GREE
Change for life

Service Manual

Commercial Air Conditioners

D series air cooled scroll chiller

T1/ R410A /60Hz

(GC201608-A)

Contens

Ⅰ Engineering Data

1. Product

1.1 Product Lineup

Series	Product	Product Code	Cooling Capacity (kW/Ton)	Heating Capacity (kW/Ton)	Power	Refrigerant	Pictures
D	LSQWRF65M/NaD-F	EL01500630	60/17.06	65/18.48	208-230V 3~ 60HZ	R410A	
	LSQWRF80M/NaD-F	EL01500560	75/21.33	85/24.17			
	LSQWRF130M/NaD-F	EL01500550	120/34.12	135/38.39			
	LSQWRF160M/NaD-F	EL01500610	145/41.23	170/48.34			

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

1.2 Nomenclature

LS	QW	R	F	130	M	/	Na	D	-	F
1	2	3	4	5	6		7	8		9

NO.	Items	Options
1	Product type	LS- chillers
2	Compressor type	QW- hermetic scroll compressors
3	Function type	Default-cooling only R-heat pump
4	Condenser type	F: air-cooled
5	Nominal cooling capacity	65:60kW=17.06RT 80:75kW=21.33RT 130:120kW=34.12RT 160:145kW=41.23RT

6	Structural design	M—Modular
7	Refrigerant	Default—R22 Na—R410A
8	Design Code	—
9	Power	M–380-415V 3N 50Hz F–208-230V 3~ 60Hz

1.3 Features

1.3.1 General

D series modular air-cooled scroll chillers are well-developed products incorporated with multiple advanced technologies. It features the low noise level, compact structure, easy operation, reliable running, and convenient installation and service, widely used at newly built or retrofitted industrial and civil buildings in various sizes, such as, hotels, apartments, restaurants, office buildings, shopping malls, theaters, gyms, workshops, hospitals and other places where there are high requirements on noise level and air quality and it is troublesome to install the cooling tower.

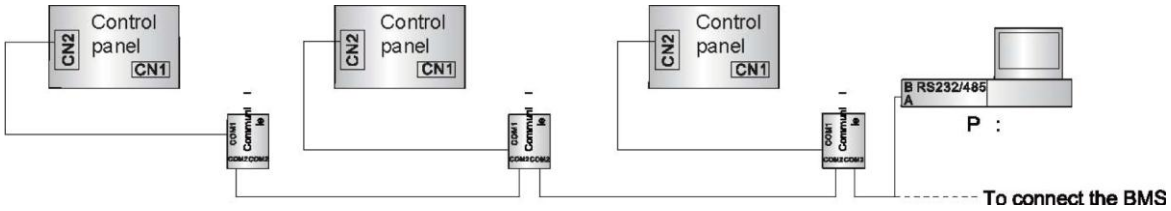
D series modular air-cooled scroll chillers are constructed of one or up to 16 single units which may vary in structure and in cooling capacity. The 65 and 80 units have two independent refrigeration cycles and the 130 and 160 units have four. The modular design is able to realize the modular system with the cooling capacity ranging from 60 to 1160kW.

1.3.2 Features

D series modular air-cooled scroll chillers work outstandingly by virtue of their major features stated below.

- **High energy efficiency:** it is initially certified as one of the energy-saving chiller products in China.
- **Free master unit design:** any single unit can operate as the master once connected with the control panel. It overcomes the problem which would occur to the product of other manufacturer that the whole system would fail to work properly when the fixed master unit malfunctions.
- **Excellent compatibility:** each chiller is constructed of up to 16 single 65/80 units or up to 8 single 130/160 units.
- **Hermetic scroll compressor:** 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.
- **High reliability:** it is constructed of well-designed refrigeration parts for multiple refrigeration cycles, adequately guaranteeing the reliable operation.
- **Compact structure:** the modular design enables the compact structure, reduced volume, light weight, easy handling and shipping and flexible installation.
- **Low noise:** the unit runs with low noise and vibration, widely applicable for various projects.
- **Quiet mode:** the unit is allowed to run in the quiet mode based on the user's requirement, which can not only save energy but also create a comfortable and pleasant living environment.
- **Economy mode:** the unit can run in the economy mode without lessening the air conditioning effect so as to cut down the electricity consumption.
- **Equilibrium running:** it indicates each compressor will run alternately so as to extend their service life.

- **User-friendly design:** when the running temperature is out of the allowed range, a friendly warning will come out on the display.
- **Powerful remote monitoring:** with RS485 communication, the universal BACnet protocol as well as standard BACnet interfaces, Gree centralized air conditioning system can be perfectly integrated to the BMS or Gree remote monitoring system.



Wiring Diagram of Groups of Communication Modules

- **Intelligent Start/Stop of the Compressor:** according to the load change of the terminals, the D series modular units are able to start/stop the compressor by controlling the entering water temperature and rate of the water temperature rise so as to make the operating capability perfectly match with the required load. However, it won't allow frequent start or stop but save as much energy as possible and ensure there is no remarkable fluctuation of the water temperature.

1.4 Product Data

1.4.1 Normal Working Conditions

Models		Heat Pump	LSQWRF65M/NaD-F	LSQWRF80M/NaD-F	LSQWRF130M/NaD-F	LSQWRF160M/NaD-F
		Product Code	EL01500630	EL01500560	EL01500550	EL01500610
Capacity step		%	0-50-100	0-50-100	0-25-50-100	0-25-50-100
Capacity	Cooling	kW	60	75	120	145
		Ton	17.06	21.33	34.12	41.23
	Heating	kW	65	85	135	170
		Ton	18.48	21.17	38.39	48.34
Power Input	Cooling	kW	21.5	27.6	43	53.5
	Heating	kW	22.5	28	45	56
EER		W/W	2.79	2.72	2.79	2.71
COP		W/W	2.89	3.04	3.00	3.04
Power Supply		—	208-230V 3~ 60Hz			
Running Control		—	Microcomputer Auto Control; Running Status Display; Abnormal Status Alarm			
Safeties			High-low pressure protection, discharge temp. protection, motor overload protection, anti-freeze, water flow protection, phase-sequence protection,compressor overload protection			
Compressor	Type	—	Constant Speed Scroll			
	Starting mode	—	Direct starting			
	Quantity	—	2	2	4	4
Refrigerant Type		—	R410A			
Water	Type		Dry Expansion Evaporator			

side heat exchanger	Water flow volume	m^3/h	10.3	12.9	20.6	24.9
		GPM	45.0	57.0	91.0	110.0
	Pressure Drop	kPa	15	15	30	35
		ft.WG	4.92	4.92	9.84	11.48
	Max. working Pressure	MPa	1			
	water in/outlet pipe flange specification	mm	DN65	DN65	DN80	DN80
Air side heat exchanger	Type	—	Aluminum Fin-copper Tube			
	Fan type/ Number of fans	—	Axial Fan/2	Axial Fan/2	Axial Fan/4	Axial Fan/4
	Total fan air flow	m^3/h	2.76×10^4	3.0×10^4	5.52×10^4	6.0×10^4
		L/s	0.75×10^4	0.83×10^4	1.53×10^4	1.67×10^4
		CFM	1.624×10^4	1.764×10^4	3.248×10^4	3.528×10^4
	Total fan motor power	kW	0.65×2	0.75×2	0.65×4	0.75×4
Sound pressure level		dB(A)	70	71	72	74
Outline Dimension	Width	mm	2040	2040	2278	2278
	Depth	mm	1000	1000	1830	1830
	Height	mm	2230	2230	2278	2278
Net Weights		kg	720	770	1370	1580
Operating weight		kg	725	847	1507	1585
Auxiliary electric heater-power(Ref.)		kW	15	15	30	30
Loading quantity	40'GP/40' HQ	—	11/11	11/11	6/6	6/6

Notes:

a. It is designed, manufactured and tested strictly in accordance with GB/T18430.1-2007.

b. See the nameplate for exact product parameters.

c. Height of the outline dimensions includes the height of the rubber pad which is about 70mm.

d. Please contact the local sales representatives for special sales orders. We are targeted to serve all your requirements.

1.4.2 Normal Working Temperature

Item	Water Side		Air Side		
	Water Flow Rate $m^3/(h \cdot kW)$	Leaving Water Temp (℃)	DB (℃)		WB (℃)
Cooling	0.172	7	35		—
Heating		45	7		6

1.4.3 Working Temperature Range

Item	Water Side		Air Side
	Leaving Water Temp (℃)	Leaving and Entering Water Temperature Difference (℃)	DB Temp (℃)
Cooling	5～15	2.5～6	15～45
Heating	40～50	2.5～6	-15～24

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

1.4.4 Electric Data

Model	Power Supply	Compressor			Fan		Air Switch
		Qty	MRC Each(A)	NRC Each（A）	Qty	NRC Each(A)	MRC (A)
LSQWRF65M/NaD-F	208~230V 3~ 60Hz	2	61	43.6	2	2.95	100
LSQWRF80M/NaD-F		2	69	49.3	2	3.41	160
LSQWRF130M/NaD-F		4	61	43.6	4	2.95	250
LSQWRF160M/NaD-F		4	69	49.3	4	3.41	250

Notes:

MRC: Max Running Ampere (A).

NRC: Nominal Running Ampere (A)

1.4.5 Performance Correction

Performance Correction Value					
Leaving Chilled Water (℃ / ℉)	Ambient Temperature (℃ / ℉)				
	25(77)	30(86)	35(95)	40(104)	45(113)
5(41.0)	1.07	1.00	0.94	0.84	0.81
6(42.8)	1.10	1.03	0.97	0.87	0.83
7(44.6)	1.14	1.07	1.00	0.91	0.86
8(46.4)	1.17	1.10	1.03	0.94	0.88
9(48.2)	1.20	1.13	1.06	0.98	0.91
10(50.0)	1.23	1.16	1.09	1.01	0.93

11(51.8)	1.27	1.19	1.12	1.04	0.96
12(53.6)	1.31	1.23	1.15	1.07	0.99
13(55.4)	1.34	1.26	1.17	1.09	1.01
14(57.2)	1.37	1.29	1.20	1.12	1.03
15(59.0)	1.41	1.32	1.23	1.14	1.06

Performance Correction Value						
Hot Water Outlet (℃ / ℉)	Ambient Temperature (℃ / ℉)					
	-10(14)	-5(23)	0(32)	5(41)	10(50)	15(59)
30(86)	0.70	0.77	0.86	0.96	1.07	1.21
35(95)	0.68	0.76	0.85	0.96	1.07	1.19
40(104)	0.67	0.75	0.85	0.95	1.06	1.18
45(113)	0.66	0.74	0.84	0.95	1.05	1.18
50(122)	0.64	0.74	0.84	0.94	1.05	1.17

1.4.6 Freeze Protection

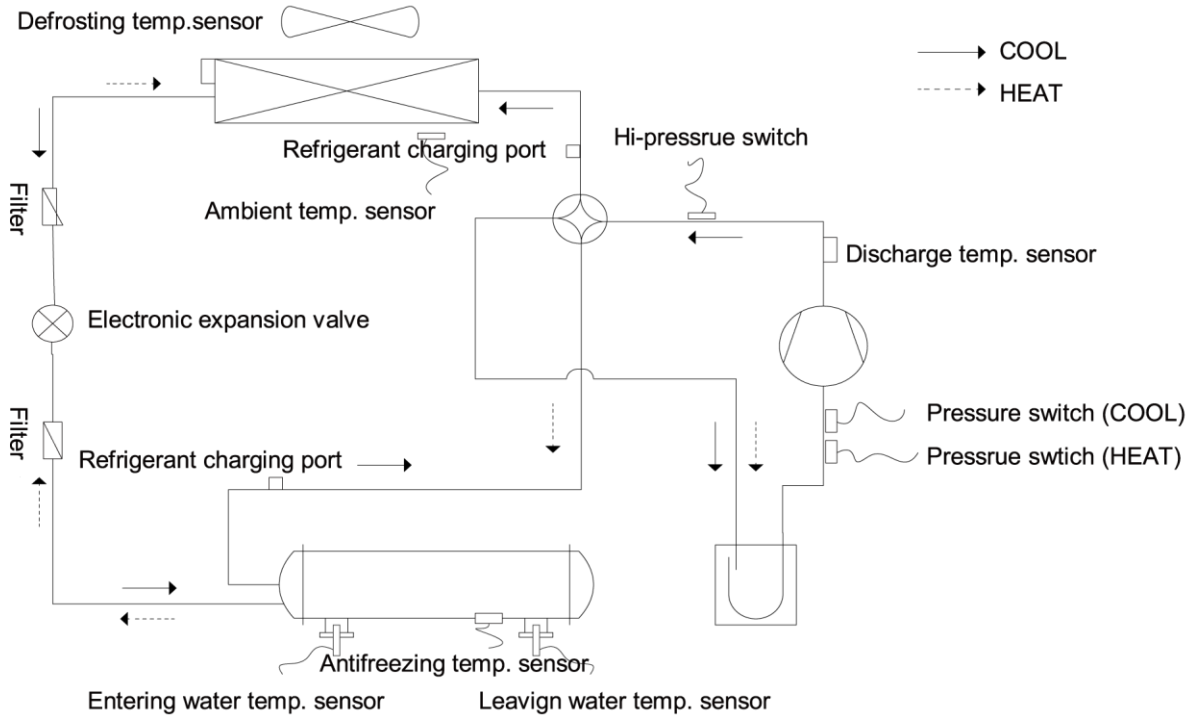
When the flow passage of the shell-and-tube heat exchanger is frozen up, it would cause serious damage to the heat exchanger, such as cracking and leakage which are out of warranty, therefore, the user should take measures stated below for freeze protection.

- Under subzero conditions, it is necessary to shut down the chiller installed outdoor and then drain the evaporator completely.
- Failure of the chilled water flow switch and the anti-freezing temperature sensor will cause the tube frozen up, so the flow switch shall be interlocked with the chiller.
- When discharging or recovering the refrigerant, the evaporator would crack because of frost bite provided the refrigerant pressure inside the evaporator is under 0.7MPa. Therefore, be sure to keep the water flow continually inside the evaporator or drain it completely.

1.5 Working Principles

1.5.1 Schematic Diagram

Each circuit of the modular chiller is independent and identical. Therefore the schematic diagram of only a circuit is taken for example herein.



1.5.2 Schematic Diagram

- **Refrigeration Cycle:** The low-pressure superheated refrigerant vapor from the evaporator is drawn into the compressor through which the low-pressure vapor is compressed to hi-temperature and hi-pressure refrigerant vapor. Then, the refrigerant vapor passes the condenser and turns to saturated or sub- cooled refrigerant liquid. And then, it passes the throttling device and flows into the evaporator where it evaporates by absorbing heat from the second refrigerant and then is drawn into the compressor again. The second refrigerant is then transferred to where air cooling is required continuously.
- **Reverse Refrigeration Cycle:** During the reverse refrigeration cycle, a 4-way valve is used to make the refrigerant flow in a reverse direction as stated below. The hi-temperature and hi-pressure refrigerant vapor coming out from the compressor directly releases heat to the secondary refrigerant and turns to the refrigeration liquid. Then, the refrigerant vapor passes the throttling device and flows into the air-cooled exchanger where it evaporates by absorbing heat from the surrounding environment and then is drawn into the compressor again. The second refrigerant which has approached the temperature set point is then transferred to where air heating is required continuously.

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

1.6.1.1 Definitions

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

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

Testing Distance: the vertical distance between surfaces of the reference body

1.6.1.2 Selection of the Testing Surface:

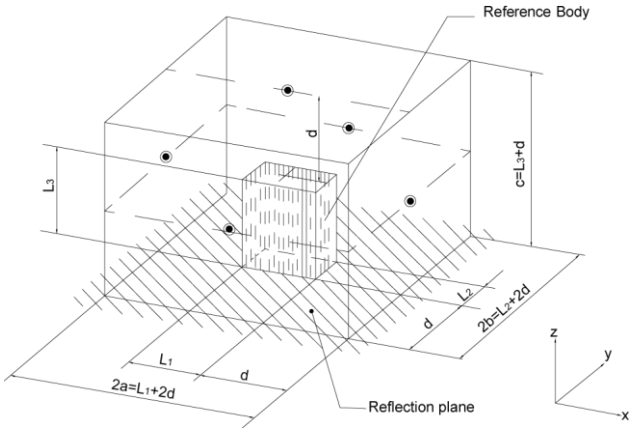
In order to determine the location of the microphone on the testing surface, it is necessary to assume a reference body, regardless of the important noise energy which emanates from the sound source but does not radiate. The reference testing distance is 1m and should be 0.15m at least. Other options include: 0.25m, 0.5m, 0.5m, 1m, 2m, 4m and 8m.

1.6.1.3 Testing Surface and Location of Microphones of the Parallelepiped

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.

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

Where L_1, L_2 and L_3 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

1.6.2.1 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.

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

$\overline{L}_{PA}$—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 L_{PAi} 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.

Where:

1.6.2.2 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

—Average A-weighted background noise pressure pressured at the testing surface located at the microphone no.i.,dB.

N—number of microphones

1.6.2.3 Correction of Background Noise

The corrected value K_{1A} 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 $>\Delta L_A$10dB, the corrected value is not needed.

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

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

Note: the above principles don't apply when ΔL_A<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".

1.6.2.4 Correction of the Test Environment

The correction factor K_{2A} 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.

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

Where:

A: equivalent sound absorption area of the 1KHz test room, m^2.

S: testing surface area, m^2.

$$A=a.S_V$$

Where:

a—average A-weighted sound absoprtion coefficient

S_V—total area of the test room boundaries (wall, ceiling ,floor), m^2

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:

$$L_P = L_w - 20\text{Log}r + 10\text{Log}Q - 11$$

Where:

L_P=sound pressure

L_W=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:

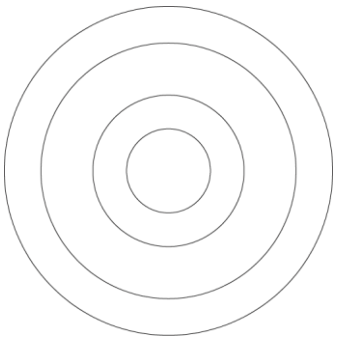
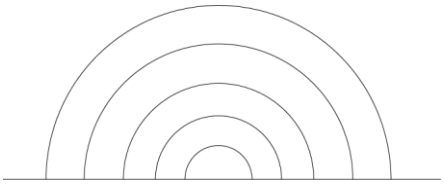
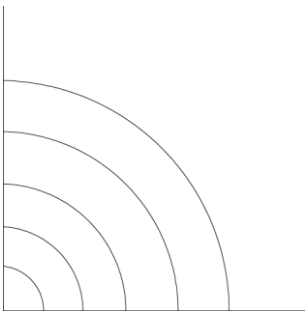
$$L_P = L_W - 20\text{log}r - 1$$

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:

$$LP = LW - 20\text{log}r - 8$$

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:

$$L_P = L_W - 20\text{log}r - 5$$

		
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.

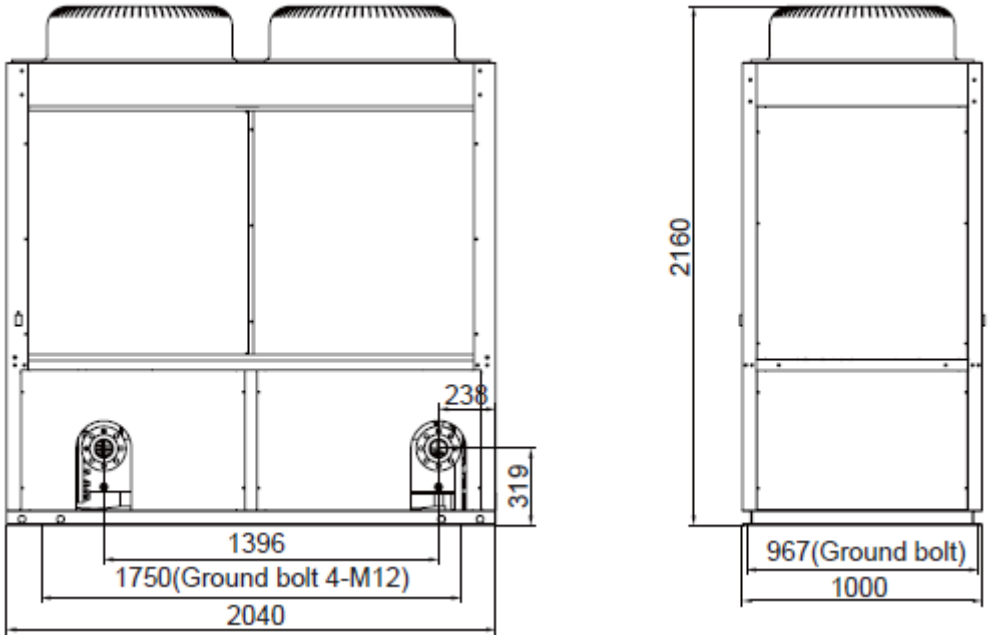
	DB Reduction from Sound Power at the Source to Sound Pressure at Referenced Distance	
	Q=2	Q=4
5	22.0	19.0
10	28.0	25.0

15	31.5	28.5
20	34.0	31.0
25	35.9	32.9

2. Outline Dimensions

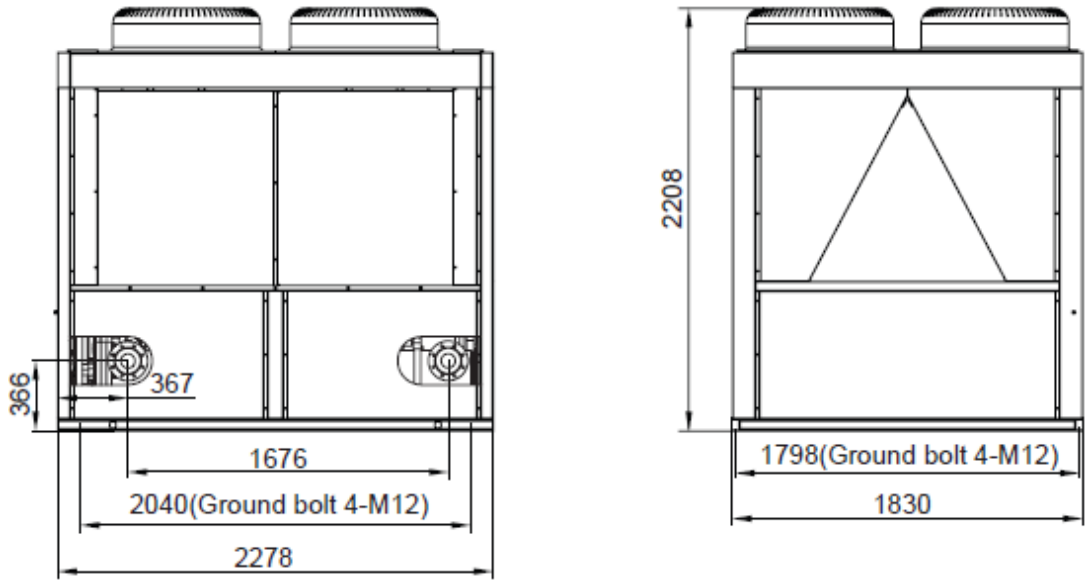
（1）Graph for the shape and size for LSQWRF65M/NaD-F，LSQWRF80M/NaD-F

Unit:mm



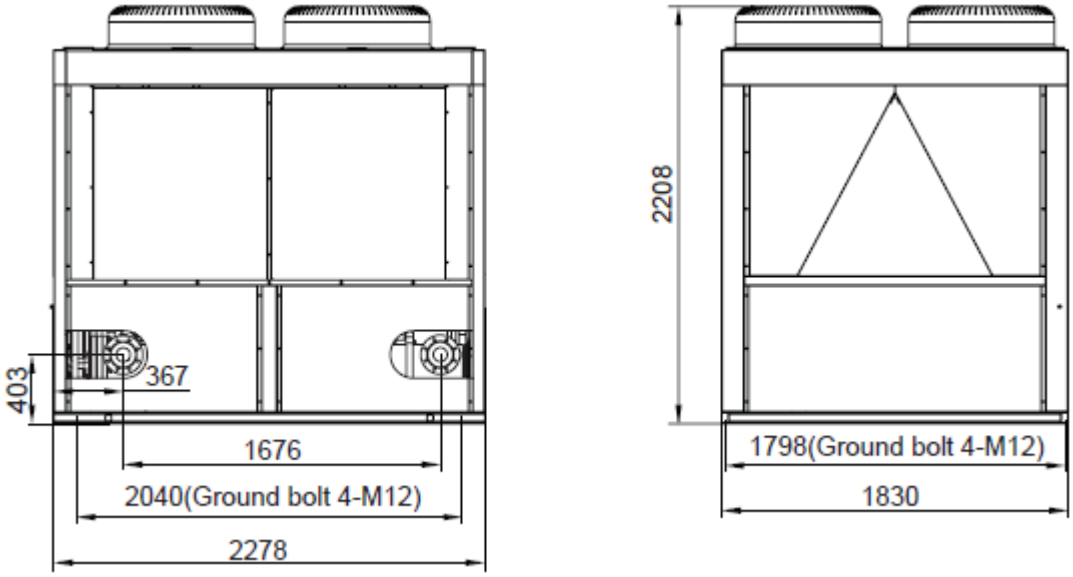
（2）Graph for the shape and size for LSQWRF130M/NaD-F

Unit:mm



（3）Graph for the shape and size for LSQWRF160M/NaD-F

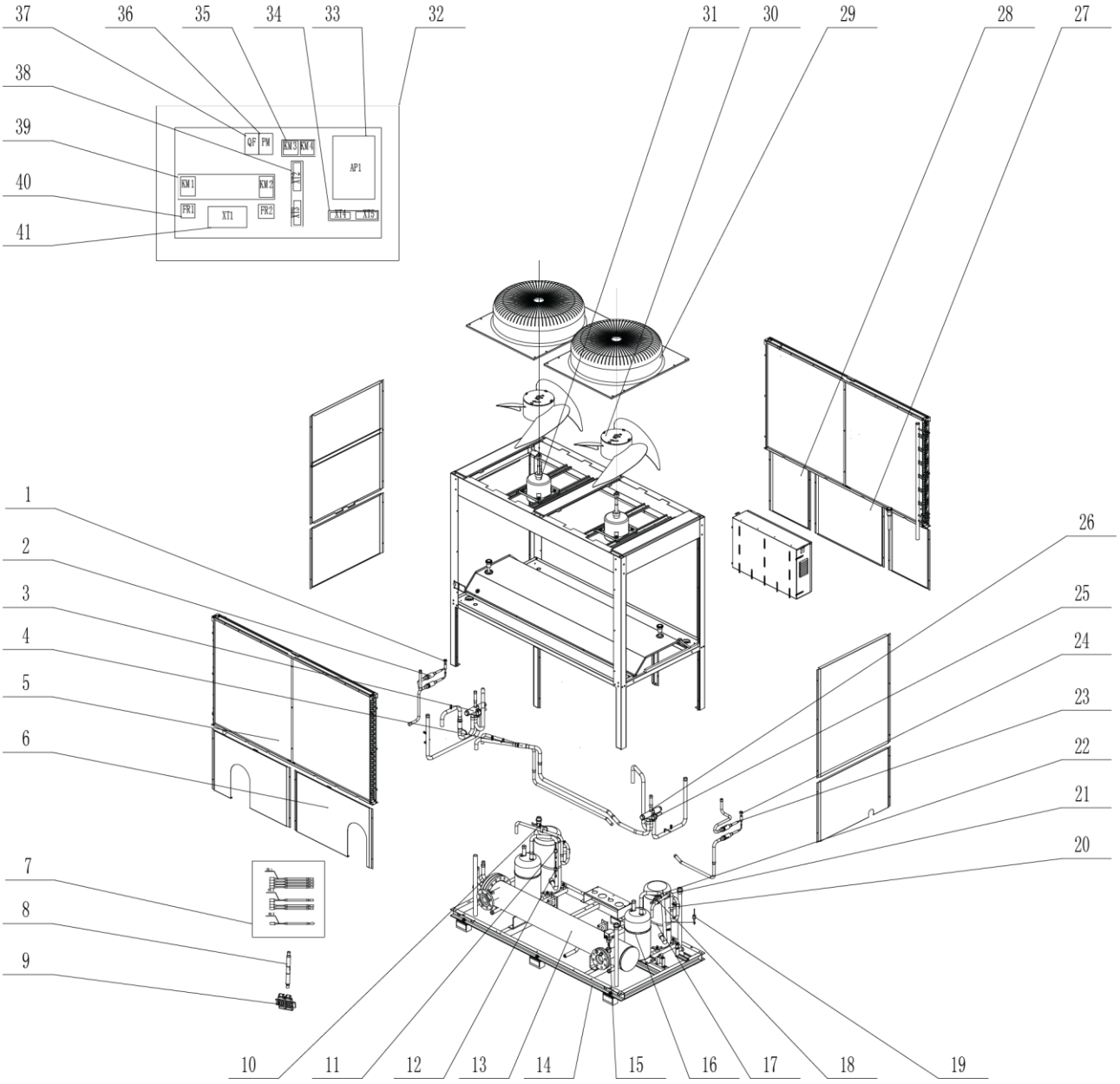
Unit:mm



Note: Height of the outline dimensions includes the height of the rubber pad which is about 70mm.

3. Explosive Views and Parts List

(1) Model: LSQWRF65M/NaD-F

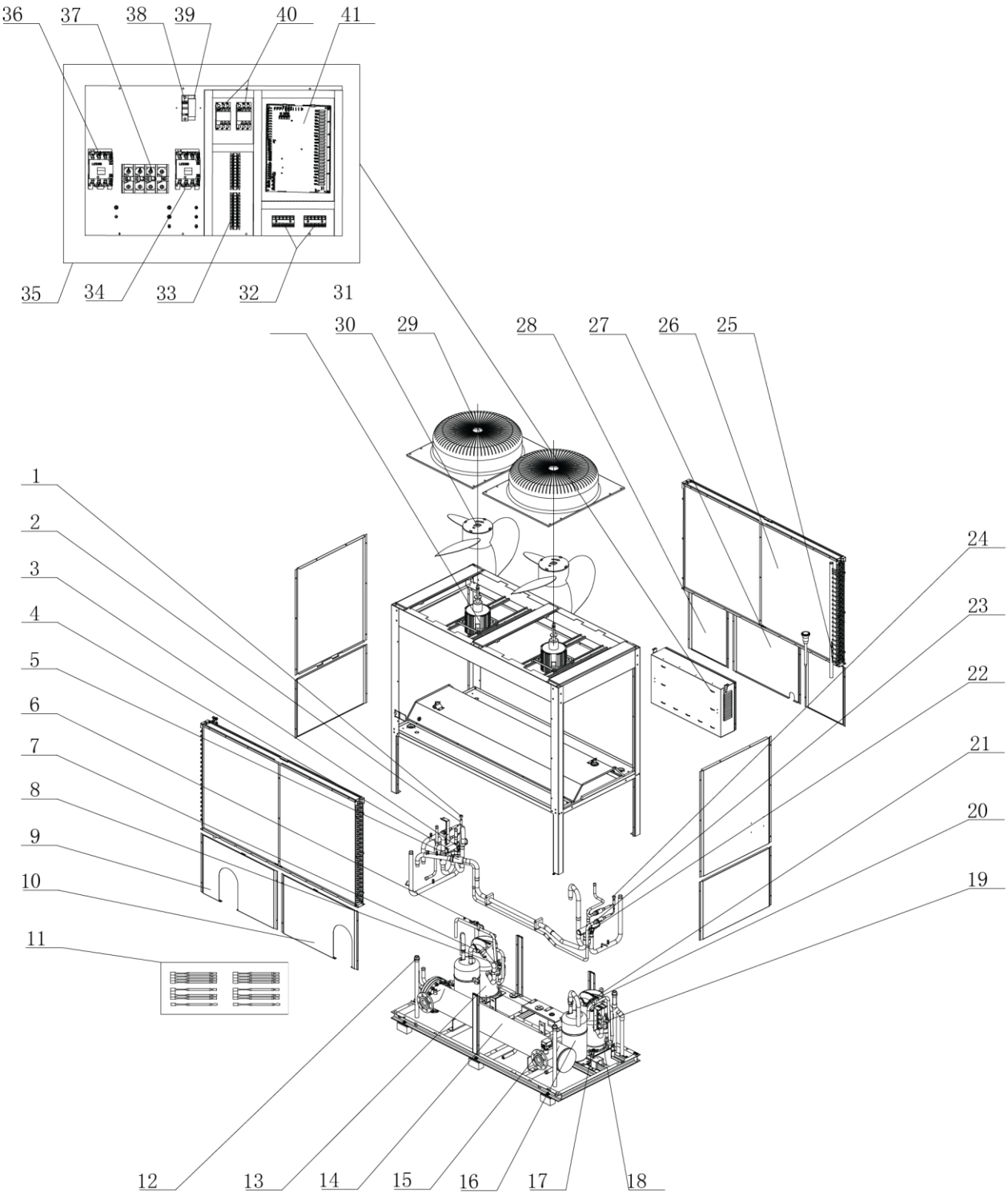


Parts List: LSQWRF65M/NaD-F for EL01500630

No.	Name of part	Part code
1	Electric Expand Valve Fitting	4304413214
2	Strainer	07210037
3	Magnet Coil	4300040064
4	Filter	07218603
5	Condenser Assy	0112110001001
6	Rear Panel	01541100001P
7	Sensor Sub-assy	39008000004G
8	One Way Valve	0733420001
9	Sensor Support	26905202

10	Pressure Protect Switch	4602001570
11	Pressure Protect Switch	4602001579
12	Pressure Protect Switch	4602001582
13	Dry Evaporator	0105887701
14	Base Frame Assy	01281100012P
15	Steam current Switch	45028205
16	Gas-liquid Separator	07424148
17	Electrical Heater	76515211
18	Pressure Protect Switch	4602001569
19	Pressure Protect Switch	4602001581
20	Compressor and Fittings	00201100008
21	Pressure Protect Switch	4602001583
22	Compressor Gasket	02118049
23	Electronic Expansion Valve	07331139
24	Electric Expand Valve Fitting	4304413213
25	Magnet Coil	4300040048
26	4-Way Valve	43041100041
27	Front Panel 2	01541100003P
28	Front Panel 1	01541100002P
29	Streamlined Dome	22265801
30	Centrifugal Fan	10355801
31	Fan Motor	15701100004
32	Electric Cabinet Assy	01391100124
33	Terminal Board	42018452
34	Main Board	30222000002
35	AC Contactor	44010232
36	Phase Reverse Protector	32214101
37	Single-phase Air Switch	45020203
38	Terminal Board	42011135
39	AC Contactor	44010239
40	Thermal Overload Relay	44020383
41	Terminal Board	42010247

(2) Explosive View of LSQWRF80M/NaD-F

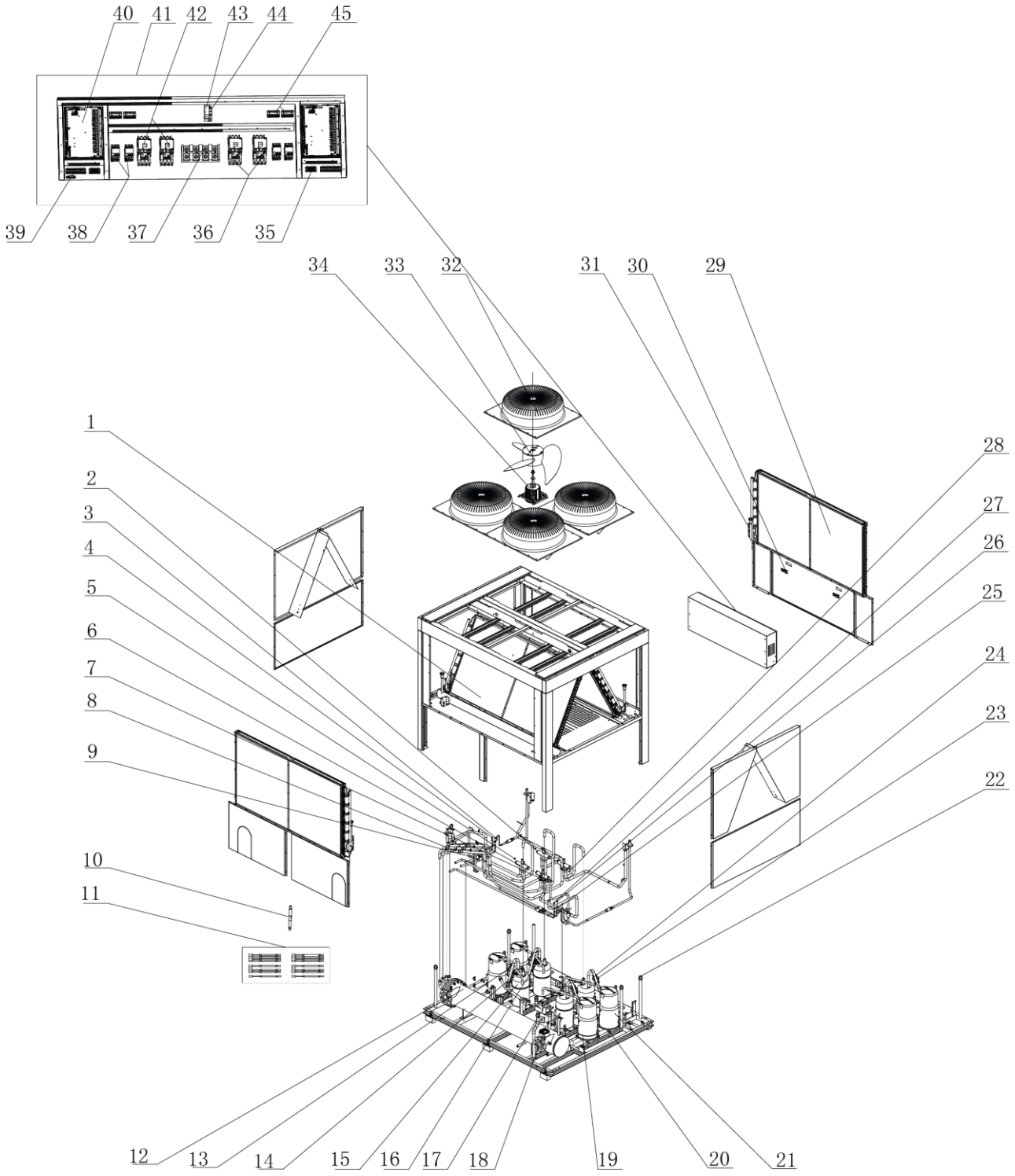


Parts List: LSQWRF80M/NaD-F for EL01500560

No.	Name of part	Part code	Quantity
1	Electric Expand Valve Fitting	4304413213	1
2	Electronic Expansion Valve	07331139	2
3	Magnet Coil	4300040064	1
4	4-way Valve	43000412	2
5	Filter	07414118	2
6	Pressure Protect Switch	4602001570	1

7	Pressure Protect Switch	4602001582	1
8	Pressure Protect Switch	4602001579	1
9	Rear Panel	0154110000101P	1
10	Rear Panel	01541100001P	1
11	Sensor Sub-assy	39008000004G	1
12	pipe connector	06128301	2
13	Compressor and fittings	00201126	2
14	Dry Evaporator	01058800057	1
15	Steam current Switch	45028205	1
16	Gas-liquid Separator	07424148	1
17	Compressor Gasket	/	/
18	Electrical Heater	76515211	4
19	Pressure Protect Switch	4602001581	1
20	Pressure Protect Switch	4602001583	1
21	Pressure Protect Switch	4602001569	1
22	Magnet Coil	4300040048	6
23	Strainer	07210037	4
24	Electric Expand Valve Fitting	4304413214	1
25	One Way Valve	0733420001	1
26	Condenser Assy	0112110002001	2
27	Front Panel	01541100003P	1
28	Front Panel	01541100002P	2
29	Streamlined Dome	22265801	2
30	Centrifugal Fan	10355801	2
31	Fan Motor	15701100005	2
32	Terminal Board	42018452	2
33	Terminal Board	42011135	2
34	Thermal Overload Relay	44020383	2
35	Electric Cabinet Assy	01391100078	1
36	AC Contactor	44010232	2
37	Terminal Board	42010247	1
38	Single-phase Air Switch	45020203	1
39	Phase Reverse Protector	32214101	1
40	AC Contactor	44010239	2
41	Main Board	30222000002	1

(3) Explosive View of LSQWRF130M/NaD-F

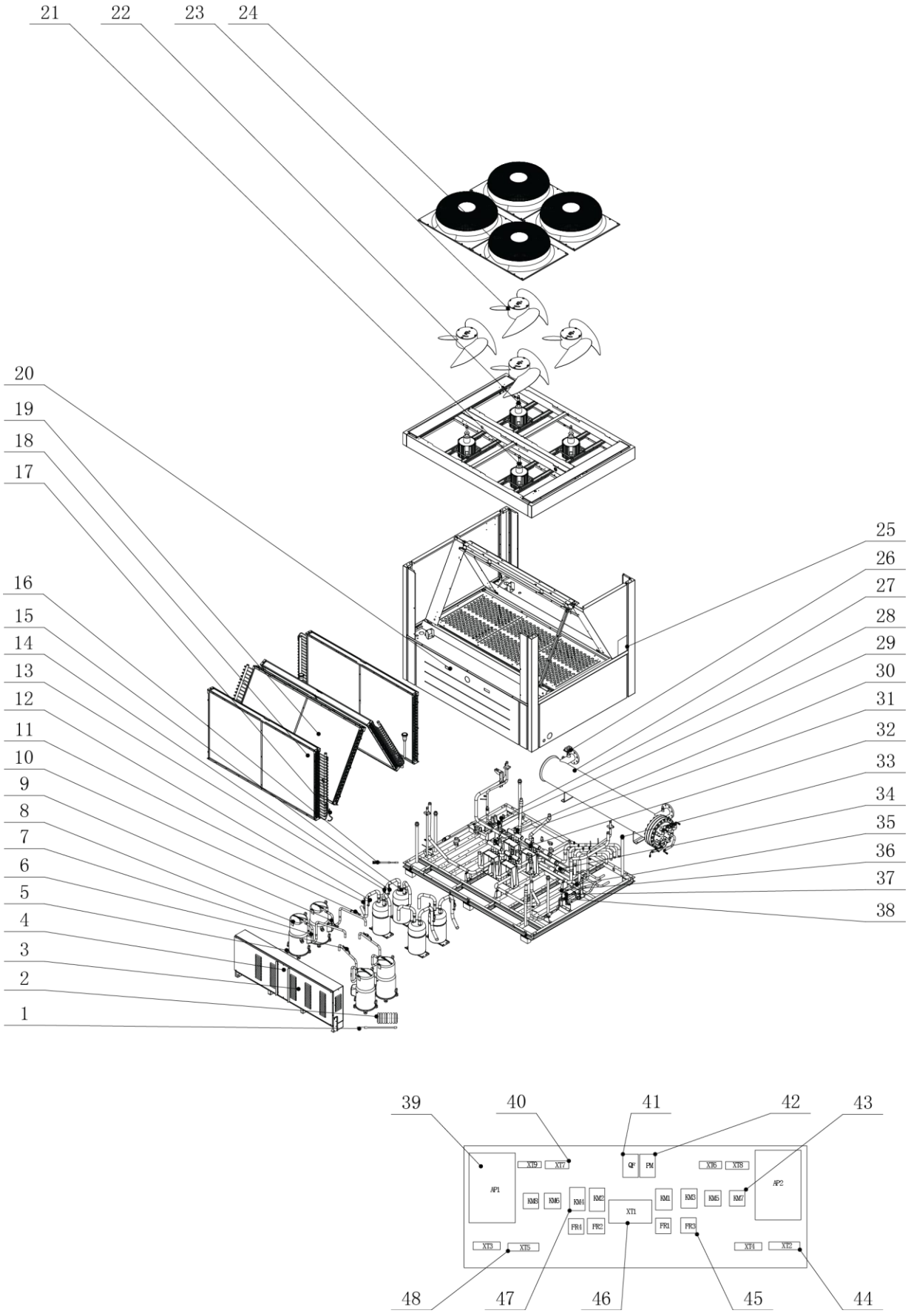


Parts List: LSQWRF130M/NaD-F for EL01500550

No.	Name of part	Part code	Quantity
1	Condenser Assy	01121100028	2
2	Magnet Coil	4300040048	1
3	Electric Expand Valve Fitting	4304413232	1
4	Electric Expand Valve Fitting	4304413214	1
5	Magnet Coil	4300040063	1
6	4-Way Valve	43041100041	4
7	Magnet Coil	4300040075	1

8	Filter	07218603	4
9	Strainer	07210037	8
10	One way Valve	0733420001	2
11	Sensor Sub-assy	39008000089G	1
12	Dry Evaporator	01058800013	1
13	Pressure Protect Switch	4602001583	1
14	Pressure Protect Switch	4602001581	1
15	Gas-liquid Separator	07424148	4
16	Pressure Protect Switch	4602001589	2
17	Pressure Protect Switch	4602001569	2
18	Steam current Switch	45028205	1
19	Electrical Heater	76515211	8
20	Compressor Gasket	/	/
21	Compressor and fittings	00201100008	4
22	pipe connector	06128301	2
23	Pressure Protect Switch	4602001590	1
24	Pressure Protect Switch	4602001591	1
25	Electronic Expansion Valve	4304413232	1
26	Electric Expand Valve Fitting	4304413213	1
27	Electric Expand Valve Fitting	4304413231	1
28	Magnet Coil	4300040049	1
29	Condenser Assy	01121100029	2
30	Handle	26235253	2
31	One way Valve	0733420001	2
32	Streamlined Dome	22265801	4
33	Centrifugal Fan	10355801	4
34	Fan Motor	15701100004	4
35	Terminal Board	42010254	2
36	Thermal Overload Relay	44020383	4
37	Terminal Board	42010006	1
38	AC Contactor	44010232	4
39	Terminal Board	42011135	2
40	Main Board	30222000002	2
41	Electric Cabinet Assy	01391100070	1
42	AC Contactor	44010239	4
43	Phase Reverse Protector	32214101	1
44	Single-phase Air Switch	45020203	1
45	Terminal Board	42018452	4

(4) Model: LSQWRF160M/NaD-F



Parts List: LSQWRF160M/NaD-F for EL01500610

No.	Name of part	Part code
1	Electrical Heater	76515211
2	Ripple Pipe	26906016
3	Electric Cabinet Assy	01391100121
4	Scram switch	45010024
5	Compressor Gasket	76815200004
6	Pressure Protect Switch	4602001589
7	Temp Sensor Sleeving	05210001
8	Compressor and Fittings	00201126
9	Temp Sensor Sleeving	05212423
10	Pressure Protect Switch	4602001569
11	Pressure Protect Switch	4602001590
12	Pressure Protect Switch	4602001591
13	Pressure Protect Switch	4602001581
14	Pressure Protect Switch	4602001583
15	Gas-liquid Separator	07424148
16	Sensor Sub-assy	39008000089G
17	One Way Valve	0733420001
18	Condenser Assy 1	'0112110002601
19	Condenser Assy2	'0112110002501
20	Handle	26235253
21	Fan Motor	1570110000501
22	Fan Motor	15701100005
23	Centrifugal Fan	10355801
24	Streamlined Dome	22265801
25	Sensor Support	26905202
26	Steam current Switch	'45028205
27	Dry Evaporator	01058800064
28	Electric Expand Valve Fitting	4304413231
29	Electric Expand Valve Fitting	4304413213
30	Magnet Coil	4300040048
31	4-way Valve	43000412
32	Magnet Coil	4300040049
33	pipe connector	06128301
34	Strainer	07414118
35	Strainer	07210037
36	Electric Expand Valve Fitting	4304413232
37	Electronic Expansion Valve	07331139
38	Electric Expand Valve Fitting	4304413214
39	Main Board	30222000002
40	Terminal Board	42018452

41	Single-phase Air Switch	45020203
42	Phase Reverse Protector	32214101
43	Terminal Board	42011135
44	AC Contactor	44010232
45	Thermal Overload Relay	44020383
46	Terminal Board	42010006
47	AC Contactor	44010239
48	Terminal Board	42010254

II Design and Selection

1. Design and Selection Procedures

1.1 Estimated Cooling Load Look-up Tables

(1) Cooling Load per Unit Air Conditioning Area

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

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

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

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

(3) Estimated Cooling Load per Unit Building Area

Building Type	Cooling Load (W/m^2)	Cooling Load (W/m^2)
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:

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

(2) Take the lower limit when the total building area is less than 5000m^2 and take the upper limit when the total building area is large than 10000 m^2.

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

(4) 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 10500m^2 to be air conditioned, among which the big meeting rooms take up 500m^2, the small meeting rooms take up 1500m^2 and office rooms take up 8500m^2, and fresh air is required.

(1) Calculate the cooling load.

a) by the estimated cooling load

Big meeting rooms: 500×180 (W/m^2)=90000W=120kW

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

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

Total: 120kW+360kW+1290kW =1770kW

Capacity required for the air conditioner: 1770kW ×0.70=1239kW

b) by the builiing area

12000×98W=1176kW

c) 1239kW is conclude in accordance with the calculation values in a and b.

(2) Calculate the heating load in accordance with the heating load of the air conditioning unit.

12000×70=840000W=840kW

(3) Preselect the desired model and quantity

Look up the GREE Technical Guide Manual and it is concluded that 8 LSQWRF160M/D-M and 1 LSQWRF130M/D-M meet the design requirement (cooling load: 1283, heating load: 1460).

2. Selection of Power Lines and the Air Switch

Model	Power Supply	Min. sectional area of the power cable (mm^2)		Capability of the Air Switch(A)
		Live Line	Earth Line	
LSQWRF65M/NaD-F	208~230V 3~ 60Hz	25	16	100
LSQWRF80M/NaD-F		50	25	160
LSQWRF130M/NaD-F		120	70	250
LSQWRF160M/NaD-F		150	70	250

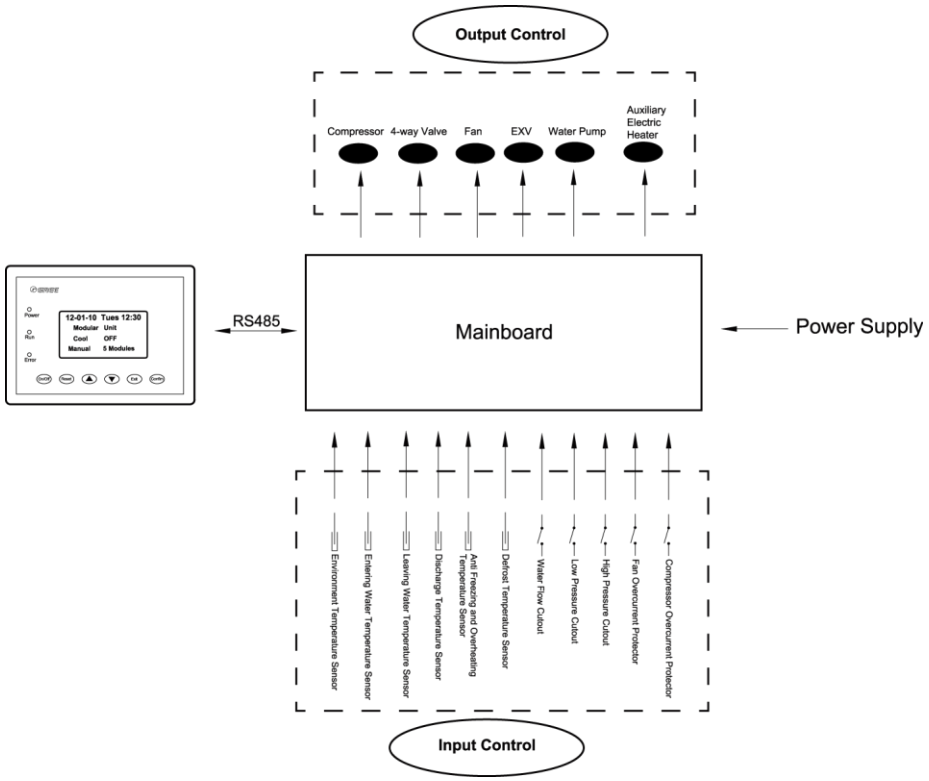
Notes:

a) The neutral line should be 4mm^2 at least.
b) The specifications of the power lines and the air switch in the table above are determined based on the maximum power supply (maximum amps) of the unit.
c) The specifications of the 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 IEC60364-5-523:1999). If the working condition changes, they should be modified according to the related national standard.
d) The specifications of the air switch listed in the table above are applied to the air switch with the working temperature at 40℃. If the working condition changes, they should be modified according to the related national standard.

Ⅲ Unit Control

1. General Control Logic

1.1 Schematic Diagram



（1）Water Flow Cutout: it is used to judge the water flow rate: when the flow rate is too low, it will trip off, and the control board will send this signal to the display and the water pump. Then, the display will tell there is an error, the water pump will stop and the unit will stop or will not start.

（2）High/Low Pressure Cutout: it is used to judge the system pressure: when the system pressure is too high/low, it will trip off, and the control board will send this signal to the display. Then, the display will tell there is an error and the unit will stop or will not start.

（3）Compressor Overcurrent Cutout: it is used to judge the running ampere of the compressor: when the current is too large, it will trip off and the control board will send this signal to the display. Then, the display will tell there is an error and the unit will stop or will not start.

（4）Fan Overcurrent Cutout: it is used to judge the running ampere of the fan: when the current is too large, it will trip off and the control board will send this signal to the display. Then, the display will tell there is an error and the unit will stop or will not start.

（5）Environment Temperature Sensor: it is used to detect the temperature of the environment where the unit is which will determine if to start or stop the fan and determine the steps of the electrostatic expansion valve when initializing. When this sensor fails, the control board will detect and send this signal to the display. Then, the display will tell there is an error and the unit will stop or will not start.

（6）Discharge Temperature Sensor: it is used to detect the discharge temperature. When the sensed temperature is too high or this sensor fails, the control board will detect and send this signal to

the display. Then, the display will tell there is an error and the unit will stop or will not start.

（7）Entering Water Temperature Sensor: it is used to detect the temperature of the entering water which will determine if to start or stop the compressor and the auxiliary electric heater. When this sensor fails, all compressors of the unit will stop.

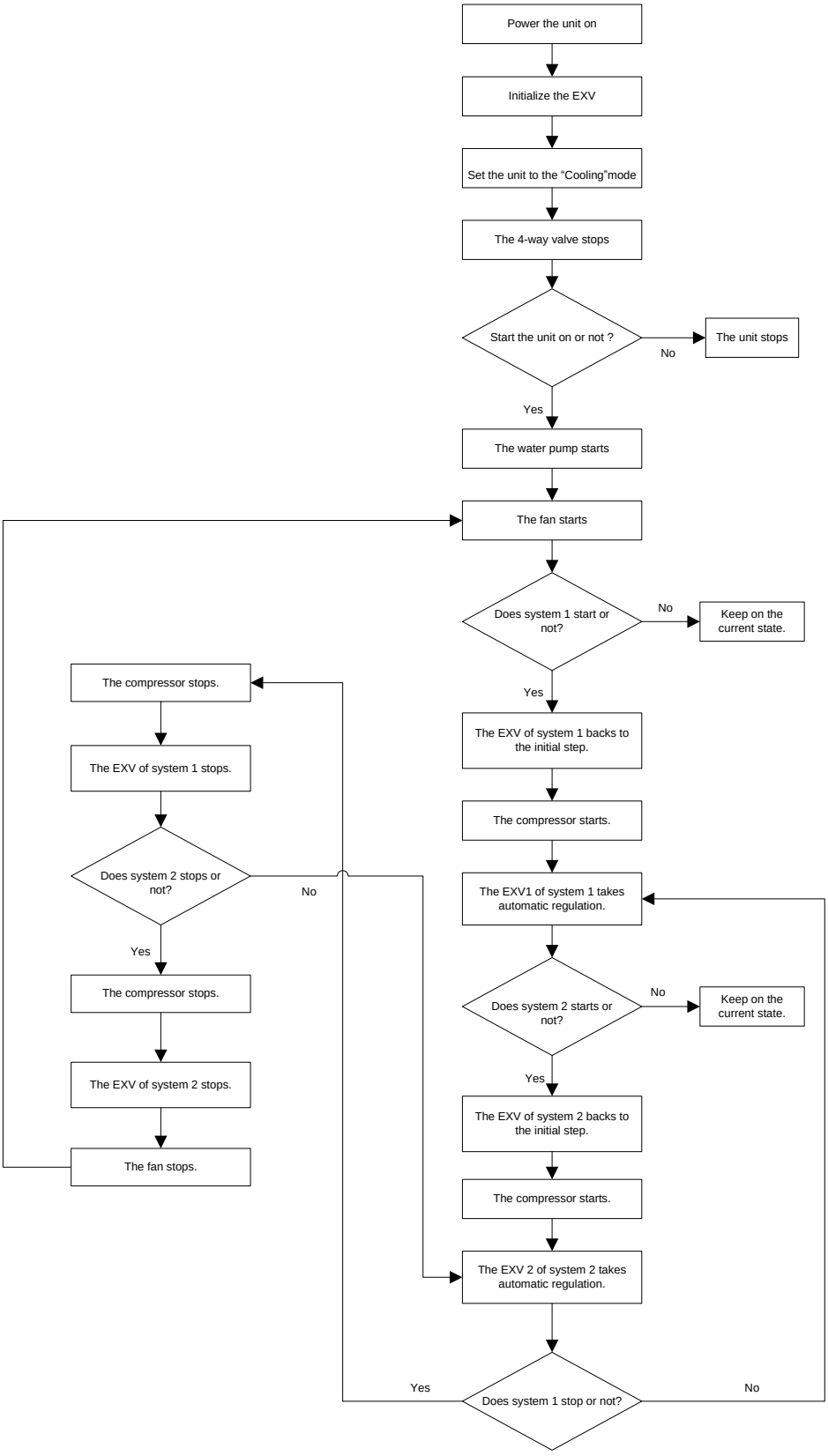
（8）Defrosting Temperature Sensor: it is used to detect the temperature of the fins of the evaporator which will determine if to start defrosting. When this sensor fails, the corresponding compressor will stop.

（9）Anti-freezing Temperature Sensor: it is used to detect the water temperature. When it fails, compressors of the unit will stop and 30 seconds later the fan also will stop.

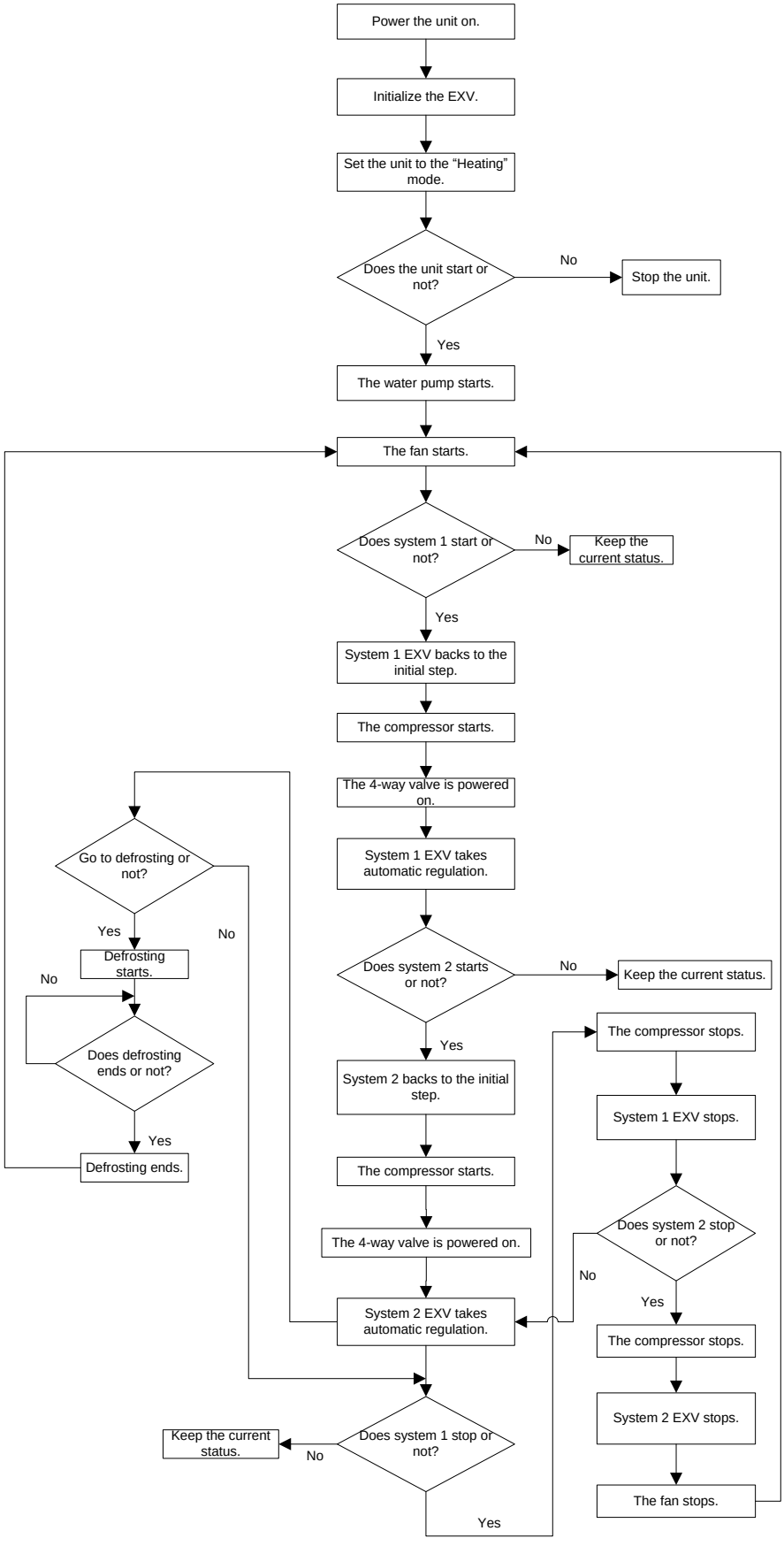
（10） Leaving Water Temperature Sensor: it is used to detect the leaving water temperature. When this sensor fails, compressors of the unit will stop and 30 seconds later the fan also will stop.

1.2 Operation Flowchart

1.2.1 Cooling



1.2.2 Heating


Power the unit on.
Initialize the EXV.
Set the unit to the “Heating” mode.
Does the unit start or not?
No
Stop the unit.
Yes
The water pump starts.
The fan starts.
Does system 1 start or not?
No
Keep the current status.
Yes
System 1 EXV backs to the initial step.
The compressor starts.
The 4-way valve is powered on.
System 1 EXV takes automatic regulation.
Go to defrosting or not?
Yes
No
Defrosting starts.
No
Does defrosting ends or not?
Yes
Defrosting ends.
Does system 2 starts or not?
No
Keep the current status.
Yes
System 2 backs to the initial step.
The compressor starts.
The 4-way valve is powered on.
System 2 EXV takes automatic regulation.
The compressor stops.
System 1 EXV stops.
Does system 2 stop or not?
No
Yes
The compressor stops.
System 2 EXV stops.
The fan stops.
Does system 1 stop or not?
Keep the current status.
No
Yes

2. Control Logic

2.1 Cooling Control

2.1.1 Control to the Compressor

（1）“First On, First Off”

“First On, First Off”/“First Off, First On” control indicates the numbered compressor which is started/stopped firstly will then be stopped/started firstly.

（2）Temperature Drop/Rise Rate Control

The water temperature range control assisted by the temperature drop/rise rate control is capable of precisely adapting the load change of the terminal units and avoiding remarkable water temperature fluctuation.

2.1.2 Freeze Protection

For each single module, when the anti-freezing temperature or the leaving water temperature is lower than the limit value, freeze protection will work and this module stops; when the anti-freezing temperature and the leaving water temperature go higher than the normal value, freeze protection will quit; when the anti-freezing temperature and the leaving water temperature are between the limit value and the normal value, the module is protected again freeze.

2.1.3 Shutdown

Shutdown manually or timely: in this case, the compressor and the auxiliary electric heater stop firstly, then the electronic expansion valve initializes, and then the 4-way valve is de-energized, and lastly the water pump stops.

Shutdown when reaching the set point: in this case, the compressor stops firstly, and then the fan stops and the electronic expansion valve initializes. However, the 4-way valve keeps its state unchanged and the water pump keeps running.

Shutdown due to errors: in this case, the compressor stops firstly, and then the fan stops (except that the fan is malfunctioning), and the electronic expansion valve initializes. However, the 4-way valve keeps its state unchanged and the water pump keeps running.

2.2 Heating Control

2.2.1 Control on the Compressor

It is the same as that in selection 2.1.1.

2.2.2 Over-temperature Protection

For each single module, when the over-temperature is higher than the limit value, over-temperature protection will work; when the over-temperature goes lower than the normal value, over-temperature protection will quit; when the over-temperature is between the limit value and the normal value, the module is still protected again over-temperature.

2.2.3 Control on the Auxiliary Electric Heater

When the auxiliary electric heater is enabled through the wired controller, it will work in accordance with the change of the entering water temperature.

When the flow switch and the entering water temperature sensors work normally, any other error can be ignored.

When the auxiliary electric heater is disabled through the wired controller, the auxiliary electric heater will stop working.

When all entering water temperature sensors malfunction, the auxiliary electric heater will stop working.

When any flow switch malfunctions, the auxiliary electric heater will stop working.

When the unit is under over-temperature protection but the auxiliary electric heater is not allowed to stop, the auxiliary electric heater will keep working until the entering water temperature reaches the set point.

2.3 Freeze Protection

Under the OFF state at any mode (except the manual defrosting mode), when the freeze protection is activated through the wired controller, the unit will be protected again freeze. Free protection is factory defaulted to be ON.

When the module is in the freeze protection, its compressor will work as per the on/off setting and also the principle of “Six-minute On, Thee-minute Off”.

2.4 Control to the Compressor

All compressors run as per the principle of “First On, First Off” and “First Off, First On”. See section 2.1 and section 2.2.

2.5 Control to the Fan

The fan starts earlier than the compressor upon startup, and stops later than the compressor upon shutdown. During defrosting, the fan and the 4-way valve stops. After defrosting they start again.

2.6 Control the 4-way Valve

The 4-way valve is stopped at the cooling mode. At the heating mode, it will start after the compressor runs. During defrosting it stops and then starts again after defrosting. It will stop later than the compressor upon shutdown.

2.7 Control to the Water Pump

When any module is required to run (incl. manual startup, timely startup, startup again freeze), water pumps of all module starts. Then, when one module reaches the set point and is shut down, water pumps of all modules keep running; when one module is shut down manually or timely, its water pump keeps running and will stop only after all modules are shut down; when one module malfunctions and is shutdown, its water pump keeps running.

2.8 Control to the Electronic Expansion Valve

The electronic expansion valve initialize when the wired controller is emerged for the first time. After the compressor has been started, the electronic expansion valve starts to adjust its opening angle.

2.9 Protection

2.9.1 Recoverable Protection

（1） Compressor 1/2 low pressure protection

When it is detected the low-pressure switch of compressor 1 (compressor 2) is opened compressor 1 (compressor 2) will be shut down immediately.

Meanwhile the indicating LED will light on and the error information will be displayed among the error log which must be manually cleared for normal operation of next time.

（2） Compressor 1/2 high discharge protection

When it is detected in three consecutive seconds that the discharge temperature of compressor 1 (compressor 2) exceeds the set point, compressor 1 (compressor 2) will be shut down immediately but the fan will still run for some time.

Meanwhile the indicating LED will light on and the error information will be displayed among the error log which must be manually cleared for normal operation of next time.

2.9.2 Irrecoverable Protection

（1） Compressor 1/2 high pressure or over-current protection

When it is detected that the high pressure switch of compressor 1 (or compressor 2) is open, compressor 1 (or compressor 2) will be shut down but the fan will still last for some time.

Meanwhile the indicating LED will light on and the error information will be displayed among the error log which must be manually cleared for normal operation of next time.

（2） Fan 1/2 over-current protection

When any fan is over-current, this module unit will be shut down automatically. Meanwhile, the error information will be displayed among the error log which must be manually cleared for normal operation of next time.

（3） Flow switch protection

When a single module unit detect that the flow switch is closed (under normal condition, it keeps open), it will be shut down automatically.

When all modules are shut down because of flow switch protection, the water pump will stop.

（4） Communication protection

When a single module unit fails to receive any signal from the wired controller, it will be shut down automatically and then the water pump will stop.

（5） Phase loss/reversal protection

When phase loss/reversal occurs, the power supply to the main board will be cut off.

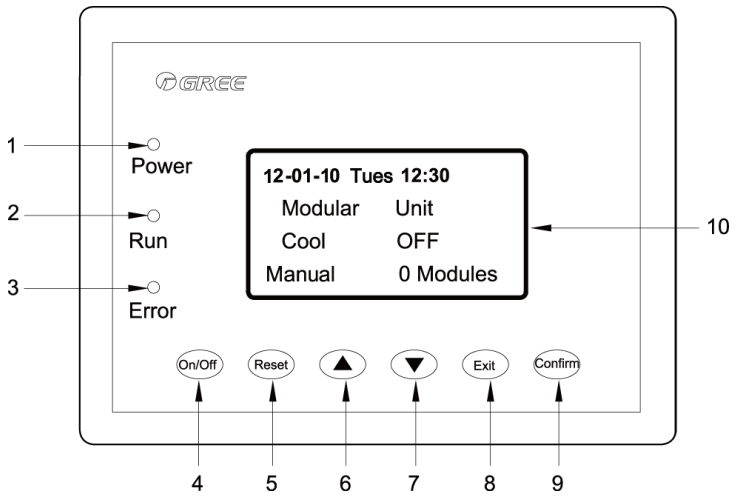
3. Controller

3.1 Control Panel

This control panel, especially designed for D series modular air-cooled chillers, is capable of controlling and displaying each running parameter of the chiller and being integrated into the remote monitoring system.

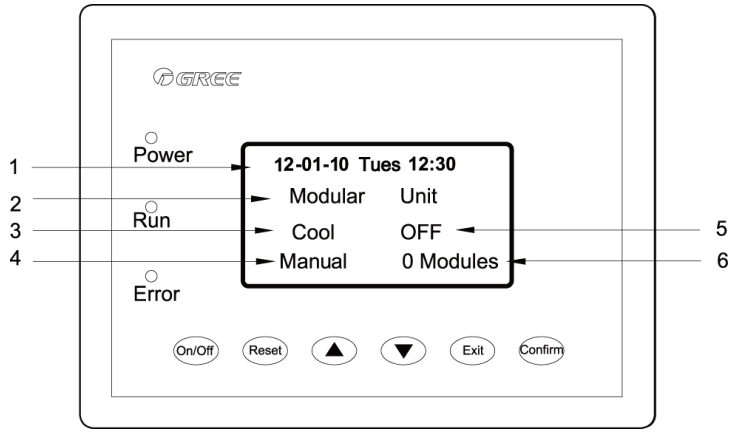
3.1.1 Press Buttons and Icons on the Homepage

（1） Press Buttons



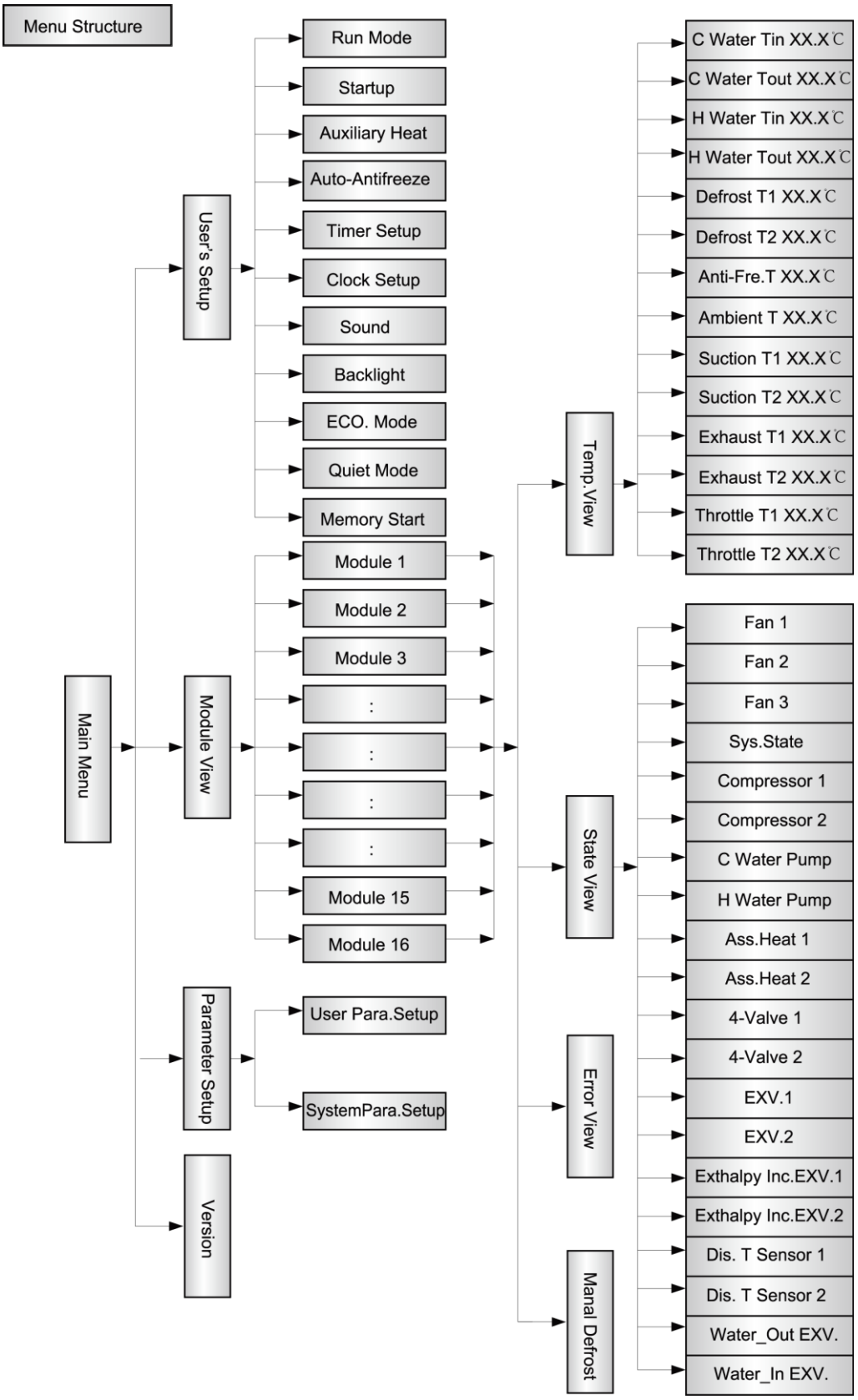
NO.	Name	Function description
1	Power indicator(red)	the indicator is on when the Wired Controller is powered on, or otherwise it is off.
2	Run indicator(green)	the indicator is on when the Wired Controller is started, or otherwise it is off.
3	Error indicator(red)	The indicator is on when the unit is at fault, or otherwise it is off.
4	On/Off button	For controlling unit conversion between start and stop, press the button (for 3 seconds) in stop state to start the unit and press the button (for 3 seconds) in operation state to stop the unit.
5	Reset button	Press the button to clear fault and relieve the air discharge temperature sensor locking.
6	Up selection button	in menu selection, press the button to move the cursor upward or leftward; and in data modification mode, press the button to increase the value.
7	Down selection button	In menu selection, press the button to move the cursor downward or rightward; and in data modification mode, press the button to decrease the value.
8	Exit button	Press the button to go back to the previous menu.
9	Confirm button	In menu selection, press the button to confirm the selected item; and in data modification mode, press the button to confirm the parameter and move the cursor.
10	LCD	Information display zone.

（2） Display Icons on the Homepage



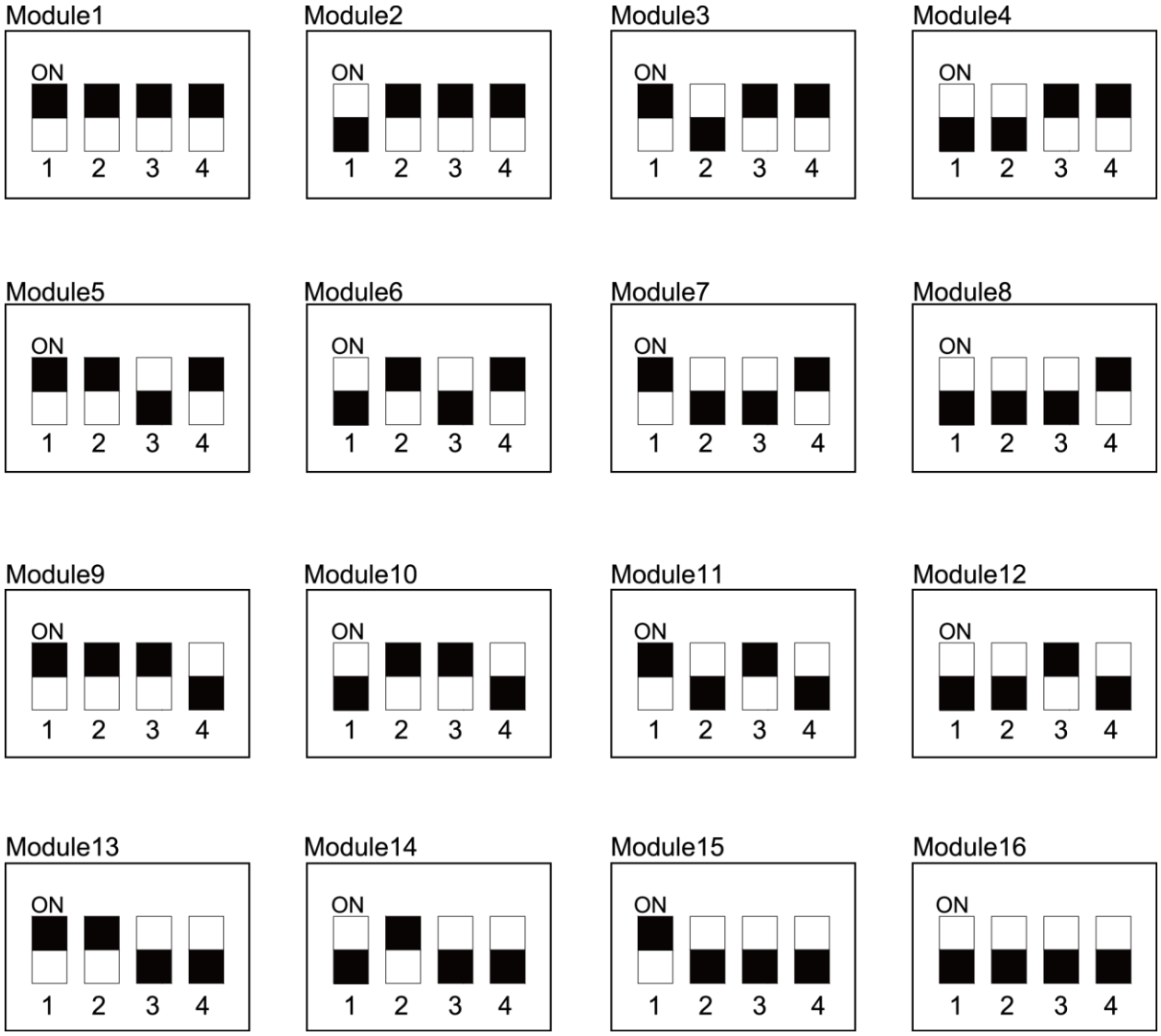
No.	Icon	Description
1	Time	It indicates the current time.
2	Unit name	It indicates the unit name.
3	Running mode	It indicates the running mode (cooling, heating or manual defrosting)
4	On/Off mode	It indicate the on/off mode, manual or timing)
5	Running status	It indicates the running status, on or off.
6	Module quantity	It indicates how many modules this system is consisted of. (max. 16)

3.1.2 Menu Structure of Controller



3.2 Setup of DIP Switches on the Mainboard

Four-bit DIP switches are used for indicating hardware address (1～16) of modules, with module No. displayed alternately on the panel as Module 1, Module 2, ……, Module 16. DIP switches 1, 2, 3 and 4 are binary code, with 1 for the lowest bit and 4 for the highest bit. See the figures below for more details. (Caution: DIP switches can be set only when the power supply is cut off):



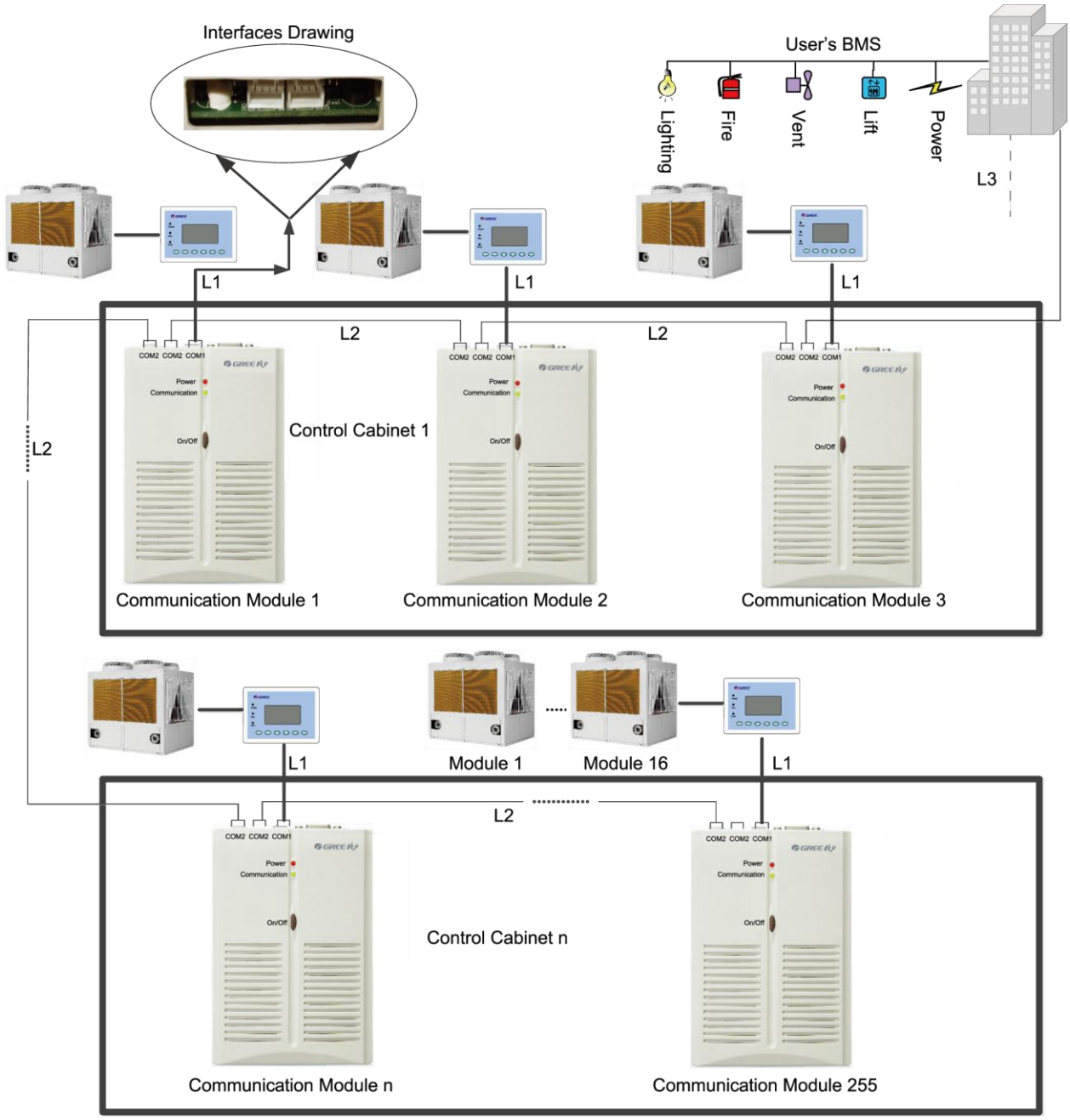
4. Long-distance Monitoring/BMS Interface

4.1 Brief Introduction

4.1.1 General

This long-distance monitoring system allows users through a computer to remotely monitor up to 255 D series modular (heat pump) chillers, including turning on/off the units, setting parameters, giving alarms for malfunctions, which is an efficient tool for management of intelligent air conditioning systems for modern buildings.

4.1.2 Net Topological Diagram



Note: the air conditioning system as shown in the figure above consists of up to 16 single units depending on the actual demand of the project.

4.1.3 Communication Lines

S=Standard, O=Field Supplied, P=Optional

Line Code	Description	Class
L1	A pair of category-5 twisted pairs, one RJ-11 connectors for the communication module, another connector for the communication port on the display board.	s
L2	A pair of category-5 twisted pairs, two RJ-11 connectors	s
L3	A pair of category-5 twisted pairs, one RJ-11 connectors, another connector for BMS port.	o

4.1.4 Description to the Topological Diagram

From the topological diagram above, the long-distance monitoring system consists of 3 parts:

The first part is the BMS and the converter used to convert RS232 signals from the BMS into RS485 signals of the long-distance monitoring network.

The second part refers to the communication network, that is, the communication lines and the connected hardware.

The third part is the communication module responsible for the data exchange between the air conditioning system and the monitoring PC, which is an important link for the whole network. Each communication module has an address set through an 8-position DIP switch. This same address is not allowed to be repeated in a system. For the sake of easy installation and future service, all communication modules are installed together in the central control cabinet.

4.2 Hardware Introduction

4.2.1 Parts List

S=Standard, O=Field Supplied, P=Optional

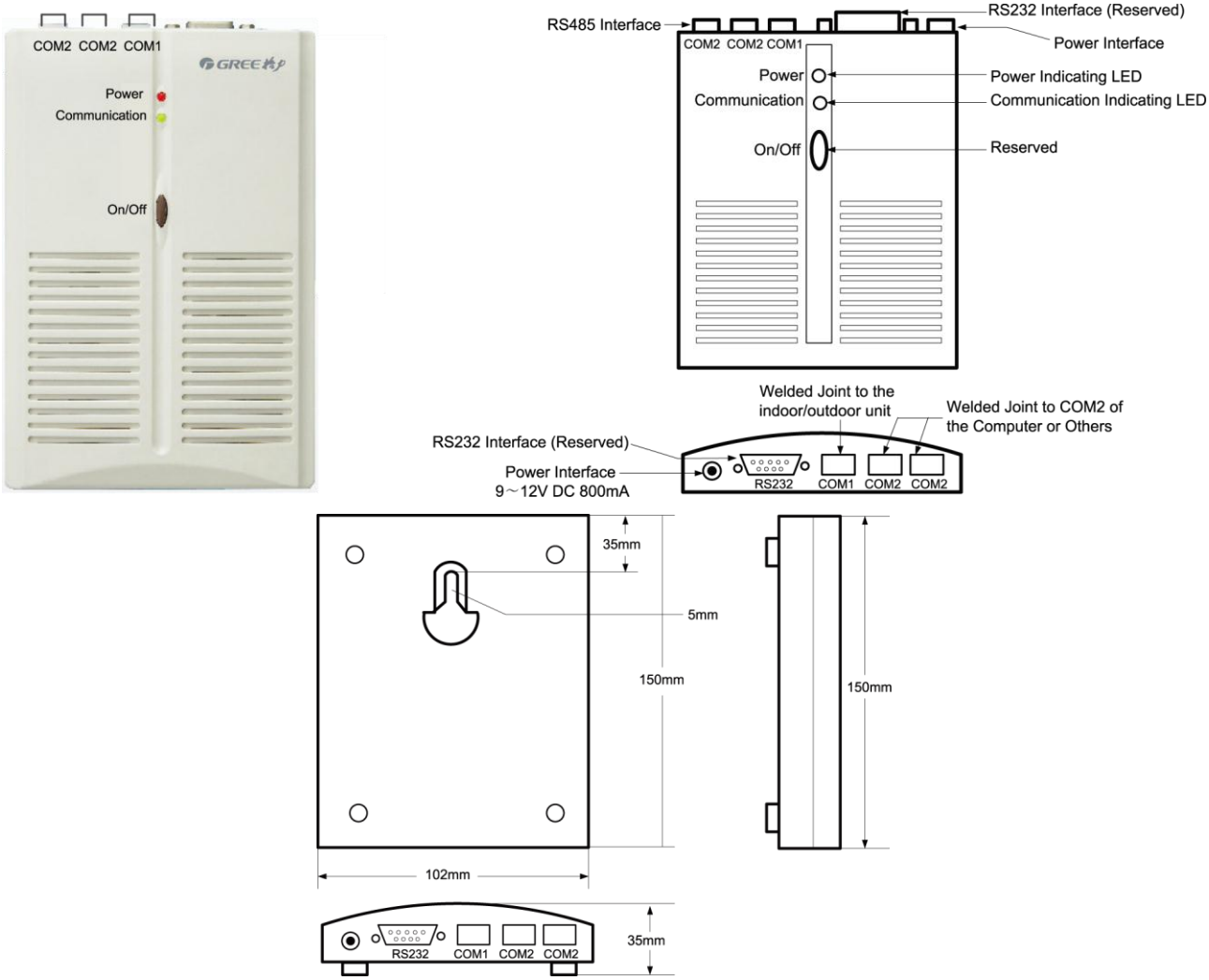
Name	Model	Material Code	Class	Remarks
Communication Module	ME30-28/E(M)	MC200022	S	It can be integrated into the BMS system with RS485 interface which supports Modbus RTU. Main parts: communication module, transformer, connection line, User's Manual.
Optoelectronic Isolated Rpeater	RS485-W	EN02200010	P	A repeater is required every 800m communication distance or every 30 communication modules.
Optoelectronic Isolated Converter	GD02	EN02200020	P	It is required for RS232
Central Control Cabinet	\	\	O	

4.2.2 Communication Module ME30-28/E(M)

4.2.2.1 Functional Introduction

The communication module is intended to bridge the computer and the air conditioning system for data conversion and transmission.

4.2.2.2 Appearance



4.2.2.3 Precaution for Installation

（1）Be sure the correct adapter is used, otherwise the communication module would fail or even be damaged.

（2）Be sure each communication module has a unique address, otherwise communication would fail.

（3）Be sure the communication line is plugged into the correct port, otherwise communication would fail.

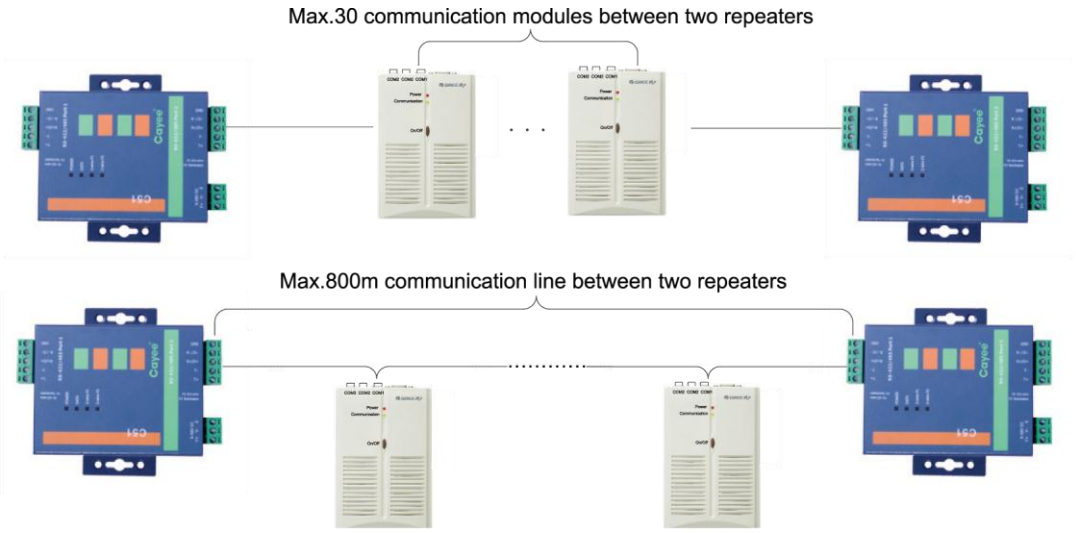
（4）Do not place the communication module where there is direct sunlight or it is high-temperature and damp, but instead put all of them in the central control cabinet.

4.2.3 Optoelectronic Isolated Repeaters

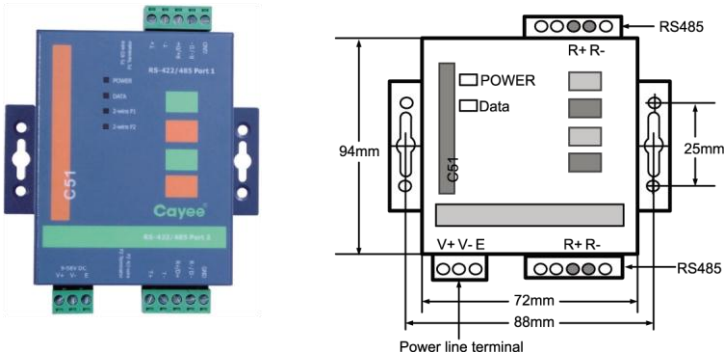
4.2.3.1 Functional Introduction

The repeater is applied to keep signals integrated and from attenuation when the distance between two nodes in the communication network is beyond 800m.

The repeater is applied to keep signal integrated and transmitted normally when more than 30 nodes exist in the communication network. Generally, a converter supports up to 32 nodes.



4.2.3.2 Appearance



4.2.3.3 Precautions for Installation

（1）It shall be installed inside the door and not subject to collision, direct sunlight and rain water. Installation inside the monitor room is preferred.

（2）The OEM device shall be used and the use of the substitute from other manufacturer or of other model is prohibited.

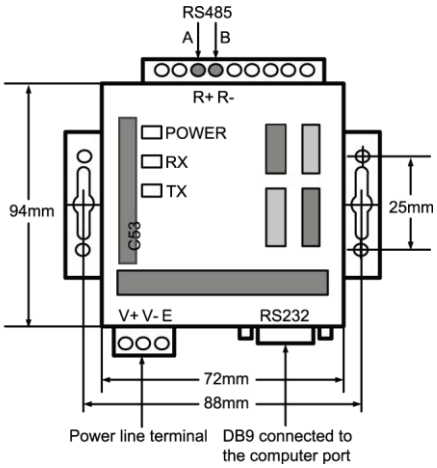
（3）The separate power supply is required as well as enough 220V sockets.

4.2.4 Optoelectronic Isolated Converter

4.2.4.1 Functional Introduction

It is intended to convert the RS232 signals from the computer serial ports to RS485 signals from the bus and vice versa.

4.2.4.2 Appearance



4.2.4.3 Precautions for Installation

（1）It shall be installed inside the door and not subject to collision, direct sunlight and rain water. Installation inside the monitor room is preferred.

（2）The OEM device shall be used and the use of the substitute from other manufacturer or of other model is prohibited.

（3）The separate power supply is required as well as enough 220V sockets.

4.3 Model Selection Instructions

4.3.1 Rules for Model Selection

4.3.1.1 Supply Scope

S=Standard, O=Field Supplied, P=Optional

Supply Scope	Model	Class	Remarks
Communication Module Kit	ME30-28/E(M)	S	It can be integrated into the BMS system with RS485 interface which supports Modbus RTU. Main parts: communication module, transformer, connection line, User's Manual.
Optoelectronic Isolated Repeater	EN02200010	P	A repeater is required every 800m communication distance or every 30 communication modules.
category-5 twisted pairs	\	O	Its length depends on the actual demand.
Optoelectronic Isolated Converter	EN02200020	P	It is requried only for the RS232 interface.

4.3.1.2 Selection Solution

Model	Long-distance Monitoring Kit	Optoelectronic Isolated Repeaters
All D series modular (heat pumps) chillers	One monitoring kit is required for each unit.	A repeater is required every 800m communication distance or every 30 communication modules.

4.3.2 Examples of Model Selection

4.3.2.1 Example 1

This project consists of one LSQWRF80M/NaD-F and one communication module. The communication distance between the monitoring computer and the unit is within 800m. The BMS interface is RS232 and one converter is required.

Name	Code	Quantity
The Unit LSQWRF80M/NaD-F	\	1
Communication Module ME30-28/E(M)	MC200022	1
Optoelectronic Isolated Converter	EN02200020	1

4.3.2.2 Example 2

This project consists of three groups LSQWRF80M/NaD-F, two groups concluding 16 and the three concluding 3. One repeater is required for somewhere the communication distance is over 800m. The BMS interface is RS485.

Name	Code	Quantity
The Unit LSQWRF80M/NaD-F	\	16+16+3
Communication Module ME30-28/E(M)	MC200022	3
Optoelectronic Isolated Repeater	EN02200010	1

4.3.2.3 Example 3

This project consists of 35 LSQWRF80M/NaD-F and two repeaters are required, one for somewhere the communication distance is beyond 800m, and the other for the quantity of chillers which is over 30.

Name	Code	Quantity
The Unit LSQWRF80M/NaD-F	\	35
Communication Module ME30-28/E(M)	MC200022	35
Optoelectronic Isolated Repeater	EN02200010	2

Ⅳ Unit Installation

Installation Guides

WARNING:

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

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

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

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

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

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

CAUTION:

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

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

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

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

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

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

SAFETY:

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

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

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

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

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

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

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

EXECUTIVE STANDARDS:

（1）Fire Protection Design of Tall Buildings GB50045-95.

（2）Code of Design on Building Fire Protection and Prevention GB50016-2006.

（3）Code for Electric Design of Civil Buildings JGJ16-2008.

（4）Technical Specification f 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.

1. Material for Installation

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.

1.1 Pipeline Material

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

1.2 Insulation Material

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.

1.3 Sectional Material

（1）Angle Steel

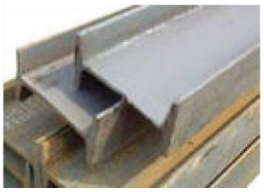
（2）I steel

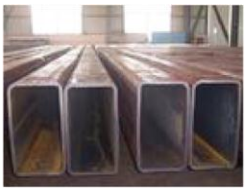
（3）Channel Steel

（4）Squire Steel

（5）Rectangular Steel

（6）H Steel

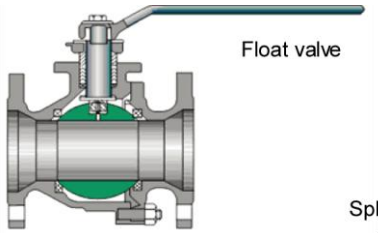
1.4 Valves

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.

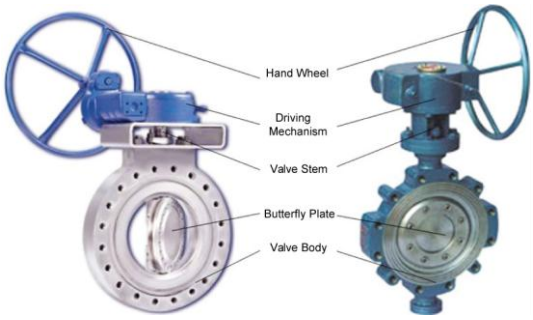
（2）Shut-off Valve and Throttling Valve: its nominal diameter is limited to 200 or below. The shut-off valve is used to cut off the tube flow and the throttling valve is mainly used to throttle the tube flow.

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



Split ball valve (large caliber)

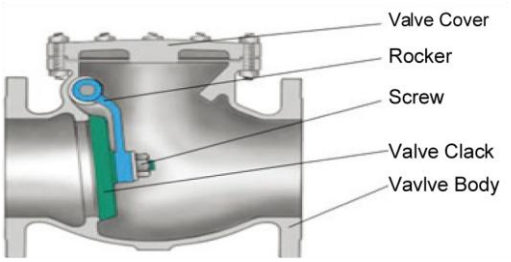
（4）Batterfly Valve: it is widely applicable to all kinds of fluids under 2.0MPa and 200℃.



（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.

1.5 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

1.6 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.

2. Tools

2.1 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.

2.2 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

3. Installation

3.1 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.

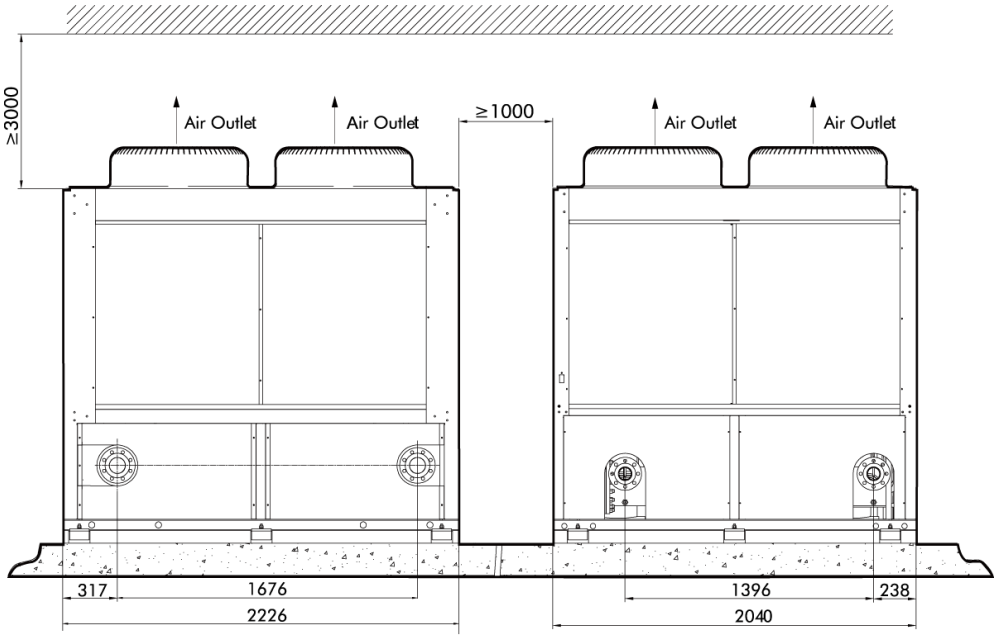
（7）Necessary tools and materials include: flexible joint, vibration-isolating pad, lifting equipment, lifting beam, lifting chain, jack, skid, crow bar etc.

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.

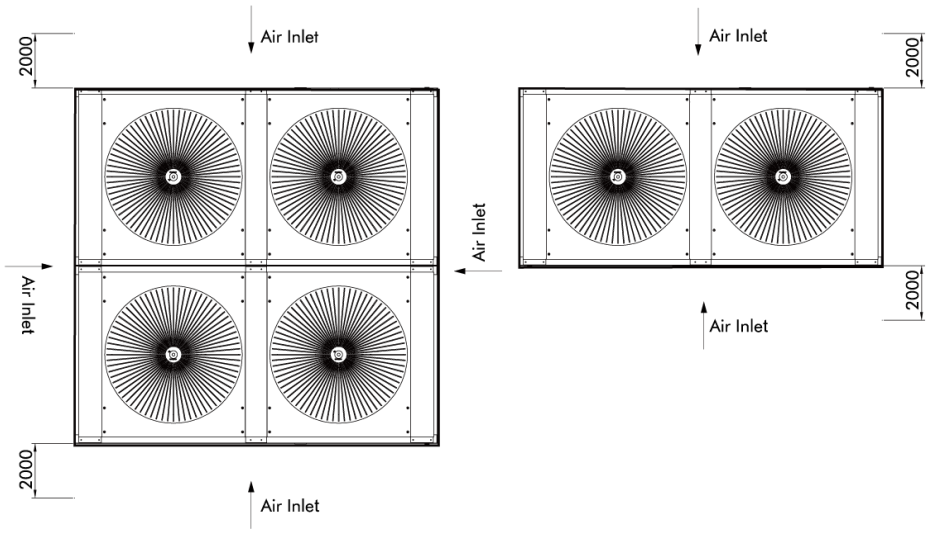
3.2 Space for Installation and Maintenance

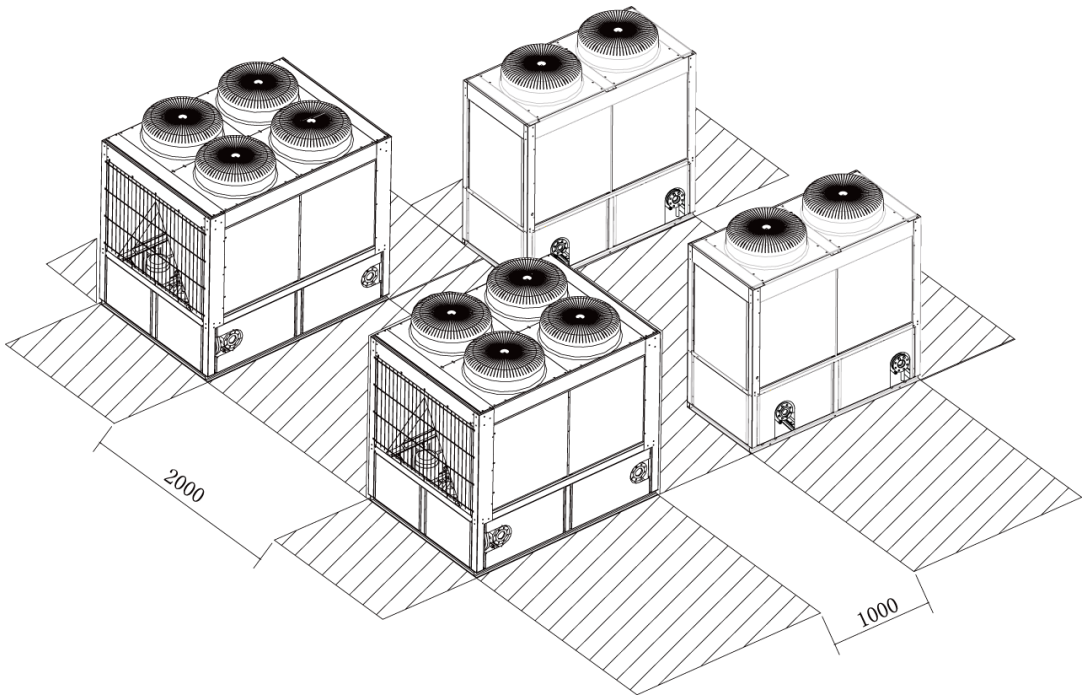
The interval between each module should be larger than 1m so that there is enough space for entering air and maintenance. The distance between the unit and any barrier should be or larger than 2m so as to keep good ventilation around the unit. If possible, a suncover can be set up 3m ahead of the unit.

(Unit:mm)



Rubber cushion pad shall be attached under the unit base which shall be fixed on the foundation with bolts.





（1）When the unit is installed where air flows dramatically, like rooftop, it can be taken into consideration to use a stub wall or blinds.

（2）If a stub wall is used, its height is not allowed to exceed that of the unit. If blinds are used, then the total static pressure loss should be smaller than the external static pressure.

（3）If the unit is required to run in winter and snow is probably accumulated at the installation site, then the unit should be higher than the snow cover so as to ensure air freely pass through the condenser.

3.3 Installation Foundation

（1）The installation foundation should be designed by the professional designers.

（2）The installation foundation should be made of concrete or steel structure and capable of supporting the running weight of the unit

（3）The unit should be fastened securely and the footing should be smooth and horizontal.

（4）There should be a drain channel around the installation foundation.

3.4 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

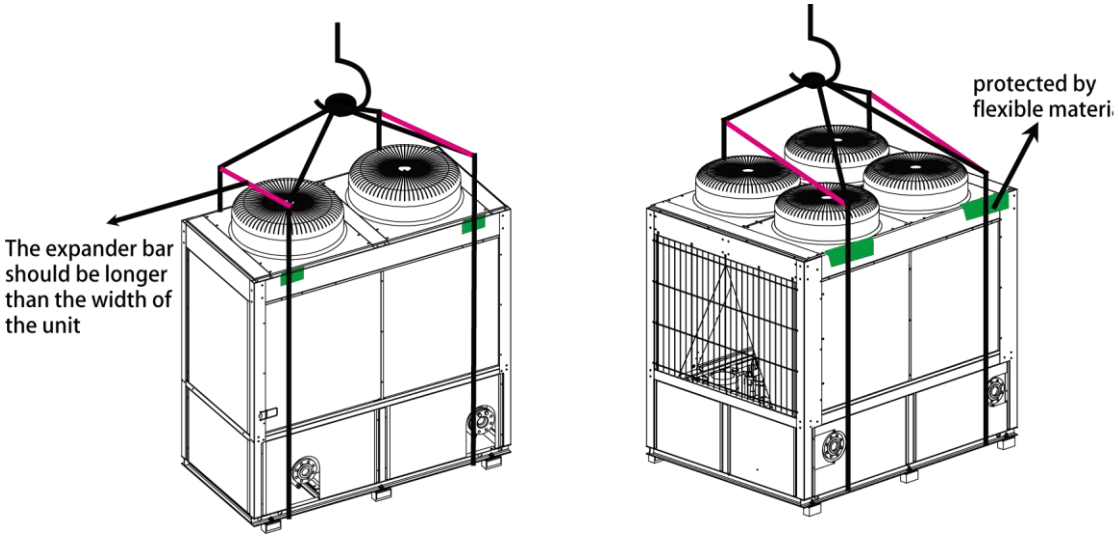
（3）When the unit is unpacked during handing, please follow the lifting instructions stated below

3.4.1 Handling and Lifting

（1）Refrigerant has been charged into the unit before transport. Therefore, care should be exercised in transport to avoid any damaged caused by imprudent operation.

（2）Unless otherwise specified in the order, the unit can’t be transported in the wooden case.

（3）Be sure the lifting hook works perfectly with the unit so as to prevent the unit from being damaged by the lifting hook.



3.4.2 Placement

（1）Place the unit on the foundation.

（2）There should be no clearance between the foundation and the baseboard of the unit.

（3）Lift the unit, put the rubber pad on the foundation and then place the unit on the rubber pad.

（4）After that, be sure the horizontal slope of the unit can’t exceed 1/1000. If so, take an adjustment by stuffing spacers into the clearance between the foundation and the baseboard of the unit until the slope is satisfactory.

3.5 Water System

3.5.1 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.

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

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

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

（4）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.

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

（6）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.

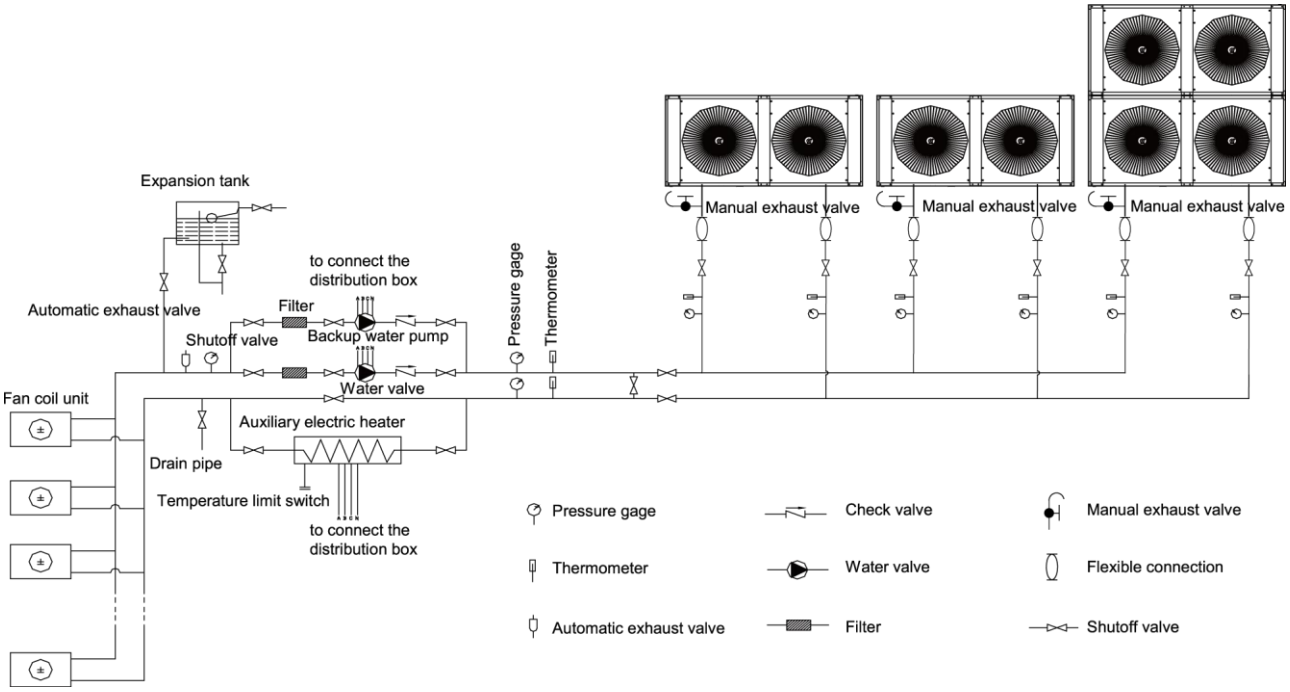
（7）All pipes which are probably frozen up should be thermally insulated, including the drain pipe and flanges of the evaporator.

（8）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.

（9）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℃.

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

（11）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.



Installation Diagram of the Chilled Water Pipes

3.5.2 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.

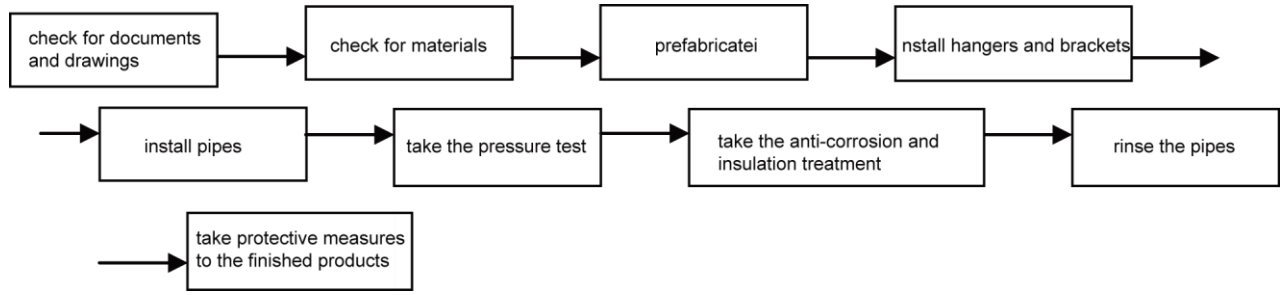
（3） No matter which connection is used, welding, threaded connection or flange connection, the connection joint can’t be in the wall, floor or sleeve pipe.

（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:



3.5.2.1 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.

3.5.2.2 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.



3.5.2.3 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.

3.5.2.4 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.

3.5.2.5 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.

1) Threads should be processed by the threading machine.
2) Use marnen as stuffing material and remove those outside of the threads after pipes have been installed.
3) 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

1) 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	—	—	

2) 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.

3) 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.

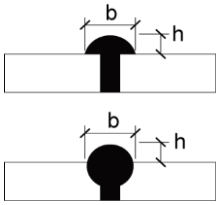
4) Welding should be done by the qualified welder. In welding, there should be a wind, rain, or snow guard. The environmental temperature for welding can't be lower than -20℃. A 250mm groove for welding should be preheated to 100℃ .

5) 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.

6) 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.

7) 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

1) 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.

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

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

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

5) 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.

6) 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.

3.5.2.6 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.

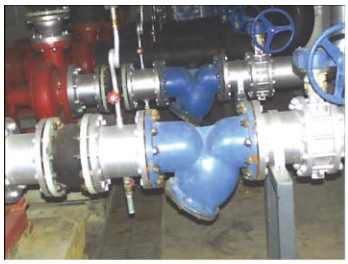
（4） Installation of electric valves and solenoid valves should be guided by electricians. They should be commissioned prior to installation.

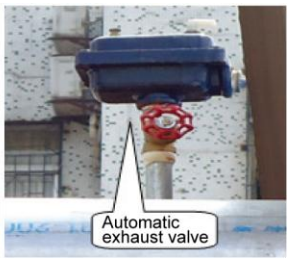
（5） The water filter is usually installed at the inlet pipe of the water pump and other equipment. Pay attention to the water flow direction.

（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.





3.5.2.7 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.

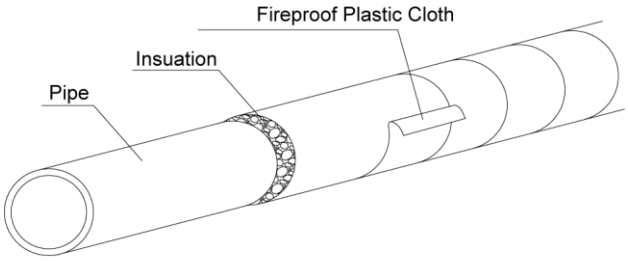
3.5.2.8 Anti-corrosion and Insulating

（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.

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

a) Pipes should be painted without curtaining and holidays.

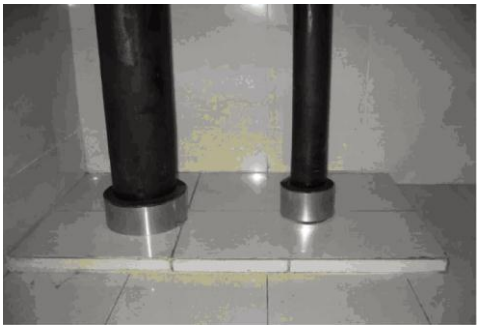
（2） Insulating: PEF (δ=30mm) is taken as the insulating material.



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.

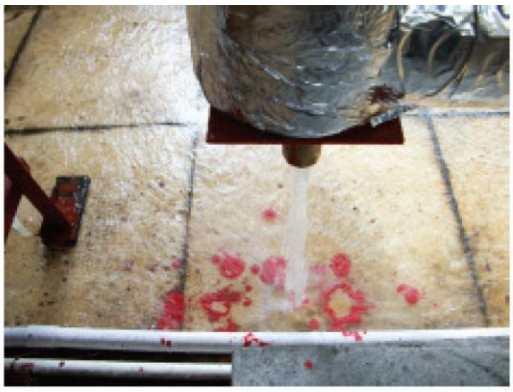


（4） Pipes should be labeled with legible fonts and the direction of the fluid. The paint color should be selected properly. Once color circles are used, their intervals should be even. Labels listed in parallel should be arranged reasonably.

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.

3.5.2.9 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.

3.5.2.10 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.

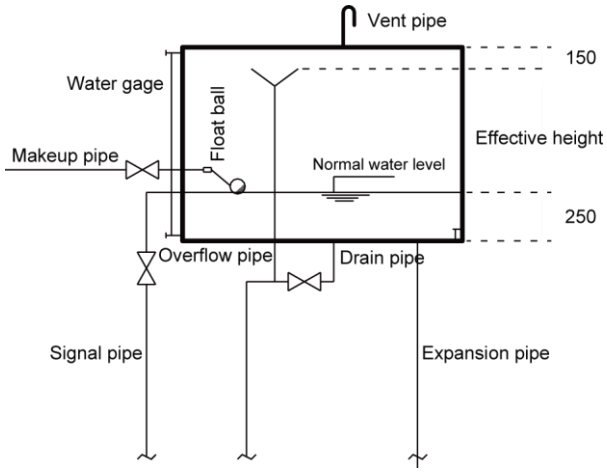
（3） Pipe repair should be finished prior to external decoration and do not damage any wall and floor

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.

3.6 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.

3.7 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.

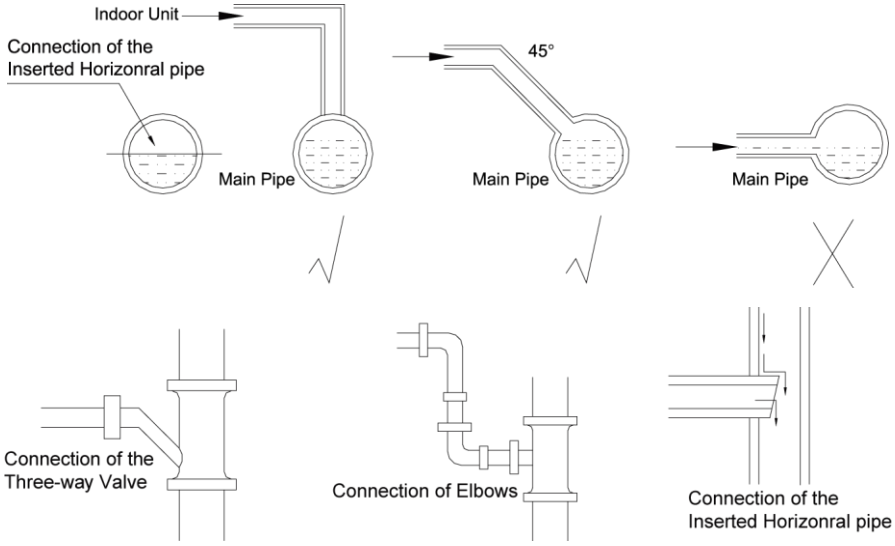
（5） The diameter of the pipes should be suitable.

（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.

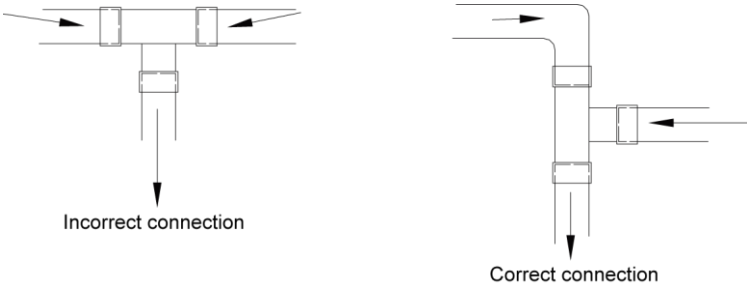
3.7.1 Setup

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:

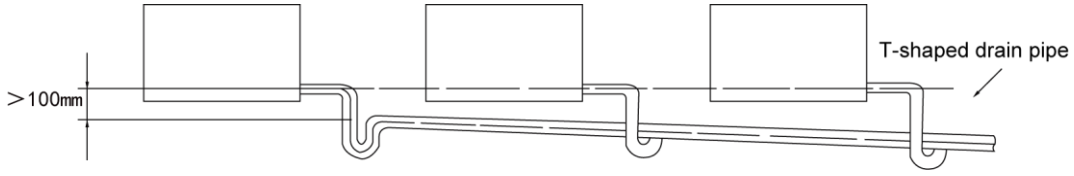


When the three-way valve is used for the condensate pipe, its straight two connectors should be kept at the same level as shown in the right figure.



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.

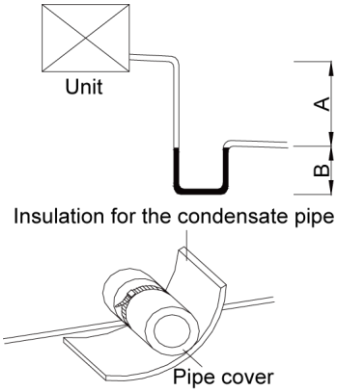
When the negative pressure at the pipe outlet is too large, elbows should be fitted to the drain pipe.

A=P+25mm

B=P/2+25mm

P—negative pressure mmH_2O

Pipe Size≥32mm



3.7.2 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.

3.7.3 Fastening

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

3.8 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).

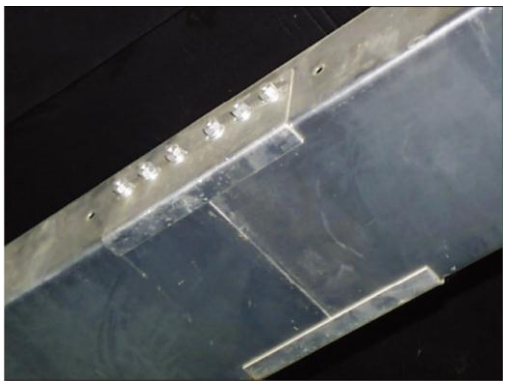
（2）All field-supplied conductors, equipment, and conductor joints should meet corresponding regulations and requirements.

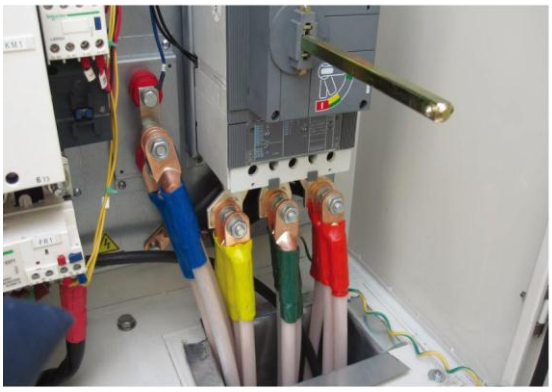
1) All wiring should be done by the qualified electrician.
2) Cut off the power supply prior to wiring.
3) The installer should take responsibilities for losses caused by improper external wiring.

WARNING-only copper conductors are allowed.

（3） Wiring and Protection of the Power Lines

1) The power lines should run in the wireways or wire conduits.
2) Wires entering the electric box should be protected with rubber or plastic to prevent them from being damaged by the sharp edge of the metal sheet.
3) 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.
4) Power line should be grounded reliably and never connect with the gas lines, water lines, lightening rod, or phone lines.


3.9 Wiring of Control Lines

3.9.1 Requirments on Control Lines

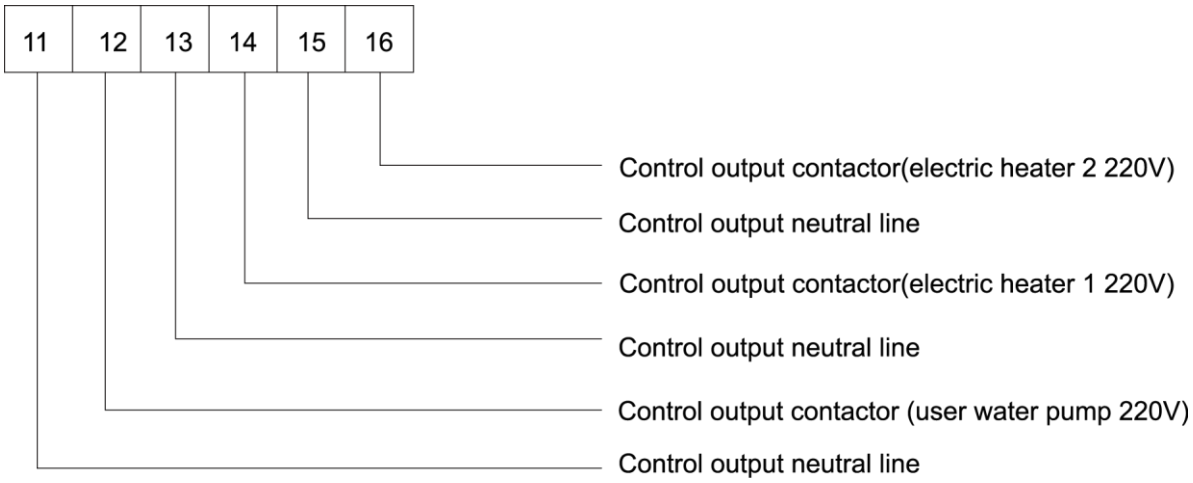
（1） The minimal size of the field supplied control line should be 1mm^2.

（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.

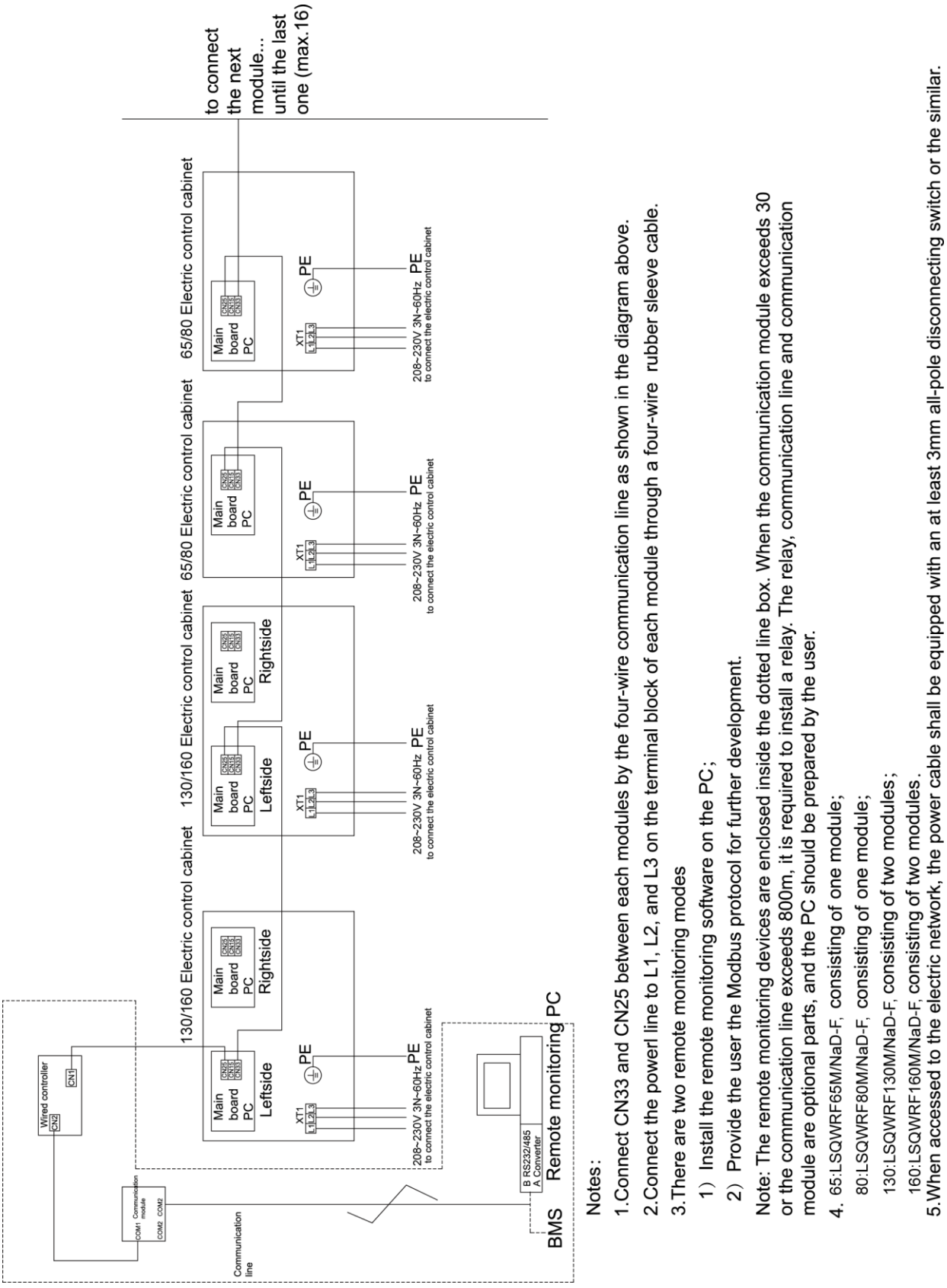
（4） Length of the control line inside the electric box should be proper, and never bundle it and then stuff it into the electric box.

3.10 External Wirnig of Control Lines



Note: control lines of auxiliary electric heater 1, auxiliary electric heater 2 and user water pump ac contactor can be wired to terminal 11, 12, 13, 14, 15 and 16 of the terminal board XT3 of any module.

3.11 Wiring among Modules

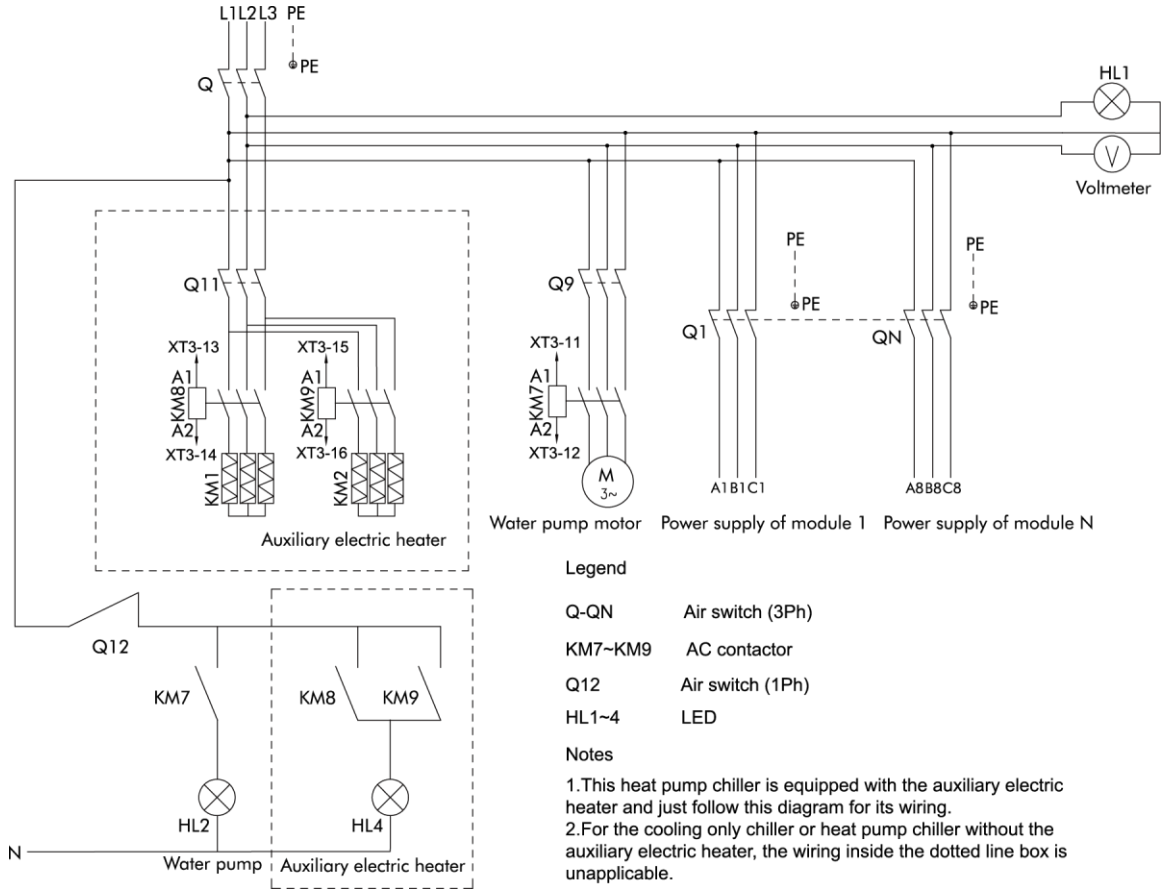


Notes:

1. Connect CN33 and CN25 between each modules by the four-wire communication line as shown in the diagram above.
2. Connect the powerl line to L1, L2, and L3 on the terminal block of each module through a four-wire rubber sleeve cable.
3. There are two remote monitoring modes
   1) Install the remote monitoring software on the PC;
   2) Provide the user the Modbus protocol for further development.

   Note: The remote monitoring devices are enclosed inside the dotted line box. When the communication module exceeds 30 or the communication line exceeds 800m, it is required to install a relay. The relay, communication line and communication module are optional parts, and the PC should be prepared by the user.
4. 65:LSQWRF65M/NaD-F, consisting of one module;
   80:LSQWRF80M/NaD-F, consisting of one module;
   130:LSQWRF130M/NaD-F, consisting of two modules;
   160:LSQWRF160M/NaD-F, consisting of two modules.
5. When accessed to the electric network, the power cable shall be equipped with an at least 3mm all-pole disconnecting switch or the similar.

3.12 Wiring of the Electric Cabinet (Ref.)



Legend

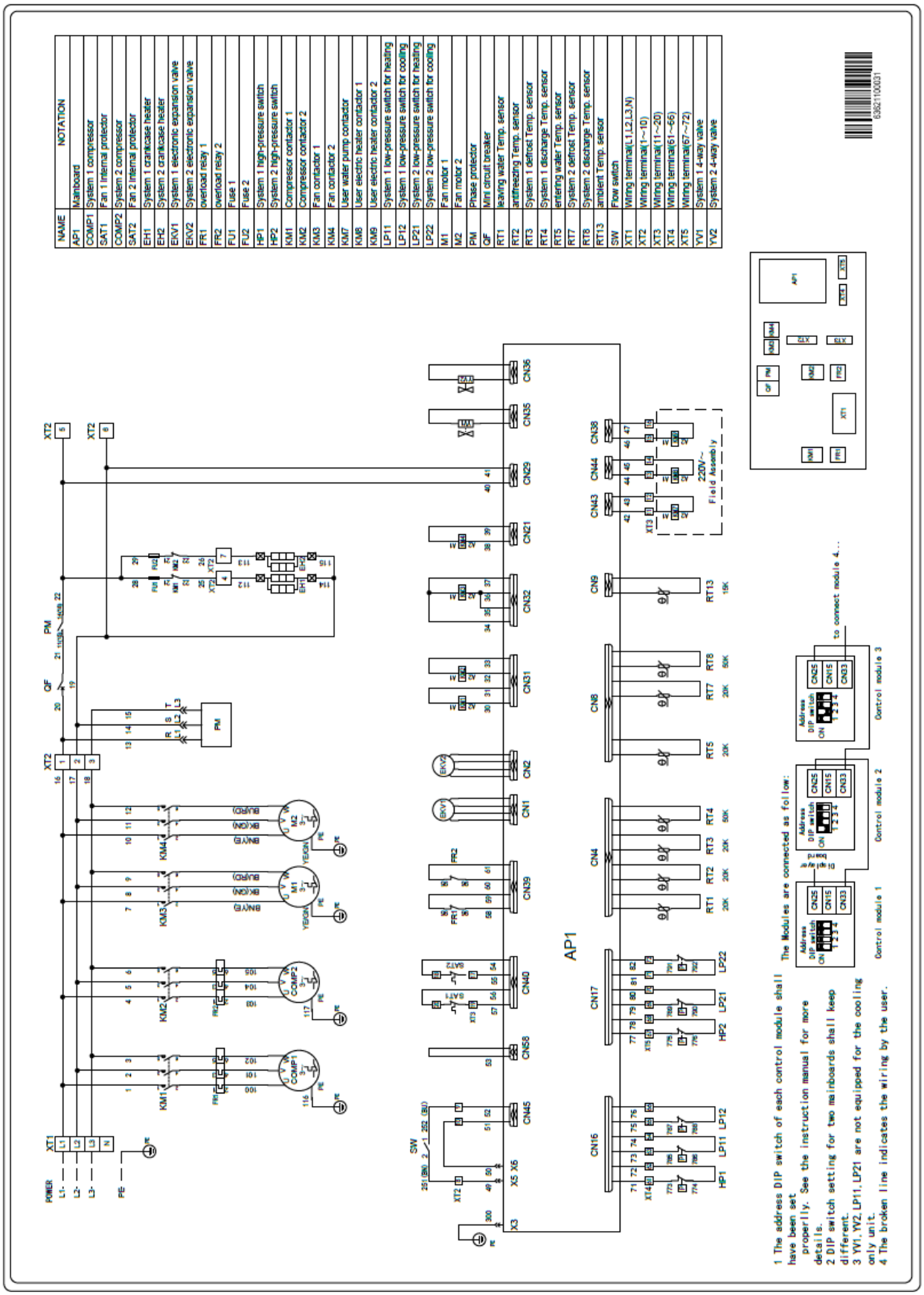
Q-QN	Air switch (3Ph)
KM7~KM9	AC contactor
Q12	Air switch (1Ph)
HL1~4	LED

Notes

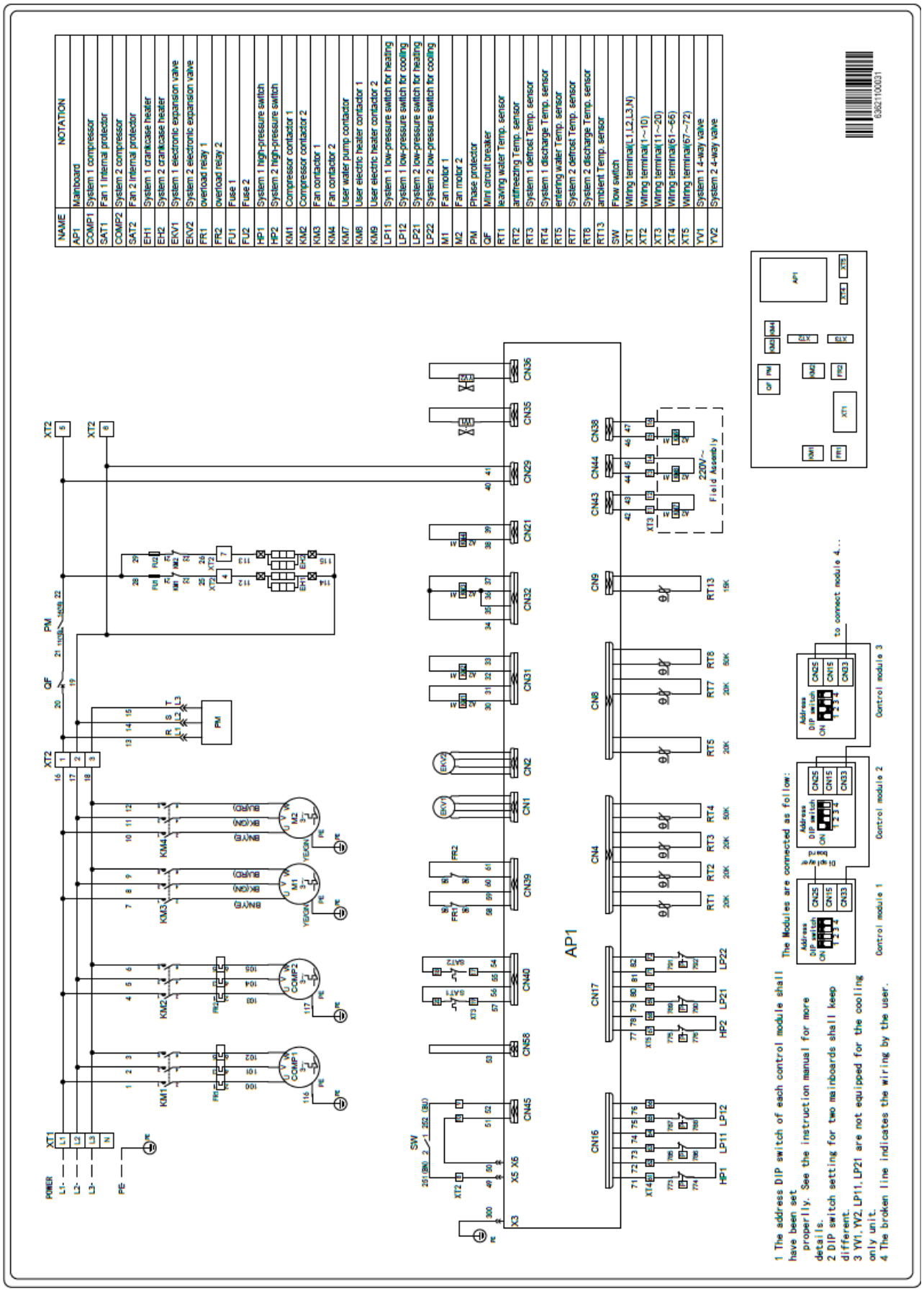
1.This heat pump chiller is equipped with the auxiliary electric heater and just follow this diagram for its wiring.
2.For the cooling only chiller or heat pump chiller without the auxiliary electric heater, the wiring inside the dotted line box is unapplicable.

3.13 Wiring diadram

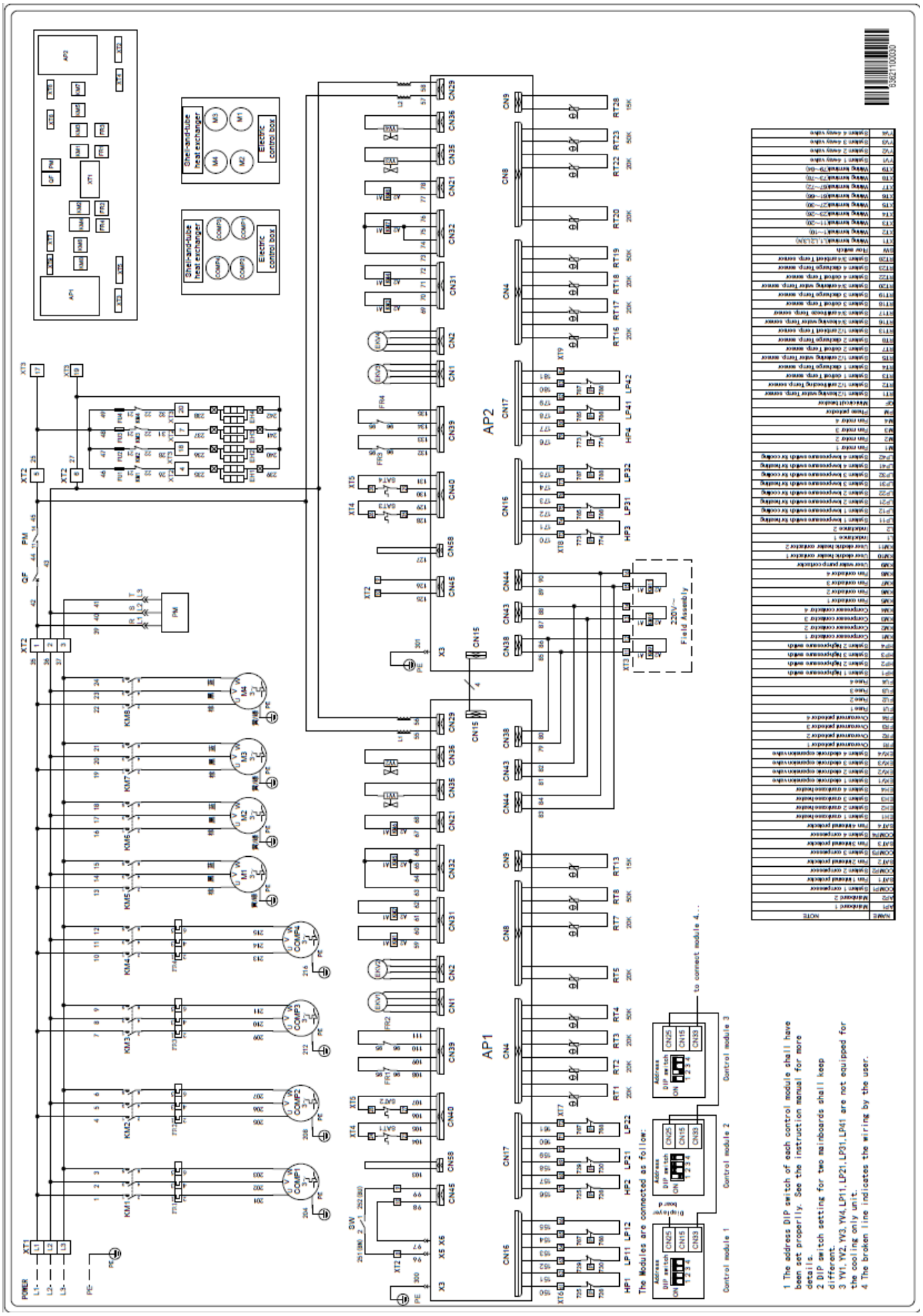
(1) LSQWRF65M/NaD-F



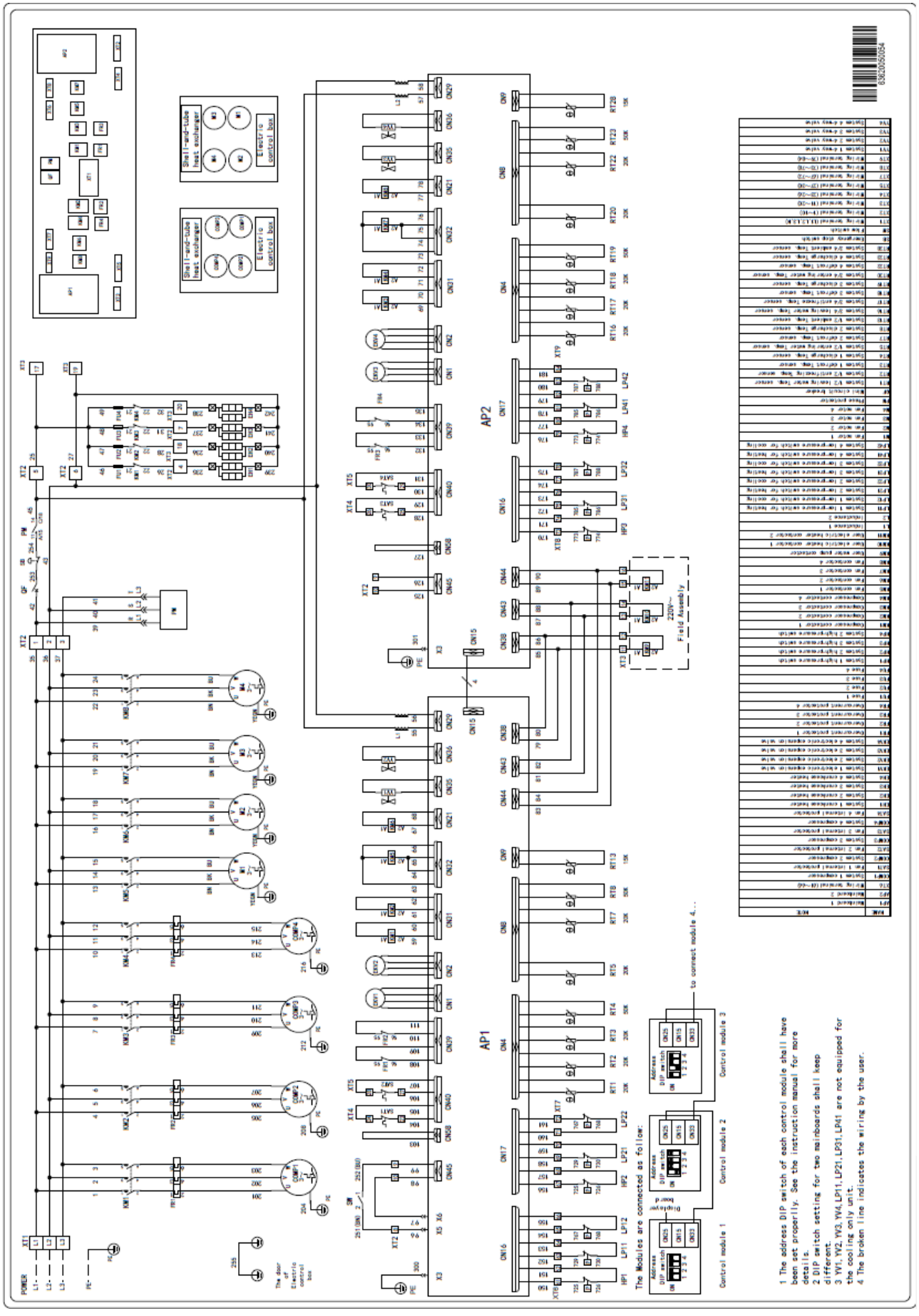
(2) LSQWRF80M/NaD-F



(3) LSQWRF130M/NaD-F



(4) LSQWRF160M/NaD-F



3.14 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.

3.14.1 Preparation

3.14.1.1 Documents

（1） User’s Manual

（2） certificates

（3） wiring diagram

（4） saturated temperature and pressure

3.14.1.2 Tools

（1） Refrigeration tools

（2） Digital volt-ohmmeter

（3） Clip-on mete

（4） Electric leak detector

（5） Megohmmeter

3.14.2 Check before Commissioning

3.14.2.1 Check for Instalation of the Main Unit

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

3.14.2.2 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.

3.14.3 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?

3.14.4 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

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

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

（3） Is all wiring correct?

（4） Are all interlocks work well?

（5） Do contacts of all contactors work well?

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

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

3.14.5 Commissioning

Following inspections above, the unit is allowed for commissioning.

（1） 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.

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

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

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

（5） 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.

（6） 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:

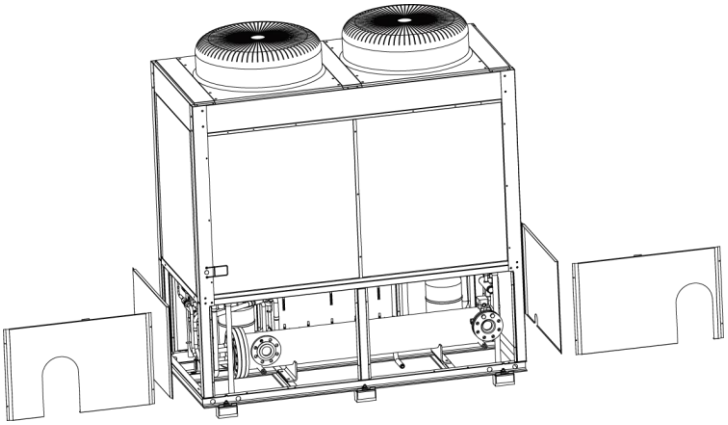
（1） Do not start the unit when rinsing the water system.

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

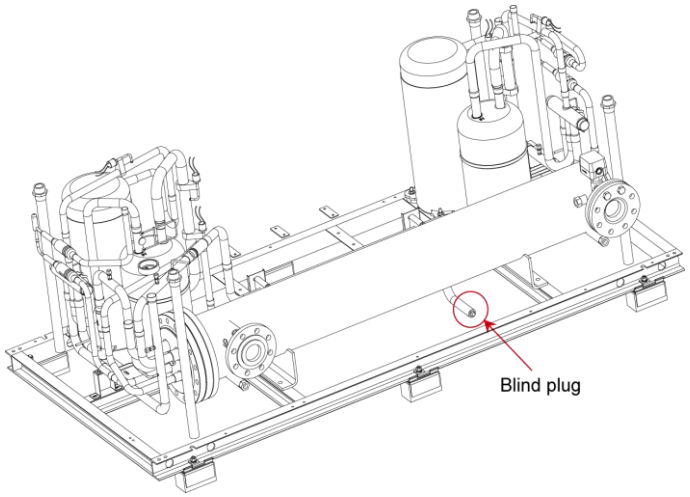
（3） A flow switch should be installed at the water pipe and interlocked with the unit, or the user will take full responsibility for losses caused by water break.

Figures below shows how to the drain the water system.

Step 1: Loosen screws on the front panel and then remove the front panel.



Step 2: Open counter clockwise the blind plug at the bottom of the evaporator to let the chilled water flow out freely. After that, place the blind plug back. (Note: place a container for foul water beneath the evaporator to prevent the foul water from polluting the site).



Note: the drain outlet and exhaust valve should be always kept open in order to drain the water system completely.

Diameter of Main Inlet and Outlet Pipes

Pipe Diamter (mm)	Cooling Load (kW)
DN15	0～3
DN20	3～7
DN25	5～13
DN32	10～25
DN40	15～38
DN50	29～75
DN65	46～126
DN80	84～230
DN100	167～461
DN125	314～586
DN150	523～1151
DN200	1068～2094

4. 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. Commissioning

1.1 Check for Communication

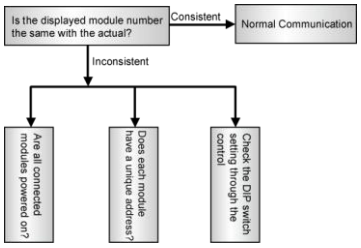
Check if the displayed number of modules is the same as the real number. If so, it indicates communication goes normal. If not, take the following inspections.

（1） Are all connected modules powered on?

（2） Does each module have a unique address?

（3） Is there any module which has not been detected by the control?

（4） Is the communication line of the mainboard connected correctly or is the communication line itself non-defective?



1.2 Check for a Single Unit

（1） Commission one module first and stop all others.

（2） Do its compressor, fans and the 4-way valve run normally without any unusual noise?

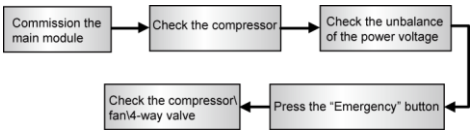
（3） Is the voltage phase difference lower than ±2%?

（4） Voltage phase difference =(Phase difference between the max and average voltage)/(Average voltage)×100%.

（5） Start up this module.

（6） Do its compressor, fans and the 4-way valve run normally without any unusual noise?

（7） Check other modules one by one in the same way.



1.3 Check for the Water Flow of a Single Module

In order to prevent the water temperature changing too quickly, it is suggested to open all terminal units in commissioning, and observe and record the pressure drop of the manometers at the outlet and inlet pipes. Also, adjust the flow control valves or shut-off valves to make the flow meet application requirements.

When the environmental temperature is available, let the module perform cooling (>15℃) or perform heating (<24℃). When the module has run stably for 10 minutes, the normal difference of the entering and leaving water should be 4-6℃.

（1） If the temperature difference is larger than 4-6℃, raise it by reducing the water flow of other modules.

（2） If the temperature difference is smaller than 4-6℃, ignore it in the event that the difference of other modules is suitable, and reduce the water flow of this module in the event that the difference of other modules is also unsuitable.

（3） Check for the water flow of other modules one by one in the same way.

1.4 Check for Operation of the Whole Unit

（1） Check the difference of the entering and leaving water temperature of each module when the whole unit has been in operation. If temperature adjustment fails, reconsider the capacity of the selected water pump.

（2） Start up the whole unit under the full load. When the whole unit has run stably for one hour, check if the water temperature and the air conditioning effect meet the user's requirements.

（3） Observe and record the entering and leaving water temperature, condensing and evaporating pressure. Then, stop the unit and check the set point of each parameter on the control panel. After that, complete the commissioning date sheet.

（4） When the unit goes into the protection state, figure out causes as well as solutions.

2. Errors

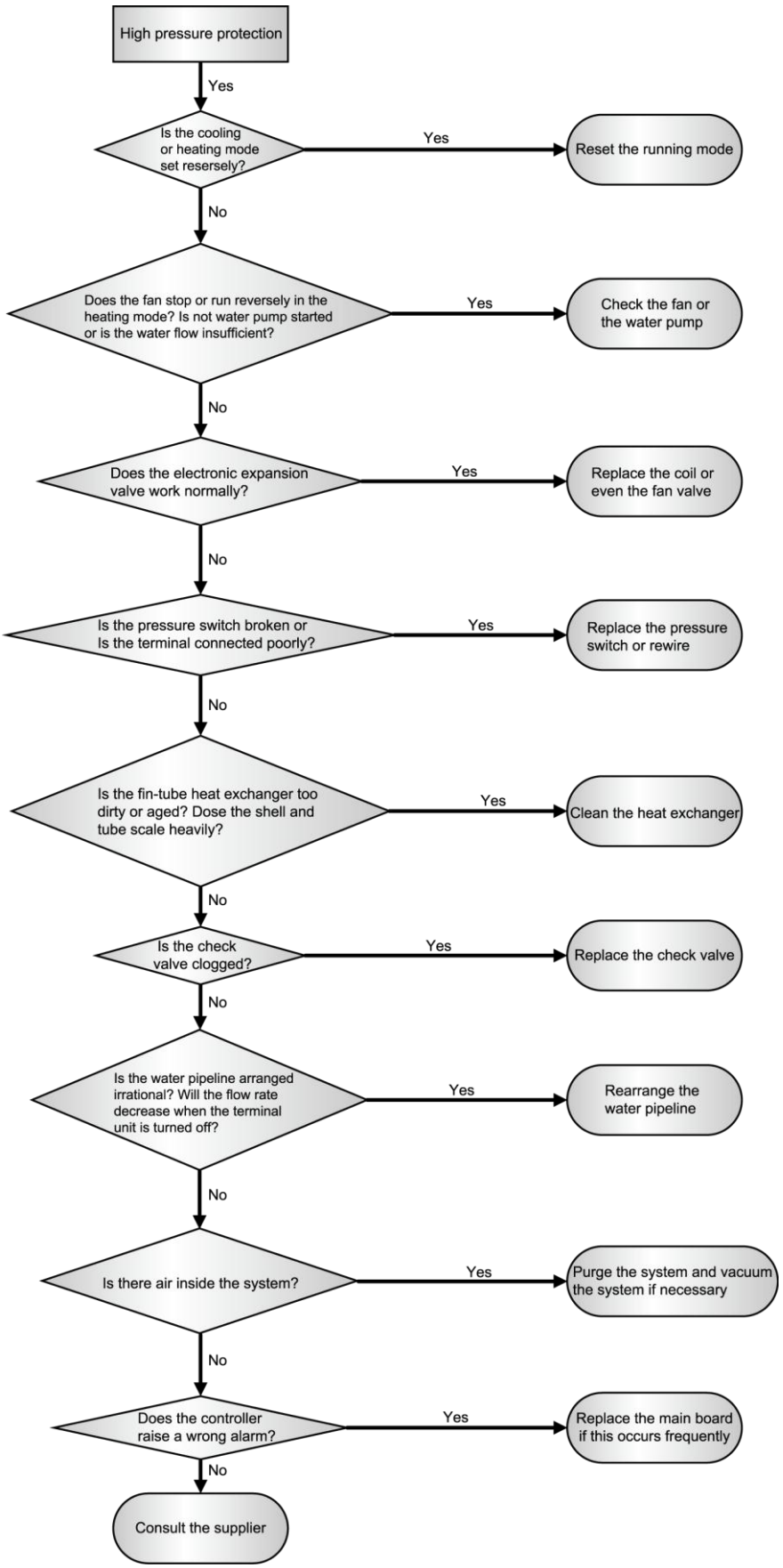
2.1 Error List

<table>
<tr><th colspan="2">Error</th><th>Error Code</th><th>Element</th><th>Protection Logic</th></tr>
<tr><td colspan="2">High-pressure protection</td><td>E1</td><td>High pressure switch</td><td rowspan="2">When the pressure is too high or the current exceeds the set point, the corresponding compressor will stop and the indicating LED on the control panel will light on and the error information will be displayed on the error log which must be manually cleared for normal operation of next time.</td></tr>
<tr><td colspan="2">Compressor over-current protection</td><td>E5</td><td>Over-current protector</td></tr>
<tr><td colspan="2">Low pressure protection</td><td>E3</td><td>Low-pressure switch</td><td>When it is detected the low-pressure switch of the compressor is opened frequently, the compressor will be shut down immediately. Meanwhile, the error information will be displayed among the error log which must be manually cleared for normal operation of next time.</td></tr>
<tr><td colspan="2">High discharge protection</td><td>E4</td><td>Discharge temperature sensor</td><td>When it is detected in three consecutive seconds that the discharge temperature exceeds the set point, the compressor will be shut down immediately. Meanwhile, the error information will be displayed among the error log which must be manually cleared for normal operation of next time.</td></tr>
<tr><td colspan="2">Fan over-current protection</td><td>EF</td><td>Fan over-current protector</td><td>When a fan is over-current, the corresponding unit will be shut down. Meanwhile, the error information will be displayed among the error log which must be manually cleared for normal operation of next time.</td></tr>
<tr><td rowspan="2">Temperature sensor protection</td><td>Defrosting temperature/ heating throttling point temperature sensor error</td><td>d6</td><td rowspan="2">Temperature sensor</td><td rowspan="2">When an entering water temperature sensor fails, the compressor of the corresponding module will be shut down immediately while the fan will still run for some time.
When a discharge temperature sensor fails, or the sensed discharge temperature is always below the set point, the compressor of the corresponding module will be shut down immediately. It can recover in three seconds but If the same case occurs more than three times, the system will be</td></tr>
<tr><td>Environment temperature</td><td>F3</td></tr>
</table>

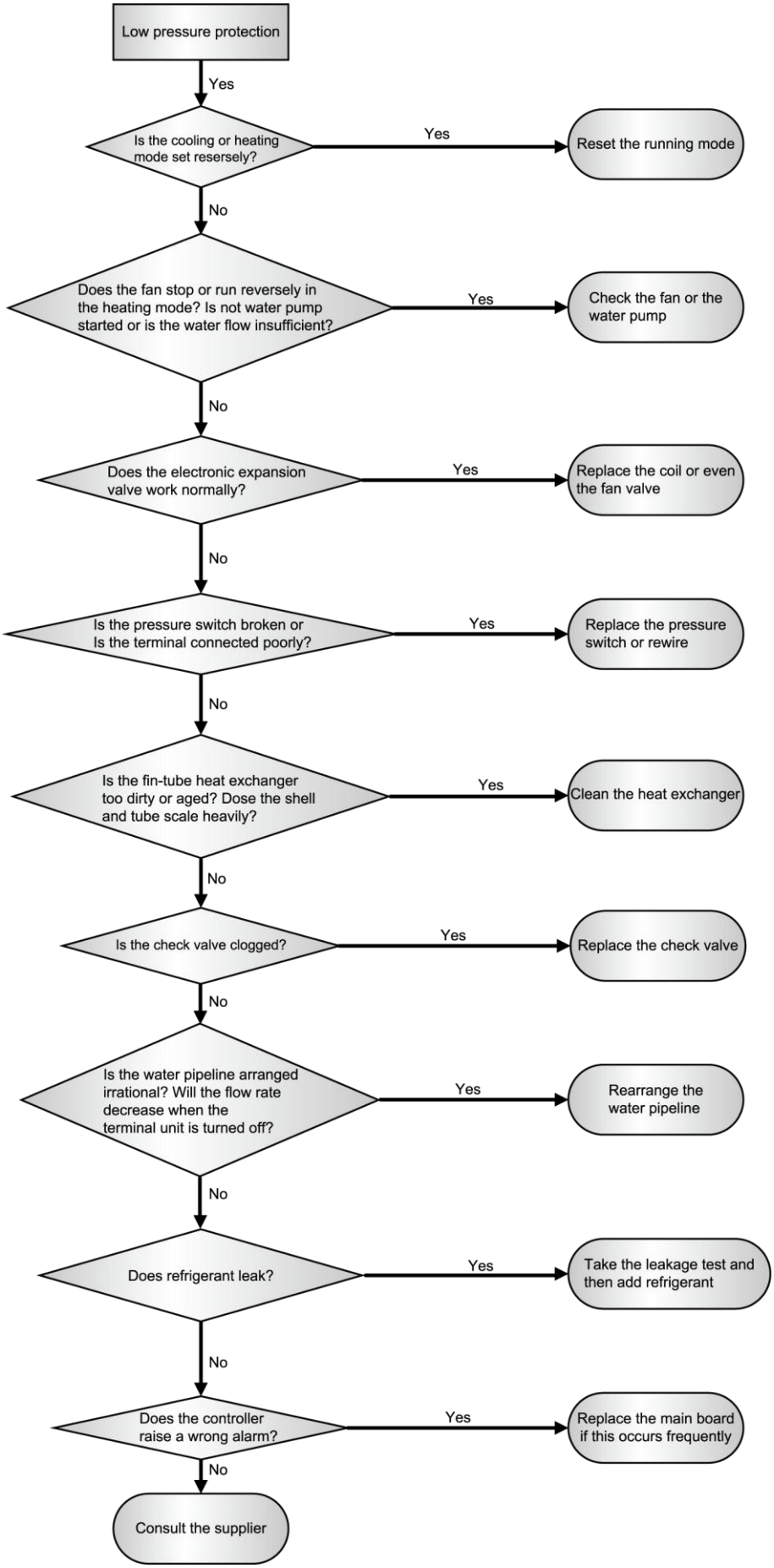
	sensor error			locked until the system is unlocked and then it should be manually cleared for normal operation of next time. When the anti-freezing temperature sensor or the leaving water temperature sensor fails, it can be automatically cleared as the temperature sensor automatically recover. But if the same case occurs three times in one hour or the temperature sensor fails to recover, it should be manually cleared for normal operation of next time. Meanwhile, the indicating LED on the control panel will light on and the error information will be displayed on the error log
	Discharge temperature sensor error	F4		
	Anti-freeze temperature sensor error	d3		
	Entering water temperature sensor error	F8		
	Leaving water temperature sensor error	F9		
	Defective discharge temperature sensor	Dp		
Water flow switch protection		EC	Contactor	When a single module detects its flow switch is closed, this module will automatically be shut down. When all flow switches are closed, the water pump will stop.
Phase loss/reversal protection		/	Phase protector	When phase loss/reversal occurs, the phase protector will cut off the power supply to the main board.
Communication error		E6	Main board	When the single module fails to receive signals from the control panel, it will automatically be shut off.

2.2 Flow Chart of Troubleshooting

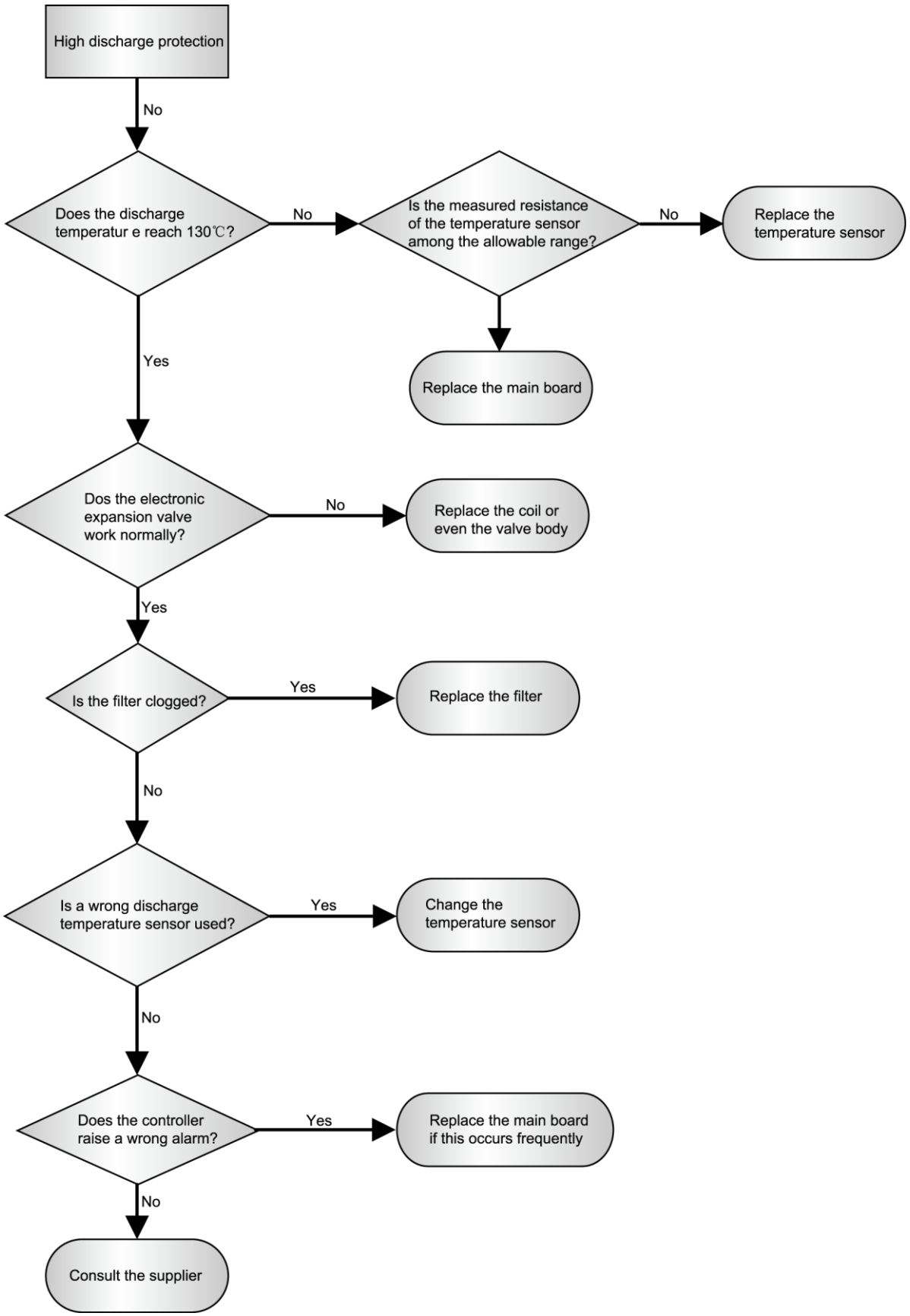
（1）High pressure protection



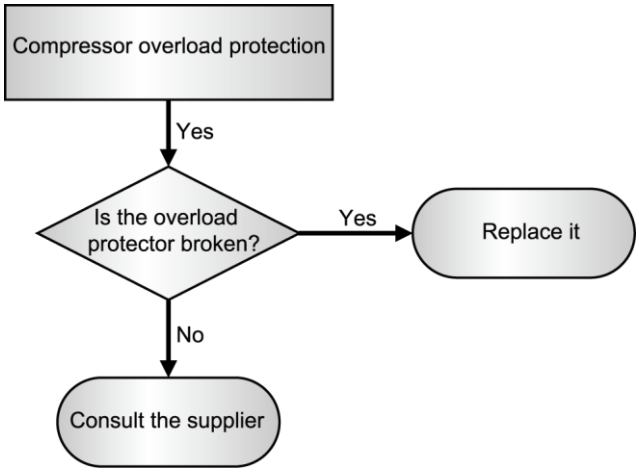
（2）Low pressure protection



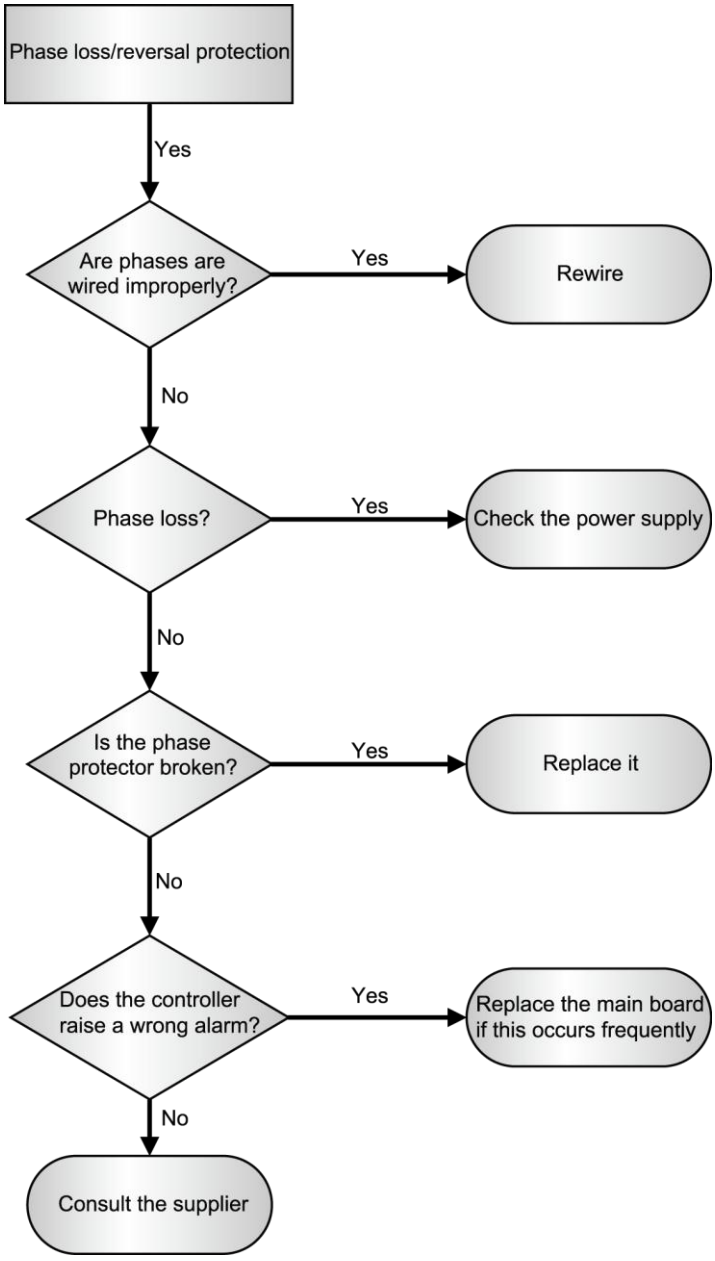
（3）High discharge protection



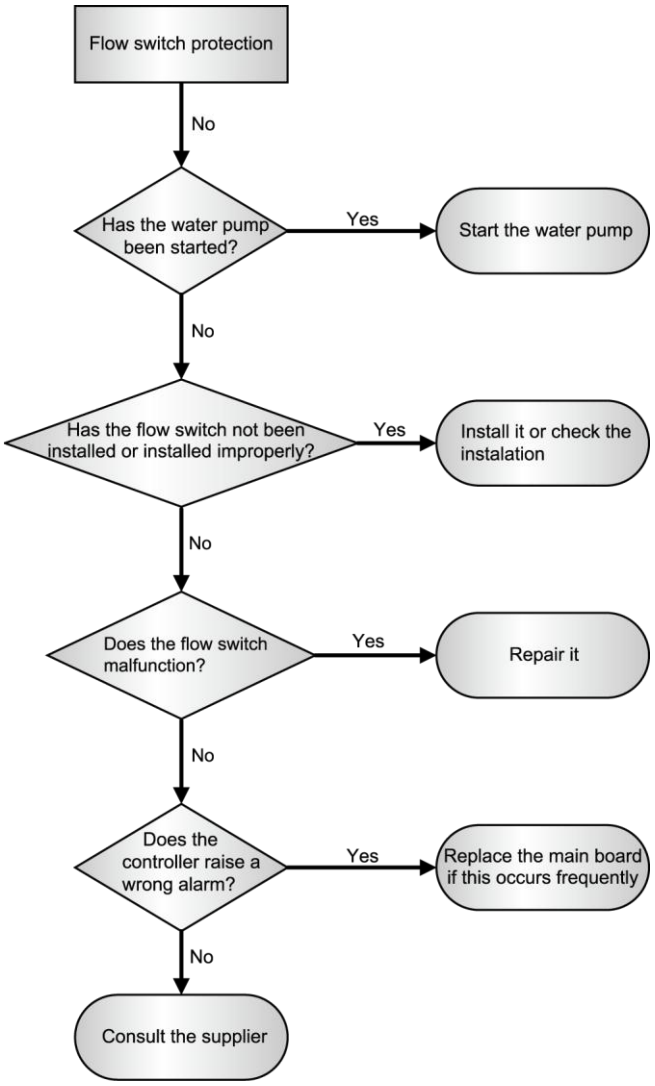
（4）Compressor over-load protection



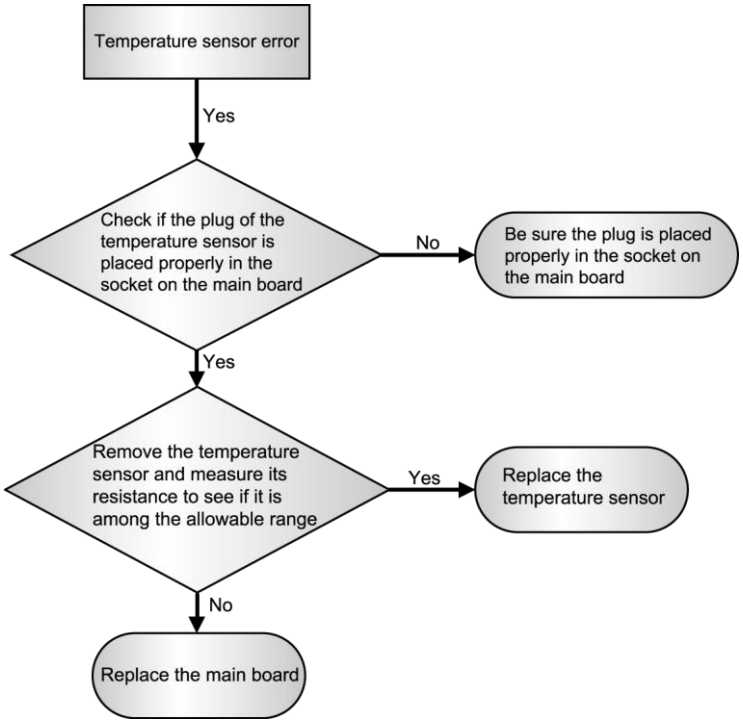
（5）Phase protection



（6）Water flow switch protection



（7）Temperature sensor error



3. Maintenance

3.1 Significant of Maintenance

The unit has undergone a series of strict tests prior to delivery to ensure qualified performance, however, in order to keep reliable performance and extend its service life, the unit should be maintained routinely and periodically by the qualified servicemen.

3.2 Maintenance Items

3.2.1 Routine Maintenance Items

Routine Maintenance Items
Is there any unusual noise and vibration?
Is there any unusual noise and vibration for the compressor in operation? Is there any unusual smell?
Do the operating pressure, voltage and current keep normal? If not, figure out the cause and then eliminate it?
Are all temperature sensors and pressure transducers installed securely?

3.2.2 Periodic Maintenance Items

Periodic Maintenance Items
Is any wiring loosened and insulated securely?
Does any electric element work reliably? If not, change it timely.
Does any throttling valve and control valve leaks? Can any valve be opened or closed flexibly? Is any filter clogged?
Is the temperature set point proper?
Is there a large amount of condensate at the chilled water pipe or the condensate pipe? Is insulation layer damaged?

3.2.3 Periodic Cleaning

（1）Requirements on Water Quality and Cleaning

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.

Requirements on Water Quality				
Item	Chilled Watere		Trend	
	Circulating Water (<20℃)	Supply Water	Corrosion	Scalelike Sediment
PH	6.5～8.0	6.5～8.0	○	○
Conductivity	<200uV/cm(25℃)	<200uV/cm(25℃)		
Cl^-	<50ppm	<50ppm	○	
SO_4^{2-}	<50ppm	<50ppm	○	
Fe	<1ppm	<0.3ppm	○	○
Alkali ion	<50ppm	<50ppm		
Hardness	<50ppm	<50ppm		○
S^{2+}	/	/		

$NH4^+$	/	/		
Si	<30ppm	<30ppm		○
Na^+	/	/		

Note: “○” in the table above indicates the cause for corrosion and scalelike sediment.

Even though water quality is under strict control, calcium oxide or other minerals 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.

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

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

1) Preparation of Materials and Tools

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

2) Cleaning Instructions

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

ii. add the scale remover to the water tank and the scale remover.

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

iv. 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 d and e.

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) Be sure that the power supply is cut off when cleaning the shell and tube.

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

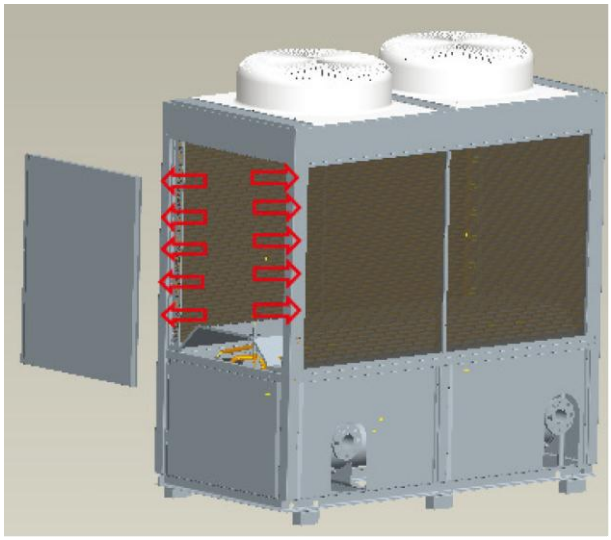
c) the serviceman with injuries on the hand is not allowed to take this task.

（2）Inspection and Cleaning of the Finned Heat Exchanger

In order to keep fins work efficiently, be sure there are no leaves, cotton wool, insects, and other contaminants on the outer layer of fins, or they would lead to more energy consumption and high discharge pressure. Generally, fins should be cleaned after the unit has run for 6-12 month, or more frequently when the environment is polluted more severely.

1) Cut off the power supply.

2) Clean with high-pressure air fins against the direction of the inlet air, or clean with high-pressure water fins at the direction upright with that of the fins but care must be taken to control the water pressure to prevent the fins from being pulled down and protect each electric element. If fins stick with oily matters, clean fins with neutral detergent solution.



Drawing for the Cleaning Direction of the Finned Heat Exchanger

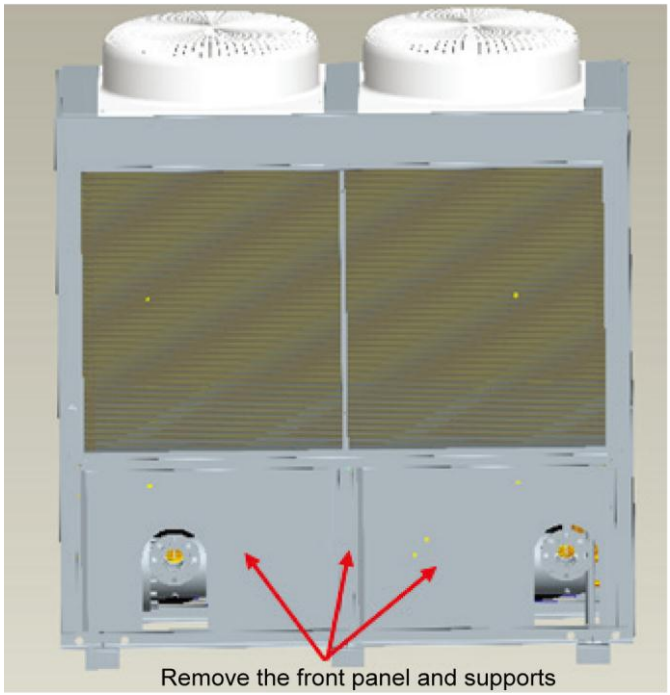
3) The vacuum cleaner and nylon brush also can be used to remove dust and foreign matters on the surface of the heat exchanger.

3.3 Freeze Protection in Winter

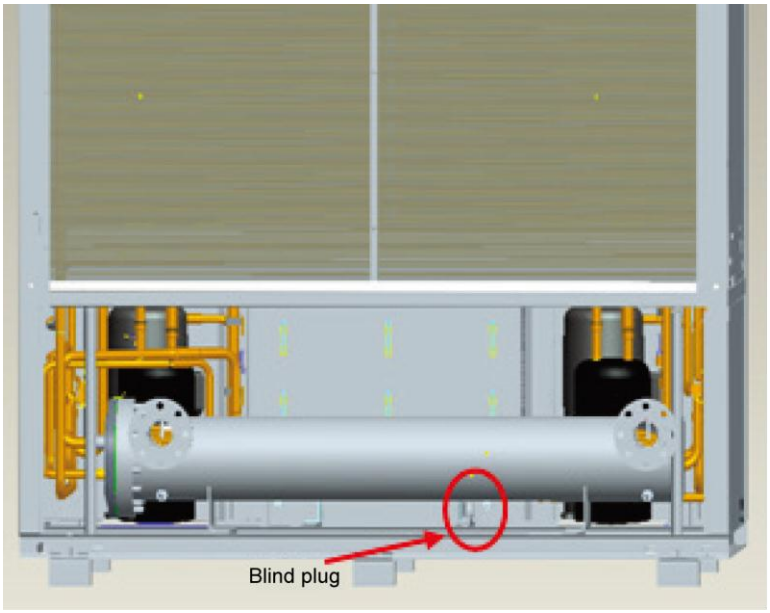
When the unit is not going to be used for a long time, clean and dry the internal and external surfaces of the unit, and then it would be better to wrap it. Under the subzero climate, the unused unit should be drained completely so that the shell-and-tube evaporator would not be frozen up. Instead, the other way is adding some antifreeze into water to keep the water temperature no less than 0℃.

See the following steps for how to drain water out.

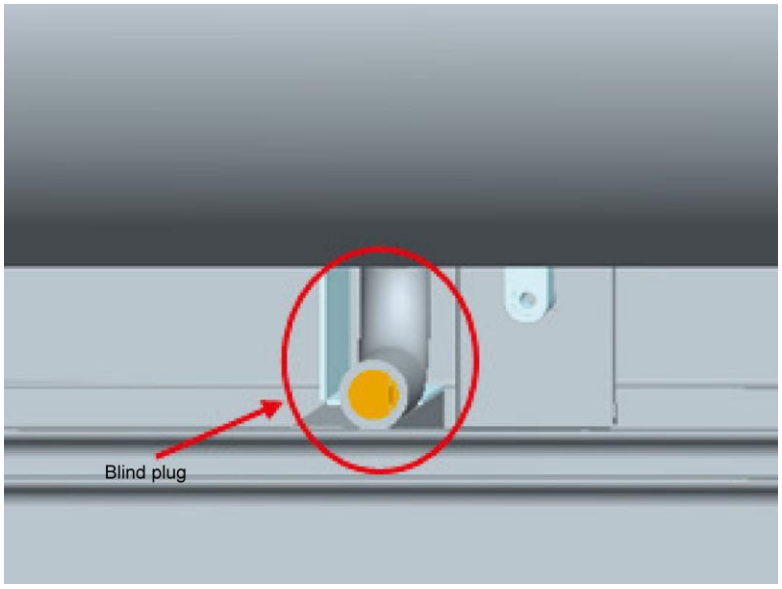
（1） loosen screws on the front panel and then remove the front panel.



（2） Draw out the blind plug counter clockwise to let the chilled water flow out freely until no water stays in. After that, place the blind plug back. (Note: put the container for foul water beneath the drain pipe to prevent foul water from polluting the site).

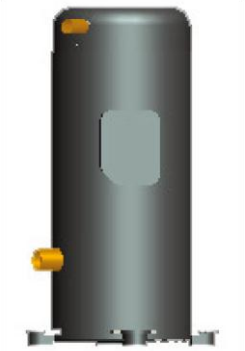
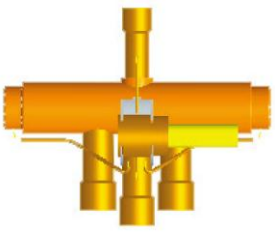


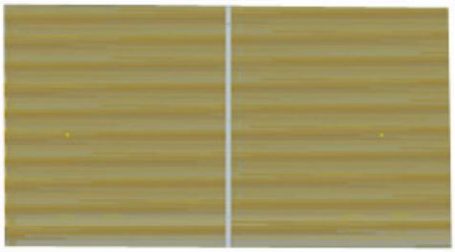
Note: always keep the drain outlet and the exhaust valve open in order to drain the water system completely.



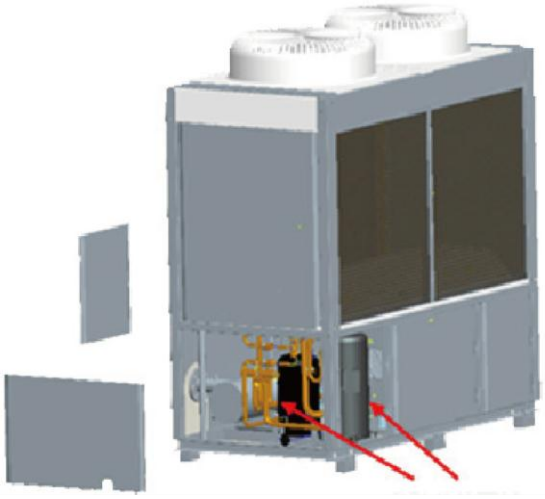
3.4 Main Parts

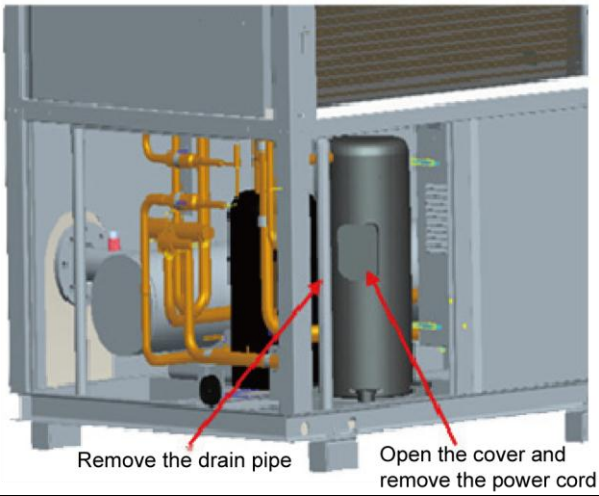
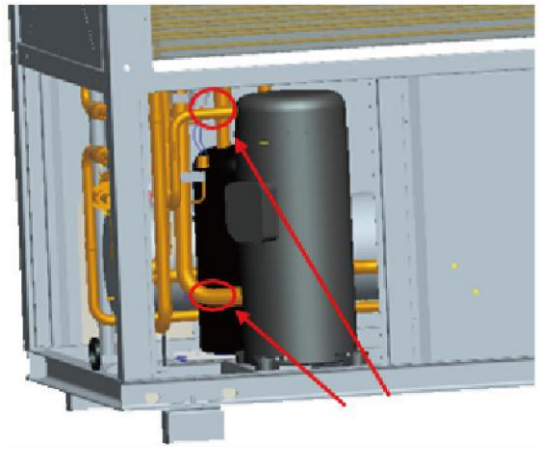
3.4.1 Introduction to Main Parts

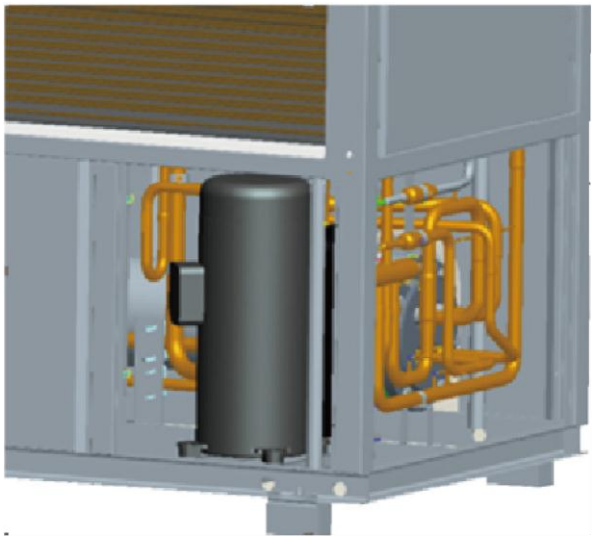
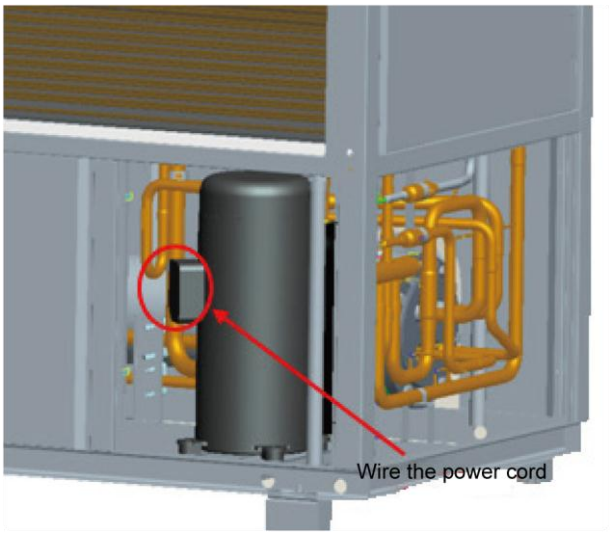
Appearance	Name	Function
	Compressor	It drives the refrigerant cycle and turns the low-temperature, low pressure refrigerant vapor into high-temperature, high-pressure vapor.
	Accumulator	It is used to separate oil and refrigerant liquid from the refrigerant vapor.
	4-way Valve	It is used to shift the direction of the refrigerant flow to realize either cooling or heating.

	Shell-and-tube heat exchanger	In the cooling mode, it is used to absorb heat and evaporate the liquid refrigerant In the heating mode, it is used to release heat and condense the refrigerant vapor.
	Fintube heat exchanger	In the cooling mode, it is used to absorb heat and evaporate the liquid refrigerant In the heating mode, it is used to release heat and condense the refrigerant vapor.
	Electronic expansion valve	It is used to regulate the flow rate of the refrigerant to make it perfectly match with the load in need.

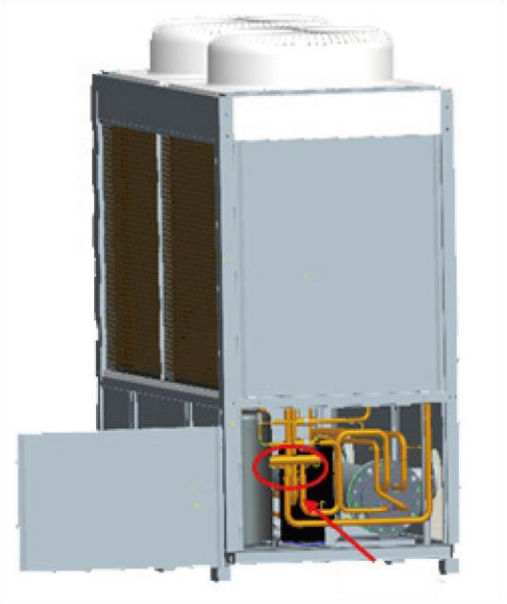
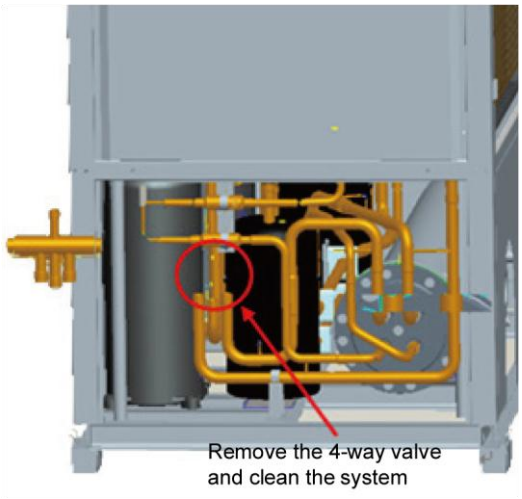
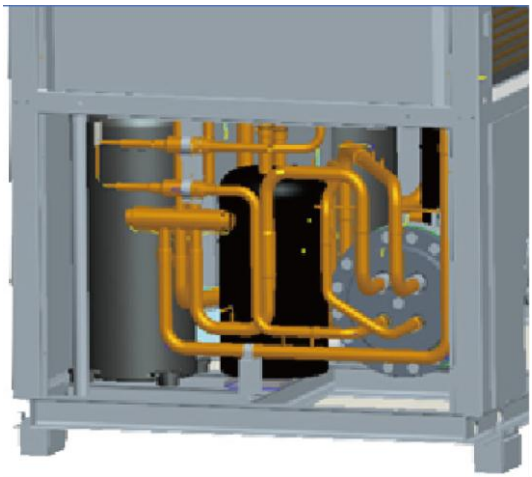
3.4.2 Removal and Installation of Main Parts

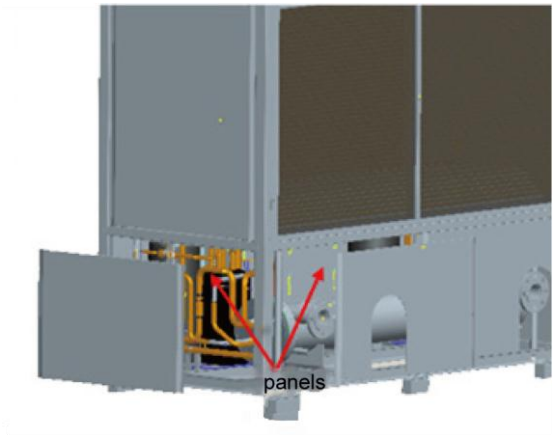
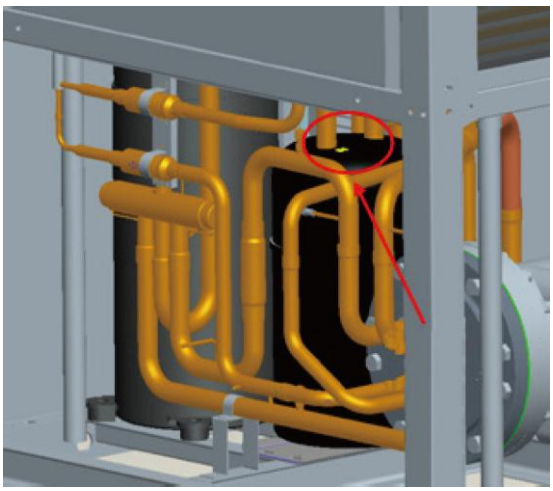
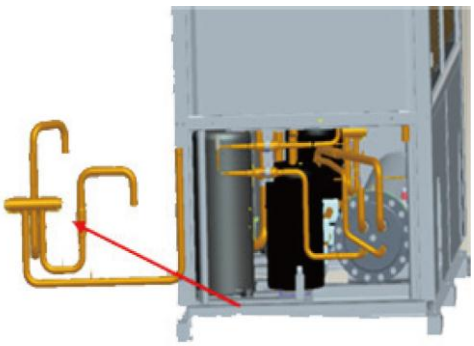
Compressor (These steps listed below are applicable to the dual-system unit. For the four-system unit, please first remove the electric boxes of two compressors in between and then follow the steps below.)		
Note: Be sure there is no refrigerant in the pipeline system and the power supply is cut off.		
Steps	Graphic Reprentation	Instructions
1. Remove the panel		Loosen screws around the panel with a screwdriver. Remove the panel. Collect the screws in case of loss. Place the panel in the right place to avoid inadvertent damage.

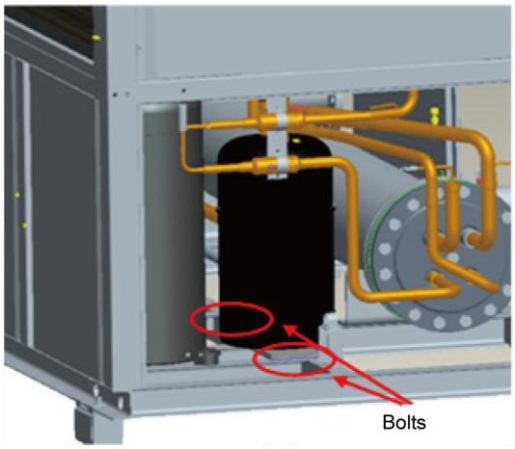
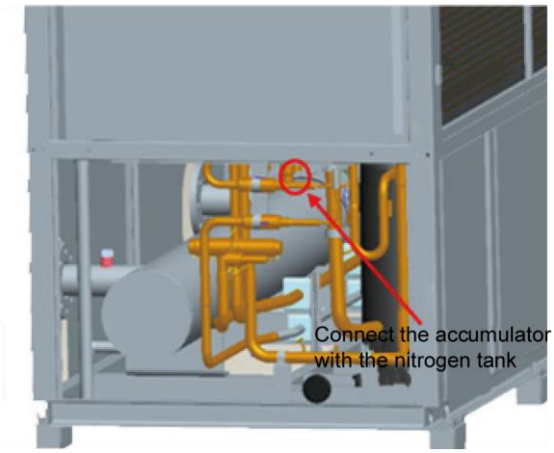
2. Remove the power cord and drain pipe		Loosen screws for the power cord with a screwdriver. Draw out the power cord. Remove the crankcase heater, if applicable. Remove the drain pipe. Note: when removing the power cord, mark the color of the power cord and the code of the wring terminal to avoid misconnection.
3. Separate the compressor from the pipeline system		Unbraze the brazing spots of the pipeline as quick as possible. Minimize damage on the compressor for further analysis.
4. Loose screws at the base of the compressor		Remove screws with an adjustable wrench or a socket wrench. Collect screws in case of loss.

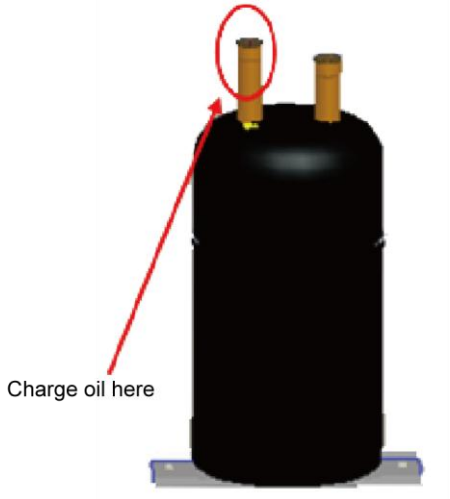
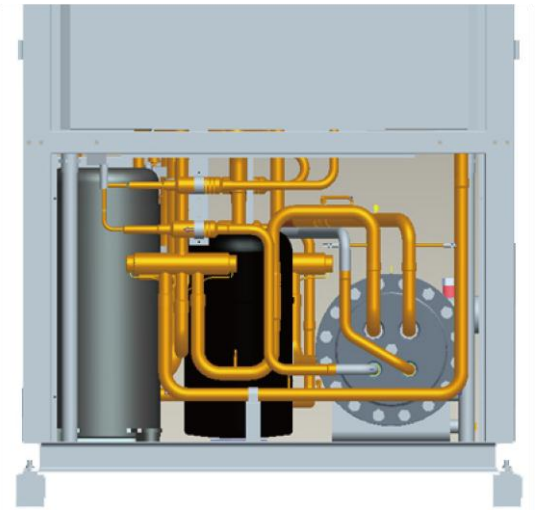
5. Replace the compressor		Remove the compressor and do not damage the rubber pad. Package the removed compressor to prevent moisture entering. Place a new compressor at the base. Tighten screws.
6 Connect the pipeline and power cord		Connect the suction and discharge lines to the compressor by brazing. Note that nitrogen shall be charged during brazing. After brazing, use high-pressure nitrogen for leakage test. Energize the unit and manually close the AC contactor of the compressor to let the compressor run for 2~3 seconds. When the compressor runs reversely, sharp sound will generates.

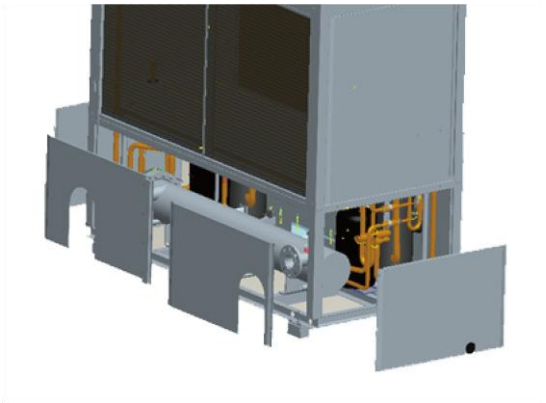
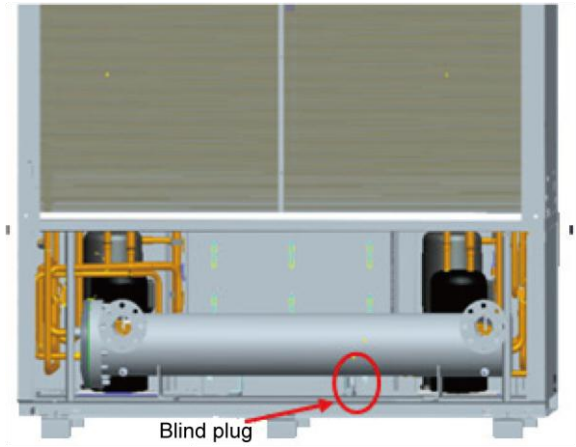
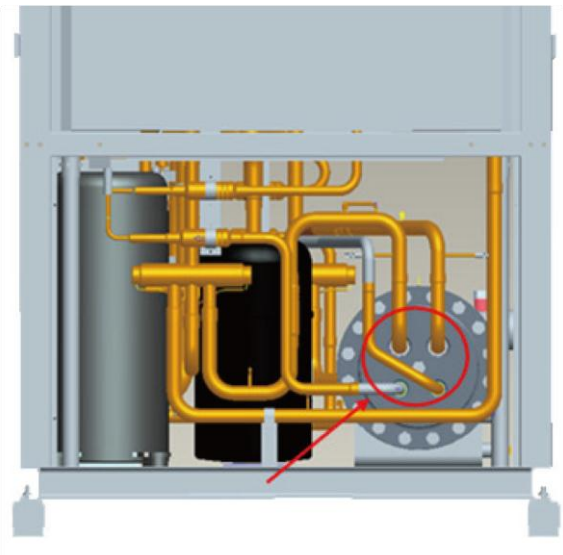
Note: after the compressor is replaced, most amount of oil will still remain in the system, which will not affect the reliability of the newly installed compressor but will increase the running resistance to the rotor and increase electricity consumption. Therefore, a valve should be installed at the lower part of the inlet of the suction line to discharge excessive oil. After installing the valve, start the compressor for ten minutes and then open this valve until all oil flows out completely. Do it twice to guarantee the oil keeps at the normal level.

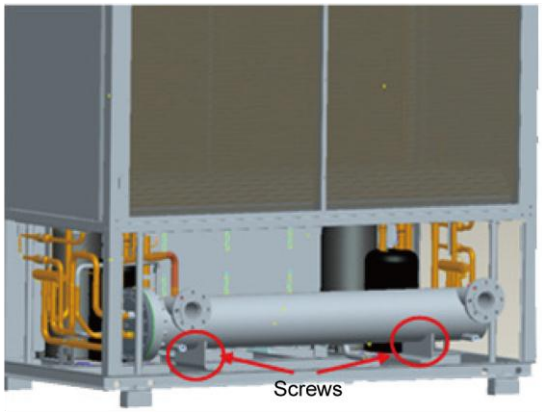
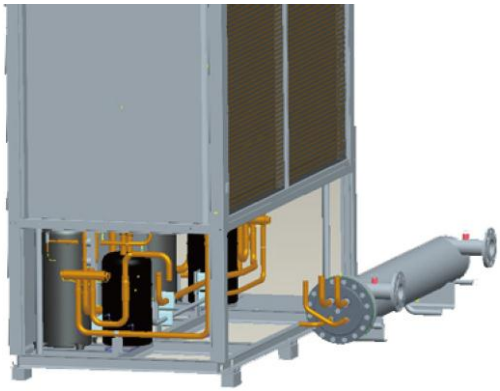
4-way Valve		
Note: Be sure to cut off the power supply and recover the refrigerant firstly		
Steps	Graphic Representation	Instructions
1. Record the installation direction of the 4-way valve		Remember the installation direction of the 4-way valve before removal. Remove the coil. Wrap the 4-way valve prior to unbrazing to prevent it from being damaged and use it for future analysis. Unbraze the 4-way valve.
2. Clean the system, replace the 4-way valve and reconnect the pipeline as before		Replace the 4-way valve with the same model, or that approved by the qualified technician. Wrap the 4-way valve with wet cloth. Reconnect the connection pipe as before. Braze the pipeline. Charge nitroge when unbrazing.
3. Vacuum the system and charge refrigerant again		Vacuum the system until the pressure goes as low as -1.0bar. The refrigerant charge and quality shall comply with the specification on the nameplate.

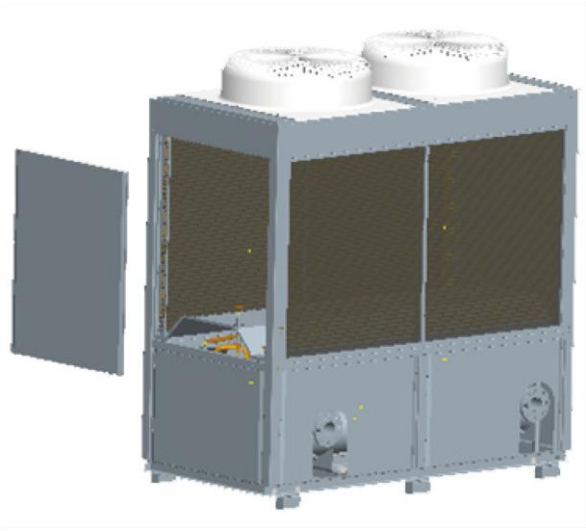
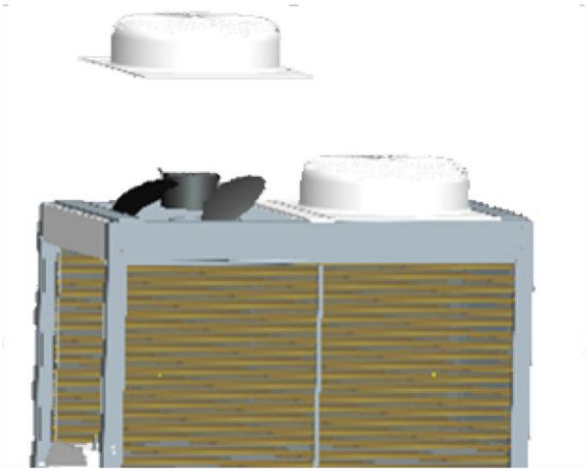
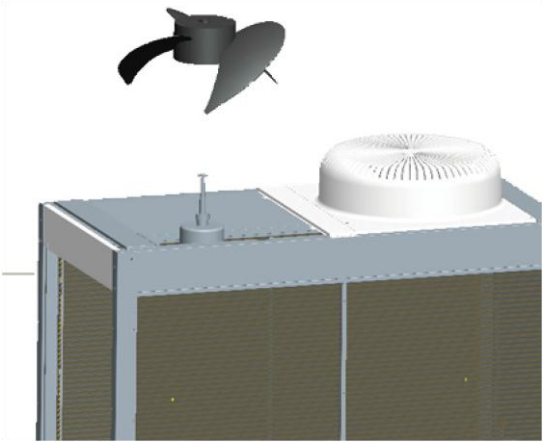
Accumulator		
Note: Be sure to recover the refrigerant, prepare proper devices and tools and keep a good ventilation.		
Steps	Graphic Representation	Instructions
1. Remove the panel as shown in the right figure		Remove the panel as shown in the left figure with a screwdriver.
2. Disconnect the connection pipe of the accumulator		Unbrazer the connection pipe of the accumulator.
3. Remove the 4-way valve assembly if necessary		Unbraze the 4-way valve assembly.

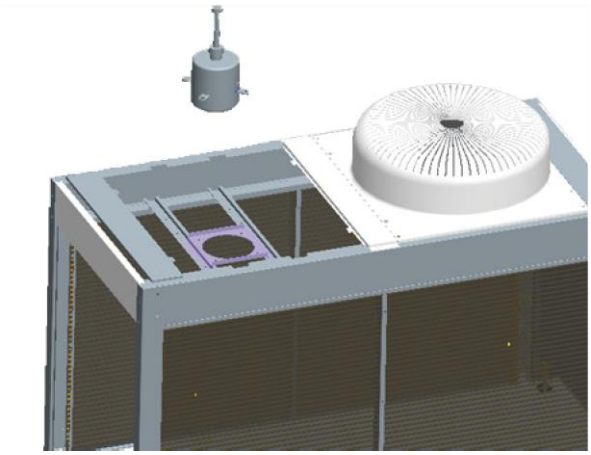
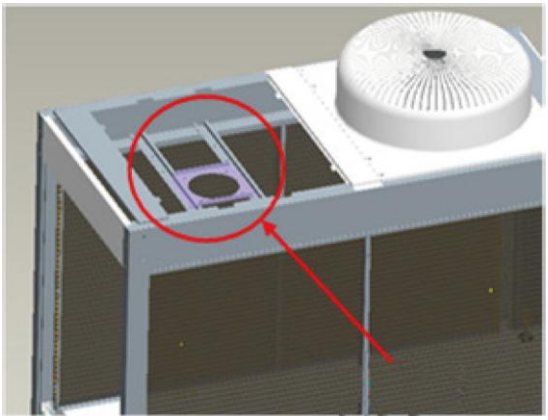
4. Remove the bolts at the base		Remove bolts at the base with a wrench.
5. Remove the accumulator .		Remove the accumulator
6. Purge the system by charging nitrogen		Connect the pipeline of the accumulator with the nitrogen tank and adhesive tape can is allowed to be used for the large-sized pipeline. Purge the system by charging nitrogen.

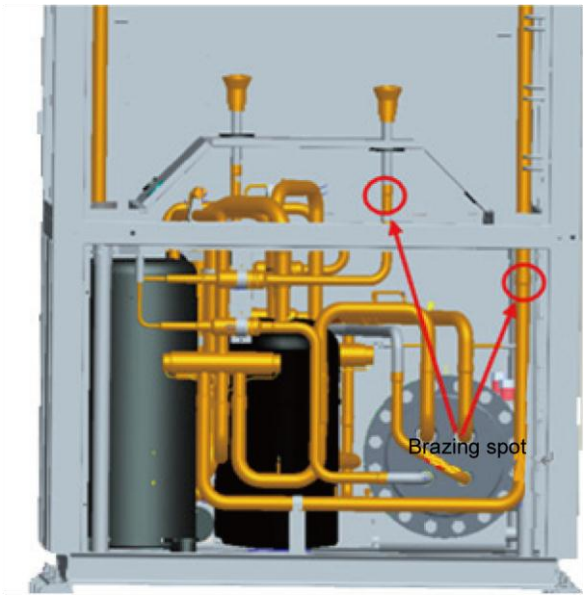
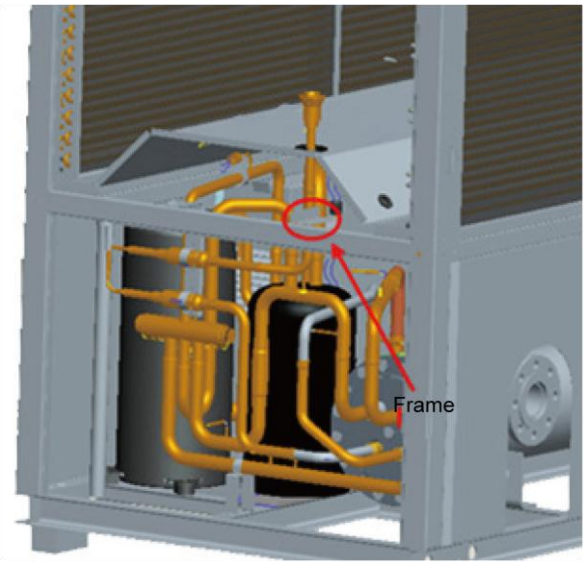
7. Replace it with the one of the same model and same volume.		Be sure the selected vapor liquid separator is of the same model and volume with the replaced and can work normally.
8. Add oil if necessary		Charge oil to the accumulator prior to brazing.
9. Reconnect the connection pipe of the accumulator and vacuum the system and then charge refrigerant again		Charge nitrogen when brazing. Vacuum the system until the pressure goes as low as -1.0bar. The refrigerant charge and quality shall comply with the specification on the nameplate.

Shell-and-tube Heat Exchanger		
Note: Check the water system and be sure the shell-and-tube heat exchanger shall be replaced. And then cut off the power and recover the refrigerant.		
Steps	Graphic Representation	Instructions
1. Remove the panel as shown in the right figure		Remove four panels around the heat exchanger and the frame in front of the blind plug.
2. Loosen the pipeline connectors and remove the panel outside of the heat exchanger		Remove the pipeline Remove the metal sheets located underside with a screwdriver. Loosen the blind plug and drain the water inside the pipeline.
3. Unbraze the pipeline connecting the heat exchanger. (Different heat exchangers vary in structure so it is better to remember the piping location to prevent misconnection		Wrap the cooper pipe with wet cloth. Unbraze the pipelines connecting the heat exchanger.

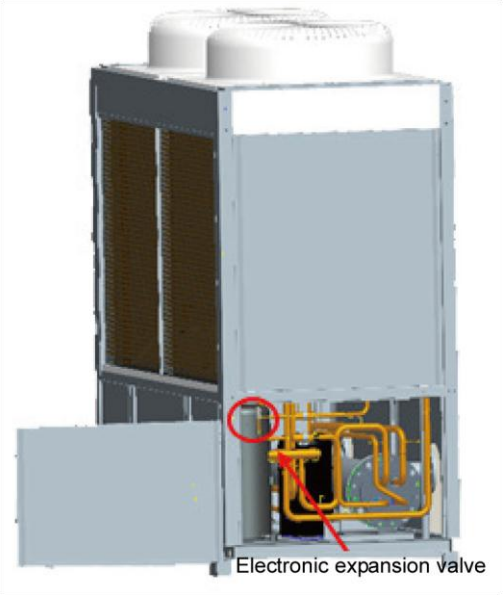
4. Loosen four screws fixing the heat exchanger		Loosen four screws fixing the heat exchanger with a screwdriver.
5. Remove the shell-and-tube heat exchanger		Remove the shell-and-tube heat exchanger.
6. Place a new heat exchanger and connect the pipeline and then vacuum the system and lastly charge refrigerant		Replace the heat exchanger with the same model. Wrap the cooper pipe with wet cloth and braze the pipeline. Vacuum the system until the pressure goes as low as -1.0bar. The refrigerant charge and quality shall comply with the specification on the nameplate. Connect the water pipeline. Put the metal sheets back.

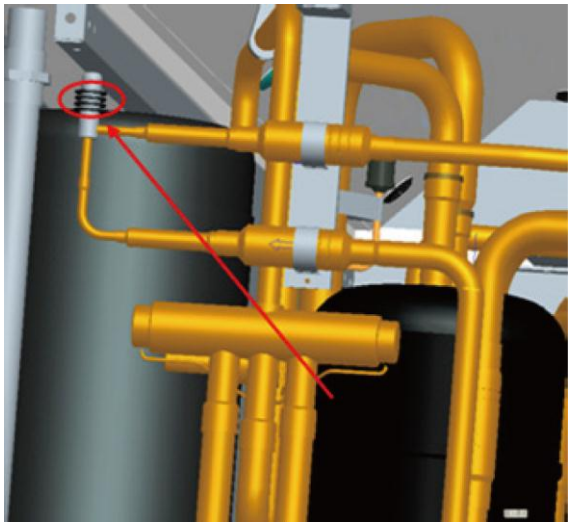
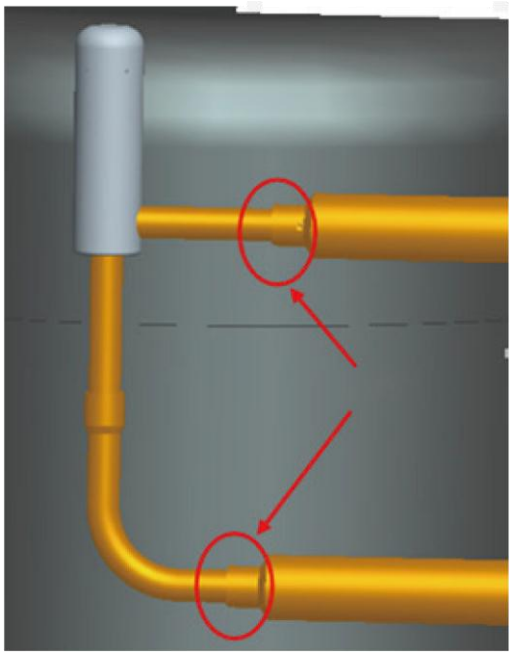
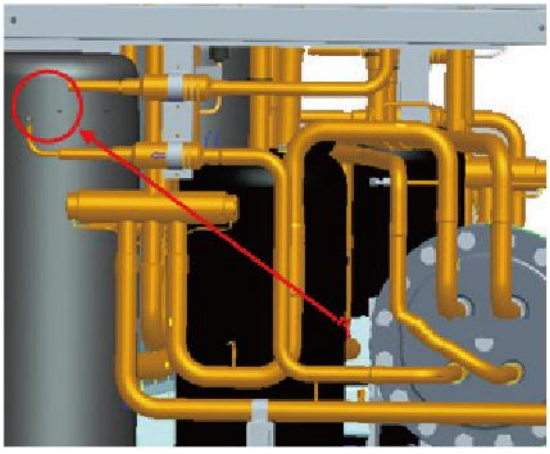
Fan		
Note: Be sure to cut off the power supply firstly		
Steps	Graphic Representation	nstructions
1. Remove the panel as shown in the right figure		Remove the panel as shown in the left figure.
2. Remove the guard cover		Remove the guard cover with a wrench.
3. Remove the fan blades		Remove the fan blades with a screwdriver.

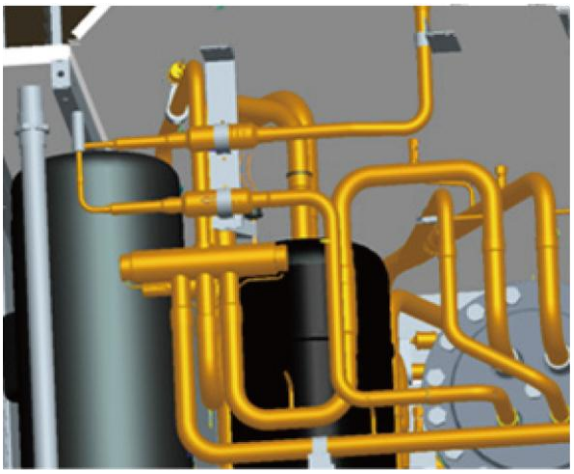
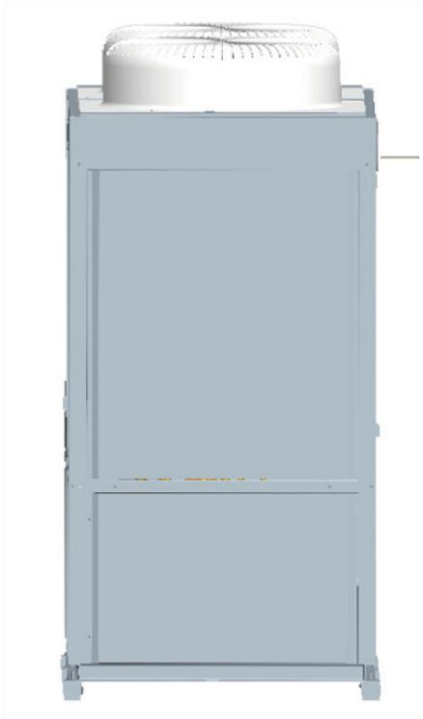
4. Remove the motor		Remove the motor with a wrench.
5. Remove the frame		Remove the frame.
6. Reinstall the fan assembly		Reinstallation sequence: 1. frame; 2. motor; 3. fan blades; 4. guard cover; 5. panel.

Fintube Heat Exchanger		
Note: Be sure to cut off the power supply and recover the refrigerant firstly.		
Steps	Graphic Representation	Instructions
1. Remove the panel as shown the right figure		Recover refrierant completly. Cut off the power supply. Remove the fan assembly and draw out the power cord of the fan motor and then remove the metal sheets outside the condenser. Note: remember the wiring sequence of the fan motor.
2. Unbraze the inlet/outlet pipeline of the heat exchanger. Do not damage the fins and metal sheets during unbrazing		Unbraze the pipeline of the condenser.
3. Remove the frame of the header and screws and bolts on the heat exchanger		Remove the frame of the header with a wrench. Remove screws and bolts on the heat exchanger.

4. Place a new heat exchanger and vacuum the system and then charge refrigerant and lastly put the fan and metal sheets back		Install a new heat exchanger. Braze the pipeline. Vacuum the system until the pressure is as low as -1.0bar. The refrigerant charge and quality shall comply with the specification on the nameplate. Take care to the wiring sequence when rewiring the fan motor.

Electornic Expansion Valve		
Note: check the refrigeration system and be sure the electronic expansion valve shall be replaced, and then cut off the power supply and recover the refrigerant.		
Steps	Graphic Representation	Instructions
1. Recover the refrigerant and remove the panel		Cut off the power supply Recover the refrigerant. Remove the panel.

2. Remove the electronic expansion valve coil.		Wrap the valve with wet close to prevent the slide block from being burnt down and never the let water flow into the pipeline.
3 Remove the connection pipe of the electronic expansion valve		Unbraze the electronic expansion valve Charge nitrogen during brazing. Take care to prevent surrounding item from being burnt down owing to high temperature during brazing.
4. Remove the electronic expansion valve		Remove the electronic expansion valve.

5. Place a new electronic expansion valve		Braze each pipeline. Charge nitrogen during brazing. Take care to prevent surrounding item from being burnt down owing to high temperature during brazing.
6. Reinstall the electronic expansion valve coil and vacuum the system and then charge refrigerant and lastly put the panel back		The coil shall be matched with the valve body exactly. The degree of vacuum shall be kept as low as -1.0 bar. The refrigerant charge and quality shall comply with the specification on the nameplate. After replace the electronic expansion valve, energize the unit again. Reinstall the panel.

4. Routine Maintenance

Routine maintenance shall be performed by the skilled and qualified servicemen.

（1） Refrigerant Leakage

Suds is usually used for the leakage test by applying it at the spot (soldering spots, valve pistols, connectors) where leakage is probably to occur. During the test, if soap bubbles pop up, it indicates leakage exists and repair is required. If suds fails to work, a electronic leakage detectors is a alternative. Refrigerant charge can be checked by measuring the suction and discharge pressure. Leakage test should be performed wherever leakage occurs or some components of the refrigeration system are replaced.

There are two difference conditions for charging refrigeration stated as below.

（1） Complete charging

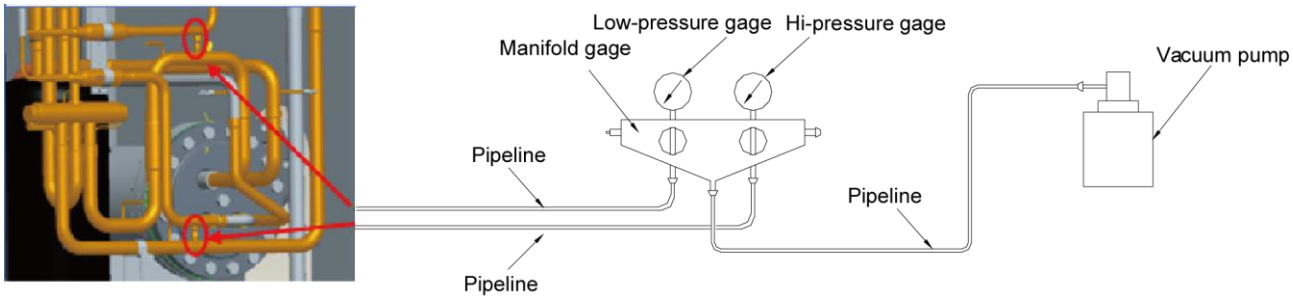
In this case, take a leakage test by charging hi-pressure nitrogen (15～20kg) or refrigerant into the system. If soldering is required, note that gas inside the system must be expelled firstly. The whole system must be dried and vacuumed prior to charging.

a) Connect the manifold gage.

b) Vacuum the system with a vacuum pump.

Step 1: Expel the hi-pressure nitrogen for leakage test.

Step 2: Connect the pipeline at both the high and low pressure sides of the manifold gage as shown in the figure below. Note that vacuuming shall be taken at both sides. The degree of vacuum will refer to the reading of the manometer at the low side.



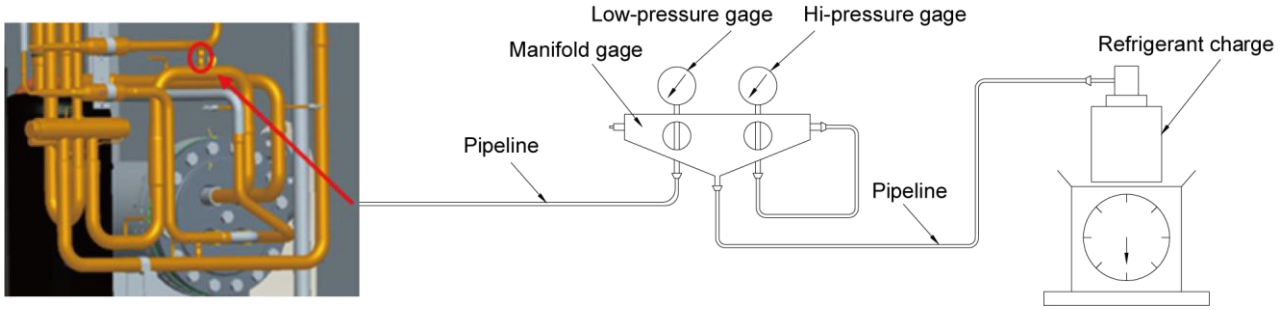
Step 3: Open the valves at both the high-pressure and low-pressure sides and then start the vacuum pump until the gage reading is below -1bar. After that, let the vacuum pump lasts for another 0.5～1.0 hour.

Step 4: Close the valves and stop the vacuum pump. Note that only the valves have been closed can the vacuum pump be stopped, otherwise air is possible to go into the system again.

Step 5: Take the leakage test. Be sure the vacuumed system keeps a pressure no higher than 80Pa and keeps little pressure rise in half an hour.

c) c. Refrigerant charging starts after the degree of vacuum reaches the expected range and lasts for 30 minutes. The amount of refrigerant charge shall comply with that specified on the nameplate or product data sheet.

（2） Adding



Refrigerant charge is determined through stringent tests, as excess or shortage of refrigerant would cause the compressor to run improperly. Thus, the refrigerant charge shall be consistent with that specified on the nameplate. If refrigerant charge is indeed insufficient, follow the steps below for adding.

Step 1: Weigh the refrigerant tank with an electronic scale and connect the refrigerant tank with the pressure gage through the pipeline.

Step 2: Expel the air inside the pipeline. Firstly half open the shutoff valve of the refrigerant tank and then loosen the connector connecting the pressure gage to expel the air until the connector hisses for five seconds and then tighten the connector.

Step 3: Return the electric scale to zero by energizing it again.

Step 4: Open all valves between the refrigerant tank and the unit to charge refrigerant as per the amount specified on the nameplate. Excessive refrigerant would dilute oil while insufficient refrigerant would lower the refrigeration capability and result in poor lubrication and high discharge temperature etc. Note that only refrigerant vapor can be charged into the system at the low-pressure side when the unit is in operation. However, it is highly recommended to charge refrigerant at the hi-pressure side when the unit is shut down, otherwise it would cause slugging during startup.

（2） Air Purge

Prior to refrigerant charging, it is imperative to expel air inside the system and the system must be vacuumed.

a) Connect the manifold gage

b) Vacuum the system with a vacuum pump.

c) harge refrigerant at the low-pressure side as per the amount specified on the nameplate or product data sheet when the degree of vacuum approaches the expected range.

d) The refrigerant charge will be affected by the ambient temperature. When the charge is under the required amount, it is allowed to add refrigerant vapor after starting the water pump and the unit.

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