GREE
Change for life

Service Manual

Commercial Air Conditioners

MODULAR AIR-COOLED CHILLERS

Contens

Ⅰ PRODUCT

1. Product

1.1 Product Lineup

Product Model	Product Code	Nominal Capacity(kW/Ton)	Power	Refrigerant	Pictures
LSBLGF320MH/NbA-M	EL03500670	320/91	380V~400V 3Ph 50Hz	R134a	 Picture is for reference and is subject to change without prior
LSBLGF420MH/NbA-M	EL03500660	420/119			
LSBLGF520MH/NbA-M	EL03500710	520/148			
LSBLGF580MH/NbA-M	/	580/165			
LSBLGF650MH/NbA-M	EL03500550	650/185			
LSBLGF750MH/NbA-M	/	750/213			
LSBLGF860MH/NbA-M	EL03500610	860/245			
LSBLGF950MH/NbA-M	EL03500540	950/270			
LSBLGF1050MH/NbA-M	EL03500680	1050/299			
LSBLGF1160MH/NbA-M	EL03500700	1160/330			
LSBLGF1320MH/NbA-M	EL03500640	1320/375			
LSBLGF1520MH/NbA-M	/	1520/432			

Note:1Ton =12000Btu/h = 3.517kW

1.2 Nomenclature

LS	BLG	R	F	950	M	H	R	/Nb	A	-M
1	2	3	4	5	6	7	8	9	10	11

NO.	Description	Options
1	Unit series	LS: chillers
2	Compressors type	BLG: semi-hermetic screw compressors
3	Heat pump	R: Heat pump Default: Cooling only
4	Condenser type	F: air-cooled
5	Nominal Cooling Capacity	950=950kW
6	Modular design code	M
7	High-efficiency	Default: standard unit H: High-efficiency unit

8	Heat Recovery	Default: none R: Heat Recovery
9	Refrigerant	Default: R22 Nb:R134a
10	Design code	A: A sereis
11	Power Supply	M: 380V~400V 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.

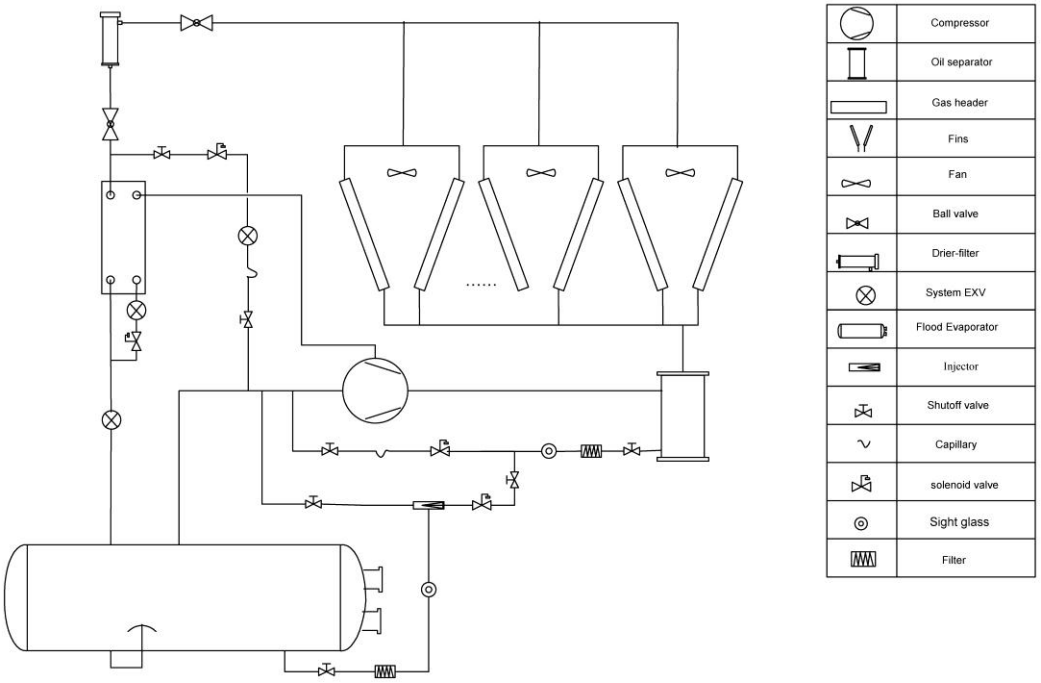
Viewing the running status. The servicemen are allowed to view the current running status and error records which then will be taken as the basis for service and maintenance.

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:

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. For the cooling only unit 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.

1.5 Product Data

1.5.1 Normal Working Conditions

Model			LSBLGF_MH/NbA-M					
			320	420	520	580	650	750
Cooling capacity		kW	320	420	520	580	650	750
cooling power input		kW	100	130	162	180	200	230
Rated power input		kW	140	182	227	252	280	322
Power			380V~400V 3Ph 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					
Refrigerant			R134a					
Water system	Water flow	m^3/h	55.0	72.2	89.4	99.8	111.8	129.0
	Pressure loss	kPa	≤35	≤45	≤45	≤50	≤55	≤55
	Heat exchanger type		Flooded Evaporator					
	Max.bearing pressure	Mpa	1.0					
	Inlet/outlet tube diameter	mm	DN100	DN125	DN125	DN150	DN150	DN150
	connection mode		Flanged connection					
Air System	Heat exchanger type		Aluminum Fin-copper Tube					
	Fan rated power	kW	1.5×6	1.5×8	1.5×10	1.5×12	1.5×12	1.5×14
Outline dimensions	Width	mm	3670	4890	6110	7340	7340	8560
	Depth	mm	2250	2250	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550	2550	2550
Package	Width	mm	3750	4970	6190	7420	7420	8640

dimensions	Depth	mm	2330	2330	2330	2330	2330	2330
	Height	mm	2250	2250	2250	2250	2250	2250
Net weight		kg	3980	4990	5930	6450	7440	8350
Gross weight		kg	4020	5030	5970	6490	7480	8390
Operating weight		kg	4060	5090	6049	6579	7589	8517
Layer of stacking		/	2	2	1	1	1	1

Model			LSBLGF_MH/NbA-M					
			860	950	1050	1160	1320	1520
Cooling capacity		kW	860	950	1050	1160	1320	1500
cooling power input		kW	260	280	320	350	395	450
Rated power input		kW	364	392	448	490	553	630
Power			380V~400V 3Ph 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					
Refrigerant			R134a					
Water system	Water flow	m3/h	147.9	163.4	180.6	199.5	227.0	261.4
	Pressure loss	kPa	≤65	≤60	≤70	≤55	≤60	≤60
	Heat exchanger type		Flooded Evaporator					
	Max.bearing pressure	Mpa	1.0					
	Inlet/outlet tube diameter	mm	DN150	DN150	DN150	DN150+ DN125	2×DN150	2×DN150
	connection mode		Flanged connection					
Air System	Heat exchanger type		Aluminum Fin-copper Tube					
	Fan rated power	kW	1.5×16	1.5×18	1.8×18	1.5×22	1.5×24	1.5×28
Outline dimensions	Width	mm	9780	11000	11000	13450	14670	17120
	Depth	mm	2250	2250	2250	2250	2250	2250
	Height	mm	2550	2550	2550	2550	2550	2550
Package	Width	mm	9860	11080	11080	13530	14750	17200

dimensions	Depth	mm	2330	2330	2330	2330	2330	2330
	Height	mm	2550	2550	2550	2550	2550	2550
Net weight		kg	9130	10280	10510	13370	14880	16950
Gross weight		kg	9170	10320	10590	13450	14960	17030
Operating weight		kg	9313	10486	10720	13637	15178	17289
Layer of stacking		/	1	1	1	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	—

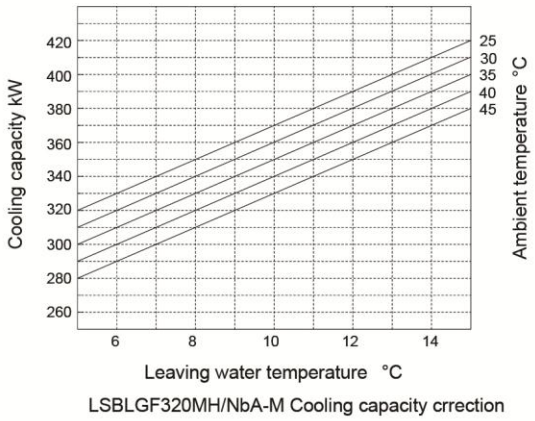
1.5.3 Working Temperature Range

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

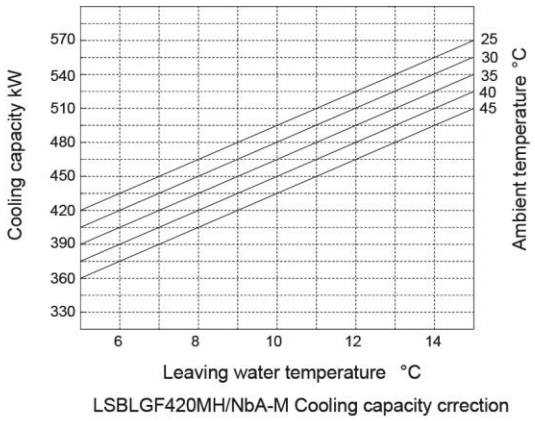
Note: please contact us when the working conditions are out of the range stated in the table above.

1.5.4 Performance Correction

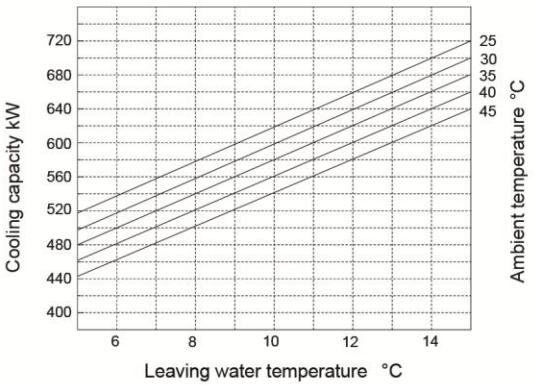
Correction curves for the cooling capacity at difference ambient temperature and leaving chilled water temperature are as shown below.



LSBLGF320MH/NbA-M Cooling capacity crrection



LSBLGF420MH/NbA-M Cooling capacity crrection



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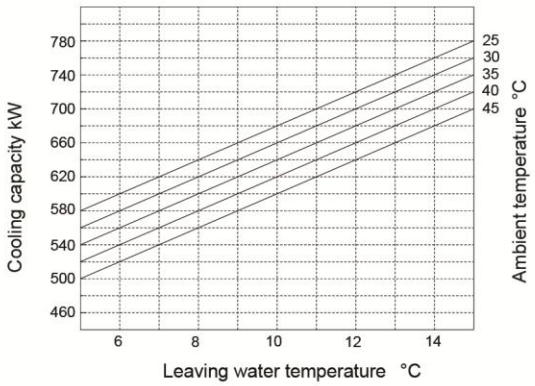

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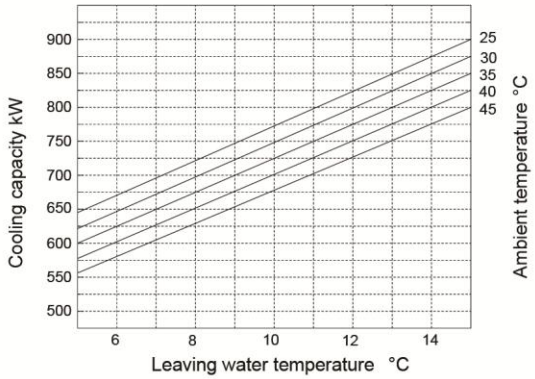
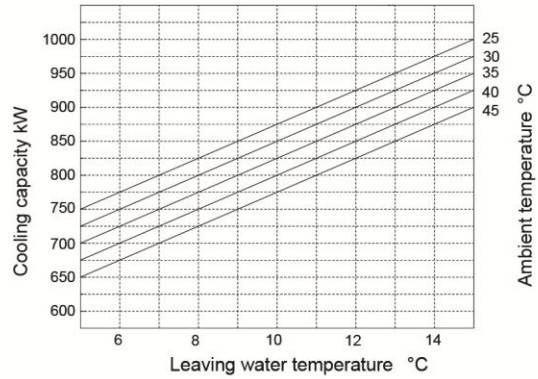
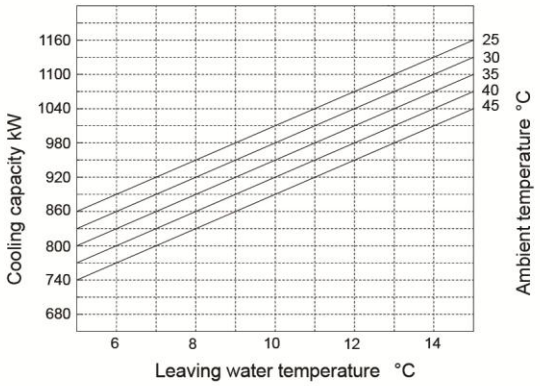


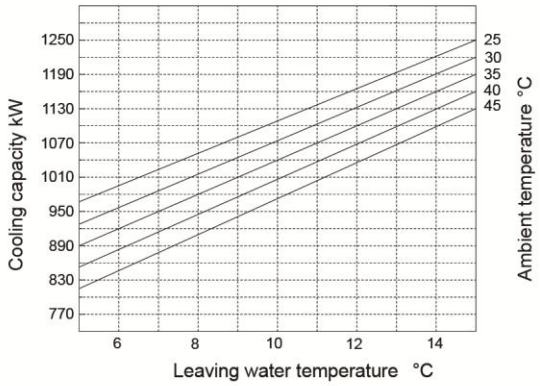
LSBLGF650MH/NbA-M Cooling capacity crrection



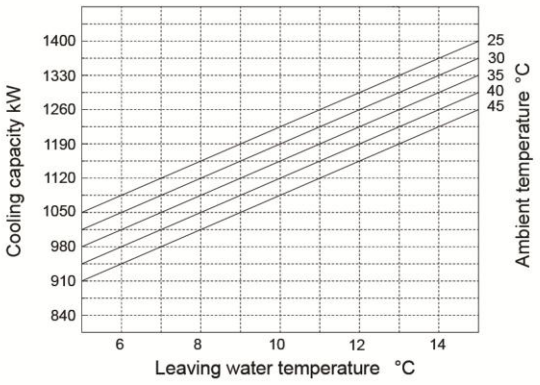
LSBLGF750MH/NbA-M Cooling capacity crrection



LSBLGF860MH/NbA-M Cooling capacity crrection



LSBLGF950MH/NbA-M Cooling capacity crrection



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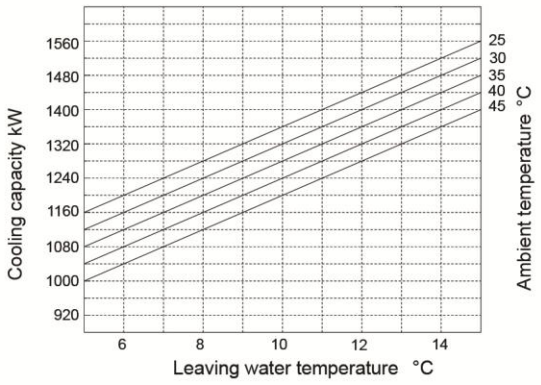

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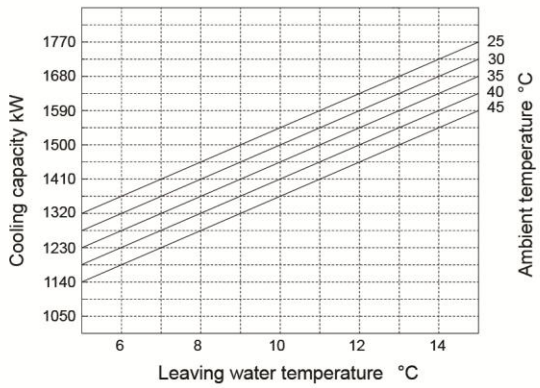

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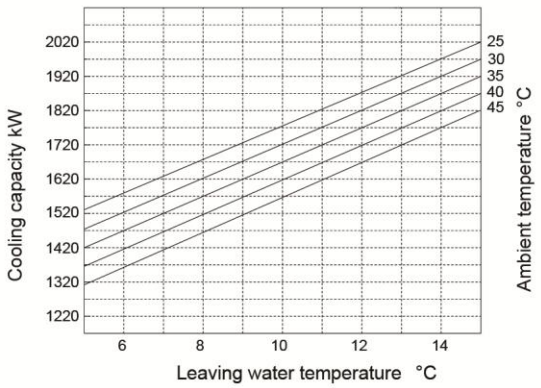


LSBLGF1520MH/NbA-M Cooling capacity crrection

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:

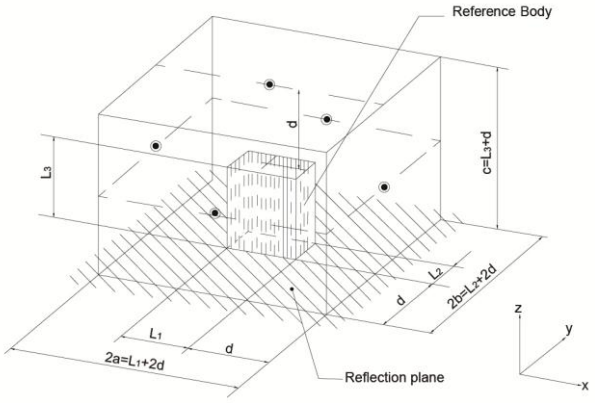
(1) In order to determine the location of the microphone on the testing surface, it is necessary to assume a reference body, regardless of the important noise energy which emanates from the sound source but does not radiate. The reference testing distance is 1m and should be 0.15m at least. Other options 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 backgroud 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, 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 1KHz test room, m2.

S: testing surface area, m2.

$$A = a.S_V$$

Where:

a—average A-weighted sound absoprtion 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	Partically empty room and glossy walls.
0.15	Room with furniture; Rectangular worshop; Rectangular industrial plant
0.2	Irregular room with furniture; Irregular worshop 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 ceilng 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:

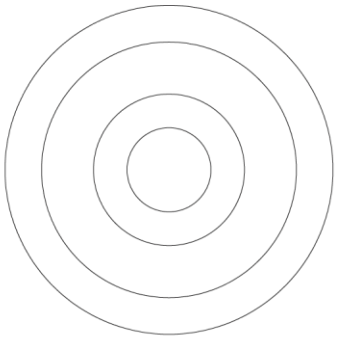
$$L_P=L_W-20\log r-1$$

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:

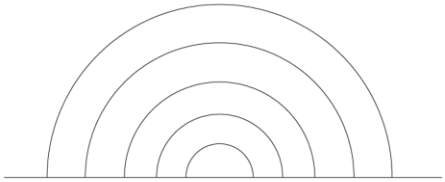
$$LP=LW-20\log r-8$$

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:

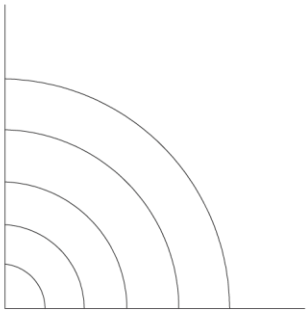
$$L_P=L_W-20\log r-5$$



Uniform Spherical Radiation
Q=1 no reflecting surface



Uniform Hemispherical Radiation
Q=1 single reflecting surface

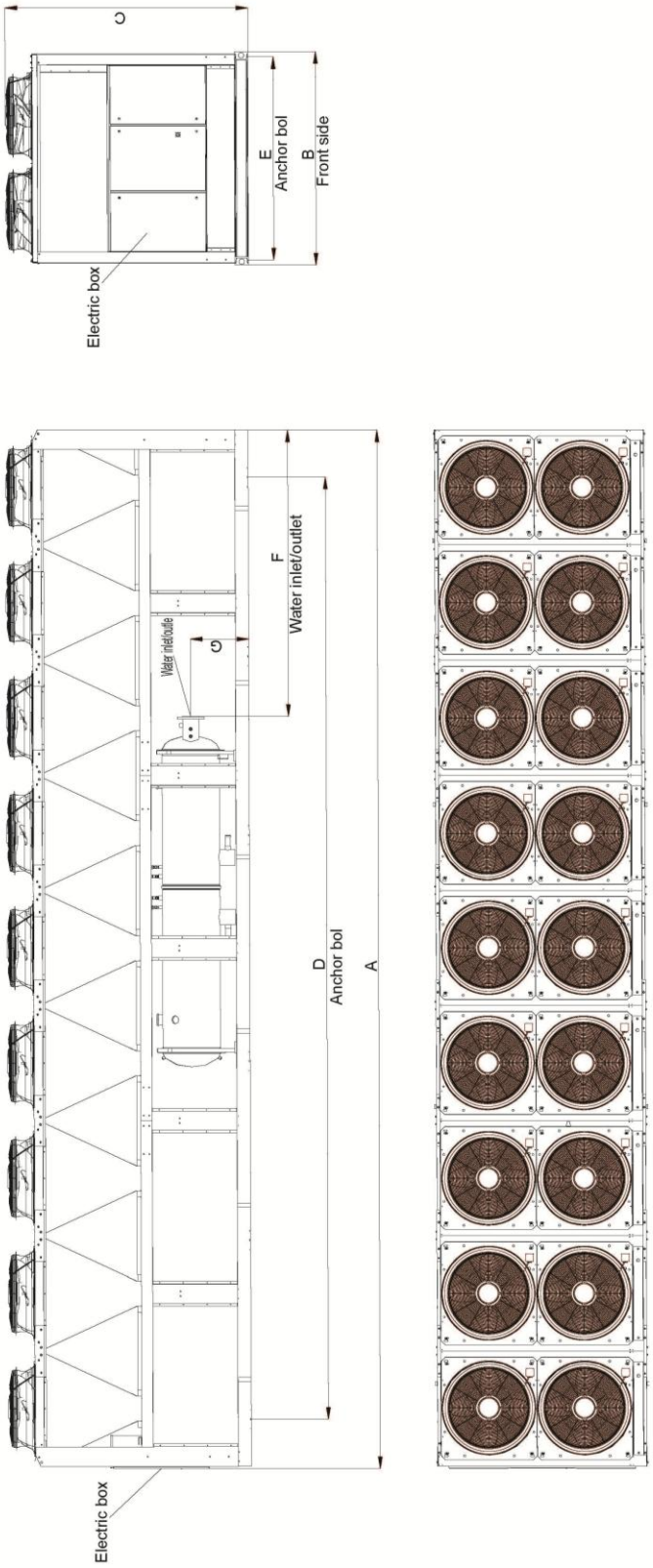


Uniform Radiation over of sphere
Q=1 single reflecting surface

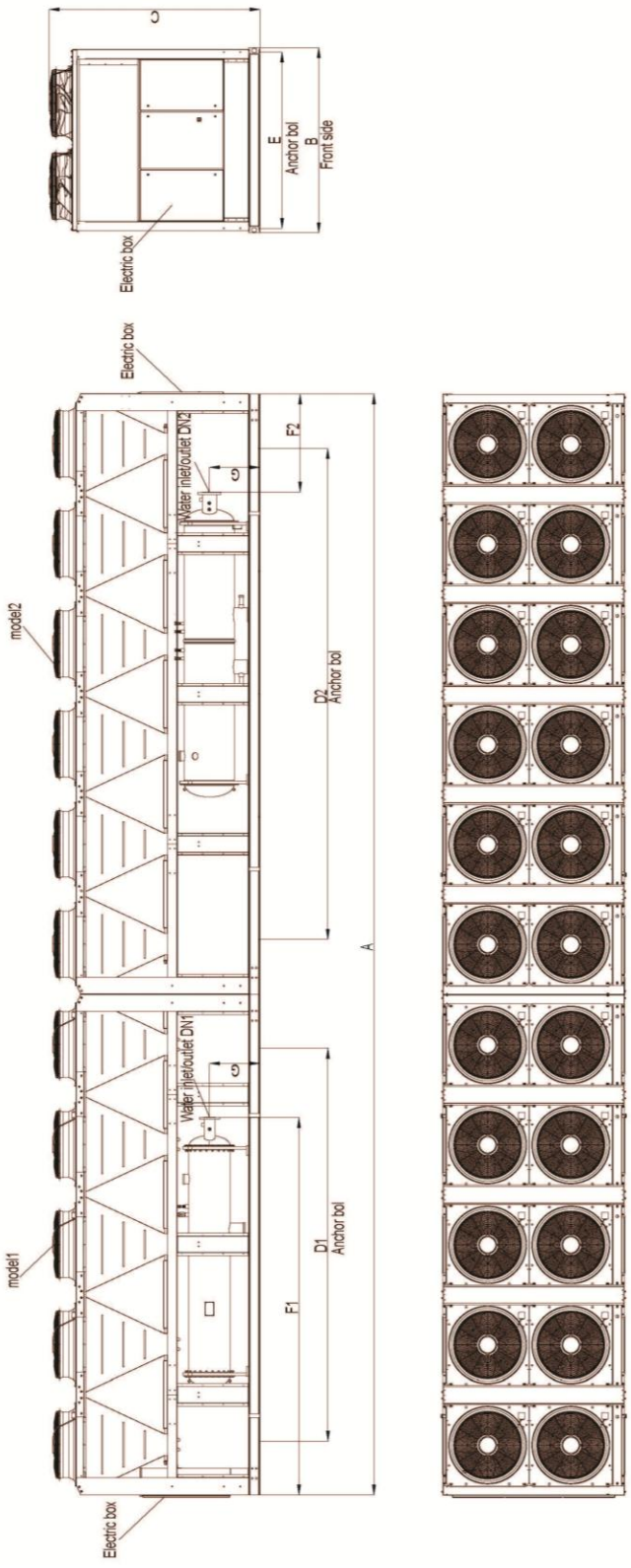
The equations are reduced to the table form for various distances and the two most usual cases of "Q" type of location. Results for typical distances are tabulated in the table below.

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



Dimension	Outline dimension			Installation dimension		Pipeline dimension Maintenance dimension		Pipe Connection dimension
Model	A	B	C	D	E	F	G	
LSBLGF320MH/NbA-M	3670	2250	2550	2400	2150	100	615	DN100
LSBLGF420MH/NbA-M	4890	2250	2550	3600	2150	310	615	DN125
LSBLGF520MH/NbA-M	6110	2250	2550	4800	2150	1510	615	DN125
LSBLGF580MH/NbA-M	7340	2250	2550	6000	2150	1780	615	DN150
LSBLGF650MH/NbA-M	7340	2250	2550	6000	2150	1780	615	DN150
LSBLGF750MH/NbA-M	8560	2250	2550	7200	2150	2400	615	DN150
LSBLGF860MH/NbA-M	9780	2250	2550	8400	2150	3030	615	DN150
LSBLGF950MH/NbA-M	11000	2250	2550	9600	2150	3540	615	DN150
LSBLGF1050MH/NbA-M	11000	2250	2550	9600	2150	3540	615	DN150



Dimension	Outline dimension			Installation dimension			Pipeline dimension Maintenance dimension			Pipe Connection dimension	
Model	A	B	C	D1	D2	E	F1	F2	G	DN1	DN2
LSBLGF1160MH/NbA-M	13450	2250	2550	4800	6000	2150	4610	1780	615	DN125	DN150
LSBLGF1320MH/NbA-M	14670	2250	2550	6000	6000	2150	5560	1780	615	DN150	DN150
LSBLGF1520MH/NbA-M	17120	2250	2550	7200	7200	2150	6160	2400	615	DN150	DN150

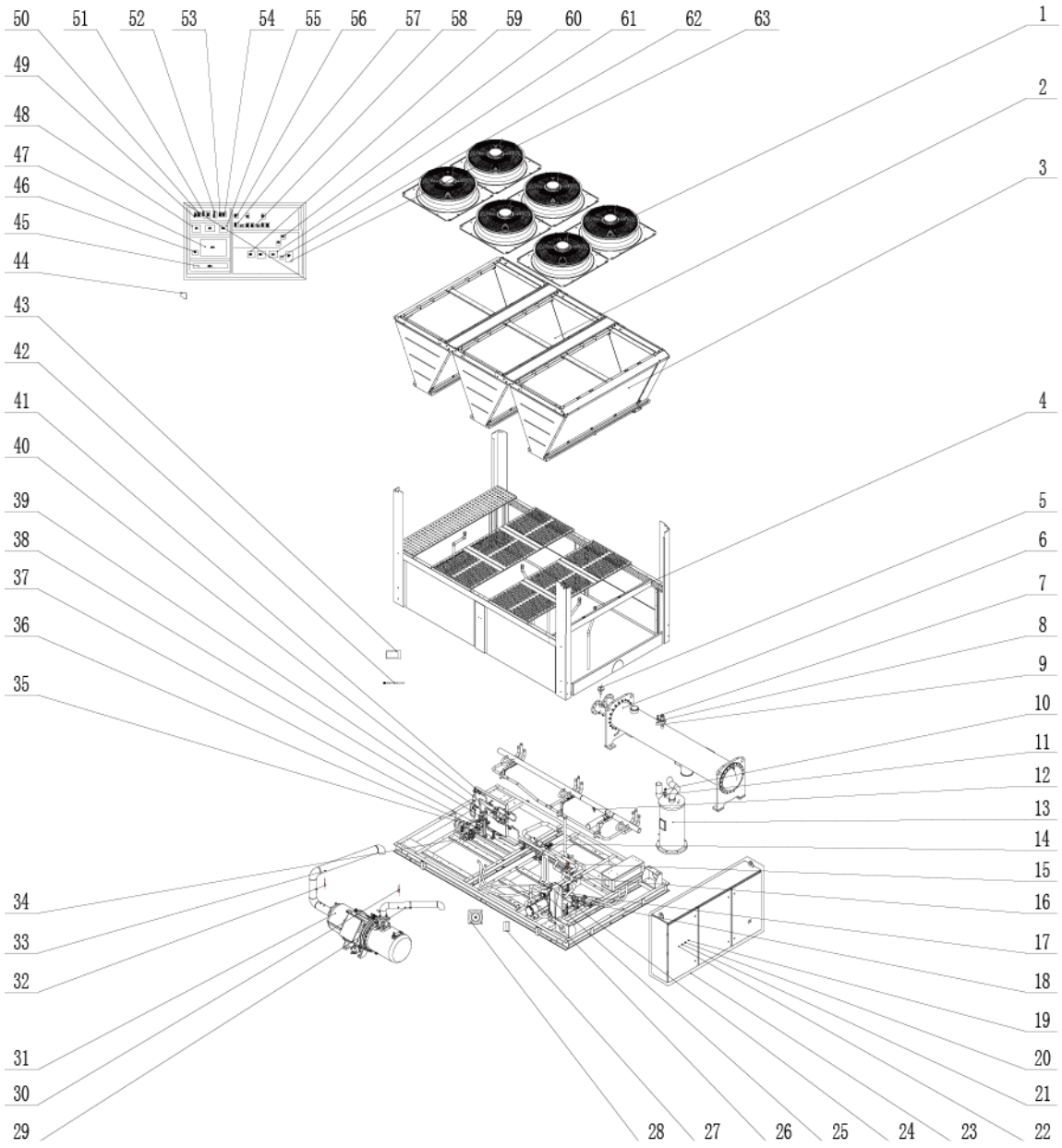
Model	Model1	Model2
LSBLGF1160MH/NbA-M	LSBLGF1160MH/NbA-M-1	LSBLGF1160MH/NbA-M-2
LSBLGF1320MH/NbA-M	LSBLGF1320MH/NbA-M-1	LSBLGF1320MH/NbA-M-2
LSBLGF1520MH/NbA-M	LSBLGF1520MH/NbA-M-1	LSBLGF1520MH/NbA-M-2

Note:

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

3. Explosive Views and Parts List

(1) Explosive View of LSBLGF320MH/NbA-M



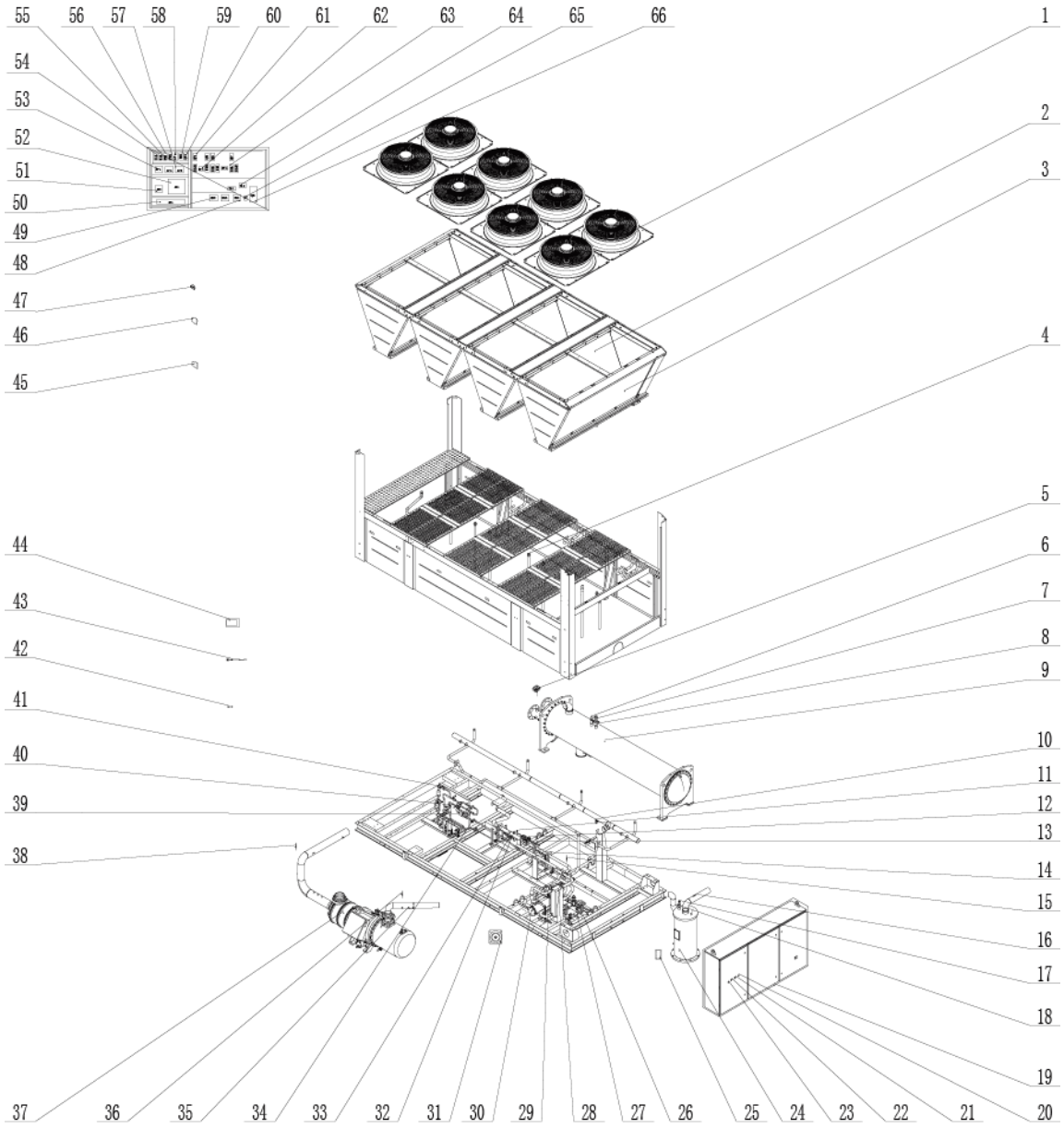
Parts List: LSBLGF320MH/NbA-M for EL03500670

No.	Name of part	Part code
1	Blower for Axial Fan Sub- Assy	15408000009
2	Condenser Assy 1	01128000164
3	Condenser Assy 2	01128000165
4	pipe connector	06128301
5	Steam current Switch	4502800000902
6	Flooded Evaporator	011102000016
7	Taper Thread Cut-off Valve	0713083204
8	Relief valve 1	0718190301
9	Ball valve	07130831

10	Relief Valve	0718000801
11	Taper Thread Valve	07131901
12	Taper Thread Cut-off Valve	0713083201
13	Oil Separator	07428000026
14	Electronic Expansion Valve	0733800601
15	Pressure Sensor	3221811802
16	Temp Sensor Sleeving	05210001
17	Electromagnetic Valve	43000073
18	Electronic Expansion Valve	43048000004
19	Indicator Light (red)	35030062
20	Indicator Light (green)	35030061
21	Indicator Light	35030060
22	Scram switch	45010013
23	Electric Cabinet Assy	100003000199
24	Plate-type Heat Exchanger	00908000005
25	Valve	07189057
26	Dry Filter	07218158
27	Filtering Core	07218205
28	Vibration Isolator	07498000012P
29	Pressure Protect Switch	460200047
30	Sensor (High Pressure)	3011800202
31	Compressor and Fittings	00208000123
32	Sensor	3011800307
33	Temp Sensor Sleeving	05212423
34	Cut-off Valve	07138235
35	Electronic Expansion Valve	07331139
36	Cut-off Valve	07138234
37	Electric Expand Valve Fitting	4304413218
38	Magnet Coil	4304000431
39	Strainer	07418001
40	Electromagnetic Valve	43044107
41	Liquid level indicator	22458401
42	Sensor Sub-assy	390002000018
43	Display Board	30292000038
44	Auxiliary contacts	45010008
45	Terminal Board	42018000549
46	Communication Interface Board	30118023
47	Main Board	30222000047
48	Main Board	30221007
49	Middle relay	44020338
50	holder of relay	42031501
51	Powe Panel	30245000001
52	Filter	43130017

53	Phase Reverse Protector	430055000002
54	Single-phase Air Switch	45020203
55	Detecting Plate	30272000003
56	Overcurrent Circuit Breaker	46020022
57	AC Contactor	44010232
58	Terminal Board	42011221
59	AC Contactor	44010238
60	Current transducer	43128011
61	AC Contactor	44010237
62	Insulation Gasket	49018110
63	Overcurrent Circuit Breaker	46028000020

(2) Explosive View of LSBLGF420MH/NbA-M



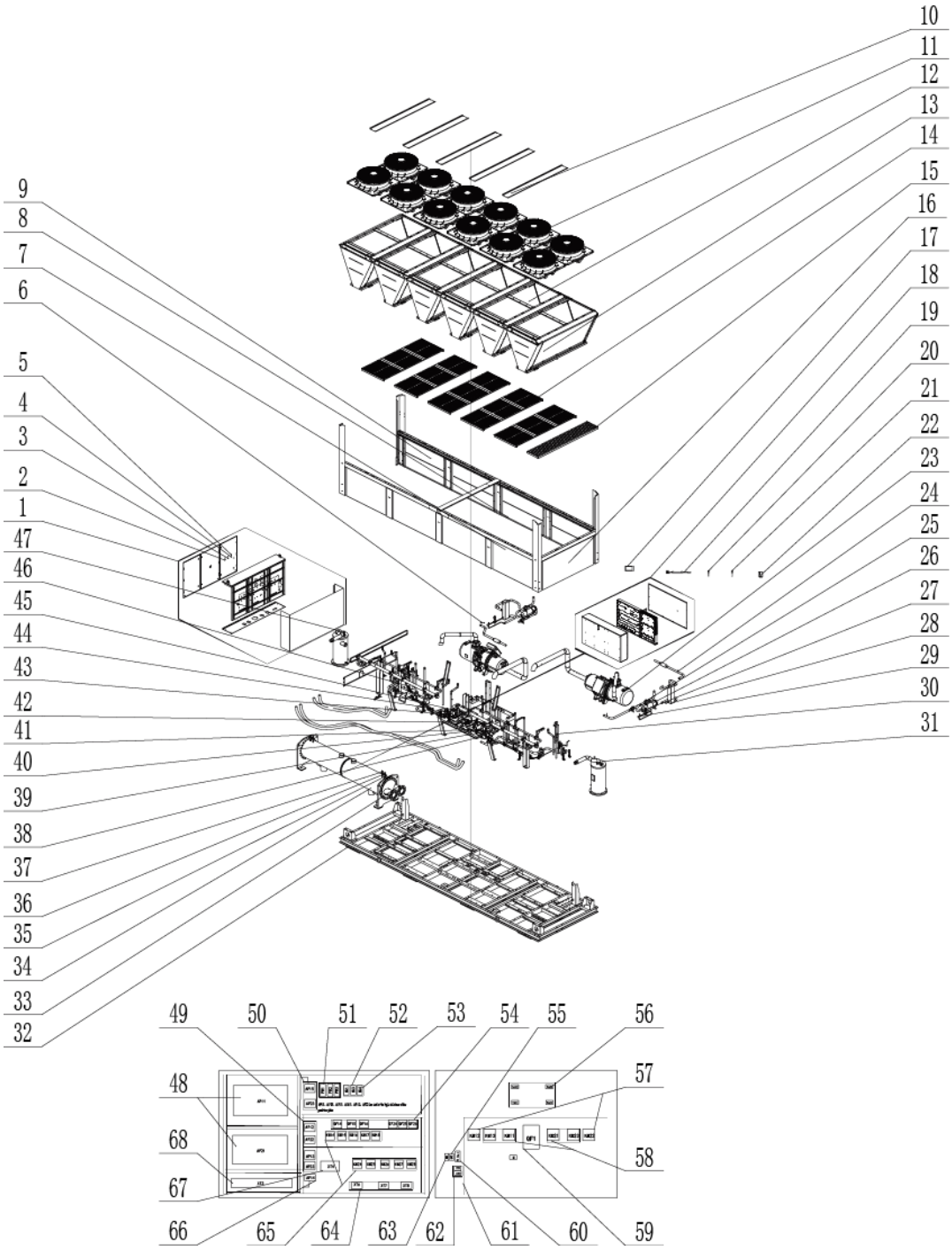
Parts List: LSBLGF420MH/NbA-M for EL03500660

No.	Name of part	Part code
1	Blower for Axial Fan Sub- Assy	15408000009

2	Condenser Assy 2	01128000165
3	Condenser Assy 1	01128000164
4	pipe connector	06128301
5	Steam current Switch	4502800000902
6	Taper Thread Cut-off Valve	0713083204
7	Relief valve 1	0718190301
8	Ball valve	07130831
9	Flooded Evaporator	011102000015
10	Taper Thread Cut-off Valve	0713083201
11	Electronic Expansion Valve	07331139
12	Electronic Expansion Valve	0733800601
13	Electromagnetic Valve	43000073
14	Cut-off Valve	07138235
15	Pressure Sensor	3221811802
16	Temp Sensor Sleeving	05210001
17	Relief Valve	0718000801
18	Taper Thread Valve	07131901
19	Electric Cabinet Assy	100003000209
20	Indicator Light (red)	35030062
21	Indicator Light (green)	35030061
22	Indicator Light	35030060
23	Scram switch	45010013
24	Oil Separator	07428000026
25	Filtering Core	07218205
26	Magnet Coil	4304000431
27	Electronic Expansion Valve	43048000004
28	Plate-type Heat Exchanger	00908000007
29	Valve	07189057
30	Dry Filter	07218204
31	Vibration Isolator	07498000012P
32	Electric Expand Valve Fitting	4304413233
33	Current Divider	03410101
34	Cut-off Valve	07138234
35	Pressure Protect Switch	460200047
36	Sensor (High Pressure)	3011800202
37	Compressor and Fittings	00208000071
38	Sensor	3011800308
39	Strainer	07418001
40	Electromagnetic Valve	43044107
41	Liquid level indicator	22458401
42	Temp Sensor Sleeving	05212423
43	Sensor Sub-assy	390002000018
44	Display Board	30292000038

45	Auxiliary contacts	45010025
46	Auxiliary contacts	45010008
47	Handle	26235253
48	AC Contactor	44010249
49	AC Contactor	44010237
50	Terminal Board	42018000549
51	Communication Interface Board	30118023
52	Main Board	30222000047
53	Main Board	30221007
54	holder of relay	42031501
55	Middle relay	44020338
56	Powe Panel	30245000001
57	Detecting Plate	30272000003
58	Filter	43130017
59	Phase Reverse Protector	430055000002
60	Single-phase Air Switch	45020203
61	Overcurrent Circuit Breaker	46020022
62	Terminal Board	42011221
63	AC Contactor	44010232
64	Current transducer	43128011
65	Insulation Gasket	49018110
66	Overcurrent Circuit Breaker	46028000020

(3) Explosive View of LSBLGF650MH/NbA-M



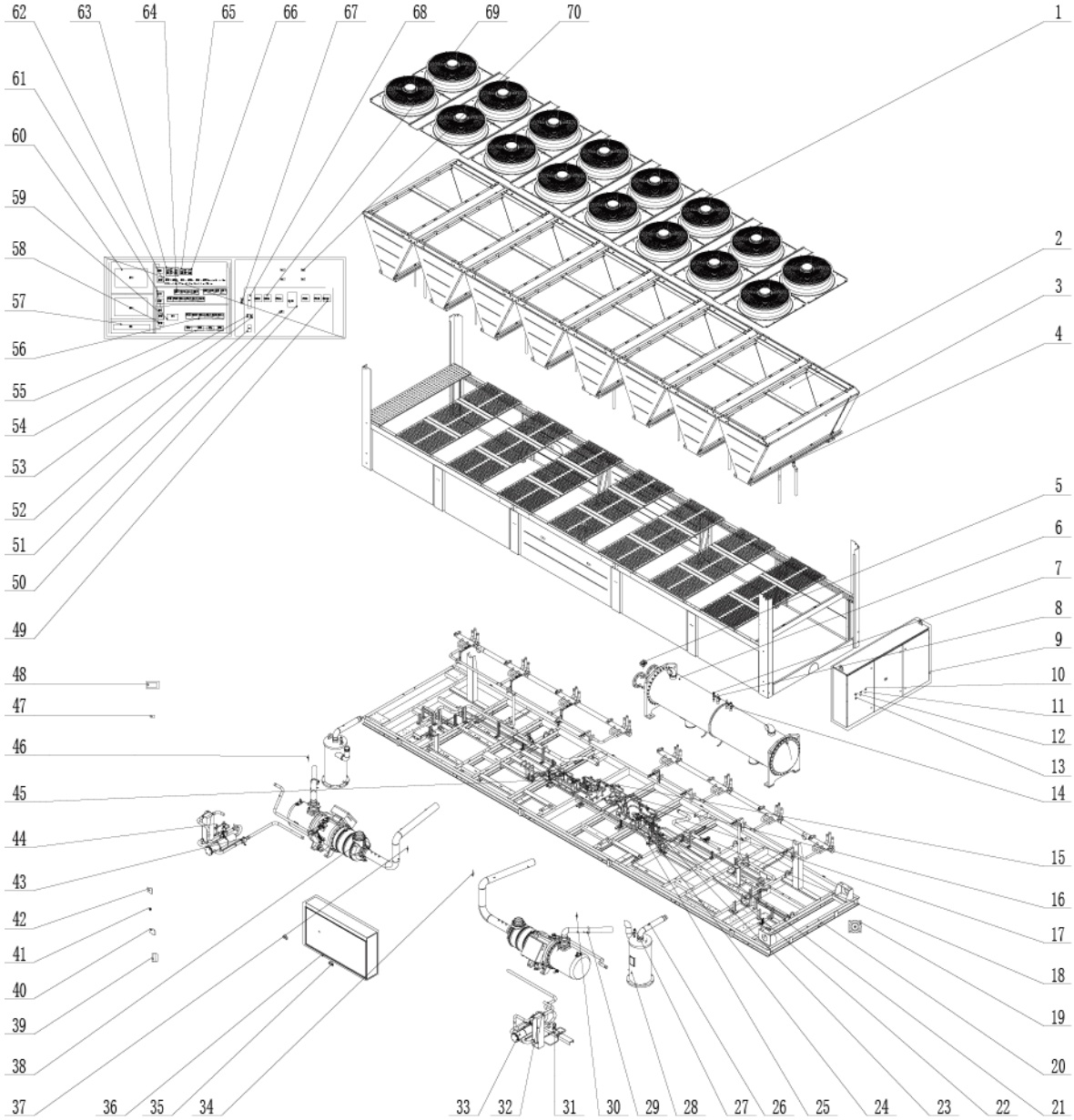
Parts List: LSBLGF650MH/NbA-M for EL03500550

No.	Name of part	Part code
1	Electric Cabinet Assy	01398000407
2	Indicator Light (red)	35030062
3	Indicator Light (green)	35030061
4	Indicator Light	35030060
5	Scram switch	45010013
6	Pressure Protect Switch	460200047
7	Front Panel	01548000058
8	Front Panel	01548000056

9	Front Panel	01548000057
10	Breakwater	01358000136P
11	Blower for Axial Fan Sub- Assy	15408000009
12	Condenser Assy	01128000164
13	Condenser Assy	01128000165
14	Cover Plate	01268000121
15	Cover Plate	01268000105
16	Front Panel	01548000085
17	Display Board	30292000038
18	Electric Cabinet Assy	01398000418
19	Temp Sensor Sleeving	05212423
20	Sensor	3011800307
21	Sensor (High Pressure)	3011800202
22	Filtering Core	07218205
23	Compressor and Fittings	00208000123
24	Pressure Sensor	3221811802
25	Valve	07189057
26	Dry Filter	07218158
27	Electronic Expansion Valve	43048000004
28	Plate-type Heat Exchanger	00908000005
29	Electromagnetic Valve	43000073
30	pipe connector	6128301
31	Oil Separator	07428000026
32	Base Frame Assy	01288000114P
33	Steam current Switch	45028205
34	Flooded Evaporator	01058800114
35	Taper Thread Cut-off Valve	713083204
36	Taper Thread Valve	07131901
37	Relief Valve	07388802
38	Cut-off Valve	7138234
39	Liquid level indicator	22458401
40	Electromagnetic Valve	43044107
41	Strainer	7418001
42	Electronic Expansion Valve	07331139
43	Magnet Coil	4304000431
44	Cut-off Valve	7138235
45	Electric Expand Valve Fitting	4304413218
46	Electronic Expansion Valve	07338006
47	Relief Valve	718000801
48	Main Board	30222000047
49	Main Board	30221007
50	Detecting Plate	30272000003
51	Powe Panel	30245000001

52	Middle relay	44020338
53	Holder of relay	42031501
54	Overcurrent Circuit Breaker	46020022
55	Overcurrent Circuit Breaker	45020203
56	Current transducer	43128011
57	AC Contactor	44010238
58	AC Contactor	44010237
59	Overcurrent Circuit Breaker	46028000019
60	Filter	43130017
61	Electric raceway	4201030202
62	Terminal Board	42011103
63	Phase Reverse Protector	430055000002
64	Terminal Board	42011221
65	AC Contactor	44010232
66	Communication Interface Board	30118023
67	Terminal Board	42010311
68	Terminal Board	42018000549

(4) Explosive View of LSBLGF860MH/NbA-M



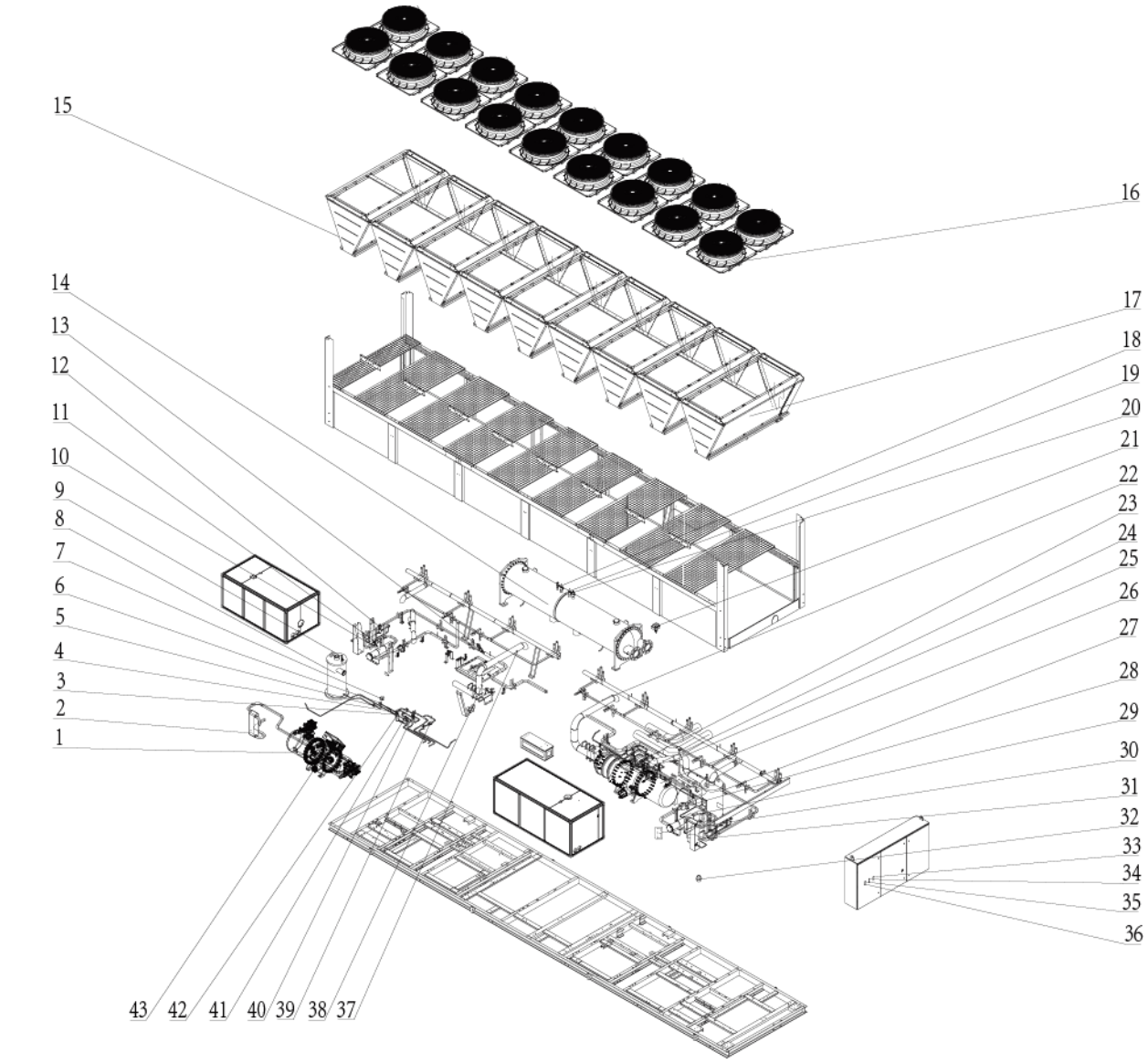
Parts List: LSBLGF860MH/NbA-M for EL03500610

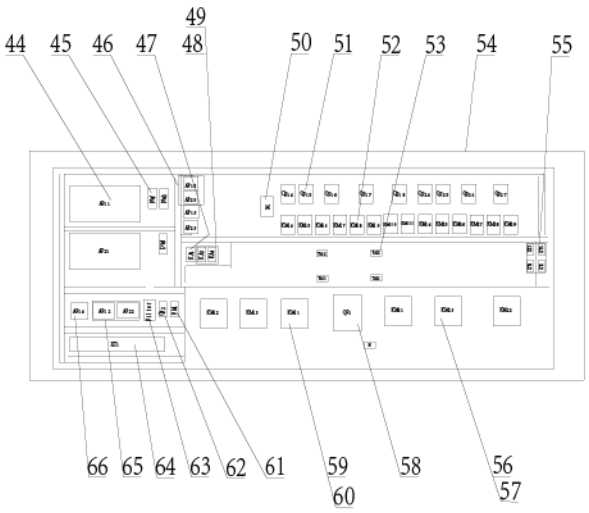
No.	Name of part	Part code
1	Blower for Axial Fan Sub- Assy	15408000009
2	Condenser Assy 2	01128000165
3	Condenser Assy 1	01128000164
4	pipe connector	06128301
5	Steam current Switch	4502800000902
6	Flooded Evaporator	01058800121
7	Relief Valve	07388802
8	Taper Thread Cut-off Valve	0713083204
9	Electric Cabinet Assy	100003000092
10	Indicator Light (red)	35030062
11	Indicator Light (green)	35030061
12	Scram switch	45010013

13	Indicator Light	35030060
14	Taper Thread Valve	07131901
15	Liquid level indicator	22458401
16	Strainer	07418001
17	Electromagnetic Valve	43044107
18	Electronic Expansion Valve	0733800601
19	Vibration Isolator	07498000012P
20	Base Frame Assy	0128800011801P
21	Electromagnetic Valve	43000073
22	Cut-off Valve	07138235
23	Electronic Expansion Valve	07331139
24	Cut-off Valve	07138234
25	Current Divider	03410101
26	Temp Sensor Sleeving	05210001
27	Relief Valve	0718000801
28	Oil Separator	07428000026
29	Pressure Protect Switch	460200047
30	Pressure sensor	32218118
31	Electronic Expansion Valve	43048000004
32	Plate-type Heat Exchanger	00908000007
33	Dry Filter	07218204
34	Pressure Sensor	3221811802
35	Handle	26235253
36	Electric Cabinet Assy	100003000091
37	Sensor	3011800307
38	Compressor and Fittings	00208000071
39	Filtering Core	07218205
40	Auxiliary contacts	45010025
41	connecting hose	06120003
42	Auxiliary contacts	45010008
43	Valve	07189057
44	Magnet Coil	4304000431
45	Electric Expand Valve Fitting	4304413218
46	Pressure Sensor	3011800209
47	Temp Sensor Sleeving	05212423
48	Display Board	30292000038
49	AC Contactor	44010237
50	Overcurrent Circuit Breaker	46028023
51	Insulation Gasket	49018110
52	Terminal Board	420102471
53	Single-phase Air Switch	45020203
54	Phase Reverse Protector	430055000002
55	Terminal Board	42011221

56	AC Contactor	44010232
57	Terminal Board	42018000549
58	Communication Interface Board	30118023
59	Terminal Board	42010311
60	Main Board	30222000047
61	Main Board	30221007
62	Detecting Plate	30272000003
63	Powe Panel	30245000001
64	Overcurrent Circuit Breaker	46020022
65	holder of relay	42031501
66	Middle relay	44020338
67	Filter	43130017
68	Terminal Board	42018037
69	AC Contactor	44010249
70	Current transducer	43128011

(5) Explosive View of LSBLGF950MH/NbA-M



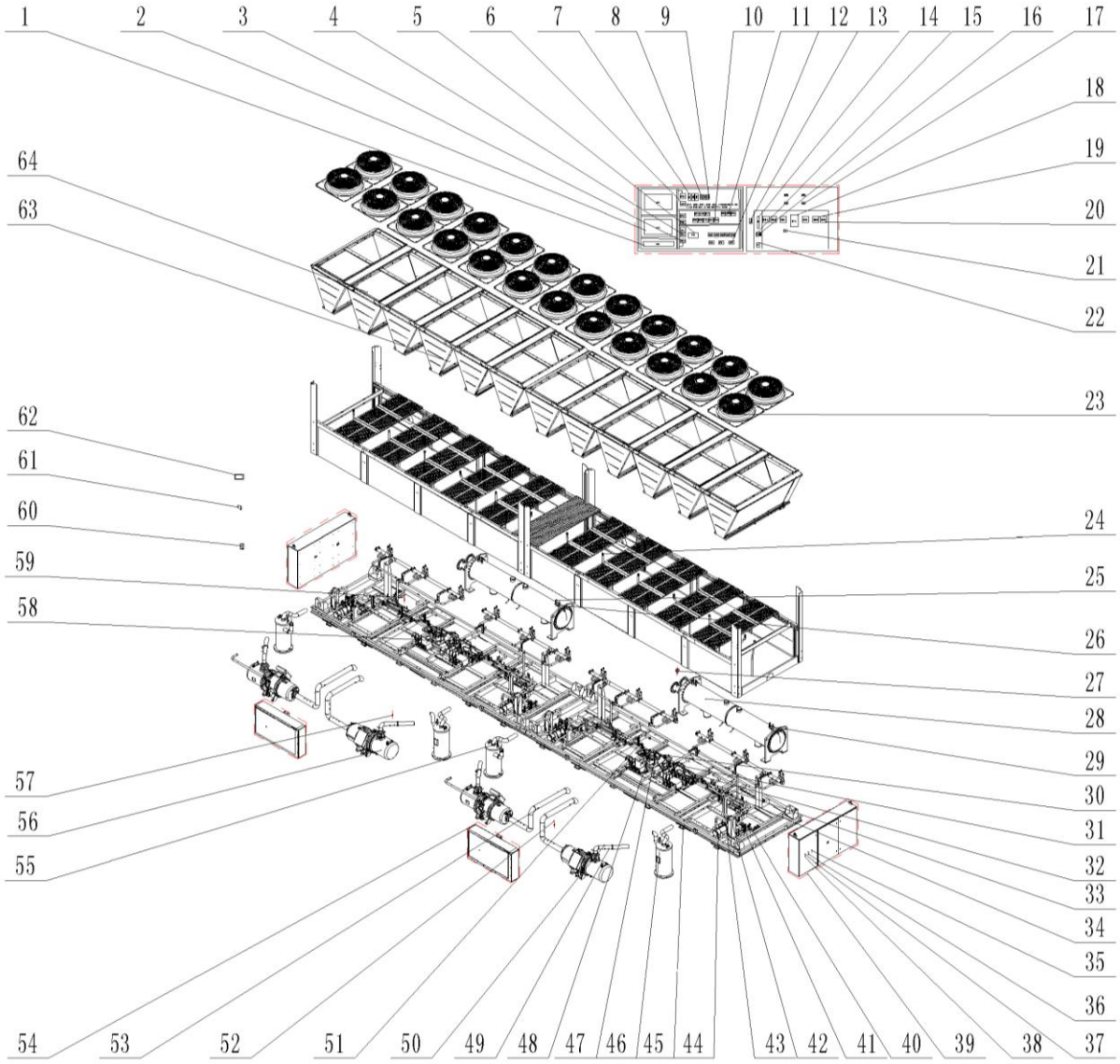


Parts List: LSBLGF950MH/NbA-M for EL03500540

No.	Name of part	Part code
1	Compressor and Fittings	208000109
2	Plate-type Heat Exchanger	908000007
3	Electronic Expansion Valve	7331139
4	Electric Expand Valve Fitting	4304413233
5	Cut-off Valve	7138235
6	Electromagnetic Valv	43000073
7	Magnet Coil	4304000431
8	Oil Separator	7428000026
9	Relief Valve	718000801
10	Dry Filter	7218204
11	Valve	7189057
12	Electronic Expansion Valve	43048000004
13	Electronic Expansion Valve	733800601
14	Flooded Evaporator	1058800105
15	Condenser Assy 1	1128000164
16	Blower for Axial Fan Sub- Assy	15408000009
17	Condenser Assy 2	1128000165
18	Taper Thread Valve	7131901
19	Taper Thread Cut-off Valve	713083204
20	Relief Valve	7388802
21	Steam current Switch	45028205
22	Pressure sensor	32218118
23	Electric Expand Valve Fitting	4304413218
24	Sensor (High Pressure)	3011800202
25	Pressure Protect Switch	460200047
26	Compressor and Fittings	208000107
27	Oil Separator	7428000048
28	Valve	7180007
29	Dry Filter	7218157
30	Filtering Core	7218205
31	Plate-type Heat Exchanger	908000024
32	pipe connector	6128301
33	Indicator Light (red)	35030062
34	Indicator Light (green)	35030061
35	Scram switch	45010013

36	Indicator Light	35030060
37	Pressure sensor	3221811801
38	Sensor	3011800308
39	Strainer	7418001
40	Electromagnetic Valve	43044107
41	Liquid level indicator	22458401
42	Cut-off Valve	7138234
43	Pressure Sensor(High)	3011800208
44	Main Board	30222000047
45	Powe Panel	30245000001
46	Detecting Plate	30272000003
47	Middle relay	44028000009
48	Middle relay	44020338
49	holder of relay	42031501
50	Fan(radiation)	49010501
51	Overcurrent Circuit Breaker	46020022
52	AC Contactor	44010232
53	Current transducer	43128011
54	Electric Cabinet Assy	1398000374
55	Terminal Board	42011221
56	AC Contactor	44010249
57	Auxiliary contacts	45010025
58	Overcurrent Circuit Breaker	46028023
59	AC Contactor	44010237
60	Auxiliary contacts	45010008
61	Phase Reverse Protector	430055000002
62	Single-phase Air Switch	45020203
63	Filter	43130017
64	Terminal Board	42018000549
65	Main Board	30221007
66	Communication Interface Board	30118023

(6) Explosive View of LSBLGF1320MH/NbA-M



Parts List: LSBLGF1320MH/NbA-M for EL03500640

No.	Name of part	Part code
1	Terminal Board	42018000549
2	Main Board	30222000047
3	Communication Interface Board	30118023
4	Main Board	30221007
5	Terminal Board	42010311
6	Detecting Plate	30272000003
7	Powe Panel	30245000001
8	Middle relay	44020338
9	holder of relay	42031501

10	AC Contactor	44010232
11	Overcurrent Circuit Breaker	46020022
12	Terminal Board	42011221
13	Filter	43130017
14	Terminal Board	42018037
15	Phase Reverse Protector	32218018
16	Single-phase Air Switch	45020203
17	Current transducer	43128011
18	Overcurrent Circuit Breaker	46028000019
19	AC Contactor	44010237
20	AC Contactor	44010238
21	Insulation Gasket	49018110
22	Terminal Board	420102471
23	Blower for Axial Fan Sub- Assy	15408000009
24	pipe connector	06128301
25	Relief Valve	07388802
26	Taper Thread Cut-off Valve	0713083204
27	Steam current Switch	45028000009
28	Flooded Evaporator	01058800114
29	Taper Thread Valve	07131901
30	Liquid level indicator	22458401
31	Strainer	07418001
32	Electromagnetic Valve	43044107
33	Electronic Expansion Valve	07331139
34	Electronic Expansion Valve	07338006
35	Indicator Light (red)	35030062
36	Indicator Light (green)	35030061
37	Scram switch	45010013
38	Indicator Light	35030060
39	Electric Cabinet Assy	01398000407
40	Electromagnetic Valve	43000073

41	Electronic Expansion Valve	43048000004
42	Plate-type Heat Exchanger	00908000005
43	Valve	07189057
44	Dry Filter	07218158
45	Vibration Isolator	07498000012P
46	Oil Separator	07428000026
47	Magnet Coil	4304000431
48	Electric Expand Valve Fitting	4304413218
49	Pressure Protect Switch	460200047
50	Temp Sensor Sleeving	05210001
51	Cut-off Valve	07138235
52	Sensor	3011800307
53	Temp Sensor Sleeving	05212423
54	Electric Cabinet Assy	01398000418
55	Relief Valve	0718000801
56	Compressor and Fittings	00208000123
57	Sensor (High Pressure)	3011800202
58	Cut-off Valve	07138234
59	Pressure Sensor	3221811802
60	Filtering Core	07218205
61	Auxiliary contacts	45010008
62	Display Board	30292000038
63	Condenser Assy 2	01128000165
64	Condenser Assy 1	01128000164

4. 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	P
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/m2)	Cooling Load (W/m2)
Totel	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)
Staduim	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
Hoel	/	105～116

Notes:

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

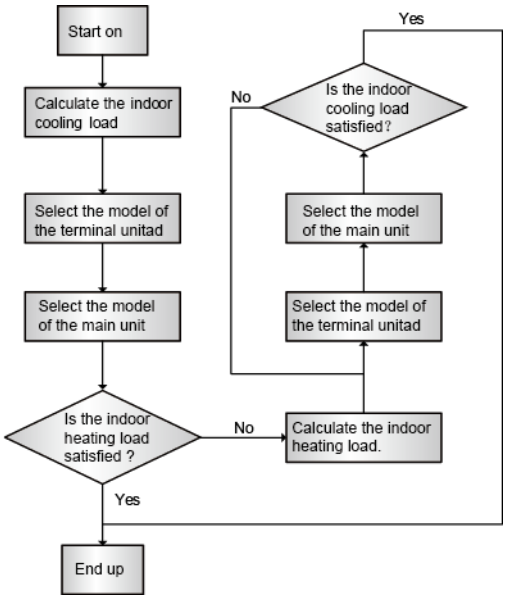
(b) Take the lower limit when the total building area is less than 5000m2 and take the upper limit when the total building area is large than 10000 m2.

(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/m2) =360000W=360kW

Offices: 8600×150 (W/m2)=1290000W=1290kW

Total: 360kW+1290kW =1650kW

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

(b) by the builiing area

12000×98W=1176kW

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

(2) Preselect the desired model and quantity

Look up the GREE Technical Guide Manual and it is concluded that 1 LSBLGF1160MH/NbA-M meet the design requirement (cooling load: 1160kW).

2. Selection of Power Lines and the Air Switch

Model	Breaker(A)	Power cord(mm^2)	Ground wire(mm^2)	Neutral Line(mm^2)
LSBLGF320MH/NbA-M	250	150	70	70
LSBLGF420MH/NbA-M	400	240	120	120
LSBLGF520MH/NbA-M	630	2×120	120	120
LSBLGF580MH/NbA-M	630	2×150	150	150
LSBLGF650MH/NbA-M	630	2×150	150	150
LSBLGF750MH/NbA-M	630	2×185	185	185
LSBLGF860MH/NbA-M	800	2×240	240	240
LSBLGF950MH/NbA-M	800	2×300	300	300
LSBLGF1050MH/NbA-M	1000	2×300	300	300
LSBLGF1160MH/NbA-M	2×630	2×120、2×150	120、150	120、150
LSBLGF1320MH/NbA-M	2×630	2×150、2×150	150、150	150、150
LSBLGF1520MH/NbA-M	2×630	2×185、2×185	185、185	185、185

NOTES:

(1) Size of the power lines and the air switch in the table above is determined based on the maximum power supply (maximum amps) of the unit.

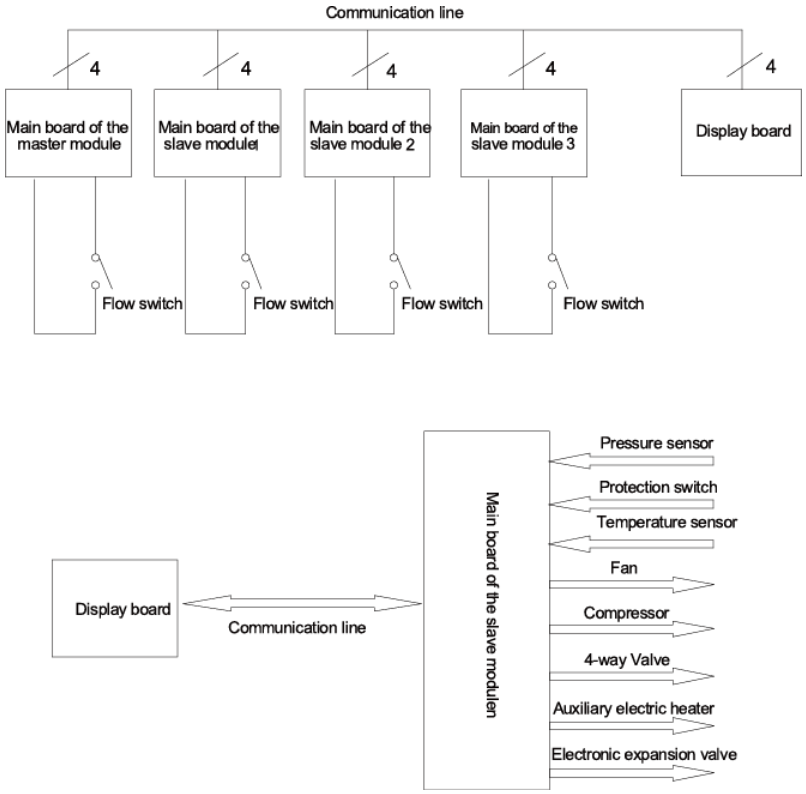
(2) Power lines listed in the table above are applied to the conduit-guarded multi-wire copper cable (like, JYV copper cable, consisting of PV insulated wires and a PVC cable jacket) used at 40℃ and resistible to 90℃ (see IEC 60364-5-523). If the working condition changes, they should be modified according to the related IEC standards.

(3) The air switch listed in the table above are applied to 40℃ working temperature. If the working condition changes, they should be modified according to its detailed specifications.

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.

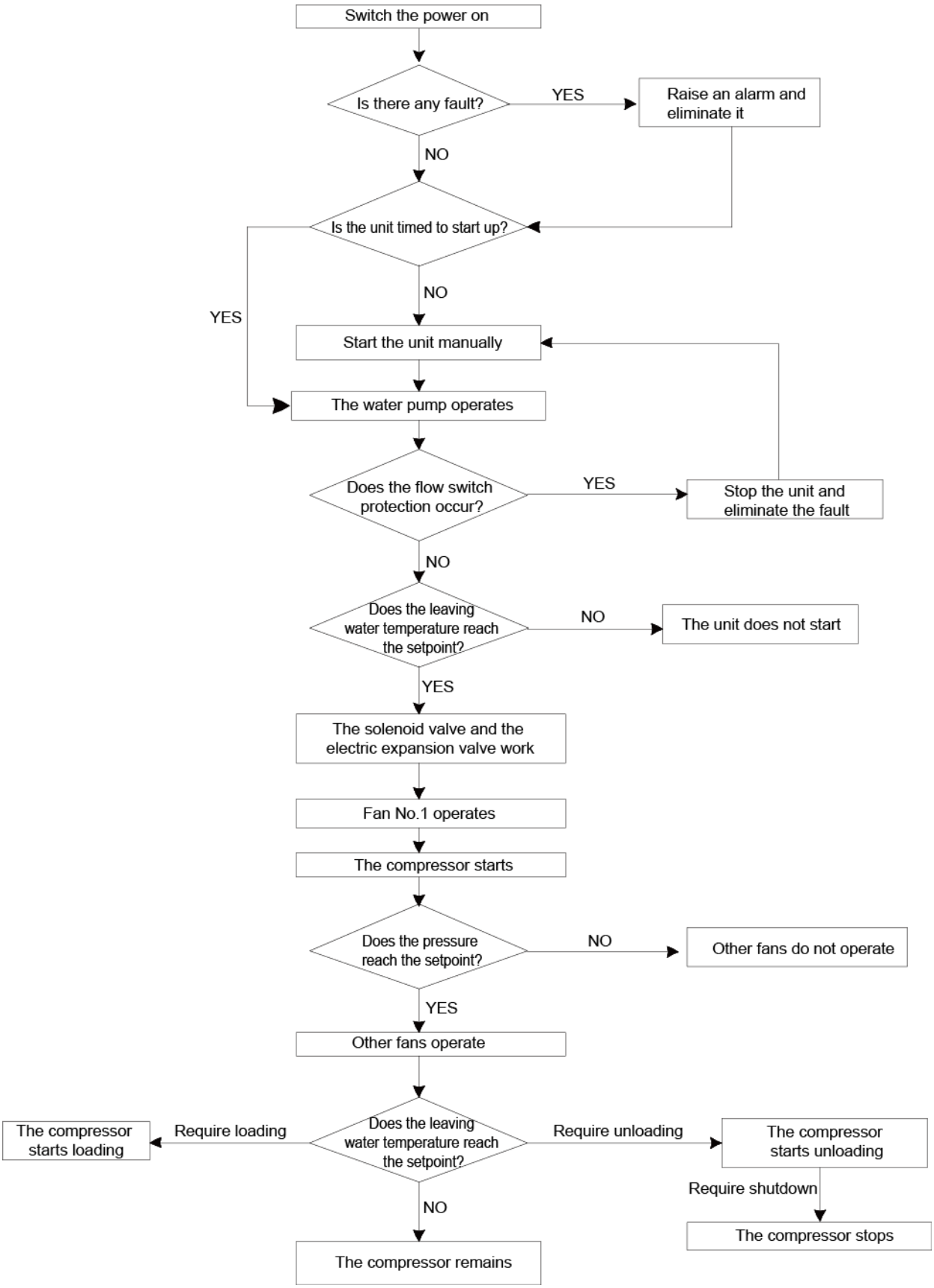
The unit is allowed to be started only after the control has detected all input signals are correct. The compressor will start, unload or stop automatically in accordance with the detected leaving chilled water temperature. Freeze protection will act depend on the detected antifreeze protection limits. 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.

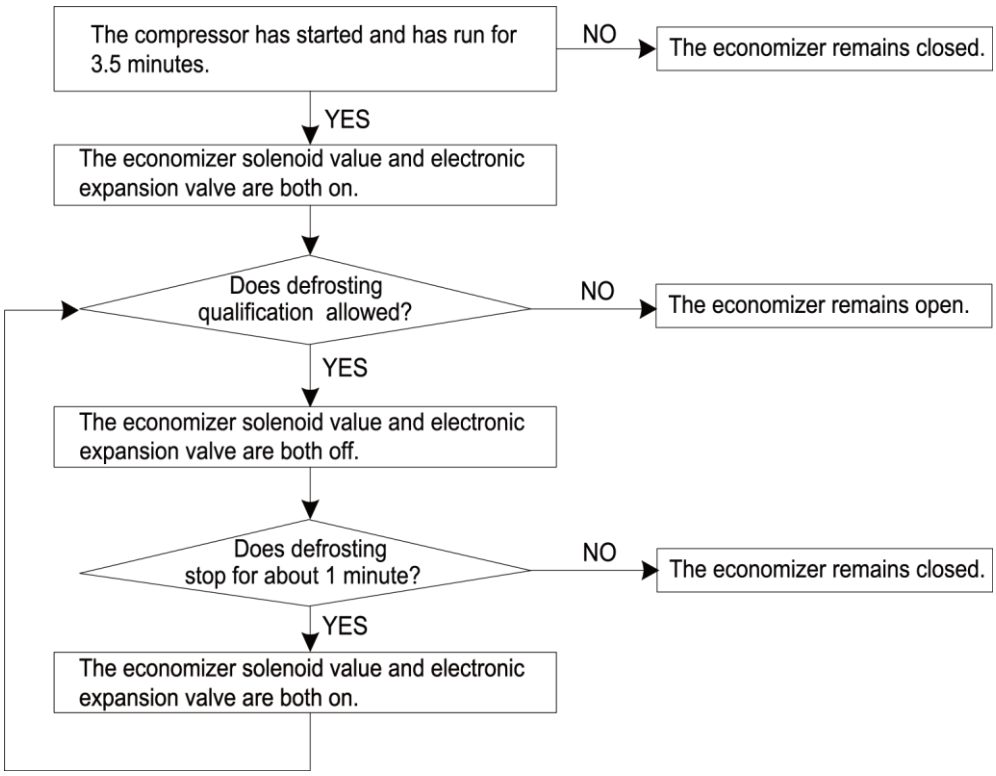
When the shutdown command is performed, the compressor will stop firstly, and then the fan and lastly the chilled water pump.

1.2 Control Flowchart

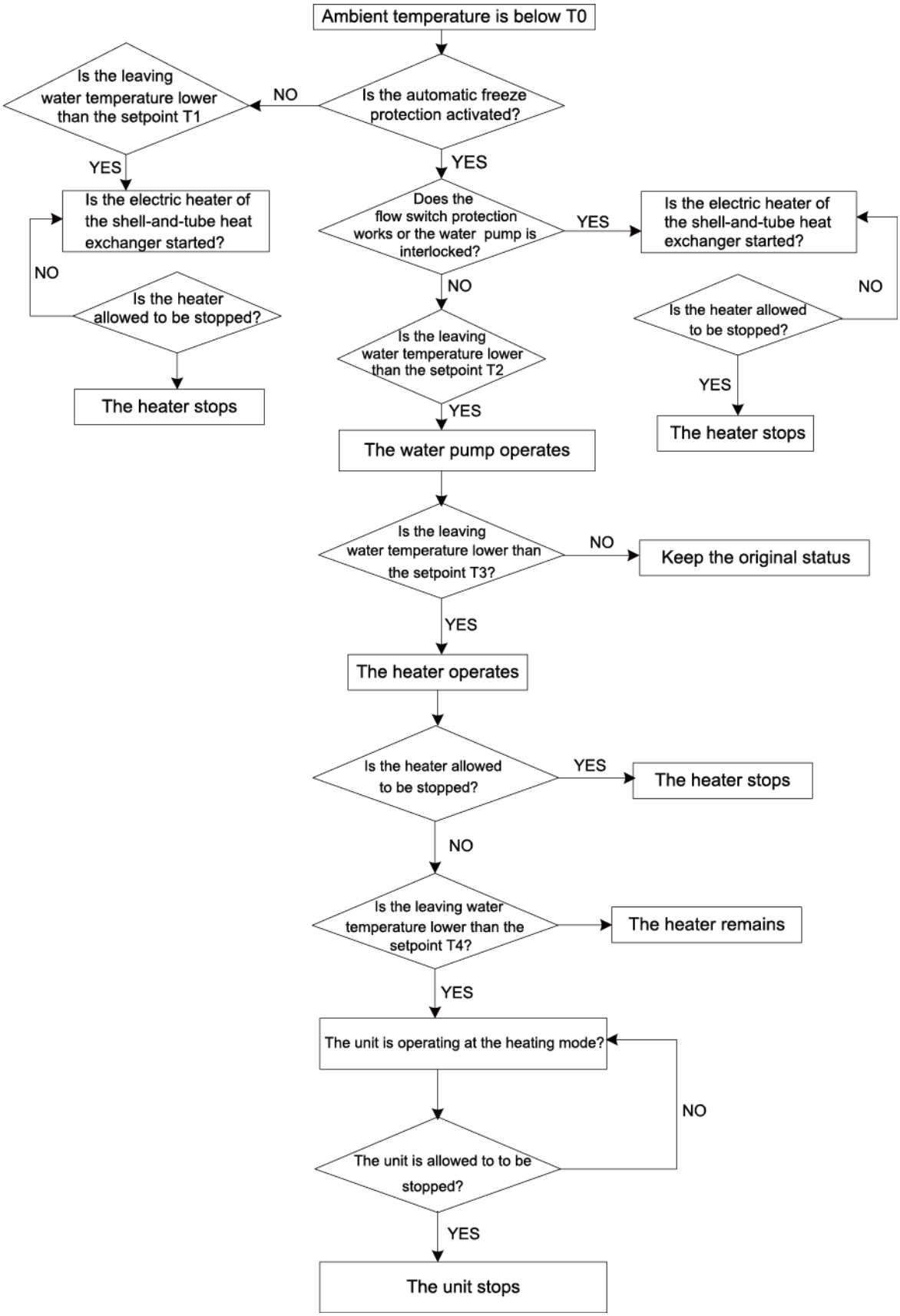
Cooling



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.

Freeze Protection and Control to the Electric Heater of the Shell-and-tube Heat Exchanger



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.

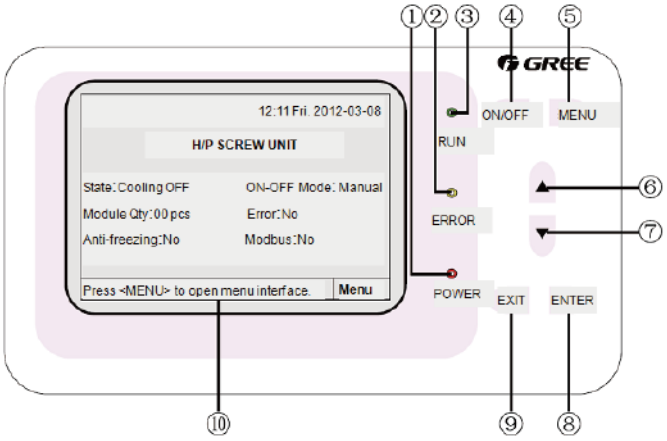
As for the heat pump unit, when one single module unit detects the ambient temperature is equal to or lower than 5℃and the anti-freezing temperature is or lower than 3.5℃, all water pumps will operate; when the anti-freezing temperature is or lower than 1.5℃, this module unit will operate at the heating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

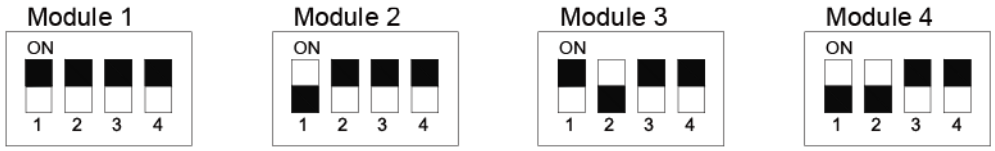
Up to 4 sets of Modules involved in one network can be controlled by only one display which is capable of displaying and setting kinds of parameters.

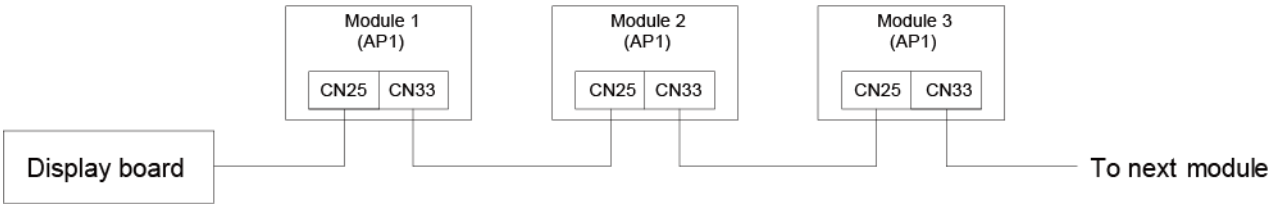


1	POWER	it lights up when the display is energized
2	ERROR	it lights up when some errors occur
3	RUN	it lights up when the Module starts running
4	ON/OFF	it is used to start or stop the Module by a five seconds press
5	MENU	it is used to open the Menu Page
6	▲	It is used to move the cursor upward to 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 specificationf 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

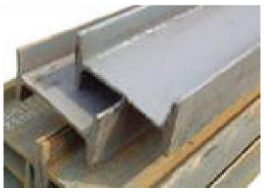
(2) I steel

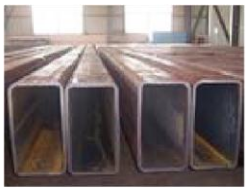
(3) Channel Steel

(4) Squire Steel

(5) Rectangular Steel

(6) H Steel

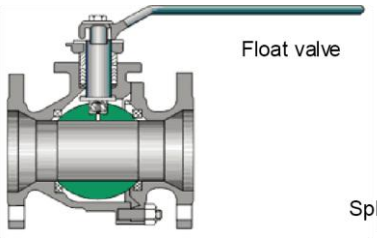
2.4 Valves

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.

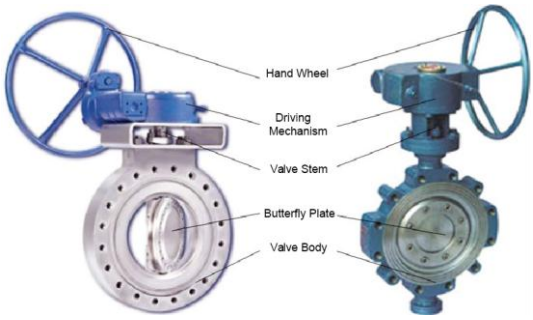
(2) Shut-off Valve and Throttling Valve: its nominal diameter is limited to 200 or below. The shut-off valve is used to cut off the tube flow and the throttling valve is mainly used to throttle the tube flow.

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



Split ball valve (large caliber)

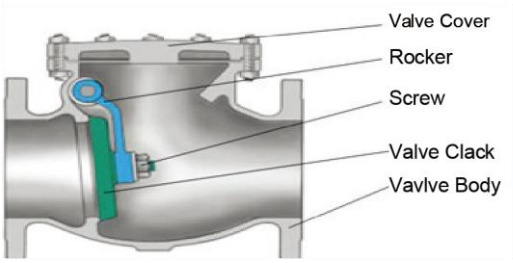
(4) Batterfly Valve: it is widely applicable to all kinds of fluids under 2.0MPa and 200℃.



(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

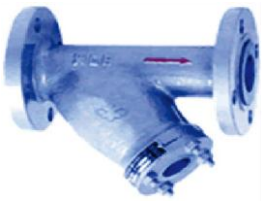
(7) Selection of Valves

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.

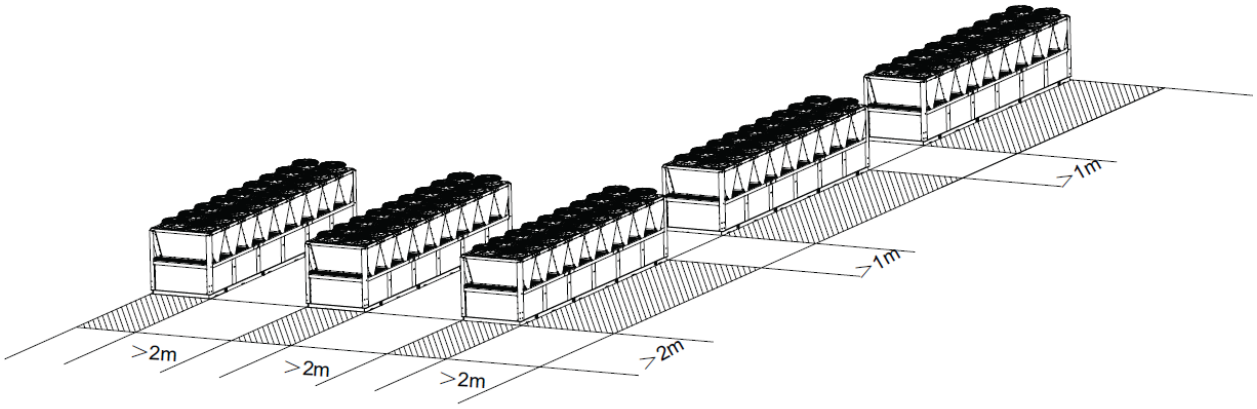
(7) Necessary tools and materials include: flexible joint, vibration-isolating pad, lifting equipment, lifting beam, lifting chain, jack, skid, crow bar etc.

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

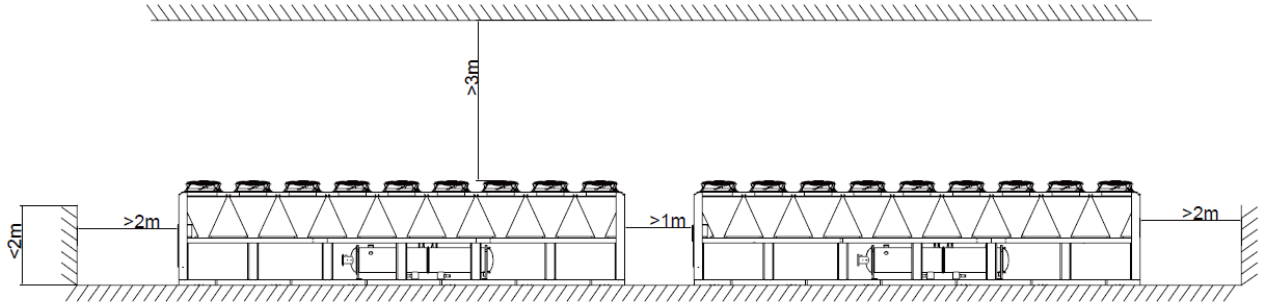
(1) Horizontal Arrangement

The longitudinal distance between units should be larger than 1m, and the transverse distance should be larger than 2m and keep it as large as possible. When there is a barrier beside the unit, their distance should be kept more than 2m, while if there is a barrier over the unit, their distance should be kept more than 3m.

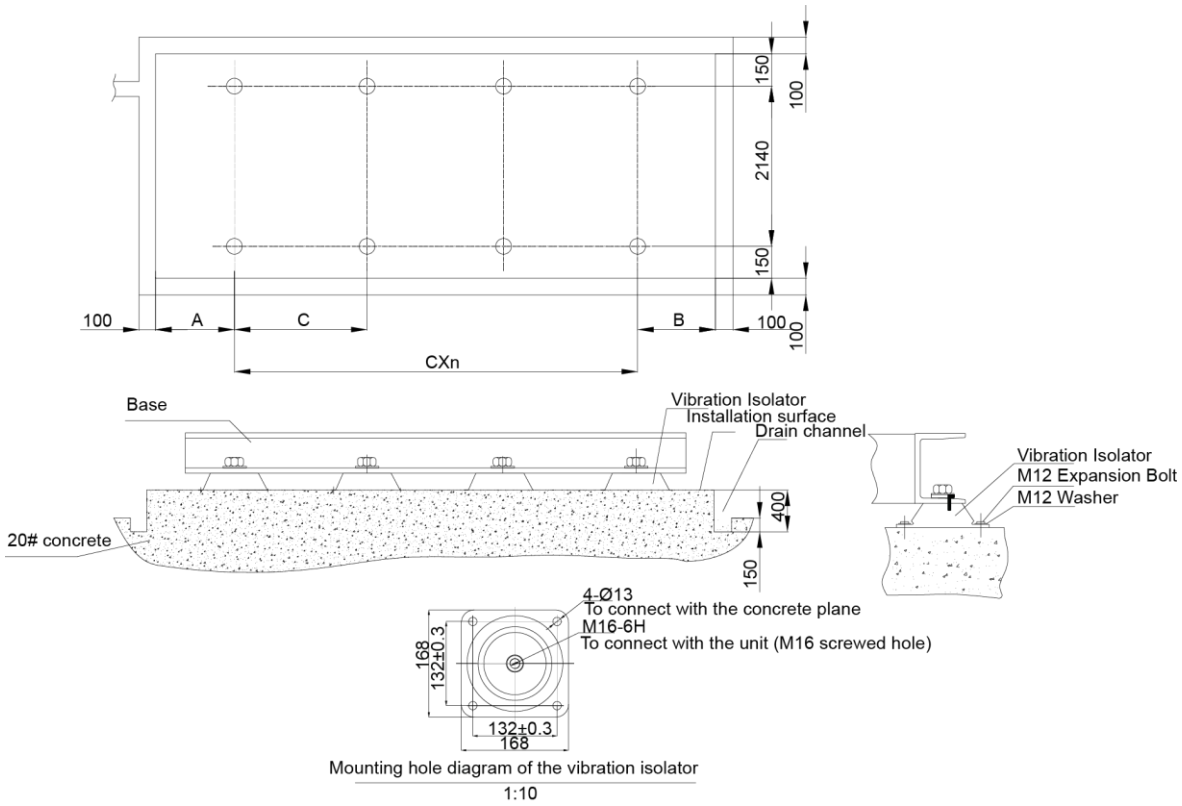


(2) Arrangement in the Recess

The longitudinal distance between units should be larger than 1m, and the transverse distance should be larger than 2m and keep it as large as possible. When there is a barrier beside the unit, their distance should be kept more than 2m; while if there is a barrier over the unit, their distance should be kept more than 3m.



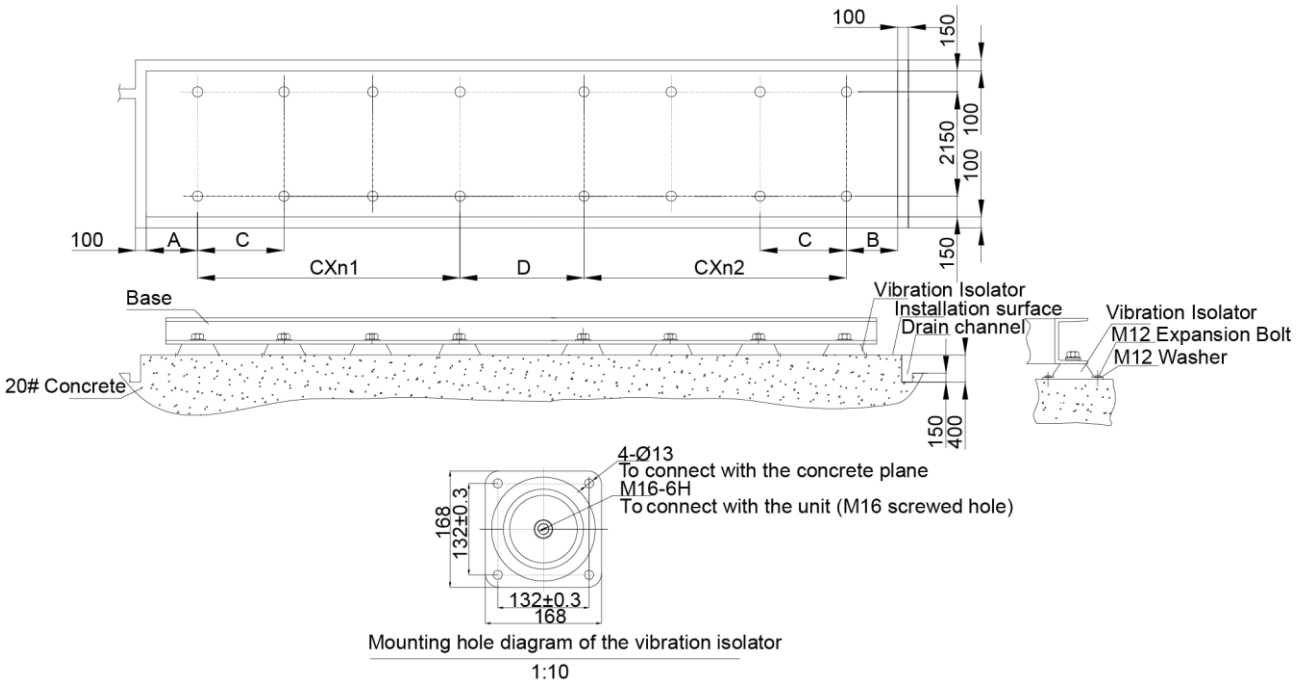
4.3 Installation Foundation



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
LSBLGF320MH/NbA-M	1000	1000	1200	1200×2
LSBLGF420MH/NbA-M	1000	1000	1200	1200×3
LSBLGF520MH/NbA-M	1000	1000	1200	1200×4
LSBLGF580MH/NbA-M	1000	1000	1200	1200×5
LSBLGF650MH/NbA-M	1000	1000	1200	1200×5
LSBLGF750MH/NbA-M	1000	1000	1200	1200×6
LSBLGF860MH/NbA-M	1000	1000	1200	1200×7
LSBLGF950MH/NbA-M	1000	1000	1200	1200×8
LSBLGF1050MH/NbA-M	1000	1000	1200	1200×8



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
LSBLGF1160MH/NbA-M	1000	1000	1200	1360	1200x4	1200x5
LSBLGF1320MH/NbA-M	1000	1000	1200	1370	1200x5	1200x5
LSBLGF1520MH/NbA-M	1000	1000	1200	1390	1200x6	1200x6

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.

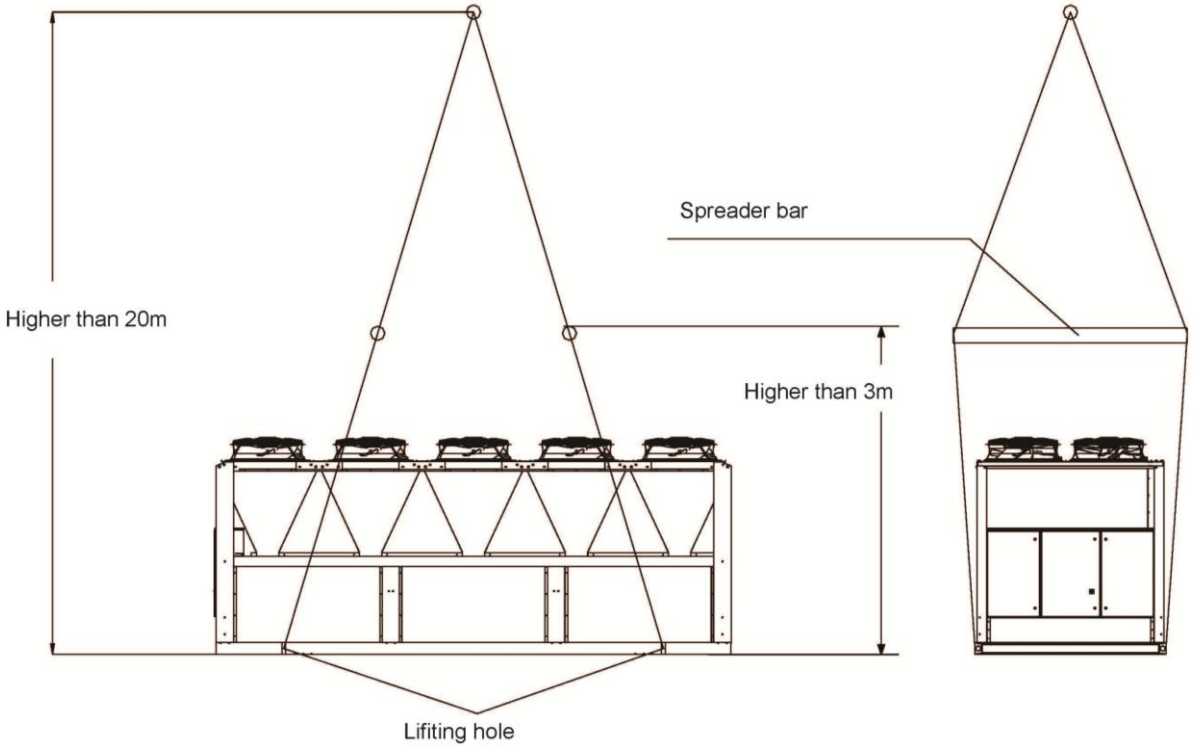
4.4 Main Unit

(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.

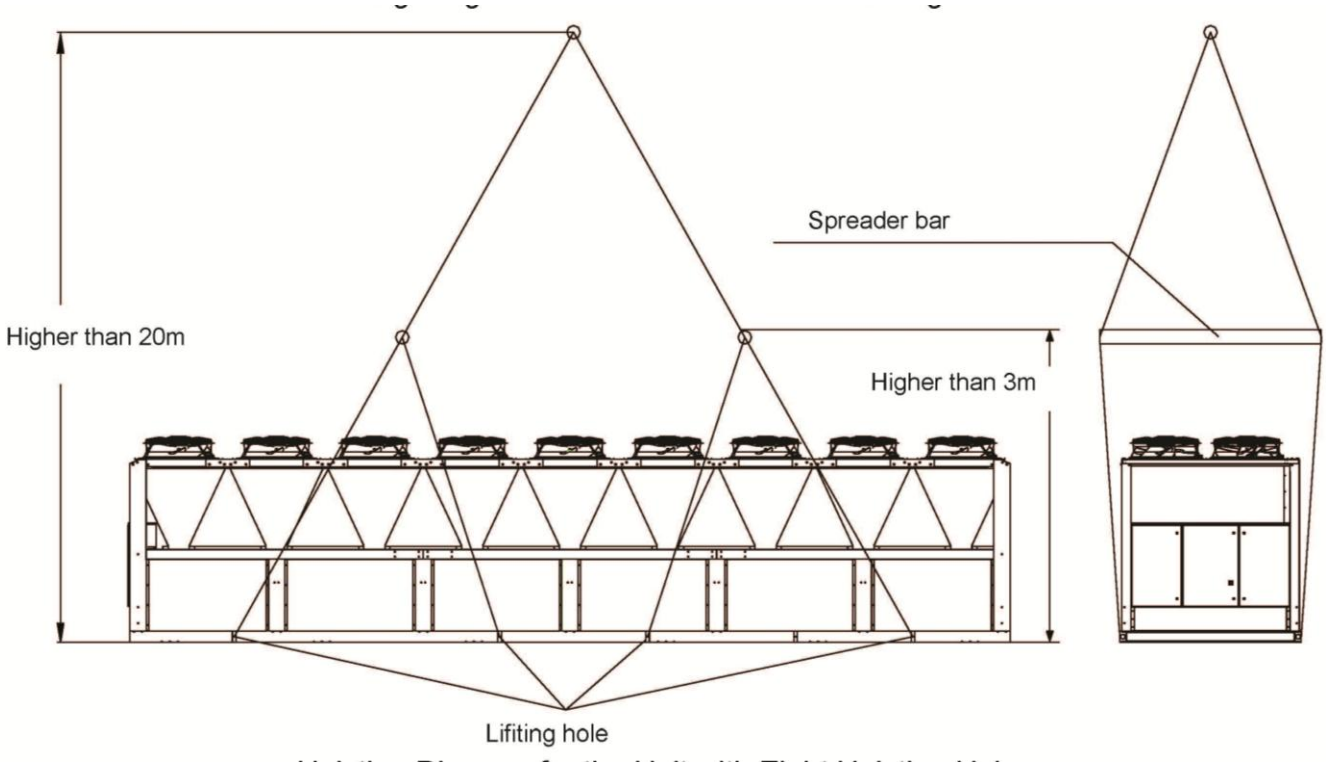
(2) It is best to unpack the unit at the installation location and keep the chiller upward

(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.

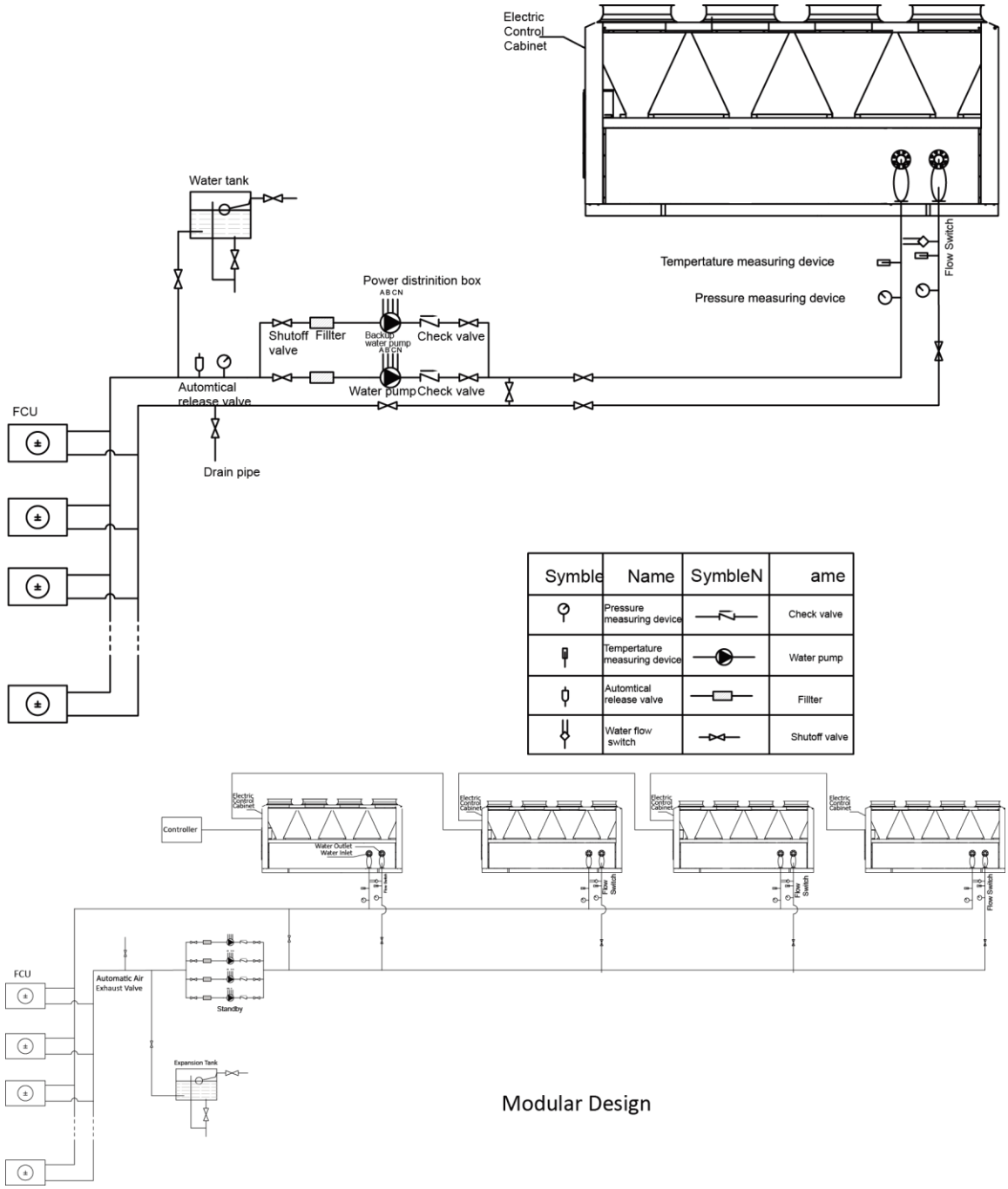
(12) The chilled water pipe outside should be equipped with an electric heater to prevent it from being frozen up under ultra-low temperature. The electric heater should have a separate fuse.

(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.



Modular Design

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.

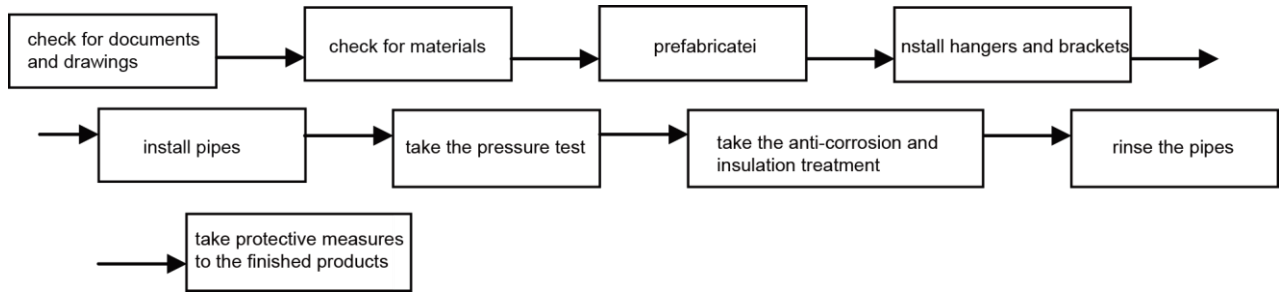
(3) No matter which connection is used, welding, threaded connection or flange connection, the connection joint can't be in the wall, floor or sleeve pipe.

(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.

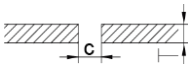
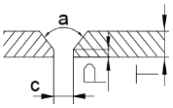
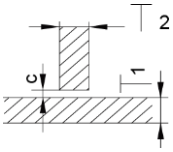
(b) Use marnen as stuffing material and remove those outside of the threads after pipes have been installed.

(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(º)	
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℃ .

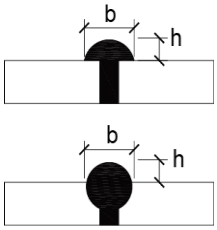
(e) The welding height can't be lower than the surface of the parent metal. There should be no crack and poor welding at the welding seam and the heat-affected zone. There should be no slag inclusion, crater and pore at the welding zone.

(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.

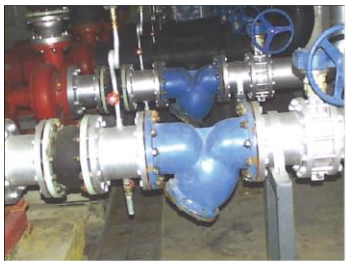
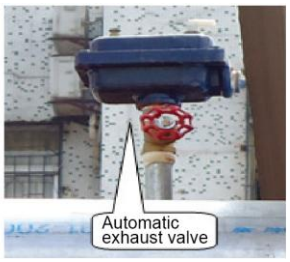
(4) Installation of electric valves and solenoid valves should be guided by electricians. They should be commissioned prior to installation.

(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, a 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.

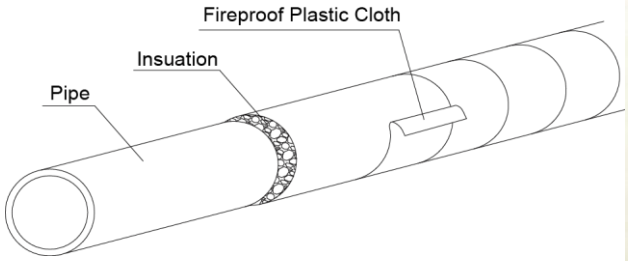
- Anti-corrosion and Insulating

(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.

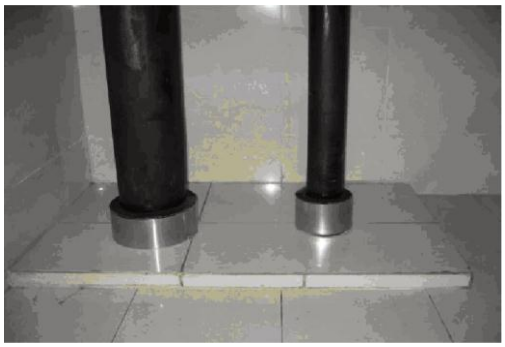
(c) Seams of the insulation should be airproof.

(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.

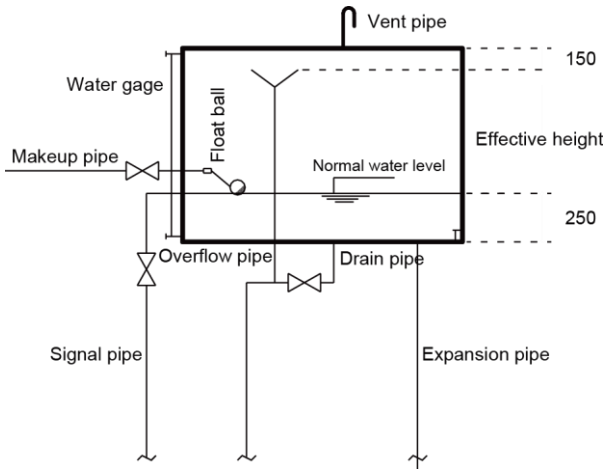
(2) Installed pipes can't be taken as the lifting center, and also can't be stepped on.

(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 Instalation 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.

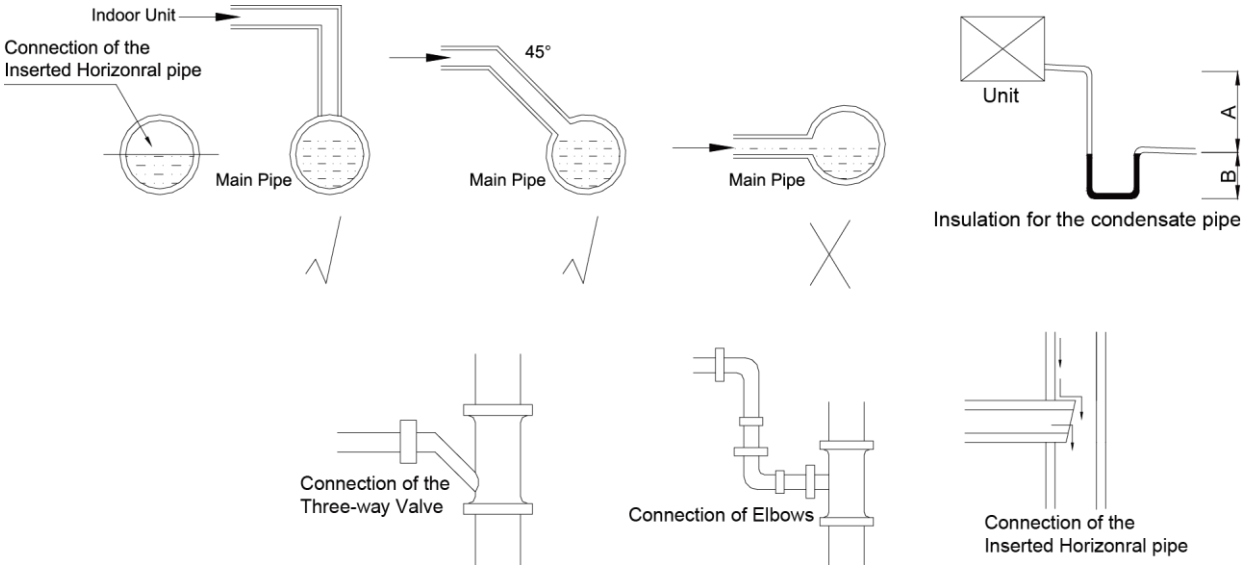
(5) The diameter of the pipes should be suitable.

(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.

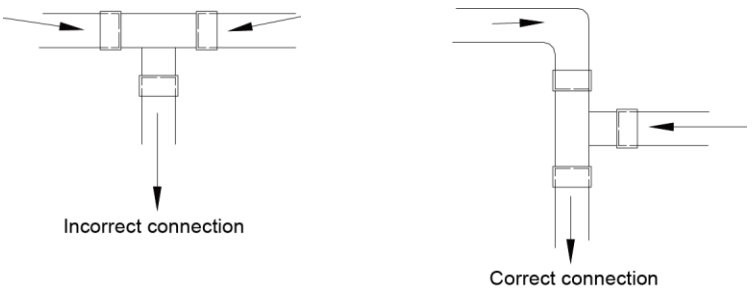
4.6.1 Setup

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:

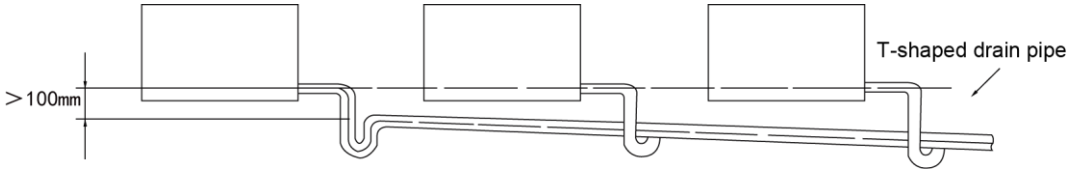


When the three-way valve is used for the condensate pipe, its straight two connectors should be kept at the same level as shown in the right figure.



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

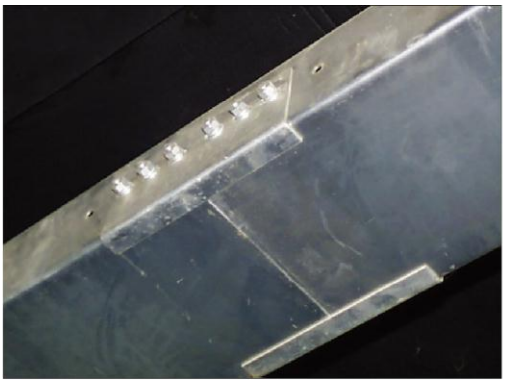
(b) The power lines should run in the wireways or wire conduits.

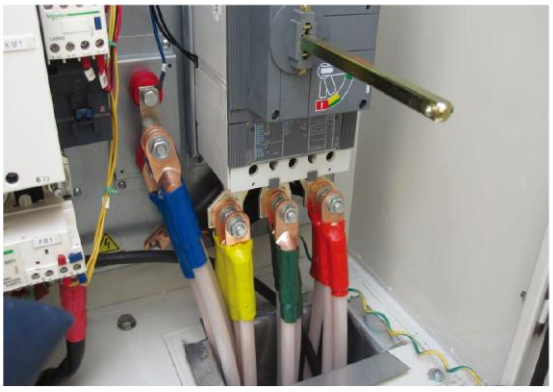
(c) Wires entering the electric box should be protected with rub

er 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 Requirments on Control Lines

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

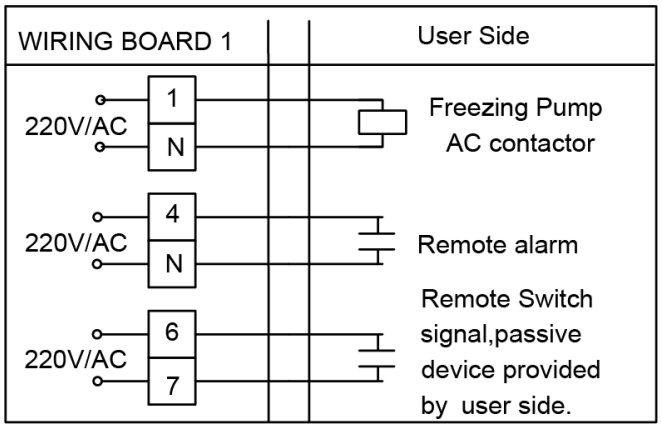
(2) Never let 50v or higher lines go parallel with the control lines of the flow switch. If inevitable, they should be kept away with a distance of at least 150mm.

(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.

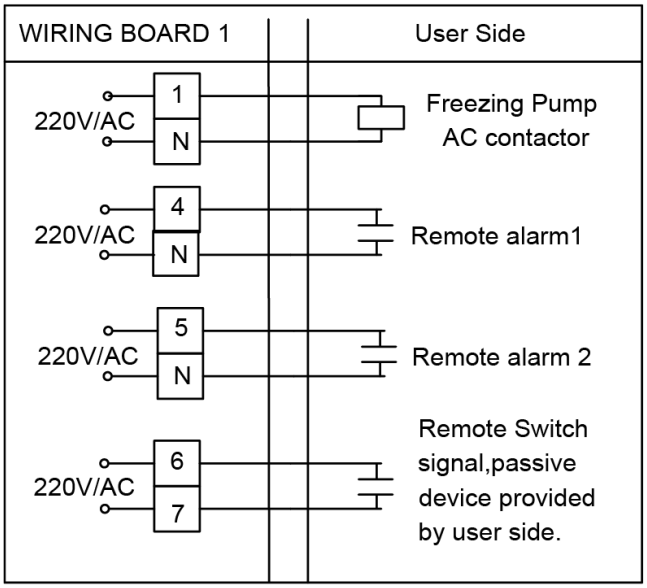
(4) Length of the control line inside the electric box should be proper, and never bundle it and then stuff it into the electric box.

4.9 External Wirnig of Control Lines

Single compressor



Dual compressor



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

Model	Breaker(A)	Power cord(mm^2)	Ground wire(mm^2)	Neutral Line(mm^2)
LSBLGF320MH/NbA-M	320	150	70	70
LSBLGF420MH/NbA-M	400	185	95	95
LSBLGF520MH/NbA-M	500	300	150	150
LSBLGF580MH/NbA-M	630	2×150	150	150
LSBLGF650MH/NbA-M	630	2×150	150	150
LSBLGF750MH/NbA-M	630	2×185	185	185
LSBLGF860MH/NbA-M	800	2×240	240	240
LSBLGF950MH/NbA-M	800	2×300	300	300
LSBLGF1050MH/NbA-M	800	2×300	300	300

LSBLGF1160MH/NbA-M	1000	2×150/2×150	150/150	150/150
LSBLGF1320MH/NbA-M	1250	2×150/2×150	150/150	150/150
LSBLGF1520MH/NbA-M	1250	2×185/2×185	185/185	185/185

① Power incoming lines are double-entry lines for LSBLGF1160MH/NbA-M, LSBLGF1320MH/NbA-M and LSBLGF1520MH/NbA-M.

② The power line is sized based on 40 ℃ environment temperature, and the cable with multiple copper conductors in the raceway can withstand 90℃ (IEC 60364). However, the user should make some adjustment according to local environment and relevant standards.

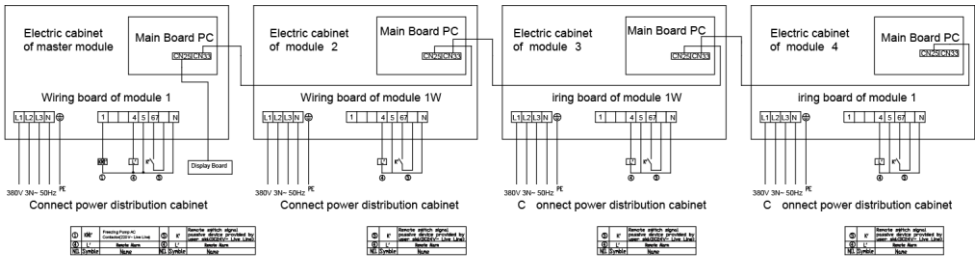
③ An all-pole disconnect switch must be provided in the user's power distribution box and the drop-out distance of the contact should be at least 3mm.

④ The appliance shall be installed in accordance with national wiring regulations.

⑤ Disconnect the power supply before cleaning and maintenance.

⑥ If the supply cord is damaged, it must be replaced by the manufacturer or its service agent or a similarly qualified person in order to avoid a hazard.

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 Instalation 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 swtich 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

1.1 Significance

In order to keep the unit operating reliably in a long term, commissioning shall be performed by GREE qualified personnel or under the guide of them. Also, routine operation and maintenance shall be done by them.

1.2 Typical Maintenance Items

1.2.1 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.

1.2.2 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.

1.2.3 Requirements on the Water Quality

After the water tube has been flushed several times, check for the water quality by refilling the water system and then testing the water flow and outlet pressure etc.

Industrial water used as chilled water produces little scale, but well or river water will bring much scale, sand and other sediment which then would block up the chilled water flow and make the evaporator frozen up. Therefore, it is necessary to filter or chemically soften water before it flows into the water system and also take analysis to quality. Once it is found water quality is dissatisfactory, and then only industrial water is available.

pecification of Chilled Water					
Item		Chilled Water		Trend	
		Circulating Water (<20℃)	Supply Water	Corrosion	Scalelike Sediment
Basic items	PH	6.8～8.0	6.8～8.0	○	○
	Conductivity	<400μs/cm (25℃)	<300μs/cm (25℃)	○	○
	Cl^-	<50 (mg/L)	<50 (mg/L)	○	
	SO_4^{2-}	<50 (mg/L)	<50 (mg/L)	○	
	Acid consumption (PH4.8)	<50 (mg/L)	<50 (mg/L)		○
	Hardness	<70ppm	<70ppm		○
Reference Items	Fe	<1.0 (mg/L)	<0.3 (mg/L)	○	○
	S^{2-}	0 (mg/L)	0 (mg/L)	○	

	NH_4^+	<1.0 (mg/L)	<0.3 (mg/L)	○	
	SiO_2	<30 (mg/L)	<30 (mg/L)		○
Note: "○" indicates there is a possibility of scaling or corrosion.					

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.

(1) 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

(2) 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.

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

(b) 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.

(c) 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.

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

(e) 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).

(f) Repeat steps 4 and 5.

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

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

(3) Precautions

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

(b) 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.

1.2.4 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.

1.2.5 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

1.2.6 Part Replacement

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

1.2.7 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.

1.3 Winterization

Once the flow passage of the shell-and-tube system is frozen up, it will pose severe damages, like cracking or leakage which are beyond the warranty. Therefore, careful attention shall be paid on winterization as stated below.

(1) When the unit is standby at quite low ambient temperature (under subzero), the evaporator shall

be drained completely.

(2) As the water pipe may be frozen up when the flow switch and the temperature sensor fail, so the flow switch shall be interlocked with the unit.

(3) During charging or discharging refrigerant, the evaporator is probably frozen up whenever the pressure of refrigerant drops below 0.3Mpa(absoluteness pressure). Thus, it is necessary to keep a smooth flow or drain water out completely.

Other precautions include:

(1) Periodic maintenance shall be done to the unit in accordance with instructions covered in the product manual to guarantee its reliable operation.

(2) When refrigerant leak, shut down the unit immediately and contact the servicemen. No open fire is allowed in the field, as refrigerant will decompose into harmful as soon as it touches the open fire.

(3) When a fire hazard occurs, please cut off the main power supply and put it down with fire extinguishers.

(4) The unit shall be located away from gas, alcohol and other inflammable substances to avoid the explosion risk.

(5) When the unit is broken down, restart is allowed only after the fault is figured out and eliminated. When refrigerant or second refrigerant (chilled water) leaks, all switches shall be closed. If unavailable, please cut off the main power supply.

(6) Do not shortcut the protective device, otherwise it would bring trouble.

In order to extend the service life of the unit, improve the operation performance and save more energy, it is necessary to perform the routine check and maintenance. The user should retain the monthly, quarterly and yearly records which then will be taken as the basis for troubleshooting by servicemen.

Maintenance Period

Lubrication oil level of the compressor	Per day
Water flow of the water circulation system	Per day
Power supply	Per day
Refrigerant charge (through the sight glass)	Per day
Electric connection and insulation	Per quarter
Temperature setting	Per quarter
Dryer-filter	Per quarter
Replacement of the Oil filter	Per 3000 hours
Replacement of the compressor shaft bearing	Per 4000 hours

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 bar, 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 can not 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.

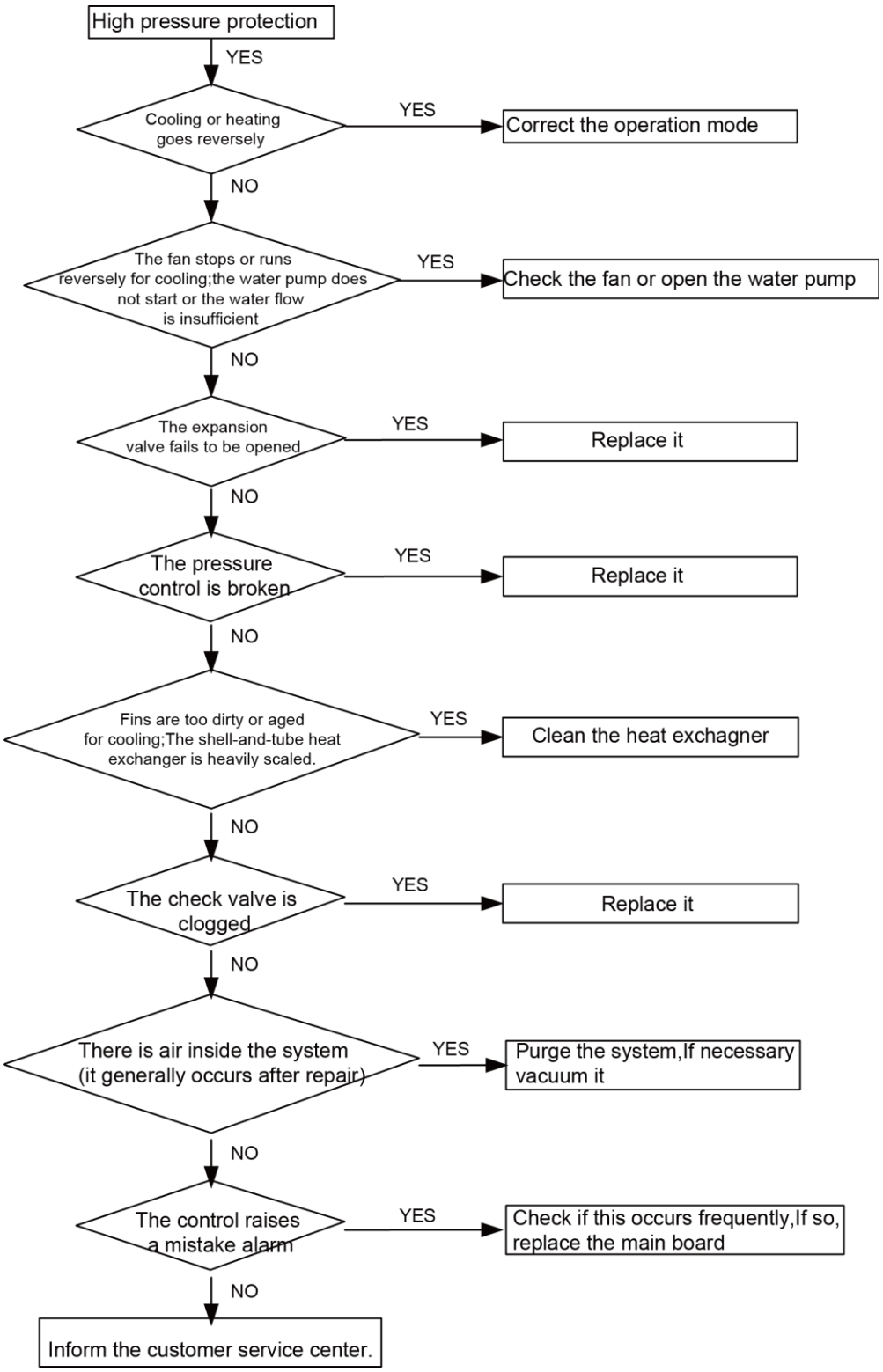
2.2 Error Code

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 sensor error	F4	Discharge temperature 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

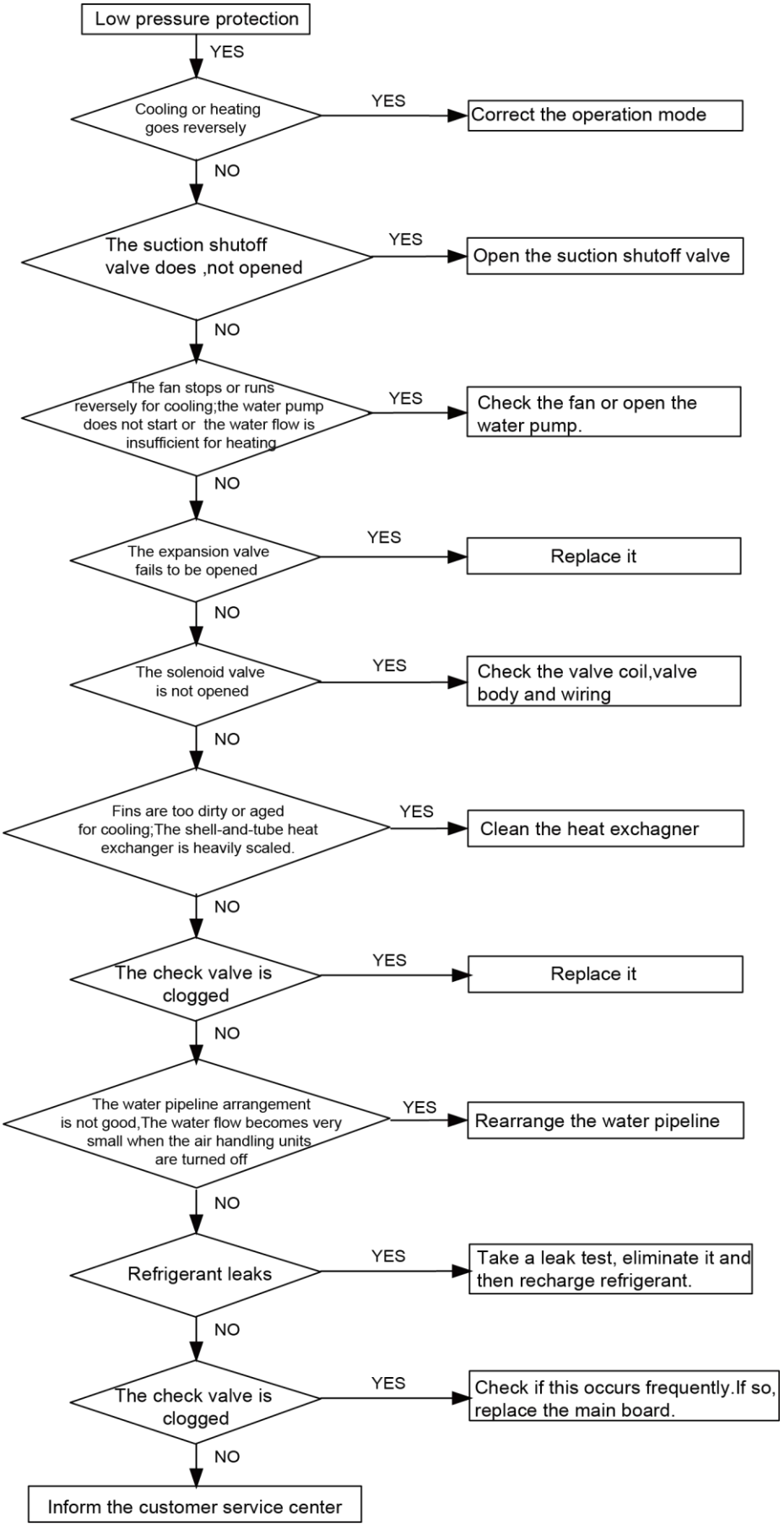
E1	High pressure protection	Pc	Compressor current sensor error
E1	Oil pressure high protection	U7	4-way valve reversing error
E2	Freeze protection	Uc	Oil pressure difference protection
E3	Low pressure protection	UL	Inverter fan error

2.3 Typical Troubleshooting

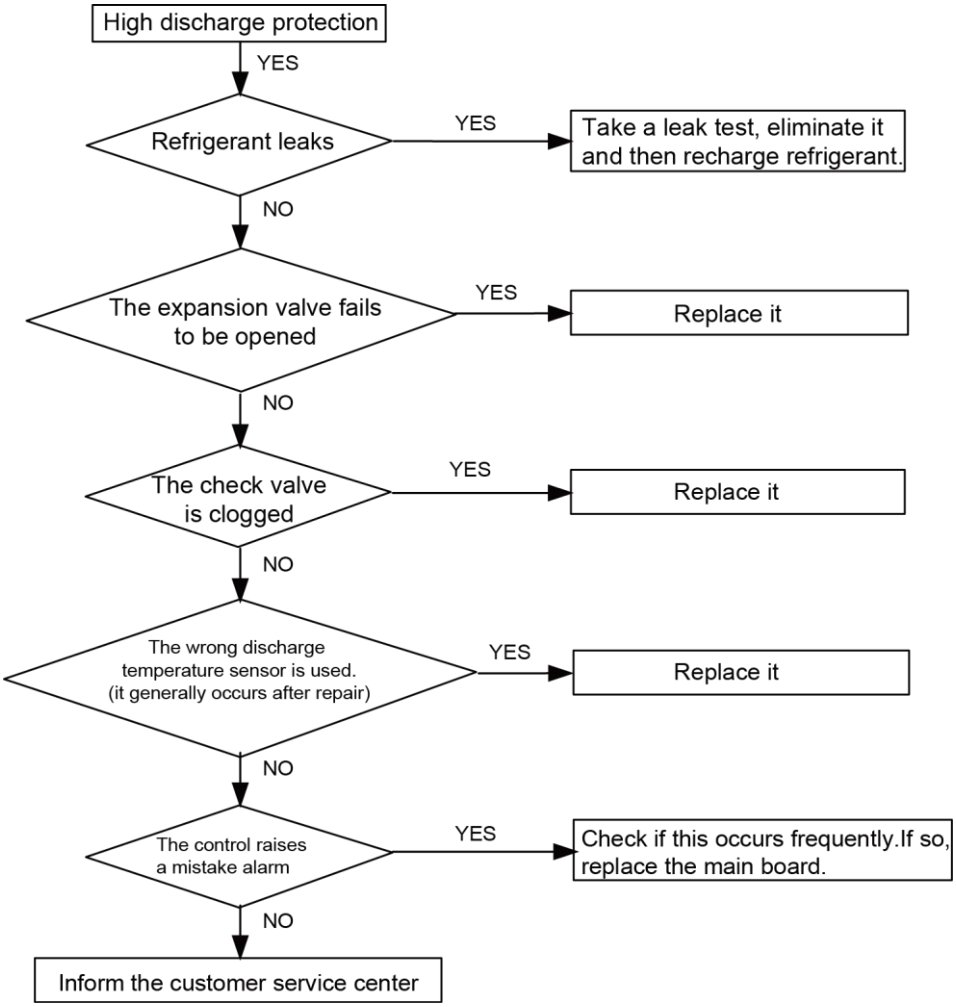
(1) High pressure protection



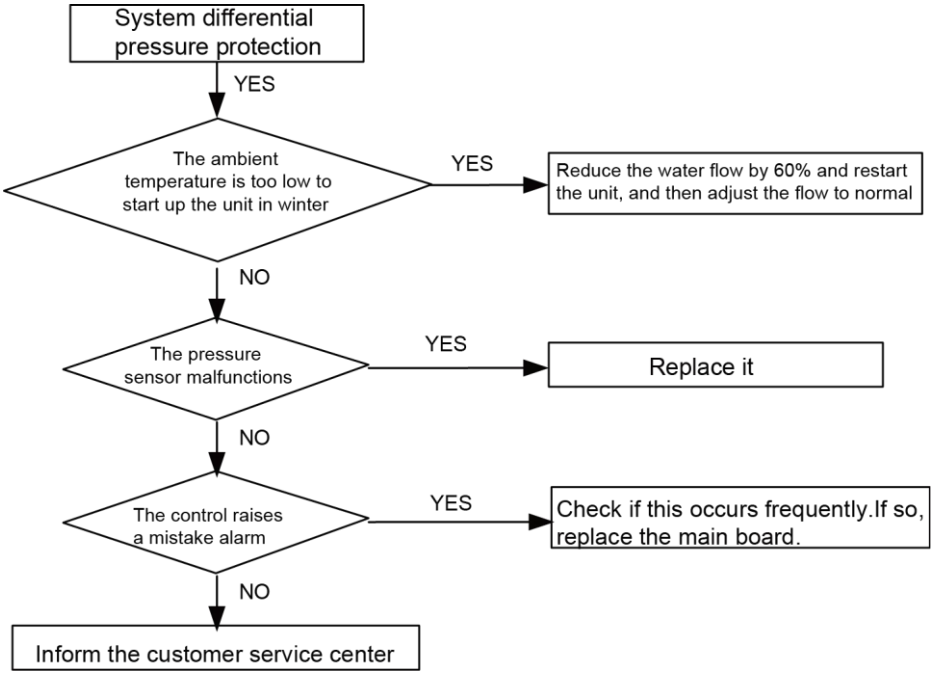
(2) Low pressure protection



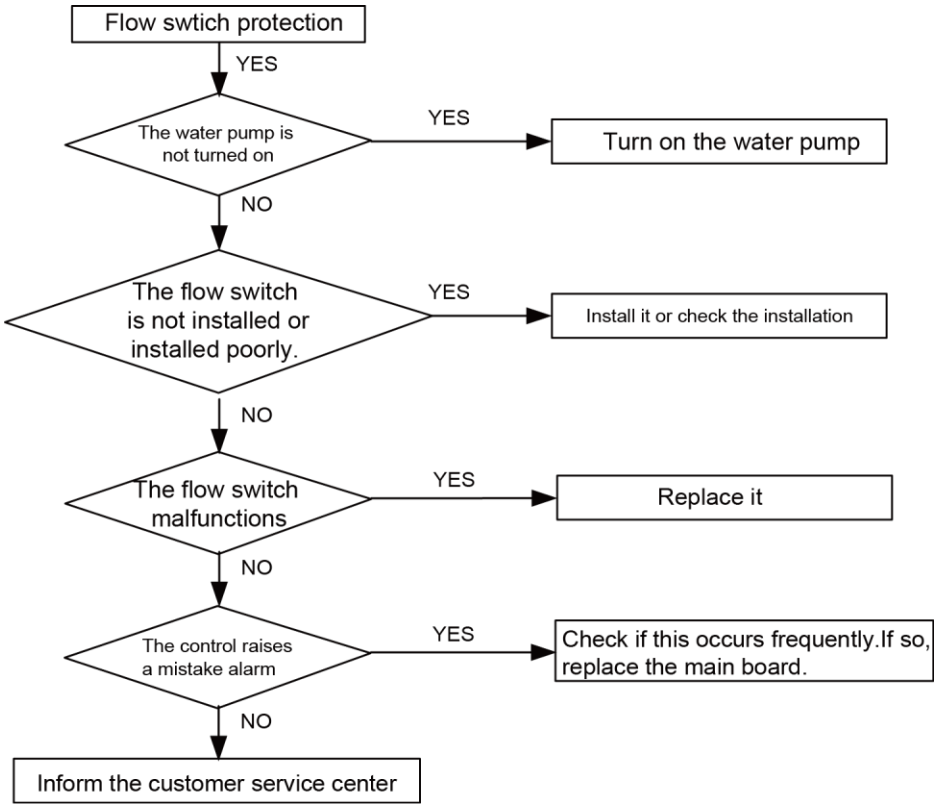
(3) High discharge protection



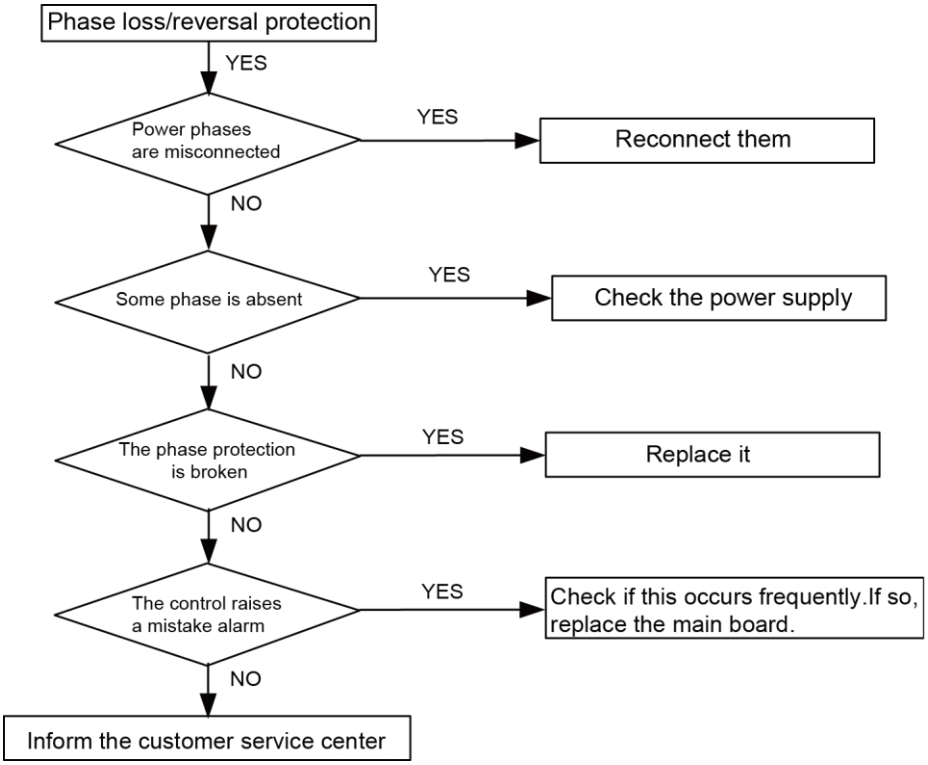
(4) Differential pressure protection



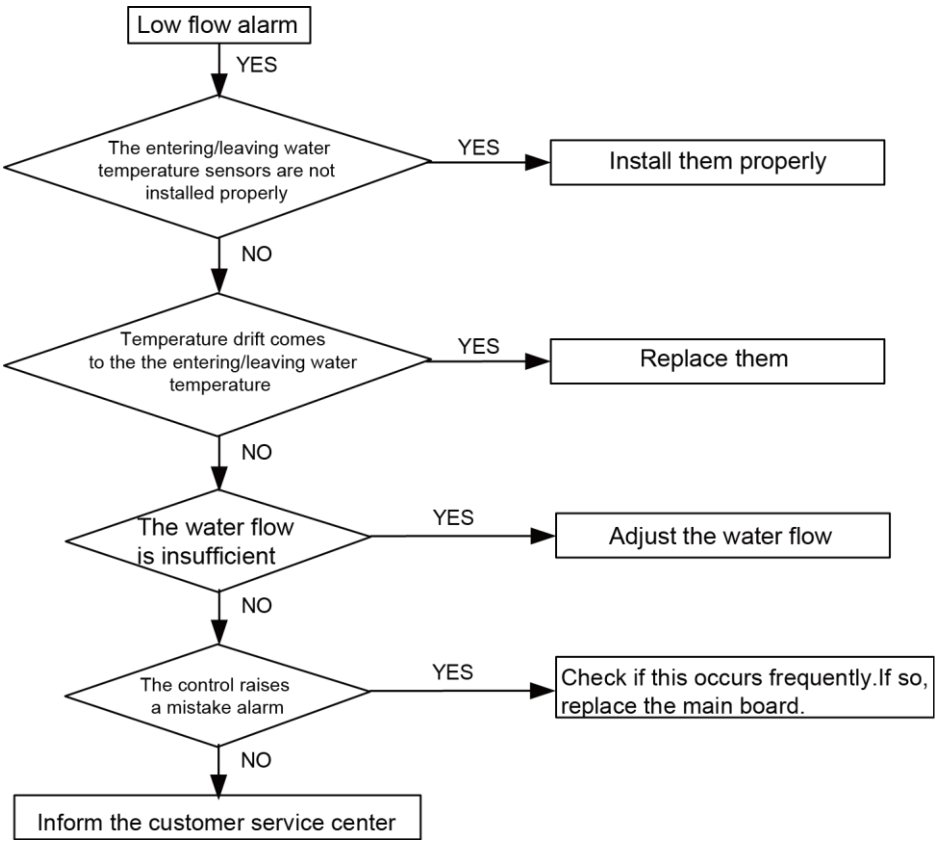
(5) Flow switch protection



(6) Phase loss/reversal protection

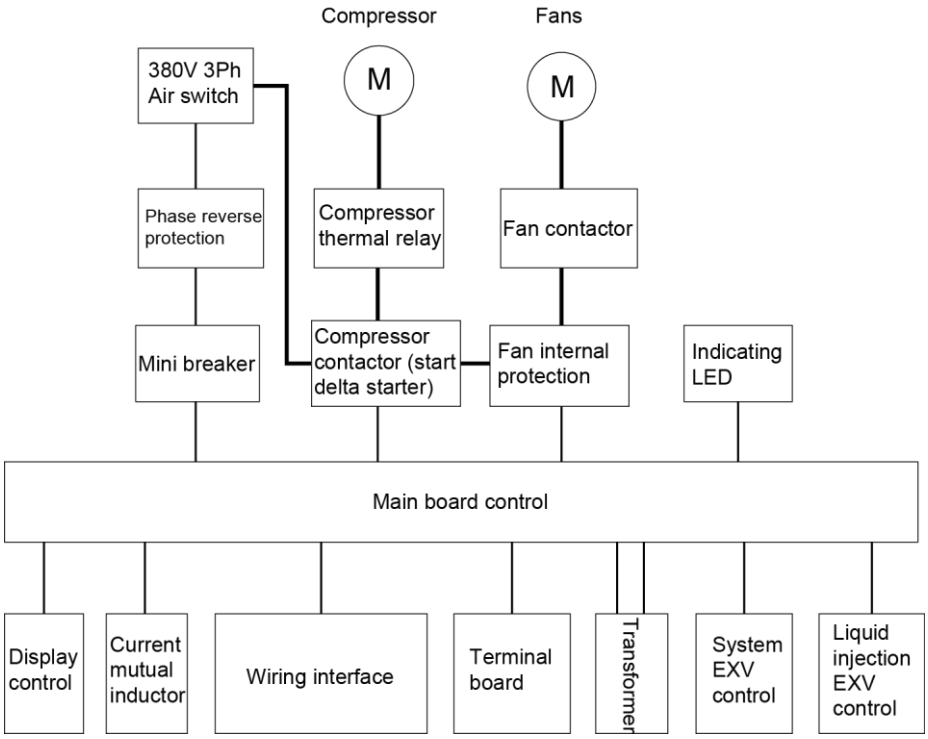


(7) Low flow alarm



3. Power Distribution

3.1 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 can not 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 can not 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.

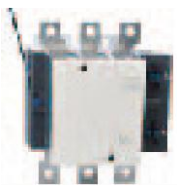
- Motor Protection

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.

3.2 Key Element Parts

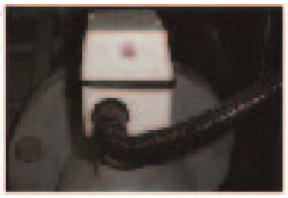
Name	**Picture**	Functional Description
Thermal Relay		It acts by measuring the current which passes through the load. When the measured current is larger than the limit of the relay, its N.O contact will be closed and its N.C contact will be opened.
AC Contactor		Coils of the contactor pick up when 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.

4. Disassembly and Assembly

4.1 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.

4.2 Disassembly and Assembly

4.2.1 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.

4.2.2 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.

4.2.3 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.

4.2.4 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.

4.2.5 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.

4.2.6 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.

5. 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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