels. These values have been measured and/or calculated in accordance with JB/T 4330 Standard.

Sound pressure is the sound level that can be measured at some distance from the source. Sound pressure varies with distance from the source and depends on the surroundings. For example, a brick wall (a reflective surface) located 10 feet away from a unit will affect the sound pressure measurements differently than a brick wall at 20 feet. Sound pressure is measured in decibels (dB). All sound pressure data in the following pages are considered typical of what can be measured in a free field with a handheld sound meter, in the absence of any nearby reflective surfaces except the floor under the unit. Sound pressure levels are measured at 100% load and standard conditions of 95°F (35°C) ambient air temperature and 44°F (7°C) leaving evaporator water temperatures for air-cooled units.

Sound power is a calculated quantity and cannot be measured directly like sound pressure. Sound power is not dependent on the surrounding environment or distance from the source, as is sound pressure. It can be thought of as basic sound level emanating from the unit without consideration of distance or obstructions. Measurements are taken over a prescribed area around the unit and the data is mathematically calculated to give the sound power, dB. Acoustical consultants sometimes use sound power octave band data to perform a detailed acoustical analysis.

1.6.1 Test Method of Noise

- Definitions

(1) Testing Surface: an imaginary surface with the area S. which envelopes the sound source and whose test point is on the surface of an imaginary parallelepiped

(2) Reference body: an imaginary minimal-sized parallelepiped which envelopes the sound source and terminates at one or more reflective planes.

(3) Testing Distance: the vertical distance between surfaces of the reference body

- Selection of the Testing Surface:

(1) In order to determine the location of the microphone on the testing surface, it is necessary to assume a reference body, regardless of the important noise energy which emanates from the sound source but does not radiate. The reference testing distance is 1m and should be 0.15m at

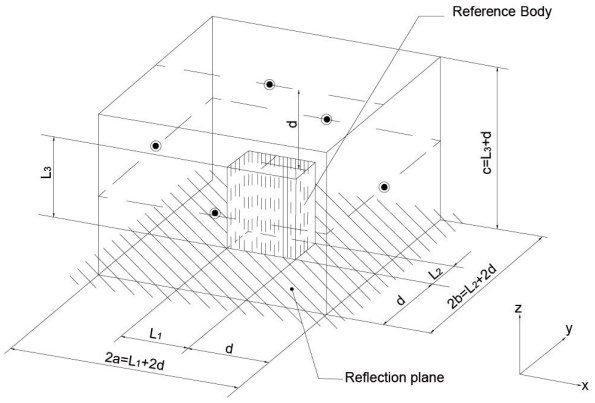
least. Other options include: 0.25m, 0.5m, 0.5m, 1m, 2m, 4m and 8m.

- Testing Surface and Location of Microphones of the Parallelepiped

(1) The testing surface is such an imaginary surface with the area S, enveloping sound source and distance d with the reference body, of which each side is parallel to the corresponding side of the reference body. See the figure below for the location of the microphones at the testing surface of the parallelepiped.

(2) S=4(ab+bc+ac),a=0.5L1+d,b=0.5L2+d,c=0.5L3+d

(3) Where L1, L2 and L3 indicate the length, width and height of the reference body respectively.



Testing Surface and Location of Microphones of the Parallelepiped

1.6.2 Calculation Method of Noise

- Calculation of the A-weighted Noise Pressure

For the unit Class B which is taking the noise test under the rated conditions, follow the equation below to calculate it A-weighted noise pressure.

$$\overline{L}_{PA} = \overline{L}'_{PA} - K_{1A} - K_{2A}$$

Where:

$\overline{L}_{PA}$—A-weighted noise pressure of the unit

$\overline{L}'_{PA}$—A-weighted noise pressure of the testing surface

K_{1A}—corrected value of the background noise

K_{2A}—corrected value of the test environment

$\overline{L}'_{PA}$ is calculated with the equation below, where is the A-weighted noise pressure measured at the microphone no.i.

$$\overline{L}'_{PA}(dB)=10\lg\left[\frac{1}{N}\sum_{i=1}^{N}10^{0.1L'_{PAi}}\right]$$

See Section 1.6.2.2~1.6.2.4 for calculation of each parameter in this equation.

- Calculation of the Average A-weighted Noise Pressure

A-weighted noise pressure and average A-weighted noise pressure of the testing surface can be

calculated with the following equations:

$$\overline{L}'_{PA}(dB)=10\lg\left[\frac{1}{N}\sum_{i=1}^{N}10^{0.1L'_{PAi}}\right]$$

$$\overline{L}''_{PA}(dB)=10\lg\left[\frac{1}{N}\sum_{i=1}^{N}10^{0.1L''_{PAi}}\right]$$

Where:

$\overline{L}'_{PA}$—average A-weighted noise pressure of the testing surface of the tested sound source, dB

$\overline{L}''_{PA}$—average A-weighted background noise pressure of the testing surface, dB

$\overline{L}'_{PAi}$—A-weighted noise pressure measured at the microphone no.i, dB

$\overline{L}''_{PAi}$—Average A-weighted background noise pressure pressured at the testing surface located at the microphone no.i.,dB.

N—number of microphones

- Correction of Background Noise

The corrected value is calculated with the following equation.

$$K_{1A}(dB)=-10\lg(1-10^{-0.1\Delta L_A})$$

Where

$$\Delta L_A=\overline{L}'_{PA}-\overline{L}''_{PA}$$

a: if >10dB, the corrected value is not needed.

b: if 3<<10dB, calculate the corrected value with the above equation.

c: 0<<3dB, take the maximum corrected value 3dB.

Note: the above principles don't apply when <3dB, as the precision would be dropped down. The allowable maximum correction value is 3dB. In this case, it should also be described in the test report, saying "no back ground noise is applicable to the requirement of this standard".

- Correction of the Test Environment

The correction factor K2A which reflects effects from room boundaries (wall, ceiling, and floor) or reflecting objects around the sound source is the radio of the testing surface area to the sound absorption area of the test room, and has little relation with the location of the sound source in the test room.

$$K_{2A}(dB)=10\lg[1+4(S/A)]$$

Where:

A: equivalent sound absorption area of the 1 KHz test room, m2.

S: testing surface area, m2.

$$A=a.S_V$$

Where:

a—average A-weighted sound absorption coefficient

SV—total area of the test room boundaries (wall, ceiling, floor), m2

Approximate Values of the Average Sound Absorption Coefficient a

Average Sound Absorption Coefficient	Applicable Location
0.05	Almost empty room and glossy walls made of concrete, bricks, compo or tiles.
0.1	Particularly empty room and glossy walls.
0.15	Room with furniture; Rectangular workshop; Rectangular industrial plant
0.2	Irregular room with furniture; Irregular workshop or industrial plant.
0.25	Room with decorative furniture and there is a little of sound-absorbing material in the ceiling or walls.
0.35	There is sound-absorbing material in the ceiling and walls.
0.5	There is plenty of sound-absorbing material in the ceiling and walls.

Qualification Requirements on the Test Room.

When the testing surface area of the test room meets the test requirements, the ratio of the sound absorption area to the testing surface area will be or larger than 1, that is, A/S≥1, the larger the ratio is, the better. When it does not, another testing surface should be selected. The new testing surface area is small but it still should be located out of the approximate field, or the test method herein will fail to meet the required precision.

1.6.3 Effects on Noise Caused by Distance

The distance between a source of sound and the location of the sound measurement plays an important role in minimizing sound problems. The equation below can be used to calculate the sound pressure level at any distance if the sound power is known.

Another way of determining the effect of distance is to work from sound pressure only. "Q", the directionality factor, is a dimensionless number that compensates for the type of sound reflection from the source. For example, a unit sitting on a flat roof or ground with no other reflective surfaces or attenuation due to grass, snow, etc. ,between source and receiver: Q=2.

Sound pressure can be calculated at any distance from the unit if the sound power is known, using the equation:

$$L_P=L_W-20\log r+10\log Q-11$$

Where:

LP=sound pressure

LW=sound power

r=distance from unit in meter

Q=directionality factor

With Q=1, Unit suspended in space (theoretical condition), the equation is simplified to:

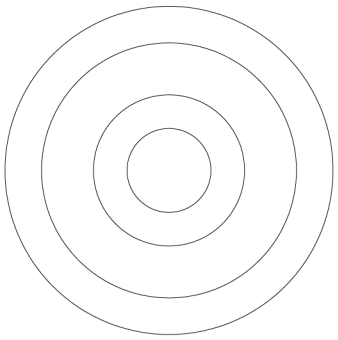
$$L_P=L_W-20\log r-1$$

With Q=2, for a unit sitting on a flat roof or ground with no adjacent vertical wall as a reflective surface, the equation is simplified to:

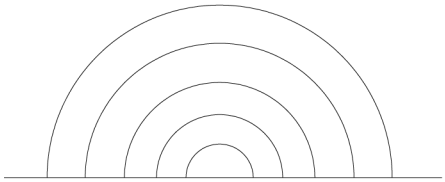
$$LP=LW-20\log r-8$$

With Q=4 for a unit sitting on a flat roof or ground with one adjacent vertical wall as a reflective surface, the equation is simplified to:

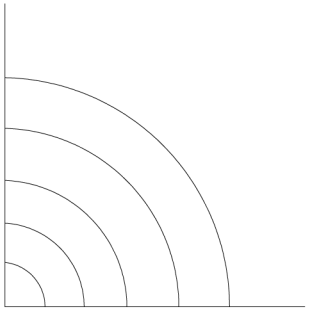
$$L_P=L_W-20\log r-5$$



Uniform Spherical Radiation
Q=1 no reflecting surface



Uniform Hemispherical Radiation
Q=1 single reflecting surface

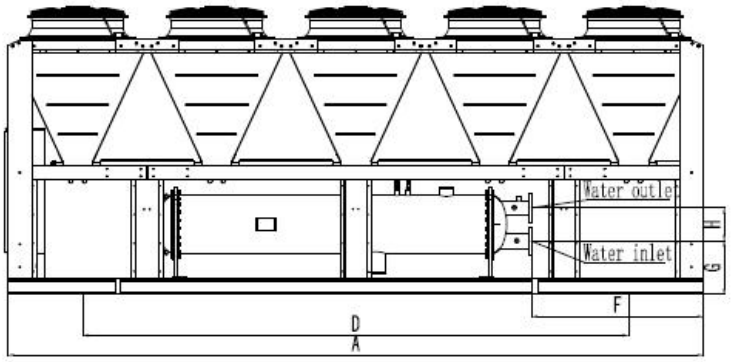


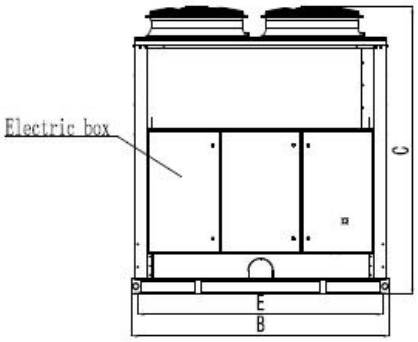
Uniform Radiation over of sphere
Q=1 single reflecting surface

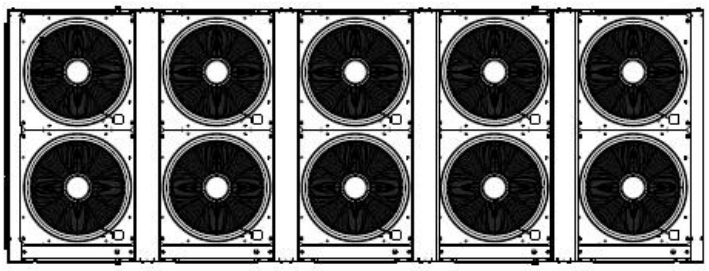
The equations are reduced to the table form for various distances and the two most usual cases of "Q" type of location. Results for typical distances are tabulated in the table below.

Distance from Sound Source(m)	DB Reduction from Sound Power at the Source to Sound Pressure at Referenced Distance	
	Q=2	Q=4
5	22.0	19.0
10	28.0	25.0
15	31.5	28.5
20	34.0	31.0
25	35.9	32.9

2. Outline Dimensions

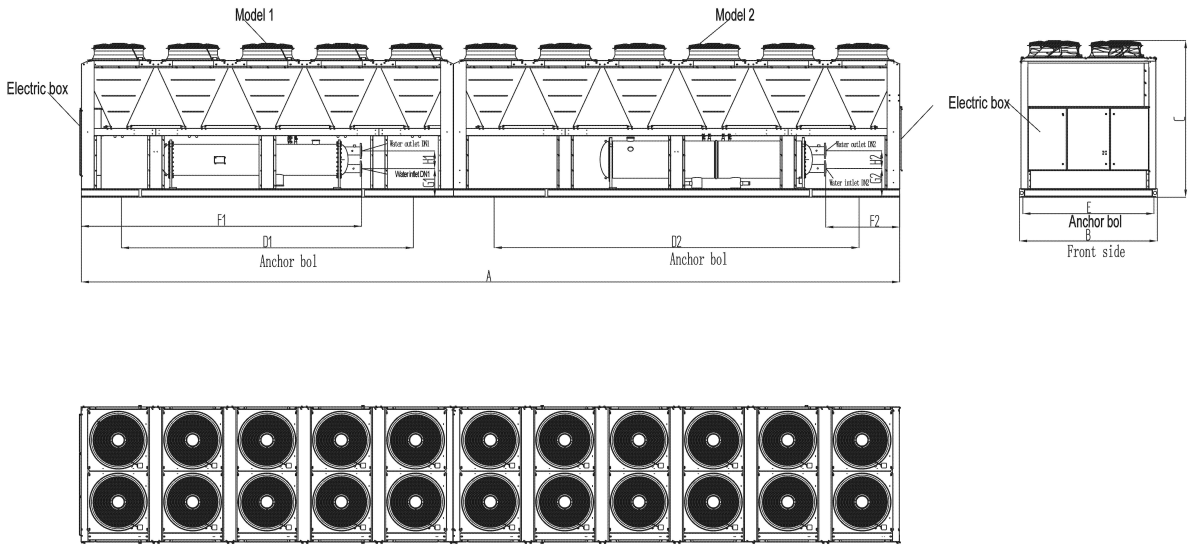






Note: The picture above is for the signal only. The actual outside view of product should be subject to the actual product.

Dimension	Outline dimension			Installation dimension		Pipeline dimension Maintenance dimension			Pipe Connection dimension
Model	A	B	C	D	E	F	G	H	
LMPA30JD4E/Nb-M	3670	2250	2550	2400	2150	310	535	240	DN100
LMPB30JD3E/Nb-M	3670	2250	2550	2400	2150	310	535	240	DN100
LMPA40JE2E/Nb-M	4890	2250	2550	3600	2150	310	470	290	DN125
LMPB40JE1E/Nb-M	4890	2250	2550	3600	2150	385	470	290	DN125
LMPA50LE8E/Nb-M	6110	2250	2550	4800	2150	1510	470	290	DN125
LMPB50LE7E/Nb-M	6110	2250	2550	4800	2150	1510	470	290	DN125
LMPA33LF6E/Nb-M	7340	2250	2550	6000	2150	1780	450	295	DN150
LMPB33LF5E/Nb-M	7340	2250	2550	6000	2150	1780	450	295	DN150
LMPB43LG4E/Nb-M	8560	2250	2550	7200	2150	1785	450	295	DN150
LMPB43LG3E/Nb-M	8560	2250	2550	7200	2150	1785	450	295	DN150
LMPA44LF2E/Nb-M	9780	2250	2550	8400	2150	3030	450	295	DN150
LMPB44LF1E/Nb-M	9780	2250	2550	8400	2150	3030	450	295	DN150
LMPB54NG2E/Nb-M	11000	2250	2550	9600	2150	3540	440	350	DN200



Note: The picture above is for the signal only. The actual outside view of product should be subject to the actual product.

Dimension	Outline dimension			Installation dimension			Pipeline dimension Maintenance dimension						Pipe Connection dimension	
Model	A	B	C	D1	D2	E	F1	F2	G1	G2	H1	H2	DN1	DN2
LMPB50LE750LE7E/Nb-M	12230	2250	2550	4800	6000	2150	4610	1780	470	470	290	295	DN125	DN125
LMPB33LF550LE7E/Nb-M	13450	2250	2550	4800	6000	2150	4610	1780	470	470	290	295	DN150	DN125
LMPB33LF533LF5E/Nb-M	14670	2250	2550	6000	6000	2150	5550	1780	450	450	295	295	DN150	DN150
LMPB33LF543LG3E/Nb-M	15890	2250	2550	6000	7200	2150	5550	1785	450	450	295	295	DN150	DN150
LMPB43LG343LG3E/Nb-M	17120	2250	2550	7200	7200	2150	6160	1785	450	450	295	295	DN150	DN150

Model	Model 1	Model 2
LMPB50LE750LE7E/Nb-M	LMPB50LE750LE7E/Nb-M-1	LMPB50LE750LE7E/Nb-M-2
LMPB33LF550LE7E/Nb-M	LMPB33LF550LE7E/Nb-M-1	LMPB33LF550LE7E/Nb-M-2
LMPB33LF533LF5E/Nb-M	LMPB33LF533LF5E/Nb-M-1	LMPB33LF533LF5E/Nb-M-2
LMPB33LF543LG3E/Nb-M	LMPB33LF543LG3E/Nb-M-1	LMPB33LF543LG3E/Nb-M-2
LMPB43LG343LG3E/Nb-M	LMPB43LG343LG3E/Nb-M-1	LMPB43LG343LG3E/Nb-M-2

3. Supply Scope

S= Standard P= Optional O= Field Supplied

Supply Scope	Type(Cooling only)
Modular Unit	S
4-core connection wire (8m)	P
Water flow switch	S
Display board	S
Power distribution	O
Power connection	O
Control connection	O
Flexible connection	O
Temperature measuring device	O
Pressure measuring device	O
Water tank	O
Built-in water conservation module	O

II Design & Selection

1. Design and Selection Procedures

1.1 Estimated Cooling Load Look-up Tables

(1) Cooling Load per Unit Air Conditioning Area

Building Type	Room Type	Cooling Load (W/m^2)	Building Type	Room Type	Cooling Load (W/m^2)
Hotel	All	70～95	Hospital	All	105～130
	Augest Room	70～100		VIP Ward	80～120
	Cafe	80～120		General Ward	70～110
	Dining Room (Western Food)	100～160		Diagnostic Room	75～140
	Dining Room (Chinese Food)	150～250		X-ray, CT, MRT Room	90～120
	Store	80～110		Delivery Room	100～150
	Service Hall	80～100		Clean Operation Room	180～380
	Atrium	100～180		Hall	70～120
	Small Meeting Room	140～250	Shopping Mall	First Floor	160～280
	Large Meeting Room(No	100～200		Intermediate Floor	150～200
	Hairdressing Room	90～140		Top Floor	180～250
	Gym	100～160		All Stores	210～240
	Bowling Alley	90～150	Cimena and Theatre	Auditorium	180～280
	Billiard Room	75～110		Lounge Smoking (Smoking)	250～360
	Swinging Pool	160～260		Boudoir	80～120
	Ball Room	180～220		Hall and WC	70～100
	Disco	220～320	Stadium	Arena	100～140
	Karaoke	100～160		VIP Room	120～180
	Office	70～120		Lounge Room (Smoking)	280～360
	WC	80～100		Lounge Room (No Smoking)	160～250
Bank	Service Hall	120～160		Rest Room	100～140
	Offfce	70～120	Office Building	VIP Office	120～160
	Machine Room	120～160		General Office	90～120
Museum		150～200		Machine Room	100～140
Auditorium		160～240		Meeting Room	150～200
Multi-functional Room		180～250		Loung Hall (Smoking)	180～260
Library	Reading Room	100～160	Office Building	Hall and WC	70～110
	Hall	90～110		General Office	95～115
	Stack Rom	70～90		High-rise Office	105～145
	Special Collection Room	100～150	Apartment	Multi-layer Building	88～150
Restaurant	Hall	200～280		High-rise Building	80～120
	VIP Room	180～250		Villa	150～220

Supermarket	Hall	160～220			
	Meat and Fish Room	90～160			

(2) Cooling and Heating Load per Unit Air Conditioning Area

Building Type			Heating and Cooling Load (W/m^2)				Loading Conditions			
			Total Cooling	Fresh Air	Total Heating	Fresh Air	Lighting (W/m^2)	Person (p/m^2)	Fresh Air (m^3/m^2h)	Exfiltration (h-1)
Bank	Service Hall		242	72	220	90	50	0.30	6	1.5
	Reception		179	48	184	59	30	0.20	4	0.5
Shopping Mall	Frist Floor		355	97	246	107	80	0.80	8	2.0
	Speciality		307	121	161	134	60	1.00	10	0.5
	Shopping		217	97	137	107	60	0.40	8	0.5
Supermarket	Fooda Zone		212	72	195	80	60	0.60	6	0.5
	Costume Zone		215	72	167	80	60	0.30	6	0.5
Hotel	Dining Hal		449	260	312	299	80	1.00	20	0
	Guest Room	S	127	78	207	90	20	0.12	6	0.5
		W	131		207		20	0.12	6	0.5
		N	125		207		20	0.12	6	0.5
		E	130		207		20	0.12	6	0.5
Public House	Dining Room		286	144	228	179	40	0.60	12	0.5
Socieity	Study Room		233	121	228	149	20	0.50	10	0.5
Library	Reading Room		143	48	125	59	30	0.20	4	0.5
Hospital	Ward	S	91	48	112	59	15	0.20	4	0.5
		W	110		112		15	0.20	4	0.5
		N	79		112		15	0.20	4	0.5
		E	96		112		15	0.20	4	0.5
Theatre	Auditorium		512	362	506	448	25	1.50	30	0
	Service Hall		237	78	219	90	30	0.30	6	0.5

(3) Estimated Cooling Load per Unit Building Area

Building Type	Cooling Load (W/m^2)	Cooling Load (W/m^2)
Hotel	35～45	70～81
Hall	56～72	/
Office Building	42～54	84～98
Library, Museum	18～32	35～41
Store	25～59	56～65(only service hall)
Stadium	35～135	209～244 (as per the arena area)
Stadium		105～122 (as per the total area)
Cinema	42～68	84～98 (only auditorium)
Theatre	/	105～128
Hospital	28～45	58～81
Hotel	/	105～116

Notes:

(a) It is cited from Design and Troubleshooting for Heating and Cooling Air Conditioners.

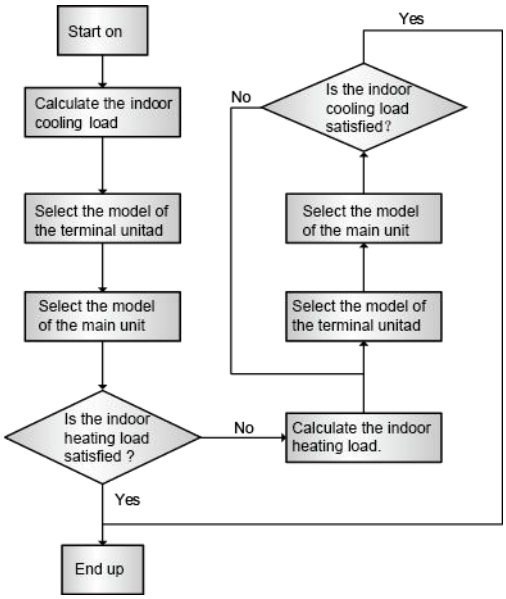
(b) Take the lower limit when the total building area is less than 5000m2 and take the upper limit when the total building area is large than 10000 m2.

(c) The estimated load is directly indicates the required capacity of the air conditioners.

(d) Unless otherwise stated, the area always indicates the total building area no matter if air conditioning is for local area or not.

Notes: The empirical value of this series is derived from markets in China.

1.2 Procedures



(1) Calculation of Indoor Load Demand

Indoor Load Demand (W) = Room Area (m^2) × Load per Unit (W/m^2)

Note: the selection of the estimated cooling load depends on the actual conditions.

(2) Selection of the Terminal Unit

Select the proper terminal unit in accordance with requirements on load, noise and installation space.

(3) Selection of the Main Unit

The main unit is selected on the premise of the service factor of the terminals: 0.7-0.8. Generally, 2-4 main units are required. Unless otherwise required, no backup main unit is required.

(4) Calculation of the Heating Load

Calculate the heating load following step (2) and (3). Then, if available, make the selection directly; if unavailable, calculate the cooling load again until both cooling and heating loads are satisfactory.

1.3 Example

Background: there is an office building covering 12000m^2 totally with 10000m^2 to be air conditioned, the small meeting rooms take up 1500m^2 and office rooms take up 8500m^2, and cooling only and fresh air is required.

(1) Calculate the cooling load.

(a) by the estimated cooling load

Small meeting rooms: 150×240 (W/m^2) =360000W=360kW

Offices: 8600×150 (W/m^2) =1290000W=1290kW

Total: 360kW+1290kW =1650kW

Capacity required for the air conditioner: 1650kW ×0.70=1155kW

(b) by the building area

12000×98W=1176kW

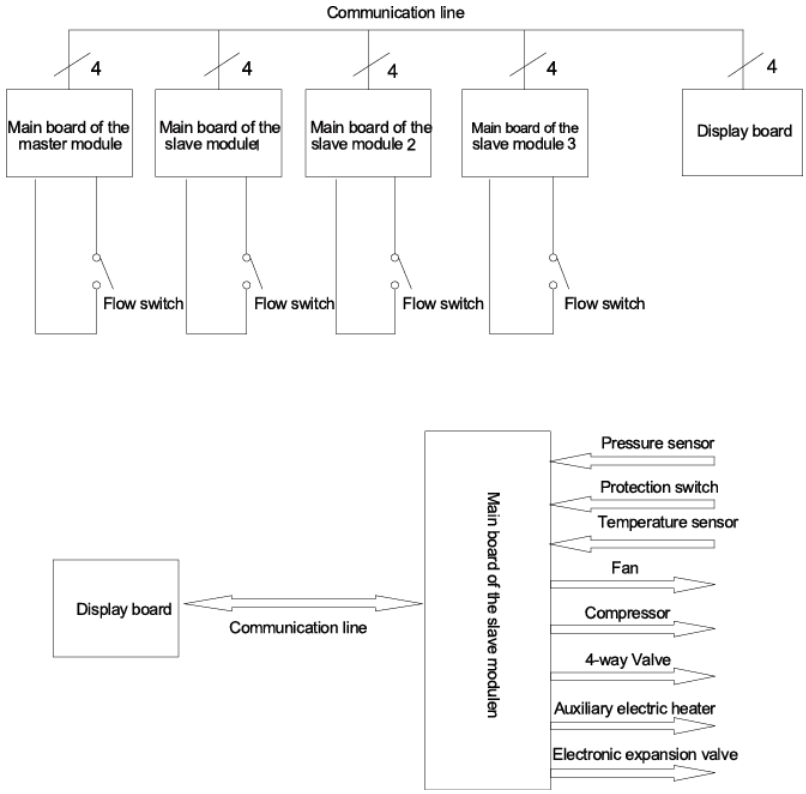
(c) 1155kW is concluded in accordance with the calculation values in a and b.

(2) Preselect the desired model and quantity

Ⅲ Unit Control

1. General Control Logic

1.1 Overall Control Flowchart



Interpretation of the Control Principle

The control consists of two parts, the main board and the display board, which are linked through the communication line. The display board is used for providing interfaces which enable to start/stop the unit, set parameters, display the unit status, like temperature, pressure and faults etc. Based on the commands and parameter settings from the display board as well as data collected itself concerning the pressure cutout switch, temperature protection switches etc., the main board is used to perform startup/shutdown, capacity control and troubleshooting etc.

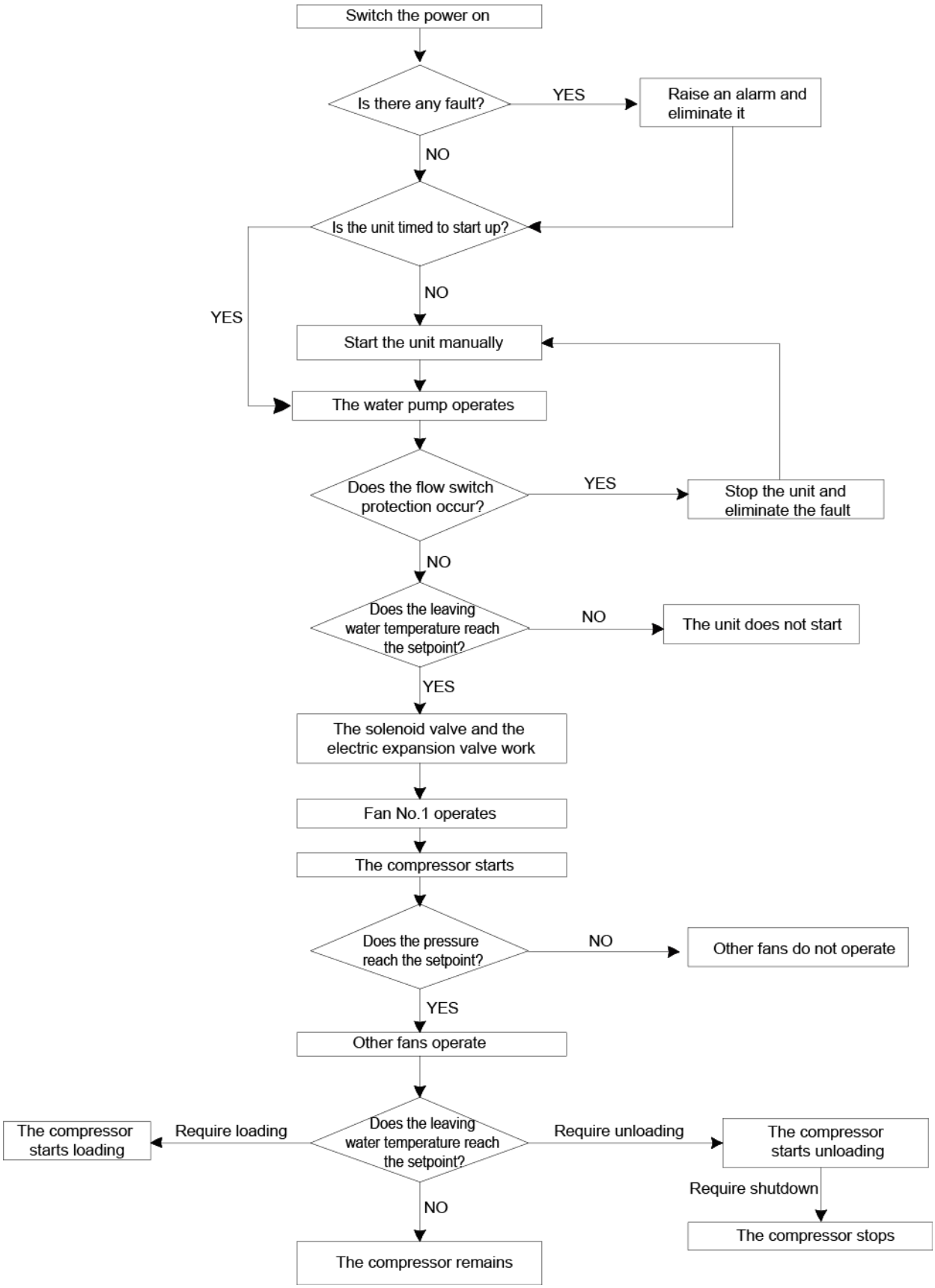
The unit is allowed to be started only after the control has detected all input signals are correct. The compressor will start, unload or stop automatically in accordance with the detected leaving chilled water temperature. Freeze protection will act depend on the detected antifreeze protection limits. The opening angle of the expansion valve will be automatically controlled relying on the detected suction temperature, suction pressure, suction superheating degree, discharge temperature, and evaporating temperature. When a protection signal comes, the compressor will take at least 6 minutes to stop completely even though the leaving chilled water temperature allows unloading and shutdown. Once the compressor stops, it can be restarted at least 10 minutes later.

At the cooling mode, the chilled water pump starts firstly, and then the fan and lastly the compressor. The capacity of the compressor can be controlled as per the leaving water temperature. At the heating mode, the chilled water pump starts firstly and then the compressor. After that, when the differential pressure reaches the setpoint or the timer is due, the 4-way valve acts and later all fans start. The capacity of the compressor can be controlled as per the leaving water temperature.

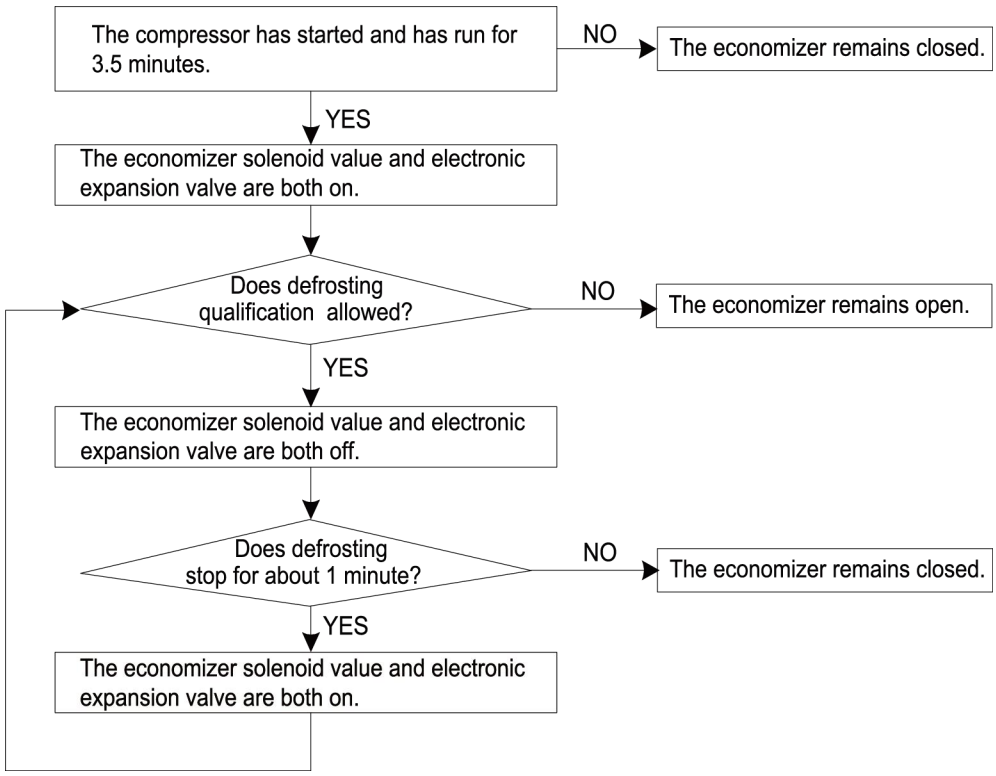
When the shutdown command is performed, the compressor will stop firstly, and then the fan and lastly the chilled water pump.

1.2 Control Flowchart

Cooling



Economizer


The compressor has started and has run for 3.5 minutes.
NO
The economizer remains closed.
YES
The economizer solenoid value and electronic expansion valve are both on.
Does defrosting qualification allowed?
NO
The economizer remains open.
YES
The economizer solenoid value and electronic expansion valve are both off.
Does defrosting stop for about 1 minute?
NO
The economizer remains closed.
YES
The economizer solenoid value and electronic expansion valve are both on.

2. Control Logic

2.1 Fan Control

At the cooling mode, the water pump starts first, later the fan group 1 and then the compressor. When the discharge pressure is more than Bkpa, another fan group will start up; when the discharge pressure is larger than A but is equal to or smaller than B, fans will keep the original status; when the discharge pressure is equal to or smaller than A, one fan group will shut down.

Discharge pressure ≤A	A<Discharge pressure ≤B	Discharge pressure>B
One fan group will shut down	Keep the original status.	One fan group will started up.

At the cooling mode, fan group 1 keeps operating, and then the start sequence of other fans are group 2, group 3 and group 4, and the stop sequence are group 4, group 3 and group 2.

At the heating mode, when the differential difference is larger than the setpoint ΔP4, or the compressor has operated for more than 600 seconds, or the 4-way valve has operated for 5 seconds, all fans will start.

2.2 Freeze Protection

The unit will be protected against freezing as long as the freeze protection function is activated through the control.

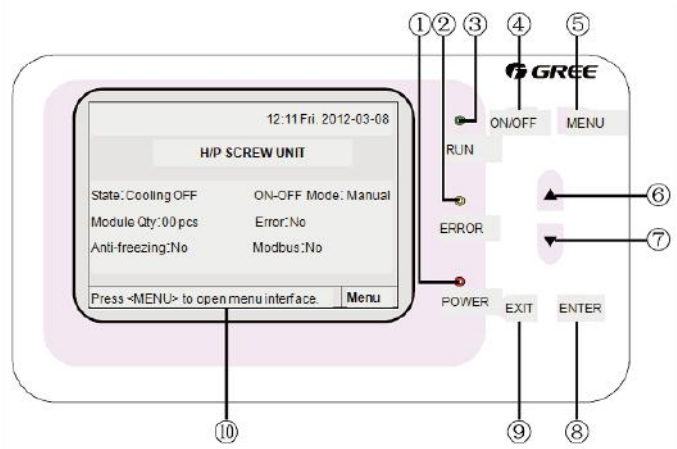
As for the heat pump unit, when one single module unit detects the ambient temperature is equal to or lower than 5℃and the anti-freezing temperature is or lower than 3.5℃, all water pumps will operate; when the anti-freezing temperature is or lower than 1.5℃, this module unit will operate at the heating mode; when the anti-freezing temperature is or lower than 15℃ but higher than 1.5℃, this module holds the original status.

As for the cooling only unit, when one single module unit detects the ambient temperature is equal to or lower than 5℃and the anti-freezing temperature is or lower than 3.5℃, all water pumps will operate; when the anti-freezing temperature is larger than 15℃, this module unit will stop; when the anti-freezing temperature is or lower than 15℃ but higher than 3.5℃, this module holds the original status.

3. Control

3.1 Indicating LEDs and Press Button

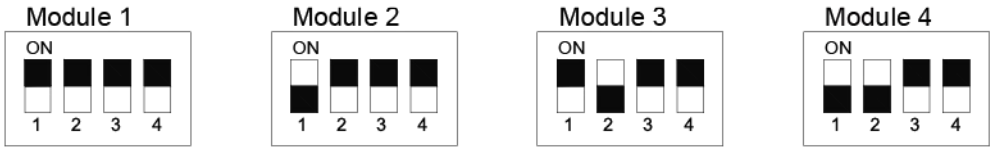
Up to 4 sets of Modules involved in one network can be controlled by only one display which is capable of displaying and setting kinds of parameters.

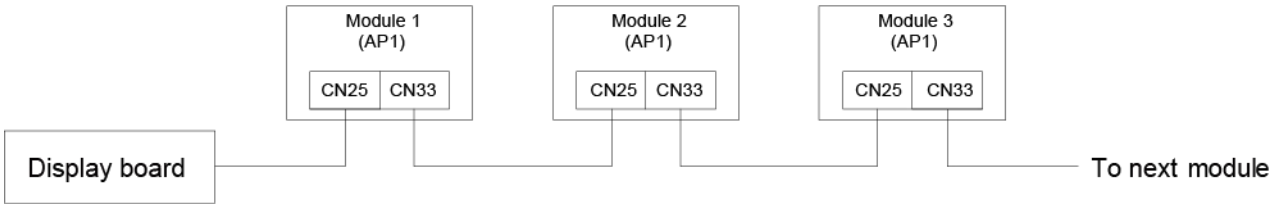


1	POWER	it lights up when the display is energized
2	ERROR	it lights up when some errors occur
3	RUN	it lights up when the Module starts running
4	ON/OFF	it is used to start or stop the Module by a five seconds press
5	MENU	it is used to open the Menu Page
6	▲	It is used to move the cursor upward to the desired option or increase the setting value. A long press on it can make a continuous increment.
7	▼	It is used to move the cursor downward to the desired option or decrease the setting value. A long press on it can make a continuous decrement
8	ENTER	it is used to confirm the selection or remove the cursor during parameter modification
9	EXIT	it is used to quit the current operation
10	Status Bar	it is used to display the detailed information of the current operation

3.2 Address DIP Setting

As shown in the figure below, the 4-position DIP switch is used to set the address of each module, “1” the least significant bit and “4” the highest.





Ⅳ Unit Installation

1.Installation Guides

- WARNING:

(1) Installation should be performed by GREE appointed servicemen, or improper installation would lead to unusual operation, water leakage, electric shock or fire hazard.

(2) The unit should be installed on the foundation which is capable of supporting the unit, or the unit would fall off or even lead to personal injury.

(3) All electric installation should be done by electrician in accordance with local laws and regulations, as well as the User's Manual and this Service Manual. Besides, the special power lines should be used, as any improper line would lead to electric shock or fire hazard.

(4) All electric lines should be safe and secured reliably. Be sure the terminal board and electric lines will not be affected by any external force, or it would lead to fire hazard.

(5) The electric lines between the indoor and outdoor units should run properly to make the cover of the electric box secured tightly, or it would cause the terminal board overheated or cause electric shock or fire hazard.

(6) Cut off the power supply before touching any electric element.

- CAUTION:

(1) The unit should be grounded properly and the ground line is not allowed to connect with the gas line, water line, lightning rod or phone line.

(2) The breaker should be installed, or it would lead to electric shock.

(3) The drain pipe should be installed in accordance with the User's Manual and this Service Manual to ensure free drainage, and the drain pipe should be insulated against condensation. Once the drain pipe is installed improperly, it would lead to water leak which then will damps the ceiling and furniture.

(4) Do not place the unit where there is oil fog, like kitchen, or the plastic would be aged, broken off or the polluted evaporator would lead to water leak and poor performance.

(5) Do not place the unit where there is corrosive gas (like sulfur dioxide), or the corroded copper tubes or welded joint would lead to refrigerant leakage.

(6) Do not place the unit where there is inflammable gas, carbon fiber, inflammable dust or volatile combustible, as they would lead to fire hazard.

- SAFETY:

(1) Always use safety outfits at the construction site.

(2) No smoking and no drunken operation are allowed at the construction site.

(3) Wear no gloves and tighten the cuff when operating the machinery and electrical equipment. Do not maintain it during operation.

(4) Use the abrasive-disk cutter and stand at the side of the rotating abrasive disk.

(5) Clean the opening when installing the riser pipe, and then cover it tightly. Do not throw down any material.

(6) The use of the electric and gas welders should be approved firstly. Once used, a fire distinguisher should be prepared and a service man should be there always. There should be no inflammable and explosive substances around the welding site.

(7) A platform should be set up when working high above the ground.

◆ EXECUTIVE STANDARDS:

(1) Fire protection design of tall buildings GB50045-95.

(2) Code of design on building fire protection and prevention GB50016-2006.

(3) Code for electric design of civil buildings JGJ16-2008.

(4) Technical specification or construction of air conduct JGJ141-2004.

(5) Unified standard for constructional quality acceptance of building engineering GB50300-2001.

(6) Code of acceptance for construction quality of ventilation and air conditioning works GB50243-2002.

(7) Code for acceptance of construction quality of water supply drainage and heating works GB50242-2002.

(8) Code for construction and acceptance of refrigeration and air separating equipment installation engineering GB 50274-2005.

2.Material for Installation

(1) Requirements on Material:

Models, specifications and material of pipelines, pipe fittings, and valves of the water system should comply with the corresponding design codes.

Specifications of the galvanized carbon steel tubes also should comply with the corresponding design and production codes: evenly galvanized internal and external tube walls, no rust, no burrs, and no unmatched thread etc. All tubes should have got the qualification certificates and other necessary quality certificates.

2.1 Pipelines

Tube Types

Application	Type
Water (t＞95℃)	Welded steel, seamless steel, galvanized steel
Water (t≤95℃) Tubes	Welded steel, seamless steel, galvanized steel, nodular cast iron, composited aluminum and plastic (PAP1, XPAP2, RPAP5), PB, PE-X
Water (t≤60℃) Tubes	Welded steel, seamless steel, galvanized steel, PP-R, composited aluminum and plastic (PAP1, XPAP2, RPAP5), PB, PE-X, PE-RT
Cooling Water Tubes	Welded steel, seamless steel, galvanized steel, nodular cast iron
Drain Tubes	PVC,UPVC
Condenation Tubes	Galvanized steel, PE, PVC, UPVC

2.2 Insulation

Typically the refrigerant copper tubes, air ducts, chilled water tubes and condensation tubes should be thermally insulated by the commonly used plastic insulation rather than glass wool, PE or PEF.

Insulation Thickess				
Diameter(mm)	Gas-expanded Rubber		Glass Wool	
	Zone Ⅰ	Zone Ⅱ	Zone Ⅰ	Zone Ⅱ
DN15-DN25	above 15mm	above 20mm	above 30mm	above 30mm
DN32-DN50	above 25mm	above 30mm	above 35mm	above 35mm
DN65-DN80	above 30mm	above 35mm	above 35mm	above 40mm
DN100	above 35mm	above 40mm	above 40mm	above 45mm
Note: under the tropical climate, the insulation should be thickened or doubled.				

Zones in China are classified by the degree of humidity.

Zone I: Beijing, Tianjin, Chongqing, Xi'an, Hangzhou, Zhengzhou, Changsha, Nanchang, Shenyang, Changchun, Herbing, Jinan, Shijiazhuang, Guiyang, Taipei.

Zone II: Shanghai, Nanjing, Wuhan, Dalian, Fuzhou, Xiamen, Gumming, Chengdu, Nanning, Hong Kong, Macao, Guangzhou, and other coastal cities.

Thickness listed in the table above all is larger than the required thickness.

Special adhesives for insulation should be used, as shown in the figure below.

2.3 Sectional Material

(1) Angle Steel

(2) I steel

(3) Channel Steel

(4) Squire Steel

(5) Rectangular Steel

(6) H Steel





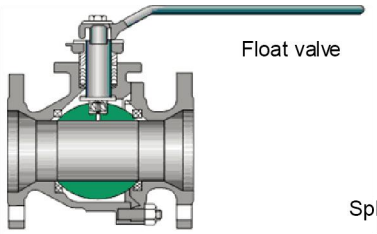
2.4 Valves

The usually used valves incudes: gate valves, shut-off valves, throttling valves, gauge valves, plunger valves, diaphragm valve, plug valves, ball valves, butterfly valve, check valves, safety valves, drain valves, regulating valves, foot valves, and sewer valves etc.

(1) Gate Valve: its nominal diameter generally is or larger than 50mm and is mainly used to cut off the tube flow.

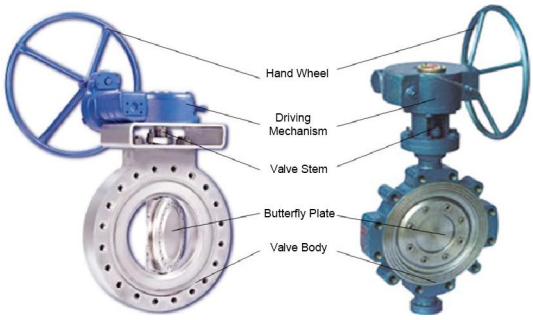
(2) Shut-off Valve and Throttling Valve: its nominal diameter is limited to 200 or below. The shut-off valve is used to cut off the tube flow and the throttling valve is mainly used to throttle the tube flow.

(3) Ball Valve: it is mainly used to cut off or distribute the tube flow or change its direction.



Split ball valve (large caliber)

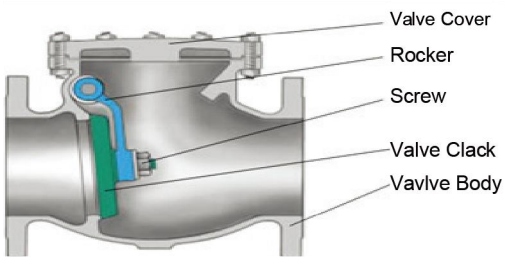
(4) Butterfly Valve: it is widely applicable to all kinds of fluids under 2.0MPa and 200℃.



(5) Plug Valve: it is mainly used to cut off or distribute the tube flow or change its direction.

(6) Check Valve: it mainly used to stop the fluid flow back.

Balance Valve: it is capable of controlling the flow rate and is mainly used to balance the hydraulic pressure of the pipeline system.



Check Valve Balance Valve

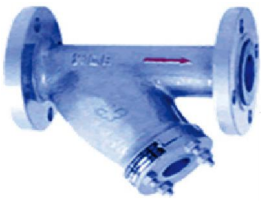
(7) Selection of Valves

Item	No	Selection Principle
Design	1	Butterfly valves for the inlet and outlet of the chilled water and cooling water tubes.
	2	Butterfly valves for the water pump inlet; check and butterfly valves for the water pump outlet.
	3	By-pass valves between the water header and the distributor.
	4	Butterfly valves for the inlet or return water tubes.
	5	Butterfly valves for the horizontal main tubes.

	6	Gate valves, filters, electric 2-way valves or electric 3-way valves for the air handling units.
	7	Gate valves (or with electric 2-way valve) for the fan coil units.
For butterfly valves, the one which diameter less than 150mm is the hand-wheel type; the one which diameter is large than 150mm is the worm-gear drive type.		
Precuations	1	The reducing valves and balance valves should work together with by-pass valves.
	2	Ball valves and gate valves are the best choice for the full-open and full-close type valves.
	3	The shut-off valves should be avoided to the most extent.
	4	Pay much attention to the calculation of the resistance of the valves.
	5	Choose the proper electric valves.
Valves for Water Supply Pipes	1	Regulating and shut-off valve are good choices when the water flow and pressure should be regulated.
	2	Gate valves are good choices when the water resistance is required to be small.
	3	Butterfly and ball valves are good choices when the installation space is small.
	4	Shut-off valves should be used when fluid flows in two directions.
	5	Multi-function valves are good choices for the water pump with large diameter.
Setup Location of Check Valves		
Setup Location	1	at Influent pipes
	2	at the inlet pipe of the closed water heater or water treatment equipment.
	3	at the outlet pipe of the water pump.
	4	at the outlet pipe used also as the inlet pipe of the water tank, water tower and high-level water pool.
	Note: the check valve is not required for the pipe with the backflow preventer	
Type Selection of Check Valves	It depends on the installation location, upstream water pressure, sealing performance and size of the water hammer etc.	
	1	Swing, ball and shuttle-type check valves are good choices when pressure upstream is small.
	2	Spring-type check valves are good choices when there is high requirement on the sealing performance.
	3	Quick-closing check valves or slow-shut check valves with damping devices are good choices when the water hammer is required to be reduced.
	4	The valve clack should be automatically closed with force of gravity or spring force.
Release Valves Required for the Water Supply Pipes	1	at the end and the highest point of the water supply network.
	2	at the peak of some pipe section in the water supply network where a huge amount of air is trapped.
	3	at the highest point of the water supply network equipped with an automatic pneumatic water tank.

2.5 Filters for the Water System

The most commonly used filter is the Y-shaped filter which is usually installed at the inlet of the water pump, reducing valve, locating valve, or other equipment. It is used to remove impurities in the water system so as to protect valves and make the unit run normally. Its mesh number generally is 8～30.



(1) e.g. 1: YBY350Ⅱ-4.0/40B: it indicates YBY series, 350 nominal diameter, 4.0MPa, Ⅱ, stainless steel, 40 meshes/inch.

(2) e.g. 2: YBY250Ⅲ-1.6/60A : it indicates YBY series, 250 nominal diameter, 1.6MPa, Ⅲ, stainless steel, 40 meshes/inch

2.6 Water Softeners

Water at the construction site is likely to be hard, which would cause heavy scale on the pipes. Therefore, a water softener should be installed in the unit. Generally, an automatic softener is preferred.

Electric Water Treating Equipment: it is used to remove impurities, hydrocarbonate, bacterial, algae etc. in the cooling water.

3. Tools

3.1 Cutting and Finishing Tools

It mainly includes: abrasive-disc cutter, hand abrasive wheel, chain blocks, electric drill, threading machine, pressure test device, handsaw, pipe wrench, box wrench, monkey wrench, hammer, and electric welder etc.

3.2 Measuring Tools

It mainly includes: steel band tape, level bar, angle square, U-shaped pressure gauge etc.

Name	Picture	Usage
Electrc Welder		to weld tubes
Abrasive-disc Cutter		to cut steel tubes

Chain Blocks		to install tubes
Pipe Wrench		to install tubes
Percussion Drill		to install brackets
Thread Taper		to draw threads
Hand Mill		to install tubes
Hand Electric Drill		to drill holes
Steel Band Tape		to measure length
Leval Bar		to judge the levelness
Booster Pump		to pressurize tubes

Oxygen Lance		to cut steel tubes

4. Installation

4.1 Preparations

(1) The unit should be installed in the dedicated machine room and measures should be taken to remove heat produced by the unit so as to keep the indoor temperature at or below 40℃.

(2) The unit should be installed at the non-deformable rigid base or concrete foundation which also should be smooth and capable of supporting the weight of the unit.

(3) There should be a drain channel around the unit so as to drain the discharged water during seasonal closedown or maintenance.

(4) There should be enough clearance around the unit for installation and maintenance and there also should be enough space for pipe drawing. Besides, there should be no pipe or wire above the compressor.

(5) It is recommended to reserve enough space for installing the vibration isolating rubber pipe before installing water pipes.

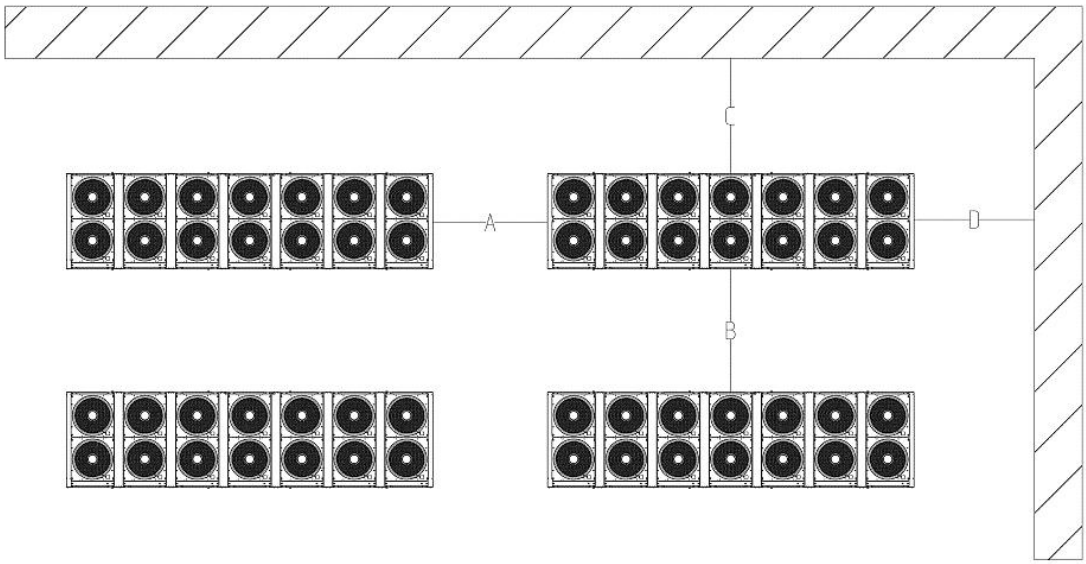
(6) Do not place the unit where there is heavy dust, corrosive smog and high humidity in consideration of the normal operation of electric elements. If so, correct it.

(7) Necessary tools and materials include: flexible joint, vibration-isolating pad, lifting equipment, lifting beam, lifting chain, jack, skid, and crow bar etc.

Note: any modification or retrofit to the unit during installation is not allowed without GREE written consent, or guarantee repair will cease to be available.

4.2 Space for Installation and Maintenance

The longitudinal distance between units should be larger than A, and the transverse distance should be larger than B and keep it as large as possible. When there is a barrier beside the unit, their distance should be kept more than C; if there is a barrier in the longitudinal direction, it should be kept away from the unit more than D.



Size of the unit (L) Height of the barrier (H)	Size of the unit (L) Height of the barrier (H)	A	B	C	D
L≤9m	H＜1.2m	1	3	1.5	1.5
	1.2m≤H＜2.5m	1	3	2.5	2.5
L＞9m	H＜1.2m	1	3.5	1.5	1.5
	1.2m≤H＜2.5m	1	3.5	2.5	2.5

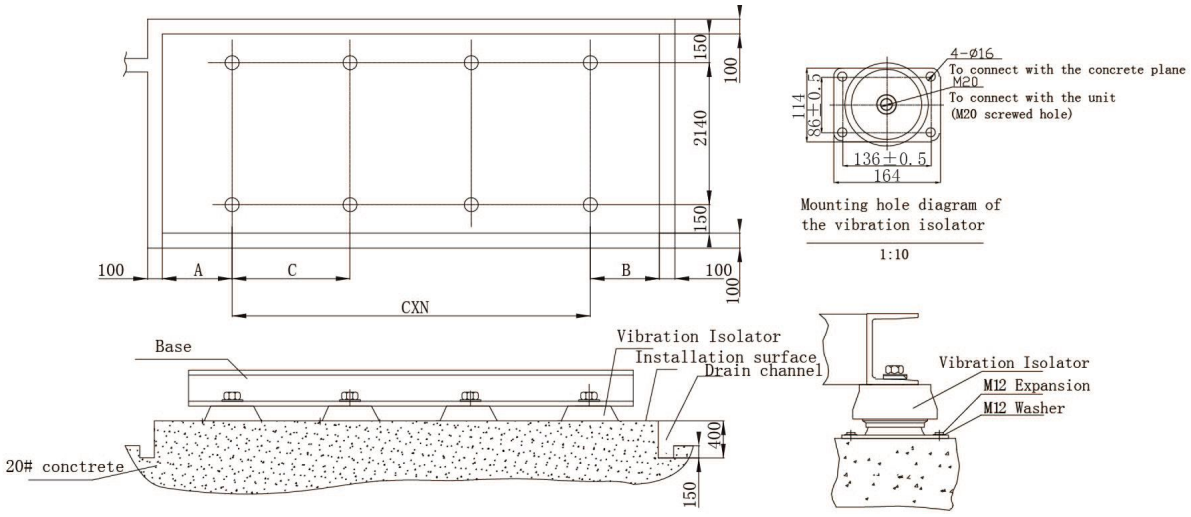
Notes:

a. The unit is not recommended to be placed in a place with barriers on all sides.

b. The unit is not recommended to be placed in a place with barriers on the upper side.

c. If the barrier is higher than 2.5m , please contact GREE.

4.3 Installation Foundation

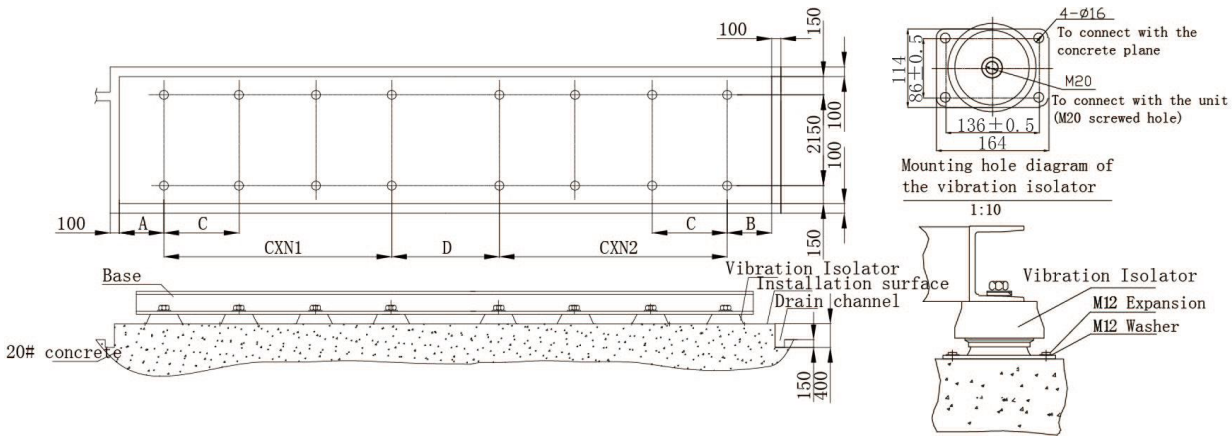


Note: The picture above is for the signal only. The actual outside view of product should be subject to the

actual product.

Sketch for base of units installation(1) (mm)

Model	A	B	C	C×n
LMPA30JD4E/Nb-M	1000	1000	1200	1200×2
LMPB30JD3E/Nb-M	1000	1000	1200	1200×2
LMPA40JE2E/Nb-M	1000	1000	1200	1200×3
LMPB40JE1E/Nb-M	1000	1000	1200	1200×3
LMPA50LE8E/Nb-M	1000	1000	1200	1200×4
LMPB50LE7E/Nb-M	1000	1000	1200	1200×4
LMPA33LF6E/Nb-M	1000	1000	1200	1200×5
LMPB33LF5E/Nb-M	1000	1000	1200	1200×5
LMPB43LG4E/Nb-M	1000	1000	1200	1200×6
LMPB43LG3E/Nb-M	1000	1000	1200	1200×6
LMPA44LF2E/Nb-M	1000	1000	1200	1200×7
LMPB44LF1E/Nb-M	1000	1000	1200	1200×7
LMPB54NG2E/Nb-M	1000	1000	1200	1200×8
LMPA30JD4E/Nb-M	1000	1000	1200	1200×9



Note: The picture above is for the signal only. The actual outside view of product should be subject to the actual product.

Sketch for base of units installation (2) (mm)

Model	A	B	C	D	C×n1	C×n2
LMPB50LE750LE7E/Nb-M	1000	1000	1200	1360	1200×4	1200×4
LMPB33LF550LE7E/Nb-M	1000	1000	1200	1360	1200×5	1200×4
LMPB33LF533LF5E/Nb-M	1000	1000	1200	1370	1200×5	1200×5
LMPB33LF543LG3E/Nb-M	1000	1000	1200	1380	1200×5	1200×6

LMPB43LG343LG3E/Nb-M	1000	1000	1200	1390	1200×6	1200×6

NOTES：

1) The installation base shall be designed by the qualified designer in accordance with the actual field conditions.
2) The installation base shall be constructed of cement or steel and capable of withstanding the operating weight of the unit. Additionally, the surface of the base shall be flat and smooth. It would be better to prepare the drainage channel for the installation foundation.
3) As shown in the figure above, place a sheet of steel plate and a sheet of spring shock absorber (instead of the skid) on the base. After the unit is fixed with the anchor bolts, take the second grouting. Generally, the anchor bolts will be 60mm above the installation surface.
4) Enough space shall be left for installation, operation and service.
5) It is highly recommended not to locate the unit where it would be affected by fire, inflammable or corrosive gas, or waste gas. Besides, sufficient ventilation space shall be kept and effective measures should be taken against vibration and noise.

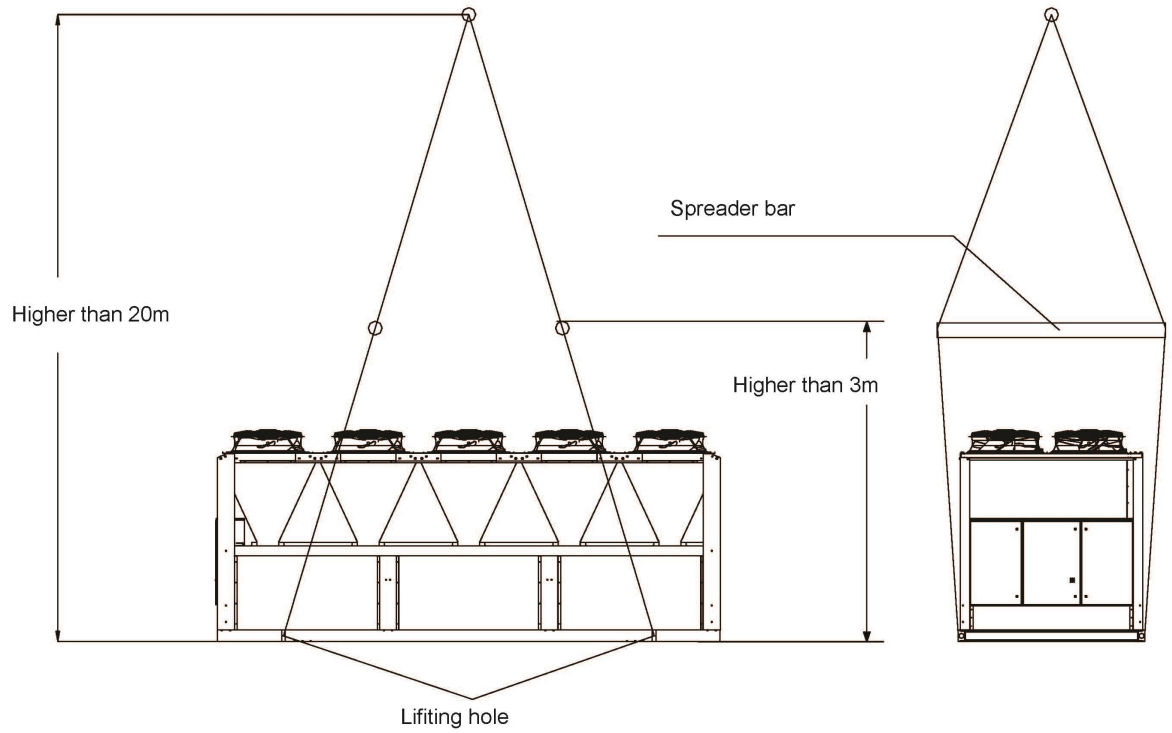
4.4 Main Unit

(1) Each unit will undergo a series of strict factory inspections and tests to guarantee the expected performance and quality. Care must be exercised during installation and transport to prevent the control system and pipelines from being damaged.

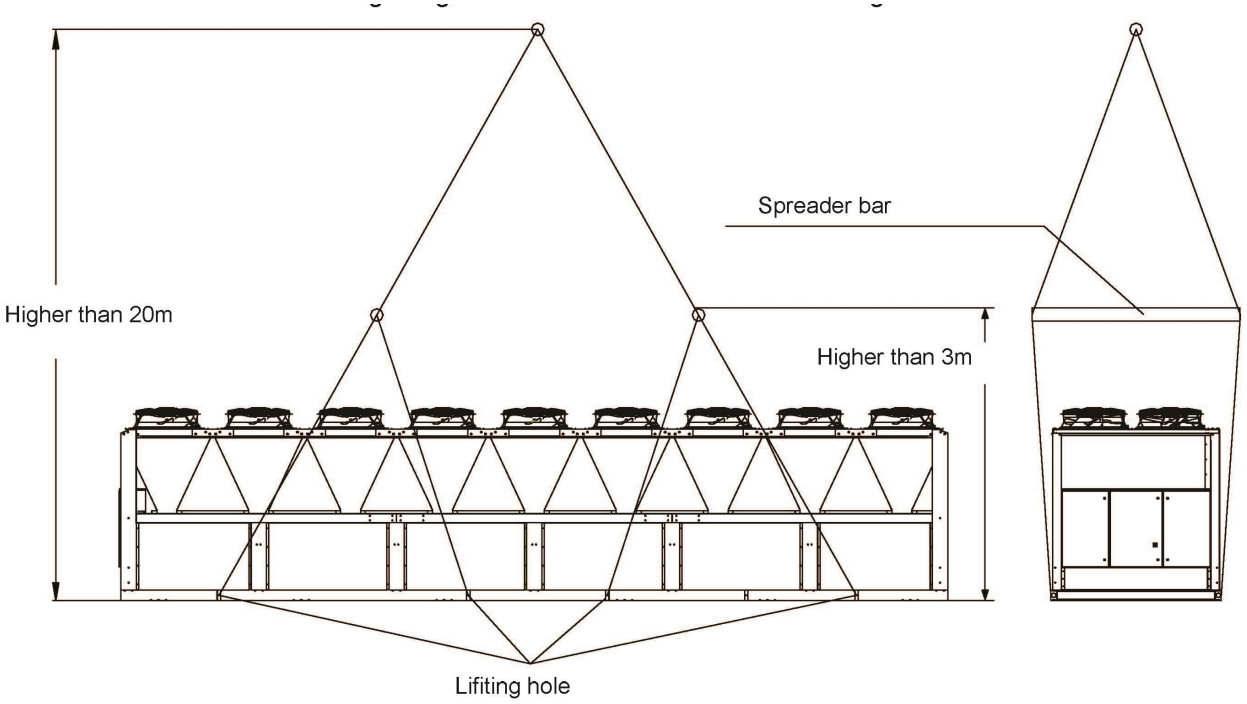
(2) It is best to unpack the unit at the installation location and keep the chiller upward

(3) When the unit is unpacked during handing, please follow the lifting instructions stated below

4.4.1 Handling and Lifting



Hoisting Diagram for the Unit with Four Hoisting Holes



Hoisting Diagram for the Unit with Eight Hoisting Holes

NOTE:

1) Make certain weight of the unit before hoisting and the hoisting ropes and tools should be strong enough to support weight of the unit.
2) Do hoisting as shown in the figure above to avoid any accident.
3) The length of support word should be more than 2600mm.
4) Before lifting the unit, please confirm whether the sheet-metal frame of unit is fixed tightly，to avoid metal sheets from injuring people.
5) Please use the lifting bayonet with lifting mark for lifting the unit. Prohibit using other non-appointed lifting bayonet.
6) The unit should be lifted flatly and stably. Prohibit moving the unit suddenly.
7) Warning lines should be set for hoisting. Do not enter the hoisting area during hoisting. Besides, make sure it is safe during whole hoisting.
8) Real appearance of the unit and quantity of fans may be difference with figures in the manual. However, the unit with the same hoisting hole can do hoisting in the same way.

4.4.2 Installation of Chilled Water Pipes

(1) The chilled water pipe can be installed when the main unit is ready in place. Installation should comply with corresponding codes and regulations so as to ensure highest operating efficiency. No foreign matters are allowed inside the pipe. All chilled water pipes should meet local codes and regulations of pipe works.

(2) The maximum allowable flow rate and pressure at any time is not allowed to be exceeded for the shell-and-tube heat exchanger.

(3) Rinse all chilled water pipes before installation to ensure there is no foreign matters inside. Do not allow any foreign matters into the shell-and-tube heat exchanger.

(4) There should be a flow switch at the outlet pipe of the evaporator in case that there is a need to cut off the flow.

Note: the flow switch is just a safety device and can’t start or stop the unit.

(5) Pipes and pipe fittings should be supported separately but not supported by the unit itself.

(6) Pipes and pipe fittings should be easily detachable so as to facilitate operation and cleaning.

(7) A bypass pipe and a bypass valve are required for the evaporator to reduce impact resistance and facilitate maintenance.

(8) A flexible joint is required between the joint of the evaporator and the joint at the construction site so as to reduce the spread of vibration to the building.

(9) A thermometer and manometer should be installed at the inlet and outlet pipes for convenient maintenance. They should be prepared by the user.

(10) There should be a drain outlet at the lowest point of the water system to drain the water system. There should be an exhaust valve at the highest point to exhaust all air inside the system. The exhaust valve and the drain outlet are not required to be insulated in consideration of convenient maintenance.

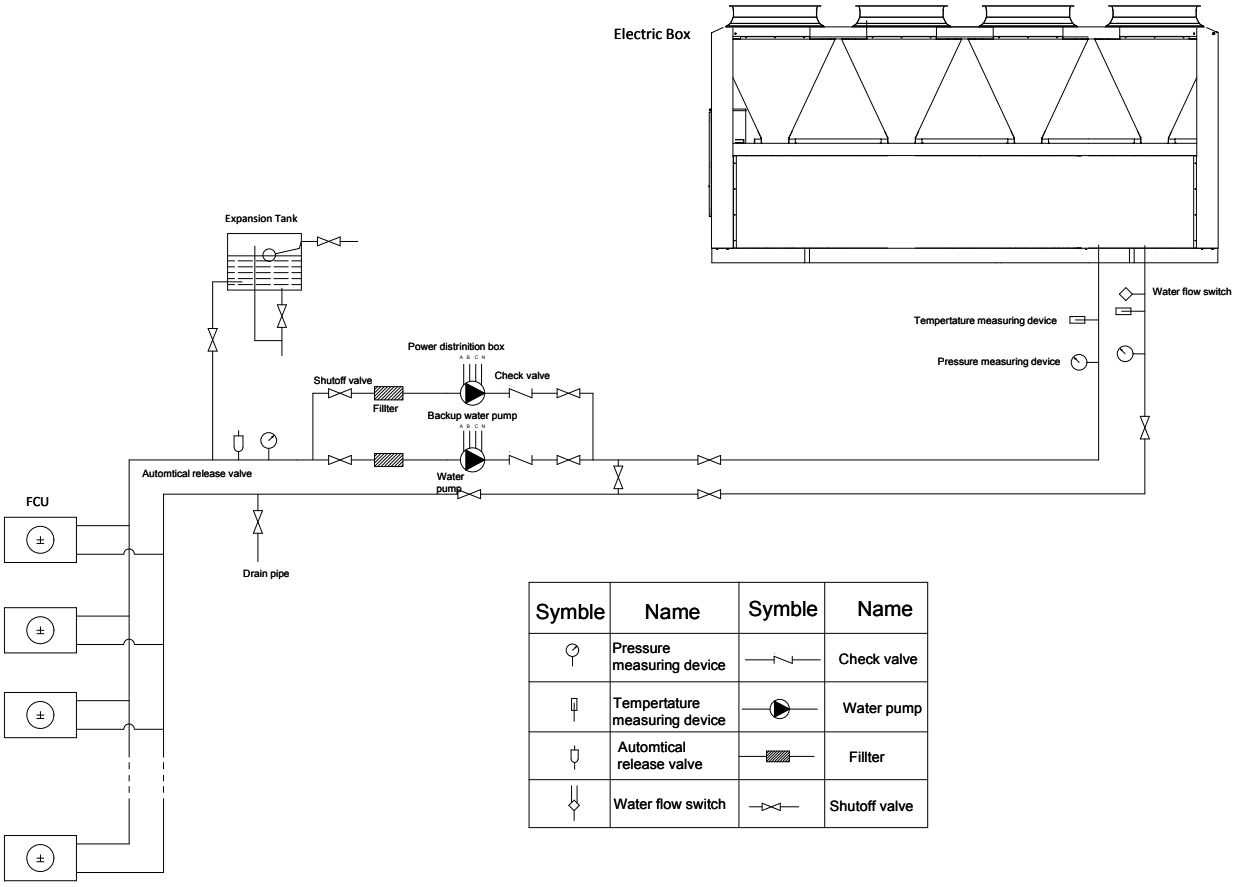
(11) All pipes which are probably frozen up should be thermally insulated, including the drain pipe and flanges of the evaporator.

(12) The chilled water pipe outside should be equipped with an electric heater to prevent it from being frozen up under ultra-low temperature. The electric heater should have a separate fuse.

(13) Under subzero climates, the water system of the unused unit should be drained completely so as to prevent the unit from being frozen up, or take other measures to keep the water temperature no less than 0℃.

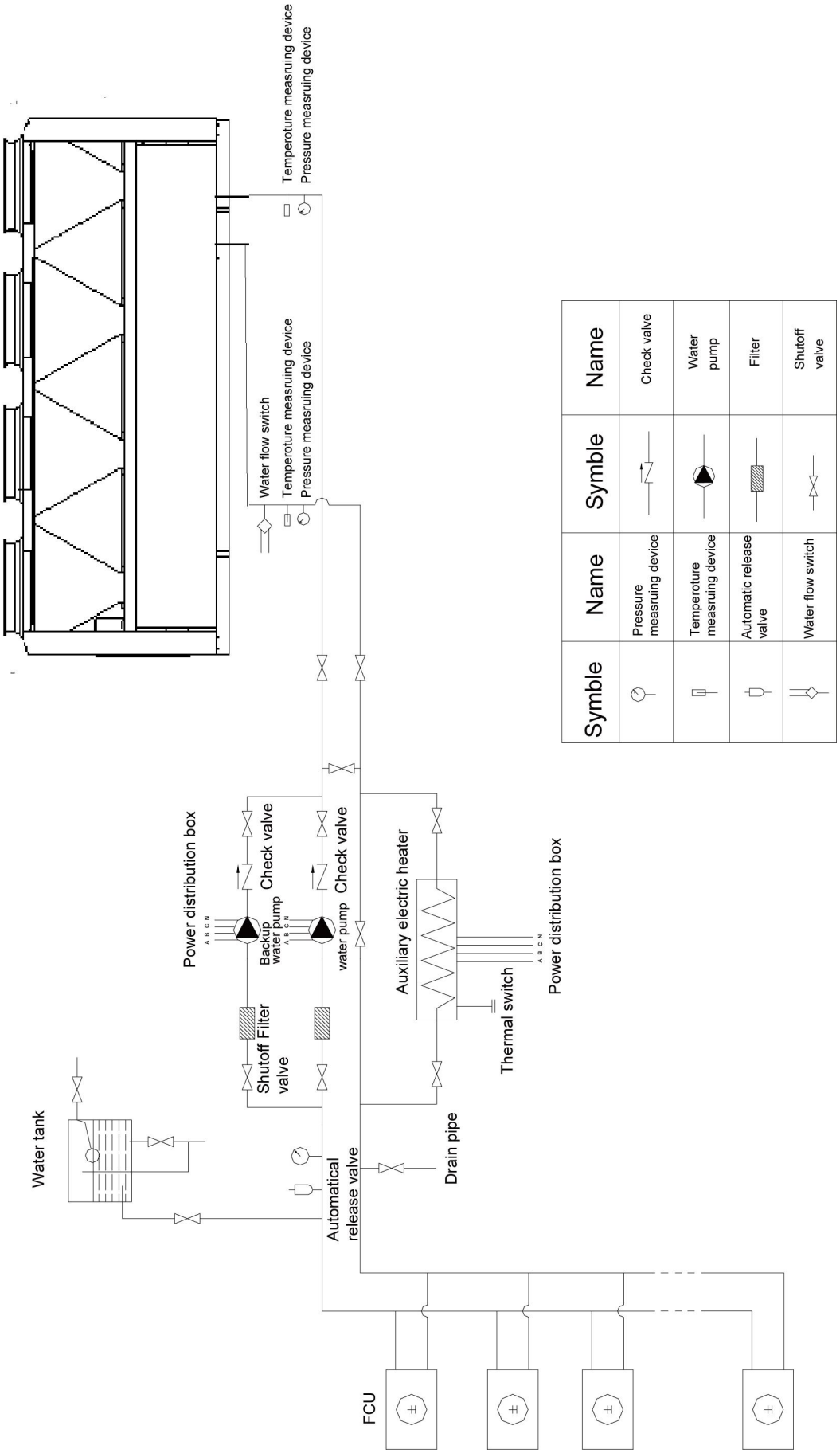
(14) For units connected in parallel, the mixed water temperature sensor should be installed at the public outlet pipe.

WARNING: the installer/user should ensure the water quality as scaling will damage the heat exchanger and water pipes, and also ensure no air enters the water system as air will oxidize the steel elements.



Symble	Name	Symble	Name
	Pressure measuring device		Check valve
	Tempertature measuring device		Water pump
	Automtical release valve		Fillter
	Water flow switch		Shutoff valve

- Heat pump


Temperoture measruing device
Pressure measruing device
Water flow switch
Temperoture measruing device
Pressure measruing device
Power distribution box
Check valve
Check valve
Backup water pump
water pump
Auxiliary electric heater
Power distribution box
Shutoff valve
Filter
Thermal switch
Water tank
Automatical release valve
Drain pipe
FCU
Symble
Name
Pressure measruing device
Temperoture measruing device
Automatic release valve
Water flow switch
Symble
Name
Check valve
Water pump
Filter
Shutoff valve

4.4.3 Requirements on Installation

(1) The piping slope should meet design and construction regulations and the flexible pipe is not allowed to be longer than 150mm.

(2) Pipes which go through the dilatation joint and the settlement joint should be protected with the flexible joint.

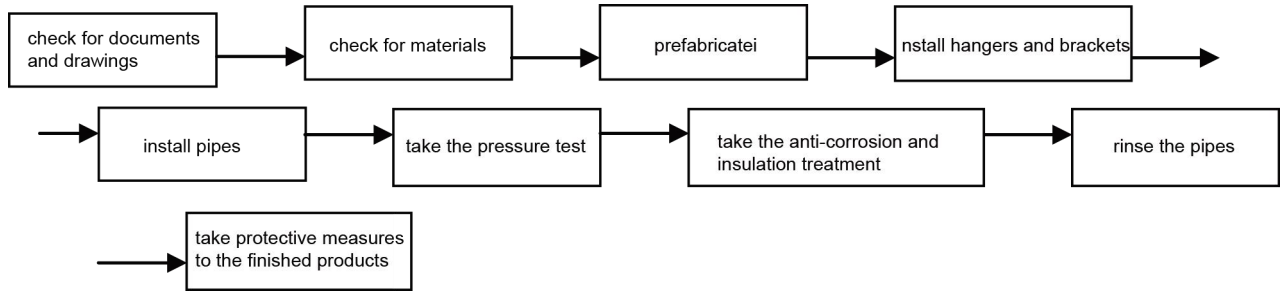
(3) No matter which connection is used, welding, threaded connection or flange connection, the connection joint can't be in the wall, floor or sleeve pipe.

(4) The riser pipe should be installed vertically. When the floor height is or less than 5m, a pipe clip is required. When the floor height is or larger than 5m, at least 2 pipe clips should be required. The installation height of the pipe clip is 1.8m. For the main riser pipe, it should be secured with the fixed bolster to support the weight of the riser pipe.

(5) See the table below for the installation standards of the pipes.

Item		Allowable Deviation	Inspection Method
Straightness	DN≤100m	2L‰,max.40mm	By the ruler, tape measurement
	DN100mm	3L‰,max.60mm	
Verticality		25L‰, max.25mm	By the ruler, tape measurement
Interval of Parallel Pipes		15mm	By the ruler, tape measurement
Parallelism of Parallel Pipes		3mm	By the ruler, tape measurement

Installation Flowchart of the Pipes:



- Check for Documents and Drawings

(1) Check the process flow, construction procedures and quality requirements in accordance with drawings and technical data.

(2) Check the installation location, installation height, arrangement, and installation space of pipes in accordance with equipment drawings and building drawings.

- Check for Materials

(1) Before installation, check for the mode of the valves, clean them and then take the strength and air-proof tests.

(2) Pipes should be cleaned with a steal brush or abrasive paper. After that, seal the pipe ends and keep both the internal and external surface dry.

(3) Pipes should be painted with anti-rust paint without any curtaining and holiday.



- Prefabricating

(1) Make out the installation drawing which clearly indicates the branch pipes, pipe diameter, reduced pipes, location of valves, installation dimensions etc. Then, prefabricate pies in accordance this installation drawing. Pipes should be processed with dedicated cutting machine, leaving no burrs at the pipe ends. After that, pipes should be cleaned to prevent sands and dusts from damaging the joint.

(2) Pipe supports should be prefabricated in accordance with design requirements. The contact part between supports and pipes should be separated with wood blocks which has taken anti-corrosion treatment and is as thick as the insulation.

- Instalation of Pipe Brackets

(1) The supporting beam should be fastened to the wall, pillar or other building structure. It should be placed horizontal horizontally with the top surface parallel with the center line of the pipe.

(2) Pattern, installation, interval and standard height of supports for metal pipes should meet corresponding design requirements and codes.

(3) Supports should be installed securely and contact the pipe closely. Separate supports are required at the connection joint between the pipe and the equipment.

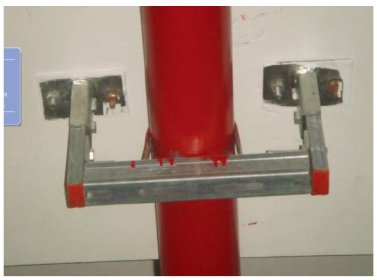
(4) Supports for chilled and cooling water pipes as well as main and branch pipes in the machine room should be anti-vibration. When a single-bar hanger is used, anti-vibration hangers should be set up every 15m and at the pipe ends, valves, tee joints and elbows.

(5) See the table below for the interval of brackets.

Diamter (mm)		15	20	25	32	40	50	70	80	100	125	150	200	250	300
Max Interval between Brackets (m)	Insulated Pipe	1.5	2	2.5	2.5	3	3.5	4.0	5.0	5.0	5.5	6.5	7.5	8.5	9.5
	Non-insulated Pipe	2.5	3	3.5	4	4.5	5.0	6	6.5	6.5	7.5	7.5	9.0	9.5	10.5

Note: it is applicable to the pipes with working pressure less than 2.0 and insulation density less than 200kg/m^3 or without any insulation.





◆ Installation of Pipes

(1) Threaded Connection

Supply and return water pipes with the diameter of being or being less than DN32 should be thread connected, and pipes with the diameter of being or larger than DN40 should be welded. Those which must be detachable should be flange connected. Before installation, foreign matters inside the pie should be removed.

(a) Threads should be processed by the threading machine.

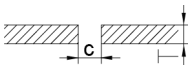
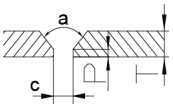
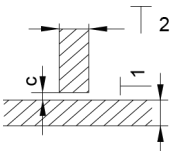
(b) Use marnen as stuffing material and remove those outside of the threads after pipes have been installed.

(c) Threads should be clean and at least 90% threads should be intact. Exposed threads at the connection joint after installation should be 2-3 without any exposed stuffing. Galvanized pipes should be protected and local damage should take anti-corrosion treatment.

(2) Welding

(a) See the table below for types and sizes of grooves for welding which should be processed by the facing machine.

Types and Sizes of Grooves for Welding

Item	Thickness T(mm)	Name	Type	Groove			Remarks
				Clearance C(mm)	ShoulderP(mm)	Angle A(°)	
1	1～3	I-shaped		0.1～1.5	—	—	Misalignment for the inner wall should be≤0.1T and≤2mm, and should be ≤3mm for the external wall.
	3～6 Doule Welding			1～2.5			
2	6～9	V-shaped		0～2.0	0～2.0	65～75	
	9～26			0～3.0	0～3.0	55～65	
3	2～30	T-shaped		0～2.0	—	—	

(b) When pipes with the same diameter and thickness are butt connected, their inner walls should be aligned within a deviation of 1/1000. Length of the groove for welding can't be larger than 10mm.

(c) The groove for welding should be as far as away from the unit and should not be parallel with the center line of the equipment interface. The welding seam should keep a distance of at least 50mm with the hanger and bracket.

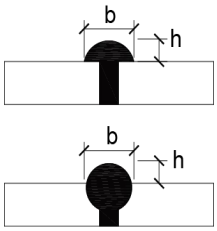
(d) Welding should be done by the qualified welder. In welding, there should be a wind, rain, or snow guard. The environmental temperature for welding can't be lower than -20℃. A 250mm groove for welding should be preheated to 100℃ .

(e) The welding height can't be lower than the surface of the parent metal. There should be no crack and poor welding at the welding seam and the heat-affected zone. There should be no slag inclusion, crater and pore at the welding zone.

(f) Distance of two neighboring butt-jointed seams should be no less than the external diameter of the pipe and can't be less than 180mm. No butt-joint seam is allowed at the elbow. The welding seam should keep a distance of at least the external diameter of the pipe from the elbow and can't be less than 100mm. No branch pipe is allowed to be welded at the elbow and welding seam. The hanger and bracket should keep a distance of at least 80mm with the welding seam.

(g) Surface of the welding seam should be cleaned and be visually inspected. Quality of the welding seam should meet requirements listed the table below.

Reinforced Height and Width of the Welding Seam

Welding Seam	Pipe Thickness (mm)		2～3	4～6	7～8
	Without grooves	Reinforced Height h(mm)	1～1.5	1.5～2	-
		Width b(mm)	5～6	7～9	-
	With grooves	Reinforced Height h(mm)	-	1.5～2	2
		Width b(mm)	About 2mm over the groove		




(3) Flange Connection

(a) The flange should keep vertical with the center line of the pipe. Flange screws should have the same length and same direction. Length of the bolt out of the nut should be a half of the diameter of the bolt.

(b) Flange screws should be fastened along the diagonal to form an even seam.

(c) The flange is not allowed to be directly welded to the elbow but used for the straight pipe at least 100mm long.

(d) When a flange is connected with another, they should match each other naturally to avoid pipes or equipment from producing extra stress.

(e) The flange at the branch should keep a distance of at least 100mm from the main pipe, and the flange at the thru-wall pipe should keep a net distance of at least 200mm with the wall.

(f) When a flange is connected to the unit, a wash should be placed at the center of the flange without any deviation. Except for design requirements, do not used dual-layer, multi-layer, or tilted washers.

- Installation of Valves and Water Filters

(1) Installation location, height and direction of valves should be correct. And they should be arranged orderly within a deviation of 3mm in the same plane.

(2) The valve stem can't be downward but toward the direction which will facilitate its operation.

(3) Attention should be paid to the arrow which indicates the direction of fluid in the valve.

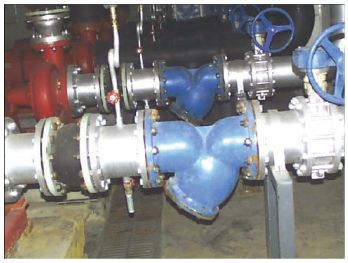
(4) Installation of electric valves and solenoid valves should be guided by electricians. They should be commissioned prior to installation.

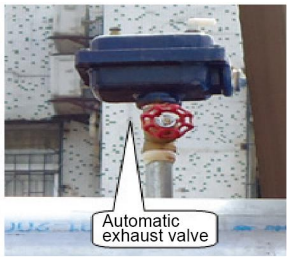
(5) The water filter is usually installed at the inlet pipe of the water pump and other equipment. Pay attention to the water flow direction.

(6) The automatic exhaust valve should be installed at the highest point of the system. In order to facilitate maintenance, a gate valve should be installed upstream of the automatic exhaust valve.

(7) A drain pipe or drain valve should be installed at the lowest point of the water system. For the closed-circuit system, an exhaust valve should be installed at the highest point of the system and where a large amount of air may be trapped.

(8) The water filter should be installed at the inlet pipe in correction direction and easily be cleaned. Material of the filter screen should meet the design requirements.





- Pressure Test

The pressure test includes single item pressure test and whole system pressure test. The former is done when the main pipes or concealed pipes have been installed. The latter is done when all main pipe and riser pipes have been installed. The pressure test should be taken prior to the insulating procedure and done in accordance with the following statement.

(1) The pressure test should be done one section by another. The manometer should be installed at the lowest point of the testing pipes.

(2) Water should be charged from the lowest point. During charging, close all inlet valves and drain valves, but open the manifold valve and each valve at the branch pipes. During the pressure test, it can't be put into normal use. Special attention should be paid that the exhaust valve should be opened until air inside the system is removed completely.

(3) For the heat pump system, when the working pressure is or less than 1.0MPa, the test pressure should be 1.5 times of the working pressure but no less than 0.6MPa; when the working pressure is larger than 1.0MPa, the test pressure is the working pressure plus 0.5MPa.

(4) Raise the pressure to the test pressure and the test pressure should be kept for 10 minutes. Then, lower the pressure to the working pressure and the working pressure should be kept for 60 minutes. No leakage through the visual inspection indicates it is satisfactory.

(5) The filling water test is taken for the condensate water system. No leakage through the visual inspection indicates it is satisfactory.

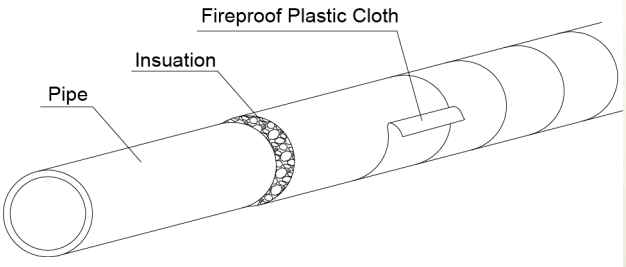
◆ Anti-corrosion and Insulating

(1) Anti-corrosion: supply water and return water pipes, branch pipes, and pipe brackets should be painted with anti-rust paint twice. The damaged galvanized condensate pipes and pipes with exposed thread also should be touched up with anti-rust paint.

(a) Pipes should be painted evenly and the paint thickness should meet relative requirements.

(b) Pipes should be painted without curtaining and holidays.

(2) Insulating: PEF (δ=30mm) is taken as the insulating material.



(a) The insulation should be arranged evenly and smoothly.

(b) Flanges should be insulated separately.

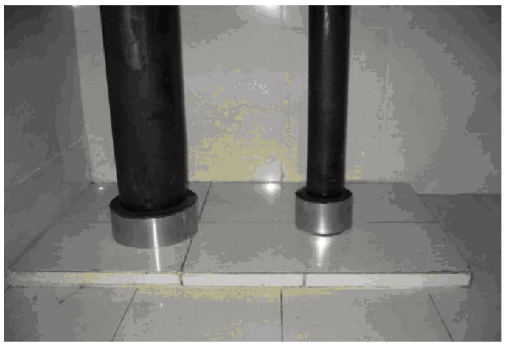
(c) Seams of the insulation should be airproof.

(d) Insulation for the stainless iron sheet should be smoothly and the seams should be airproof.

(e) Flanges should be insulated separately.

(f)Seams of the iron sheet should be at the downstream of the drain water.

(3) Note: for the riser pipes, when the floor height is or less than 5m, there should be a bracket tray for each floor; when the floor height is larger than 5m, there should be at least two bracket trays 200mm ahead of the riser pipes. The diameter of the bracket tray can't be larger than the thickness of the insulation. Expansion seams should be left for the insulation of the brackets. A 5mm expansion seam should be left every 5-7m on the branch pipes. Also 30mm seams should be left for elbows. Clearance between the insulation and the pipe sleeve should be stuffed with non-inflammable material.



(4) Pipes should be labeled with legible fonts and the direction of the fluid. The paint color should be selected properly. Once color circles are used, their intervals should be even. Labels listed in parallel should be arranged reasonably.

(a) The typeface on the label matches with the diameter of the pipes.

(b) The label indicates the name and direction of the fluid.

(c) The label is eye-catching and struck reliably.

◆ Cleaning of Pipes

After the pressure test, the system should be rinsed one section by another with the maximum allowed flow or the flow no less than 2m/s until leaving water is as clean and transparent as entering water. For the heat pump system, it can be put into normal use until it has been rinsed (leaving water is as clean and transparent as entering water.) and has taken a trial run for about 2 hours.

◆ Protection for the Finished Product

(1) Prefabricating, anti-corrosion treatment, setup, and pressure test procedures go closely one by once. If interrupted, the open mouth of pipes should be closed to prevent foreign matter entering.

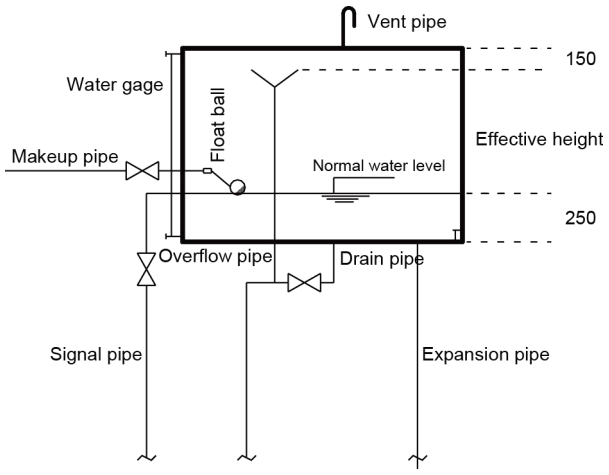
(2) Installed pipes can't be taken as the lifting center, and also can't be stepped on.

(3) Pipe repair should be finished prior to external decoration and do not damage any wall and floor finished product after external decoration.

(4) During external decoration, installed pipes, valves, gauges etc. should be guarded by appointed personnel to prevent them from being damaged in other construction procedure.

4.5 Installation of the Expansion Tank

An expansion water tank should be installed for the closed-circuit water system to buffer water expansion and constriction as well as avoid effects on the water pipes caused by makeup water.



(1) The field-supplied water tank should take the leakage test and then take derusting, seam sanding, and anti-corrosive treatment For the water tank used below 30℃, it should be painted with red lead rust-proof paint twice; for the water tank used at 30～70℃, it should be painted with vinyl chloride 4-5 times; for the water tank used at 0～95℃, it should be painted with heat-proof anti-decaying paint 4-5 times. After such treatments, no direct welding is allowed.

(2) The water tank should be installed horizontally. Its main body can be placed at the bar support which should extend out of the baseplate at least 1000mm. The height of the bar support can't be less than 300mm.

(3) When water pipes are installed where heating is unavailable, the water tank, expansion pipes, circulating pipes and signal pipes should be thermally insulated.

(4) The installation height of the expansion water tank should be in the way that the lowest level of the water tank is at least 1m above the highest point of the water system.

(5) For the mechanical circulating air-to-water system, in order to keep the expansion water tank and water system run normally, the expansion pipes of the expansion water tank should connect to the suction inlet of the circulating water pump. For the gravity circulating system, the expansion pipes should connect to the top of the main supply water riser pipe.

(6) For the two-pipe air-to-water system, the effective volume of the expansion water tank should be determined in accordance with the heating conditions.

(7) When the water tank is or higher than 1500mm, it should have ladders both inside and outside of the water tank. When the water tank is or higher than 1800mm, it should have two glass gauges to indicate the water level.

(8) The circulating pipe should connect to the main return pipe. The connection point should keep a horizontal distance of no less than 1500～3000mm with the constant pressure point.

4.6 Installation of Condensate Pipes

Setup-Insulating-Fastening

Precautions

(1) Adverse slope is not allowed for the slope larger than 1%.

(2) It can't connect with the rain water pipe, sewage pipe or other pipes.

(3) The elbow ventilator should be installed at the highest point of the condensate pipe to prevent foreign matters coming into the drain pipe.

(4) The S-shaped trap and flexible joint are necessary.

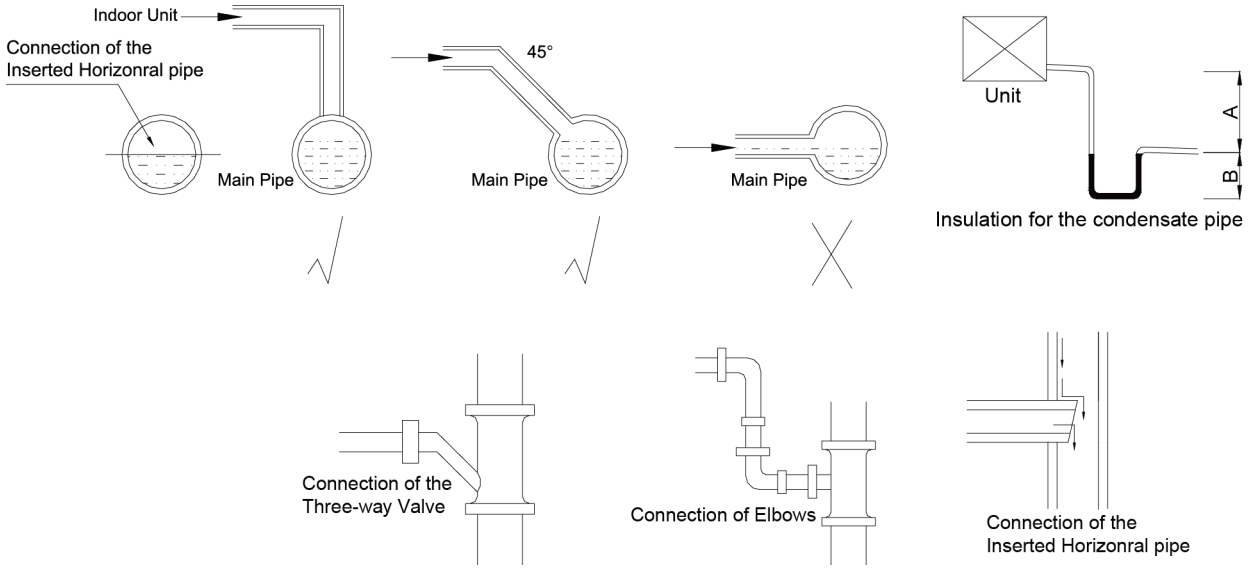
(5) The diameter of the pipes should be suitable.

(6) The wall-thru or floor-thru pipes should be protected by the steel sleeve. Do not put seams inside the sleeve. The steel sleeve should keep flush with floor, or 20mm above the floor for the floor-thru pipes. The steel sleeve is not allowed to affect the slope of the pipe and can't be used as the support of the pipe. Clearance between the pipe and the sleeve should be stuffed by flexible non-inflammable material.

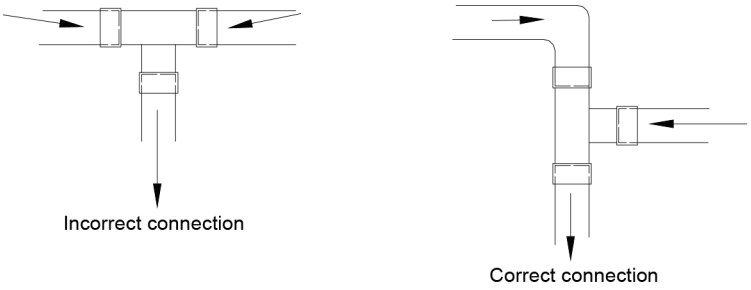
4.6.1 Setup

The condensate pipes should be at least 300mm away from the electric box of the unit. For special space, its installation location should be approved by the corresponding designers.

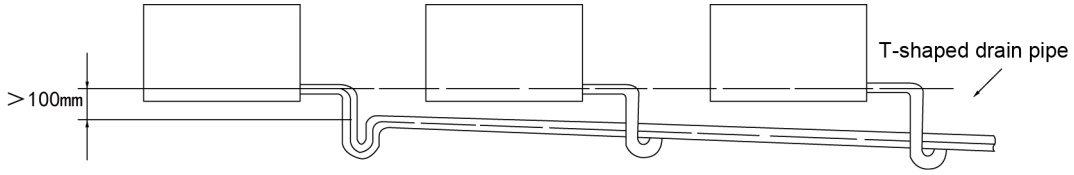
Connection of the Main Pipe and the Branches:



When the three-way valve is used for the condensate pipe, its straight two connectors should be kept at the same level as shown in the right figure.



When there are several indoor units at the same floor, their condensate is usually drained out through one main pipe. In this case, the branches pipe for each unit should be located higher than the main pipe. The size of the condensate pipe is determined by the capacity and number of the indoor units.



The T-shaped drain pipe should meet the running capacity of the unit.

When the negative pressure at the pipe outlet is too large, elbows should be fitted to the drain pipe.

A=P+25mm

B=P/2+25mm

P—negative pressure mmH_2O

Pipe Size≥32mm

4.6.2 Insulating

The extended drain pipe should be insulated and special care must be paid to the elbows. See the table below for the thickness of the insulation.

Drain Pipe(mm)	Thickness of Insulation (mm)
As required	≥15

The insulation should be thickened at the humid area.

4.6.3 Fastening

The insulating tube is just required to be bundled and fastened at the supporting bracket.

4.7 Wiring of Power Lines

(1) Sizes of the power lines and breakers have close relationship to the local climate, soil and wiring method. They are selected usually by the designing institute in accordance with the maxim power (ampere).

(2) All field-supplied conductors, equipment, and conductor joints should meet corresponding regulations and requirements.

(a) All wiring should be done by the qualified electrician.

(b) Cut off the power supply prior to wiring.

(c) The installer should take responsibilities for losses caused by improper external wiring.

(3) WARNING-only copper conductors are allowed.

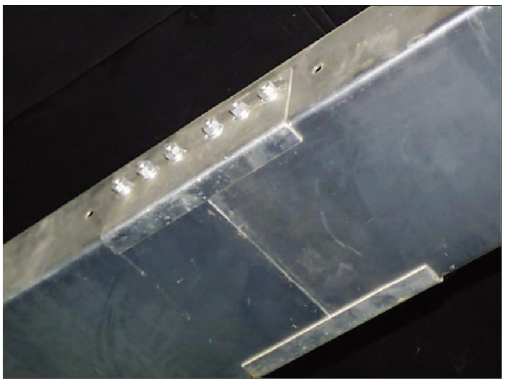
(a) Wiring and Protection of the Power Lines

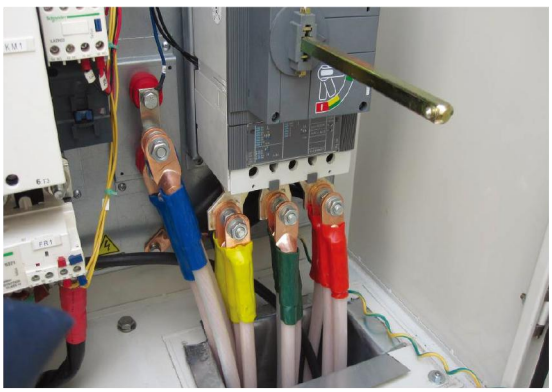
(b) The power lines should run in the wireways or wire conduits.

(c) Wires entering the electric box should be protected with rubber or plastic to prevent them from being damaged by the sharp edge of the metal sheet.

(d) Wires close to the electric box should be fastened securely so that the terminal board in the electric box won't be affected by external force.

(e) Power line should be grounded reliably and never connect with the gas lines, water lines, lightening rod, or phone lines.


4.8 Wiring of Control Lines

4.8.1 Requirements on Control Lines

(1) The minimal size of the field supplied control line should be 1mm^2.

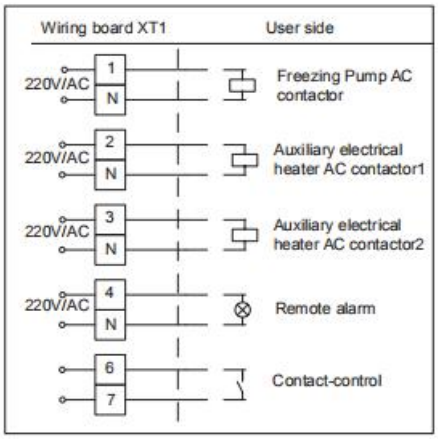
(2) Never let 50v or higher lines go parallel with the control lines of the flow switch. If inevitable, they should be kept away with a distance of at least 150mm.

(3) The control signals (220VAC, 5A) of the chilled water pump and auxiliary electric heater can drive their contactors respectively and never drive the chilled water pump and auxiliary electric heater directly.

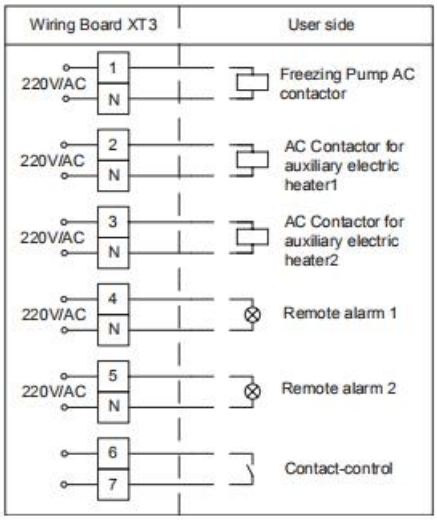
(4) Length of the control line inside the electric box should be proper, and never bundle it and then stuff it into the electric box.

4.9 External Wiring of Control Lines

Single compressor

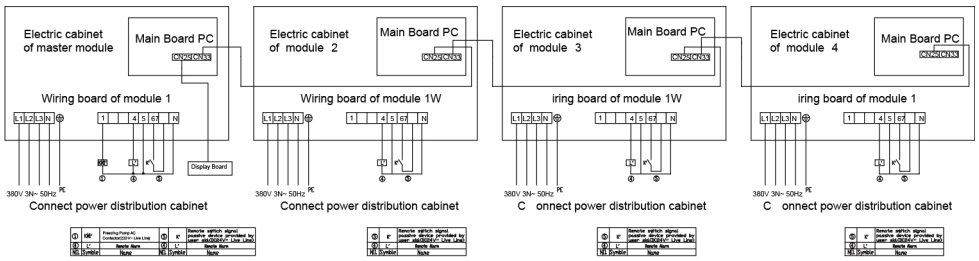


Dual compressor



Note: Please refer to the wiring diagram for the unit.

4.10 Connection method between master and slave module and wiring diagram



Note: 1. The signal connection wire among main board is the standard parts by manufacturer.
2. The wire diameter for control wires (except power cord) ≥1.0mm2.

4.11 Commissioning

When the main body, water pipes, power lines are ready in place, commissioning can be done and supervised by GREE appointed personnel.

WARNING: the unit is able to control the water pump, but the unit is not allowed to prior to commissioning. Instead the unit should be controlled through the temporary wiring.

4.11.1 Preparation

- Documents
  - (a) User's Manual
  - (b) certificates
  - (c) wiring diagram
  - (d) saturated temperature and pressure
- Tools
  - (a) refrigeration tools
  - (b) digital volt-ohmmeter
  - (c) clip-on mete
  - (d) electric leak detector
  - (e) megohmmeter

4.11.2 Check before Commissioning

- Check for Installation of the Main Unit

Check the installation location, installation foundation, and maintenance space etc.

- Check for the Water System

(1) Is the water flow direction in the condenser and evaporator correct?

(2) Are the chilled water pipes clean? Is there any foreign matter trapped in the joints? Is the water quality satisfactory?

(3) Is the insulation of the chilled water pipes in good condition?

(4) Are the manometer and thermometer connected correctly (Is the manometer at a right angle with the water pipe, and is the thermometer's probe inserted into the water pump)? Do the initial values of the manometer and thermometer comply with requirements before commissioning?

(5) Is the leaving water flow switch installed correctly? Is this flow switch correctly wired to the electric control cabinet? Start the chilled water pump through the contactor and see: does the chilled water pump run in the correct direction (clockwise)? If not, check the wiring of the water pump.

(6) Run the chilled water pump and see: is the water pressure stable? Do the reading values of water pressure change slightly? Is the running ampere in the rated range? If not, figure out and eliminate the causes.

(7) Does the water makeup device of the expansion water tank work well? Does the automatic exhaust valve work well? For the hand exhaust valve, open it to exhaust air inside the system.

4.11.3 Check for Work Load

Check and see: Are the air handling units connected correctly? do all diffusers work smoothly?; are the tightness and insulation of the conditioned space in good condition? ; does the required load match with the capacity of the unit?

4.11.4 Check for Wiring

WARNING: Do not check the power supply without any proper detection device and preventive measures, or it would lead to severe injuries or even death.

Each module should be supplied with dedicated power lines. After wiring, check the following items one by one.

(a) Is the size of the air switch proper?

(b) Does all electric installation meet corresponding electric standards or codes?

(c) Is all wiring correct?

(d) Are all interlocks work well?

(e) Do contacts of all contactors work well?

(f)Are the power supply and insulation in good condition?

(g) Is the set point of the control and protection elements correct?

4.11.5 Commissioning

Following inspections above, the unit is allowed for commissioning.

(a) Power the unit at least 8 hours before the unit is going to be started up so as to preheat the crankcase of the compressor.

(b) Adjust the flow control valves or shutoff valves of the chilled water system to make the flow meet application requirements.

(c) Check if there is any error with the control panel. If so, figure out and eliminate it before restarting the unit.

(d) Start up the unit when the set point of each parameter is correct.

(e) Check the rotating direction of the compressor. If reversed, exchange two phase lines. And also check the lubricating oil which is required to be kept at the visible position.

(f) 30 minutes later, set the entering water temperature in accordance with the user's load demand. The unit should be restarted with an interval of at least 10 minutes.

Notes:

(a) Do not start the unit when rinsing the water system.

(b) Do not start the unit when the water system has not yet drained completely.

(c) A flow switch should be installed at the water pipe and interlocked with the unit, or the user will take full responsibility for losses caused by water break.

5. Typical Problems and Impacts

No.	Typical Problem	Impact
1	Insuffcient installation space	Inconvenient maintenance, impeded discharge, reduced heat exchange efficiency, or even abnormal operation.
2	Improper piping	Startup failed
3	Improper cleaning to the water system	Scaling
4	Incorrect wiring	Damage to elements
5	Incorrect or incorrectly wired communication line	Abnormal communication or disordered control
6	Communication line under improper protection	Broken communication line and failed communication
7	Improper insulation on the chilled water pipe	Reduced heat exchange efficiency
8	Improper vibration isolation treatment	Gradually raised vibration and noise, or even abnormal operation
9	Thru-wall water pipe without the outer protection tube	Water leakage
10	unreasonably arranged equipment and pipelines	Disorder

Before installation, the servicemen should have a good knowledge of special requirements. Only the qualified servicemen are allowed to do the installation. For special workers, like welders, electricians, refrigeration mechanics, they should have got corresponding certificates.

Ⅴ Test Operation & Troubleshooting & Maintenance

1. UNIT MAINTENANCE

1.1Significance

Regular maintenance plays an important role for performance and service life of the unit. For the new unit, maintenance should be done more frequently. After one year, each part has been under harmonic status and maintenance can be down as per the table below. Besides, after disassembly and replacement, the unit should be maintained the same as the new unit.

Frequency	Record/Check/Maintenance Items	Operator	Remarks
Every day	ON/OFF status of the unit	○	Upon every ON/OFF operation
	low of the circulating pump	○	
	Level of lubricating oil	○	
	Power voltage	○	
Every week	Visual inspection to lubricating oil	○	
	Analysis to running records	○	See maintenance of each component for more details.
Every month	Analysis to water quality	△	
	Check and maintenance to the electric control box	○	
Every quarter	heck to electric wiring and insulation	○	
	Check to the filter-dryer	☆	
Every year	Check to the safety valve	○	
	Analysis to lubricating oil	△	
	Confirmation of insulation for the main motor	☆	
	Analysis to refrigerant	△	
	Leak test	○	
	Cleaning of fins	☆/○	
Every four years or every 20000 hours	Replacement of lubricating oil	☆	

Notes:

○ indicates it should be performed by the user; △ indicates it should be performed by the third party; ☆ indicates it should be performed by GREE appointed servicemen.

Frequency listed in the table above are for normal operation. When it is founded that the check part or item is likely to be degraded or would affect the normal operation, then the frequency should be increased.

1.2 Maintenance to Lubricating Oil

1.2.1 Appearance Check of Lubricating Oil

Check the appearance of lubricating oil through the sight glass (when the sun light is not enough or there is color light for interference, please use the torch).The normal lubricating oil should be transparent light-yellow liquid. As the unit runs, its color will be more and darker. Sometimes, there will be bubbles in the lubricating oil, which is normal. But when there are solid particles or other foreign mattes, it is abnormal.

When the color of the lubricating oil is apparently dark or blacken or there are quite many foreign matters, please contact GREE for replacement.

1.2.2 Analysis to the Quality of Lubricating Oil

The quality of the lubricating oil should be checked once every year. Take some oil from at the outlet as the sampling and then send it to the processional detection organization for analysis. The normal lubricating oil should meet requirements listed in the table below.

Quality Index of Lubricating Oil

Item	Unit	Index
Kinematic viscosity	Cst (40℃)	68
Freezing point	℃	39
Flash point	℃	250
Total acid value	mg KOH/g	≤ 0.15
Hydroxyl value	mg KOH/g	2
Water	(PPM)	≤ 50
Chromophore		300

1.2.3 Replacement of Lubricating Oil

Before replacement, please contact the Gree after-sales center for confirming the lubricating oil. Incorrect lubrication oil will lead to abnormal operation of the unit .Mixed oil is not allowed to be used. For the initial operation, it is suggested to replace the lubrication oil after the unit has run for 2000 hours and clean the oil filter. Then, if the system operation is good, replace it every 20000 hours or every four years. Meanwhile, please decide whether to replace it or not based on the detection results.

Do replacement as the following steps:

Step 1: discharge lubricating oil. When the unit breaks down or it is required to be disassembled, discharge oil inside firstly. Care must be taken that refrigerant should be discharged prior to the lubrication oil. When oil has been completely discharge, go to the next step.

Step 2: recharging lubricating oil. Recharging can be performed when only leak test is passed. The recharging is done in the way that: keep the pressure during the vacuum test, put one end of the charging line to the charging valve, and the other end to the oil container, then open the charging oil. After charging volume is reached, close the charging valve. During this process, do not let air entering into the unit. The charging line should be kept as short as possible. Do not overcharge or undercharge.

1.2.4 Replacement of the Oil Filter

The oil filter should be replaced when the unit goes into oil pressure difference protection frequently. Replacement should be done when refrigerant has been discharge.

NOTE
There will be some oil trapped in the filter, and please put it to the oil container during replacement.

1.3 Maintenance to the Refrigerant System

1.3.1 Routine Maintenance

For the first charging of refrigerant, check status of refrigerant through the sight glass of the electrostatic expansion valve.

If refrigerant leaks, operation parameters at the same conditions will change. For instance, at the same leaving water temperature, the evaporating pressure will decrease and the cooling capacity will go down. These can be taken as evidences for judging if refrigerant leaks or not.

1.3.2 Leak Test

Generally, little leak will not bring apparent change. Therefore, leak test should be done each year. As there is refrigerant inside the unit, the inner pressure will be higher than that outside. Therefore, foaming agent or soap water can be used for leak test at each connection point of the unit.

Leak test for the heat exchanging tube is a little complicated. It should be done once every three years. When the water quality is quite poor, leak test should be done more frequently. As it is hard to access to the inner side of the heat exchanging tube, it is suggested to use the processional electric leak detector or contact Gree after-sales center for help.

1.3.3 Refrigerant Analysis

As purity plays a key important role for operation efficiency of the unit, refrigerant analysis should be done once every year. It is suggested to do it before seasonal use. Take some refrigerant from the charging valve into an enclosed container for sampling. Then, the detection result can decide if refrigerant should be purified or not.

If purified or not	Oil mixed %	Acid (ppm)	Free moisture
Yes	above 5%	above 5ppm	observable
If regenerative or not	3~5%	3~5ppm	3~5ppm
No	below 3%	Below 3ppm	unobservable

Purification of refrigerant requires professional tools. It is suggested to invite the professional organization or contact GREE after-sales center.

For the unqualified refrigerant, all refrigerant should be discharged for purification and can be reused until it reaches the standards listed at the table above.

1.4 Maintenance to the Evaporator and Condenser

The refrigerant R134a is a kind of middle/high pressure medium. The evaporator of the unit belongs to class-2 pressure vessel and its design, manufacture, inspection and reception test should comply with NB/T 47012-2010 Pressure Vessel used in Refrigerant Device. Their installation and usage should conform to TSG 21-2016 Safety Supervision Regulation for the Fixed Pressure Vessel and Safe

Technology Supervision Regulation for Pressure Vessel. Before usage, it is a must to declare to the local safety supervision department and perform the register procedure of usage. See the nameplate of the evaporator for its main technical data.

1.4.1 Evaporator (Shell-and-tube)

(1) External Inspection

Outer inspection refers to the periodical inspection of evaporator and condenser. The inspection should be performed at least once every year and by professional staff recognized by safety inspection agency according to the 20th regulation of Inspection Regulation of Pressure Vessel.

(2) Internal and External Inspection

The first inspection period should be three years. Considering that R134a does not have erosion effect on steel, copper and aluminum, the evaporator and condenser can be inspected with the overall repair of the unit if it is running normally and agreed by safety inspection agency. However, according to TSG R0004-2009 Safe Technology Supervision Regulation for Pressure Vessel, the inspection should be executed every 6 years. It should be performed by qualified professional staff according to the 23rd regulation of Inspection Regulation of Pressure Vessel.

1.4.2 Maintenance to the Evaporator

The evaporator should be cleaned and checked every year. Based on scaling condition of the evaporator tubes, it is able to estimate the working condition of the water treater and decide if it is required to clean the tubes. Besides, it also able to estimate the scaling condition through the running parameters. Under the same leaving chilled water temperature, if the evaporating temperature goes down by 2℃， then the evaporator tubes is likely to need to be cleaned. Check and cleaning steps are stated as bellows:

(1) Cut off the power supply

(2) Close valves of the chilled water pump and the evaporator, and open the drain valve to drain the trapped water completely.

(3) Disconnect the unit and the water system, remove screw bolts of the water chamber at two ends of the evaporator, and remove the water chamber by lifting.

(4) Check the evaporator tubes and devices of the water system (like flowmeter, thermometer etc.)

(5) Clean the evaporator. If the flow meter, temperature sensor or other devices are corroded or scaled, they should be replaced or cleaned.

1.4.3 Maintenance to the Condenser

The condenser should be cleaned once every year, as fins of the evaporator contact with outside air and dust will accumulate. If it is apparent that there are many foreign matters at the fins, cleaning should be done more frequently.

Besides, under the same environment temperature, if the condensing temperature goes up by 4℃, it indicates the fins should be checked. If necessary, they should be cleaned.

Cleaning steps of the condenser is the same as these for the condenser. During cleaning, care must be taken to protect the condensing tubes, and also check devices at the condenser.

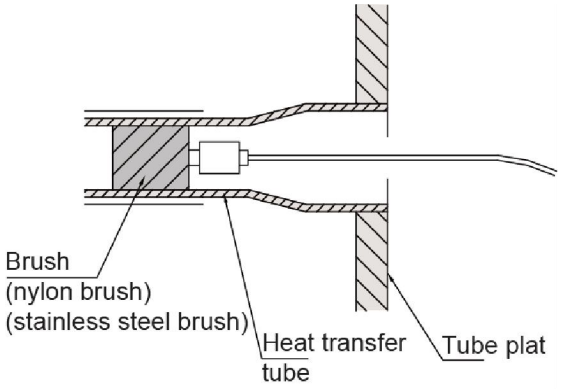
1.4.4 Cleaning of the Heat Exchanging Tube

According to the scaling condition, there are generally two cleaning methods, mechanical cleaning and chemical cleaning.

(1) Mechanical Cleaning

Mechanical cleaning can be used when scale is not very severe and the actual condition is allowed.

Cleaning steps are: open the cover and clean the heat exchange tube with brush. Bush can be nylon or stainless steel, depending on the situation of scale.



(2) Chemical Cleaning

If the scale cannot be removed with stainless-steel brush, or mechanical cleaning is not available due to site limitation, it is necessary to execute chemical cleaning. Herein the most commonly used cleaning method is introduced, namely circulation cleaning method.

Character: although there should be recycle pump for water tank, the cleaning takes less time and detergent. Cleaning steps are stated below:

① Seal the inlet and outlet pipe of the heat exchanger with stop plate.

② Mount the accessory of pipe.

③ Mount the recycle water pump.

④ Ensure no leakage of the recycle water used for cleaning.

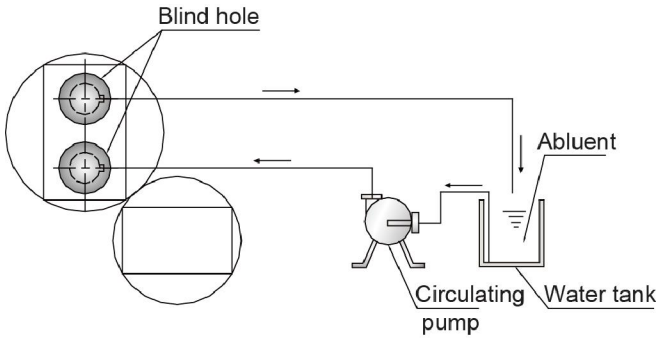
⑤ Adjust the density and temperature of the detergent.

⑥ Circulate detergent.

⑦ Clean with circulating water.

⑧ Inspect and disconnect the pipe.

After circulation, inspect the pipe or clean it again.



NOTE
The heat exchanging tube should be cleaned with professional tools. It is suggested to invite the professional organization or contact the Gree after-sales service center.

1.4.5 Corrosion Leak Test to the Heat Exchanging Tube

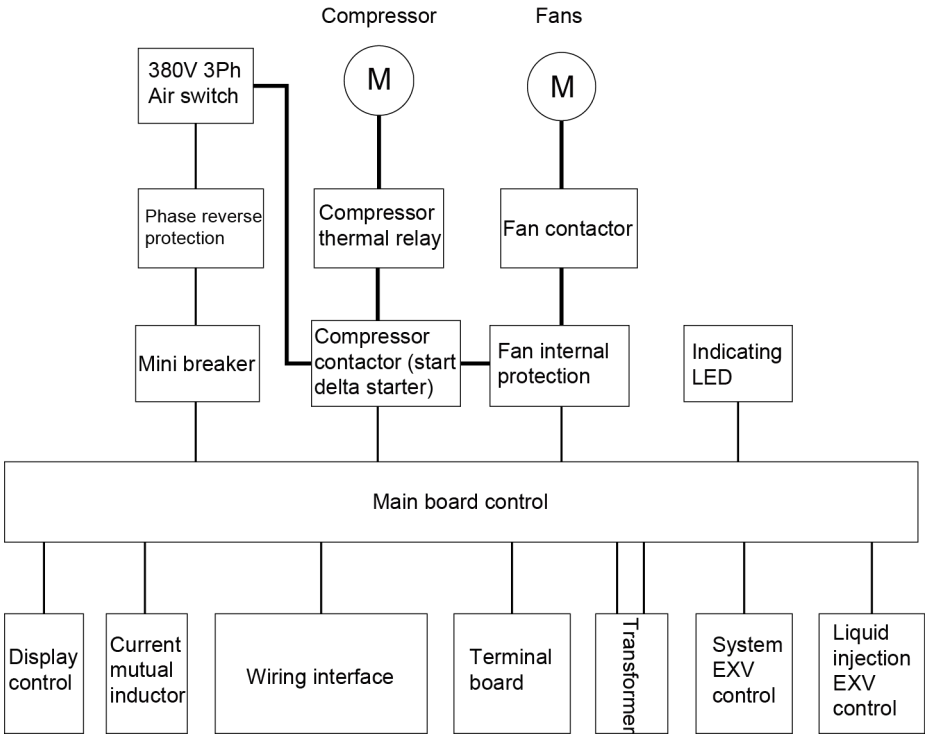
After the unit has run for about 2~3 years or the analyzing results reveal that water in refrigerant exceeds 20ppm, it is necessary to take corrosion leak test. Before test, drain water and refrigerant, then charge dry nitrogen 900kPa(6Kgf/cm2G) to the evaporator and apply soap water or foaming agent at the connection point of each connection point of the tubes to see if there is leak or looseness.

1.5 Maintenance to the Electric System

WARNING
Prior to maintenance to the electric system, please cut off the power supply.

1.5.1 Power Distribution

- **Basic Principle**



Note: the bold lines presents the main circuit and the fine lines represent the control circuit.

- Phase Protection

Condition: Power of the phase protection suffers phase loss or phase reversal.

Result: the control is powered off and the unit cannot be started.

Handling: change the wiring sequence and check the supply voltage.

- Mini Breaker

Condition: the control circuit is shortcut.

Result: the control is powered off, the unit cannot be started and the breaker goes to the OFF side.

Handling: 1) try to let the breaker go to the ON side. If it trips again, it indicates the control circuit is shortcut. In this case, please figure out if wiring or the unresponsive element is shortcut. 2) Try to let the breaker go to the ON side. If it does not trip again, restart the unit, and then check elements of the main board or the sequential controller to see if coils of the contactor, the solenoid valve etc are shortcut.

- Thermal Relay for the Compressor

Condition: the compressor is over-current, the 3-phase current is unbalanced, or there is phase loss.

Result: the control tells that the compressor is over-loaded.

Handling: check if windings of the compressor are in normal condition. If so, restart the unit and see if the operating current and pressure of the compressor go normal.

- Air Switch

Condition: The unit is over-current or the unit is shortcut.

Result: the whole unit is powered off.

Handling: check if electric controls and electric insulation are in normal condition. If so, restart the unit and see if the operating current and pressure of the compressor go normal.

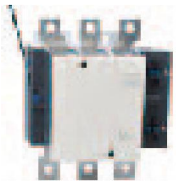
- Motor Protection

Condition: the fan is over-current or the fan is shortcut.

Result: the fan is powered off and the control tells the fan is over loaded.

Handling: check if windings of the fan are in normal conditions. If so, restart the unit and see if operation current of the fan goes normal.

1.5.2 Introduction to the Main Electric Element

Name	**Picture**	Functional Description
AC Contactor		Coils of the contactor pick up when energized and then the load works; Coils of the contactor drop out when de-energized and then the load stops.
Transformer		It is intended to transfer high-voltage signals to low-voltage signals, and power the electronic circuit, the relay and the chip of the main board.
Air Switch		It acts by measuring the current which passes through the load. When the measured current is larger than its rated value, it will trip and the whole unit will be powered off.
Phase Loss/Reversal Protection		It is intended to check if the phase sequence is correct or if there is phase loss. When phases are misconnected, exchange wiring of any two phases.
Current Mutual Inductor		It acts by measuring the current of the compressor. When the measured current is larger than its limit value or less than 10A, the AC contactor of the compressor will be opened and the whole unit will be powered off.

Mini Breaker		It is intended to open or close the control circuit and protects the circuit against shortcut.

1.5.3 Maintenance to Each Electric Element

(1) Check on Each Contact

For the contact of each electric element in the control cabinet and the startup cabinet, check if it is loosened or torn and worn or not

(2) Insulation Measurement of Each Electric Element

Measurement tools: 500V megohmmeter, 1000V megohmmeter

Special attention should be paid that the microcomputer control system can be measured as the insulation resistance.

Resistance Measurement and Judgment of Each Electric Element

Circuit or Machine Name	Insulation Resistance
Oil pump motor	Measured resistance by the 500V megohmmeter should be or larger than 3MΩ.
Oil heater	
Between high-voltage circuits or between the high-voltage circuit and the ground	Measured resistance by the 1000V megohmmeter should be or larger than 10MΩ.

1.5.4 Maintenance to the Motor

(1) Check to the Motor

- Is the insulation resistance normal or not?
- Is each wiring tightened?
- Is the rotation direction of the motor correct?

(2) Measurement of Insulation Resistance, Drying Treatment and Dielectric Strength Test

Maintenance period depends on operational and environmental conditions. Generally, maintenance should be done every three years. However, measurement of the insulation resistance should be done every year. When measurement is done with the 1000V megohmmeter, the following formula is used as the judging standard.

Insulation resistance = Rated voltage (V) / Rated power output (kW) +1000

When the measured resistance exceeds 10MΩ, it indicates the resistance is acceptable. Under incidental events or the insulation of the main motor is severely damaged, it is required to do the dielectric strength test.

WARNING
Please contact Gree and the motor manufacturer prior to the dielectric strength test. The test can be done with the presence and written consent of the representative of the motor manufacturer. In order to prevent the long-term corona discharge from damaging the coil insulation, before the dielectric strength test the inner pressure of the main motor should be equal to the atmospheric pressure.

When the insulation resistance is lower than the value listed above, please do drying treatment as the statement below. It can be used until the retested result is satisfactory.

1) Vacuum Drying

Evacuate the unit and let the inner pressure of the unit above -93.32kPa (-700mmHg), and then keep this pressure two days and nights.

2) Current Drying

When the vacuum drying fails to increase the insulation resistance, try the current drying. For the current drying, as the motor is hermetic, the coil temperature cannot be measured directly. In this case, apply 5% extra rated AC voltage to the coils for current drying. During test, keep the temperature of the motor casing within 50℃. Besides, a hot resistance is required at the coils to prevent the coils from over-temperature.

1.5.5 Maintenance to the Electric Control Box

(1) During service period, the electric control box should be de-dusted every month. Meanwhile, remember to tighten each wiring terminal and check the main circuit and control circuit.

(2) When the electric box control is not put into use for long time. After dedusting and checking of wiring terminals, take dustproof and damp-proof measures.

(3) Proper temperature will facilitate safety operation of electric elements. Overtemperature and undertemperature will shorten their service life. Therefore, attention should be paid to the environment temperature change. It is suggested to replace the desiccant inside the electric box every quarter. When the temperature and humidity is quite high, the replacement period should be shorter.

(4) When it is found that some wiring terminal is rusted, replace it in time to prevent poor contact of the terminal from affecting the normal operation of the unit.

1.6 Management of Water Quality

1.6.1 Management of Water

The incrustant as a result of bad management of chilled water and cooling water will affect the heat exchange capacity of the heat transferring tube or even lead to erosion of the tube, which consequently cause leakage, rust and insulation deterioration inside the unit. It is necessary to remove the elements that may cause erosion. Below is the general situation.

(1) Situation of Circulating Water

There is less suspended solid material and organic matter in tap water and industrial water, which is favorable for preventing block and incrustant of the pipe. Tap water and industrial water from different areas are also different. Therefore, it is necessary to manage the water condition (incrustant content) and take suitable actions, for example, chemical management, cooling tower water overflowing, changing water, and so on.

(2) Situation of Uniflow Water

There is more suspended solid material, organic matter, incrustant in well water and river water. Thus it must be treated with filter or chemicals, especially the water containing mud and sand. The accumulation of mud and sand will cause stagnation and freezing. Bacterium multiplication and incrustant will increase the erosion, so it must be strictly treated. In the well near the sea, there is polluted sea water intermingled in, so it contains more oxygen ion and sulfate radical ion, and the water near trash treatment areas or toilet is also more erosive because of mixed of alkaline. As a result, it is necessary to take some actions, for example changing water gap position, chemical treatment, and so on. When using tap water as uniflow water, it must notice that the chlorine added to the water for sterilization is one of the factors that cause erosion. (Free chlorine will disappear soon, so this problem does not exist in circulating water.)

1.6.2 Method of Water Quality Management

(1) Frequency of Water Quality Analysis

Analyze the water quality at the beginning of the usage season and once every month from then on.

(2) Analysis of Water Quality

Analysis of water quality can follow method of industrial water testing. Sampling of water is as below:

◆Sample the water during running of the unit;

◆The container used for sampling should be new, without air. The volume should be more than 2L. Besides, do not clean the container while sampling.

(3) Standard of Water Quality

The chilled water in evaporator is circulating, so the quality should be higher than the cooling water. There will be very little scaling when industry water is used as chilled water. However, when well or river water is used, there will be much scaling and sands and other deposits, which will reduce water flow in the evaporator and then lead to freezing hazards. Therefore, before it enters the chilled water system, this kind of water should be filtered, softened and analyzed in terms of the PH, electric conductivity, Cl ion concentration, S ion concentration etc.

Water Quality Standard						
Item			Cold/Hot Water System (User Side)		Trend	
			Circulating Water (<20℃)	Supply Water	Corrosion	Scalelike Sediment
Basic items	PH (25℃)		6.8～8.0	6.8～8.0	○	○
	Conductivity (25℃)	μs/cm	<400	<300	○	○
	Cl^-	mg/L	<50	<50	○	/
	SO_4^{2-}	mg/L	<50	<50	○	/
	Acid consumption (PH4.8)	mg/L	<50	<50	/	○
	Hardness ($CaCO_3$)	ppm	<70	<70	/	○
Reference Items	Fe	mg/L	<1.0	<0.3	○	○
	S^{2-}	mg/L	0	0	○	/
	NH^{4+}	mg/L	<1.0	<0.3	○	/
	SiO_2	mg/L	<30	<30	/	○
Note: “○” indicates there is a possibility of scaling or corrosion.						

1.6.3 Maintenance Method of Water Quality

Even though water quality is under strict control, calcium oxide or other minerals still will gradually accumulate on the surface of the evaporator. Then, it will reduce the heat exchange efficiency of the evaporator and consequently lead to poor performance of the unit. This scaling can be removed by formic acid, citric acid, acetic acid or other organic acid.

Therefore, the pipe system should be cleaned periodically every 6~12 months. Oxalic acid, acetic acid and formic acid can be used as the organic cleaning agent, but the strong chloracid is not allowed as it will corrode the copper tube of the heat exchanger and then lead to water and refrigerant leakage.

Follow the procedures below to how to clean the water system.

◆ Preparation of Materials and Tools

Several bags of environmental friendly scale remover, or similar cleaning liquid

◆ Cleaning Instructions

Step 1: estimate the required amount of scale remover in accordance with the system water volume and severity of scaling.

Step 2: add the scale remover to the water tank and the scale remover.

Step 3: start through the contactor the water pump every 10 minutes and spread the scale remover in water more quickly and widely.

Step 4: after that, follow the steps below.

(1) Let the water pump run for another 1-2 hours.

(2) 1-2 hours later, change the cleaning solution to anti-rusting agent. Then, drain the water system and check the water quality. If water is cloudy, then it indicates the cleaning effect is satisfactory.

(3) Open the water inlet to see if scale on the shell and tube has been removed. If not, clean the shell and tube separately again by the skilled serviceman and then rinse them. If there is still sand, scale and other foreign matters at the bottom of the shell and tube, let cleaning solution in from the inlet pipe and then let the foul water out through the drain outlet.

(4) Fully charge the water system and let it run for another 1-2 hours.

(5) Stop the unit to drain up waste solution. If impossible, drain it with making up water at the same time until all waster solution has been drained out completely (at this time water is transparent and PH is 7).

(6) Repeat steps 4 and 5.

(7) Clean or change the filters in the water system.

(8) See if the difference between the entering and leaving water temperature is improved.

◆ Precautions

(1) Although the cleaning agent is innocuous, but care also should be taken not to let it spill into eyes.

(2) The serviceman with injuries on the hand is not allowed to take this task.

Observe the running status of the unit before and after cleaning, conclude the cleaning effect and record the running parameters before and after cleaning.

1.7 Maintenance to the Safety Valve and Other Safety Devices

Safety parts such as safety valve and pressure gauge are equipped for the oil separator, vapor liquid separator and the shell and tube of this series of unit. The microcomputer control system guaranties the safety of this series of unit. When pressure is too high, the unit will stop automatically. The unit can restart only after the malfunction is removed. The safety valve is used for pressure relief and fire prevention. Therefore, it is closed in normal situation. According to TSG 21-2016 Safe Technology Supervision Regulation for Fixed Pressure Vessel, the inspection of safety valve should be executed each year. It can adopt the site checkout. During checkout, the main technicians and inspectors should check the safety state on site. There should be lead seal on the safety valve passed calibration. The pressure gauge on the unit should be inspected periodically and added lead seal. The sight glass on the evaporator is used for observing the liquid level. The sight glass is applicable to 4.0MPa and -40~180℃ . The operator should maintain the sight glass in good condition.

1.8 Confirmation after Maintenance

If possible, measure the noise to judge if it is abnormal before disassembly and after assembly. Measurement of noise should follow related regulations in JB/T4330 Measurement of Noise for Refrigerant and Air Conditioning Device.

1.9 Typical Maintenance Items

1.9.1 Startup/Shutdown

Generally, the unit is started up or shut down by pressing the ON/OFF button on the display control. There is an emergency switch located at the door of the electric control cabinet which is used to start or stop the unit in an emergency. The startup sequence is firstly the water pump and then the main unit, while the shutdown sequence is reverse. Be sure to power the unit 8 hours ahead to preheat the crankcase of the compressor and evaporate the liquid refrigerant staying inside the compressor, otherwise direct startup would bring detrimental effects on the compressor.

1.9.2 Key Parts

(1) Observe closely the suction and discharge pressure during operation. If there is something wrong, figure it out and eliminate it.

(2) Do not field reset the control and protective devices.

(3) Check periodically if wiring is loosened or not. If so, tighten it timely.

(4) Check periodically the reliability of the electric elements. If necessary, replace them.

1.9.3 Downtime

When the unit is not to be used for a long time, what should be done includes to clean, dry and cover the outer surface again dust and open the discharge valve to drain the evaporator completely.

1.9.4 Startup after Long-time Closedown

Please conduct preparations stated below when starting the unit which has not been used for a long time.

(a) Check and clean the unit thoroughly.

(b) Clean the water pipeline.

(c) Clean the water pump

(d) Tighten all connections

1.9.5 Part Replacement

Only GREE supplied parts and components shall be used for replacement.

1.9.6 Refrigerant Charging

Check the refrigerant charge through the suction and discharge pressure. Air tightness test shall be taken when refrigerant leaks or it is required to replace some part. There are two different cases for charging refrigerant.

(1) Recharging

When refrigerant leaks, a leak test shall be taken by using compressed air, or high pressure nitrogen (15~20bar), or refrigerant. If brazing is necessary, it can be done only after all air inside the system has been expelled. Before recharging, the whole system shall be dried and vacuumed.

Recharging steps are as follows:

Step 1: Be sure all shutoff valves are opened, and connect the manifold gauge for vacuuming.

Step 2: Vacuum the system.

Step 3: Charge refrigerant into the system. The refrigerant charge shall comply with that specified on the nameplate. During recharging, the throttling electronic expansion valve and solenoid valve shall be energized, and note that refrigerant is not allowed to come into the compressor.

Step 4: Refrigerant charge will be affected by the ambient temperature. If refrigerant charge is insufficient, add some by following the steps stated below.

(2) Adding

Adding steps are as follows:

Step 1: Connect the refrigerant tank at the low side, and connect the manifold gauge.

Step 2: Start the water pump and then the main unit.

Step 3: Charge refrigerant slowly into the system, and meanwhile check the suction and discharge pressure.

WARNING
When taking the leak test and air tight test, never use oxygen, acetylene and other inflammable gas and toxic gas but instead the compressed air, high-pressure nitrogen or refrigerant.

2. UNIT REPAIR

2.1 Error List

Error	Posible Causes	Countermeasures
Over-current protection of the compressor	The voltage is too low and the current is too high.	Check if the voltage is within the rated range.
	The motor is burnt out.	Check if the grounding of the motor fails, or if the motor is shortcut.
	The motor is stalling.	Check if the pressure at the high/low side changes upon startup.
	The current inductor or transducer fails.	Check the current of the compressor, and then compare it with the displayed value, and check if its wiring is in good condition.
	The unit fails to unload properly.	Check if unloading is allowed with a too high current.
Over-load protection of the compressor	The display shows the current is unusual.	Check if the displayed current is lower than the actual current.
	The voltage is too low, the current is too high, and the thermal relay of the compressor keeps open.	Check the local supply voltage.
	The setpoint of the thermal relay of the compressor is too small.	Check the setpoint of the thermal relay.
	The motor of the compressor is stalling.	Check if the pressure at the high/low side changes upon

		startup.
Internal protection of the compressor	The display shows the current is unusual.	Check if the displayed current is lower than the actual current.
	The voltage is too low or too high.	Check the local supply voltage.
	The internal protection device is wired improperly or fails.	Check its wiring or replace it.
	Refrigerant is insufficient.	Check if the throttling expansion valve works normally.
	liquid injection goes improperly.	Check the solenoid vale and the electronic expansion valve for diluent cooling.
	The motor of the compressor is stalling.	Check if the pressure at the high/low side changes upon startup.
Phase loss or reversal protection	Wiring goes wrong or loose.	Check the wiring.
	The voltage is too low.	Check the local supply voltage.
Low oil level protection	The solenoid valve for oil return fails or the shutoff valve is not opened.	Check if the coils of the solenoid valve are burnt out or loose, and check if the valve body is jammed.
	Check oil return pipelines are clogged.	Check if there are foreign matters in oil through the sight glass. If so, replace the oil filter.
	The super-heating degree of the discharge air is too low, or the discharge air mixes with large amount of refrigerant.	Check if the coils of the solenoid valve are burnt out or loose, and check if the valve body is jammed.
	Oil leaks.	Take a leakage test and add some.
	Oil in the accumulator fails to back to the compressor	Check if the system is filth clogged. If so, replace the accumulator.
Flow switch protection	There is air inside the system, and there is no release valve.	Purge the system and install a release valve at the highest point.
	The water pump is out the control of the unit.	Interlock the water pump and the unit.
	The water pump is burnt out or trips.	Replace the water pump.
	The capacity of the water pump is too small.	Reselect the water pump.
	Some element of the water flow switch is broken.	Replace it.
Low differential pressure protection	The unit fails owing to the heavy snowfall.	Remove the snowfall.
	At the cooling mode, the ambient temperature is too low.	Check if the unit operates within the designed operating conditions.
	At the heating mode, the 4-way valve works improperly.	Check if sliding blocks of the valve stay at the same side.
High oil pressure difference protection	The pressure sensors work improperly.	Shut down the unit. If the difference between the pressure at the high side and the oil pressure is less than 0.3 bars, it indicates the sensors works improperly.
	The oil filter is clogged.	Check if the oil is dirty. If so, replace the oil filter.

Over-current protection of the fan	The voltage goes wrong.	Check the local supply voltage.
	The quality of the fan is unsatisfactory.	Replace it.
	The snowfall over the unit is too heavy	Remove the snowfall.
	The wiring for the fan over-current protection goes wrong.	Check the wiring.
Communication fault of the electronic expansion valve	Wiring between the main board and the electronic expansion valve goes wrong.	Check the wiring.
	Supply voltage for the drive board of the electronic expansion valve fluctuates.	Check the local supply voltage.
	The wired controller is broken.	Check the wired controller.
Low super-heating degree protection	The throttling electronic expansion valve is jammed and its opening angle cannot be adjusted.	Check the electronic expansion valve.
	The discharge temperature sensor falls off is not bundled up tightly.	Check the installation of the temperature sensor.
	The solenoid valve and the electronic expansion valve for liquid injection fail, and refrigerant goes to the compressor.	Check the solenoid valve and the electronic expansion valve.
Temperature sensor protection	The wiring terminals have bad connection or are misused.	Check the wiring terminals.
	The connection wire is damaged.	Check the connection wire
	The sensing head has a bad connection or is damaged.	Check the sensing head.
Pressure sensor protection	The wiring terminals have bad connection or are misused.	Check the wiring terminals.
	The connection wire is damaged.	Check the connection wire
	The sensing head has a bad connection or is damaged.	Check the sensing head.

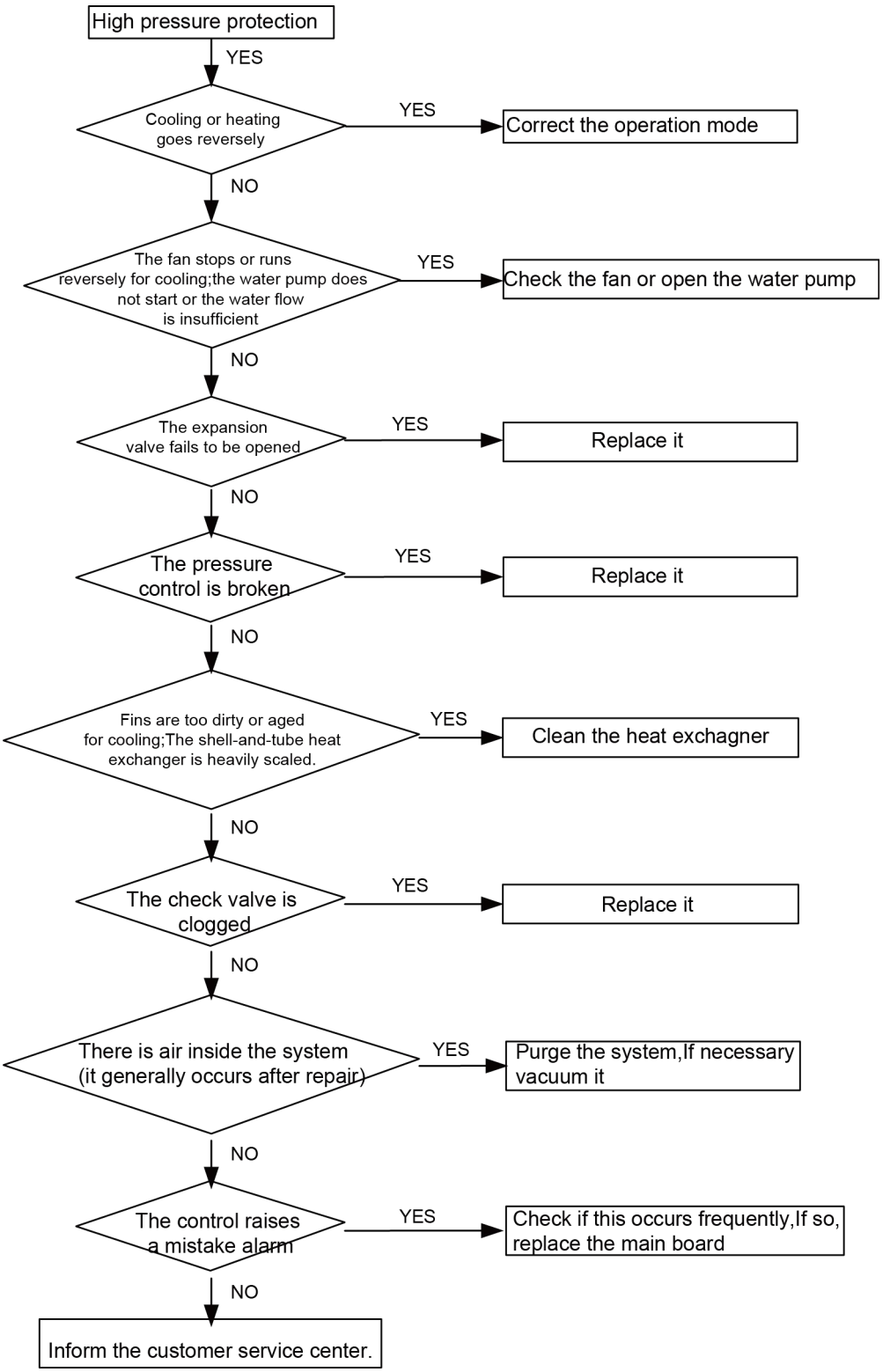
2.2 Error Code

Error Code	Error Description	Error Code	Error Description
C5	Jumper wire error	E4	High discharge protection
bd	Motor inter temperature sensor error	E5	Compressor over-current protection
be	Comp oil temperature sensor error	E5	Compressor 3-phase current protection
d3	Chilled water anti-freezing temperature sensor error	E6	Communication error
d6	Defrosting temperature sensor error	F3	Ambient temperature sensor error
d8	Heat recovery shell-and-tube temperature	F4	Discharge temperature sensor error

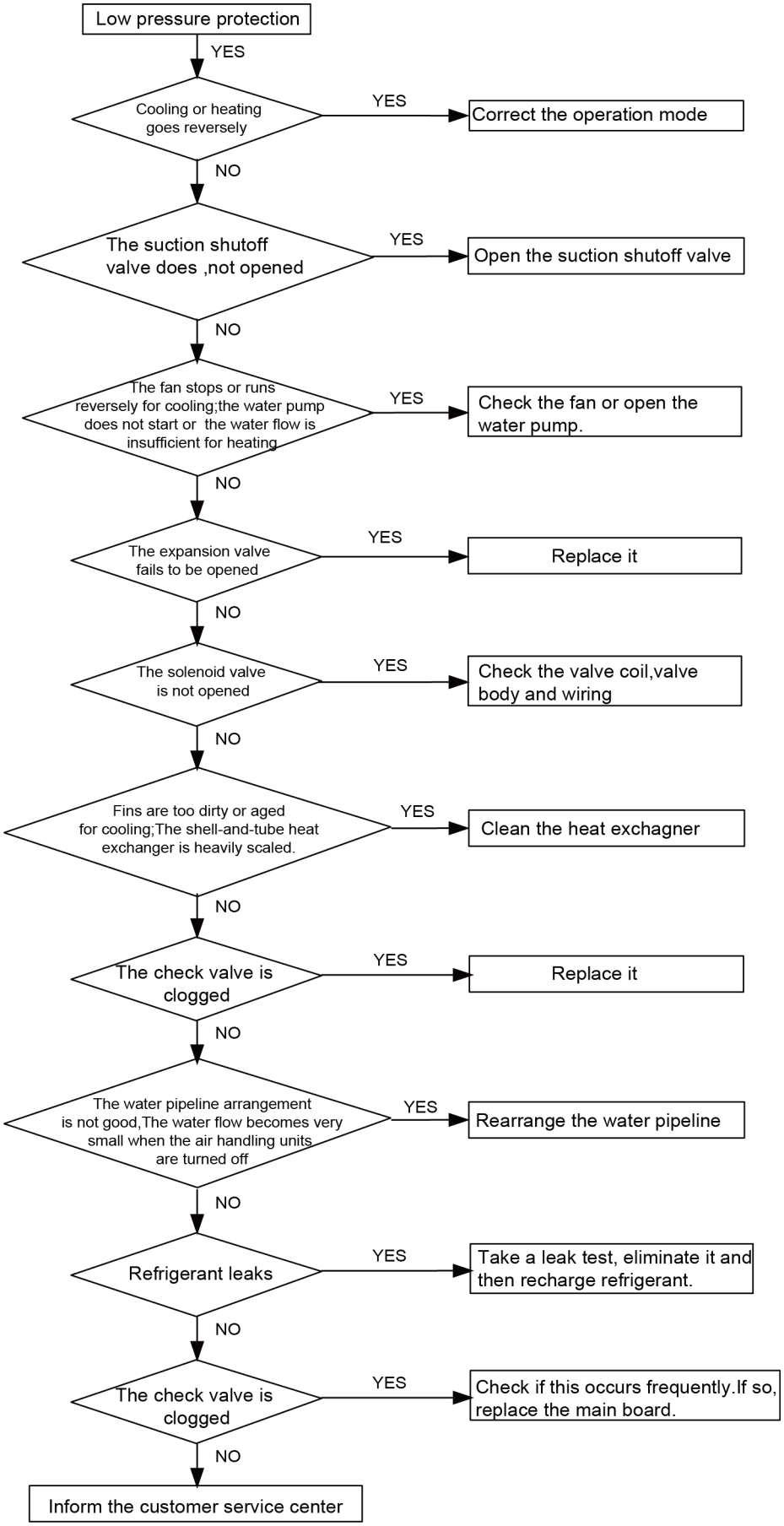
	sensor error		
d9	Heat recovery Entering water temperature sensor error	F8	Entering chilled water temperature sensor error
dc	Suction temperature sensor error	F9	Leaving chilled water temperature sensor error
dL	Low pressure sensor error	Ec	Flow switch protection
dP	Low discharge superheating degree protection	Ec	Heating but heat recovery unavailable
e0	Economizer outlet temperature sensor error	Ed	Overheating protection
e1	High pressure sensor error	EF	Fan over-current protection
e2	Low flow alarm	EJ	Oil pump overload protection
e3	Low oil level protection	FC	Liquid pipe temperature sensor error
e7	System differential pressure protection	FL	Heat recovery water tank temperature sensor error
e9	Economizer pressure sensor error	H3	Compressor internal protection
eA	Shell-and-tube pressure sensor error	H3	Motor over temperature protection
eC	Oil pressure sensor error	P6	Current board communication error
eF	Compressor type transducer error	P6	Communication error of the economizer expansion valve
eF	Compressor quantity sensor error	P6	Communication error of the throttling expansion valve
E0	Water pump interlock protection	P9	AC contactor interlock protection
E1	High pressure protection	Pc	Compressor current sensor error
E1	Oil pressure high protection	U7	4-way valve reversing error
E2	Freeze protection	Uc	Oil pressure difference protection
E3	Low pressure protection	UL	Inverter fan error

2.3 Typical Troubleshooting

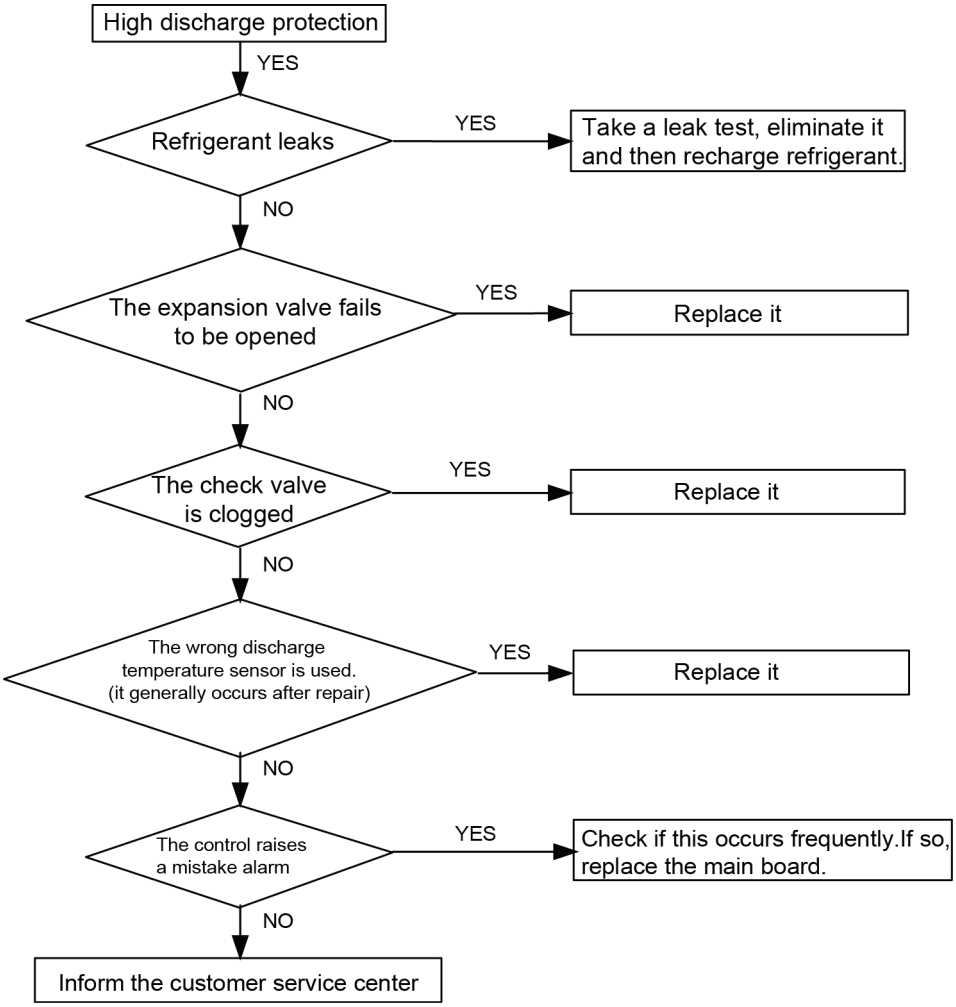
(1) High pressure protection



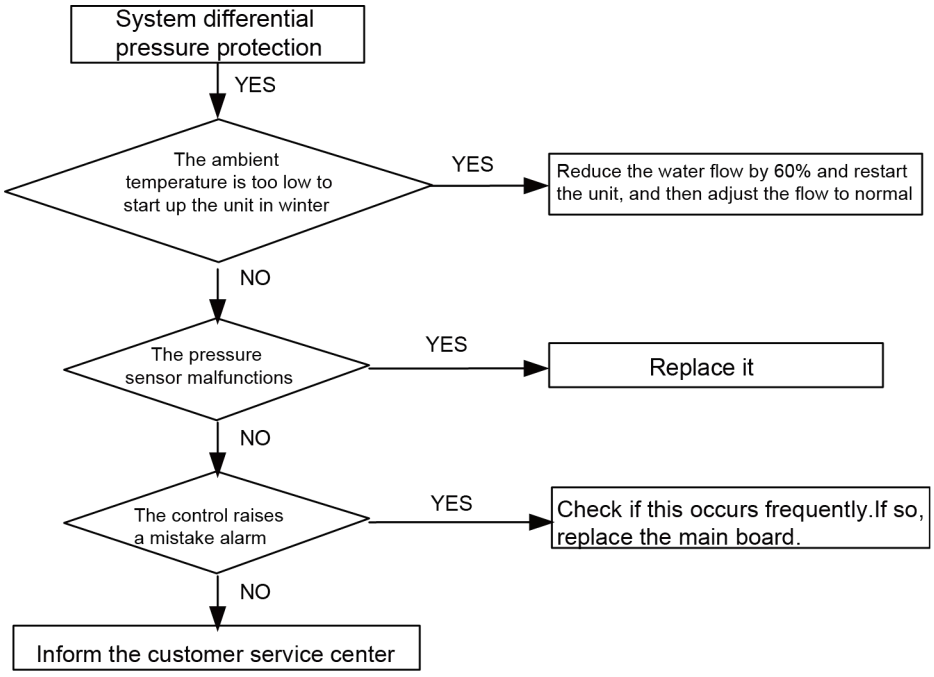
(2) Low pressure protection



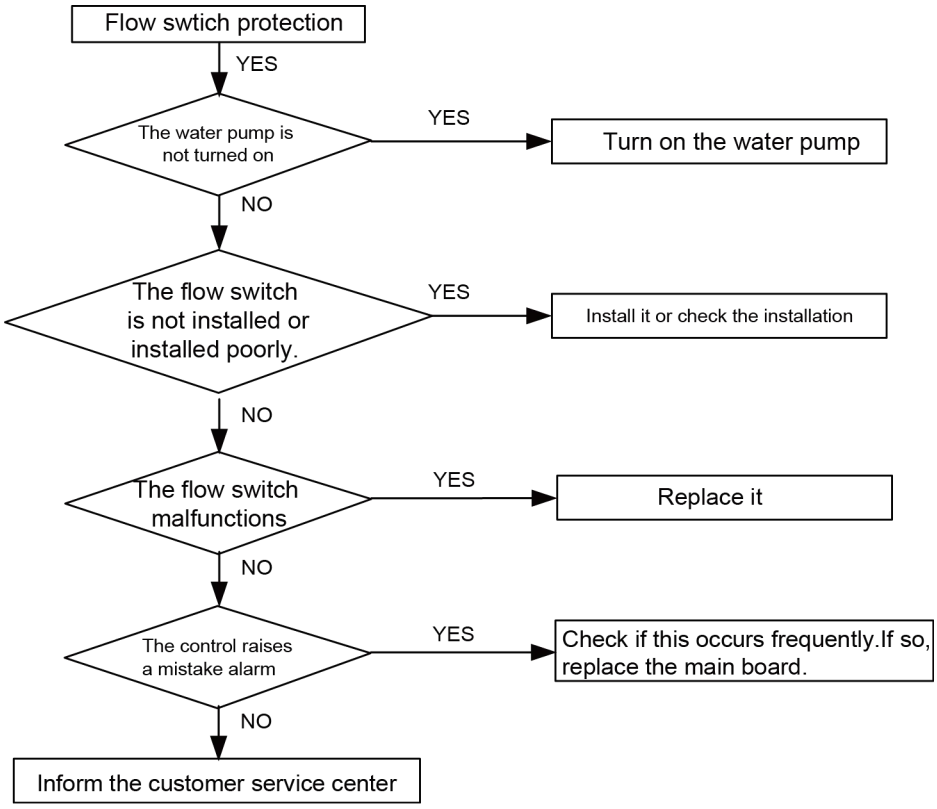
(3) High discharge protection



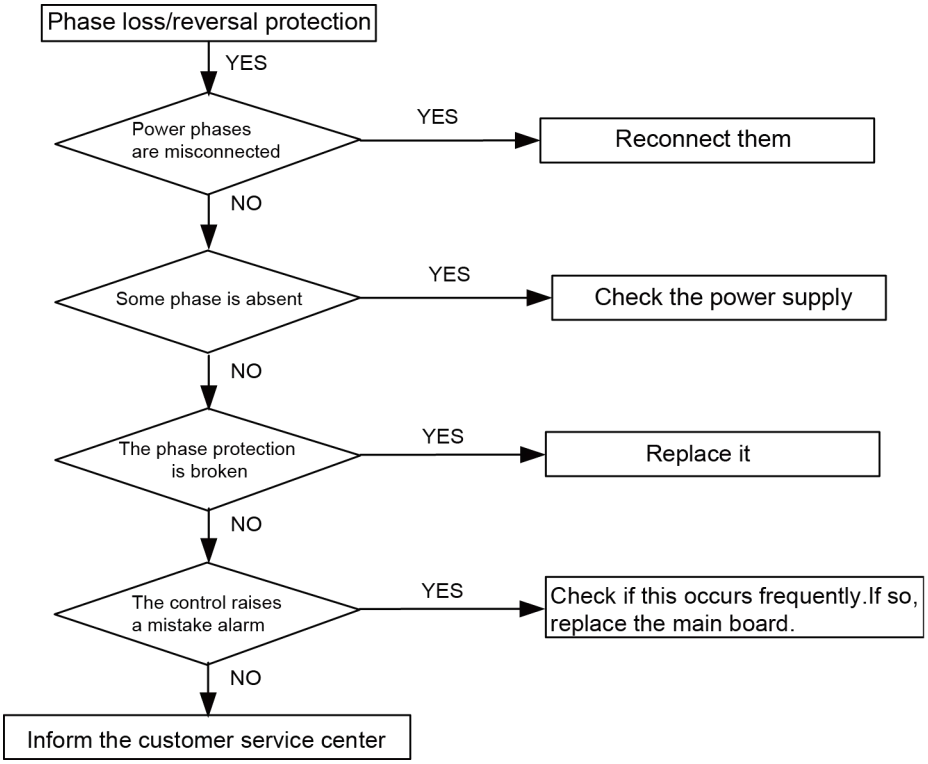
(4) Differential pressure protection



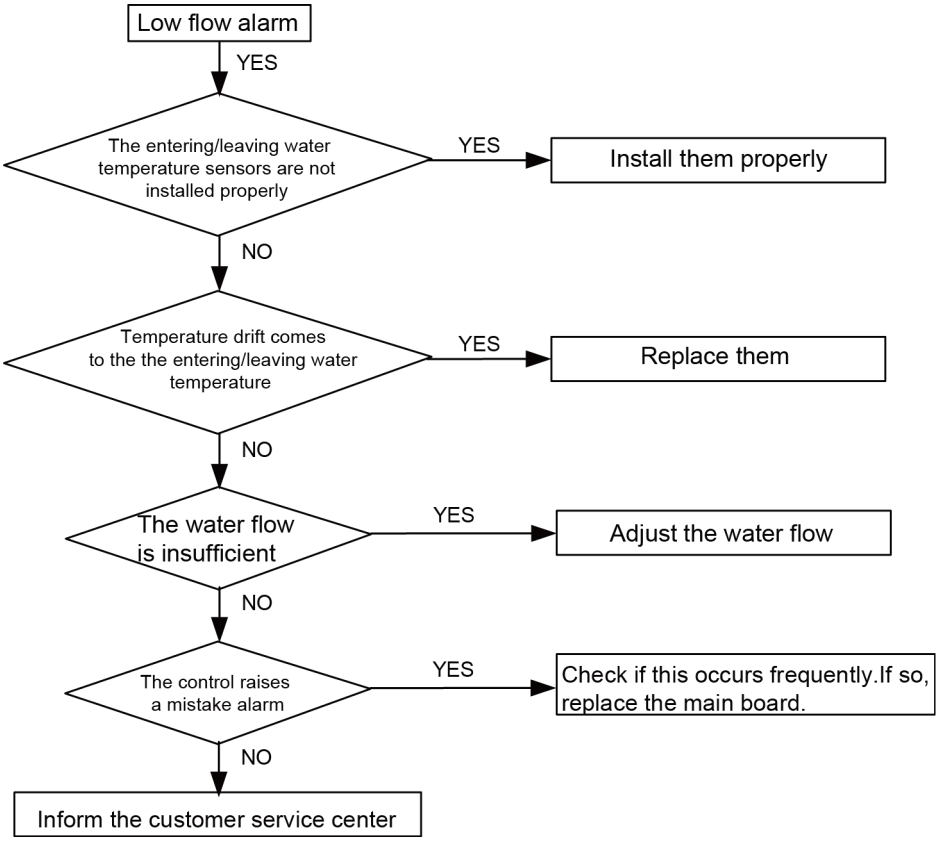
(5) Flow switch protection



(6) Phase loss/reversal protection



(7) Low flow alarm



3. Disassembly and Assembly

3.1 Introduction to Key Parts

Name	Picture	Functional Description
	Compressor	It is the power source of the whole system, used to compress refrigerant to turn it to be high-pressure and high-temperature.
	Oil Separator	It is intended to separate oil from the refrigerant vapor.
	Shell-and-tube Heat Exchanger	It is intended conduct heat exchange between the refrigerant and the second refrigerant.

	Electronic Expansion Valve	It is intended to control flow rate to make it match with the required load and make the refrigerant flowing into the evaporator evaporate completely.
	Drier-Filter	It is intended to remove moisture and foreign matters inside the water system to guarantee reliable operation and product quality.
	Flow Switch	When the unit fails to receive signals from the flow switch, the unit will go into the protection status, that is, the compressor and the auxiliary electric heater will stop.
	Economizer	It is intended to improve the sub-cooling degree of the refrigerant prior to throttling and consequently improve the cooling/heating capacity and EER.

3.2 Disassembly and Assembly

3.2.1 Drier-filter

Be sure the internal pressure of the drier-filter is released before disassembly and assembly; otherwise it would lead to safety incidents and personal injury or even death.

Disassembly and assembly steps are as follows:

(a) Step 1: When the unit is operating, turn clockwise the nut of the angle valve at the inlet of the drier-filter to let the unit stop automatically, or stop the unit manually 2 minutes later.

(b) Step 2: Close the angle valve at the other side of the drier-filter.

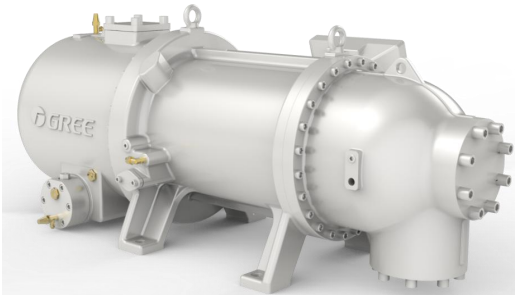
(c) Step 3: Loosen locknuts at the top cover and discharge the remaining refrigerant inside, and then replace the filter cartridge.

(d) Step 4: Vacuum it some five minutes from the angle valve.

(e) Step 5: Turn anticlockwise the unit of the angle valve, remove the manifold gauge and then tighten screws at the mouth of the pipe

(f) Step 6: Take a leak test to see if the top cover and the screws at the month of the pipe leak. If so, tighten them more.

3.2.2 Compressor



Disassembly and assembly steps are as follows:

(a) Step 1: Check the refrigerant system and all circuits, and figure out why the compressor is burnt out.

(b) Step 2: Recover the refrigerant properly. Appropriate tools should be prepared and note that the ventilation should be in good condition.

(c) Step 3: Remove the compressor away. Also the drier-filter shall be replaced.

(d) Step 4: Purge the whole system over and over again by using high-pressure nitrogen.

(e) Step 5: Vacuum the system. It is highly recommended to vacuum the system three times so as to make the system pressure drop to a satisfactory value.

(f) Step 6: Recharge refrigerant. Please note that never start the unit before at least 60% of rated refrigerant has been charged.

(g) Step 7: Continue to charge refrigerant until it reaches the rated amount. If necessary, liquid refrigerant can be charged with the charging point upstream of the accumulator, and the inlet of the evaporator is preferred.

(h) Step 8: Let the compressor run for 48 hours, then draw out some oil and check its taste as well as pH. If necessary, replace oil of the compressor.

(i) Step 9: Let the compressor run for another 48 hours. If everything goes well, replace the drier-filter with that of the same model as before.

(j) Step 10: Two weeks later, check the system again and make sure the unit runs within the rated operating conditions and design requirements.

3.2.3 Accumulator

Disassembly and assembly steps are as follows:

(a) Step 1: Check the refrigerant system and figure out why the accumulator is damaged.

(b) Step 2: Recover the refrigerant properly. Appropriate tools should be prepared and note that the ventilation should be in good condition.

(c) Step 3: Unbraze the connection pipes, loosen setscrews, and remove the accumulator.

(d) Step 4: Clean the system in accordance with the actual conditions, replace the accumulator with

the same model product and then tighten the setscrews.

(e) Step 5: Brazing the connection pipes of the accumulator. During brazing, charge nitrogen for protection.

(f) Step 6: Replace the sound insulation material before and after brazing the accumulator.

(g) Step 7: Pressurize the system to keep the leak tightness of the system.

(h) Step 8: Vacuum the system and recharge refrigerant.

3.2.4 Shell-and-tube Heat Exchanger

Disassembly and assembly steps are as follows:

(a) Step 1: Check the refrigerant system and see if the shell-and-tube heat exchanger is really damaged.

(b) Step 2: When it is certain that the shell-and-tube heat exchanger should be replaced, cut off the power supply and recover refrigerant.

(c) Step 3: Loosen connections of the inlet and outlet pipes, unbraze pipelines connected with the heat exchanger (during unbrazing, mark the pipelines respectively in case that they will be incorrectly reconnected which would result in blow-by.)

(d) Step 4: Clean the system in accordance with the actual conditions.

(e) Step 5: Loosen setscrews of the evaporator, replace it with the same model product and then braze the corresponding pipelines.

(f) Step 6: During brazing, charge nitrogen for protection.

(g) Step 7: Vacuum the system and recharge refrigerant.

3.2.5 Condenser

Disassembly and assembly steps are as follows:

(a) Step 1: Cut off the power supply and recover refrigerant.

(b) Step 2: Remove metal sheets connected with the condenser and then remove its guard.

(c) Step 3: Unbraze connections between the header and the condenser. Note that the flame of the welding gun is not allowed to touch the fins of the condenser and also metal sheets.

(d) Step 4: Clean the system in accordance with the actual conditions.

(e) Step 5: Loosen setscrews between the condenser and metal sheets, replace the condenser and then braze corresponding pipelines.

(f) Step 6: During brazing, charge nitrogen for protection.

(g) Step 7: Vacuum the system and recharge refrigerant.

3.2.6 Electronic Expansion Valve and Filter

Disassembly and assembly steps are as follows:

(a) Step 1: Check the refrigerant system and all circuits to figure out why the expansion valve or the filter is damaged.

(b) Step 2: When it is certain that the expansion valve or the filter should be replaced, cut off the power supply and recover refrigerant.

(c) Step 3: Wrap the electronic expansion valve or the filter with wet cloth, unbraze the inlet/lout tubes and then remove them away.

(d) Step 4: Make the replacement with the same model product, again wrap them with the wet cloth

and then braze the inlet/outlet tubes.

(e) Step 5: During brazing, charge nitrogen for protection. Meanwhile, note that never let water entering into the system.

(f) Step 6: Vacuum the system and recharge refrigerant.

4. Typical Troubleshooting

- Case 1: Flow Switch Protection

(1) Symptoms: the unit fails to operate owing to the flow switch protection during commissioning.

(2) Possible Causes:

(a) There is no water in the water system.

(b) The flow switch malfunctions or is installed improperly.

(c) The water pump malfunctions.

(d) The water system has not been vacuumed completely.

(e) The designed water flow is insufficient, lower than the safety limit of the flow switch.

(3) Analysis:

(a) Open the water outlet of the water circuit. If water flows out, it proves there is water inside the system.

(b) Open the top cover of the flow switch and energize the contact briefly. If the contact acts smartly and there are signals output once switched on, it proves the flow switch is good.

(c) Check the water system, open all hand-operated release valves and find out there is plenty of air inside the water system.

(d) Energize the water pump briefly to see if it can operate normally and impellers run at the correction direction. If the pressure at the suction inlet quickly drops to 0 bar, it indicates the system is thirsty for water severely. In this case, turn off the water pump immediately; otherwise it would be burnt out.

(e) In conclusion, the flow switch protection is resulted from water depletion and it should be handled in the field.

(4) Conclusion and Countermeasures:

(a) Check the water system and make sure there is no negative pressure zone in the water system.

(b) Open all hand-operated relief valves.

(c) Add water into the water system continuously. 30 minutes later, energize the water pump briefly. If the pressure at the suction inlet is about 1kgf/cm2 but the reading of the pressure gauge fluctuates to a large extent, it indicates there is large amount of air inside the system. In this case, keep adding water to the system until the pressure reading only fluctuates slightly and the no gas comes out from the release valve.

(d) Restart the water pump and observe the expansion water tank. If the water level of the water tank drops down quickly, it indicates the system suffers water depletion, which makes water inside the water tank go to the water circuit.

(e) Handle it and then start the water pump another time. When the pressure at the suction inlet keeps at 1.5kgf/cm2, the water level of the water tank does not vary, and the operating current of the water pump is close to the rated value, the unit can be started and operate normally.

- Case 2: Low Pressure Protection and Over-load Protection

(1) Symptom: the unit fails occasionally to operate owing to low pressure protection and over-load protection.

(2) Possible Causes:

(a) Heat exchange goes improperly.

(b) The pressure sensor and the over-load protection malfunction.

(c) The temperature sensor is not installed as required.

(3) Analysis:

(a) See if heat exchange goes normally via the entering/leaving water temperature difference and discharge pressure.

(b) Before and after startup, see if refrigerant leakage occurs to system 1 of module 4 and oil spillage takes place to system 2 and oil takes on the semitransparent color.

(c) Take measures against leakage of system 1 and replace the pressure gauge of system 2. After restart, other four systems are in low pressure and go into protection status.

(d) After relocating the temperature sensor of the expansion valve, the water temperature goes up to 47^{o}C and the unit can be started and stopped normally.

(4) Conclusion and Countermeasures:

(a) Refrigerant leaks and oil spills from the pressure gauge. It can be solved by repairing and replacing components and relocating the temperature sensor.

- Case 3: Differential Pressure Protection

(1) Symptom: Different pressure protection acts at the heating mode.

(2) Possible Causes:

(a) The pressure sensor is impaired.

(b) It lies in design limitations.

(3) Analysis:

(a) Check if the pressure sensor is intact.

(b) When the ambient temperature and the water temperature are quite low in winter, it will take a long period to approach the required pressure at the high side during startup, and therefore differential pressure protection is likely to occur. It is a typical issue for old products; however, it is not for the newly designed products any more.

(4) Conclusion and Countermeasures:

(a) Turn down the shutoff valve of the water circuit to reduce 60% of the water flow, and then start the unit.

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