EN

SERVICE MANUAL

01 | 07-08-2023

S-THERM YUKON

COMMERCIAL HEAT PUMPS

SMHM-650B-3
SMHM-650BH-3
SMHM-750B-3
SMHM-750BH-3
SMHM-1100B-3
SMHM-1100BH-3
SMHM-1400B-3
SMHM-1400BH-3

S-THERM | sinclair HEAT PUMPS

„ORIGINAL INSTRUCTIONS“

IMPORTANT NOTE:

Read this manual carefully before installing or operating your new heat pump.
Make sure to save this manual for future reference.

EN For downloading manual for this product, please enter the model name at this link:

CZ Pro stažení manuálu k tomuto produktu zadejte modelové označení do následujícího odkazu:

SK Pre stiahnutie manuálu k tomuto produktu zadajte modelové označenie do nasledujúceho odkazu:

DE Um das Handbuch für dieses Produkt herunterzuladen, geben Sie bitte den Modellnamen für diesen Link ein:

HR Za preuzimanje priručnika za ovaj proizvod unesite naziv modela na ovu vezu:

HU Termék kézikönyvének letöltéséhez írja be a modell megnevezését az alábbi linkre:

SL Za prenos navodil za uporabo tega izdelka, vnesite ime modela na tej povezavi:

RU Чтобы загрузить руководство для этого продукта, введите обозначение модели по следующей ссылке:

IT Per scaricare il manuale di questo prodotto, inserisci il nome del modello a questo link:

ES Para descargar el manual de este producto, ingrese la designación del modelo en el siguiente enlace:

CONTENTS

Part 1

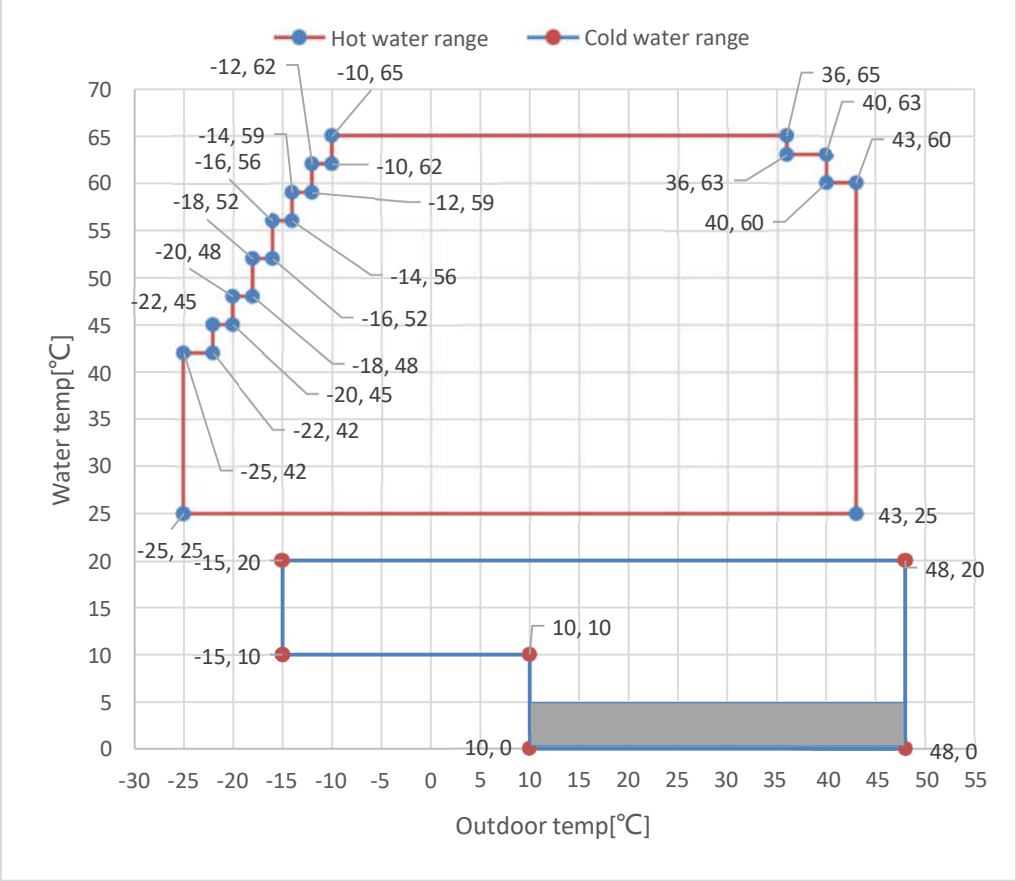
General Information

1 Unit Capacities and External Appearance

Model	SMHM-650B-3/ SMHM-650BH-3 SMHM-750B-3/ SMHM-750BH-3	SMHM-1100B-3/ SMHM-1100BH-3 SMHM-1400B-3/ SMHM-1400BH-3
Power supply	380-415V/3Ph/50Hz	380-415V/3Ph/50Hz
Appearance		

2 Water outlet temperature range

Heating and cooling operating range



Notes:

Outdoor temp：Ambient temperature(℃)

Water temp：Leaving water temperature(℃)

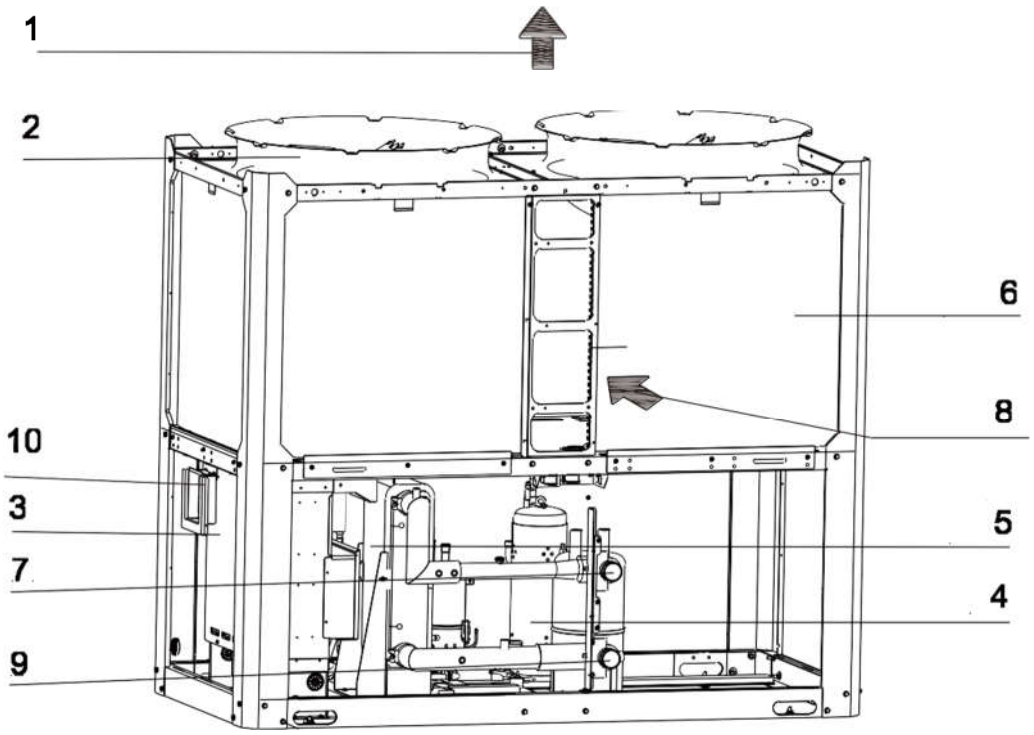
When the set temperature is less than 5℃, antifreeze liquid (concentration above 15%) should be added in the water system, otherwise the unit will be damaged. The DWH temperature of the heat pump can reach 62℃ when it is run alone, and the DWH temperature can reach 70℃ when it is paired with the electric auxiliary heating.

Part 2

Component Layout and Refrigerant Circuits

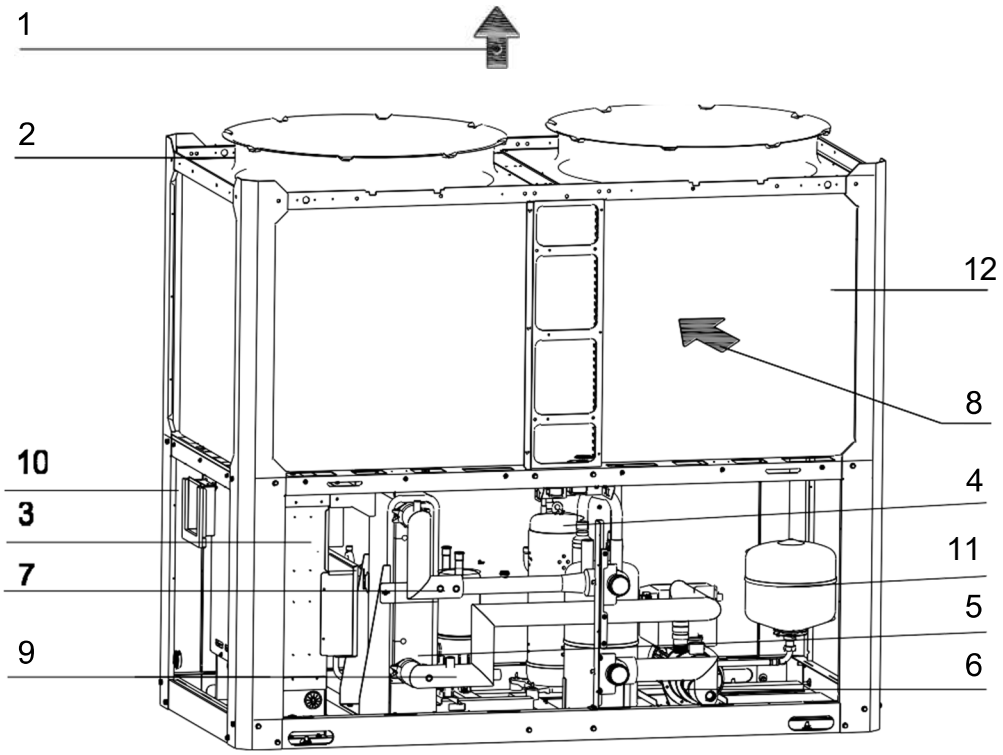
1 Layout of Functional Components

SMHM-650B-3 / SMHM-750B-3



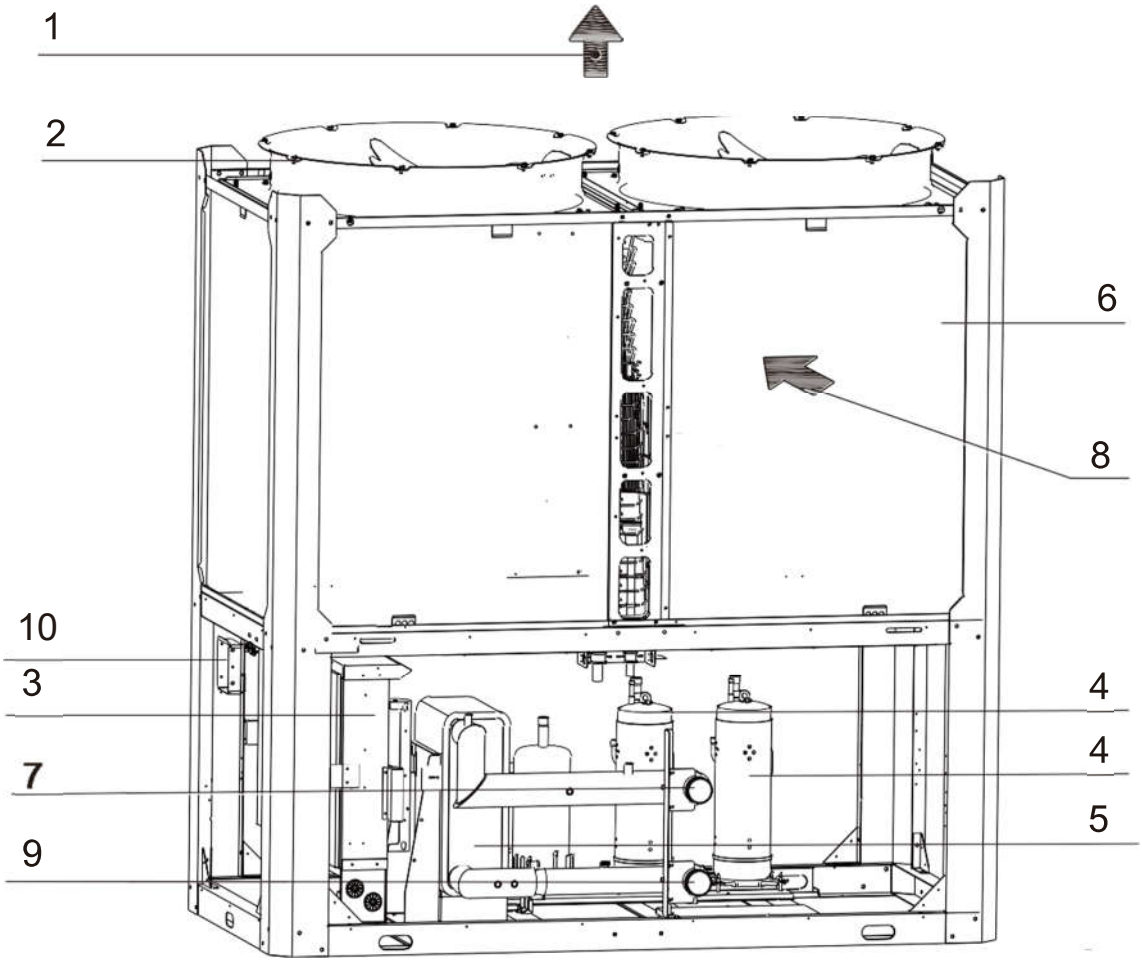
NO.	Component	NO.	Component
1	Air outlet	6	Condenser
2	Top cover	7	Water outlet
3	Electric control box	8	Air inlet
4	Compressor	9	Water inlet
5	Evaporator	10	Wire controller (It can be placed indoors)

SMHM-650BH-3 / SMHM-750BH-3



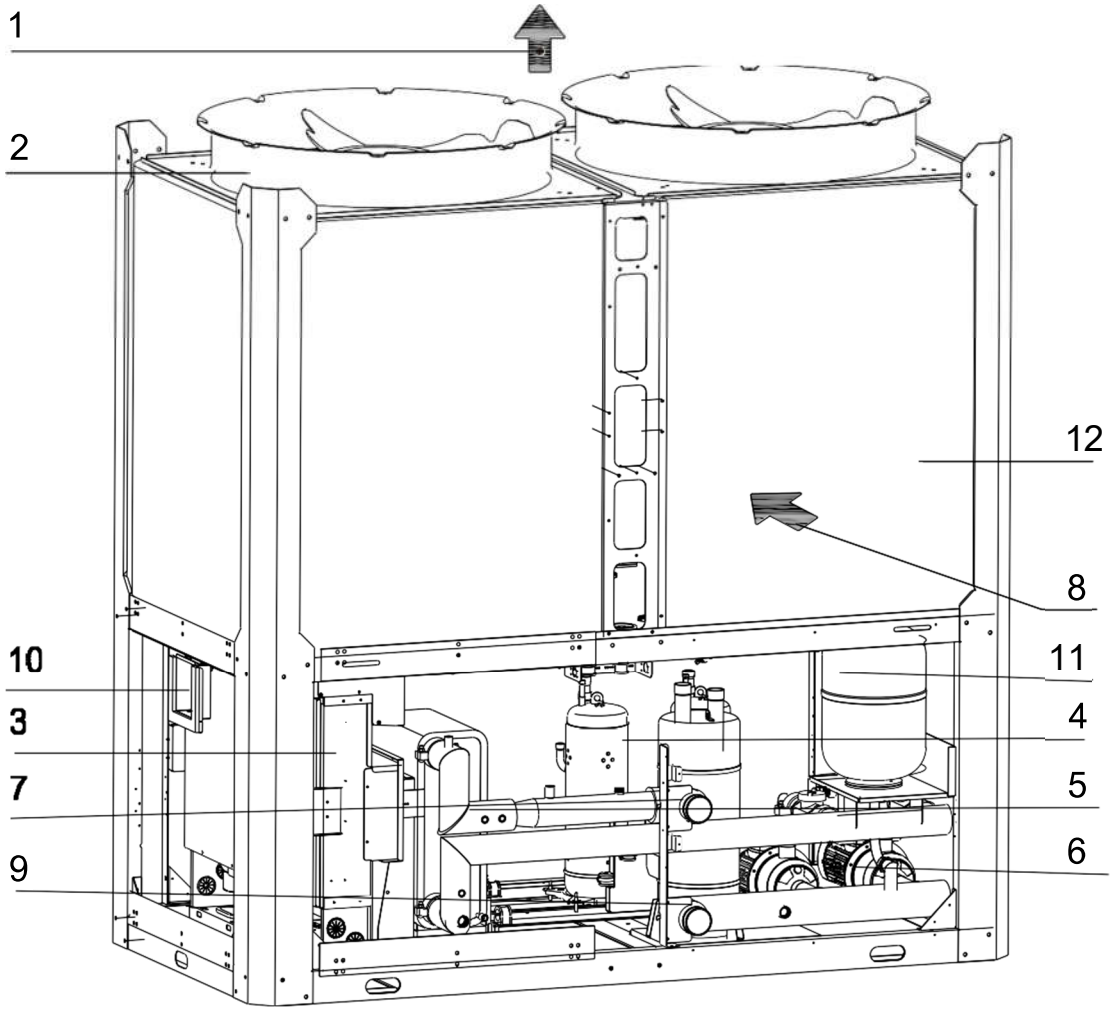
NO.	Component	NO.	Component
1	Air outlet	7	Water outlet
2	Top cover	8	Air inlet
3	Electric control box	9	Water inlet
4	Compressor	10	Wire controller (It can be placed indoors)
5	Evaporator	11	Expansion tank
6	Water pump	12	Condenser

SMHM-1100B-3 / SMHM-1400B-3



NO.	Component	NO.	Component
1	Air outlet	6	Condenser
2	Top cover	7	Water outlet
3	Electric control box	8	Air inlet
4	Compressor	9	Water inlet
5	Evaporator	10	Wire controller (It can be placed indoors)

SMHM-1100BH-3 / SMHM-1400BH-3



NO.	Component	NO.	Component
1	Air outlet	7	Water outlet
2	Top cover	8	Air inlet
3	Electric control box	9	Water inlet
4	Compressor	10	Wire controller (It can be placed indoors)
5	Evaporator	11	Expansion tank
6	Water pump	12	Condenser

2 Piping and Refrigerant Flow Diagrams

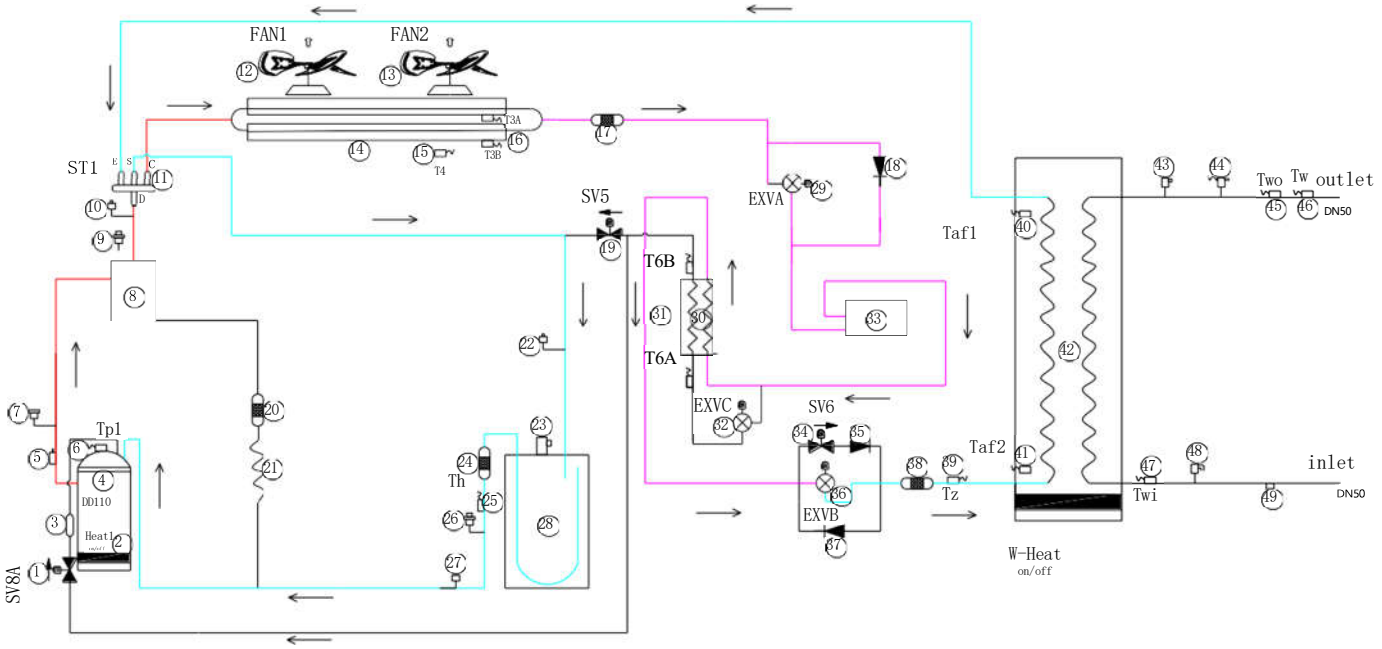
For 65/75 kW

High temperature, high press gas

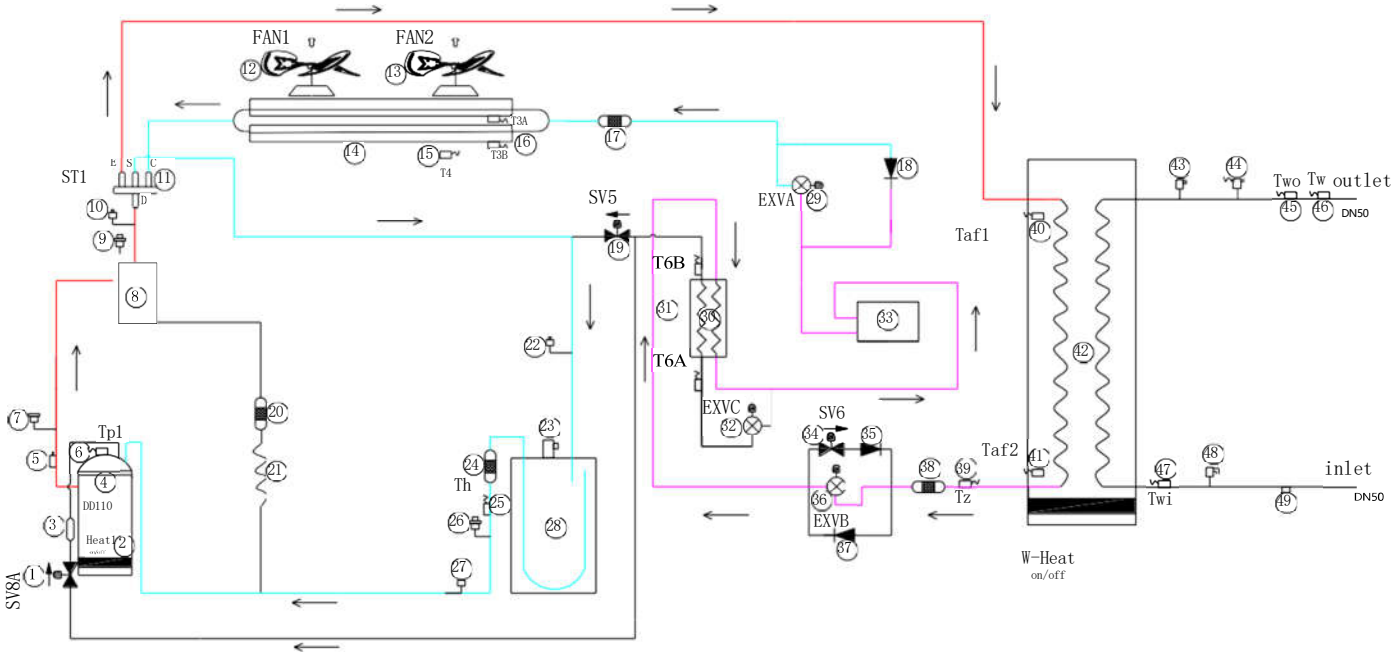
High temperature, high press liquid

Low temperature, low press

Cooling operation



Heating operation



Legend					
No.	Symbol	Description	No.	Symbol	Description
1	SV8	Enhanced vapor injection solenoid valve	26	L-YL	Low pressure sensor
2	CCH	Crankcase heater	27	L-PRO	Low pressure switch
3	/	Muffler	28	GL/S	Vapor-liquid separator
4	BP	DC inverter compressor	29	EXVA	Heating Electronic expansion valve
5	Tp-pro	Discharge temperature switch 1	30	/	Plate heat exchanger
6	Tp	Discharge temperature sensor 1	31	T6A /T6B	Heat exchanger refrigerant inlet and outlet temperature sensor T6A and T6B
7	H-SW	High pressure switch	32	EXVC	EVI Electronic expansion valve
8	O/S	Oil separator	33	/	Refrigerant radiator
9	H-YL	High pressure sensor	34	SV6	Liquid side bypass solenoid valve
10	/	Pin valve (Discharge side)	35	/	One-way valve
11	ST1	4-way-valve	36	EXVB	Cooling Electronic expansion valve
12	FAN1	DC fan 1	37	/	One-way valve
13	FAN2	DC fan 2	38	/	Filter
14	/	fin type heat exchanger	39	Tz	Temperature sensor
15	T4	Ambient temperature sensor	40	Taf1	Antifreeze temperature sensor 1
16	T3A/T3B	Temperature sensor T3A and T3B	41	Taf2	Antifreeze temperature sensor 2
17	/	Filter	42	/	Plate heat exchanger
18	/	One-way valve	43	/	Discharge valve
19	SV5	Solenoid valve	44	water SW	Target flow switch
20	/	Filter	45	Two	Unit water outlet temperature sensor
21	/	Capillary	46	Tw	Total water outlet temperature sensor
22	/	Pin valve (Suction side)	47	Twi	Unit water inlet temperature sensor
23	/	Safety valve	48	/	Safety valve
24	/	Filter	49	/	Water drain
25	Th	Suction temperature sensor	/	EVA-HEAT	Plate heat exchanger electric heating belt

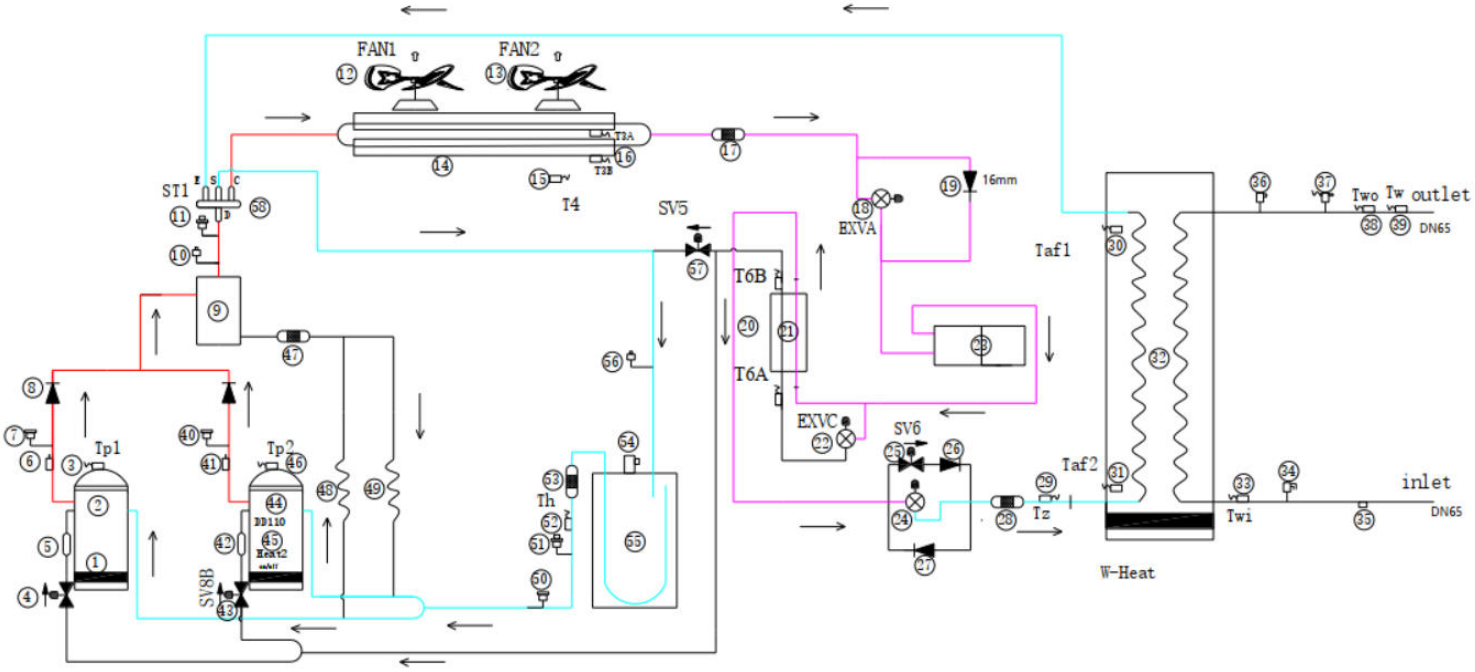
For 110/140 kW

High temperature, high press gas

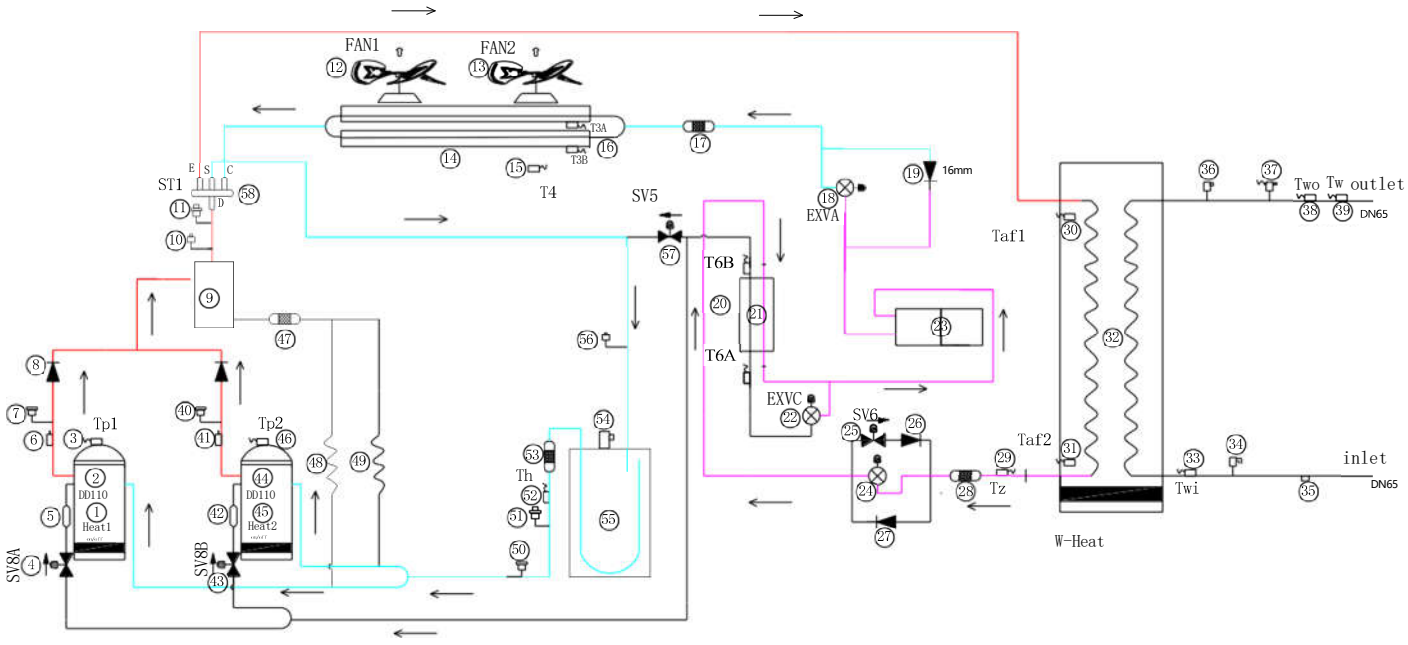
High temperature, high press liquid

Low temperature, low press

Cooling operation



Heating operation



Legend					
No.	Symbol	Description	No.	Symbol	Description
1	CCH	Crankcase heater	30	Taf1	Antifreeze temperature sensor 1
2	BP	DC inverter compressor	31	Taf2	Antifreeze temperature sensor 2
3	Tp	Discharge temperature sensor 1	32	/	Plate heat exchanger
4	SV8A	Enhanced vapor injection solenoid valve	33	T3A/B	Temperature sensor
5	/	Muffler	34	/	Safety valve
6	/	Discharge temperature switch 1	35	/	Water drain
7	H-YL	High pressure switch	36	/	Discharge valve
8	SV6	One-way valve	37	/	Target flow switch
9	O/S	Oil separator	38	/	Temperature sensor
10	/	Pin valve (Discharge side)	39	/	Temperature sensor
11	/	High pressure sensor	40	/	High pressure switch
12	FAN1	DC fan 1	41	/	Discharge temperature switch 1
13	FAN2	DC fan 2	42	/	Muffler
14	/	fin type heat exchanger	43	SV8B	Enhanced vapor injection solenoid valve
15	T4	Ambient temperature sensor	44	/	DC inverter compressor
16	/	Temperature sensor T3A and T3B	45	/	Crankcase heater
17	/	Filter	46	Tp1/Tp2	Discharge temperature sensor 1
18	/	Heating Electronic expansion valve	47	/	Filter
19	SV5	One-way valve	48	/	Capillary
20	/	Temperature sensor T6A and T6B	49	/	Capillary
21	/	Plate exchange economizer	50	LPS	Low pressure switch
22	/	EVI Electronic expansion valve	51	/	Low pressure sensor
23	/	Refrigerant radiator	52	/	Suction temperature sensor
24	/	EVI Electronic expansion valve	53	/	Filter
25	/	Liquid side bypass solenoid valve	54	/	Safety valve
26	SV8A	One-way valve	55	/	Vapor-liquid separator
27	SV8B	One-way valve	56	/	Pin valve (Suction side)
28	/	Filter	57	/	Solenoid valve
29	Tz/7	Temperature sensor	58	ST1	4-way-valve

Key components

Compressor:

Maintains pressure differential between high and low pressure sides of the refrigerant system.

Fan:

Ventilates the air side heat exchanger.

Air side heat exchanger:

In the cooling mode, the heat of the refrigerant from the water side heat exchanger can be released into the air.

In the heating mode, the refrigerant can absorb the heat in the air and provide it to the water side heat exchanger.

Water side heat exchanger:

In cooling mode, the refrigerant can absorb heat from the water and reduce the temperature of the water.

In heating mode, the refrigerant can release heat into the water and increase the temperature of the water.

4-way valve:

Controls refrigerant flow direction. Closed in cooling mode and open in heating mode. When closed, the air side heat exchanger functions as a condenser and water side heat exchanger functions as an evaporator; when open, the air side heat exchanger

functions as an evaporator and water side heat exchanger function as a condenser.

Vapor-liquid separator:

Stores liquid refrigerant to protect the compressor from liquid hammering.

Oil separator:

Separates oil from gas refrigerant pumped out of the compressor and quickly returns it to the compressor. Separation efficiency is up to 99%.

Plate heat exchanger (economizer):

In cooling mode, it can improve super-cooling degree and the super-cooled refrigerant can achieve better heat exchange in indoor side. In heating mode, the refrigerant comes from the plate heat exchanger going to the compressor can enhance the refrigerant enthalpy and improve the heating capacity in low ambient temperature. Refrigerant volume in plate heat exchanger is controlled according to temperature different between plate heat exchanger inlet and outlet.

Electronic expansion valve:

Controls refrigerant flow and reduces refrigerant pressure.

Solenoid valve SV5 (defrost):

Multiple functions for enhancing reliability.

Solenoid valve SV6 (by pass):

Increase refrigerant flow.

Solenoid valve SV8A, SV8B (injection):

Enhance enthalpy and capacity.

High and low pressure switches:

Regulate refrigerant system pressure. When the refrigerant system pressure rises above the upper limit or falls below the lower limit, the high or low pressure switches turn off, stopping the compressor.

Discharge temperature switch:

Protects the compressor from abnormally high temperatures and transient spikes in temperature.

High pressure sensor:

Measures compressor discharge side pressure of refrigerant.

Low pressure sensor:

Measures compressor suction side pressure of refrigerant.

Discharge valve:

Automatically removes air from the water circuit.

Safety valve (water side):

Prevents excessive water pressure by opening at 6bar and discharging water from the water circuit.

Water flow switch:

Detects water flow rate to protect the compressor and water pump in the event of insufficient water flow.

Safety valve (refrigerant side):

Prevents excessive refrigerant pressure by opening at 42bar and discharging refrigerant from the refrigerant system.

Crankcase heater:

Prevents refrigerant from mixing with compressor oil when the compressors are stopped.

Water side heat exchanger electric heater:

Protects the water side heat exchanger from ice formation.

Water flow switch electric heater:

Protects the water from ice formation.

Pin valve (high and low pressure side):

Charges or discharges refrigerant.

Capillary:

Normally return oil to the compressor.

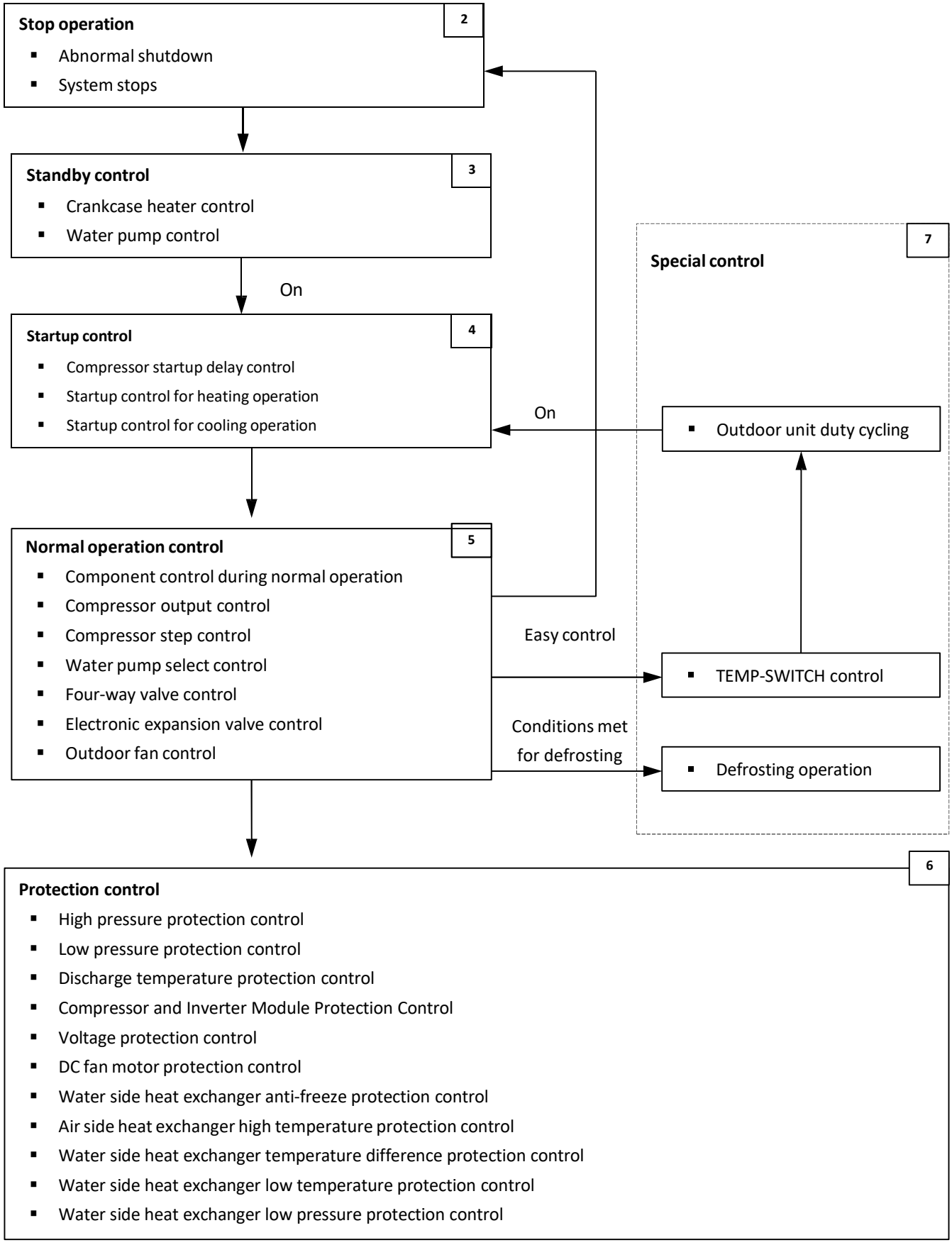
Wired Controller:

Control and query the operation status of the unit.

Part 3

Control

1 General Control Scheme Flowchart



Note:

1. Numbers in the top right-hand corners of boxes indicate the relevant section of text on the following pages.

2 Stop Operation

The stop operation occurs for one of the following reasons:

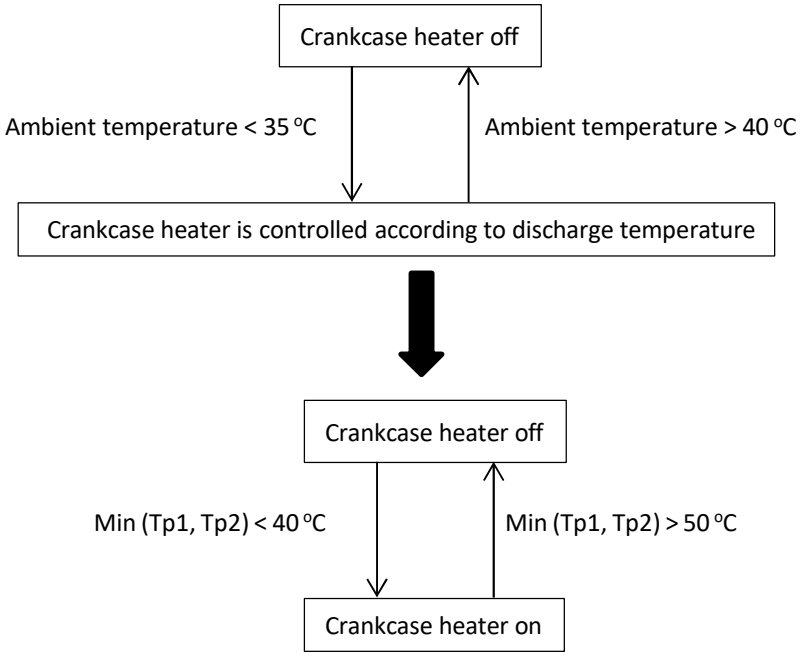
1. Abnormal shutdown: in order to protect the compressors, if an abnormal state occurs the system makes a stop with thermo off operation and an error code is displayed on the outdoor unit's PCB digital displays and on the user interface.
2. The system stops when the set temperature has been reached.

In order to prevent the compressor from starting and stopping frequently and to balance the pressure in the refrigeration system, forcibly stop the compressor for 7 minutes before starting. (Except for special controls such as defrosting).

3 Standby Control

3.1 Crankcase Heater Control

The crankcase heater is used to prevent refrigerant from mixing with compressor oil when the compressors are stopped. The crankcase heater is controlled according to the outdoor ambient temperature and discharge temperature. When the outdoor ambient temperature is above 40°C, the crankcase heater is off; when the outdoor ambient temperature is below 35°C, the crankcase heater is controlled according to discharge temperature.



Notes:

1. Tp1: discharge temperature sensor 1;
2. Tp2: discharge temperature sensor 2.

3.2 Water pump control

3.2.1 instructions of inverter water pump：

①When the start signal of the main water pump is received, the inverter water pump controls the output as follows.

②The adjustment range of the inverter water pump is 25%-100%[min ratio-max ratio], which can be set by the wire controller. Human Machine Interface can change the minimum run speed and minimum change interval is 5%, and the default value is 25%-100%. 0-100% corresponds to the output voltage range of the master control is 0-10V.

③Input and output instructions for control logic

Input	
Control logic input	Instructions
Address of the unit	The unit with address 0 is the host, and the unit with address non-0 is the slave

Inverter water pump control Selection	When S1-4=OFF, it is the single inverter water pump of the unit (default). When S1-4=ON, the unit inverter water pump and fixed frequency pump are connected in parallel
Single pump/ Multiple pump	When S1-3=OFF, single pump control (one set of system, one main pump, main engine control) When S1-3=ON, multi-pump control (one pump per machine, independent control)
Main water pump start signal	CN68 pump signal on the main board. When S1-4 is OFF, CN123 signals and CN68 signals on the expansion board are on and off simultaneously. both of the 2 ports are fix speed water pump ON/OFF signal.
Pump opening ratio column	Inverter water pump manual control frequency, set by the wire controller
Min ratio	Inverter water pump adjustment range minimum, set by wire controller, the default setting is 25%
Max ratio	Inverter water pump adjustment range maximum, set by wire controller, the default setting is 100%

Out put	
Control logic output	Instructions
Inverter water pump start and output duty cycle	0-100% corresponds to the output voltage range of the main control is 0-10V, the pump starts at the minimum set value, and the addition and subtraction output rate is 1%/0.5s.
Auxiliary pump output CN123	ON/off, when S1-4=ON, as the inverter water pump and constant frequency pump control mode of fixed speed pump control signal.

3.2.2 Temperature difference control of inverter water pump

When the actual inlet and outlet water temperature difference is less than the target water temperature difference, the pump will reduce the frequency, so as to reduce the water flow to increase the outlet temperature of the unit and increase the actual inlet and outlet water temperature difference.

When the actual inlet and outlet water temperature difference is greater than the target water temperature difference, the pump will increase the frequency, so as to increase the water flow to reduce the unit outlet temperature, reduce the actual inlet and outlet water temperature difference.

4 Startup Control

4.1 Compressor Startup Delay Control

In initial startup control and restart control (except in defrosting operation), compressor startup is delayed such that a minimum 7 minutes has elapsed since the compressor stopped, in order to prevent frequency compressor on/off and to equalize the pressure within the refrigerant system.

4.2 Startup Control for Heating/hot water Operation

Component	Wiring diagram label	65/75kW	110/140kW	Control functions and states
Water pump	PUMP	●	●	Non-standard component: After the pump is turned on for 2 minutes, detect the water flow switch continuously. The compressor can be started only after the water flow is normal.
Inverter compressor 1	BP1	●	●	Control the outlet water temperature. The operating increased and decreased frequency is 1Hz/s, and is executed according to the starting platform.
Inverter compressor 2	BP2	●	●	
Inverter fan1	FAN1	●	●	Startup after 4-way valve changes refrigerant flow direction. Controlled according to ambient temperature, discharge pressure and compressor frequency.
Inverter fan 2	FAN2	●	●	
Electronic expansion valve	EXV-A	●	●	Step from 0 to 480. Controlled according to discharge temperature superheat.
Electronic expansion valve	EXV-B	●	●	Step 480P
Electronic expansion valve	EXV-C	●	●	Enhanced vapor injection EXV，Step from 0 to 480. Controlled according to temperature difference between economizer plate heat exchanger inlet and outlet.
Four-way valve	ST1	●	●	Open
Solenoid valve (defrost)	SV5	●	●	Closed
Solenoid valve (by pass)	SV6	●	●	Closed
Solenoid valve (injection)	SV8A/B	●	●	Open
Switching of heating/hot water production Solenoid three way valve	SV1	●	●	Turn on when making hot water
Water flow switch	Water-SW	●	●	After water pump (field supplied) is turned on for 2min, if water flow switch is open, water pump stops and water flow error code appears. The compressor can be started after the water flow is normal.
Electric auxiliary heater (pipe)	-	●	●	Controlled according to ambient temperature and total water outlet temperature.
Crankcase heater	CCH	●	●	Controlled according to ambient temperature and discharge temperature.

4.3 Startup Control for Cooling Operation

Component	Wiring diagram label	65/75kW	110/140kW	Control functions and states
Water pump	PUMP	●	●	Non-standard component: After the pump is turned on for 2 minutes, detect the water flow switch continuously. The compressor can be started only after the water flow is normal.
Inverter compressor 1	BP1	●	●	Control the outlet water temperature. The operating increased and decreased frequency is 1Hz/s, and is executed according to the starting platform.
Inverter compressor 2	BP2	●	●	
Inverter fan1	FAN1	●	●	Control According to the exhaust pressure of the outdoor unit, the initial target windshield is operated for the first 60s, and then correct every 20-60s.
Inverter fan 2	FAN2	●	●	
Electronic expansion valve	EXV-A	●	●	Step 480P
Electronic expansion valve	EXV-B	●	●	Step from 0 to 480. Controlled according to suction temperature superheat.
Electronic expansion valve	EXV-C	●	●	Step from 0 to 480. Controlled according to temperature difference between economizer plate heat exchanger inlet and outlet.
Four-way valve	ST1	●	●	Closed
Solenoid valve (defrost)	SV5	●	●	Closed
Solenoid valve (by pass)	SV6	●	●	Open for 600s, then closed.
Solenoid valve (injection)	SV8A/B	●	●	Open
Water flow switch	Water-SW	●	●	After water pump (field supplied) is turned on for 2min, if water flow switch is open, water pump stops and water flow error code appears. The compressor can be started after the water flow is normal.
Water flow switch heater		●	●	Controlled according to ambient temperature, water inlet temperature and water outlet temperature.
Crank case heater	CCH	●	●	Controlled according to ambient temperature and discharge temperature.

5 Normal Operation Control

5.1 Component Control during heating mode

Component	Wiring diagram label	65/75kW	110/140kW	Control functions and states
Water pump	PUMP	●	●	Open
Inverter compressor 1	BP1	●	●	Control the outlet water temperature. The operating increased and decreased frequency is 1Hz/s.
Inverter compressor 2	BP2	●	●	
Inverter fan1	FAN1	●	●	Startup after 4-way valve changes refrigerant flow direction. Controlled according to ambient temperature, discharge pressure and compressor frequency.
Inverter fan 2	FAN2	●	●	
Electronic expansion valve	EXV-A	●	●	Step from 0 to 480. Controlled according to discharge temperature superheat.
Electronic expansion valve	EXV-B	●	●	Step 480.
Electronic expansion valve	EXV-C	●	●	Enhanced vapor injection EXV， Step from 0 to 480. Controlled according to temperature difference between economizer plate heat exchanger inlet and outlet.
Four-way valve	ST1	●	●	Open
Solenoid valve (defrost)	SV5	●	●	Open during defrost and close at other times.
Solenoid valve (by pass)	SV6	●	●	Closed
Solenoid valve (injection)	SV8A/B	●	●	Open
Switching of heating/hot water production Solenoid three way valve	SV1	●	●	Turn on when making hot water

5.2 Component control during cooling mode

Component	Wiring diagram label	65/75kW	110/140kW	Control functions and states
Water pump	PUMP	●	●	Open
Inverter compressor 1	BP1	●	●	Control the outlet water temperature. The operating increased and decreased frequency is 1Hz/s.
Inverter compressor 2	BP2	●	●	
Inverter fan1	FAN1	●	●	Control according to the exhaust pressure of the outdoor unit. Correct every 20-60s, and adjust in 0-32 gears.
Inverter fan 2	FAN2	●	●	
Electronic expansion valve	EXV-A	●	●	Step 480.
Electronic expansion valve	EXV-B	●	●	Step from 0 to 480. Controlled according to discharge temperature superheat.

Electronic expansion valve	EXV-C	●	●	Enhanced vapor injection EXV, Step from 0 to 480. Controlled according to temperature difference between economizer plate heat exchanger inlet and outlet.
Four-way valve	ST1	●	●	Closed
Solenoid valve (defrost)	SV5	●	●	Closed
Solenoid valve (by pass)	SV6	●	●	Closed
Solenoid valve (injection)	SV8A/B	●	●	Open
Water side heat exchanger heater	-	●	●	According to water side heat exchanger anti-freezing temperature
Water flow switch	Water-SW	●	●	After water pump (field supplied) is turned on for 2min, if water flow switch is open, water pump stops and water flow error code appears. The compressor can be started after the water flow is normal.
Water flow switch heater	-	●	●	Controlled according to ambient temperature, water inlet temperature and water outlet temperature
Crankcase heater	CCH	●	●	Controlled according to ambient temperature and discharge temperature

5.3 Compressor Output Control

The compressor rotation speed is controlled according to the load requirement. Before compressor startup, the outdoor unit determines the compressor target speed according to outdoor ambient temperature, discharge temperature and then runs the appropriate compressor startup program. Once the startup program is complete, the compressor runs at the target rotation speed.

The compressor speed is controlled according to two parts in normal operation:

In cooling mode: In a single system, the compressor speed is controlled according to the water outlet temperature and water outlet setting temperature. In a combination system, the compressor of master unit is controlled according total water outlet temperature and water outlet setting temperature, the compressor of the slave unit is controlled according to water inlet and water outlet temperature. Both in a single system and combination system, the compressor speed is limited by the inverter module temperature (calculated value), ambient temperature, discharge temperature, discharge pressure and air side heat exchanger refrigerant total outlet temperature.

5.4 Compressor Step Control

The running speed of six-pole compressors in rotations per second (rps) is one third of the frequency (in Hz) of the electrical input to the compressor motor. The frequency of the electrical input to the compressor motors can be altered at a rate of 1Hz in one second.

5.5 Four-way Valve Control

The four-way valve is used to change the direction of refrigerant flow through the water side heat exchanger in order to switch between cooling and heating operations. During heating operation, the four-way valve is on; during cooling and defrosting operation, the four-way valve is off.

5.6 Electronic Expansion Valve Control

- Power-on self-test:

  When the power is first turned on, the EXV is closed, proofreading the 0-step position, and re-opening at a maximum of 480.

- Startup:
  Adjust from 480 to the initial position, (the initial opening is determined by the ambient temperature), maintain for a period of time. EXV is controlled according to suction superheat, exhaust, and compressor speed.
- When the outdoor unit is in standby:
  The EXV is at position 480 (steps).
- When the outdoor unit stops:
  After the compressor shuts down for 1 minute, the EXV is fully closed first, and then opened to the initial position.

5.7 Outdoor Fan Control

For 65/75kW:

Fan speed index	Fan speed (rpm)	
	FAN A	FAN B
0	0	0
1	150	0
2	190	0
3	230	0
4	270	0
5	330	0
6	150	150
7	170	170
8	190	190
9	210	210
10	230	230
11	250	250
12	270	270
13	290	290
14	310	310
15	330	330
16	350	350
17	370	370
18	400	400
19	430	430
20	450	450
21	470	470
22	510	510
23	550	550
24	580	580
25	610	610
26	640	640
27	680	680
28	710	710
29	750	750
30	780	780
31	800	800
32	830	830

For 110/140kW::

Fan speed index	Fan speed (rpm)	
	FAN A	FAN B
0	0	0
1	150	0
2	190	0
3	230	0
4	270	0
5	330	0
6	150	150
7	170	170
8	170	170
9	190	190
10	210	210
11	230	230
12	250	250
13	270	270
14	290	290
15	310	310
16	330	330
17	350	350
18	370	370
19	400	400
20	430	430
21	470	470
22	510	510
23	550	550
24	600	600
25	650	650
26	680	680
27	700	700
28	720	720
29	750	750
30	780	780
31	800	800
32	830	830

Fan operation mode	Fan speed index			The conditions required for implementation
	65kW	110kW	75/140kW	
standard mode	26	23	32	Set by wire control
Night silent mode 1[1]	24	21	28	Set by wire control T3min≥40℃ Forced exit. Can enter when T3min≤35℃.
Night silent mode 2[2]				
Night silent mode 3[3]				
Night silent mode 4[4]				
Silent mode[5]				Set by wire control
Super silent mode[6]	22	19	25	Set by wire control

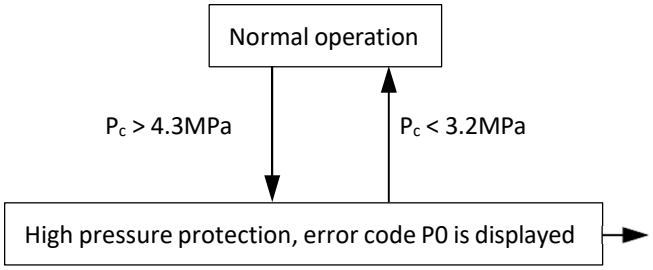
Note：

1. When setting Night silent mode 1, after T4 rises to the highest temperature, it will wait for 6 hours to enter the nighttime silent mode. After 12h of operation, the silent mode will be closed, and then it will return to the standard mode and run again.
2. When setting Night silent mode 2, after T4 rises to the highest temperature, it will wait for 6 hours to enter the nighttime silent mode. After 10h of operation, the silent mode will be closed, and then it will return to the standard mode and run again.
3. When setting Night silent mode 3, after T4 rises to the highest temperature, it will wait for 8 hours to enter the nighttime silent mode. After 10h of operation, the silent mode will be closed, and then it will return to the standard mode and run again.
4. When setting Night silent mode 4, after T4 rises to the highest temperature, it will wait for 8 hours to enter the nighttime silent mode. After 12h of operation, the silent mode will be closed, and then it will return to the standard mode and run again.
5. In silent mode, the unit output frequency is less than the maximum silent power, 65 kW maximum silent power is 80Hz, 110 kW maximum silent power is 70Hz, 75&140kW maximum silent power is 90Hz.
6. In super silent mode, the unit output frequency is less than the maximum silent power, 65 kW maximum silent power is 70Hz, 110 kW maximum silent power is 60Hz, 75&140kW maximum silent power is 88Hz.

6 Protection Control

6.1 High Pressure Protection Control

This control protects the refrigerant system from abnormally high pressure and protects the compressor from transient spikes in pressure.



When P0 protection occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.

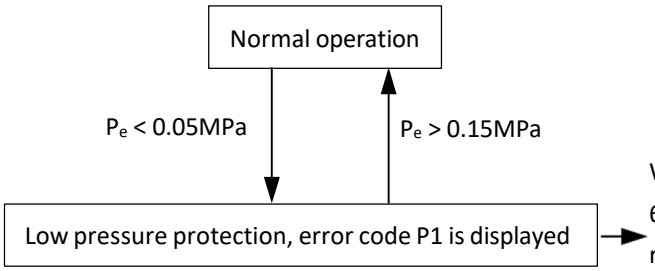
Notes:

1. P_c: Discharge pressure

When the discharge pressure rises above 4.3MPa the system displays P0 protection and the faulty unit stops running. When the discharge pressure drops below 3.2MPa, the compressor enters re-start control.

6.2 Low Pressure Protection Control

This control protects the refrigerant system from abnormally low pressure and protects the compressor from transient drops in pressure.



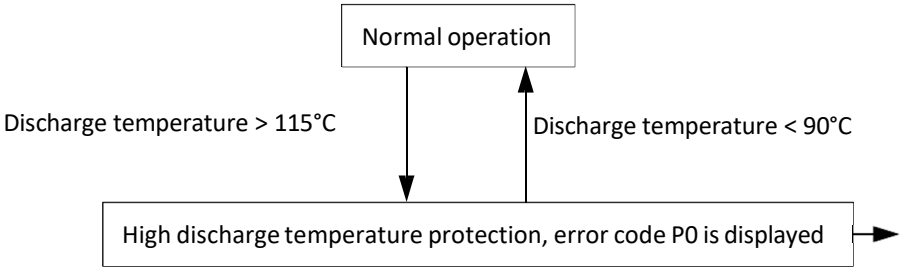
When P1 protection occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.

Notes:

1. P_e: Suction pressure

6.3 Discharge Temperature Protection Control

This control protects the compressor from abnormally high temperatures and transient spikes in temperature.

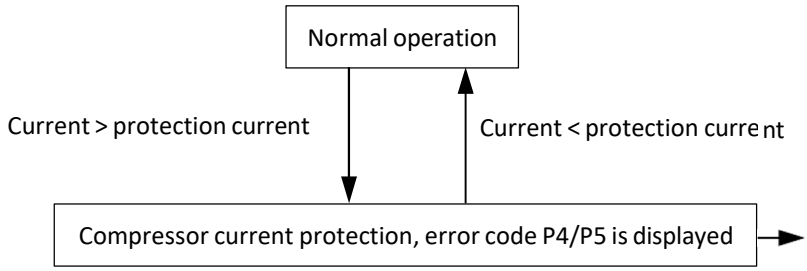


When P0 protection occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.

When the discharge temperature rises above 115°C the system displays P0 protection and the faulty unit stops running. When the discharge temperature drops below 90°C, the compressor enters re-start control.

6.4 Compressor and Inverter Module Protection Control

The protection current for 65&75kW are 53A, for 110&140kW are 106A.



CL is displayed when PL error occurs 3 times in 100 minutes, a manual system restart is required before the system can resume operation.

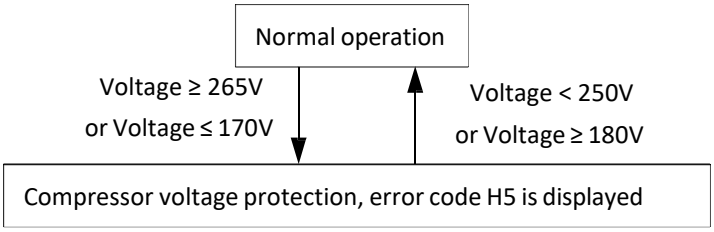
Notes:

1. P4 is the protection for System A, P5 is the protection for System B.

When the module temperature rises above 100°C, the system displays PL protection and the faulty unit stops running. When the module temperature drops below 70°C, the compressor enters re-start control.

6.5 Voltage Protection Control

This control protects the units from abnormally high or abnormally low voltages.



When the phase voltage of AC power supply is at or above 265V for more than 30 seconds, the system displays H5 protection and the faulty unit stops running. When the phase voltage drops below 250V for more than 30 seconds, the unit restart once the compressor re-start delay has elapsed. When the phase voltage is below 170V for more than 30 seconds, the system displays H5 protection and the faulty unit stops running. When the AC voltage rises to at or above 180V for more than 30 seconds, the refrigerant system restarts once the compressor re-start delay has elapsed.

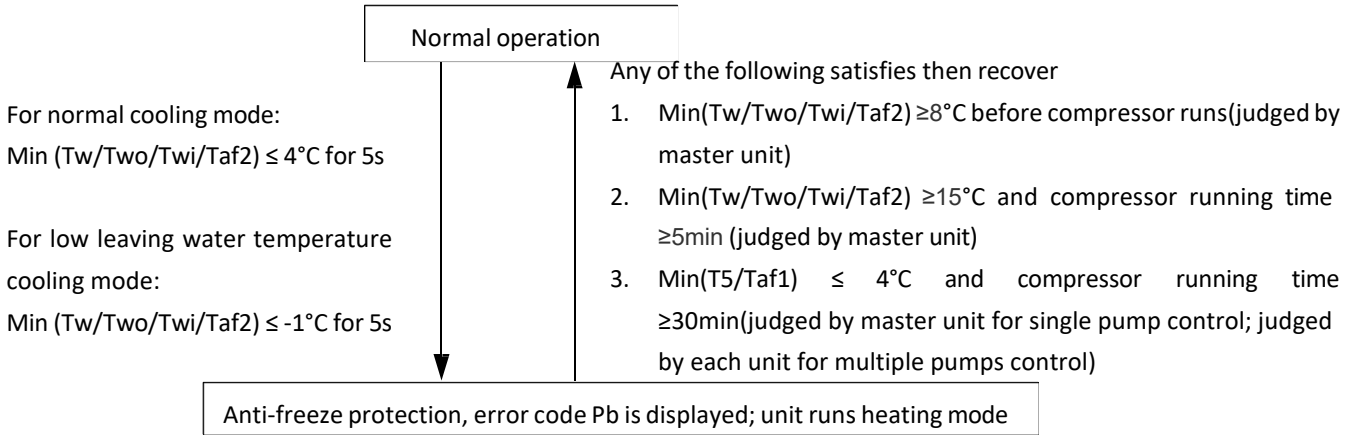
6.6 DC Fan Motor Protection Control

This control protects the DC fan motors from abnormal power supply. DC fan motor protection occurs when the fan module does not receive any feedback from the fan motor.

When DC fan motor protection control occurs the system displays the PU error code and the unit stops running. When PU protection occurs 10 times in 120 minutes, the FF error is displayed. When an FF error occurs, a manual system restart is required before the system can resume operation.

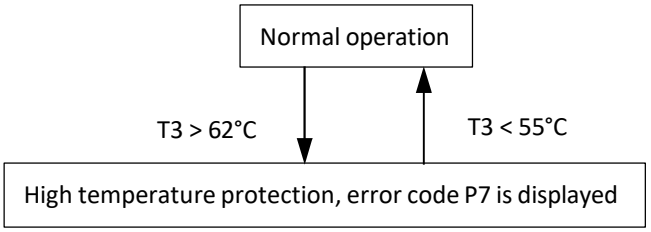
6.7 Water Side Heat Exchanger Anti-freeze Protection Control

When water side heat exchanger anti-freeze protection occurs the system displays error code Pb and all the units stop running.



6.8 Air Side Heat Exchanger High Temperature Protection Control

This control protects the air side heat exchanger from high temperature.

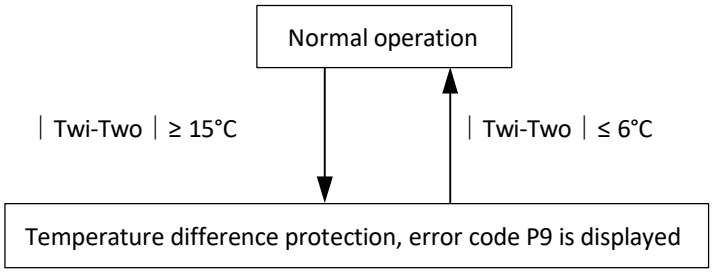


Note:

1. T3: Air side heat exchanger refrigerant outlet temperature

When the air side heat exchanger refrigerant outlet temperature (T3) rises above 62°C, the system displays P7 protection and the faulty unit stops running. When the air side heat exchanger refrigerant outlet temperature (T3) drops below 55°C, the compressor enters re-start control.

6.9 Water Side Heat Exchanger Temperature Difference Protection Control



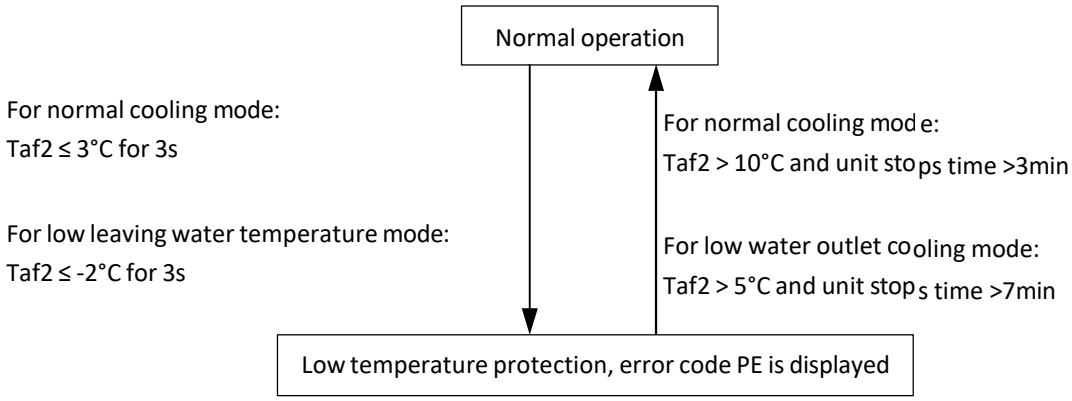
Notes:

1. Twi: Water side heat exchanger inlet temperature;
2. Two: Water side heat exchanger outlet temperature.

When the temperature difference rises at or above 15°C, the system displays P9 protection and the faulty unit stops running. When the temperature difference drops below 6°C, the compressor enters re-start control.

6.10 Water Side Heat Exchanger Low Temperature Protection Control

This control protects the water side heat exchanger from ice formation.



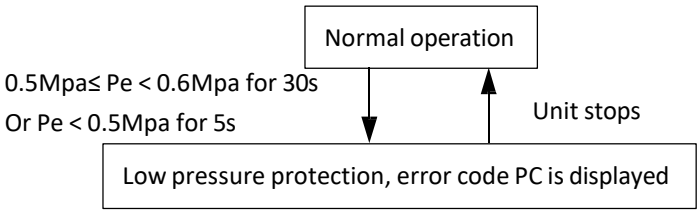
Notes:

1. Taf2: Water side heat exchanger anti-freezing temperature 2

6.11 Water Side Heat Exchanger Low Pressure Protection Control

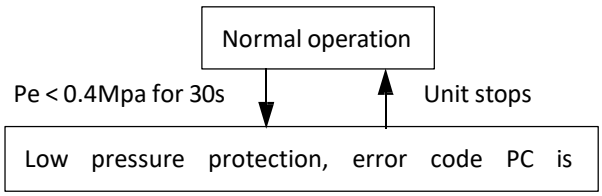
This control protects the water side heat exchanger from ice formation.

- Normal cooling mode



In normal cooling mode, when 0.5Mpa≤ Pe < 0.6Mpa for 30s or Pe < 0.5Mpa for 5s, the system displays PC protection and the faulty unit stops running. When the unit stop, the compressor enters re-start control.

- Low leaving water temperature mode



In low water temperature cooling mode, when the suction pressure drops below 0.4Mpa for 30s, the system displays PC protection and the faulty unit stops running. When the unit stop, the compressor enters re-start control.

7 Special Control

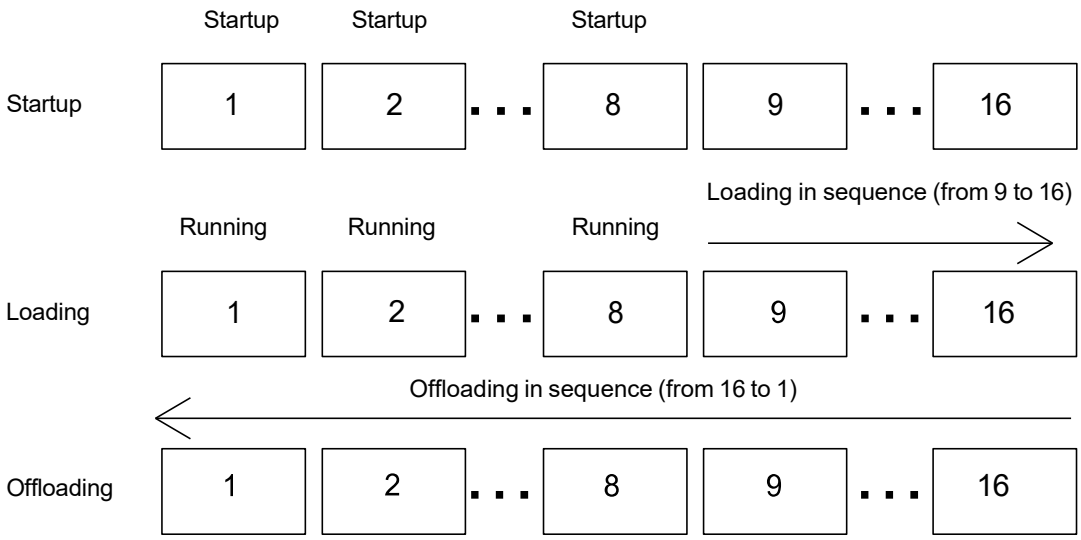
7.1 Outdoor Unit Duty Cycling

In systems with multiple outdoor units, outdoor unit duty cycling is used to balance the compressor running time. Outdoor unit duty cycling occurs whenever all the outdoor units stop running (either because the leaving water set temperature has been reached or because a master unit error has occurred):

Take 16 units in parallel as an example:

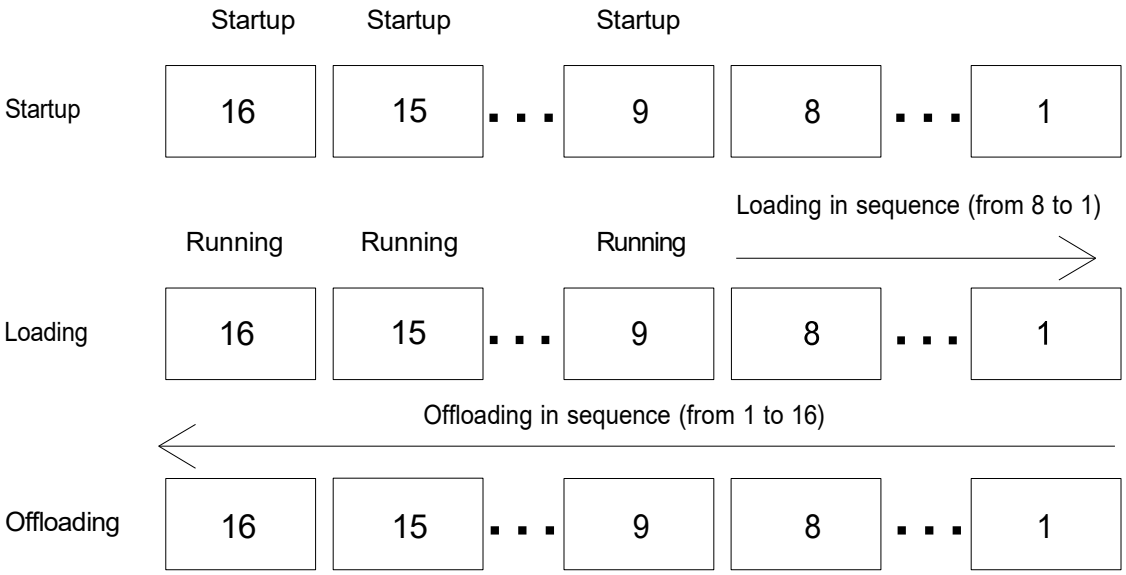
- First cycle:

When the outdoor units are powered on for the first time, if there is a load requirement, 50% of the units turn on starting with the 0# master unit to higher address slave units. As the leaving water temperature approaches its set temperature, units shut down in succession, starting with the unit with the highest address.



- Second cycle:

The next time a load requirement exists (or following a master unit error), the units turn on starting with the highest address unit to lower address units. As the leaving water temperature approaches its set temperature, units shut down in succession, starting with the unit with the lowest address.



- Subsequent cycles will repeat the actions of the first and second cycles

Notes:

1. The address settings on the outdoor unit main PCBs for master unit and slave unit do not change.

7.2 Defrosting Operation

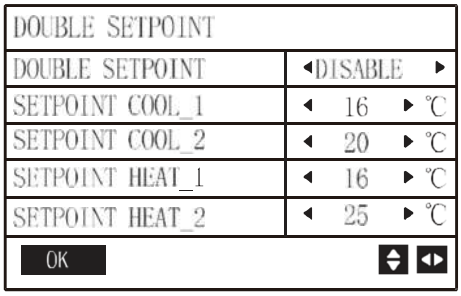
In order to recover heating capacity, the defrosting operation is conducted when the outdoor unit air side heat exchanger is performing as a condenser. The defrosting operation is controlled according to outdoor ambient temperature, air side heat exchanger refrigerant temperature, water inlet temperature, compressor running time and defrosting time.

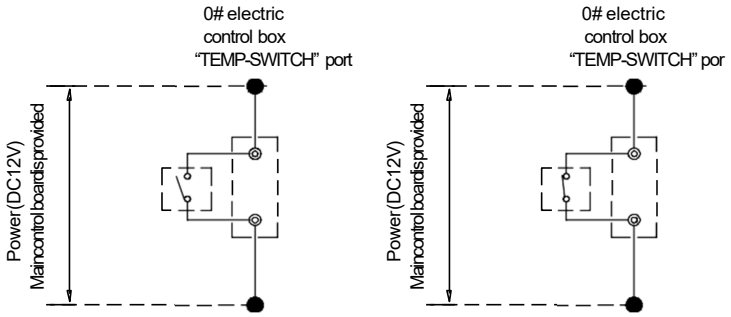
Component Name	Electrical Symbol	65/75kW	110/140kW	Function of the component
Pump	PUMP	●	●	ON
Variable frequency compressor 1	BP1	●	●	Defrosting command frequency run
Variable frequency compressor 2	BP2	●	●	
Variable frequency fan 1	FAN1	●	●	OFF
Variable frequency fan 2	FAN2	●	●	
Electronic expansion valve	EXV-A	●	●	Maximum opening 480P
Electronic expansion valve	EXV-B	●	●	Maximum opening 480P
Electronic expansion valve	EXV-C	●	●	Fixed 96P
Four-way valve	ST1	●	●	OFF
Defrosting solenoid valve	SV5	●	●	ON
Bypass solenoid	SV6	●	●	ON
Injection solenoid	SV8A/B	●	●	OFF

7.3 TEMP-SWITCH control

The function of “TEMP-SWITCH” must be set by wired controller for two target water temperature. For cooling and heating mode, different water temperatures can be switched just by one-touch. The operation method is as follows:

- Setting: “USER MENU”——“DOUBLE SETPOINT”



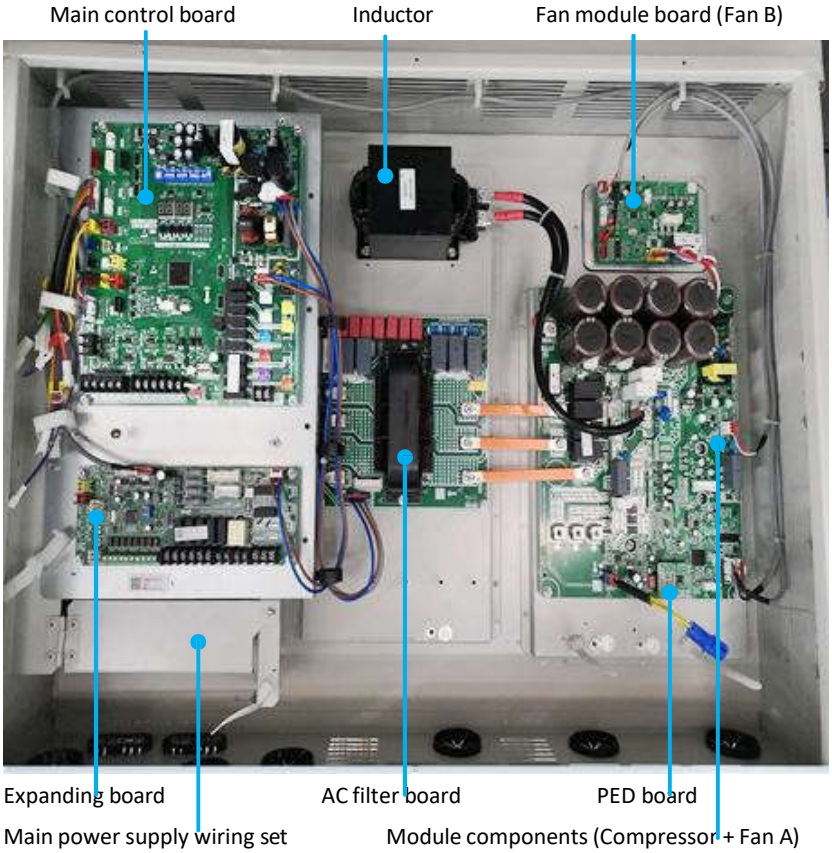


- Wire connection: Shorting the terminal block CN110 at slave board (Refer to the Part 4, 3.1 Single unit) for units. If the switch is off, unit operates at first target water temperature. If the switch is on unit operates at second target water temperature.

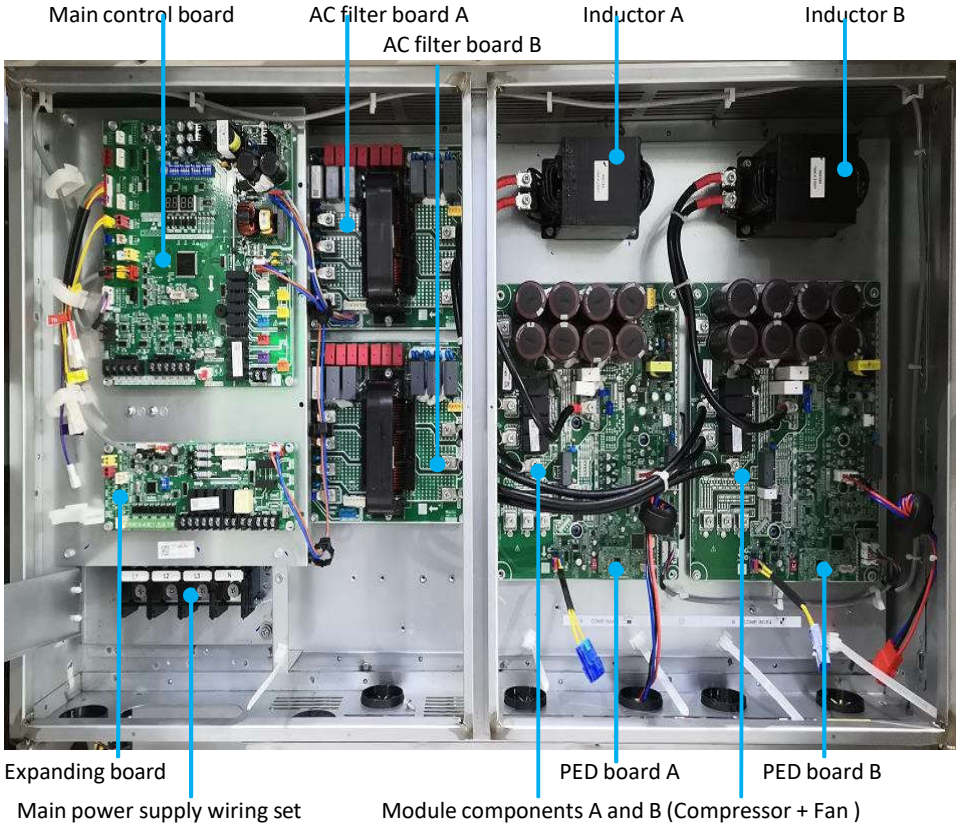
Part 4
Diagnosis and Troubleshooting

1 Electric Control Box Layout

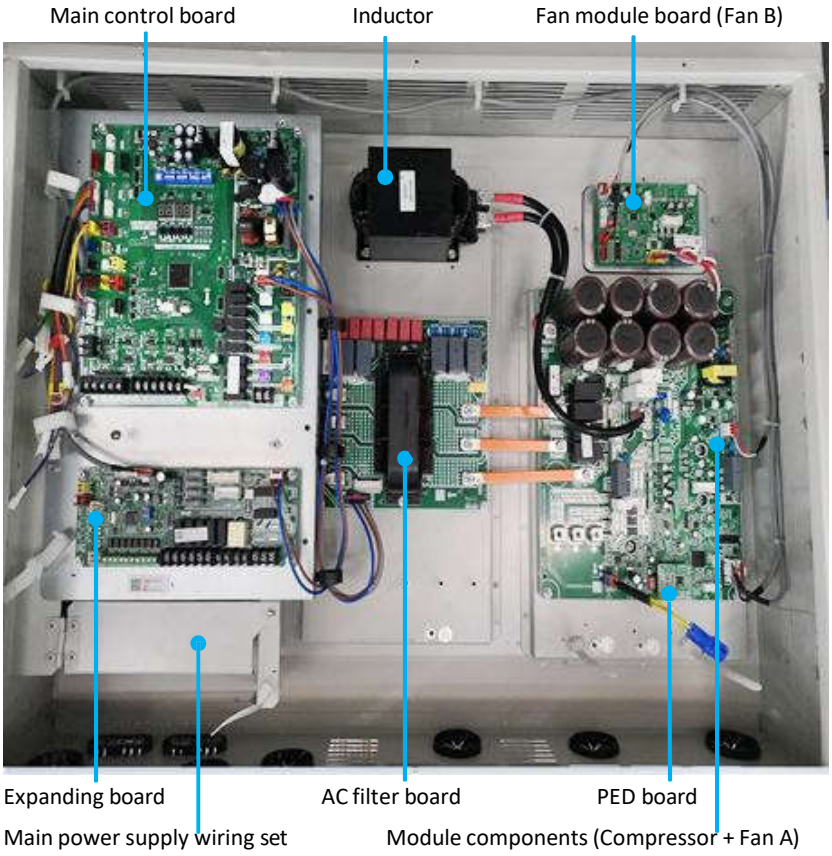
For SMHM-650B-3 and SMHM-750B-3



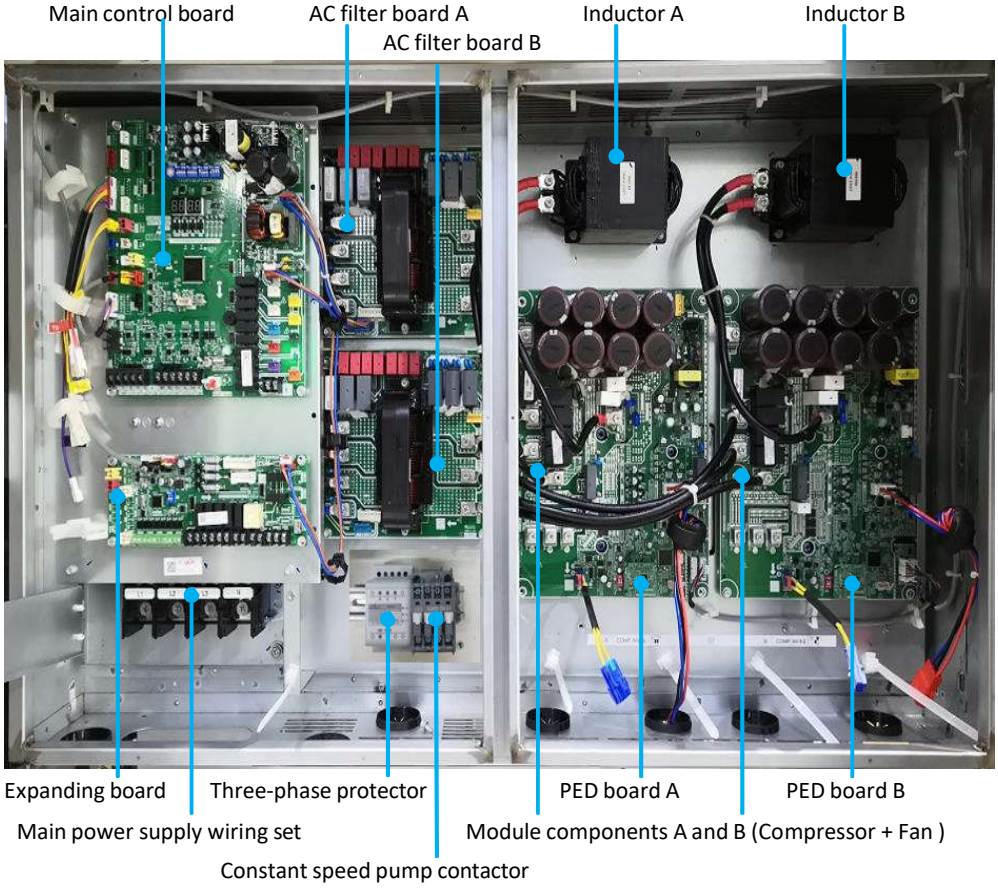
For SMHM-1100B-3 and SMHM-1400B-3



For SMHM-650BH-3 and SMHM-750BH-3



For SMHM-1100BH-3 and SMHM-1400BH-3



2 PCB Introduction

2.1 Types

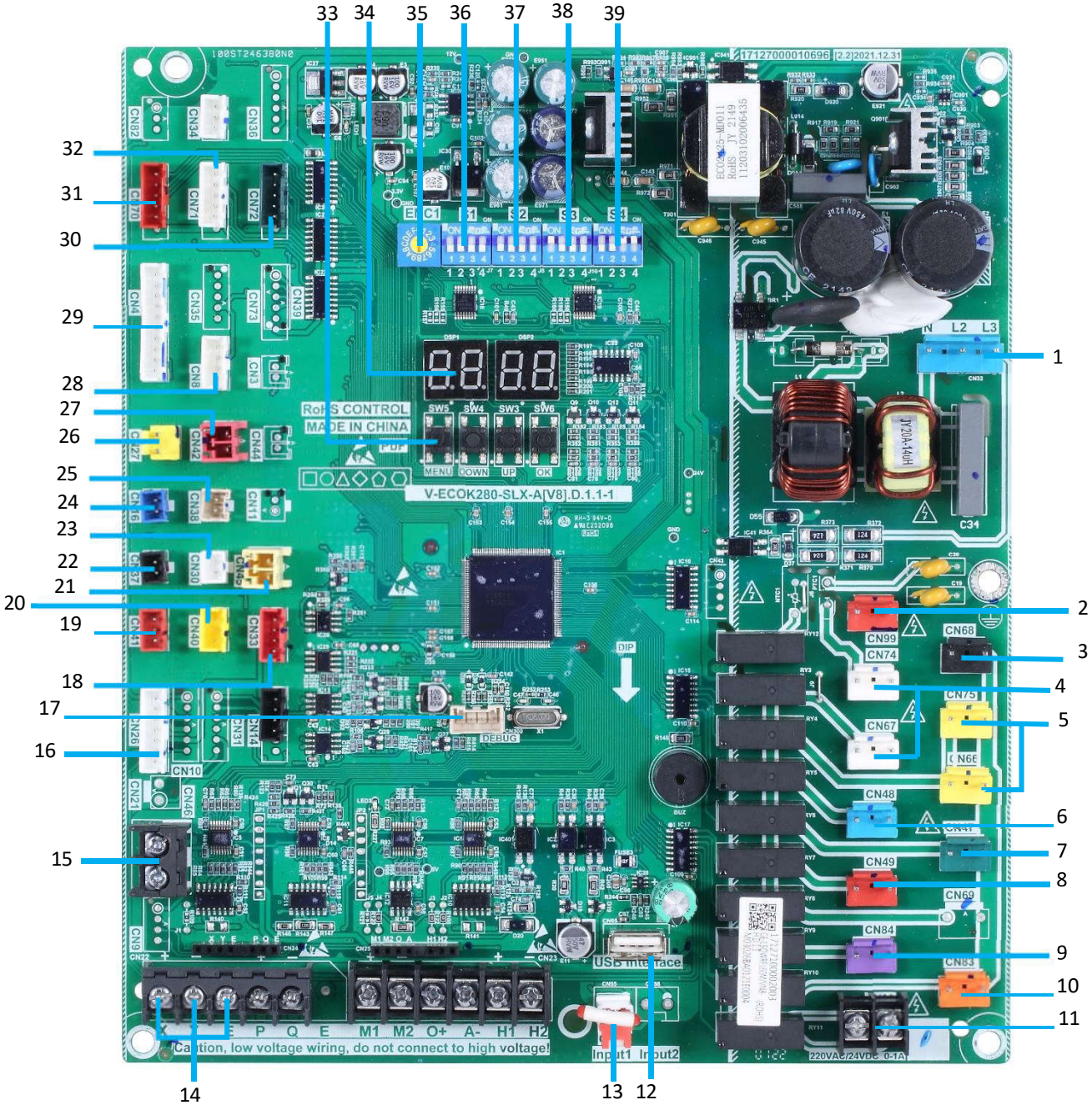
Commercial HP 65&75kW unit have one main control board, one compressor inverter module boards, two DC fan inverter module boards and one filter board.

Commercial HP 110&140kW unit have one main control board, two compressor inverter module boards, two DC fan inverter module boards and two filter boards.

2.2 Main PCB

2.2.1 Main PCB component

For 65/75/110/140kW



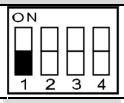
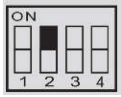
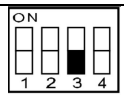
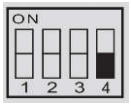
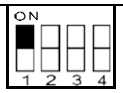
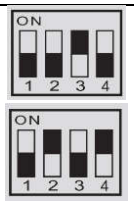
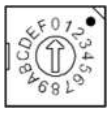
Label	Code	Port	Explanation	Voltage
1	CN32	POWER	Power supply port of the main control board	220-240V
2	CN99		Expanding board power connector	220-240V
3	CN68	PUMP	Pump contactor control port (connected in factory)	220-240V
4	CN74/CN67	CCH	compressor heating belt	220-240V
5	CN75/CN66	EVA-HEAT	Plate heat exchanger electric heating belt	220-240V
6	CN48	ST1	Four-way valve	220-240V
7	CN47	SV6	One-way solenoid valve	220-240V

8	CN49	SV5	One-way solenoid valve	220-240V
9	CN84	SV8A	One-way solenoid valve	220-240V
10	CN83	SV8B	One-way solenoid valve	220-240V
11	CN93	ALARM	Fault alarm port	/
12	CN65	USB	USB program burning port	DC5V
13	CN28	PH-PRO	Three-phase protector signal detection port	DC12V
14	CN22	XYE	External unit parallel connection communication port & external unit and wired controller communication port	DC5V
15	CN46		Wired controller power supply port	DC12V
16	CN26	O-Motor	Module board PTC relay control port/Module board communication port	DC12V/DC5V
17	CN300	DEBUG	Main control program burn port(WizPro200RS programmer)	DC3.3V
18	CN33	MS	Expanding board communication port	DC12V/DC5V
19	CN41	L-YL	Low pressure sensor	DC3.3V
20	CN40	H-YL	High pressure sensor	DC3.3V
21	CN45	Taf2	Water side antifreeze temperature sensor	DC3.3V
22	CN37	T3A	Pipe temperature sensor of the condenser	DC3.3V
23	CN30	T4	Outdoor ambient temperature sensor	DC3.3V
24	CN16	T3B	Pipe temperature sensor of the condenser	DC3.3V
25	CN38	TP2	DC inverter compressor B discharge temperature sensor	DC3.3V
26	CN27	TP-PRO	Discharge temperature controller	DC3.3V
27	CN42	L-PRO	Low pressure switch	DC3.3V
28	CN8	T6A	Refrigerant inlet temperature of EVI plate heat exchanger	DC3.3V
		T6B	Refrigerant outlet temperature of EVI plate heat exchanger	DC3.3V
29	CN4	Twi	Unit water inlet temperature sensor	DC3.3V
		Th	System suction temperature sensor	DC3.3V
		Two	Unit water outlet temperature sensor	DC3.3V
		Tz/7	Coil final outlet temperature sensor	DC3.3V
		Tp1	DC inverter compressor A discharge temperature sensor	DC3.3V
30	CN72	EXVC	Electronic expansion valve C	DC12V
31	CN70	EXVA	Electronic expansion valve A	DC12V
32	CN71	EXVB	Electronic expansion valve B	DC12V
33	SW3	UP	Up button	DC3.3V
	SW4	DOWM	Down button	DC3.3V
	SW5	MENU	Menu button	DC3.3V
	SW6	OK	Confirm button	DC3.3V
34	DSP1/DSP2		Digital tube	DC3.3V
35	ENC1		ADDRESS DIP switch	DC3.3V
36	S1	S1-1	O: Normal control mode; 1: Remote control mode	DC3.3V
		S1-2	O: Normal water outlet temperature; 1: High water outlet temperature	DC3.3V
		S1-3	0: Single water pump control mode; 1: Multiple water pumps control mode	DC3.3V
		S1-4	0: Unit single variable frequency water pump control; 1: Unit single variable frequency water pump plus single constant frequency water pump control	DC3.3V
37	S2	/	Reserve	DC3.3V
38	S3	S3-1	1 (Default)	DC3.3V
39	S4	Ability dial-up	65kW：0010；75kW：0011； 110kW：0101；140kW：0111	DC3.3V

2.2.2 Main PCB field setting

Multiple pumps control: output pump signal on all units.

Single pump control: only the master unit output pump signal, no pump signal output on the slave units.

Switch		Description	ON	OFF	Default factory setting
	S1-1	Control mode	Remote control	Normal control	OFF
	S1-2	outlet temperature	High water outlet temperature	Normal water outlet temperature	ON
	S1-3	Water pump	Multiple water pumps control	Single water pump control	OFF
	S1-4	Water pump	Single variable frequency water pump plus single constant frequency water pump control	Single variable frequency water pump control	OFF
	S3-1	-	-	-	ON
	S4	DIP switch for capacity selection	-	-	65kW：0010； 75kW：0011； 110Kw：0101； 140kW：0111；
	ENC1	0-F valid for unit address setting on the DIP switches 0 indicates the master unit and 1-F the auxiliary units (parallel connection)	-	-	0

Note:

1. Wiring of “HEAT/COOL” weak electric port

The remote function of “HEAT/COOL” must be set by DIP switch. The remote function “HEAT/COOL” is effective when S1-1 is chosen ON, at the same time, the wire controller is out of control.

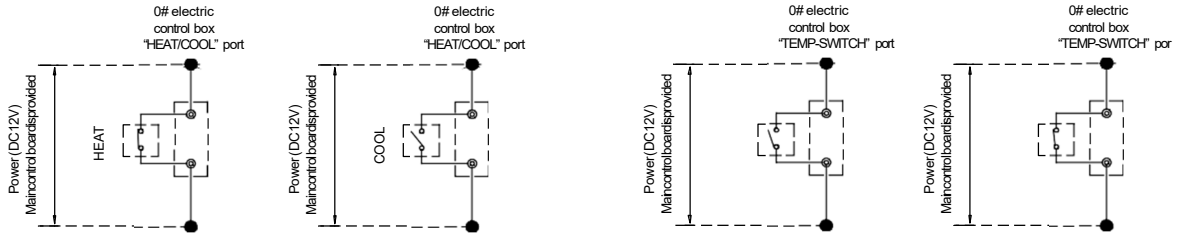
Corresponding parallel connect the “HEAT/COOL” port of the main unit’s electric control box, then, connect the “ON/OFF” signal (provide by user) to the “HEAT/COOL” port of main unit as follows.

Wiring method: Shorting the terminal block CN138 at slave board inside the electric control box to enable the remote function of “HEAT/COOL”.

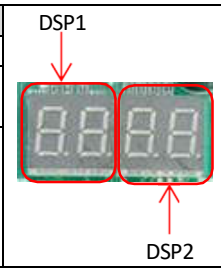
2. Wiring of “TEMP-SWITCH” weak electric port

The function of “TEMP-SWITCH” must be set by wired controller for two setting water temperature. For cooling and heating mode.

Wiring method: Shorting the terminal block CN110 at slave board inside the electric control box to choose the target water temperature.



2.2.3 Digital display output

Outdoor unit state	Parameters displayed on DSP1	Parameters displayed on DSP2	
Standby	0	1	
Normal operation	Running speed of compressor A in rotations per second	Running speed of compressor B in rotations per second	
Error or protection	-- or placeholder	Error or protection code	

2.2.4 Spot Check Description

The spot check sequence is shown as follows:

Serial number		Contents of spot check
0		Standby: host address (left 88) + number of online units (right 88), Power-on: display frequency Defrosting: dFdF
1	0.xx	Host address
2	1.xx	Number of external units (e.g. 65/110kW respectively display 65/110.)
3	2.xx	Number of online units (effective host)
4	3.xx	T4 capacity correction (reserved display "1")
5	4.xx	Operation mode (8 shutdown, 1 cooling, 2 heating, 4 hot water)
6	5.xx	Fan Gear (0 – 35)
7	6.xx	Fan gear (reserved display "0")
8	7.xx	T3 (min)
9	8.xx	T4
10	9.xx	Outlet water temperature of T5 water tank
11	10.xx	Taf1
12	11.xx	Taf2
13	12.xx	Tw total outlet water temperature of the unit
14	13.xx	Twi Unit Inlet Water Temperature
15	14.xx	Two unit outlet water temperature
16	15.xx	Tz total cold outlet temperature
17	16.xx	THeatR heat recovery sensor temperature (reserved display "--")
18	17.xx	Exhaust temperature 1
19	18.xx	Exhaust temperature 2
20	19.xx	Heat sink temperature 1
21	20.xx	Heat sink temperature 2
22	21.xx	Exhaust superheat Tdsh
23	22.xx	Compressor A current
24	23.xx	Compressor B current
25	24.xx	--
26	25.xx	Electronic expansion valve A opening (percent, maximum 100%)
27	26.xx	Electronic expansion valve B opening (percent, maximum 100%)
28	27.xx	Electronic expansion valve C opening (percent, maximum 100%)
29	28.xx	High pressure (heating mode)
30	L.xx	Low pressure (with decimal display-display during cooling or standby)
31	30.xx	Refrigeration return air superheat Tssh
32	31.xx	Th return air temperature
33	32.xx	First nixie tube on the right: mute selection (0: night mute; 1: mute; 2: ultra mute; 3: no mute (default)) The second nixie tube on the right: the value of mute time selection (0-3) depends on the parameters of the wired controller
34	33.xx	Static pressure selection (0 static pressure is reserved by default)
35	34.xx	DC voltage A (reserved)
36	35.xx	DC voltage B (reserved)
37	36.xx	Frequency limiting serial number (reserved) (0: infinite frequency; 1: T4 frequency limiting; 2: Tp exhaust frequency limiting; 3: Tz total cooling output frequency limiting; 4: Tf module temperature frequency limiting; 5: Two water output frequency limiting 6: Pressure frequency limiting, 7: Current frequency limiting, 8: Voltage frequency limiting
38	37.xx	Defrosting process status (the first digit: T4 selection scheme; the second digit: interval in the scheme; the third and fourth digits together represent defrosting timing time)
39	38.xx	Fault of Party E: 1 indicates fault, 0 indicates no fault (reserved 90kw is valid)
40	39.xx	Defrosting scheme
41	40.xx	Initial frequency
42	41.xx	Tc (saturation temperature corresponding to high pressure) spot check value + 30

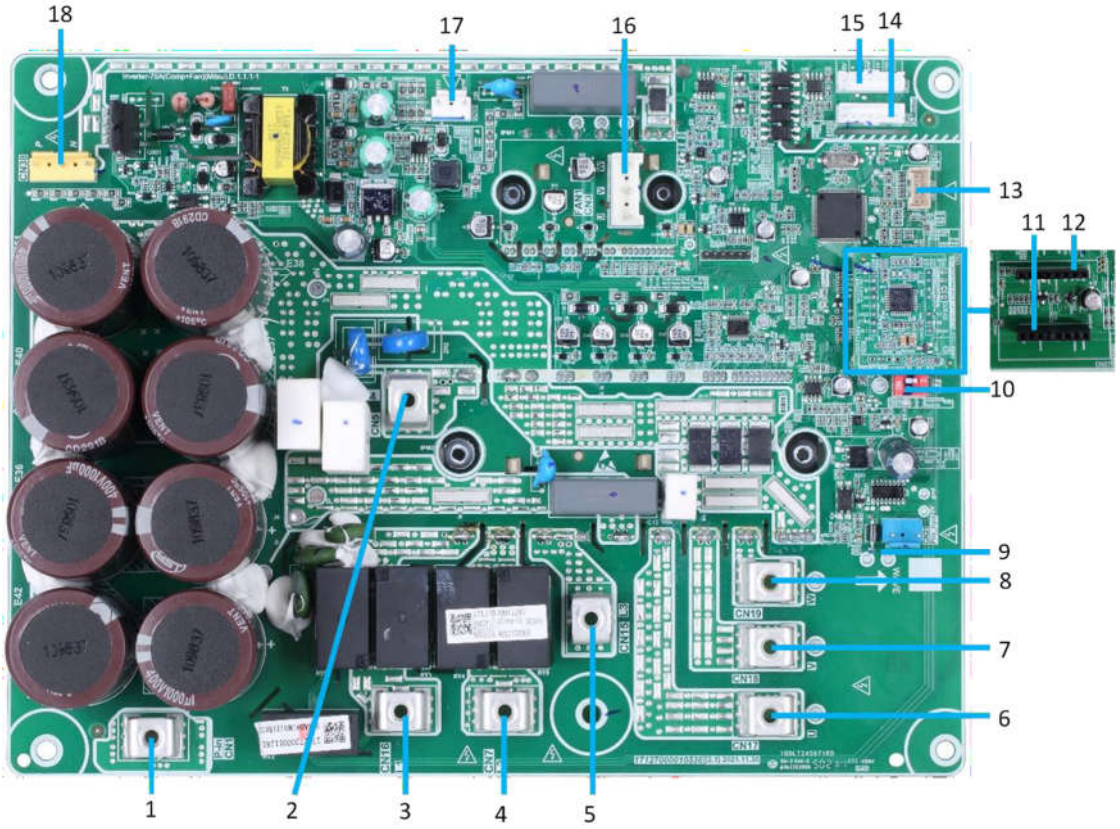
43	42.xx	Te (saturation temperature corresponding to low pressure) spot check value + 30
44	43.xx	T6a
45	44.xx	T6b
46	45.xx	Version number of main control software
47	46.xx	Extension board software version number
48	47.xx	The last failure
49	48.xx	Penultimate failure
50	49.xx	Third failure from the bottom
51	50.xx	Fourth failure from the bottom
52	51.xx	Fifth failure from the bottom
53	52.xx	Sixth failure from the bottom
54	53.xx	----

Note: Need to perform spot check operation on the online controller.

2.3 Compressor Inverter Module Board

2.3.1 Compressor Inverter Module PCB component

For 65/75/110/140kW



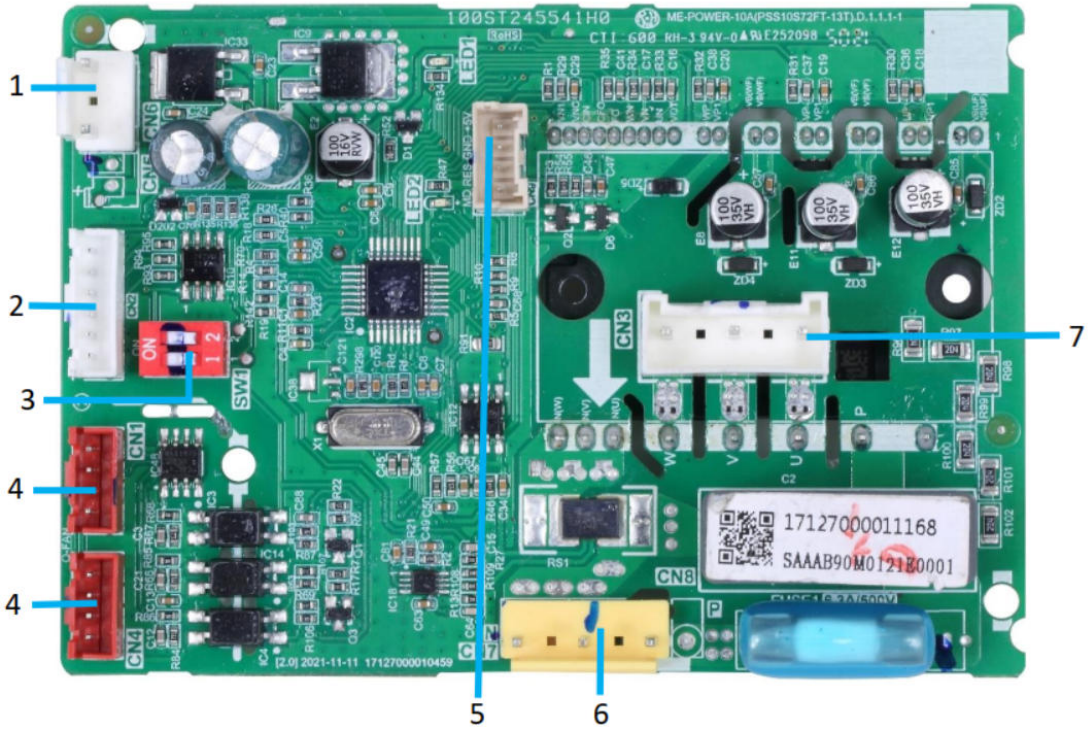
Label	Code	Port	Explanation	Voltage
1	CN1	P-in	Reactor input to module board terminals	-
2	CN5	P-out	Module board outputs to reactor terminal	-
3	CN16	L1	Power supply for module board	380-415V
4	CN7	L2		
5	CN15	L3		
6	CN17	U	Compressor output	-
7	CN18	V		
8	CN19	W		
9	CN21	H-SW	High pressure switch	-
10	S7	-	module address setting system A: 00; system B: 01	-
11	CN27-1	-	PED board connection port	DC12V/DC5V
12	CN27-2	-	PED board connection port	DC12V/DC5V
13	CN25	DEBUG	Driver burn port (WizPro200RS programmer)	DC5V
14	CN8	O-Motor	Module Board PTC Relay Control Port/Module Board Communication Port	DC12V/DC5V
15	CN9	O-Motor	Module Board PTC Relay Control Port/Module Board Communication Port	DC12V/DC5V
16	CN3	UVW	Fan output port	
17	CN26		Fan control power supply output port	DC19V
18	CN39	P N	Fan power supply output port	DC565V

2.3.2 Compressor Inverter Module PCB field setting

Switch	Description	S7-1	S7-2
S7 	Compressor A inverter module address setting	OFF	OFF
	Compressor B inverter module address setting	OFF	ON

2.4 Fan Module Board

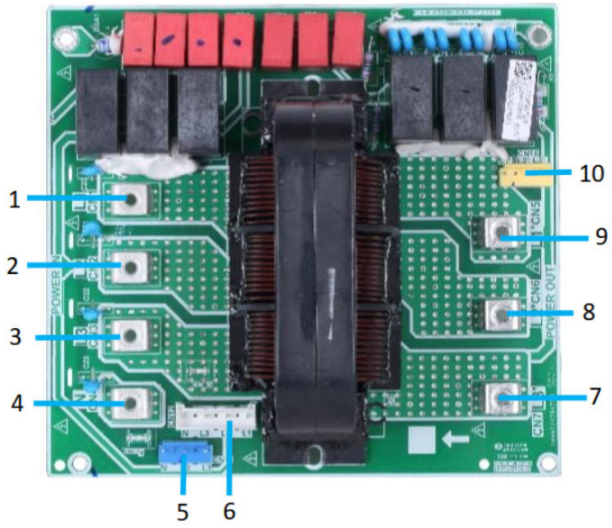
For 65/75kW



Label	Code	Port	Explanation	Voltage
1	CN6	-	Fan module control power supply input port	DC19V
2	CN12	-	Reserve	-
3	SW1	-	Fan module address setting	-
4	CN1/CN4	-	Fan module communication port	DC5V
5	CN9	DEBUG	Program burn port (WizPro200RS programmer)	DC5V
6	CN7	P N	Fan module power supply port	DC565V
7	CN3	UVW	Fan output port	-

2.5 AC Filter Board

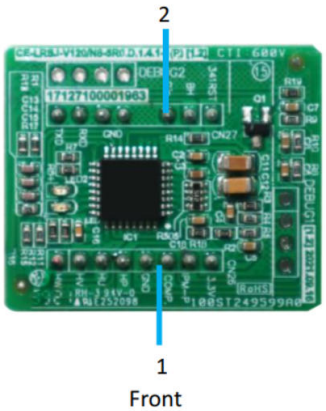
For 65/75/110/140kW



Label	Code	Port	Explanation	Voltage
1	CN1	L1	Input port L1	380-415V
2	CN2	L2	Input port L2	
3	CN3	L3	Input port L3	
4	CN4	N	Input port N	
5	CN11	-	Power supply port for main PCB	-
6	CN12	-	Port for three phase protector (reserve)	380-415V
7	CN7	L3’	Output port L3	380-415V
8	CN6	L2'	Output port L2	
9	CN5	L1'	Output port L1	
10	CN16	-	Three phase water pump power supply port (reserve)	380-415V

2.6 PED Board

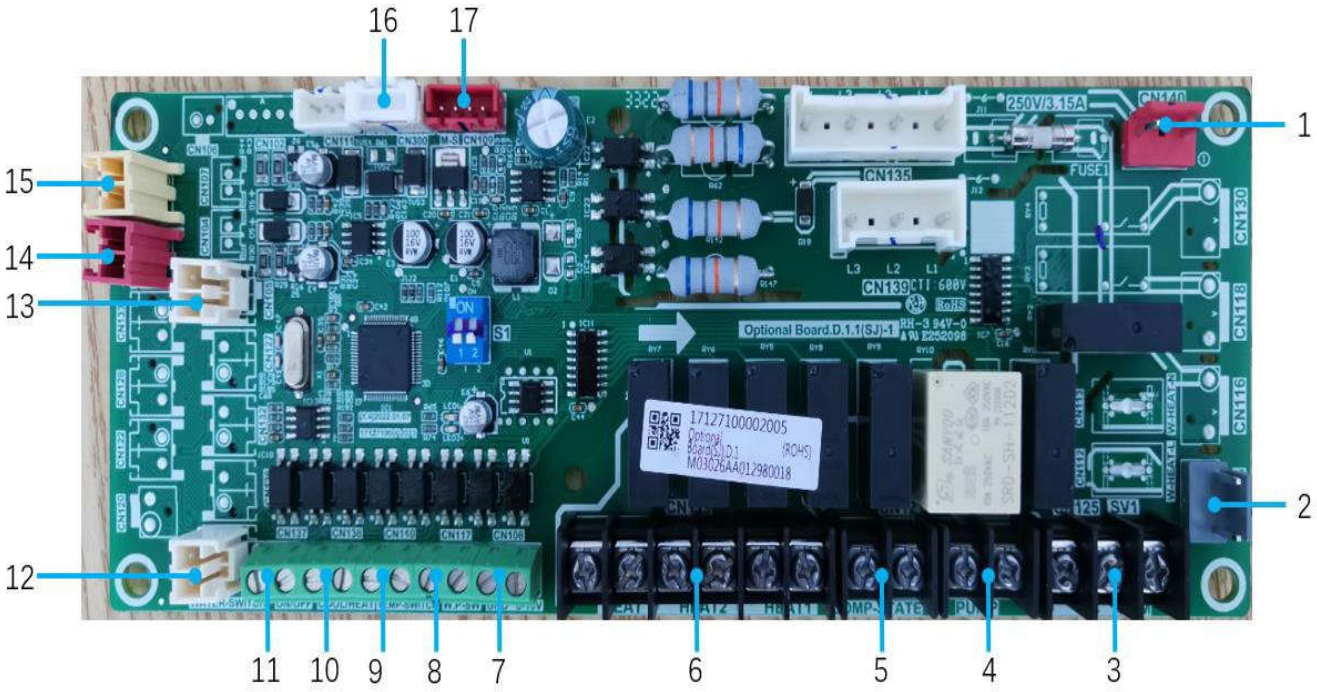
For 65/75/110/140kW



Label	Code	Port	Explanation	Voltage
1	CN26	-	For connecting compressor module board	/
2	CN27	-	For connecting compressor module board	/

2.7 Slave PCB Board

For 65/75/110/140kW



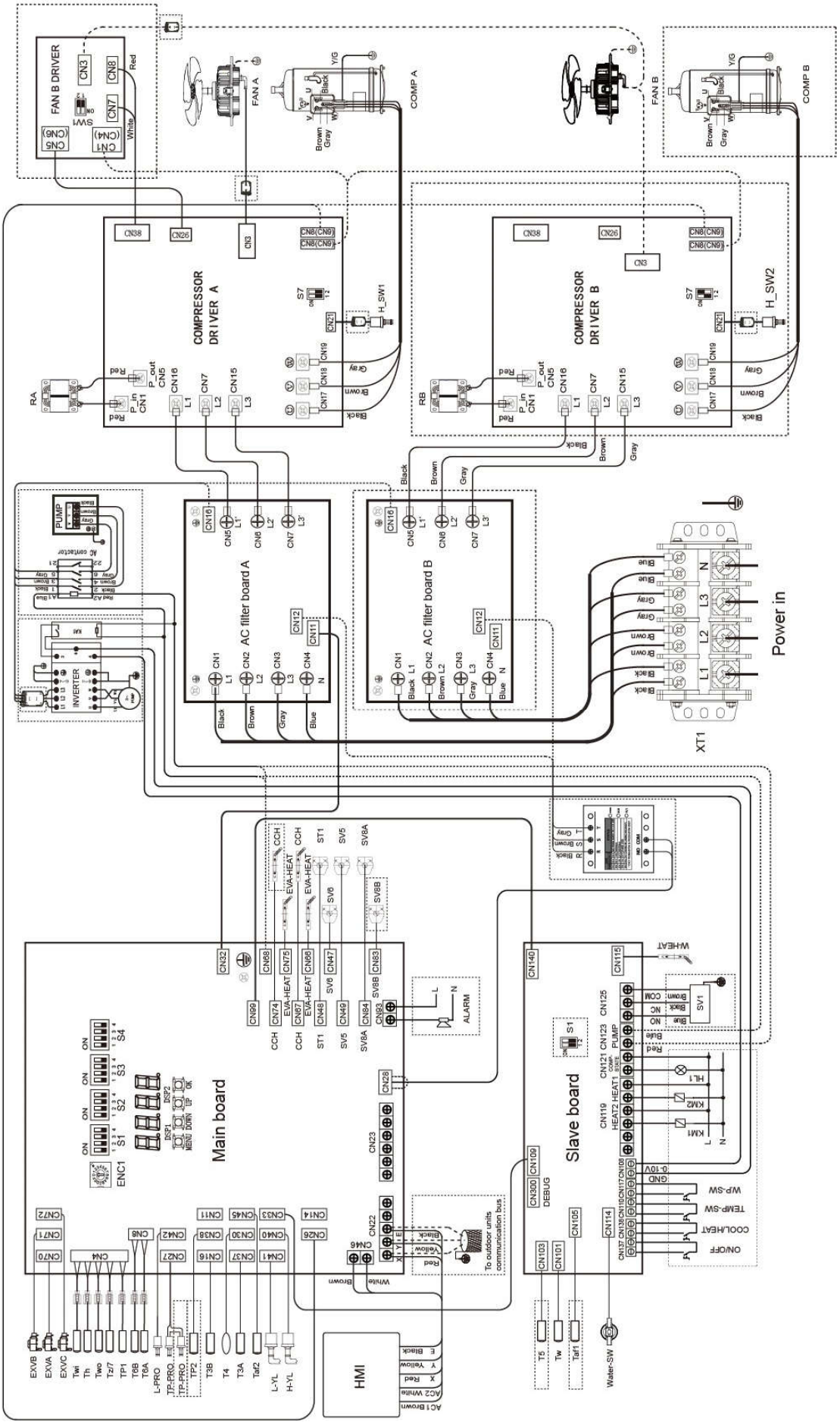
Label	Code	Port	Explanation	Voltage
1	CN140	POWER	Slave PCB board strong power supply	220-240V
2	CN115	W-HEAT	Water pipe electric heating belt	220-240V
3	CN125	3-way valve	Three-way valve for making hot water (used for customized hot water models)	220-240V
4	CN123	PUMP	Port for water pump contactor control	220-240V
5	CN121	COMP-STATE	Compressor Status Indication	/
6	CN119	HEAT1	Pipe auxiliary electric heating belt	/
		HEAT2	Hot water tank auxiliary heater	/
7	CN108	PUMP-V	Frequency conversion pump 0-10V control signal	DC 0-10V
8	CN117	W.P-SW	Target flow Switch	DC12V
9	CN110	TEMP-SW	Target water temperature switch	DC12V
10	CN138	COOL/HEAT	Remote mode control	DC12V
11	CN137	ON/OFF	Remote switch control	DC12V
12	CN114	WATER-SWITCH	Water flow switch	DC12V
13	CN105	Taf1	Water tank anti-freeze sensor	DC3.3V
14	CN101	TW	Total water sensor	DC3.3V
15	CN103	T5	Water tank sensor	DC3.3V
16	CN300	DEBUG	Main control program burn port (WizPro200RS programmer)	DC3.3V
17	CN109	MS	Communication port of slave PCB board and main PCB board	DC12V/DC3.3V

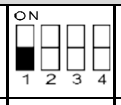
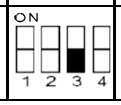
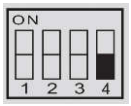
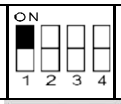
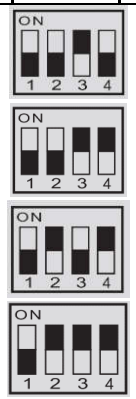
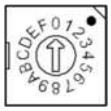
DIP Switch S1: Keep factory Settings (Reserve)

3 Wiring diagram

3.1 Single unit

For 65/75/110/140kW



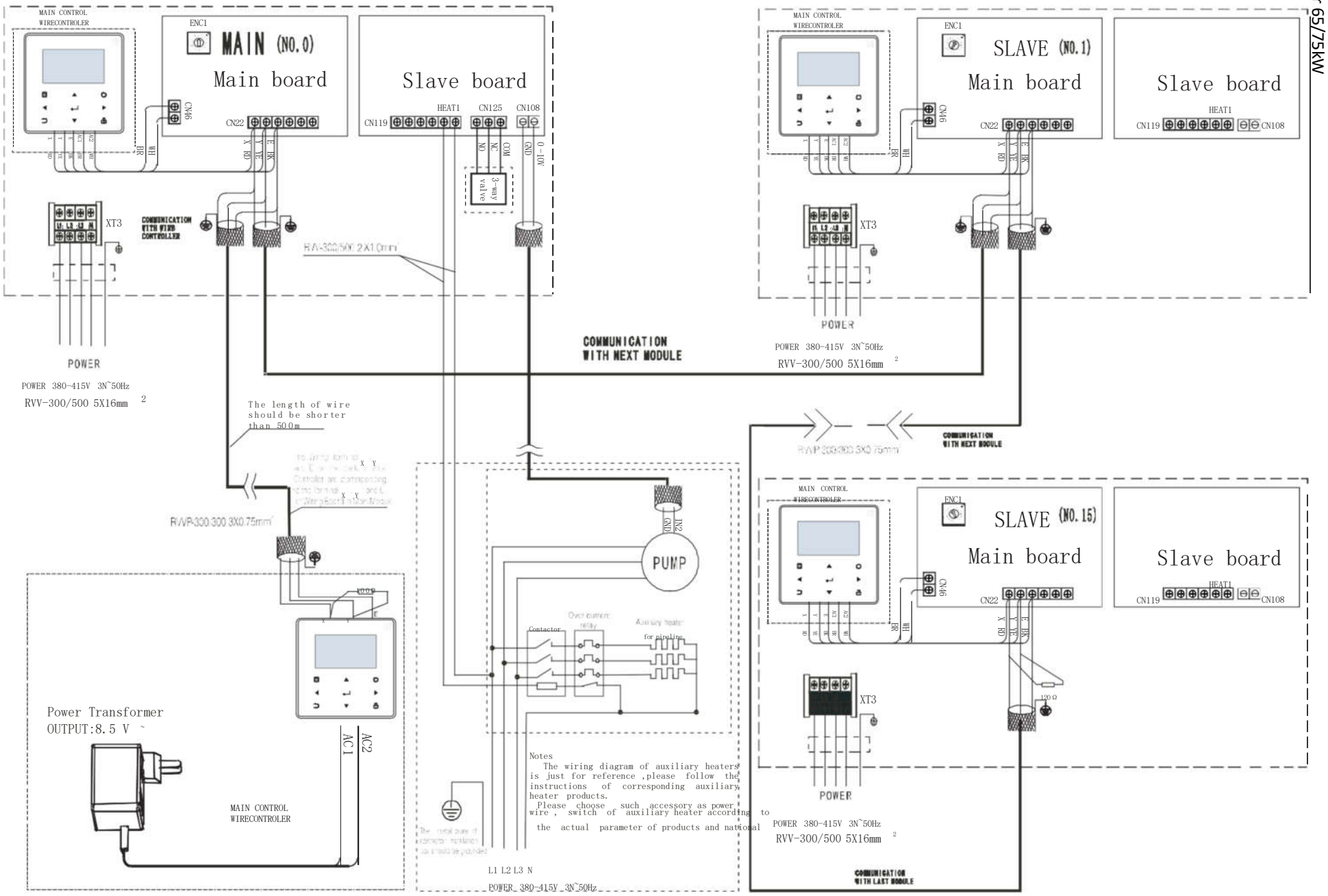
Switch		Description	ON	OFF	Default factory setting
	S1-1	Control mode	Remote control	Normal control	OFF
	S1-3	Water pump	Multiple water pumps control	Single water pump control	OFF
	S1-4	Water pump	Single variable frequency water pump plus single constant frequency water pump control	Single variable frequency water pump control	OFF
	S3-1	-	-	-	ON
	S4	DIP switch for capacity selection	-	-	65kW：0010； 75kW：0011； 110Kw：0101； 140kW：0111；
	ENC1	0-F valid for unit address setting on the DIP switches 0 indicates the master unit and 1-F the auxiliary units (parallel connection)	-	-	0

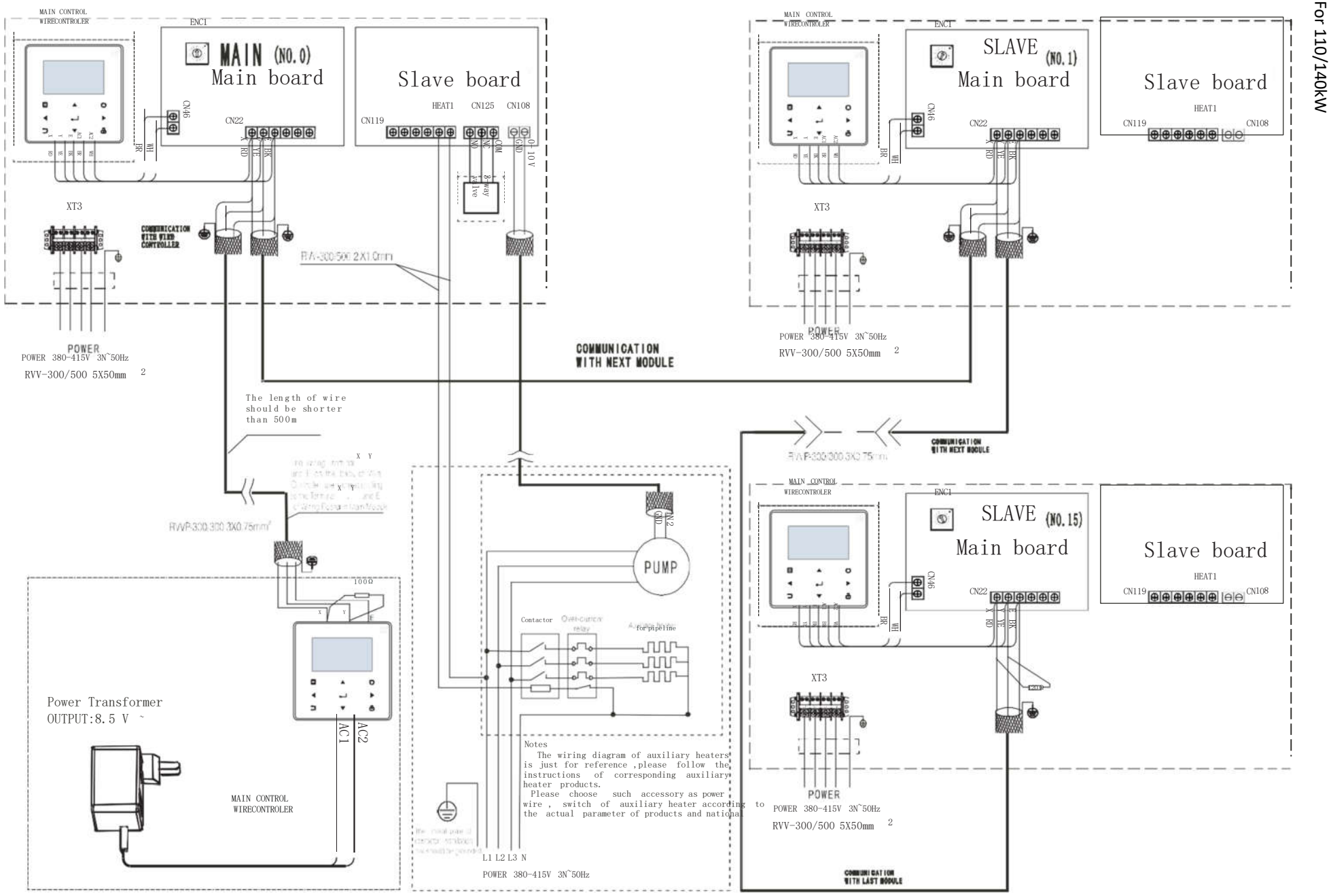
Code	Name
Fan A/B	DC fan
ST1	Four-way valve
SV1	3-way valve
SV5/SV6/ SV8A/SV8B	Solenoid valve
XT1	Terminal block
H_SW1/2	High pressure switch
L-PRO	Low pressure switch
TP-PRO	Protection switch of discharge temp.
T3A/T3B	Probe of coil outlet temp.
T4	Probe of ambient temp.

T5	Probe of water tank
T6A	Refrigerant inlet temperature of EVI plate heat exchanger
T6B	Refrigerant outlet temperature of EVI plate heat exchanger
Tz/7	Probe of coil final outlet temp.
Taf1	Probe of inlet water side antifreeze temp.
Taf2	Probe of outlet water side antifreeze temp.
Twi	Probe of unit water inlet temp.

Two	Probe of unit water outlet temp.
Tw	Probe of final unit water outlet temp.
Tp1/Tp2	Probe of discharge temp.
Th	Probe of suction temp.
H-YL	Probe of high pressure
L-YL	Probe of low pressure
RA/RB	Reactor
EXVA/EXVB /EXVC	Electronic expansion valve
CCH	Crankcase heater
EVA-HEAT	Electronic heating bele for plate heat exchanger

COOL/HEAT	Remote mode cool/heat signal
ON/OFF	Remote mode on/off signal
Water-SW	Water flow switch
W.P-SW	Water pressure switch
TEMP-SW	Targer water temperature switch
KM1	Control contactor for auxiliary heater of pipe
KM2	Control contactor for auxiliary heater of water tank
HL1	Signal lamp of compressor status
KA1	Auxiliary realy of pump inverter


MAIN CONTROL WIRECONTROLER
ENC1
MAIN (NO.0)
Main board
Slave board
CN46
CN22
CN119
HEAT1
CN125
CN108
3-way valve
0-10V
XT3
COMMUNICATION WITH WIRE CONTROLLER
POWER
POWER 380-415V 3N~50Hz
RVV-300/500 5X16mm 2
COMMUNICATION WITH NEXT MODULE
SLAVE (NO.1)
SLAVE (NO.15)
The length of wire should be shorter than 50.0m
RVVP-300/300 3X0.75mm²
PUMP
Contactor
Auxiliary heater for pipeline
Power Transformer
OUTPUT:8.5 V ~
AC1
AC2
120Ω
Notes
The wiring diagram of auxiliary heaters is just for reference ,please follow the instructions of corresponding auxiliary heater products.
Please choose such accessory as power wire , switch of auxiliary heater according to the actual parameter of products and national
L1 L2 L3 N
POWER 380-415V 3N~50Hz
COMMUNICATION WITH LAST MODULE


MAIN CONTROL WIRECONTROLER
ENC1
MAIN (NO.0)
Main board
Slave board
HEAT1
CN125
CN108
CN119
CN46
CN22
XT3
COMMUNICATION WITH WIRED CONTROLLER
RVA-300/500 2X1.0mm
POWER
POWER 380-415V 3N~50Hz
RVV-300/500 5X50mm 2
COMMUNICATION WITH NEXT MODULE
SLAVE (NO.1)
Main board
Slave board
The length of wire should be shorter than 500m
RVVP-300/300 3X0.75mm²
100Ω
Power Transformer
OUTPUT:8.5 V ~
AC1
AC2
MAIN CONTROL WIRECONTROLER
PUMP
Contactor
Over-current relay
for pipeline
L1 L2 L3 N
POWER 380-415V 3N~50Hz
SLAVE (NO.15)
Main board
Slave board
COMMUNICATION WITH LAST MODULE
Notes
The wiring diagram of auxiliary heaters is just for reference ,please follow the instructions of corresponding auxiliary heater products.
Please choose such accessory as power wire , switch of auxiliary heater according to the actual parameter of products and national

4 Check Code Table

4.1 Unit

No.	Code	Content	Recovery condition
1	E0	Main control Model setting error (Other Model Main control EPROM error)	The capability selection is inconsistent with the actual model, power on again after setting correctly
2	E1	Phase sequence error of main control board check	Automatic recovery after the fault is rectified
3	E2	Communication failure between master and the HMI or master and salve	Automatic recovery after the fault is rectified
		2E2: Communication failure between main board and slave board	Automatic recovery after the fault is rectified
4	E3	Total water outlet temperature sensor failure (main unit valid)	Automatic recovery after the fault is rectified
5	E4	Unit water outlet temperature sensor failure	Automatic recovery after the fault is rectified
6	E5	1E5 condenser tube temperature sensor T3A failure	Automatic recovery after the fault is rectified
		2E5 condenser tube temperature sensor T3B failure	Automatic recovery after the fault is rectified
7	E6	Water tank temperature sensor T5 failure	Automatic recovery after the fault is rectified
8	E7	Ambient temperature sensor failure	Automatic recovery after the fault is rectified
9	E8	Power supply phase sequence protector output error	Automatic recovery after the fault is rectified
10	E9	Water flow detection failure	Failure locking for 3 times in 60 minutes (Recovered by power off or Wired controller clear fault)
11	Eb	1Eb-->Taf1 DHW water pipe antifreeze protection sensor failure	Automatic recovery after the fault is rectified
		2Eb-->Taf2 cooling evaporator low-temperature antifreeze protection sensor failure	Automatic recovery after the fault is rectified
12	EC	Slave unit module reduction	Automatic recovery after the fault is rectified
13	Ed	system discharge temperature sensor failure	Automatic recovery after the fault is rectified
14	EE	1EE EVI plate heat exchanger refrigerant temperature T6A sensor failure	Automatic recovery after the fault is rectified
		2EE EVI plate heat exchanger refrigerant temperature T6B sensor failure	Automatic recovery after the fault is rectified
15	EF	Unit water return temperature sensor failure	Automatic recovery after the fault is rectified
16	EP	Discharge sensor failure alarm	Automatic recovery after the fault is rectified
17	EU	Tz sensor failure	Automatic recovery after the fault is rectified
18	P0	P0 System high-pressure protection or discharge temperature protection	for 3 times in 60 minutes (Recovered bypower off)
		1P0 Compressor module 1 high pressure protection	Automatic recovery after the fault is rectified
		2P0 Compressor module 2 high pressure protection	Automatic recovery after the fault is rectified
19	P1	System low pressure protection (or Severe refrigerant leakage protection)	for 3 times in 60 minutes (Recovered bypower off)
20	P3	T4 ambient temperature too high in cooling mode	Automatic recovery after the fault is rectified
21	P4	1P4 System A current protection	for 3 times in 60 minutes (Recovered by power off)
		2P4 System A DC bus current protection	
22	P5	1P5 System B current protection	for 3 times in 60 minutes (Recovered by power off)
		2P5 System B DC bus current protection	
23	P6	Inverter module failure	Automatic recovery after the fault is rectified
24	P7	High temperature protection of system condenser	for 3 times in 60 minutes (Recovered bypower off)
25	P9	Water inlet and outlet temperature difference protection	Automatic recovery after the fault is rectified
26	PA	Abnormal water inlet and outlet temperature difference protection	Automatic recovery after the fault is rectified
27	Pb	Winter antifreeze protection	Reminder code, non-fault or protection

No.	Code	Content	Recovery condition
28	PC	Cooling evaporator pressure too low	Automatic recovery after the fault is rectified for 3 times in 60 minutes (Recovered by power off)
29	PE	Cooling evaporator low temperature antifreeze protection	Automatic recovery after the fault is rectified for 3 times in 60 minutes (Recovered by power off)
30	PH	Heating T4 too high temperature protection	Automatic recovery after the fault is rectified
31	PL	Tfin module temperature too high protection	for 3 times in 100 minutes (Recovered by power off)
32	PU	1PU DC fan A module protection	Automatic recovery after the fault is rectified
		2PU DC fan B module protection	Automatic recovery after the fault is rectified
33	bH	1bH:Module 1 relay blocking or 908 chip self-check failed	Automatic recovery after the fault is rectified
		1bH:Module 2 relay blocking or 908 chip self-check failed	Automatic recovery after the fault is rectified
34	H5	Voltage too high or too low	Automatic recovery after the fault is rectified
35	xH9	1H9 Compressor A inverter module is not matched	Automatic recovery after the fault is rectified
		2H9 Compressor B inverter module is not matched	Automatic recovery after the fault is rectified
36	HC	High pressure sensor failure	Automatic recovery after the fault is rectified
37	HE	1HE No inset A valve error	Automatic recovery after the fault is rectified
		2HE No inset B valve error	Automatic recovery after the fault is rectified
		3HE No inset C valve error	Automatic recovery after the fault is rectified
38	F0	1F0 IPM module A transmission error	Automatic recovery after the fault is rectified
		2F0 IPM module B transmission error	Automatic recovery after the fault is rectified
39	F2	Superheat insufficient	Wait at least 20min before recovering
40	F4	1F4 module A L0 or L1 protection occurs for 3 times in 60 minutes	Recovered by power off
		2F4 module B L0 or L1 protection occurs for 3 times in 60 minutes	Recovered by power off
41	F6	1F6 A system bus voltage error (PTC)	Automatic recovery after the fault is rectified
		2F6 B system bus voltage error (PTC)	Automatic recovery after the fault is rectified
42	Fb	Low pressure sensor error	Automatic recovery after the fault is rectified
43	Fd	Suction temperature sensor error	Automatic recovery after the fault is rectified
44	FF	1FF DC fan A error	Recovered by power off
		2FF DC fan B error	Recovered by power off
45	FP	DIP switch inconsistency of multiple water pumps	Recovered by power off
46	C7	If PL occurs 3 times in 100 minutes ,the system reports the C7 failure	Recovered by power off or Wired controller clear fault
47	xL0	Compressor inverter module protection(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
48	xL1	low-voltage protection(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
49	xL2	high-voltage protection(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
50	xL4	MCE error(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
51	xL5	zero-speed protection(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
52	xL7	phase loss(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
53	xL8	frequency change over 15Hz (x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
54	xL9	frequency phase difference 15Hz(x=1or 2,1 for Compressor A,2 for Compressor B)	Automatic recovery after the fault is rectified
55	dF	Defrosting prompt	Flash when entering the defrosting
56	L10	Overcurrent protection	Overcurrent fault
	L11	Transient phase current overcurrent protection	
	L12	Phase current overcurrent lasts 30s protection	

57	L20	Module over temperature protection	Over temperature fault
No.	Code	Content	Recovery condition
58	L30	Low bus voltage error	Power fault
	L31	High bus voltage error	
	L32	Excessively high bus voltage error	
	L34	Phase loss error	
59	L43	Phase current sampling bias abnormal	hardware fault
	L45	Motor code not match	
	L46	IPM protection	
	L47	Module type not match	
60	L50	Startup failure	Control fault
	L51	Out of step error	
	L52	Zero speed error	
61	L60	Fan motor phase loss protection	Diagnostic fault
	L65	IPM short circuit error	
	L66	FCT detection error	
	L6A	Open circuit of U-phase upper tube	
	L6B	Open circuit of U-phase lower tube	
	L6C	Open circuit of V-phase upper tube	
	L6D	Open circuit of V-phase lower tube	
	L6E	Open circuit of W-phase upper tube	
	L6F	Open circuit of W-phase lower tube	

4.2 Water pump

In case of water pump failure, disassemble the unit sheet metal and check the failure on the LED panel of the water pump.

Error N°	Reaction time before error signalisation	Time before consideration of the defect, after signalisation	Waiting time before automatic restart	Max defects over 24 hours	Faults Possible causes	Remedies	Waiting time before reset
E001	60s	immediate	60s	6	The pump is in overload, defective.	Density and/or viscosity of the conveyed are too big.	300s
					The pump is obstructed by particles.	Dismantle the pump and replace the defective components or clean them.	
E004 (E032	~5s	300s	Immediate if defect deleted	6	The converter supply is in under voltage.	Check the converter terminals: error if network < 330V	0s
E005 (E033)	~5s	300s	Immediate if defect deleted	6	The converter supply is in over voltage.	Check the converter terminals: error if network > 480V	0s
E006	~5s	300s	Immediate if defect deleted	6	A supply phase is missing.	Check the supply.	0s
E007	immediate	immediate	Immediate if defect deleted	no limit	The converter runs like a generator. It is a warning, without stop of the pump.	The pump veers, check the tightness of the non-return valve.	0s
E010	~5s	immediate	no restart	1	The pump is locked.	Dismantle the pump, clean it and replace the defective parts. It may be a mechanical failure of the motor (bearings).	60s
E011	15s	immediate	60s	6	Pump is no more primed or runs dry.	Prime the pump once again by filling it (see chapter 8.3). Check the tightness of the foot valve.	300s

E020	~5s	immediate	300s	6	The motor heats.	Clean the cooling ribs of the motor.	300s
					Ambient temperature higher than +40°C.	The motor is foreseen to run at an ambient temperature of +40°C.	
E023	immediate	immediate	60s	6	The motor is in short-circuit.	Dismantle the motor-converter of the pump, check it or replace it.	60s
E025	immediate	immediate	no restart	1	Missing phase of the motor.	Check the connection between motor and converter.	60s
E026	~5s	immediate	300s	6	The thermal sensor of the motor is defective or has a wrong connection.	Dismantle the motor-converter of the pump, check it or replace it.	300s
E030 E031	~5s	immediate	300s	6	The converter heats.	Clean the cooling ribs rear side and under the converter as well as the fan cover.	300s
					Ambient temperature higher than +40°C.	The converter is foreseen to run at an ambient temperature of +40°C.	
E042	~5s	immediate	no restart	1	The cable of the sensor (4-20mA) is cut.	Check the correct supply and the cable connection of the sensor.	60s
E050	60s	immediate	Immediate if defect deleted	no limit	BMS communications time-out.	Check the connection.	300s
E070	immediate	immediate	no restart	1	Internal communication error.	Call the after-sales technician.	60s
E071	immediate	immediate	no restart	1	EEPROM error.	Call the after-sales technician.	60s
E072 E073	immediate	immediate	no restart	1	Problem inside converter.	Call the after-sales technician.	60s
E075	immediate	immediate	no restart	1	Inrush current relay defect.	Call the after-sales technician.	60s
E076	immediate	immediate	no restart	1	Current sensor defect.	Call the after-sales technician.	60s
E077	immediate	immediate	no restart	1	24V defect	Call the after-sales technician.	60s
E099	immediate	immediate	no restart	1	Unknown pump type.	Call the after-sales technician.	Power off/on

5 Troubleshooting

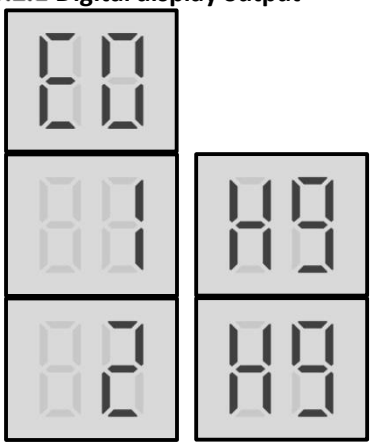
5.1 Warning

Warning

- All electrical work must be carried out by competent and suitably qualified, certified and accredited professionals and in accordance with all applicable legislation (all national, local and other laws, standards, codes, rules, regulations and other legislation that apply in a given situation).
- Power-off the outdoor units before connecting or disconnecting any connections or wiring, otherwise electric shock (which can cause physical injury or death) may occur or damage to components may occur.

5.2 E0/H9 Troubleshooting

5.2.1 Digital display output



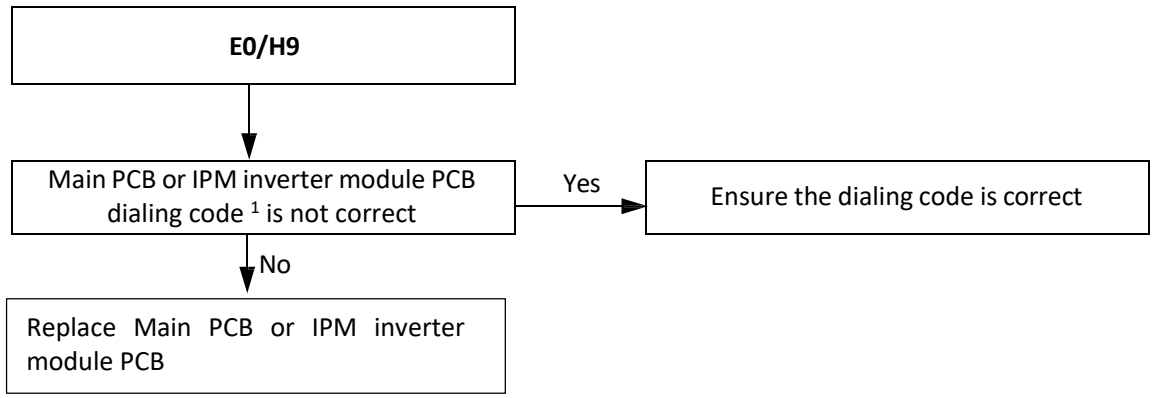
5.2.2 Description

- E0 indicates that the capability dialing code of the main PCB is inconsistent with the actual model.
- 1H9 indicates that the driving model of IPM inverter module (compressor A) does not match.
- 2H9 indicates that the driving model of IPM inverter module (compressor B) does not match.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface...d user interface.

5.2.3 Possible causes

- The dialing code of main PCB capability is error.
- The address dialing code of the IPM inverter module PCB is error.
- Main PCB or IPM inverter module damaged.

5.2.4 Procedure



Notes:

1. Main PCB capability DIP switch is designated S4 on the main PCBs (S4 in Part 4, 2.2.1 Main PCB component).
2. Compressor inverter module PCB address DIP switch is designated S7 on compressor inverter module PCB (S7 in Part 4, 2.3.2 Compressor Inverter Module PCB field setting).

5.3 E1 Troubleshooting

5.3.1 Digital display output

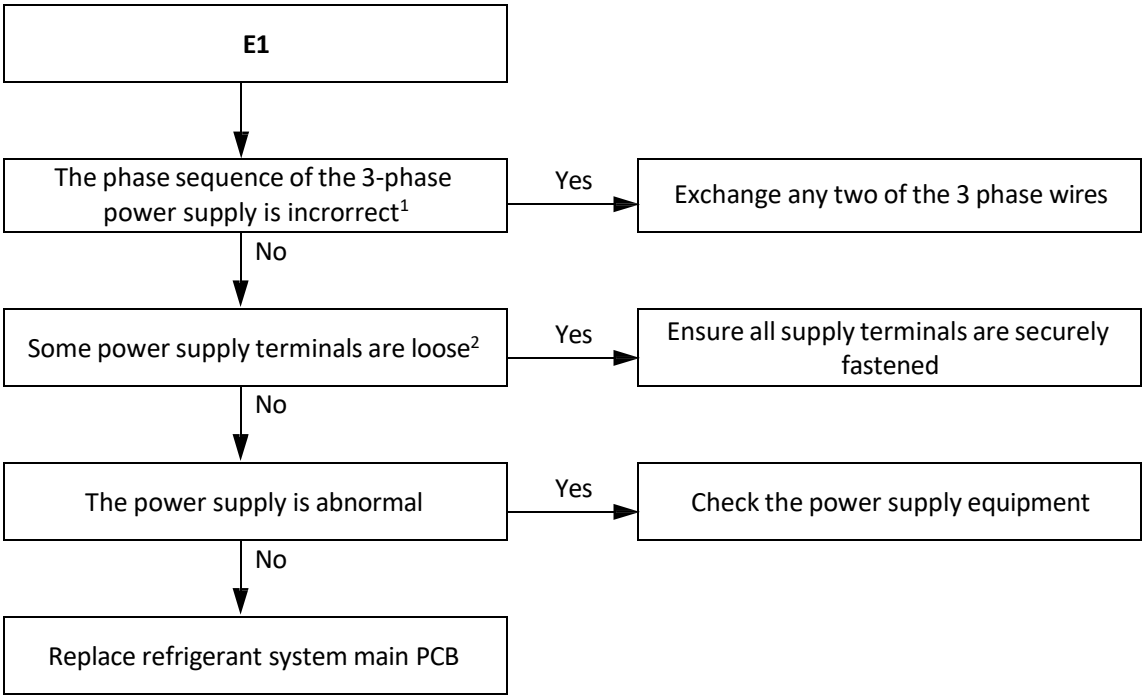
5.3.2 Description

- Phase sequence error.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.3.3 Possible causes

- Power supply phases not connected in correct sequence.
- Power supply terminals loose.
- Power supply abnormal.
- Main PCB damaged.

5.3.4 Procedure

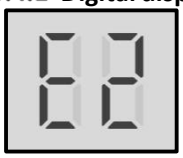


Notes:

1. The A, B, C terminals of 3-phase power supply should match compressor phase sequence requirements. If the phase sequence is inverted, the compressor will operate inversely. If the wiring connection of each outdoor unit is in A, B, C phase sequence, and multiple units are connected, the current difference between C phase and A, B phases will be very large as the power supply load of each outdoor unit will be on C phase. This can easily lead to tripped circuits and terminal wiring burnout. Therefore if multiple units are to be used, the phase sequence should be staggered, so that the current is distributed among the three phases equally.
2. Loose power supply terminals can cause the compressor to operate abnormally and compressor current to be very large.

5.4 E2 Troubleshooting

5.4.1 Digital display output



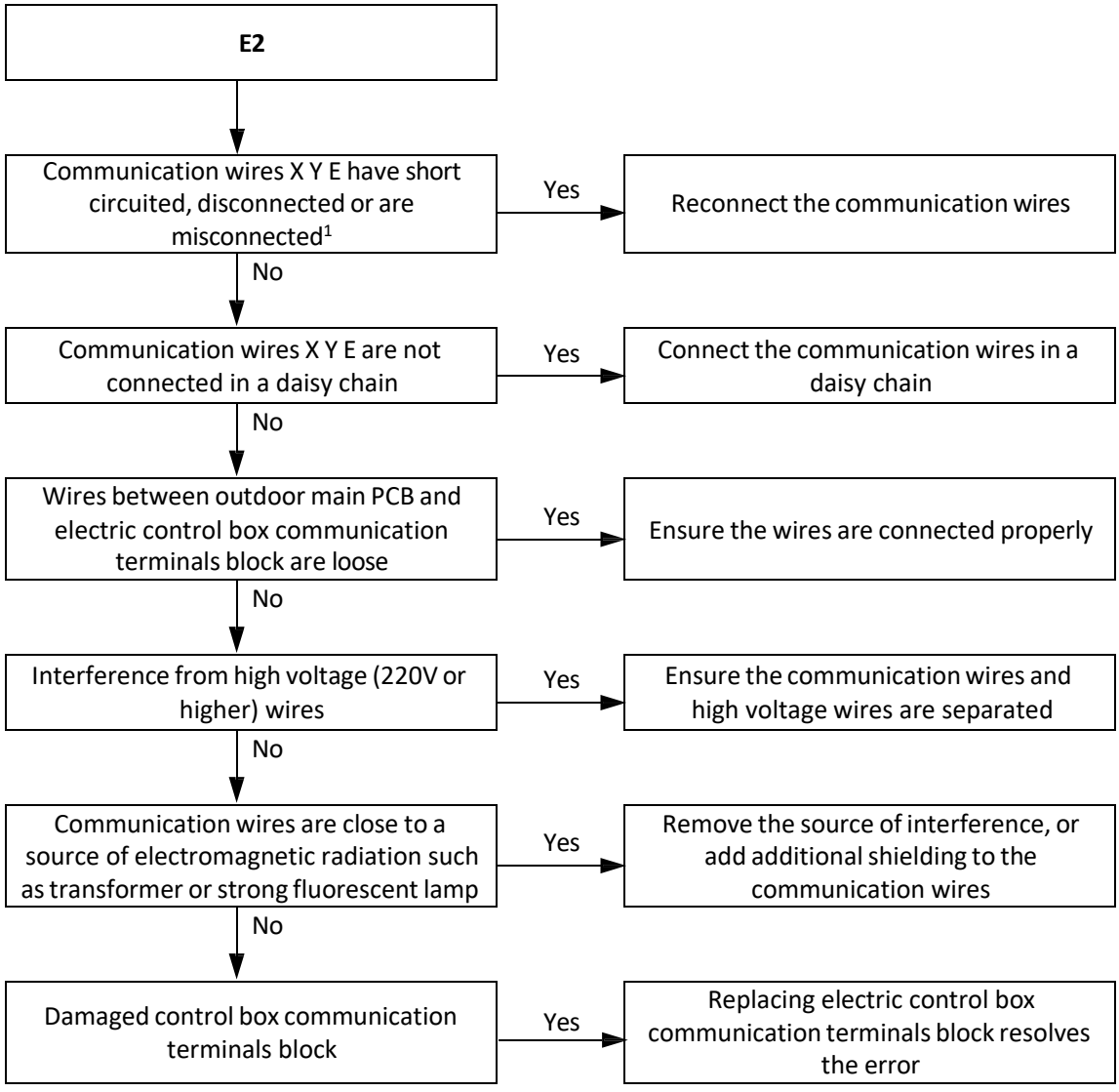
5.4.2 Description

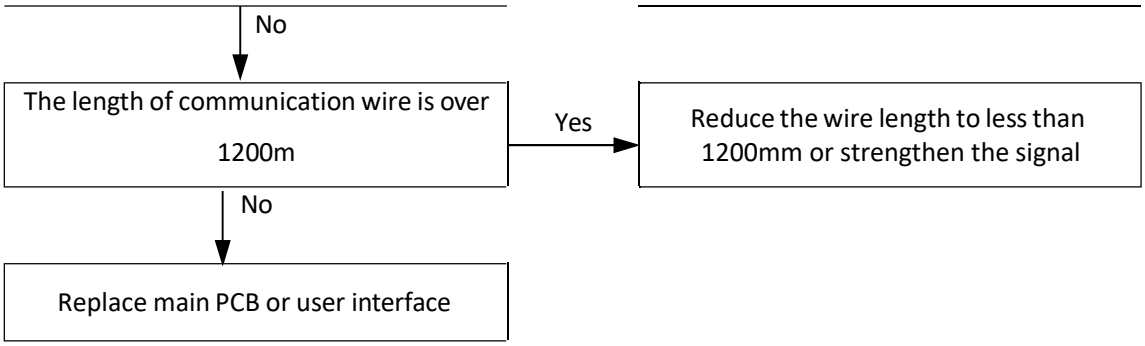
- Communication error between outdoor unit and user interface.
- Communication failure between master and slave units
- When this error occurs in the main unit, all units stop running. When this error occurs in the slave unit, the slave unit stops running..
- Error code is displayed on main PCB and user interface.

5.4.3 Possible causes

- Communication wires between outdoor unit and user interface not connected properly.
- Communication wiring X Y E terminals misconnected.
- Wiring connection is loosen
- Interference from high voltage wires or other sources of electromagnetic radiation.
- Communication wire too long.
- Damaged main PCB, user interface or electric control box communication terminals block.

5.4.4 Procedure



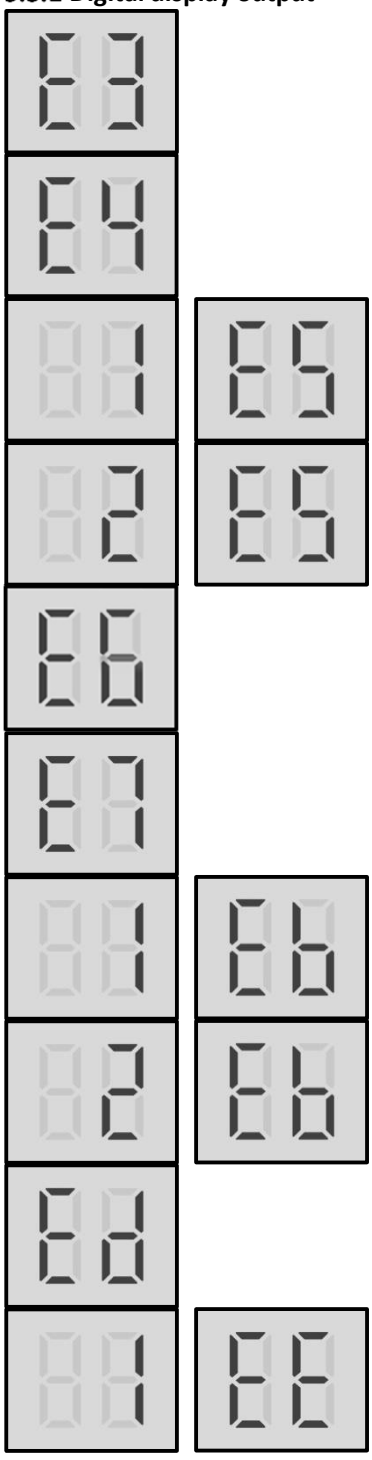


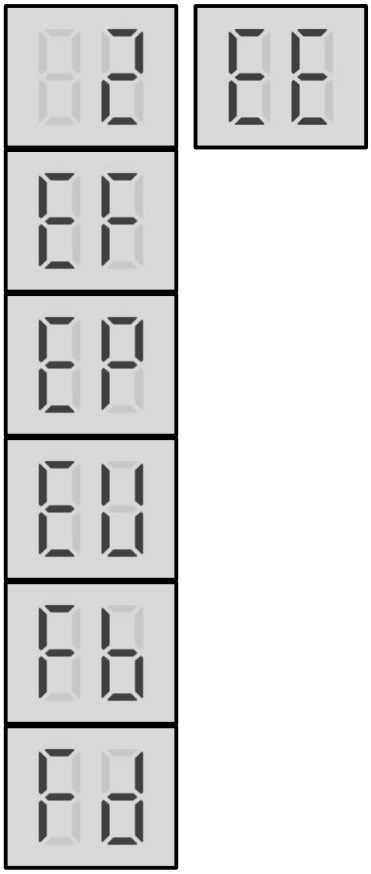
Notes:

1. Measure the resistance among X, Y and E. The normal resistance between X and Y is 120Ω, between X and E is infinite, between Y and E is infinite. Communication wiring has polarity. Ensure that the X wire is connected to X terminals and the Y wire is connected to Y terminals.

5.5 E3, E4, E5, E6,E7, Eb, Ed, EE, EF, EP, EU, Fb, Fd Troubleshooting

5.5.1 Digital display output





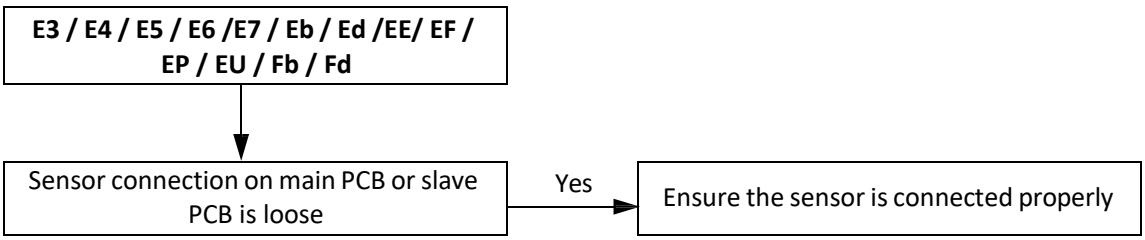
5.5.2 Description

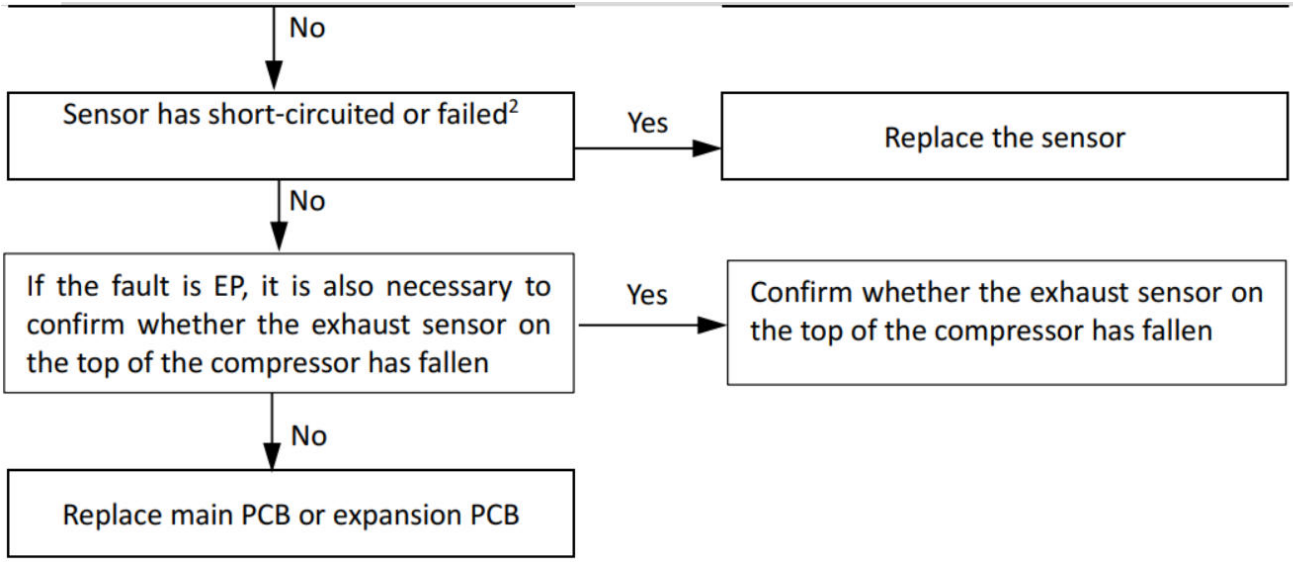
- E3 indicates total water outlet temperature sensor error (valid for the main unit)
- E4 unit water outlet temperature sensor error
- 1E5 indicates condenser tube temperature sensor T3A error
- 2E5 indicates condenser tube temperature sensor T3B error
- E6 Water tank temperature sensor T5 failure
- E7 indicates ambient temperature sensor error
- 1Eb indicates DHW water pipe antifreeze protection sensor Taf1 error
- 2Eb indicates cooling evaporator low-temperature antifreeze protection sensor Taf2 error
- Ed indicates discharge pipe temperature sensors Tp1 and Tp2 error at the same time
- 1EE indicates EVI plate heat exchanger refrigerant temperature sensor T6A error
- 2EE indicates EVI plate heat exchanger refrigerant temperature sensor T6B error
- EF indicates unit water return temperature sensor error
- EP indicates discharge temperature sensor failure error
- EU indicates water side heat exchanger refrigerant total outlet temperature sensor Tz error in heating mode.
- Fb indicates Low pressure sensor error.
- Fd indicates suction temperature sensor Th error.
- All stop running.
- Error code is displayed on main PCB and user interface.

5.5.3 Possible causes

- Sensor not connected properly or has malfunctioned.
- Damaged main PCB.

5.5.4 Procedure





Notes:

1. Most sensors are connected to ports CN4（E4）, CN37（1E5）， CN16（2E5）, CN30(E7）， CN45（2Eb）,CN4 and CN38（Ed）， CN8（EE）， CN4（EF）， CN4 and CN38（EP）， CN4（EU）,CN41(Fb）， CN4（Fd）on the main PCB（labeled 29, 22, 24, 23,21,25, 28,19 in Part 4, 2.2.1 Main PCB component）, A few sensors are connected to ports CN101(E3),CN103(E6）,CN105(1Eb）on the slave PCB（labeled 14,15,13 in Part 4, 2.2.2 Slave PCB component）.
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 "Temperature Sensor Resistance Characteristics".

5.6 E8 Troubleshooting

5.6.1 Digital display output

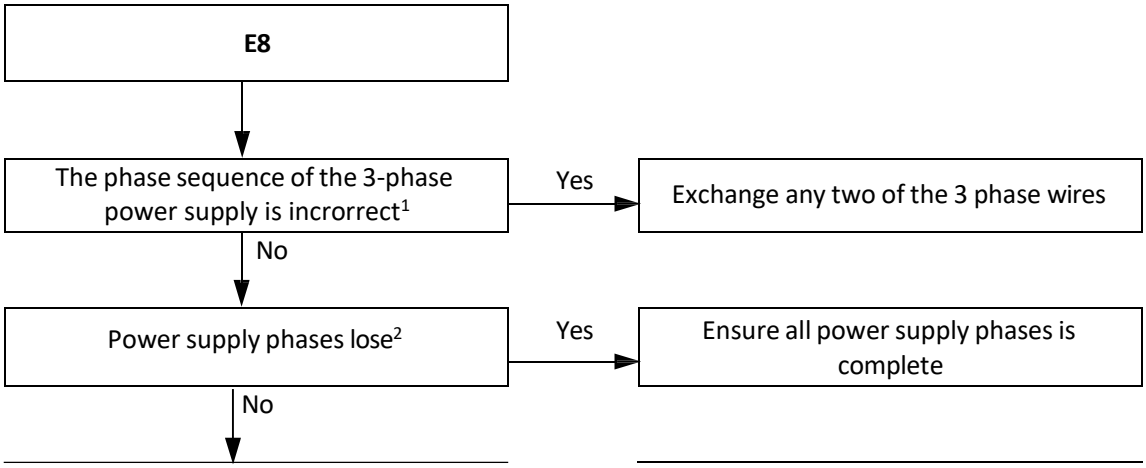
5.6.2 Description

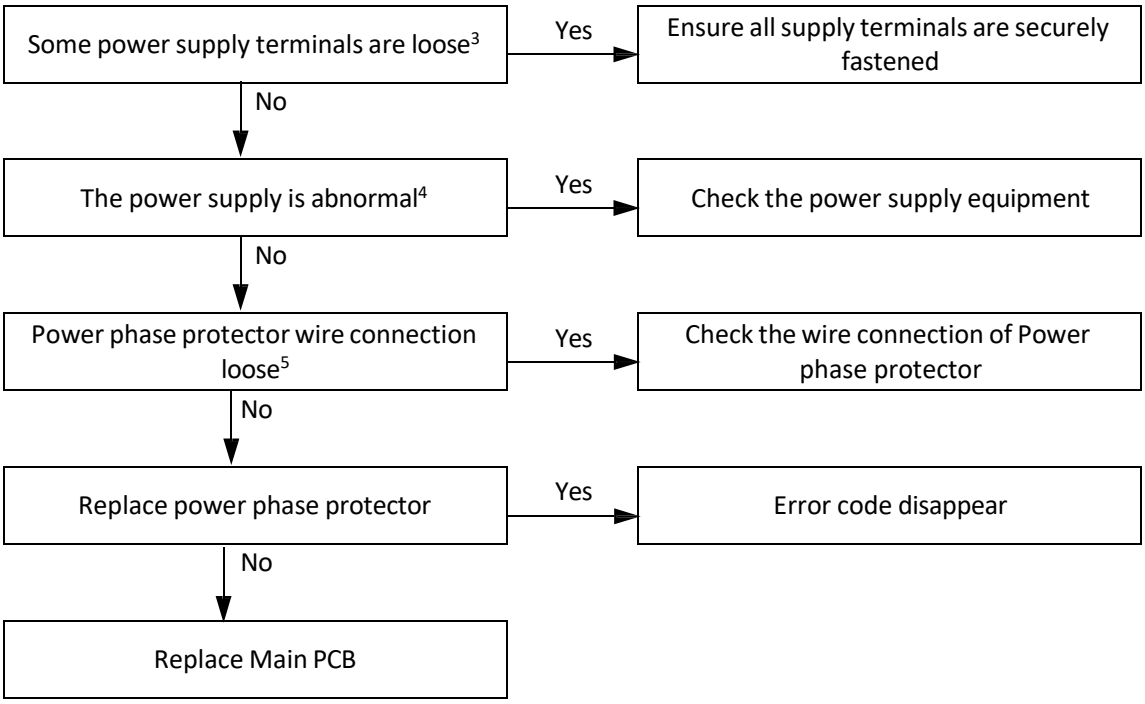
- Power supply phase sequence protector output error
- When this error occurs in the main unit, all units stop running. When this error occurs in the slave unit, the slave unit stops running.
- Error code is displayed on main PCB and user interface.

5.6.3 Possible causes

- Power supply phases not connected in correct sequence or lose.
- Power supply terminals or Power phase protector wire connection loose (For the model without a three-phase protector, use a jumper to short the CN28 terminal on the main control board).
- Power supply abnormal.
- Damaged main PCB.
- Damaged power phase protector.

5.6.4 Procedure





Notes:

1. Some models do not have three-phase protectors. The CN28 terminal on the main control board needs to be short-connected with a short connector. The red LED on the power phase protector will on.
2. The red LED on the power phase protector will flash with 1HZ.
3. The A, B, C terminals of 3-phase power supply should match compressor phase sequence requirements. If the phase sequence is inverted, the compressor will operate inversely. If the wiring connection of each outdoor unit is in A, B, C phase sequence, and multiple units are connected, the current difference between C phase and A, B phases will be very large as the power supply load of each outdoor unit will be on C phase. This can easily lead to tripped circuits and terminal wiring burnout. Therefore if multiple units are to be used, the phase sequence should be staggered, so that the current is distributed among the three phases equally.
4. The red LED on the power phase protector will flash with 3HZ. Loose power supply terminals can cause the compressor to operate abnormally and compressor current to be very large.
5. Wire connected to port CN28 on the main PCB (labeled 34 in Part 4, 2.2.1 Main PCB component)

5.7 E9 Troubleshooting

5.7.1 Digital display output

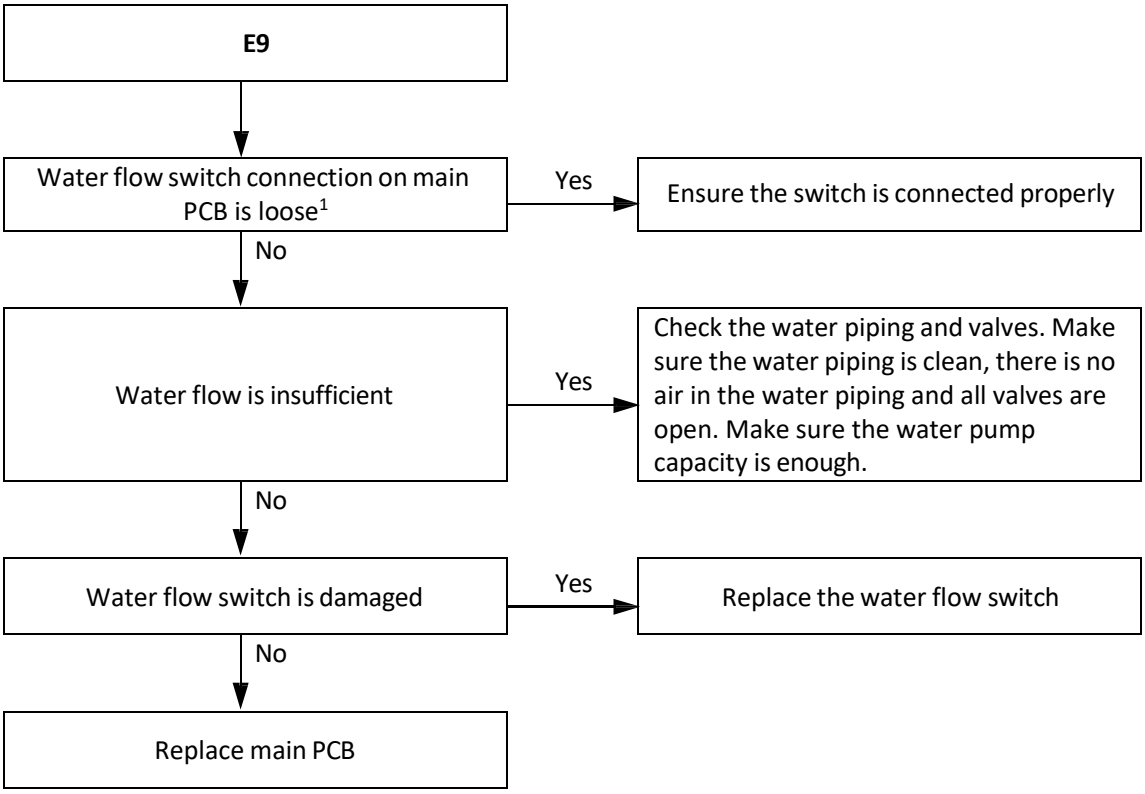
5.7.2 Description

- Water flow failure.
- E9 indicates water flow switch error. When E9 error occurs 3 times in 60 minutes, manual system restart is required before the system can resume operation.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.7.3 Possible causes

- The wire circuit is short connected or open.
- Water flow rate is too low.
- Water flow switch damaged.
- Damaged main PCB.

5.7.4 Procedure

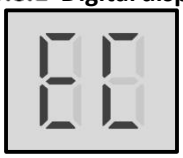


Notes:

1. Water flow switch connection is port CN114 on the slave PCB (labeled 12 in Part 4, 2.2.2 Slave PCB component).

5.8 EC Troubleshooting

5.8.1 Digital display output



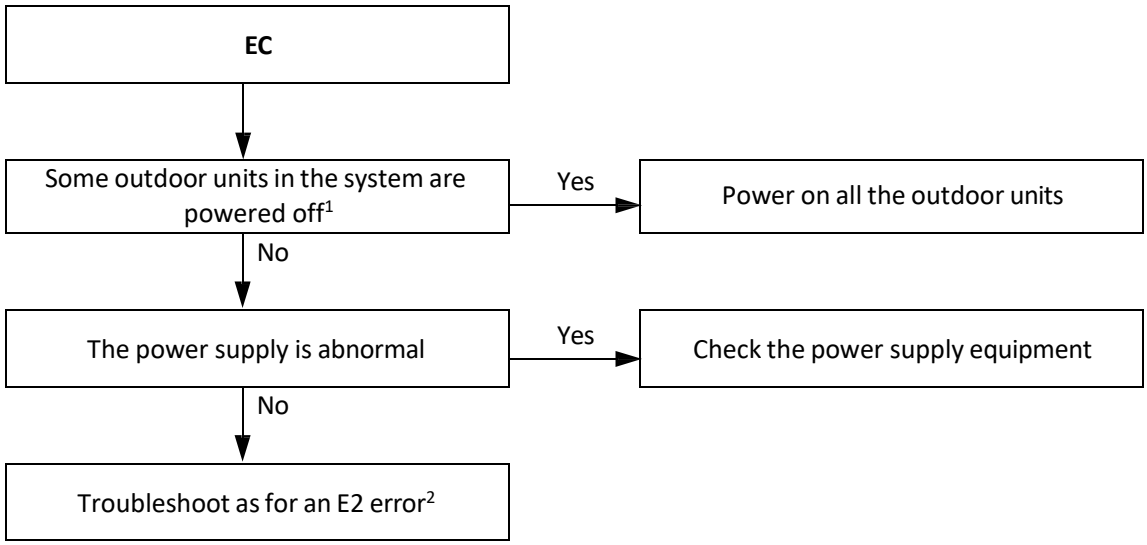
5.8.2 Description

- EC indicates that the number of slave units detected by master unit has decreased.
- The slave unit that has lost contact with the main unit stops running.
- Error code is only displayed on the user interface.

5.8.3 Possible causes

- Some outdoor units power off.
- Power supply abnormal.
- Incorrect outdoor unit address setting.
- Communication wires between outdoor units not connected properly.
- Wiring connection is loosen.
- Damaged main PCB or electric control box communication terminals block.

5.8.4 Procedure

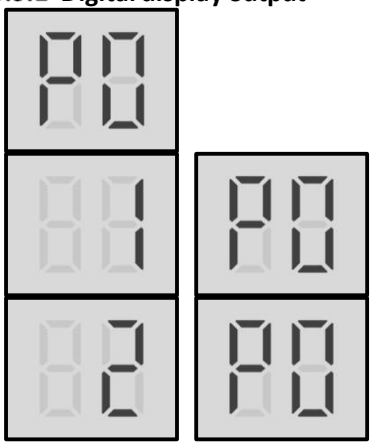


Notes:

1. Check digital display on the main PCB. If digital display is on, the main PCB is powered on, if digital display is off, the main PCB is powered off. Please refer to labeled 11 in Part 4, 2.2.2 Slave PCB component.
2. See Part 4, 4. “E2 Troubleshooting”.

5.9 P0 Troubleshooting

5.9.1 Digital display output



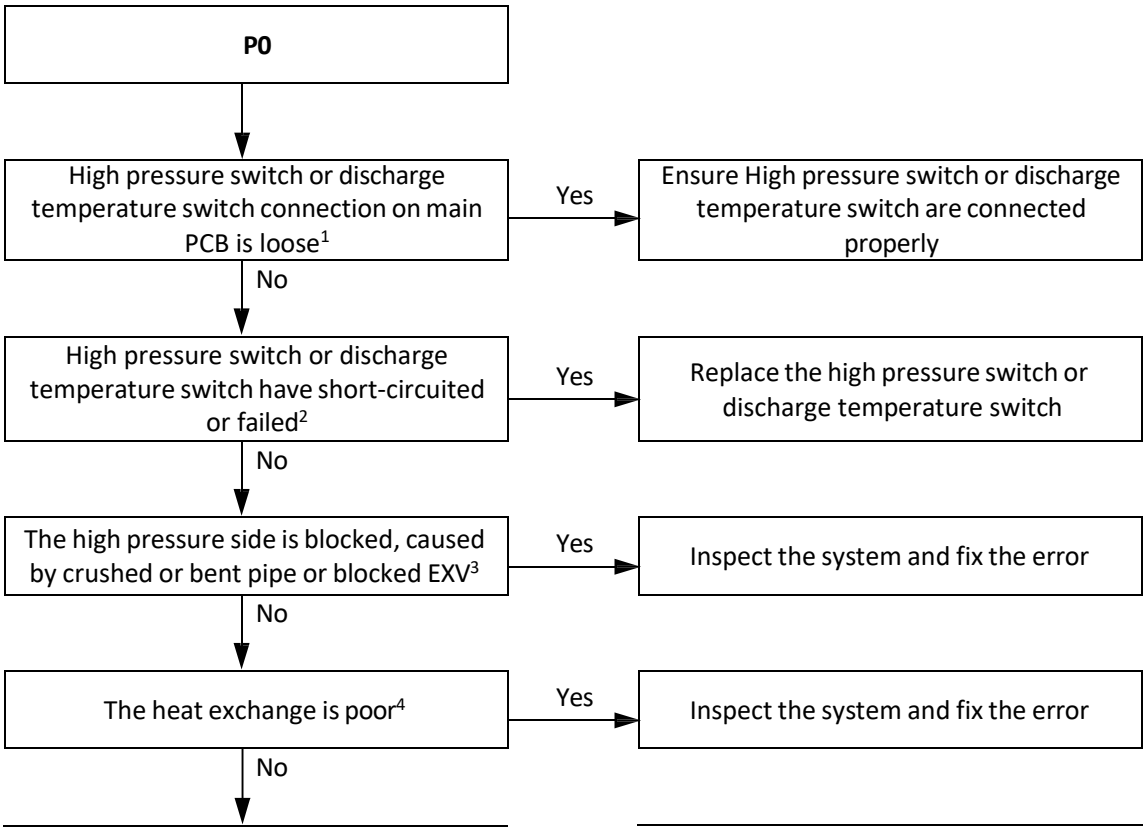
5.9.2 Description

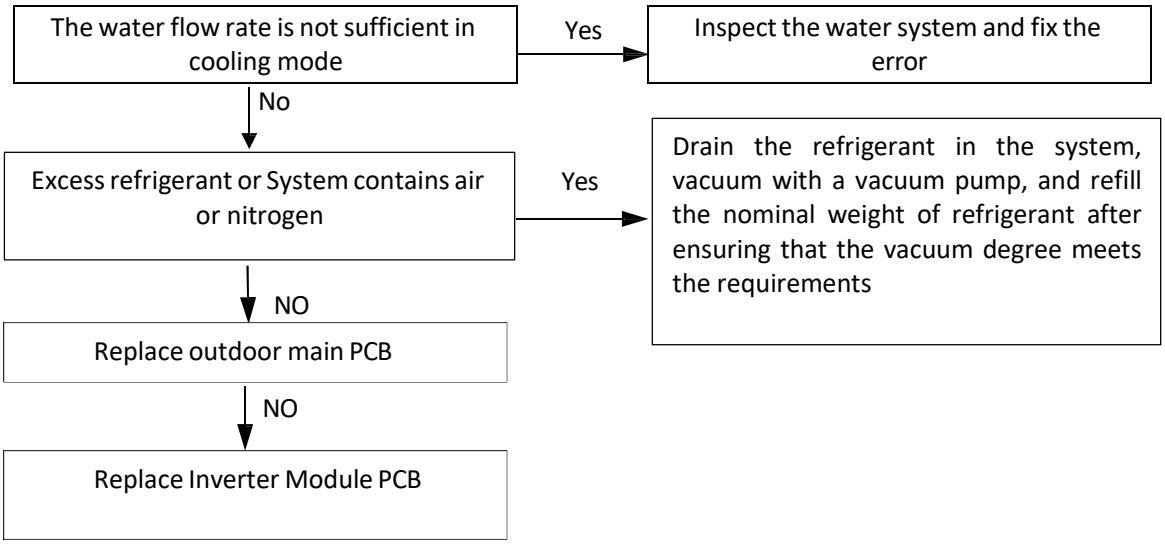
- Discharge pipe high pressure or discharge temperature switch protection. When the discharge pressure rises above 4.2MPa or discharge temperature rises above 115°C, the system displays P0 protection and all units stop running. When the discharge pressure falls below 3.2MPa or discharge temperature fall below 90°C, P0 is removed and normal operation resumes. When P0 error occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.
- Error code is displayed on main PCB and user interface.

5.9.3 Possible causes

- High pressure switch or discharge temperature switch not connected properly or has malfunctioned.
- Excess refrigerant.
- System contains air or nitrogen.
- High pressure side blockage.
- Poor condenser heat exchange.
- Main PCB damaged.

5.9.4 Procedure





Notes:

1. Discharge temperature switch connection is port CN27 on the main PCB (labeled 26 in Part 4, 2.2.1 Main PCB component) .High pressure switch connection is port CN21 on the IPM inverter module PCB.
2. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
3. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal.
4. In heating mode check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages. In cooling mode check air side heat exchanger, fan(s) and air outlets for dirt/blockages.

5.10 P1 Troubleshooting

5.10.1 Digital display output

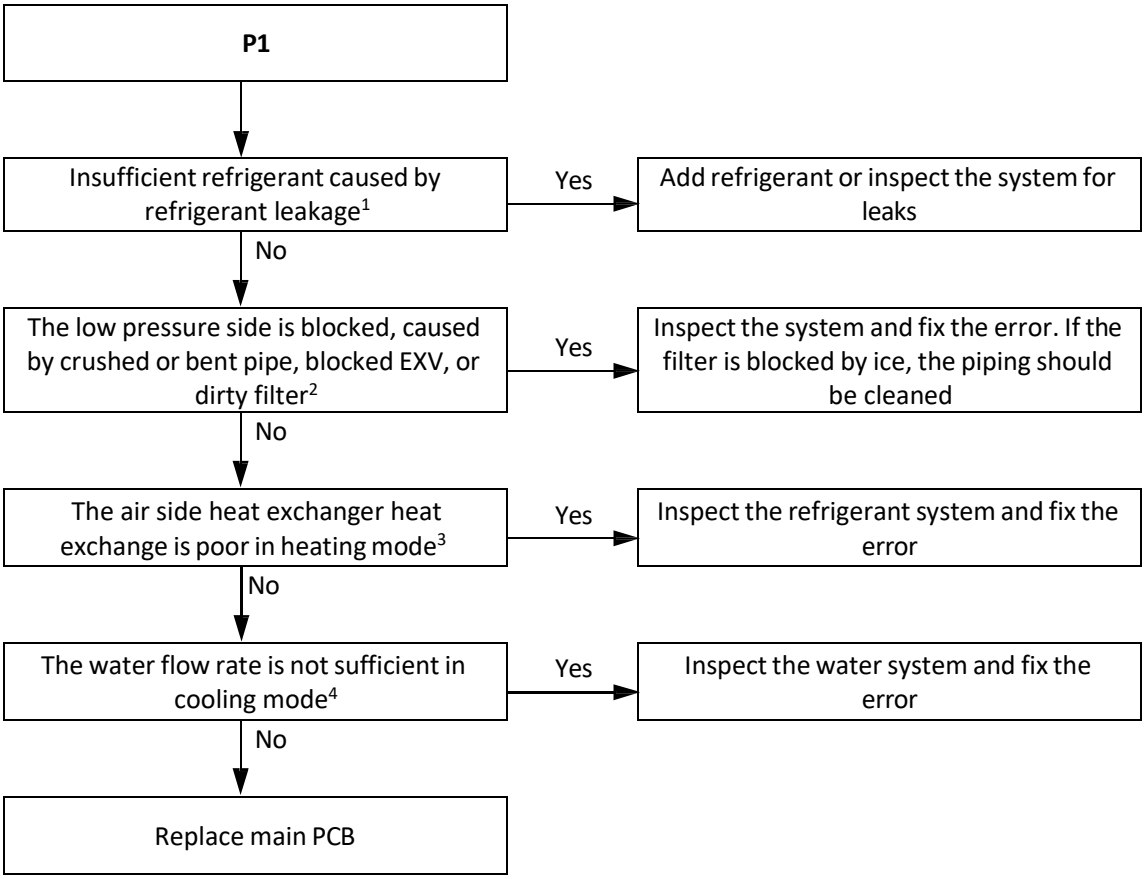
5.10.2 Description

- P1 one of indicates suction pipe low pressure protection. When the suction pressure falls below 0.05MPa, the system displays P1 protection and all units stop running. When the pressure rises above 0.15MPa, P1 is removed and normal operation resumes. When P1 error occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.
- P1 another indicates in the standby state or shutdown state, after the compressor stops for 3min, it is determined that the refrigerant quantity of the refrigerant system of the unit is insufficient through the saturation temperature corresponding to the high-pressure pressure, the system displays P1 protection, the unit does not start and the protection is not locked; When the detection pressure returns to above the judgment value, the protection is released and the unit can resume startup.
- P1 the last one indicates during the operation of the compressor of the unit, if the exhaust superheat is too high and lasts for 30min, report P1 protection first, and then judge the low refrigerant. If the low refrigerant protection is not triggered, P1 protection is removed and the operation is restarted according to the demand.
- Error code is displayed on main PCB and user interface.

5.10.3 Possible causes

- Low pressure switch not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in heating mode.
- Insufficient water flow in cooling mode.
- Main PCB damaged.

5.10.4 Procedure

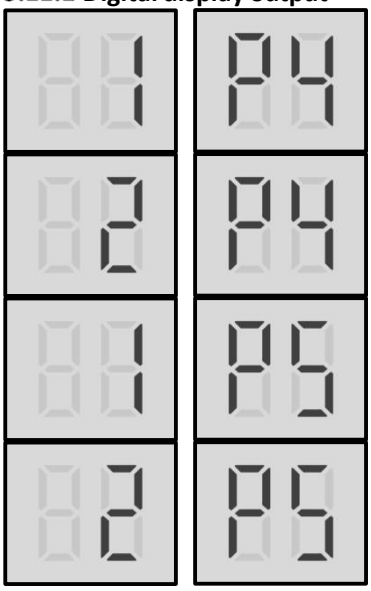


Notes:

1. To check for insufficient refrigerant: An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system.
2. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters.
3. Check air side heat exchanger, fan(s) and air outlets for dirt/blockages.
4. Check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

5.11 P4, P5 Troubleshooting

5.11.1 Digital display output



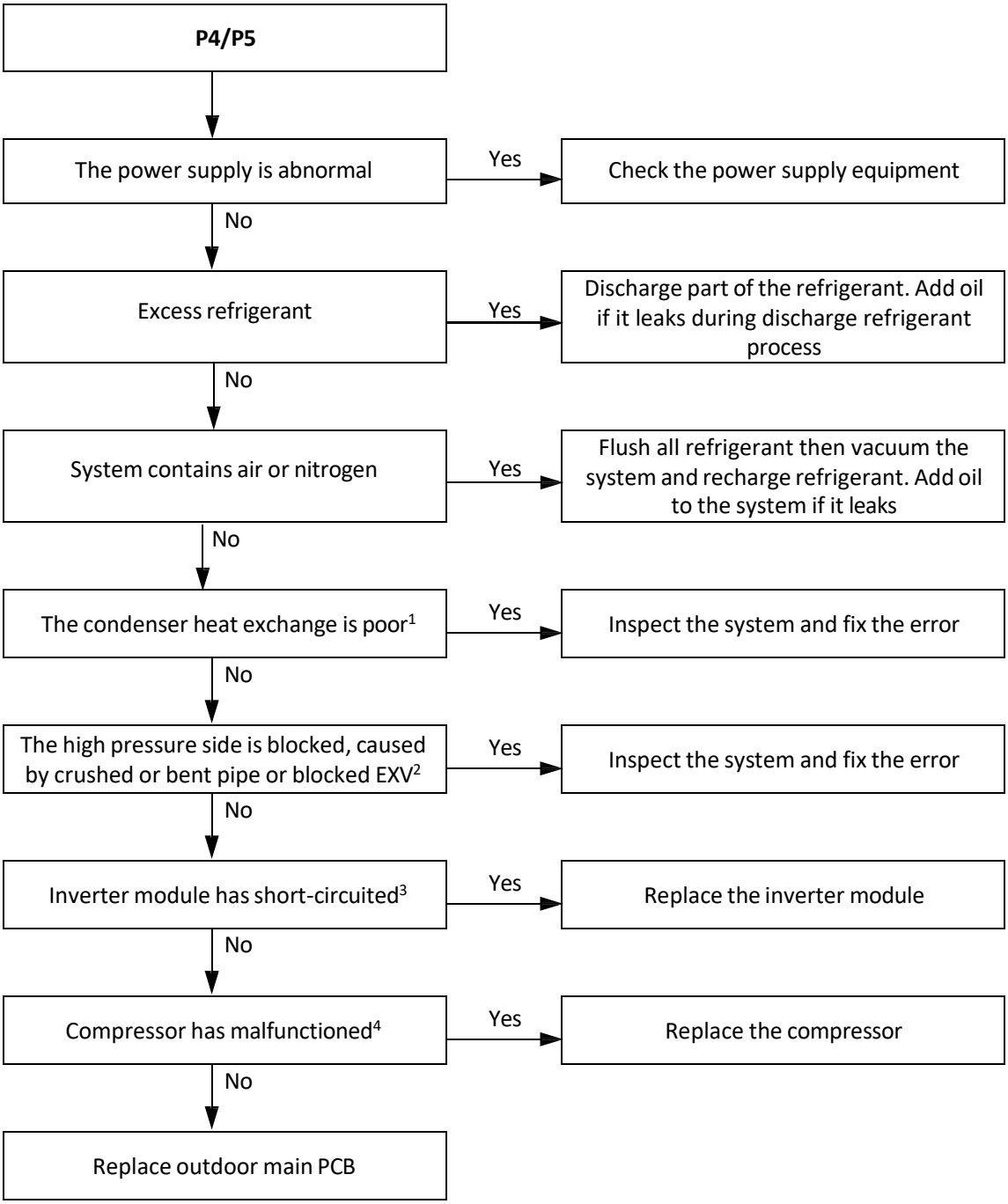
5.11.2 Description

- 1 P4 indicates system A current protection
- 2 P4 indicates system A DC bus current protection
- 1 P5 indicates system B current protection
- 2 P5 indicates system B DC bus current protection
- When the compressor current rises above the protection value 53A, the system displays P4 or P5 protection and the faulty unit stops running. When the current returns to the normal range, P4 or P5 is removed and normal operation resumes. When P4 or P5 error occurs 3 times in 60 minutes, a manual system restart is required before the system can resume operation.
- Error code is displayed on main PCB and user interface.

5.11.3 Possible causes

- Power supply abnormal.
- Poor condenser heat exchange.
- High pressure side blockage.
- Excess refrigerant.
- System contains air or nitrogen.
- Inverter module damaged.
- Compressor damaged.
- Main PCB damaged.

5.11.4 Procedure



Notes:

1. In heating mode check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages. In cooling mode check air side heat exchanger, fan(s) and air outlets for dirt/blockages.
2. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal.
3. Set a multi-meter to buzzer mode and test any two terminals of P N and U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited.
4. The normal resistances of the inverter compressor is 0.124Ω(at 20℃ ambient temperature) among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.

5.12 P7 Troubleshooting

5.12.1 Digital display output

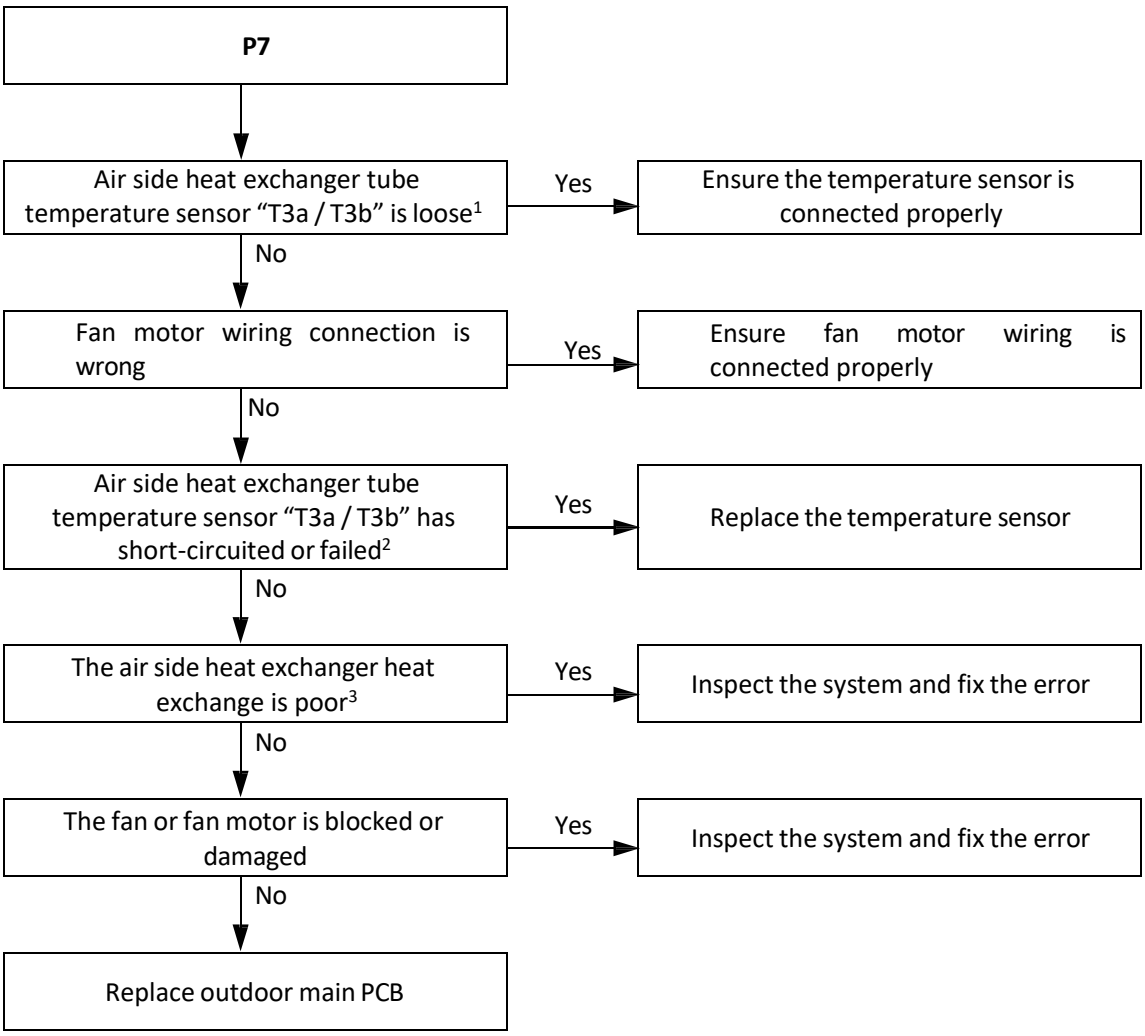
5.12.2 Description

- High temperature protection of air side heat exchanger tube temperature sensor “T3a / T3b” in cooling mode. When the tube temperature of air side heat exchanger is higher than 62°C, the system displays P7 protection and the faulty unit stops running. The unit stops for three times within 60 minutes, and cannot be restored without power failure. When the tube temperature of air side heat exchanger returns drops below 55°C, P7 is removed and normal operation resumes.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.12.3 Possible causes

- Air side heat exchanger tube temperature sensor “T3a / T3b” not connected properly or has malfunctioned.
- Fan motor wiring connection is wrong.
- Poor condenser heat exchange.
- Fan motor damaged.
- Main PCB damaged.

5.12.4 Procedure



Notes:

1. Air side heat exchanger tube temperature sensor “T3a / T3b” connection port is CN37/CN16 on the main PCB (labeled 22,24 in Part 4, 2.2.1 Main PCB component)
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor’s resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 “Temperature Sensor Resistance Characteristics”.
3. Check air side heat exchanger, fan(s) and air outlets for dirt/blockages.

5.13 P9 Troubleshooting

5.13.1 Digital display output

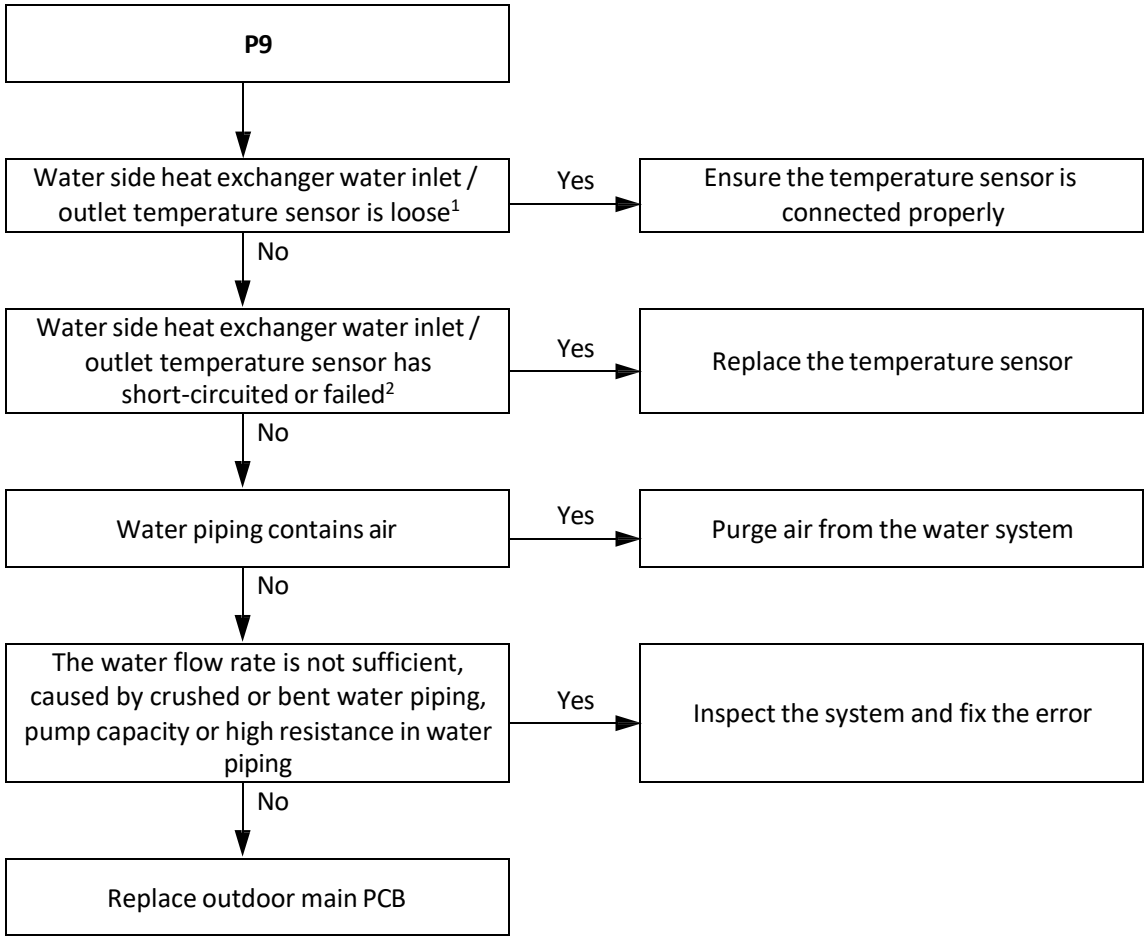
5.13.2 Description

- Water inlet and outlet temperature difference protection
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.13.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Water piping contains air.
- Insufficient water flow.
- Main PCB damaged.

5.13.4 Procedure



Notes:

1. Water side heat exchanger water inlet temperature sensor and water side heat exchanger water outlet temperature sensor connections are port CN4 on the main PCB (labeled 29 in Part 4, 2.2.1 Main PCB component)
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 "Temperature Sensor Resistance Characteristics".

5.14 Pb Troubleshooting

5.14.1 Digital display output

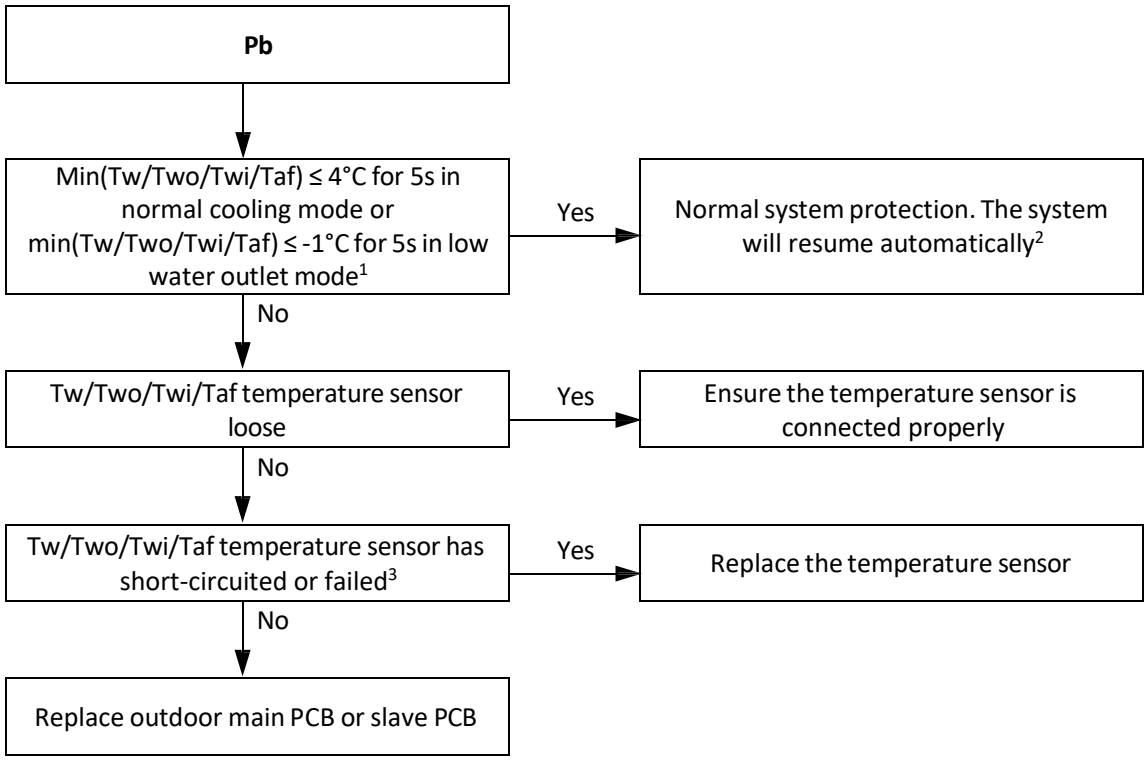
5.14.2 Description

- Water side heat exchanger anti-freeze protection.
- The unit enters anti-freezing mode (When the unit is a single water pump, all the units jointly determine the entry and exit conditions of anti-freezing protection. When multiple water pumps are used, the main unit and slave units respectively determine the entry and exit conditions of anti-freezing protection).
- Error code is displayed on main PCB and ANTI.FREEZE icon is displayed on user interface.

5.14.3 Possible causes

- Normal system protection.
- Temperature sensor not connected properly or has malfunctioned.
- Main PCB or slave PCB damaged.

5.14.4 Procedure



Notes:

1. Combined Water side heat exchanger water outlet temperature sensor (Two), water side heat exchanger water inlet temperature sensor (Twi) and water side heat exchanger anti-freezing temperature sensor (Taf2) connections are ports CN4 and CN45 on the main PCB(labeled 29,21 in Part 4, 2.2.1 Main PCB component).Water outlet temperature sensor (Tw) connections is ports CN101 on the slave PCB (labeled 14 in Part 4, 2.2.2 Slave PCB component).
2. Refer to Part 3, 6.7 “Water Side Heat Exchanger Anti-freeze Protection Control”.
3. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor’s resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 “Temperature Sensor Resistance Characteristics”.

5.15 PC Troubleshooting

5.15.1 Digital display output

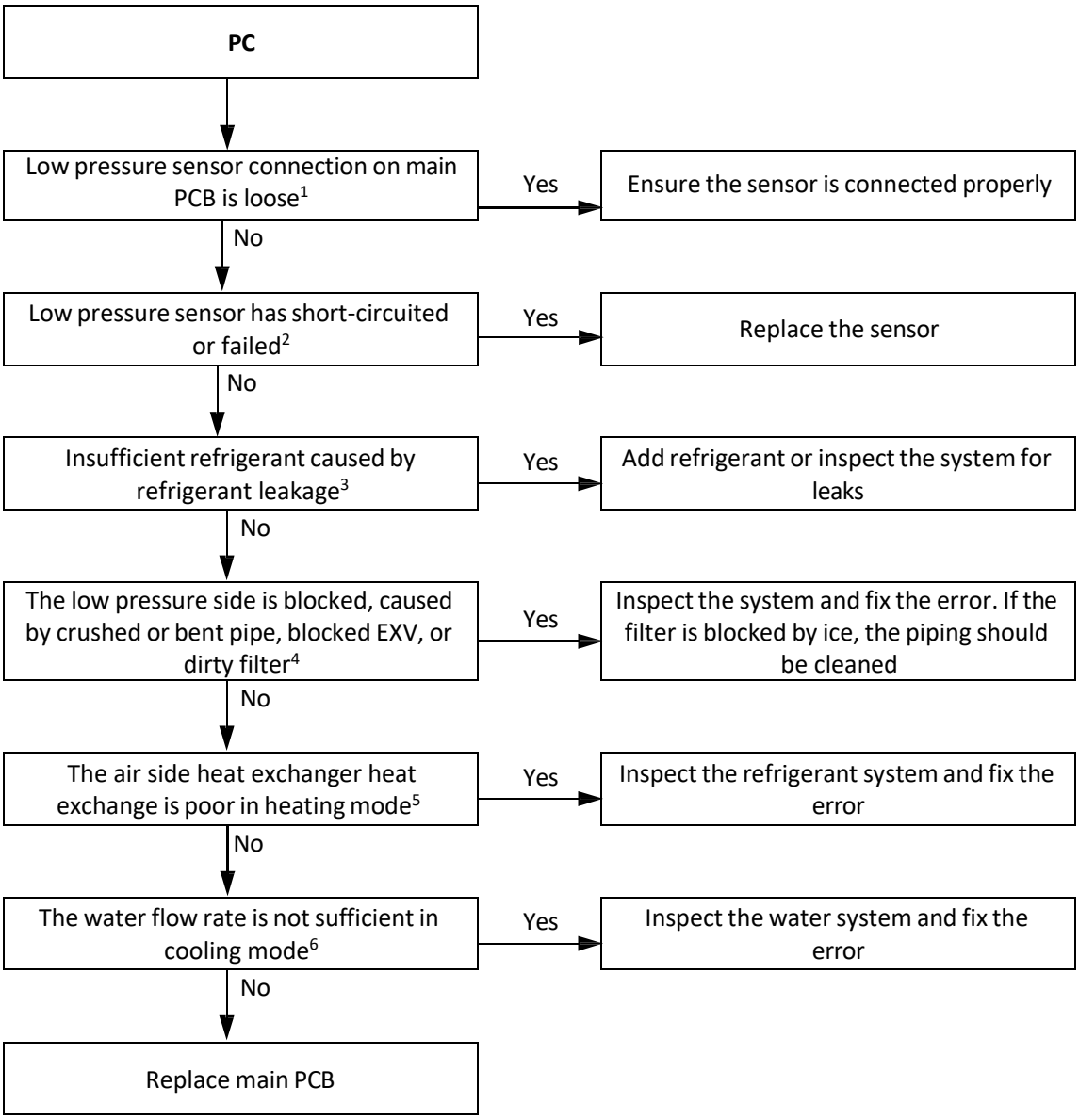
5.15.2 Description

- Water side heat exchanger low pressure protection.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.15.3 Possible causes

- Low pressure switch not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in heating mode.
- Insufficient water flow in cooling mode.
- Main PCB damaged.

5.15.4 Procedure



Notes:

1. Low pressure sensor connection is port CN42 on the main PCB (labeled 27 in Part 4, 2.2.1 Main PCB component)

2. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
3. To check for insufficient refrigerant: An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system.
4. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters.
5. Check air side heat exchanger, fan(s) and air outlets for dirt/blockages.
6. Check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

5.16 PH Troubleshooting

5.16.1 Digital display output

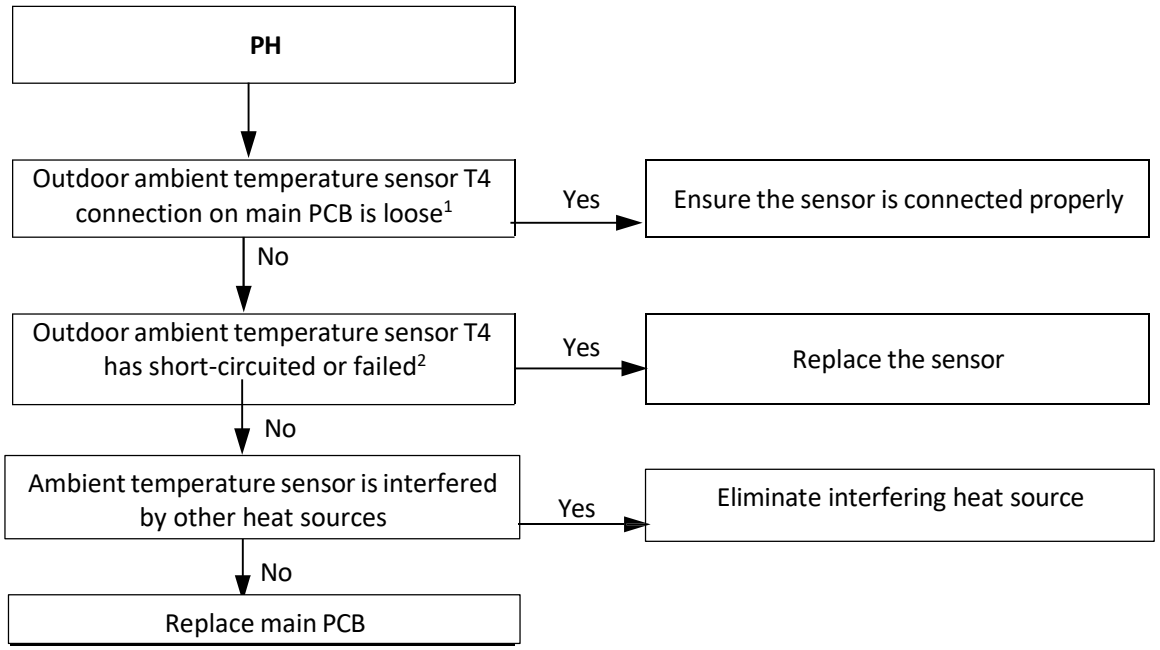
5.16.2 Description

- Ambient temperature too high protection in heating mode.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.16.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Ambient temperature sensor is interfered by other heat sources and the temperature detection value exceeds 65°C.
- Main PCB damaged.

5.16.4 Procedure



Notes:

1. T4 temperature sensor connection is port CN30 on the main PCB (labeled 23 in Part 4, 2.2.1 Main PCB component).
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 5-5.1 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".

5.17 PE Troubleshooting

5.17.1 Digital display output

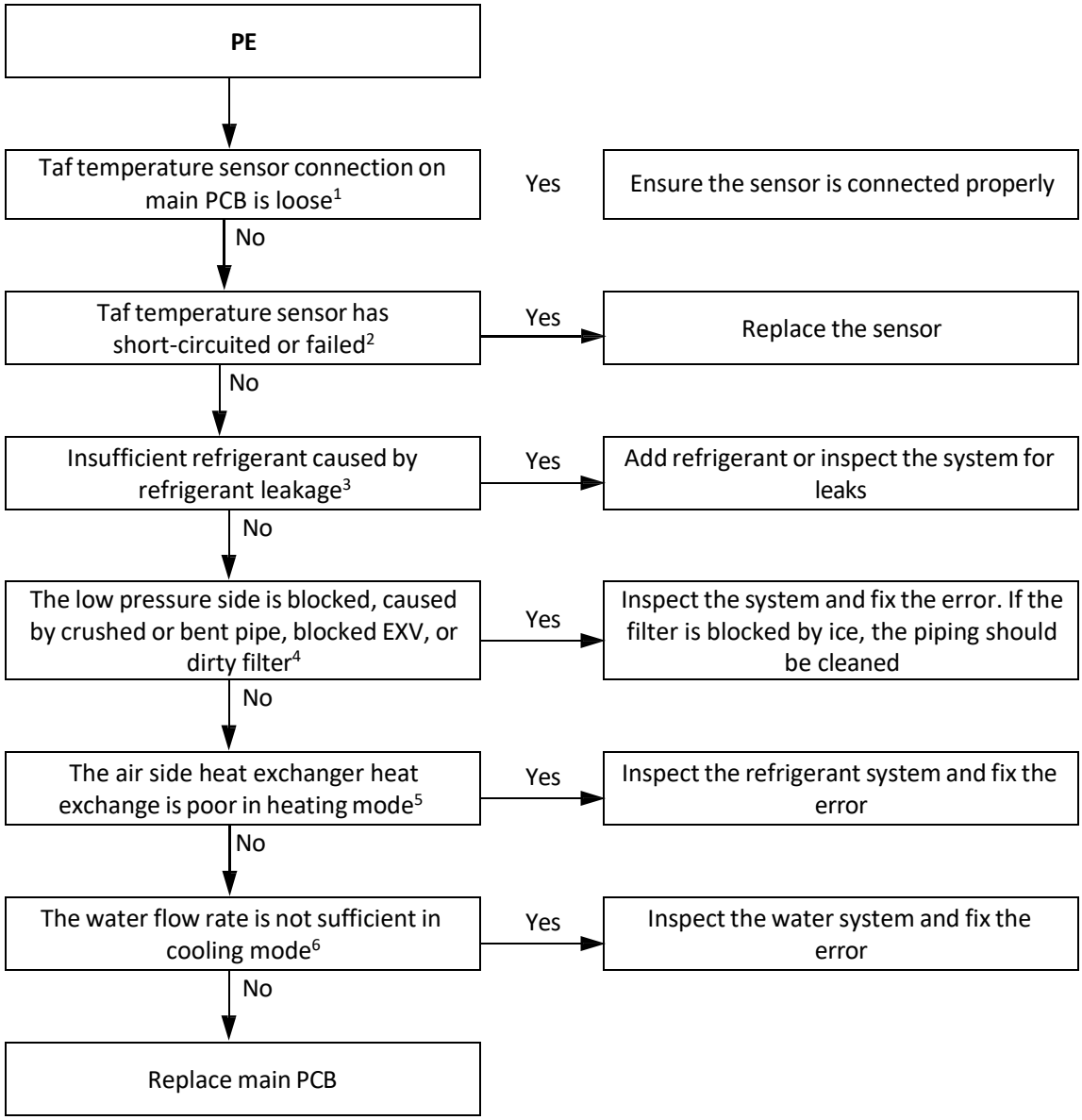
5.17.2 Description

- Water side heat exchanger low temperature antifreeze protection.
- The faulty unit stops running.
- Error code is displayed on main PCB and user interface.

5.17.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in heating mode.
- Insufficient water flow in cooling mode.
- Main PCB damaged.

5.17.4 Procedure



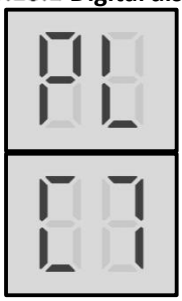
Notes:

1. Water side heat exchanger anti-freezing temperature sensor (Taf2) connection are ports CN45 on the main PCB (labeled 21 in Part 4, 2.2.1 Main PCB component)

2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 "Temperature Sensor Resistance Characteristics".
3. To check for insufficient refrigerant: an insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system.
4. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters.
5. Check air side heat exchanger, fan(s) and air outlets for dirt/blockages.
6. Check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

5.18 PL/C7 Troubleshooting

5.18.1 Digital display output



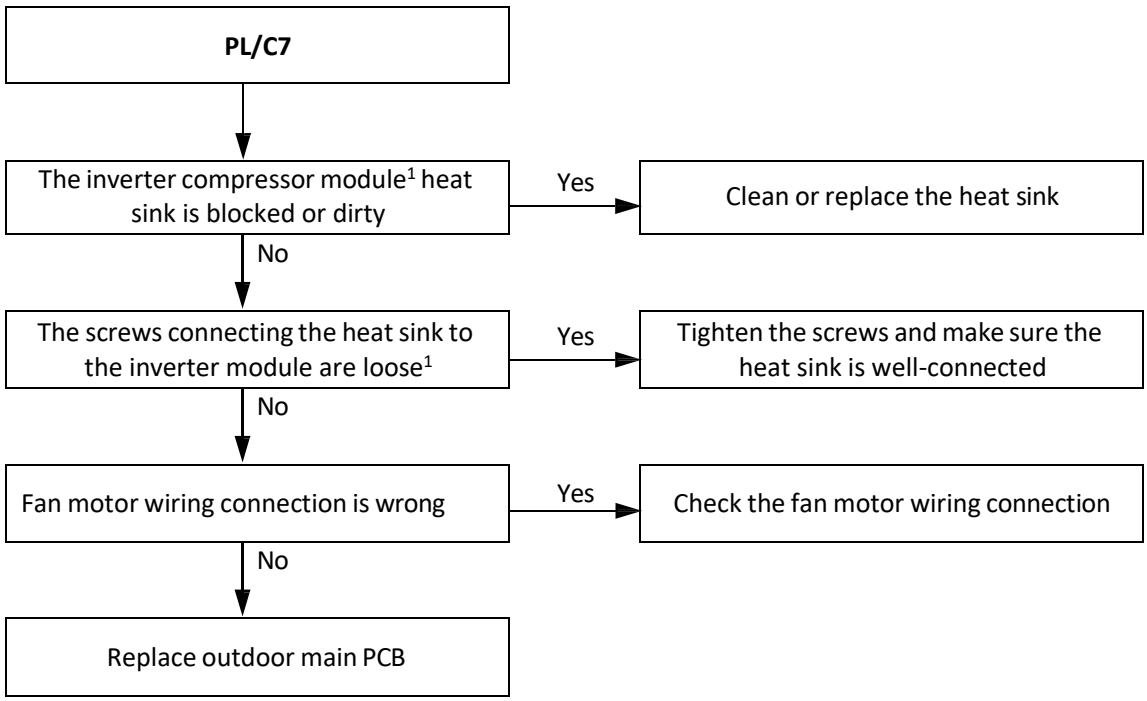
5.18.2 Description

- PL indicates inverter module temperature protection. When the main inverter module temperature rises above 100°C, the system displays PL protection and all the units stop running. When the inverter module temperature drops below 70°C, the compressor enters re-start control
- When a PL error occurs 3 times in 100 minutes, C7 will display, a manual system restart is required before the system can resume operation.
- Error code is displayed on the main PCB and user interface.

5.18.3 Possible causes

- Blocked, dirty or loose heat sink.
- Temperature sensor not connected properly or has malfunctioned.
- Fan motor wiring connection is wrong.
- Main PCB damaged.

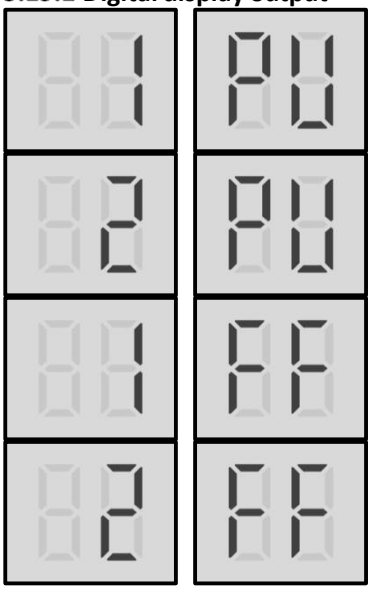
5.18.4 Procedure



Notes:
1. Refer to Part 4, 1 "Electric Control Box Layout".

5.19 PU/FF Troubleshooting

5.19.1 Digital display output



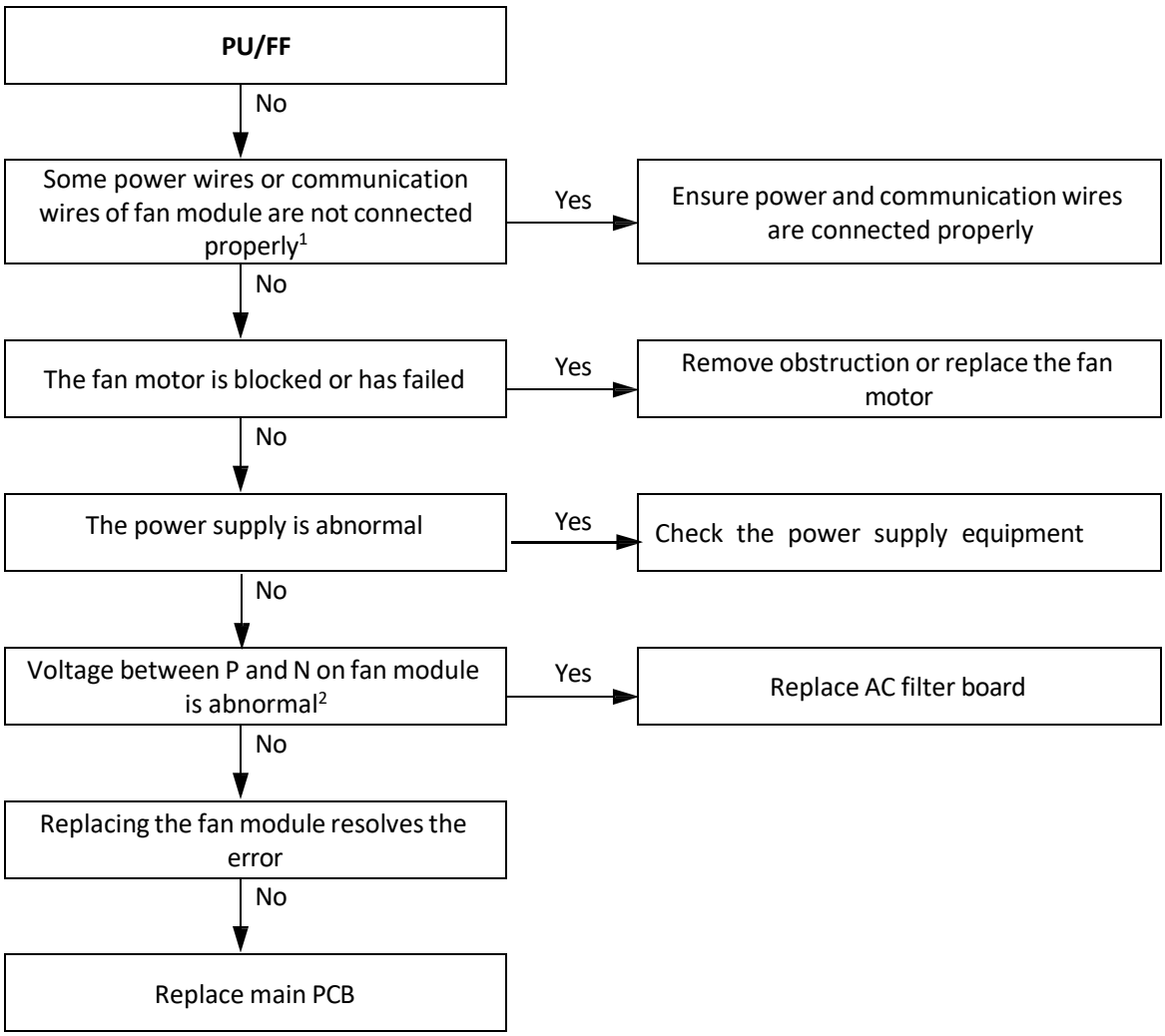
5.19.2 Description

- 1PU/FF indicates fan A module protection.
- 2PU/FF indicates fan B module protection.
- FF indicates PU protection has displayed 10 times. When a FF occurred, a manual system restart is required before the system can resume operation.
- The faulty unit stops running. If 10 PU occurs in 120 minutes, FF fault is reported, and the power must be cut off and cannot be recovered.
- Error code is only displayed on the main PCB and user interface.

5.19.3 Possible causes

- Switch SW1 incorrectly set.
- Power or communication wires not connected properly.
- Fan motor blocked or has failed.
- Power supply abnormal.
- AC filter board damaged.
- Fan module damaged.
- Inverter module PCB damaged.

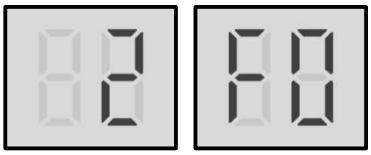
5.19.4 Procedure



Notes:
1. Refer to Part 4, 3 “Wiring diagram” and PCB components to make sure wire connection is firm.
2. The normal voltage between P and N on the fan module is 650V DC. Refer to Part 4, 1 “Outdoor Unit Electric Control Box Layout” and to Part 4, 2.4 “Fan module board”

5.20 F0 Troubleshooting

5.20.1 Digital display output



5.20.2 Description

- 1F0 indicates a communication error between the main control chip and the compressor A inverter driver chip.
- 2F0 indicates a communication error between the main control chip and the compressor B inverter driver chip.
- The faulty unit stops running.
- Error code is only displayed on the unit with the error.

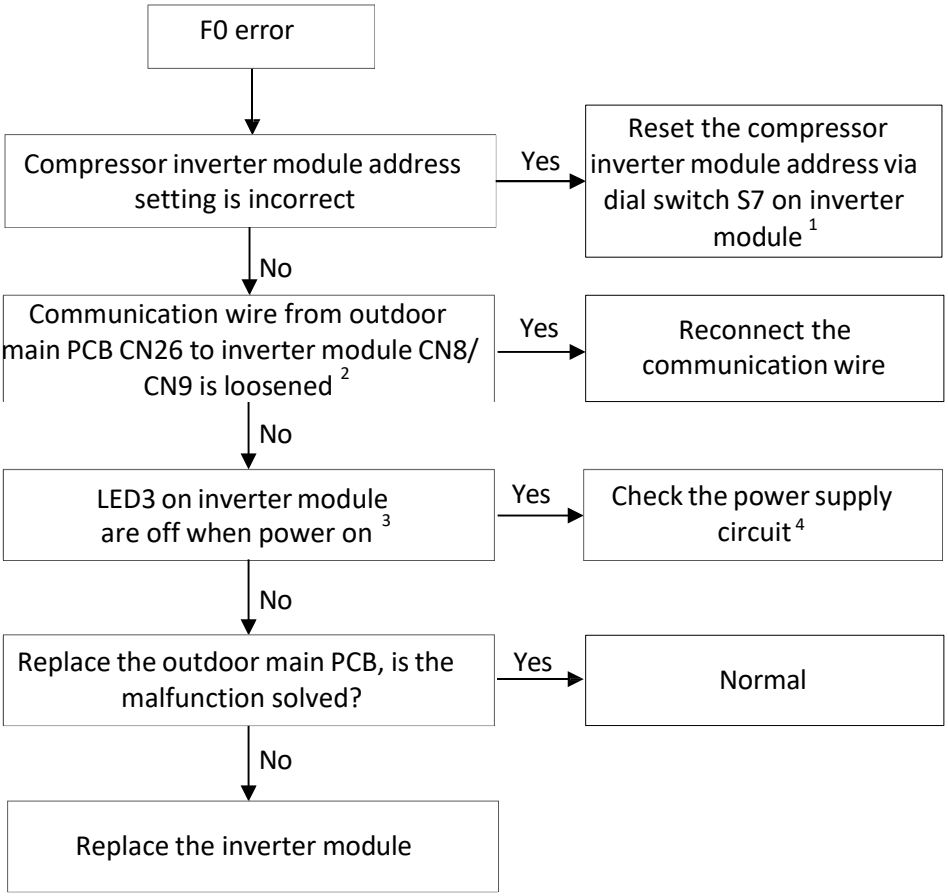
5.20.3 Trigger / recover condition

- Trigger condition: Main control chip and inverter driver chip cannot communication for 2 minutes.
- Recover condition: Communication go back to normal.
- Reset method: Resume automatically.

5.20.4 Possible causes

- Incorrect compressor inverter module address setting.
- Loosened communication wiring from the main PCB to the inverter module.
- Bridge rectifier damaged.
- Main PCB damaged.
- Compressor inverter module damaged.

5.20.5 Procedure

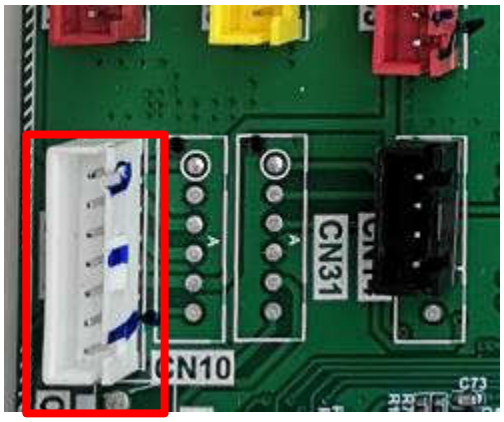
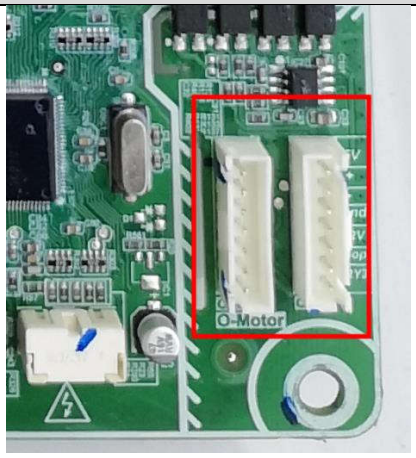


Notes:

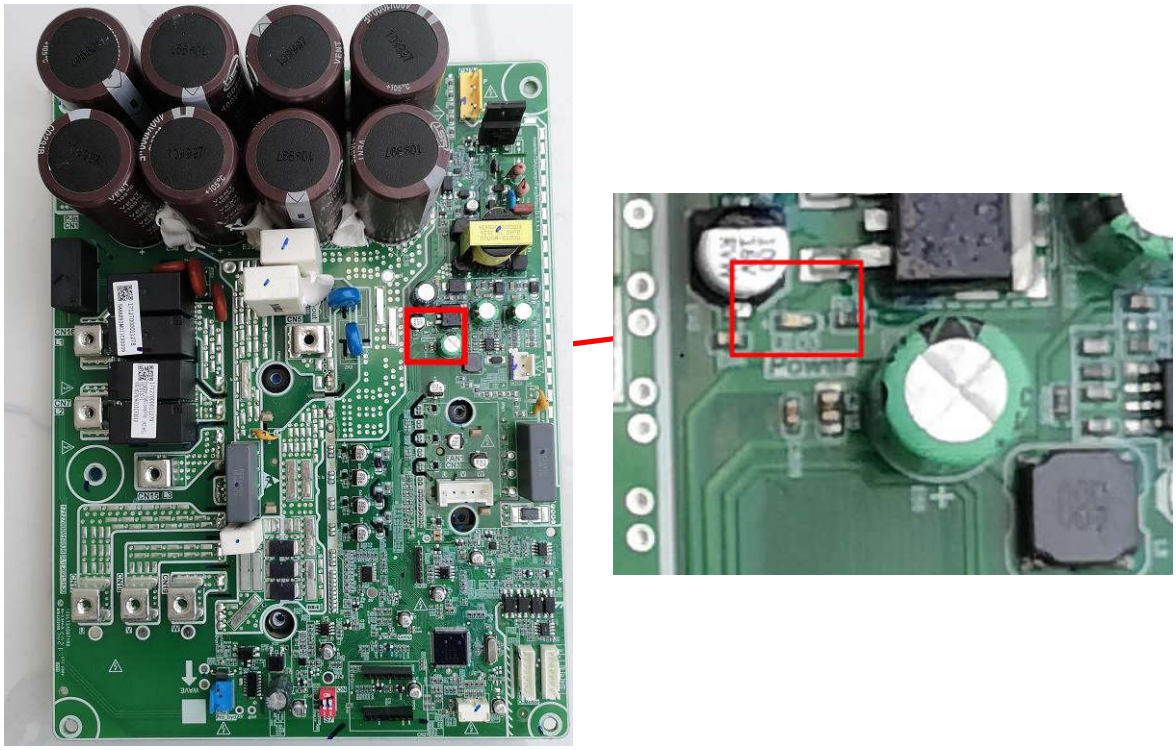
1. Compressor inverter module address is set through dial switch S7 on the inverter module. The compressor inverter module A/B location refers to the wiring diagram.

Switch	Description	S7-1	S7-2
S7 	Compressor A inverter module address setting	*OFF*	OFF
	Compressor B inverter module address setting	*OFF*	*ON*

2. Communication wire from outdoor main PCB CN26 to inverter module CN8/CN9.

Communication port CN28 on main PCB	Communication port CN8/CN9 on inverter module
	

3. LED3 on inverter module



4. Check the wired connection between CN5/CN6/CN7 of filter board and CN6/CN7/CN15 of compressor module board, the normal voltage should be 380-415VAC

5.21 H5 Troubleshooting

5.21.1 Digital display output

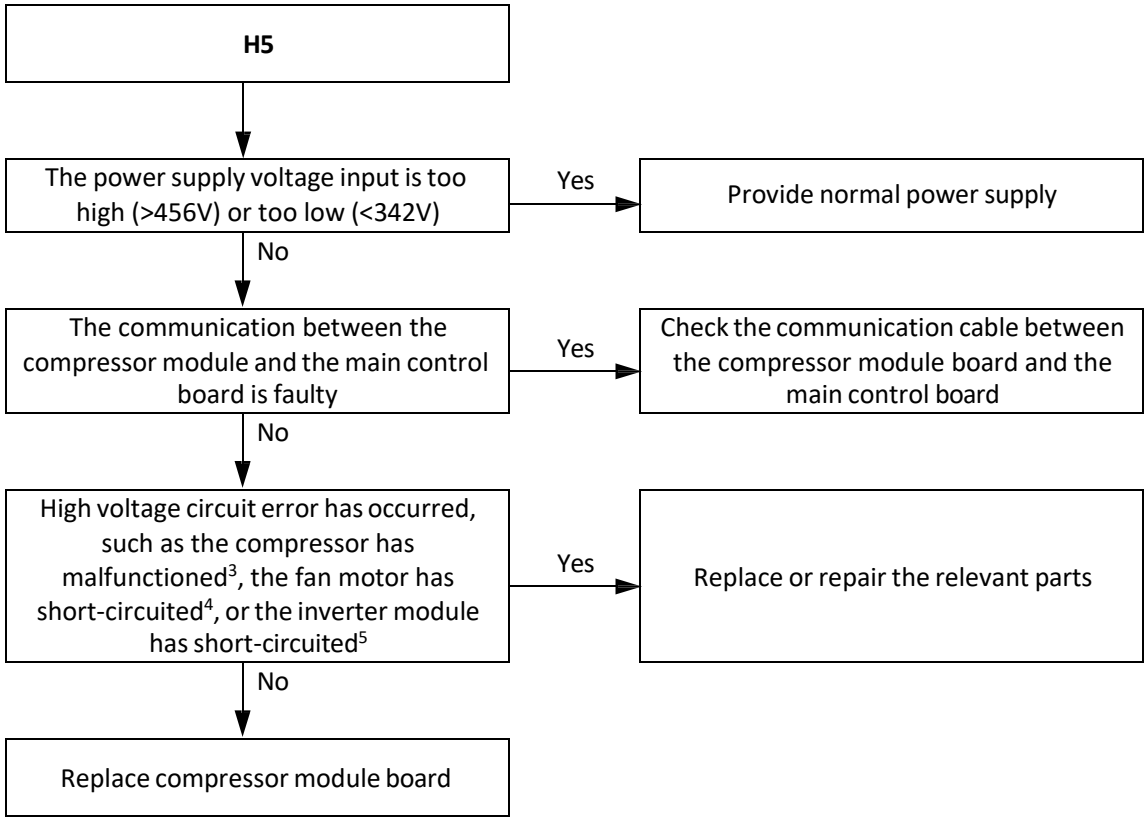
5.21.2 Description

- Abnormal power supply voltage.
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.21.3 Possible causes

- Outdoor unit power supply voltage at or above 265V or drops below 170V or a phase is missing.
- Loosened wiring within electric control box.
- High voltage circuit error.
- Main PCB damaged.

5.21.4 Procedure

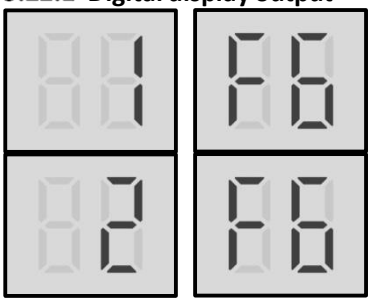


Notes:

1. The compressor module detects the voltage and sends the voltage to the main control board. The main control board determines the voltage sent by the compressor module (>456 v or <342V reported fault).
2. Refer to Part 4, 3 “Wiring diagram” and PCB components to make sure wire connection is firm.
3. The normal resistances of the inverter compressor is 0.124Ω(at 20℃ ambient temperature) among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.
4. The normal resistances of the fan motor coil among U V W are less than 15Ω. If a measured resistance is 0Ω, the fan motor has short-circuited.
5. Set a multi-meter to buzzer mode and test any two terminals of P N and U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited. Refer to Part 4, 1 “Outdoor Unit Electric Control Box Layout”.

5.22 F6 Troubleshooting

5.22.1 Digital display output



5.22.2 Description

- 1F6 indicates A system buss voltage error (PTC)
- 2F6 indicates B system buss voltage error (PTC)
- Only occurred in standby status.
- Error code is displayed on main PCB and user interface.

5.22.3 Possible causes

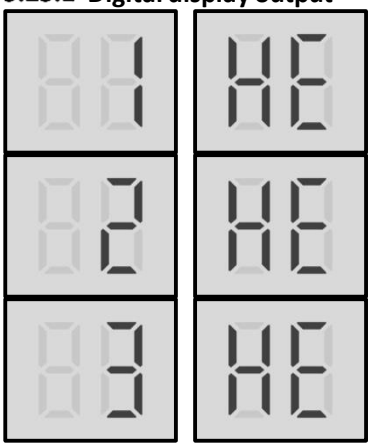
- Abnormal power supply voltage
- Loosened wiring within electric control box.
- High voltage circuit error.
- AC filter board damaged.
- 3-pahse bridge rectifier damaged.
- Compressor Inverter module damaged.

5.22.4 Procedure

Refer to P6 protection troubleshooting: xL1 and xL2.

5.23 HE Troubleshooting

5.23.1 Digital display output



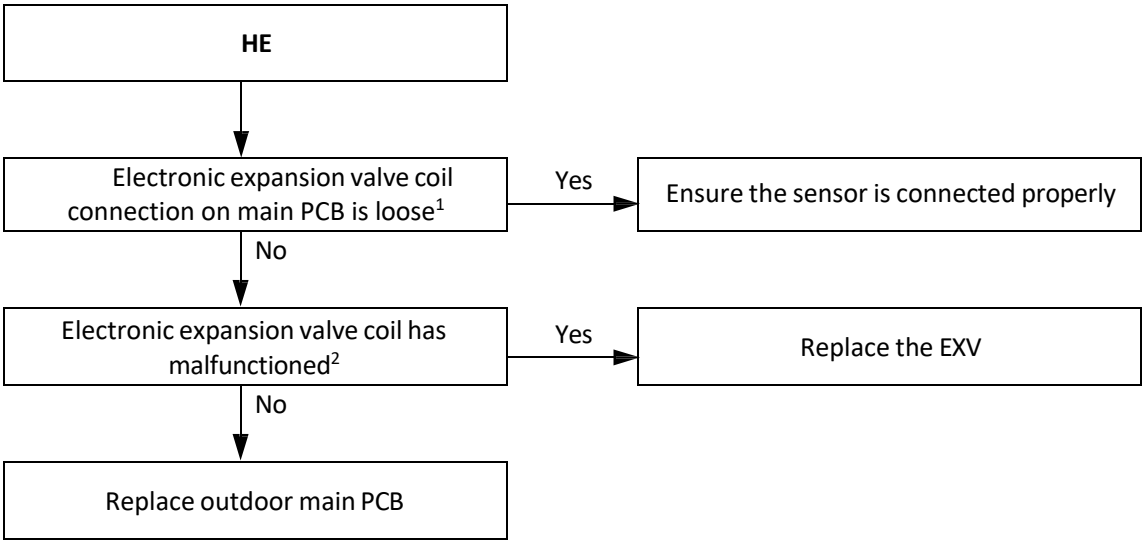
5.23.2 Description

- Electronic expansion valve connection error.
- The faulty unit stops running.
- Error code is only displayed on the unit with the error.

5.23.3 Possible causes

- Electronic expansion valve coil not connected properly or has malfunctioned.
- Damaged main PCB.

5.23.4 Procedure



Notes:

1. Electronic expansion valve coil connections are port CN70, CN71 and CN72 on the main PCB (labeled 31, 32,30 in Part 4, 2.2.1 Main PCB component)
2. The normal resistances between EXV coil wiring terminals is 40-50Ω. If any of the resistances differ from the value, the EXV coil has malfunctioned.

5.24 F2 Troubleshooting

5.24.1 Digital display output

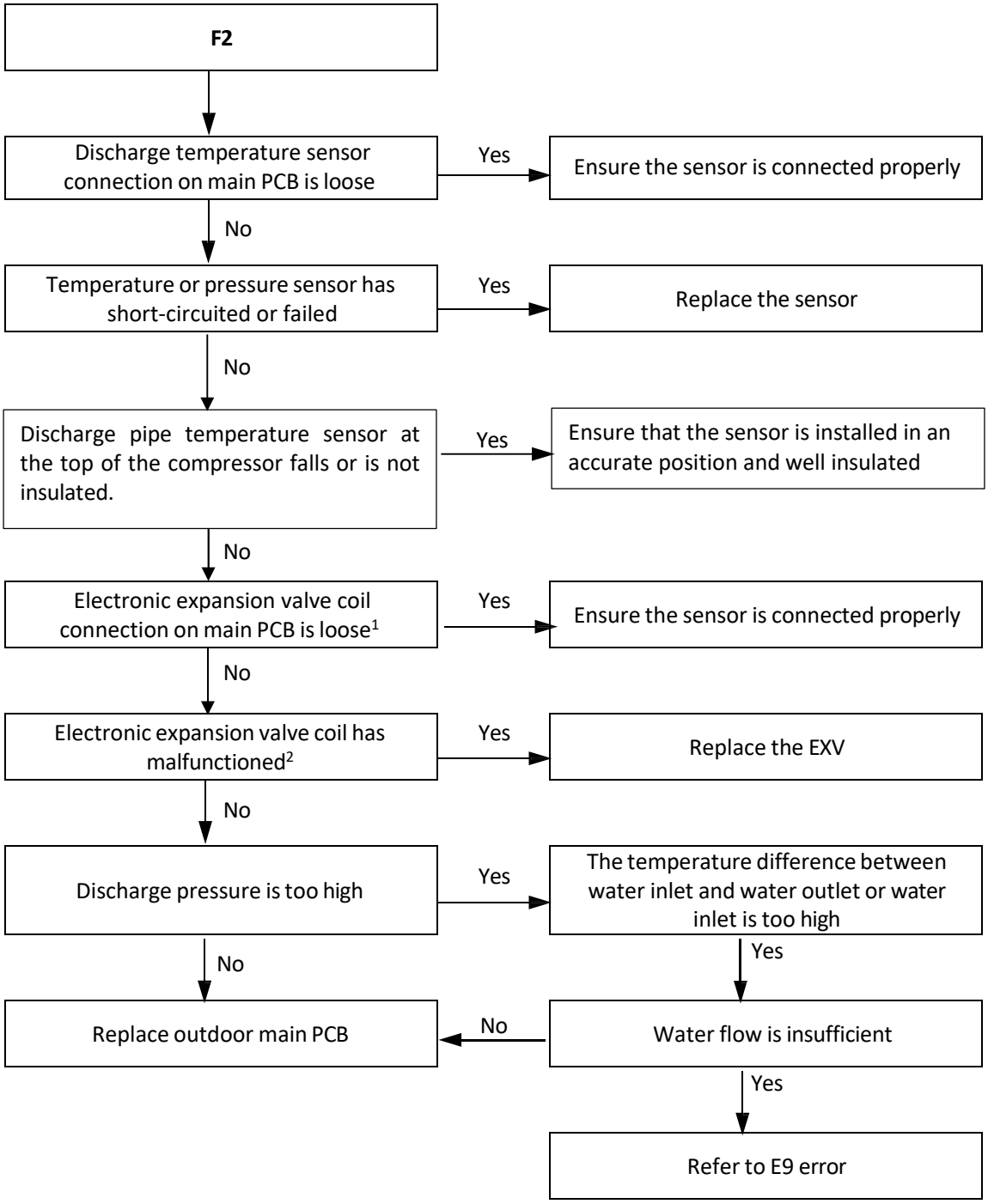
5.24.2 Description

- Insufficient protection of exhaust superheat.
- The faulty unit stops running, it will take at least 20 minutes to recover.
- Error code is only displayed on main PCB and user interface.

5.24.3 Possible causes

- Discharge pipe temperature sensor connected properly or has malfunctioned.
- Discharge pipe temperature sensor at the top of the compressor falls or is not insulated.
- Electronic expansion valve coil not connected properly or has malfunctioned.
- Damaged main PCB.

5.24.4 Procedure

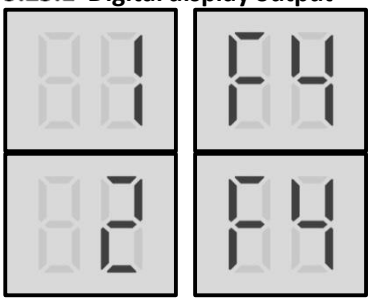


Notes:

1. Electronic expansion valve coil connections are port CN70, CN71 and CN72 on the main PCB (labeled 31, 32,30 in Part 4, 2.2.1 Main PCB component)
2. The normal resistances between EXV coil wiring terminals is 40-50Ω. If any of the resistances differ from the value, the EXV coil has malfunctioned.

5.25 F4 Troubleshooting

5.25.1 Digital display output



5.25.2 Description

- 1F4 module A L0 or L1 protection occurs for 3 times in 60 minutes
- 2F4 module B L0 or L1 protection occurs for 3 times in 60 minutes
- When F4 displays, a manual system restart is required before the system can resume operation.

5.25.3 Possible causes

- Refer to L0 or L1 error troubleshooting.

5.25.4 Procedure

- Refer to L0 or L1 error troubleshooting.

5.26 FP Troubleshooting

5.26.1 Digital display output

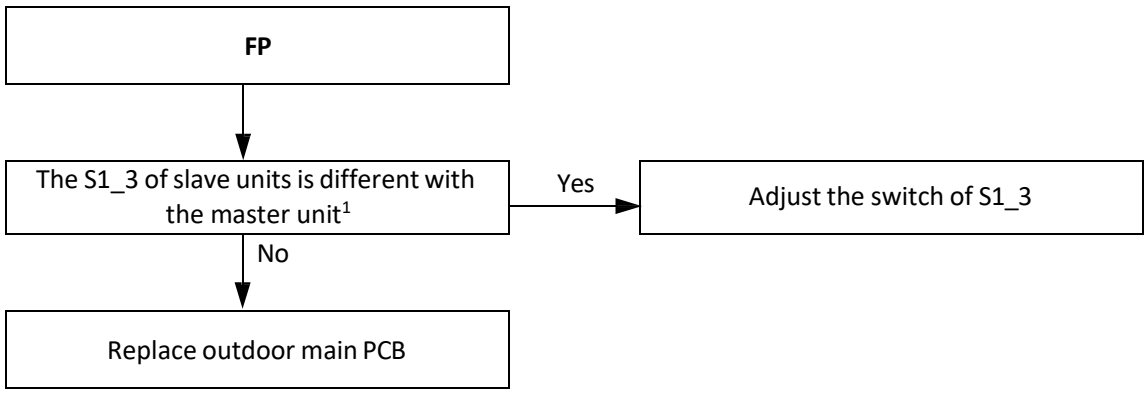
5.26.2 Description

- FP indicates pump in a combination system dial to different status. When the FP displayed, a manual system restart is required before the system can resume operation.
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.26.3 Possible causes

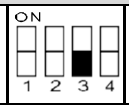
- The S1_3 of slave units is different with the master unit.
- Main PCB damaged.

5.26.4 Procedure



Notes:

1. Dial switch S1_3 on the main PCB

Switch			Description	ON	OFF	Default factory setting
		S1-3	Water pump	Multiple pumps control	Single pump control	OFF

5.27 bH troubleshooting

5.27.1 Digital display output

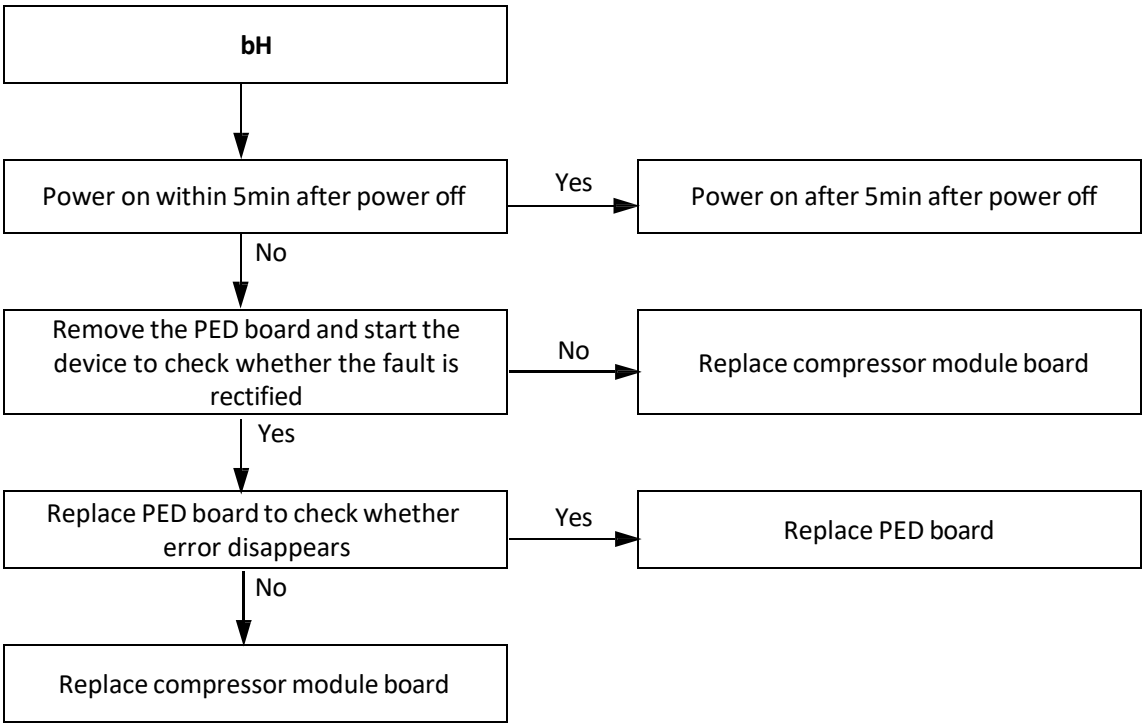
5.27.2 Description

- bH indicates adhesion of compressor relay or PED board damaged
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.27.3 Possible causes

- Power on within 5min after power off
- PED board damaged
- Compressor module board damaged

5.27.4 Procedure



5.28 HC troubleshooting

5.28.1 Digital display output

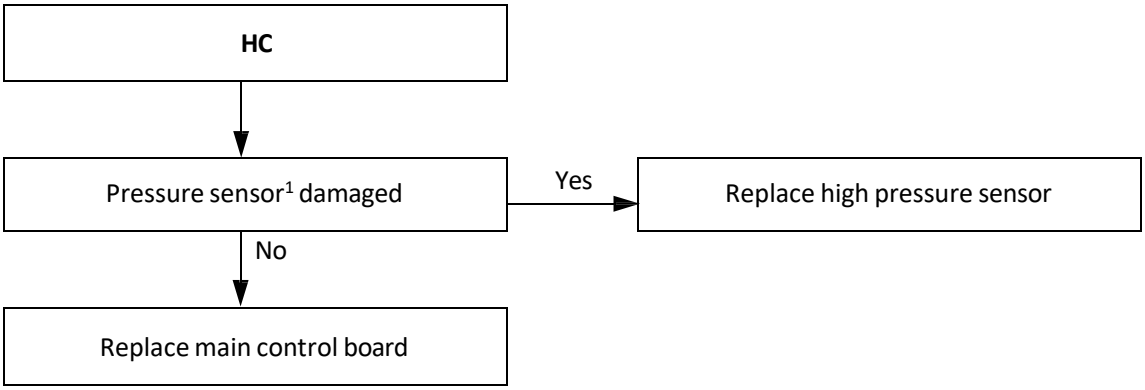
5.28.2 Description

- HC indicates high pressure sensor error
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.28.3 Possible causes

- Pressure sensor damaged
- Main control board damaged

5.28.4 Procedure



Note:

1. Pressure sensor connection is port CN40 on the main PCB (labeled 20 in Part 4, 2.2.1 Main PCB component). Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.

5.29 P3 troubleshooting

5.29.1 Digital display output

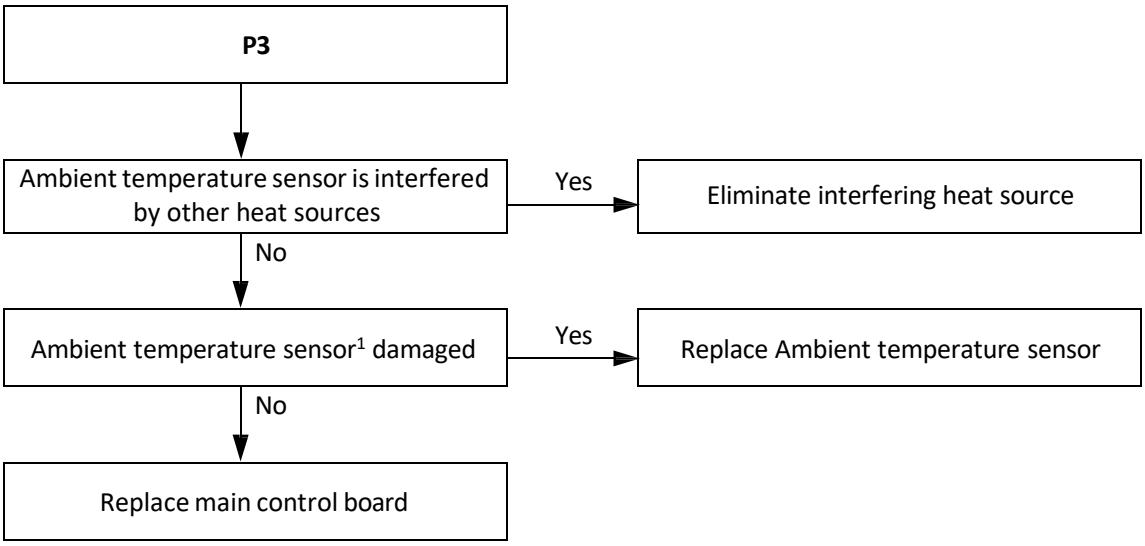
5.29.2 Description

- P3 indicates ambient temperature too high for cooling mode
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.29.3 Possible causes

- Ambient temperature sensor is interfered by other heat sources and the temperature detection value exceeds 65°C
- Ambient temperature sensor damaged
- Main control board damaged

5.29.4 Procedure



Note:

1. Ambient temperature sensor connection port is CN30 on the main PCB (labeled 23 in Part 4, 2.2.1 Main PCB component). Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 "Temperature Sensor Resistance Characteristics".

5.30 PA troubleshooting

5.30.1 Digital display output

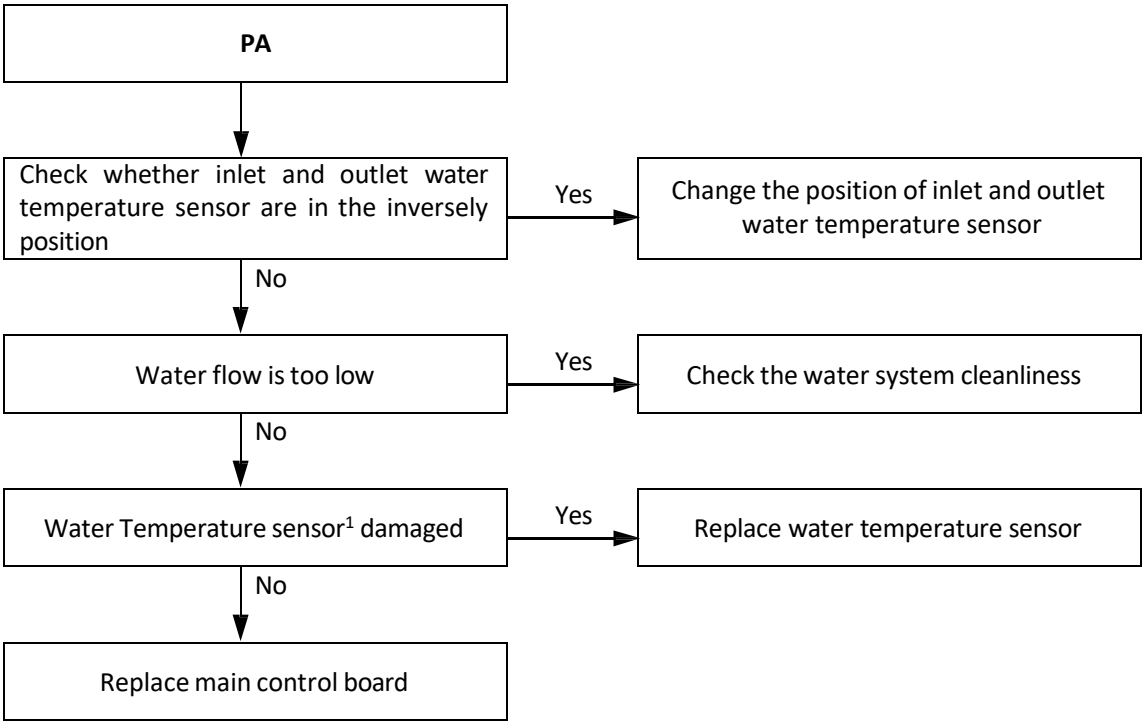
5.30.2 Description

- PA indicates abnormal water inlet and outlet temperature difference protection
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.30.3 Possible causes

- Water temperature sensor damaged
- Inlet and outlet water temperature sensor are in the inversely position
- Water flow is too low
- Main control board damaged

5.30.4 Procedure



Note:

1. Inlet and outlet water temperature sensor connection port is CN4 on the main PCB (labeled 29 in Part 4, 2.2.1 Main PCB component). Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 4, 6.1 "Temperature Sensor Resistance Characteristics".

5.31 PC troubleshooting

5.31.1 Digital display output

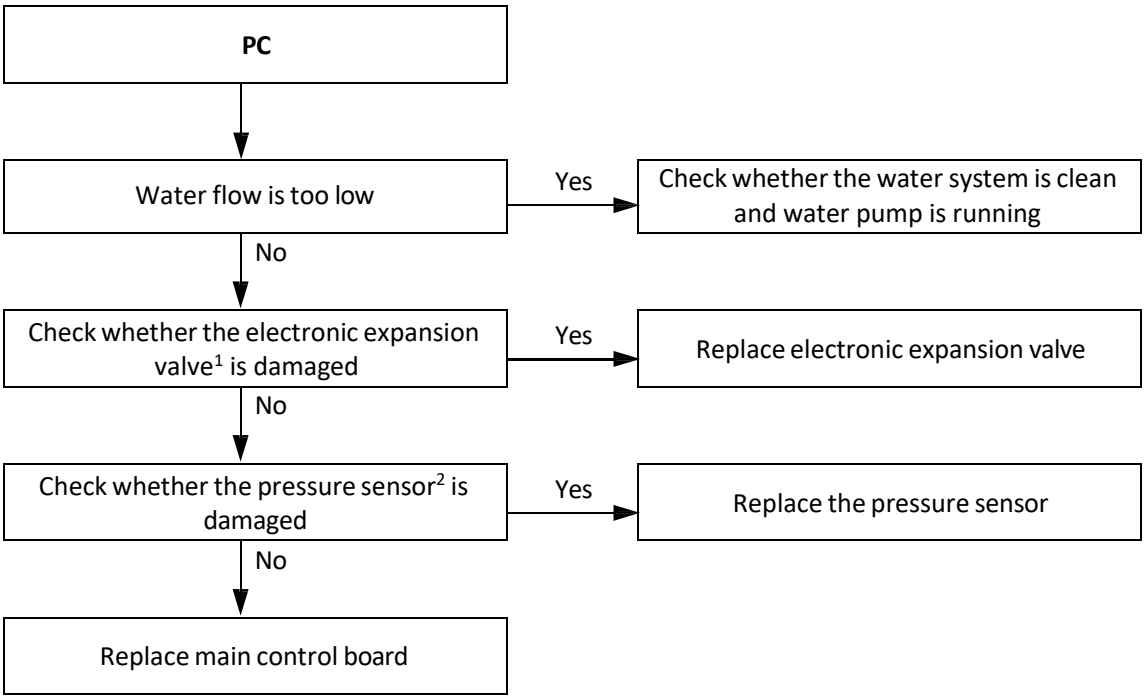
5.31.2 Description

- PC indicates cooling evaporator pressure too low
- The faulty unit stops running.
- Error code is only displayed on main PCB and user interface.

5.31.3 Possible causes

- Evaporator pressure less than 0.6MPa
- Water flow is too low
- Electronic expansion valve damaged
- Pressure sensor damaged
- Main control board damaged

5.31.4 Procedure



Note:

1. Electronic expansion valve coil connections are port CN70, CN71 and CN72 on the main PCB (labeled31, 32, 30 in Part 4, 2.2.1 Main PCB component). The normal resistances between EXV coil wiring terminals is 40-50Ω. If any of the resistances differ from the value, the EXV coil has malfunctioned.
2. Pressure sensor connection is port CN41 on the main PCB (labeled 19 in Part 4, 2.2.1 Main PCB component). Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.

6 Drive Module Failure

6.1 Check code table

Error code	Content	Error category	Need to power on again
L10	Overcurrent protection	Overcurrent fault	NO
L11	Transient phase current overcurrent protection		NO
L12	Phase current overcurrent lasts 30s protection		NO
L20	Module over temperature protection	Over temperature fault	NO
L30	Low bus voltage error	Power fault	NO
L31	High bus voltage error		NO
L32	Excessively high bus voltage error		NO
L34	Phase loss error		NO
L43	Current sampling bias is abnormal	hardware fault	NO
L45	Motor code not match		YES
L46	IPM protection (FO)		NO
L47	Module type not match（After module resistance detection）		YES
L50	Startup failure	Control fault	NO
L51	Out of step error（Reserved）		NO
L52	Zero speed protection		NO
L60	Fan motor phase loss protection	Diagnostic fault	NO
L65	IPM short circuit error		NO
L66	FCT detection error		NO
L6A	Open circuit of U-phase upper tube		NO
L6b	Open circuit of U-phase lower tube		NO
L6C	Open circuit of V-phase upper tube		NO
L6d	Open circuit of V-phase lower tube		NO
L6E	Open circuit of W-phase upper tube		NO
L6F	Open circuit of W-phase lower tube		NO
Lb0	High pressure switch motion	Authentication fault	NO
Lb1	Relay adhesion（Reserved）		NO
Lb2	RAM check error（Reserved）		NO
Lb3	ROM check error（Reserved）		NO
Lb4	Register or ALU check error（Reserved）		NO
Lb5	Stack over flow check error（Reserved）		NO
Lb6	Program stream check error（Reserved）		NO
Lb7	Other abnormal check /PED diagnostic errors		NO
Lb8	PED 5V abnormal（Reserved）		NO

6.2 L10: Hardware overcurrent

6.2.1 Description

- The current exceeds the OCP protection value (peak value) set by the hardware or receives the FO signal from the IPM module.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor starts again.

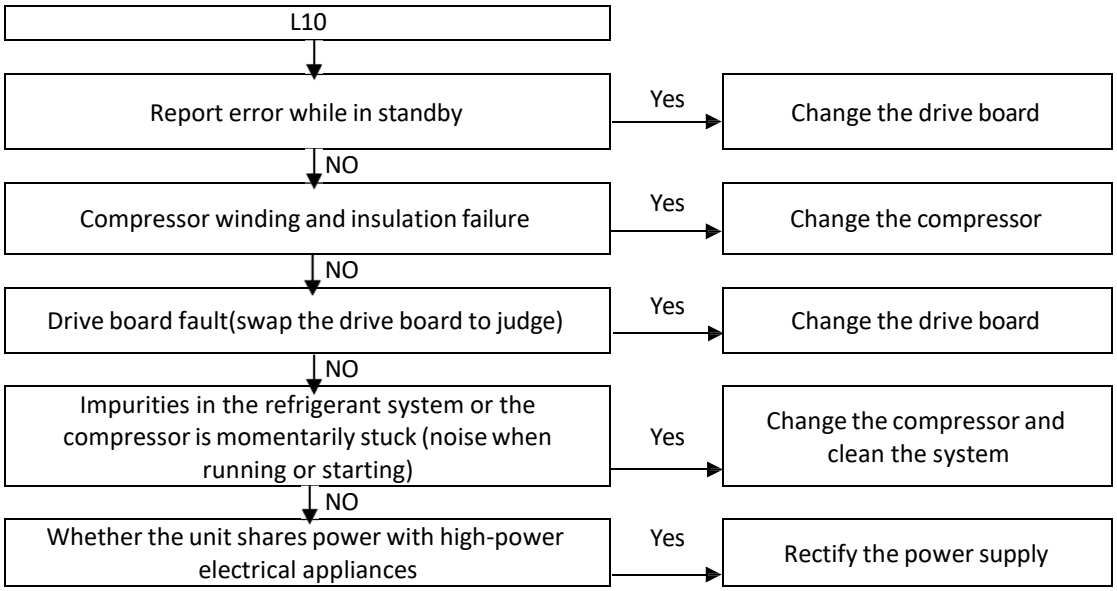
6.2.2 Trigger/resume condition

- The current reaches the OCP protection value
  Trigger condition: The current reaches the OCP protection value.
  Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition one minute later.
  Reset method: Automatic recovery after reaching the fault exit condition one minute later.
- A falling edge or continuously low level of the FO signal is detected:
  Trigger condition: The falling edge or continuously low electrical level of the FO signal is detected.
  Recovery Condition: The FO signal turns into high level.
  Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.2.3 Possible causes

- There are impurities in the refrigerant system or the compressor is momentarily stuck, causing the current surge to trigger OCP;
- The compressor winding is short-circuited between phases, resulting in instantaneous high current to trigger OCP or FO;
- The voltage of the system power supply drops or is interrupted for a short time, resulting in an instantaneous surge of current to trigger OCP;
- Condensation of the IPM module leads to a short circuit between the control pins;
- System backflow;
- The rotor has a certain speed when the compressor is started (commonly when a compressor has been started or the main engine has been started, and the refrigerant drives the rotor of the compressor that is about to start when the four-way valve is reversed);
- The abnormality of the module board (Idc, OCP comparison circuit, PWM circuit, IPM, IGBT drive power circuit) causes the control to lose step and generate a large current to trigger the OCP.

6.2.4 Procedure



6.3 L11: Software overcurrent

6.3.1 Description

- The current exceeds the OCP protection value (peak value) set by the software;
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor starts again.

6.3.2 Trigger/resume condition

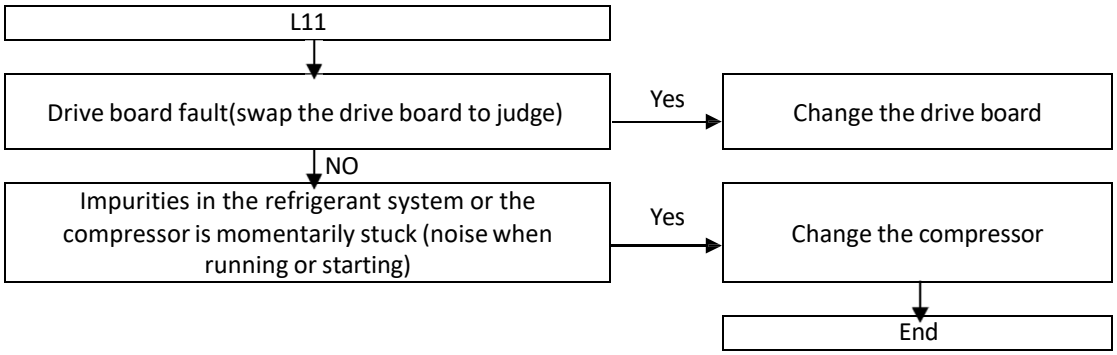
- Trigger condition: The compressor current exceeds the OCP protection value set by the software for three consecutive carrier cycles.
- Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition one minute later.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.3.3 Possible causes

- There are impurities in the refrigerant system or the compressor is momentarily stuck, causing the current surge to trigger OCP;

- Module board Icd op amp sampling circuit is abnormal.

6.3.4 Procedure



6.4 L20: Module overheat protection

6.4.1 Description

- IPM module temperature exceeds 105 °C.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

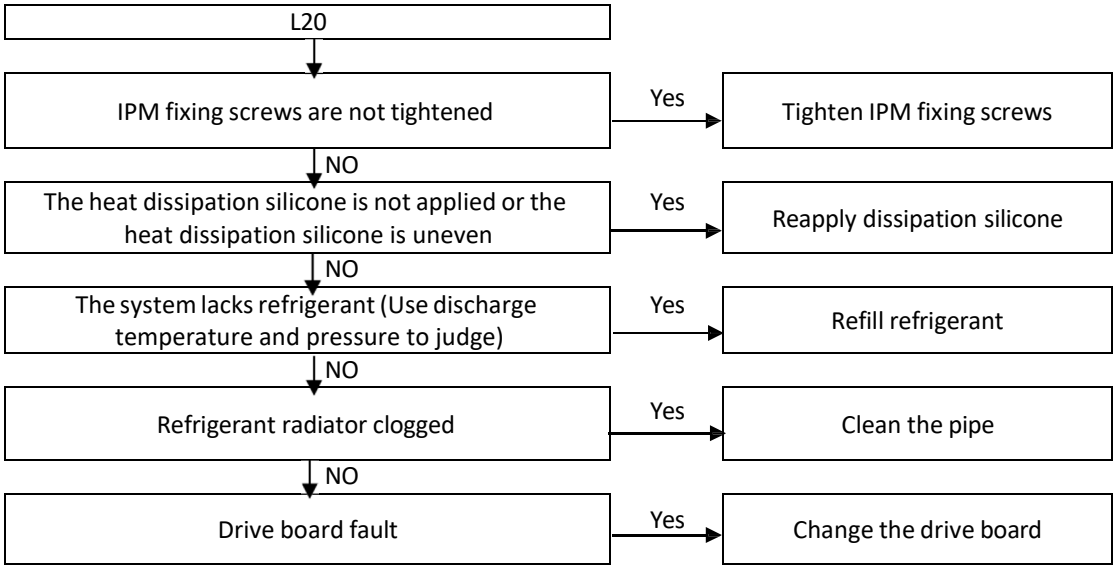
6.4.2 Trigger/resume condition

- Trigger condition: IPM module temperature exceeds 105 °C;
- Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition (The module temperature is lower than 105 °C) one minute later;
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.4.3 Possible causes

- IPM fixing screws are not tightened, resulting in poor heat dissipation;
- The heat dissipation silicone of the IPM module is not evenly spread, resulting in poor heat dissipation;
- The system lacks refrigerant or the refrigerant radiator pipeline is blocked, resulting in poor heat dissipation of the refrigerant radiator;
- The system refrigerant radiator is abnormally welded, resulting in too large thermal resistance and poor heat dissipation;
- The module board IPM temperature detection circuit is abnormal.

6.4.4 Procedure



6.5 L30: Low bus voltage protection

6.5.1 Description

- The bus voltage is lower than the low bus voltage protection threshold (350VDC) set by the software.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

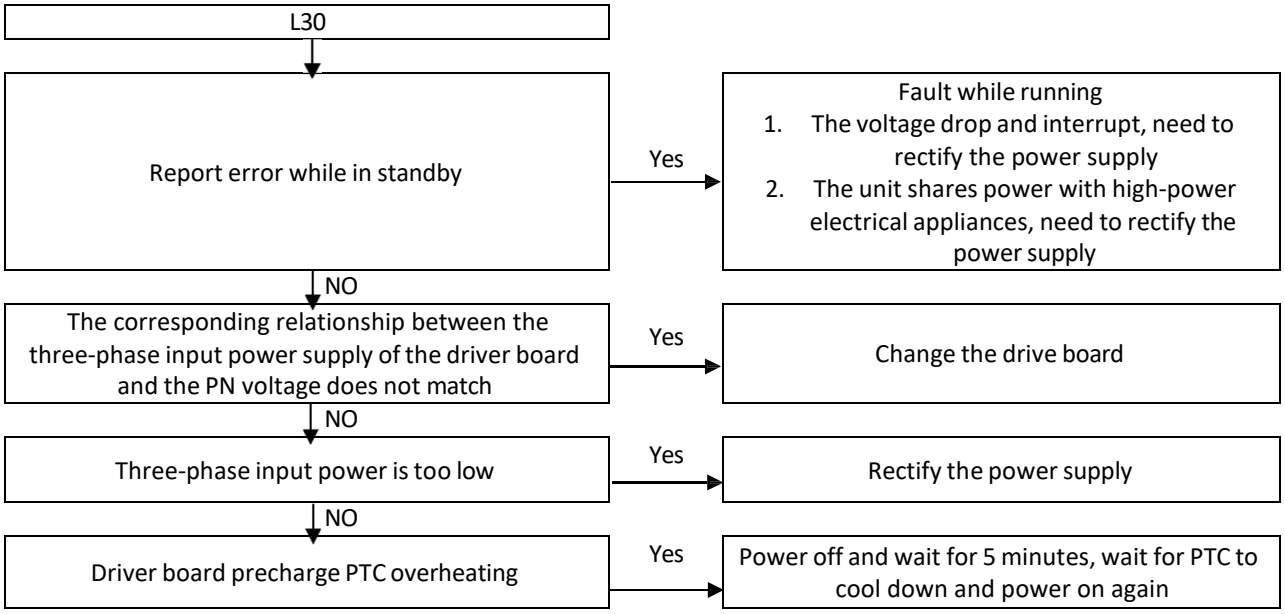
6.5.2 Trigger/resume condition

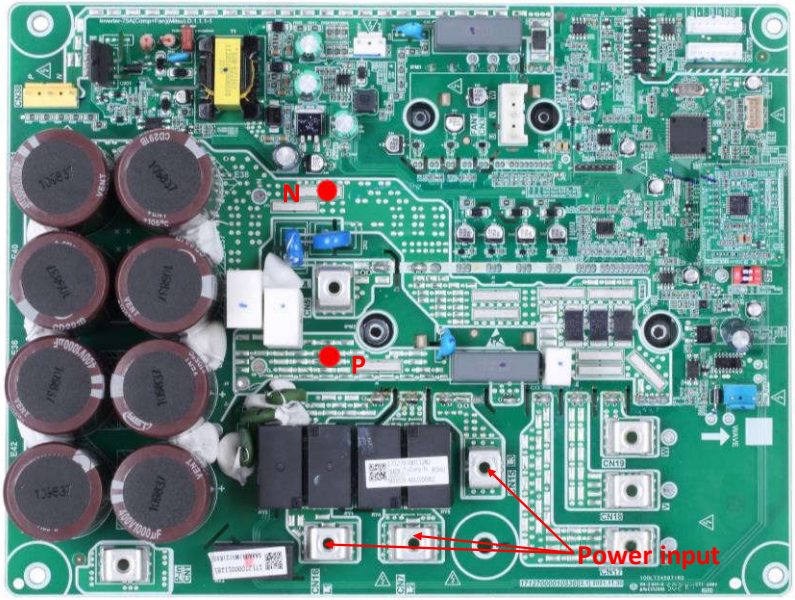
- Trigger condition: The bus voltage is lower than the low bus voltage protection threshold (350VDC) set by the software.
- Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition (The bus voltage is higher than the low bus voltage protection threshold (350VDC) (set by the software.) one minute later.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.5.3 Possible causes

The input voltage is too low, resulting in low bus voltage;
The voltage drop and interrupt, resulting in the low instantaneous bus voltage;
The module board bus voltage detection circuit is abnormal.

6.5.4 Procedure





6.6 L31: High bus voltage error

6.6.1 Description

- The bus voltage is higher than the high bus voltage protection threshold (750VDC) set by the software.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

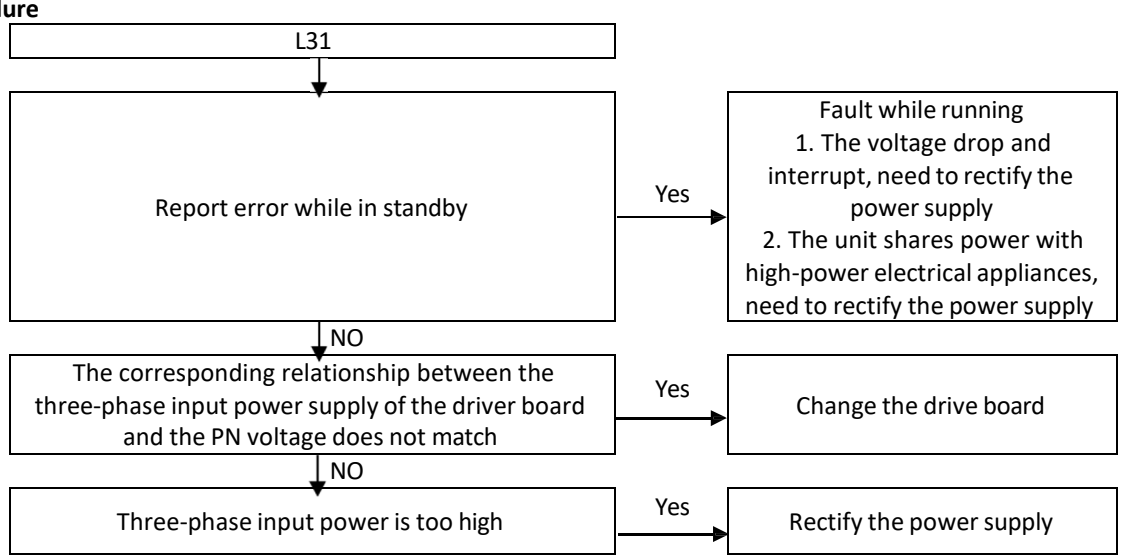
6.6.2 Trigger/resume condition

- Trigger condition: The bus voltage is higher than the high bus voltage protection threshold set by the software.
- Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition (The bus voltage is lower than the high bus voltage protection threshold set by the software.) one minute later.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.6.3 Possible causes

- The input voltage is too high, resulting in high bus voltage;
- The grid voltage is abnormally high instantaneously.
- The module board bus voltage detection circuit is abnormal.

6.6.4 Procedure



6.7 L32: Excessively high bus voltage error

6.7.1 Description

- The bus voltage is higher than the excessively high bus voltage protection threshold (770V) set by the software.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

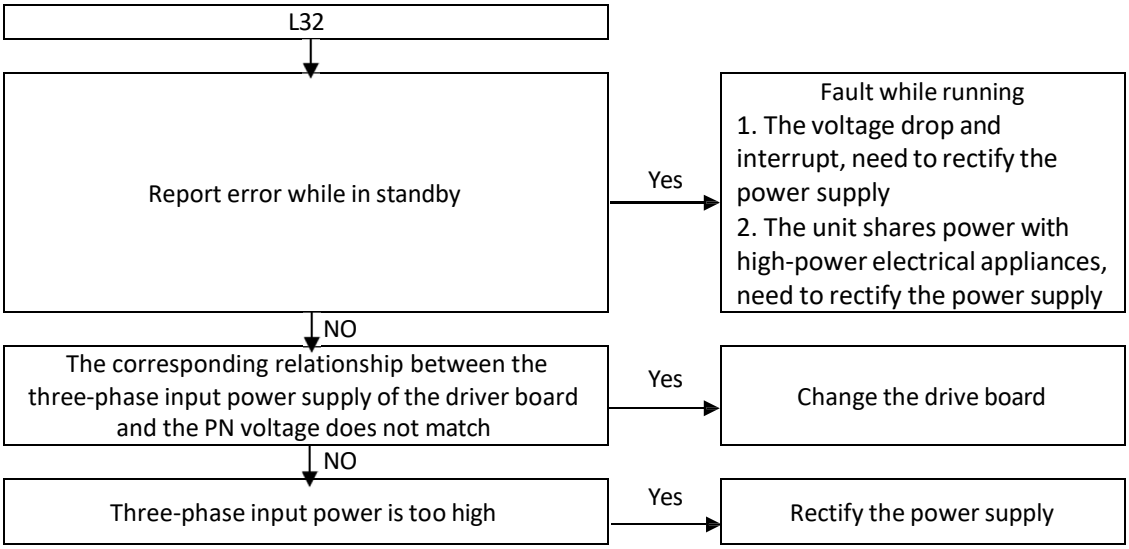
6.7.2 Trigger/resume condition

- Trigger condition: The bus voltage is higher than the excessively high bus voltage protection threshold set by the software.
- Resume condition: The compressor shuts down after a fault, and resumes after reaching the fault exit condition (The bus voltage is lower than the excessively high bus voltage protection threshold set by the software.) one minute later.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.7.3 Possible causes

- The input voltage is too high, resulting in high bus voltage;
- The grid voltage is abnormally high instantaneously
- The module board bus voltage detection circuit is abnormal.

6.7.4 Procedure



6.8 L34: Phase loss error

6.8.1 Description

- The power input phase is missing or the three-phase power supply is seriously unbalanced.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.8.2 Trigger/resume condition

- Trigger condition: The power input phase is missing or the three-phase power supply is seriously unbalanced.
- Resume condition: Detect the factors that cause the phase loss, such as poor power input wiring or the screw of the

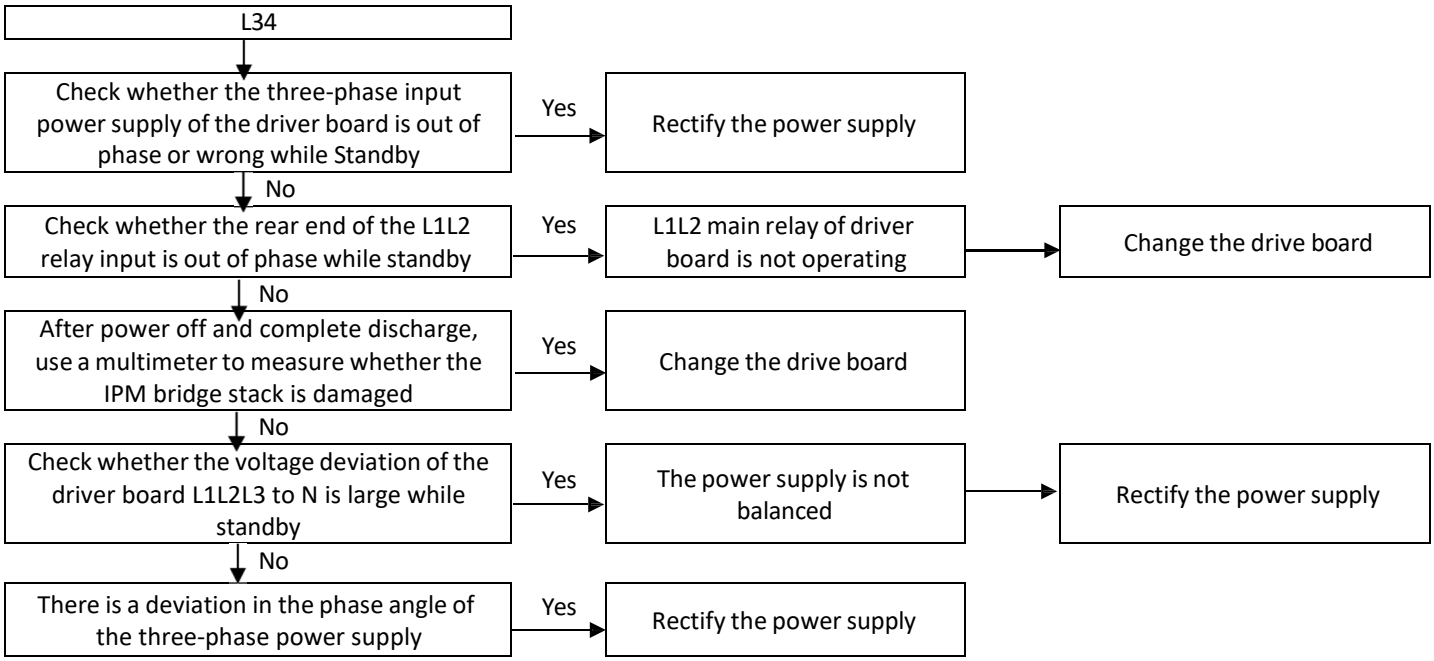
terminal is not tightened, or disconnect other electrical equipment that shares the power supply with the unit.

- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.8.3 Possible causes

- Abnormal system power wiring leads to phase loss, or the N line and the phase line are reversed;
- The system power cord is poorly wired or the screws are not tightened;
- The module board is abnormal (one-phase relay is not operating);
- There is a large load on one or two phases of the system power supply, resulting in an unbalanced supply voltage;
- The power distribution phase unbalance degree exceeds 3% (phase angle unbalance, or three-phase voltage unbalance, or both).

6.8.4 Procedure



6.9 L43: Current sampling bias abnormal

6.9.1 Description

- The current sampling circuit calibration has failed.
- After this fault occurs, the compressor cannot be started. It is necessary to check whether there is a problem with the drive board.

6.9.2 Trigger/resume condition

- Trigger condition: The AD offset value of the current sampling circuit reaches half of the AD full scale.
- Resume condition: After this fault occurs, the compressor cannot be started. It is necessary to check whether there is a problem with the drive board. After that, the AD bias value of the current sampling circuit is less than half of the AD full scale when the power is turned on again. Then this fault will not occur again.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.9.3 Possible causes

- There is a problem with sampling circuit of the driver board.

6.9.4 Procedure

- Change the driver board.

6.10 L45: Motor code not match

6.10.1 Description

- Parameters do not match.
- After this fault occurs, the compressor cannot be started. It is necessary to check whether there is a problem with the drive board.

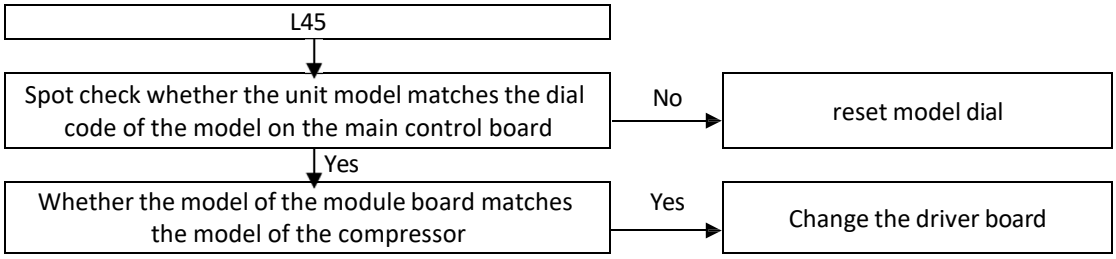
6.10.2 Trigger/resume condition

- Trigger condition: The compressor model selected by the master through communication does not match the compressor drive parameters in the drive.
- Resume condition: Check whether the dial code of the model is wrongly dialed, and re-select the dial code of the corresponding model.
- Reset method: Re-select the dial code of the corresponding model, then power off and restart.

6.10.3 Possible causes

- The main controller's capacity dial or model dial is set incorrectly;
- The matching model of the module board is incorrectly selected;
- The main board circuit or the module board circuit is abnormal.

6.10.4 Procedure



6.11 L46: IPM protection (FO)

6.11.1 Description

- The FO signal of the IPM module has a falling edge or a continuous low level.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

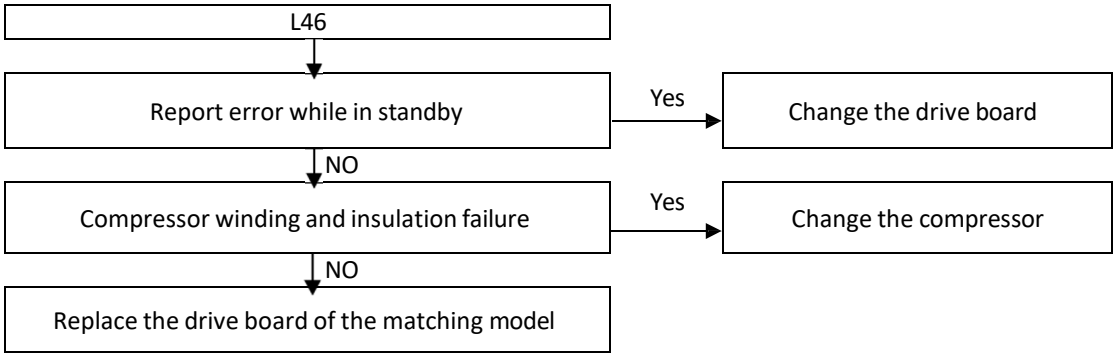
6.11.2 Trigger/resume condition

- Trigger condition: The FO signal of the IPM module has a falling edge or a continuous low level.
- Resume condition: The FO signal of the IPM module turns into high level.
- Reset method: Automatic recovery after reaching the fault exit condition one minute later.

6.11.3 Possible causes

- Internal short circuit of the IPM module;
- Short circuit of compressor winding;
- System condensation results in short circuit of IPM module pins;
- The drive voltage of the lower bridge IGBT of the IPM module is lower than 10.3V;
- The module board is abnormal.

6.11.4 Procedure



6.12 L47: Module type not match

6.12.1 Description

- The driver board detected by the module detection resistor does not match the setting in the driver parameter table.

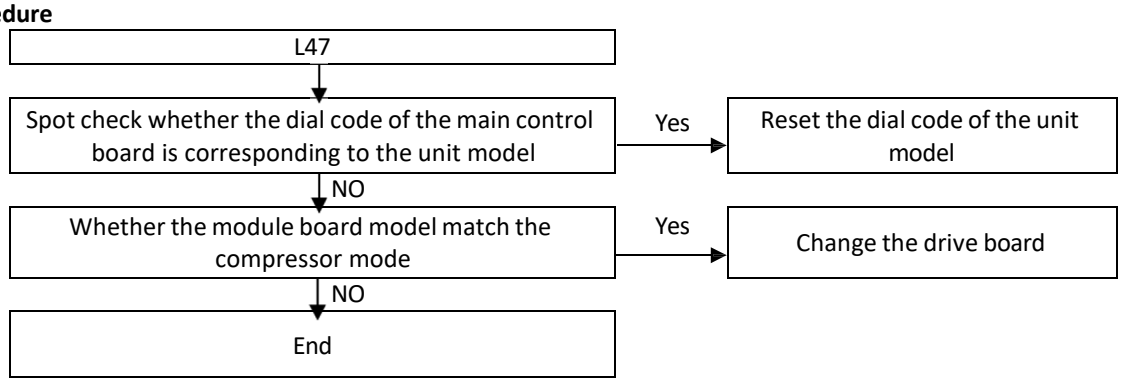
6.12.2 Trigger/resume condition

- Trigger condition: The current level of the drive board and the compressor information detected by the module detection resistor do not match the settings in the drive parameter table.
- Resume condition: Change the module board.
- Reset method: Re-select the module board corresponding to the model, then power off and restart.

6.12.3 Possible causes

- The main control capacity dial code and model selection are wrong;
- Wrong module board which does not correspond to the model;
- Module board fault.

6.12.4 Procedure



6.13 L50: Startup failure

6.13.1 Description

- Compressor failed to start.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

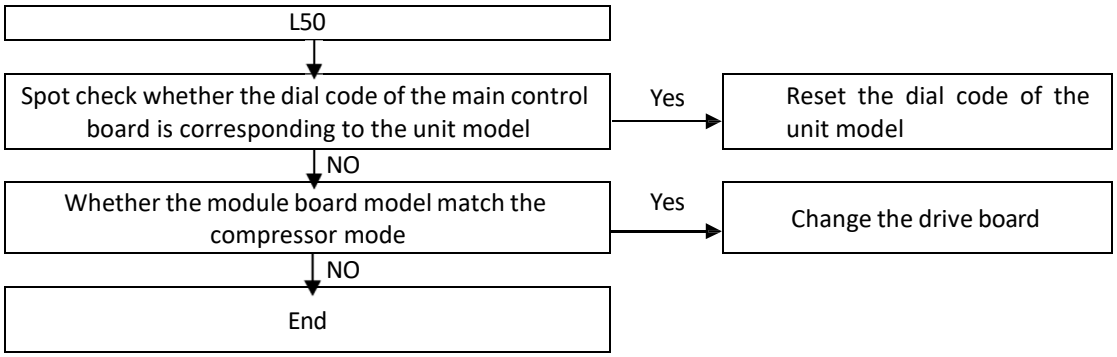
6.13.2 Trigger/resume condition

- Trigger condition: Compressor failed to start.
- Resume condition: After the compressor fails to start, the compressor restarts again. The fault is recovered after successful restart.
- Reset method: Automatic recovery after successful restart.

6.13.3 Possible causes

- There is a pressure difference when the system starts;
- Compressor stuck.

6.13.4 Procedure



6.14 L52: Zero speed protection

6.14.1 Description

- Compressor locks rotor.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.14.2 Trigger/resume condition

- Trigger condition: Compressor locks rotor.
- Resume condition: Troubleshoot locked rotor.
- Reset method: Automatic recovery after reaching the fault exit condition.

6.14.3 Possible causes

- Impurities in the system or lack of lubricating oil.

6.14.4 Procedure

If possible, switch the compressors and start up again. If the problem persists, replace the two compressors.

6.15 L60: Fan motor phase loss protection

6.15.1 Description

- Compressor has phase loss protection.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.15.2 Trigger/resume condition

- Trigger condition: The compressor wire is not connected or has poor contact.
- Resume condition: Check the wiring of the compressor. After wiring again, the phase loss protection fault is eliminated.
- Reset method: Automatic recovery after reaching the fault exit condition.

6.15.3 Possible causes

- The compressor wire is not in good contact or the terminal screws are not tightened.
- Module board is abnormal.

6.15.4 Procedure

- Check the UVW output connection wire of the compressor drive board, and check the UVW wiring of the compressor;
- If possible, switch the compressor wire to confirm whether the drive board is normal, otherwise replace the drive board.

6.16 L61: Short circuit to ground protection

6.16.1 Description

- Compressor has short circuit to ground protection.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.16.2 Trigger/resume condition

- Trigger condition: Compressor has short circuit to ground protection.
- Resume condition: Check whether the compressor casing is damaged, resulting in poor insulation.
- Reset method: Automatic recovery after reaching the fault exit condition.

6.16.3 Possible causes
- The compressor casing is in poor insulation.

6.16.4 Procedure
- Disconnect the compressor wire, measure the compressor UVW resistance to ground, confirm and replace the compressor.

6.17 L65: IPM short circuit protection
6.17.1 Description
- The IPM corresponding to the compressor has short circuit protection.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.17.2 Trigger/resume condition
- Trigger condition: The IPM corresponding to the compressor has short circuit protection.
- Resume condition: Replace the drive board.
- Reset method: Automatic recovery after reaching the fault exit condition.

6.17.3 Possible causes
- There is a problem with drive board.

6.17.4 Procedure
- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

6.18 L6b: Open circuit of U-phase lower tube
6.18.1 Description
- Open circuit of U-phase lower tube.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.18.2 Trigger/resume condition
- Trigger condition: Open circuit of U-phase lower tube corresponding to compressor.
- Resume condition: Check whether the IPM module is working.
- Reset method: Change the module board. Power on and start up again.

6.18.3 Possible causes
- There IPM module is damaged.

6.18.4 Procedure
- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

6.19 L6c: Open circuit of V-phase upper tube
6.19.1 Description
- Open circuit of V-phase upper tube.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.19.2 Trigger/resume condition
- Trigger condition: Open circuit of V-phase upper tube corresponding to compressor.
- Resume condition: Check whether the IPM module is working.
- Reset method: Change the module board. Power on and start up again.

6.19.3 Possible causes
- There IPM module is damaged.

6.19.4 Procedure
- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

6.20 L6d: Open circuit of V-phase lower tube
6.20.1 Description
- Open circuit of V-phase lower tube.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.20.2 Trigger/resume condition
- Trigger condition: Open circuit of V-phase lower tube corresponding to compressor.
- Resume condition: Check whether the IPM module is working.
- Reset method: Change the module board. Power on and start up again.

6.20.3 Possible causes
- There IPM module is damaged.

6.20.4 Procedure
- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

6.21 L6E: Open circuit of W-phase upper tube

6.21.1 Description

- Open circuit of W-phase upper tube.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.21.2 Trigger/resume condition

- Trigger condition: Open circuit of W-phase upper tube corresponding to compressor.
- Resume condition: Check whether the IPM module is working.
- Reset method: Change the module board. Power on and start up again.

6.21.3 Possible causes

- There IPM module is damaged.

6.21.4 Procedure

- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

6.22 L6F: Open circuit of W-phase lower tube

6.22.1 Description

- Open circuit of W-phase lower tube.
- After the fault, the compressor stops running, and if the fault disappears after one minute, the compressor starts again.

6.22.2 Trigger/resume condition

- Trigger condition: Open circuit of W-phase lower tube corresponding to compressor.
- Resume condition: Check whether the IPM module is working.
- Reset method: Change the module board. Power on and start up again.

6.22.3 Possible causes

- There IPM module is damaged.

6.22.4 Procedure

- Check whether the IPM virtual welding and the PWM related transmission circuit of the MCU are connected to the welding. If so, change the replace the drive board.

7 Compressor replacement procedure

Step 1: Remove faulty compressor and remove oil

- Remove the faulty compressor from the outdoor unit.
- Before removing the oil, shake the compressor so as to not allow impurities to remain settled at the bottom.
- Drain the oil out of the compressor and retain it for inspection. Normally the oil can be drained out from the compressor discharge pipe.

Step 2: Inspect oil from faulty compressor

- The oil should be clear and transparent. Slightly yellow oil is not an indication of any problems. However, if the oil is dark, black or contains impurities, the system has problems and the oil needs to be changed. Refer to Figure 4-4.20 for further details regarding inspecting compressor oil. (If the compressor oil has been spoiled, the compressor will not be being lubricated effectively. The scroll plate, crankshaft and bearings will wear. Abrasion will lead to a larger load and higher current. More electric energy will get dissipated as heat and the temperature of the motor will become increasingly high. Finally, compressor damage or burnout will result.)

Step 3: Check oil in other compressors in the system

- If the oil drained from the faulty compressor is clean, go to Step 6.
- If the oil drained from the faulty compressor is only lightly spoiled, go to Step 4.
- If the oil drained from the faulty compressor is heavily spoiled, check the oil in the other compressors in the system. Drain the oil from any compressors where the oil has been spoiled. Go to Step 4.

Step 4: Replace oil separator(s) and accumulator(s)

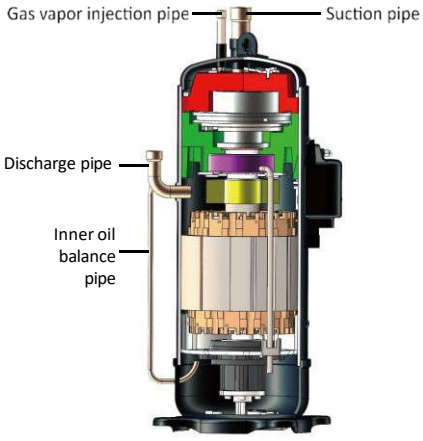
- If the oil from a compressor is spoiled (lightly or heavily), drain the oil from the oil separator and accumulator in that unit and then replace them.

Step 5: Check filters(s)

- If the oil from a compressor is spoiled (lightly or heavily), check the filter between the gas stop valve and the 4-way valve in that unit. If it is blocked, clean with nitrogen or replace.

Step 6: Replace the faulty compressor and re-fit the other compressors

- Replace the faulty compressor.
- If the oil had been spoiled and was drained from the non-faulty compressors in Step 3, use clean oil to clean them before re-fitting them into the units. To clean, add oil into the compressor through the discharge pipe using a funnel, shake the compressor, and then drain the oil. Repeat several times and then re-fit the compressors into the units. (The discharge pipe is connected to the oil pool of the compressor by the inner oil balance pipe.)



Step 7: Add compressor oil

- Only use FW68H oil. Different compressors require different types of oil. Using the wrong type of oil leads to various problems.
- The original system contains 6.2L oil. Each compressor contains 1.1L and 4L are added in the factory. The principle during changing compressor is to keep the system oil amount is the same as original state.

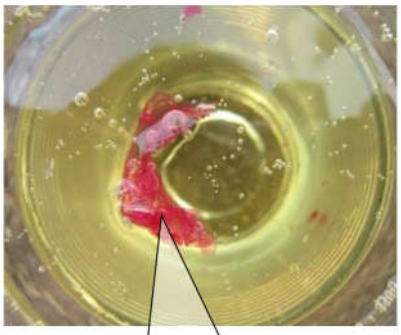
Step 8: Vacuum drying and refrigerant charging

- Once all the compressors and other components have been fully connected, vacuum dry the system and recharge refrigerant.

Inspecting compressor oil

This oil is black - it has been carbonized

This oil is a little yellow, but is clear and transparent and the condition is acceptable



This oil is still transparent but there are impurities which may clog the filter

Cloudy or gray oil indicates abnormal system operation

This oil contains particles of copper

Effects of spoiled compressor oil

Worn crankshaft

Filter blocked by impurities, which leads to abnormal compressor suction

Worn scroll plate

Worn scroll plate

Normal compressor bearings

Seriously worn and damaged bearings

8 Appendix

8.1 Temperature Sensor Resistance Characteristics

Resistance table of exhaust temperature sensor -- 3950K(25-50) 5K(R90) 3% (with deviation)

Contains: TP1/TP2 exhaust temperature sensor

R90=5KΩ±3%，B25/50=3950K±3%

Temp	Resistance（KΩ）			Resist.tol(%)		Temp.tol(℃)	
（℃）	Rmax	R（t）Normal	Rmin	MAX(+)	MIN(-)	MAX(+)	MIN(-)
-30.0	1093.521	907.487	721.452	20.50	20.50	3.44	3.44
-29.0	1031.137	856.752	682.368	20.35	20.35	3.44	3.44
-28.0	972.588	809.086	645.583	20.21	20.21	3.43	3.43
-27.0	917.615	764.281	610.947	20.06	20.06	3.42	3.42
-26.0	865.981	722.152	578.323	19.92	19.92	3.41	3.41
-25.0	817.469	682.528	547.586	19.77	19.77	3.41	3.41
-24.0	771.875	645.245	518.616	19.63	19.63	3.40	3.40
-23.0	729.009	610.156	491.303	19.48	19.48	3.39	3.39
-22.0	688.698	577.121	465.544	19.33	19.33	3.38	3.38
-21.0	650.778	546.012	441.246	19.19	19.19	3.37	3.37
-20.0	615.097	516.708	418.318	19.04	19.04	3.36	3.36
-19.0	581.515	489.096	396.678	18.90	18.90	3.35	3.35
-18.0	549.899	463.073	376.247	18.75	18.75	3.34	3.34
-17.0	520.129	438.542	356.955	18.60	18.60	3.33	3.33
-16.0	492.089	415.411	338.733	18.46	18.46	3.31	3.31
-15.0	465.672	393.595	321.518	18.31	18.31	3.30	3.30
-14.0	440.779	373.014	305.250	18.17	18.17	3.29	3.29
-13.0	417.316	353.595	289.874	18.02	18.02	3.28	3.28
-12.0	395.197	335.268	275.339	17.88	17.88	3.27	3.27
-11.0	374.340	317.967	261.594	17.73	17.73	3.26	3.26
-10.0	354.669	301.632	248.595	17.58	17.58	3.25	3.25
-9.0	336.113	286.206	236.298	17.44	17.44	3.24	3.24
-8.0	318.604	271.634	224.664	17.29	17.29	3.22	3.22
-7.0	302.080	257.867	213.653	17.15	17.15	3.21	3.21
-6.0	286.483	244.857	203.232	17.00	17.00	3.20	3.20
-5.0	271.757	232.561	193.365	16.85	16.85	3.19	3.19
-4.0	257.852	220.937	184.022	16.71	16.71	3.18	3.18
-3.0	244.717	209.945	175.173	16.56	16.56	3.16	3.16
-2.0	232.309	199.550	166.790	16.42	16.42	3.15	3.15
-1.0	220.585	189.716	158.848	16.27	16.27	3.14	3.14
0.0	209.504	180.412	151.321	16.13	16.13	3.13	3.13
1.0	199.029	171.607	144.186	15.98	15.98	3.11	3.11
2.0	189.125	163.273	137.422	15.83	15.83	3.10	3.10
3.0	179.759	155.383	131.007	15.69	15.69	3.09	3.09
4.0	170.899	147.911	124.923	15.54	15.54	3.08	3.08
5.0	162.517	140.835	119.152	15.40	15.40	3.06	3.06
6.0	154.585	134.130	113.675	15.25	15.25	3.05	3.05
7.0	147.077	127.778	108.478	15.10	15.10	3.04	3.04
8.0	139.970	121.757	103.544	14.96	14.96	3.02	3.02
9.0	133.239	116.049	98.859	14.81	14.81	3.01	3.01
10.0	126.864	110.638	94.411	14.67	14.67	3.00	3.00
11.0	120.825	105.505	90.185	14.52	14.52	2.98	2.98
12.0	115.103	100.636	86.170	14.38	14.38	2.97	2.97
13.0	109.679	96.017	82.354	14.23	14.23	2.96	2.96
14.0	104.537	91.633	78.728	14.08	14.08	2.94	2.94
15.0	99.662	87.471	75.280	13.94	13.94	2.93	2.93
16.0	95.038	83.520	72.001	13.79	13.79	2.92	2.92
17.0	90.652	79.767	68.882	13.65	13.65	2.90	2.90
18.0	86.489	76.202	65.915	13.50	13.50	2.89	2.89

19.0	82.539	72.815	63.091	13.35	13.35	2.87	2.87
20.0	78.789	69.596	60.404	13.21	13.21	2.86	2.86
21.0	75.228	66.537	57.845	13.06	13.06	2.84	2.84
22.0	71.846	63.627	55.409	12.92	12.92	2.82	2.82
23.0	68.633	60.860	53.088	12.77	12.77	2.81	2.81
24.0	65.580	58.228	50.877	12.63	12.63	2.79	2.79
25.0	62.678	55.724	48.770	12.48	12.48	2.78	2.78
26.0	59.919	53.340	46.762	12.33	12.33	2.76	2.76
27.0	57.295	51.071	44.847	12.19	12.19	2.74	2.74
28.0	54.800	48.910	43.021	12.04	12.04	2.73	2.73
29.0	52.426	46.853	41.279	11.90	11.90	2.71	2.71
30.0	50.167	44.892	39.617	11.75	11.75	2.69	2.69
31.0	48.016	43.024	38.031	11.60	11.60	2.67	2.67
32.0	45.969	41.243	36.517	11.46	11.46	2.65	2.65
33.0	44.019	39.546	35.072	11.31	11.31	2.64	2.64
34.0	42.162	37.927	33.692	11.17	11.17	2.62	2.62
35.0	40.392	36.383	32.373	11.02	11.02	2.60	2.60
36.0	38.706	34.910	31.113	10.88	10.88	2.58	2.58
37.0	37.098	33.504	29.909	10.73	10.73	2.56	2.56
38.0	35.566	32.162	28.758	10.58	10.58	2.54	2.54
39.0	34.104	30.881	27.657	10.44	10.44	2.52	2.52
40.0	32.709	29.657	26.605	10.29	10.29	2.49	2.49
41.0	31.379	28.488	25.598	10.15	10.15	2.47	2.47
42.0	30.109	27.372	24.634	10.00	10.00	2.45	2.45
43.0	28.896	26.304	23.712	9.85	9.85	2.43	2.43
44.0	27.739	25.284	22.829	9.71	9.71	2.41	2.41
45.0	26.633	24.309	21.984	9.56	9.56	2.38	2.38
46.0	25.577	23.376	21.174	9.42	9.42	2.36	2.36
47.0	24.568	22.483	20.399	9.27	9.27	2.34	2.34
48.0	23.603	21.629	19.656	9.13	9.13	2.31	2.31
49.0	22.681	20.812	18.943	8.98	8.98	2.29	2.29
50.0	21.799	20.030	18.261	8.83	8.83	2.26	2.26
51.0	20.956	19.281	17.606	8.69	8.69	2.24	2.24
52.0	20.149	18.563	16.978	8.54	8.54	2.21	2.21
53.0	19.377	17.876	16.375	8.40	8.40	2.18	2.18
54.0	18.638	17.218	15.797	8.25	8.25	2.16	2.16
55.0	17.931	16.587	15.243	8.10	8.10	2.13	2.13
56.0	17.254	15.982	14.710	7.96	7.96	2.10	2.10
57.0	16.606	15.402	14.199	7.81	7.81	2.08	2.08
58.0	15.984	14.846	13.708	7.67	7.67	2.05	2.05
59.0	15.389	14.313	13.236	7.52	7.52	2.02	2.02
60.0	14.819	13.801	12.783	7.37	7.37	1.99	1.99
61.0	14.272	13.310	12.348	7.23	7.23	1.96	1.96
62.0	13.748	12.839	11.929	7.08	7.08	1.93	1.93
63.0	13.246	12.387	11.527	6.94	6.94	1.90	1.90
64.0	12.764	11.952	11.140	6.79	6.79	1.87	1.87
65.0	12.302	11.535	10.768	6.65	6.65	1.84	1.84
66.0	11.858	11.134	10.411	6.50	6.50	1.81	1.81
67.0	11.432	10.749	10.066	6.35	6.35	1.77	1.77
68.0	11.024	10.380	9.735	6.21	6.21	1.74	1.74
69.0	10.632	10.024	9.416	6.06	6.06	1.71	1.71
70.0	10.255	9.682	9.109	5.92	5.92	1.68	1.68
71.0	9.894	9.354	8.814	5.77	5.77	1.64	1.64
72.0	9.546	9.038	8.530	5.63	5.63	1.61	1.61
73.0	9.213	8.734	8.255	5.48	5.48	1.57	1.57
74.0	8.892	8.442	7.992	5.33	5.33	1.54	1.54
75.0	8.584	8.161	7.737	5.19	5.19	1.51	1.51

76.0	8.288	7.890	7.492	5.04	5.04	1.47	1.47
77.0	8.003	7.629	7.256	4.90	4.90	1.43	1.43
78.0	7.729	7.379	7.028	4.75	4.75	1.40	1.40
79.0	7.466	7.137	6.809	4.60	4.60	1.36	1.36
80.0	7.213	6.905	6.597	4.46	4.46	1.32	1.32
81.0	6.969	6.681	6.393	4.31	4.31	1.29	1.29
82.0	6.735	6.466	6.196	4.17	4.17	1.25	1.25
83.0	6.509	6.258	6.006	4.02	4.02	1.21	1.21
84.0	6.292	6.058	5.823	3.88	3.88	1.17	1.17
85.0	6.084	5.865	5.646	3.73	3.73	1.13	1.13
86.0	5.883	5.679	5.476	3.58	3.58	1.09	1.09
87.0	5.689	5.500	5.311	3.44	3.44	1.06	1.06
88.0	5.502	5.327	5.152	3.29	3.29	1.02	1.02
89.0	5.323	5.161	4.998	3.15	3.15	0.97	0.97
90.0	5.150	5.000	4.850	3.00	3.00	0.93	0.93
91.0	4.996	4.845	4.694	3.11	3.11	0.97	0.97
92.0	4.847	4.696	4.545	3.22	3.22	1.01	1.01
93.0	4.703	4.552	4.400	3.33	3.33	1.05	1.05
94.0	4.564	4.412	4.261	3.43	3.43	1.09	1.09
95.0	4.430	4.278	4.127	3.54	3.54	1.13	1.13
96.0	4.300	4.149	3.997	3.65	3.65	1.17	1.17
97.0	4.175	4.024	3.872	3.76	3.76	1.21	1.21
98.0	4.054	3.903	3.752	3.87	3.87	1.25	1.25
99.0	3.937	3.787	3.636	3.98	3.98	1.29	1.29
100.0	3.824	3.674	3.524	4.09	4.09	1.33	1.33
101.0	3.715	3.565	3.416	4.19	4.19	1.38	1.38
102.0	3.609	3.460	3.312	4.30	4.30	1.42	1.42
103.0	3.507	3.359	3.211	4.41	4.41	1.46	1.46
104.0	3.409	3.261	3.114	4.52	4.52	1.51	1.51
105.0	3.313	3.167	3.020	4.63	4.63	1.55	1.55
106.0	3.221	3.075	2.929	4.74	4.74	1.59	1.59
107.0	3.131	2.987	2.842	4.85	4.85	1.64	1.64
108.0	3.045	2.901	2.758	4.95	4.95	1.68	1.68
109.0	2.962	2.819	2.676	5.06	5.06	1.73	1.73
110.0	2.881	2.739	2.597	5.17	5.17	1.78	1.78
111.0	2.802	2.662	2.521	5.28	5.28	1.82	1.82
112.0	2.727	2.587	2.448	5.39	5.39	1.87	1.87
113.0	2.653	2.515	2.377	5.50	5.50	1.92	1.92
114.0	2.582	2.445	2.308	5.61	5.61	1.96	1.96
115.0	2.514	2.378	2.242	5.72	5.72	2.01	2.01
116.0	2.447	2.313	2.178	5.82	5.82	2.06	2.06
117.0	2.383	2.249	2.116	5.93	5.93	2.11	2.11
118.0	2.320	2.188	2.056	6.04	6.04	2.16	2.16
119.0	2.260	2.129	1.998	6.15	6.15	2.21	2.21
120.0	2.201	2.072	1.942	6.26	6.26	2.26	2.26
121.0	2.145	2.016	1.888	6.37	6.37	2.32	2.32
122.0	2.090	1.963	1.836	6.48	6.48	2.37	2.37
123.0	2.037	1.911	1.785	6.58	6.58	2.42	2.42
124.0	1.985	1.860	1.736	6.69	6.69	2.48	2.48
125.0	1.935	1.812	1.689	6.80	6.80	2.53	2.53

Resistance table of water temperature sensor -- 3970(0-100) 2% 17.6K(R50) 3% (with deviation)

Contains: Taf2 board changing anti-freezing sensor, Twi unit water inlet sensor, Two unit water outlet sensor, Tw total water outlet sensor

R50=17.6±3%， B0/100=3970±2%

Temp	Resistance（KΩ）			Resist.tol(%)		Temp.tol(℃)	
（℃）	Rmax	R（t）Normal	Rmin	（℃）	Rmax	R（t）Normal	Rmin
-30.0	953.957	853.724	753.491	11.74	11.74	1.98	1.98
-29.0	896.053	802.986	709.918	11.59	11.59	1.96	1.96
-28.0	842.002	755.557	669.113	11.44	11.44	1.95	1.95
-27.0	791.530	711.210	630.889	11.29	11.29	1.94	1.94
-26.0	744.384	669.728	595.072	11.15	11.15	1.92	1.92
-25.0	700.328	630.913	561.498	11.00	11.00	1.91	1.91
-24.0	659.144	594.580	530.015	10.86	10.86	1.90	1.90
-23.0	620.629	560.556	500.483	10.72	10.72	1.88	1.88
-22.0	584.595	528.683	472.771	10.58	10.58	1.87	1.87
-21.0	550.871	498.814	446.757	10.44	10.44	1.86	1.86
-20.0	519.295	470.812	422.328	10.30	10.30	1.85	1.85
-19.0	489.718	444.548	399.379	10.16	10.16	1.83	1.83
-18.0	462.003	419.907	377.812	10.02	10.02	1.82	1.82
-17.0	436.022	396.779	357.537	9.89	9.89	1.81	1.81
-16.0	411.657	375.063	338.468	9.76	9.76	1.79	1.79
-15.0	388.797	354.662	320.527	9.62	9.62	1.78	1.78
-14.0	367.343	335.492	303.641	9.49	9.49	1.77	1.77
-13.0	347.198	317.470	287.743	9.36	9.36	1.75	1.75
-12.0	328.275	300.521	272.767	9.24	9.24	1.74	1.74
-11.0	310.495	284.576	258.658	9.11	9.11	1.73	1.73
-10.0	293.780	269.569	245.359	8.98	8.98	1.71	1.71
-9.0	278.060	255.439	232.818	8.86	8.86	1.70	1.70
-8.0	263.273	242.131	220.989	8.73	8.73	1.69	1.69
-7.0	249.357	229.593	209.828	8.61	8.61	1.67	1.67
-6.0	236.255	217.774	199.293	8.49	8.49	1.66	1.66
-5.0	223.915	206.630	189.345	8.37	8.37	1.64	1.64
-4.0	212.289	196.119	179.949	8.25	8.25	1.63	1.63
-3.0	201.332	186.201	171.070	8.13	8.13	1.62	1.62
-2.0	191.001	176.840	162.678	8.01	8.01	1.60	1.60
-1.0	181.258	168.001	154.744	7.89	7.89	1.59	1.59
0.0	172.066	159.653	147.240	7.77	7.77	1.57	1.57
1.0	163.391	151.766	140.141	7.66	7.66	1.56	1.56
2.0	155.200	144.311	133.422	7.55	7.55	1.55	1.55
3.0	147.466	137.264	127.062	7.43	7.43	1.53	1.53
4.0	140.159	130.599	121.038	7.32	7.32	1.52	1.52
5.0	133.253	124.293	115.332	7.21	7.21	1.50	1.50
6.0	126.725	118.326	109.926	7.10	7.10	1.49	1.49
7.0	120.554	112.679	104.803	6.99	6.99	1.47	1.47
8.0	114.715	107.330	99.945	6.88	6.88	1.46	1.46
9.0	109.191	102.265	95.338	6.77	6.77	1.44	1.44
10.0	103.963	97.466	90.969	6.67	6.67	1.43	1.43
11.0	99.013	92.918	86.822	6.56	6.56	1.41	1.41
12.0	94.327	88.607	82.888	6.45	6.45	1.40	1.40
13.0	89.887	84.519	79.152	6.35	6.35	1.38	1.38
14.0	85.679	80.642	75.604	6.25	6.25	1.37	1.37
15.0	81.692	76.963	72.234	6.14	6.14	1.35	1.35
16.0	77.911	73.471	69.032	6.04	6.04	1.34	1.34
17.0	74.326	70.157	65.989	5.94	5.94	1.32	1.32
18.0	70.925	67.011	63.097	5.84	5.84	1.31	1.31
19.0	67.699	64.023	60.347	5.74	5.74	1.29	1.29

20.0	64.636	61.184	57.731	5.64	5.64	1.28	1.28
21.0	61.729	58.486	55.243	5.54	5.54	1.26	1.26
22.0	58.967	55.921	52.875	5.45	5.45	1.25	1.25
23.0	56.345	53.483	50.621	5.35	5.35	1.23	1.23
24.0	53.854	51.165	48.476	5.26	5.26	1.22	1.22
25.0	51.485	48.959	46.432	5.16	5.16	1.20	1.20
26.0	49.234	46.860	44.486	5.07	5.07	1.19	1.19
27.0	47.094	44.863	42.632	4.97	4.97	1.17	1.17
28.0	45.058	42.961	40.865	4.88	4.88	1.16	1.16
29.0	43.121	41.151	39.181	4.79	4.79	1.14	1.14
30.0	41.278	39.427	37.575	4.70	4.70	1.13	1.13
31.0	39.524	37.784	36.044	4.61	4.61	1.11	1.11
32.0	37.854	36.219	34.583	4.52	4.52	1.10	1.10
33.0	36.263	34.726	33.189	4.43	4.43	1.08	1.08
34.0	34.748	33.304	31.860	4.34	4.34	1.06	1.06
35.0	33.305	31.947	30.590	4.25	4.25	1.05	1.05
36.0	31.929	30.653	29.378	4.16	4.16	1.03	1.03
37.0	30.617	29.419	28.220	4.07	4.07	1.02	1.02
38.0	29.367	28.241	27.114	3.99	3.99	1.00	1.00
39.0	28.174	27.115	26.057	3.90	3.90	0.99	0.99
40.0	27.036	26.042	25.048	3.82	3.82	0.97	0.97
41.0	25.949	25.015	24.082	3.73	3.73	0.95	0.95
42.0	24.913	24.036	23.159	3.65	3.65	0.94	0.94
43.0	23.924	23.100	22.276	3.57	3.57	0.92	0.92
44.0	22.979	22.206	21.432	3.48	3.48	0.90	0.90
45.0	22.076	21.350	20.624	3.40	3.40	0.89	0.89
46.0	21.213	20.532	19.850	3.32	3.32	0.87	0.87
47.0	20.389	19.749	19.110	3.24	3.24	0.86	0.86
48.0	19.602	19.001	18.401	3.16	3.16	0.84	0.84
49.0	18.848	18.285	17.722	3.08	3.08	0.82	0.82
50.0	18.128	17.600	17.072	3.00	3.00	0.80	0.80
51.0	17.466	16.944	16.422	3.08	3.08	0.83	0.83
52.0	16.831	16.316	15.801	3.16	3.16	0.86	0.86
53.0	16.223	15.714	15.206	3.23	3.23	0.88	0.88
54.0	15.641	15.139	14.638	3.31	3.31	0.91	0.91
55.0	15.081	14.586	14.092	3.39	3.39	0.94	0.94
56.0	14.545	14.058	13.571	3.47	3.47	0.96	0.96
57.0	14.030	13.550	13.070	3.54	3.54	0.99	0.99
58.0	13.537	13.064	12.591	3.62	3.62	1.01	1.01
59.0	13.063	12.597	12.132	3.69	3.69	1.04	1.04
60.0	12.608	12.150	11.692	3.77	3.77	1.07	1.07
61.0	12.171	11.721	11.270	3.84	3.84	1.09	1.09
62.0	11.752	11.309	10.866	3.92	3.92	1.12	1.12
63.0	11.349	10.913	10.478	3.99	3.99	1.15	1.15
64.0	10.962	10.533	10.105	4.06	4.06	1.17	1.17
65.0	10.589	10.168	9.748	4.14	4.14	1.20	1.20
66.0	10.231	9.818	9.405	4.21	4.21	1.23	1.23
67.0	9.887	9.481	9.075	4.28	4.28	1.25	1.25
68.0	9.556	9.157	8.758	4.35	4.35	1.28	1.28
69.0	9.237	8.846	8.454	4.43	4.43	1.31	1.31
70.0	8.932	8.547	8.163	4.50	4.50	1.34	1.34
71.0	8.637	8.259	7.882	4.57	4.57	1.37	1.37
72.0	8.354	7.983	7.613	4.64	4.64	1.39	1.39
73.0	8.080	7.717	7.354	4.71	4.71	1.42	1.42

74.0	7.818	7.461	7.105	4.78	4.78	1.45	1.45
75.0	7.565	7.215	6.866	4.85	4.85	1.48	1.48
76.0	7.322	6.978	6.635	4.92	4.92	1.50	1.50
77.0	7.087	6.750	6.414	4.99	4.99	1.53	1.53
78.0	6.861	6.531	6.201	5.05	5.05	1.56	1.56
79.0	6.643	6.319	5.995	5.12	5.12	1.59	1.59
80.0	6.433	6.115	5.798	5.19	5.19	1.62	1.62
81.0	6.230	5.919	5.608	5.26	5.26	1.64	1.64
82.0	6.035	5.730	5.425	5.32	5.32	1.67	1.67
83.0	5.847	5.548	5.249	5.39	5.39	1.70	1.70
84.0	5.666	5.372	5.079	5.46	5.46	1.74	1.74
85.0	5.491	5.204	4.916	5.52	5.52	1.77	1.77
86.0	5.323	5.041	4.759	5.59	5.59	1.80	1.80
87.0	5.160	4.884	4.608	5.65	5.65	1.82	1.82
88.0	5.003	4.732	4.462	5.72	5.72	1.86	1.86
89.0	4.852	4.587	4.322	5.78	5.78	1.88	1.88
90.0	4.706	4.446	4.186	5.85	5.85	1.92	1.92
91.0	4.565	4.310	4.056	5.91	5.91	1.94	1.94
92.0	4.429	4.179	3.929	5.98	5.98	1.99	1.99
93.0	4.298	4.053	3.809	6.04	6.04	2.01	2.01
94.0	4.172	3.932	3.692	6.10	6.10	2.04	2.04
95.0	4.049	3.814	3.579	6.16	6.16	2.08	2.08
96.0	3.932	3.701	3.471	6.23	6.23	2.10	2.10
97.0	3.817	3.591	3.365	6.29	6.29	2.15	2.15
98.0	3.708	3.486	3.265	6.35	6.35	2.17	2.17
99.0	3.601	3.384	3.167	6.41	6.41	2.21	2.21
100.0	3.499	3.286	3.073	6.47	6.47	2.24	2.24
101.0	3.400	3.191	2.983	6.54	6.54	2.25	2.25
102.0	3.303	3.098	2.894	6.60	6.60	2.29	2.29
103.0	3.210	3.009	2.809	6.66	6.66	2.33	2.33
104.0	3.120	2.923	2.727	6.72	6.72	2.36	2.36
105.0	3.032	2.840	2.647	6.78	6.78	2.39	2.39
106.0	2.948	2.759	2.571	6.84	6.84	2.42	2.42
107.0	2.866	2.681	2.497	6.90	6.90	2.45	2.45
108.0	2.787	2.606	2.425	6.95	6.95	2.49	2.49
109.0	2.711	2.533	2.356	7.01	7.01	2.52	2.52
110.0	2.637	2.463	2.288	7.07	7.07	2.55	2.55
111.0	2.565	2.394	2.224	7.13	7.13	2.58	2.58
112.0	2.496	2.328	2.161	7.19	7.19	2.61	2.61
113.0	2.428	2.264	2.100	7.25	7.25	2.65	2.65
114.0	2.363	2.202	2.041	7.30	7.30	2.68	2.68
115.0	2.300	2.142	1.985	7.36	7.36	2.71	2.71
116.0	2.239	2.084	1.930	7.42	7.42	2.75	2.75
117.0	2.179	2.028	1.876	7.47	7.47	2.78	2.78
118.0	2.122	1.973	1.825	7.53	7.53	2.81	2.81
119.0	2.066	1.920	1.775	7.59	7.59	2.85	2.85
120.0	2.012	1.869	1.726	7.64	7.64	2.88	2.88
121.0	1.960	1.820	1.680	7.70	7.70	2.91	2.91
122.0	1.909	1.772	1.634	7.75	7.75	2.95	2.95
123.0	1.860	1.725	1.590	7.81	7.81	2.98	2.98
124.0	1.812	1.680	1.548	7.86	7.86	3.01	3.01
125.0	1.765	1.636	1.506	7.92	7.92	3.05	3.05
126.0	1.720	1.593	1.466	7.97	7.97	3.08	3.08
127.0	1.677	1.552	1.428	8.03	8.03	3.12	3.12

128.0	1.634	1.512	1.390	8.08	8.08	3.15	3.15
129.0	1.593	1.473	1.354	8.13	8.13	3.18	3.18
130.0	1.553	1.436	1.318	8.19	8.19	3.22	3.22
131.0	1.515	1.399	1.284	8.24	8.24	3.25	3.25
132.0	1.477	1.364	1.251	8.29	8.29	3.29	3.29
133.0	1.440	1.329	1.219	8.34	8.34	3.32	3.32
134.0	1.405	1.296	1.187	8.40	8.40	3.36	3.36
135.0	1.370	1.264	1.157	8.45	8.45	3.39	3.39
136.0	1.337	1.232	1.127	8.50	8.50	3.43	3.43
137.0	1.304	1.202	1.099	8.55	8.55	3.46	3.46
138.0	1.273	1.172	1.071	8.60	8.60	3.50	3.50
139.0	1.242	1.143	1.044	8.66	8.66	3.53	3.53
140.0	1.212	1.115	1.018	8.71	8.71	3.57	3.57
141.0	1.183	1.088	0.993	8.76	8.76	3.60	3.60
142.0	1.155	1.061	0.968	8.81	8.81	3.64	3.64
143.0	1.127	1.036	0.944	8.86	8.86	3.67	3.67
144.0	1.101	1.011	0.921	8.91	8.91	3.71	3.71
145.0	1.075	0.986	0.898	8.96	8.96	3.75	3.75
146.0	1.050	0.963	0.876	9.01	9.01	3.78	3.78
147.0	1.025	0.940	0.855	9.06	9.06	3.82	3.82
148.0	1.001	0.918	0.834	9.11	9.11	3.85	3.85
149.0	0.978	0.896	0.814	9.16	9.16	3.89	3.89
150.0	0.955	0.875	0.794	9.21	9.21	3.92	3.92

Resistance table of pipe temperature sensor -- 4100K(25-50) 10K(R25) 3% (with deviation)

Contains: T6A auxiliary inlet temperature sensor, T6B auxiliary outlet temperature sensor, Th suction temperature sensor, Tz/7 heating plate exchange outlet sensor, T4 outdoor temperature sensor, T3A/T3B evaporator sensor.

R25=10KΩ±3%，B25/50=4100K±3%

Temp	Resistance（KΩ）			Resist.tol(%)		Temp.tol(℃)	
（℃）	Rmax	R（t）Normal	Rmin	（℃）	Rmax	R（t）Normal	Rmin
-30.0	220.320	197.792	176.705	11.39	10.66	1.72	1.71
-29.0	206.384	185.547	166.037	11.23	10.52	1.71	1.70
-28.0	193.407	174.131	156.075	11.07	10.37	1.70	1.69
-27.0	181.317	163.481	146.768	10.91	10.22	1.68	1.67
-26.0	170.049	153.543	138.071	10.75	10.08	1.67	1.66
-25.0	159.543	144.266	129.939	10.59	9.93	1.65	1.65
-24.0	149.745	135.601	122.333	10.43	9.79	1.64	1.63
-23.0	140.602	127.507	115.216	10.27	9.64	1.62	1.62
-22.0	132.067	119.941	108.555	10.11	9.49	1.61	1.60
-21.0	124.098	112.867	102.318	9.95	9.35	1.59	1.59
-20.0	116.539	106.732	96.920	9.19	9.19	1.59	1.59
-19.0	110.231	100.552	91.451	9.63	9.05	1.57	1.57
-18.0	103.743	94.769	86.328	9.47	8.91	1.56	1.55
-17.0	97.673	89.353	81.525	9.31	8.76	1.54	1.54
-16.0	91.990	84.278	77.017	9.15	8.62	1.53	1.52
-15.0	86.669	79.521	72.788	8.99	8.47	1.51	1.50
-14.0	81.684	75.059	68.815	8.83	8.32	1.49	1.48
-13.0	77.013	70.873	65.083	8.66	8.17	1.47	1.47
-12.0	72.632	66.943	61.574	8.50	8.02	1.45	1.45
-11.0	68.523	63.252	58.274	8.33	7.87	1.44	1.43
-10.0	64.668	59.784	55.169	8.17	7.72	1.42	1.41
-9.0	61.048	56.524	52.246	8.00	7.57	1.40	1.39
-8.0	57.649	53.458	49.492	7.84	7.42	1.38	1.37
-7.0	54.456	50.575	46.899	7.67	7.27	1.35	1.35
-6.0	51.456	47.862	44.455	7.51	7.12	1.33	1.32
-5.0	48.636	45.308	42.150	7.35	6.97	1.31	1.30
-4.0	45.984	42.903	39.977	7.18	6.82	1.29	1.28
-3.0	43.490	40.638	37.927	7.02	6.67	1.27	1.26
-2.0	41.144	38.504	35.992	6.86	6.52	1.25	1.24
-1.0	38.935	36.492	34.165	6.70	6.38	1.23	1.21
0.0	36.857	34.596	32.440	6.53	6.23	1.21	1.19
1.0	34.898	32.807	30.810	6.38	6.09	1.18	1.17
2.0	33.055	31.120	29.271	6.22	5.94	1.16	1.15
3.0	31.317	29.528	27.815	6.06	5.80	1.14	1.12
4.0	29.681	28.026	26.440	5.90	5.66	1.12	1.10
5.0	28.138	26.608	25.140	5.75	5.52	1.10	1.08
6.0	26.682	25.268	23.909	5.60	5.38	1.07	1.06
7.0	25.310	24.003	22.745	5.45	5.24	1.05	1.03
8.0	24.016	22.808	21.644	5.30	5.10	1.03	1.01
9.0	22.794	21.678	20.601	5.15	4.97	1.01	0.99
10.0	21.641	20.610	19.614	5.00	4.83	0.99	0.97
11.0	20.553	19.601	18.680	4.86	4.70	0.96	0.94
12.0	19.525	18.646	17.794	4.71	4.57	0.94	0.92
13.0	18.554	17.743	16.955	4.57	4.44	0.92	0.90
14.0	17.636	16.888	16.160	4.43	4.31	0.90	0.88
15.0	16.769	16.079	15.406	4.29	4.19	0.88	0.85
16.0	15.949	15.313	14.691	4.15	4.06	0.86	0.83
17.0	15.174	14.588	14.014	4.02	3.94	0.84	0.81
18.0	14.442	13.902	13.372	3.89	3.81	0.81	0.79
19.0	13.748	13.251	12.762	3.75	3.69	0.79	0.76

20.0	13.093	12.635	12.183	3.62	3.57	0.77	0.74
21.0	12.471	12.050	11.634	3.50	3.46	0.75	0.72
22.0	11.883	11.496	11.112	3.37	3.34	0.73	0.70
23.0	11.327	10.971	10.617	3.25	3.23	0.71	0.68
24.0	10.800	10.473	10.147	3.12	3.11	0.69	0.66
25.0	10.300	10.000	9.700	3.00	3.00	0.67	0.63
26.0	9.848	9.551	9.255	3.11	3.10	0.69	0.66
27.0	9.418	9.125	8.834	3.21	3.19	0.72	0.69
28.0	9.010	8.721	8.434	3.31	3.29	0.75	0.71
29.0	8.621	8.337	8.055	3.41	3.38	0.77	0.74
30.0	8.252	7.972	7.695	3.51	3.47	0.80	0.77
31.0	7.900	7.625	7.353	3.61	3.57	0.83	0.79
32.0	7.566	7.296	7.029	3.70	3.66	0.85	0.82
33.0	7.247	6.982	6.721	3.80	3.74	0.88	0.84
34.0	6.944	6.684	6.428	3.89	3.83	0.91	0.87
35.0	6.656	6.401	6.150	3.98	3.92	0.93	0.90
36.0	6.381	6.131	5.886	4.08	4.00	0.96	0.93
37.0	6.119	5.874	5.634	4.17	4.09	0.98	0.95
38.0	5.870	5.630	5.395	4.26	4.17	1.01	0.98
39.0	5.631	5.397	5.167	4.34	4.26	1.03	1.01
40.0	5.404	5.175	4.951	4.43	4.34	1.06	1.03
41.0	5.188	4.964	4.745	4.52	4.42	1.09	1.06
42.0	4.982	4.763	4.549	4.60	4.50	1.12	1.09
43.0	4.785	4.571	4.362	4.69	4.58	1.14	1.12
44.0	4.596	4.387	4.183	4.77	4.66	1.17	1.14
45.0	4.417	4.213	4.014	4.85	4.74	1.19	1.17
46.0	4.246	4.046	3.851	4.93	4.81	1.22	1.20
47.0	4.082	3.887	3.697	5.02	4.89	1.25	1.23
48.0	3.925	3.735	3.550	5.10	4.97	1.28	1.25
49.0	3.776	3.590	3.409	5.18	5.04	1.30	1.28
50.0	3.632	3.451	3.274	5.25	5.12	1.33	1.30
51.0	3.495	3.318	3.146	5.33	5.19	1.35	1.33
52.0	3.363	3.191	3.023	5.41	5.26	1.41	1.36
53.0	3.237	3.069	2.905	5.49	5.34	1.43	1.38
54.0	3.116	2.952	2.793	5.56	5.41	1.46	1.41
55.0	3.001	2.841	2.685	5.64	5.48	1.48	1.44
56.0	2.890	2.734	2.582	5.71	5.55	1.51	1.46
57.0	2.784	2.632	2.484	5.79	5.62	1.54	1.49
58.0	2.682	2.534	2.390	5.86	5.69	1.56	1.52
59.0	2.585	2.440	2.299	5.93	5.76	1.59	1.54
60.0	2.491	2.350	2.213	6.01	5.83	1.62	1.57
61.0	2.401	2.264	2.130	6.08	5.90	1.64	1.60
62.0	2.315	2.181	2.051	6.15	5.96	1.67	1.62
63.0	2.233	2.102	1.975	6.22	6.03	1.70	1.65
64.0	2.154	2.026	1.903	6.29	6.10	1.72	1.68
65.0	2.077	1.953	1.833	6.36	6.16	1.75	1.70
66.0	2.004	1.883	1.766	6.42	6.23	1.77	1.73
67.0	1.934	1.816	1.702	6.49	6.29	1.80	1.76
68.0	1.867	1.752	1.641	6.56	6.35	1.83	1.78
69.0	1.802	1.690	1.582	6.62	6.41	1.85	1.81
70.0	1.740	1.631	1.525	6.69	6.48	1.88	1.84
71.0	1.680	1.574	1.471	6.75	6.54	1.91	1.86
72.0	1.622	1.519	1.419	6.82	6.60	1.93	1.89
73.0	1.567	1.466	1.369	6.88	6.66	1.96	1.92
74.0	1.514	1.416	1.321	6.94	6.71	1.98	1.94
75.0	1.463	1.367	1.275	7.00	6.77	2.01	1.97
76.0	1.414	1.321	1.230	7.06	6.83	2.04	2.00

77.0	1.367	1.276	1.188	7.12	6.88	2.06	2.02
78.0	1.321	1.233	1.147	7.17	6.94	2.09	2.05
79.0	1.277	1.191	1.108	7.23	6.99	2.12	2.08
80.0	1.235	1.151	1.070	7.28	7.04	2.14	2.11
81.0	1.195	1.113	1.034	7.33	7.09	2.17	2.13
82.0	1.156	1.076	0.999	7.39	7.14	2.20	2.16
83.0	1.118	1.041	0.966	7.44	7.18	2.22	2.19
84.0	1.082	1.007	0.934	7.48	7.23	2.25	2.21
85.0	1.047	0.974	0.903	7.53	7.27	2.27	2.24
86.0	1.014	0.942	0.874	7.57	7.31	2.30	2.27
87.0	0.982	0.912	0.845	7.62	7.35	2.33	2.29
88.0	0.951	0.883	0.818	7.66	7.39	2.35	2.32
89.0	0.921	0.855	0.791	7.69	7.43	2.38	2.35
90.0	0.892	0.828	0.766	7.73	7.46	2.41	2.37
91.0	0.864	0.802	0.742	7.76	7.49	2.43	2.40
92.0	0.838	0.777	0.719	7.80	7.52	2.46	2.43
93.0	0.812	0.753	0.696	7.82	7.54	2.48	2.45
94.0	0.787	0.730	0.675	7.85	7.57	2.51	2.48
95.0	0.763	0.708	0.654	7.87	7.59	2.54	2.51
96.0	0.740	0.686	0.634	7.89	7.61	2.56	2.53
97.0	0.718	0.666	0.615	7.91	7.62	2.59	2.56
98.0	0.697	0.646	0.597	7.93	7.63	2.62	2.59
99.0	0.677	0.627	0.579	7.94	7.64	2.64	2.61
100.0	0.657	0.609	0.562	7.94	7.65	2.67	2.64
101.0	0.638	0.591	0.546	7.95	7.65	2.70	2.67
102.0	0.620	0.574	0.530	7.95	7.65	2.72	2.69
103.0	0.602	0.558	0.515	7.94	7.64	2.75	2.72
104.0	0.585	0.542	0.501	7.94	7.63	2.77	2.75
105.0	0.569	0.527	0.485	7.92	7.92	2.80	2.77

8.2 Normal Operating Parameters of Refrigerant System

Under the following conditions, the operating parameters given in Tables should be observed:

- If the outdoor ambient temperature is high, the system is being run in normal cooling mode with the following settings: temperature 5°C.
- If the outdoor ambient temperature is low, the system is being run in heating mode with the following settings: temperature 65°C.
- The system has been running normally for more than 30 minutes.

For 65/75/110/140kW

Outdoor unit in normal cooling mode operating parameters

Outdoor ambient temperature	**℃**	< 10	10 to 25	25 to 35	35 to 48
Average discharge temperature	**℃**	40-95	65-105	65-105	75-110
Average discharge superheat	**℃**	15-50	25-60	25-65	30-60
Discharge pressure	**MPa**	1.6-3.0	2.1-3.2	2.3-3.8	2.6-4.1
Average suction superheat	**℃**	2-20	2-25	2-25	3-25
Suction pressure	**MPa**	0.6-1.3	0.7-1.0	0.7-1.3	0.7-1.4
Average suction temperature	**℃**	1-30	3-30	3-35	5-40
T3	**℃**	5-40	15-43	30-52	35-58
Tz/7	**℃**	/	/	/	/
Taf	**℃**	5-25	5-25	5-25	5-25
T6A/B	**℃**	/	5-30	8-30	10-40
Twi	**℃**	10-25	10-25	10-25	10-25
Two	**℃**	5-20	5-20	5-20	5-20
Tw	**℃**	5-20	5-20	5-20	5-20
DC fan motor current	**A**	0.2-3.2 (65KW) 0.2-4.5 (110KW)	1-3.2 (65KW) 1-4.5 (110KW)	1.5-3.2 (65KW) 1.5-4.5 (110KW)	2-3.2 (65KW) 2-4.5 (110KW)
DC inverter compressor current	**A**	15-38	15-40	20-45	20-45

Outdoor unit in heating mode operating parameters

Outdoor ambient temperature	**℃**	< -10	-10 to 0	0 to 7	7 to 20	> 20
Average discharge temperature	**℃**	60-105	60-105	60-105	65-105	65-105
Average discharge superheat	**℃**	35-55	35-63	30-60	20-55	20-55
Discharge pressure	**MPa**	1.6-4.2	1.8-4.2	2.0-4.2	2.0-4.2	2.5-4.2
Average suction superheat	**℃**	-2-10	-5-15	-2-10	0-8	0-10
Suction pressure	**MPa**	0.2-0.5	0.25-0.65	0.3-0.9	0.6-1.2	0.7-1.4
Average suction temperature	**℃**	-25 to -5	-22 to 2	-12 to 7	0 to 15	5 to 25
T3	**℃**	-25 to -11	-22 to 0	-12 to 6	0 to 19	5 to 40
Tz/7	**℃**	20 to 65	20 to 65	20 to 65	20 to 65	20 to 65
Taf	**℃**	20-65	20-65	20-65	20-65	20-65
T6A/B	**℃**	-10-35	0-45	0-40	8-45	/
Twi	**℃**	20-60	20-60	20-60	20-60	20-60
Two	**℃**	25-65	25-65	25-65	25-65	25-65
Tw	**℃**	25-65	25-65	25-65	25-65	25-65
DC fan motor current	**A**	1-3.2 (65KW) 1-4.5 (110KW)	1-3.2 (65KW) 1-4.5 (110KW)	1-3.2 (65KW) 1-4.5 (110KW)	1-3.0 (65KW) 1-4.0 (110KW)	1-3.0 (65KW) 1-4.0 (110KW)
DC inverter compressor current	**A**	10-38	10-38	20-45	20-45	15-38

CONTENTS

Part 5

General Information

1 System introduction

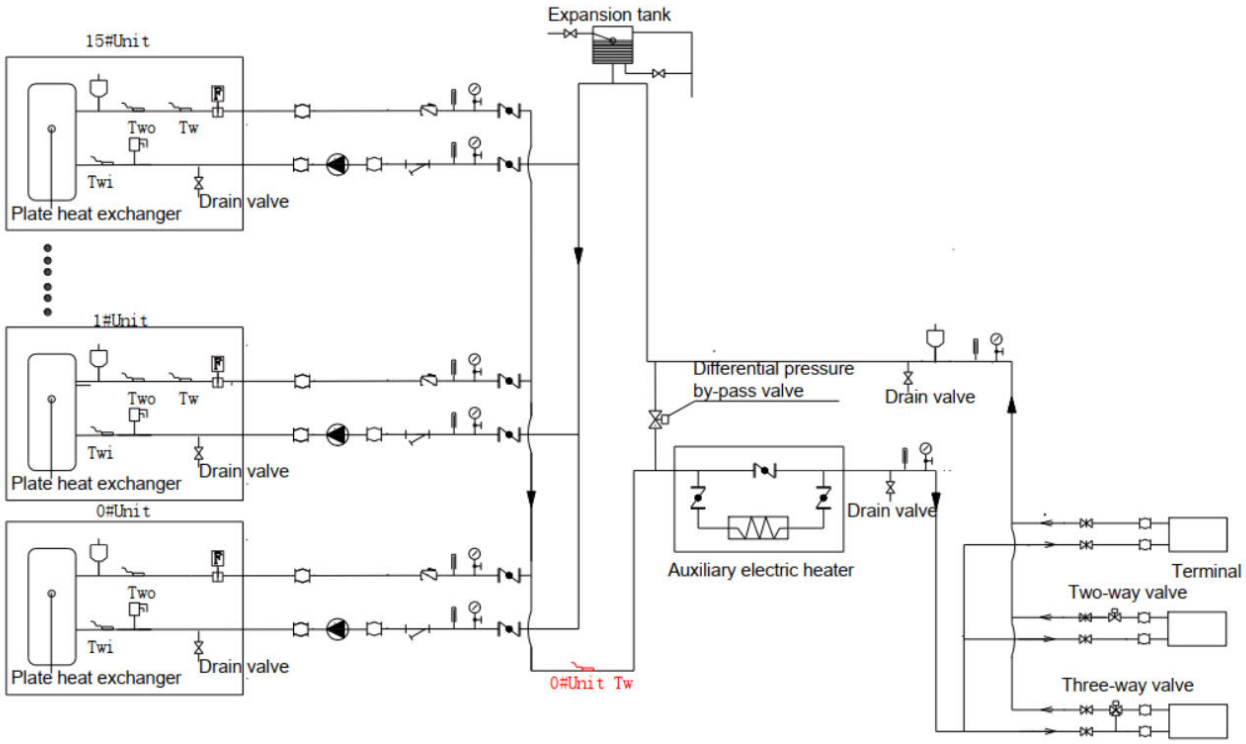
1.1 System Schematic

Commercial heat pump is an integrated air-to-water space heating and space cooling heat pump system. The outdoor heat pump system extracts heat from the outdoor air and transfers this heat through refrigerant piping to the plate heat exchanger in the hydronic system. The heated water in the hydronic system circulates to low temperature heat emitters (floor heating loops or low temperature radiators) to provide space heating. The 4-way valve in the outdoor unit can reverse the refrigerant cycle so that the hydronic system can provide chilled water for cooling using fan coil units.

The heating capacity of heat pumps decreases with the decrease of ambient temperature. Commercial heat pump is reserved an auxiliary electric heater control port to provide additional heating capacity for use during extremely cold weather when the heat pump capacity is insufficient. The auxiliary electric heater also serves as a backup in case of heat pump malfunction and for anti-freeze protection of the outside water piping in winter.

1.2 Typical Applications

1.2.1 Air Conditioning mode



Symbol explanation				
Drain vavle	Water pressure instrument	Water flow switch	Gate valve	Differential pressure by-pass valve
Y-filter	Thermometer	Pump	Check valve	Atmospheric exhaust valve
Expansion tank	Safety valve	Soft joint	Solenoid three-way valve	

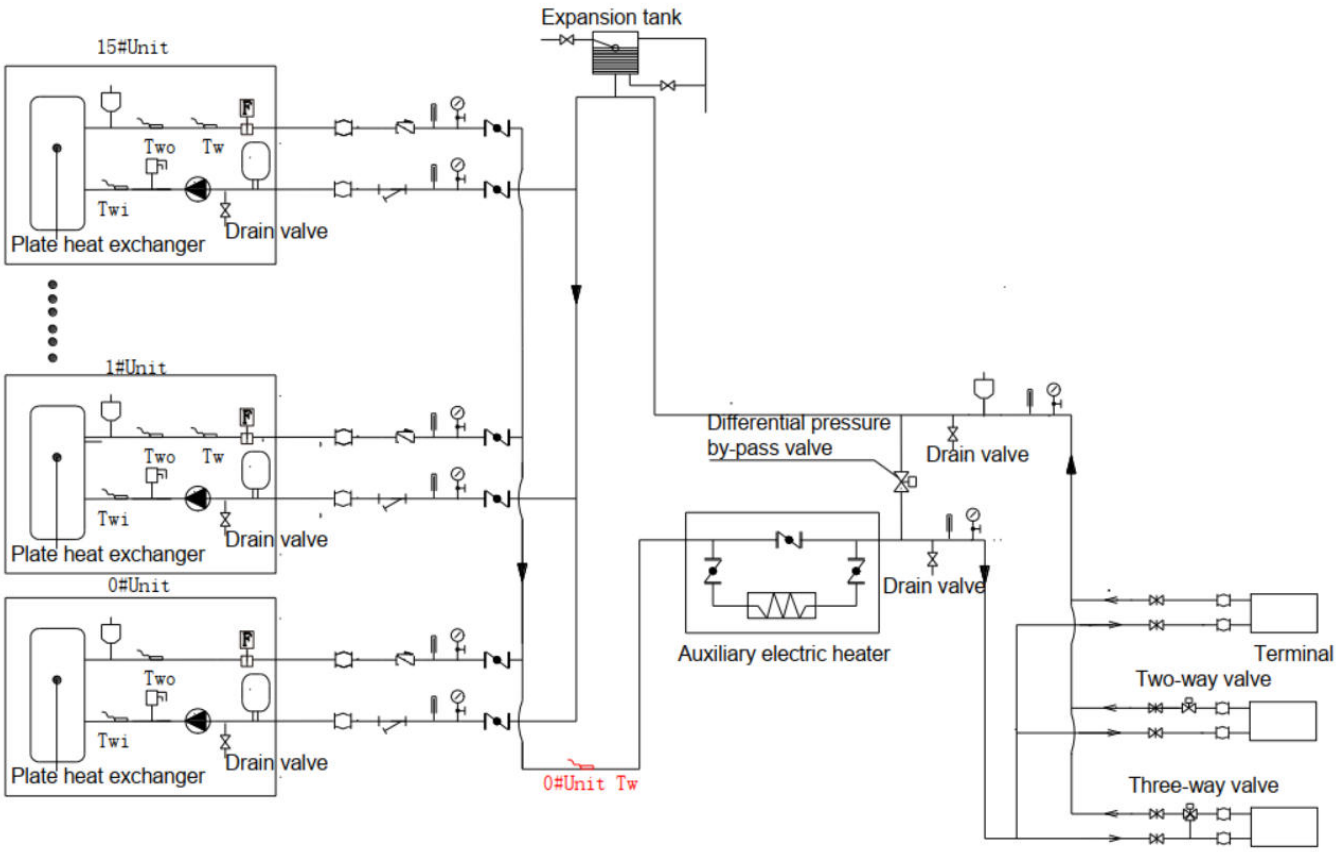
Note:

1. The ratio of the two - way valves on the terminal shall not exceed 50 percent.

2. The main outlet water temperature sensing (Tw) head of the unit at address 0 needs to be placed on the main outlet pipe.

3. The hot water tank and the hot water exchange pump of the unit use the CN125（220V）port control switch on the slave board of the 0 # unit, pump output is controlled through CN108（0-10V). (CN125 is a three-way valve control port for switching between hot water mode and air conditioning mode)

1.2.2 Air Conditioning mode (unit with variable frequency pump)



Symbol explanation				
Drain vavle	Water pressure instrument	Water flow switch	Gate valve	Differential pressure by-pass valve
Y-filter	Thermometer	Pump	Check valve	Atmospheric exhaust valve
Expansion tank	Safety valve	Soft joint	Solenoid three-way valve	

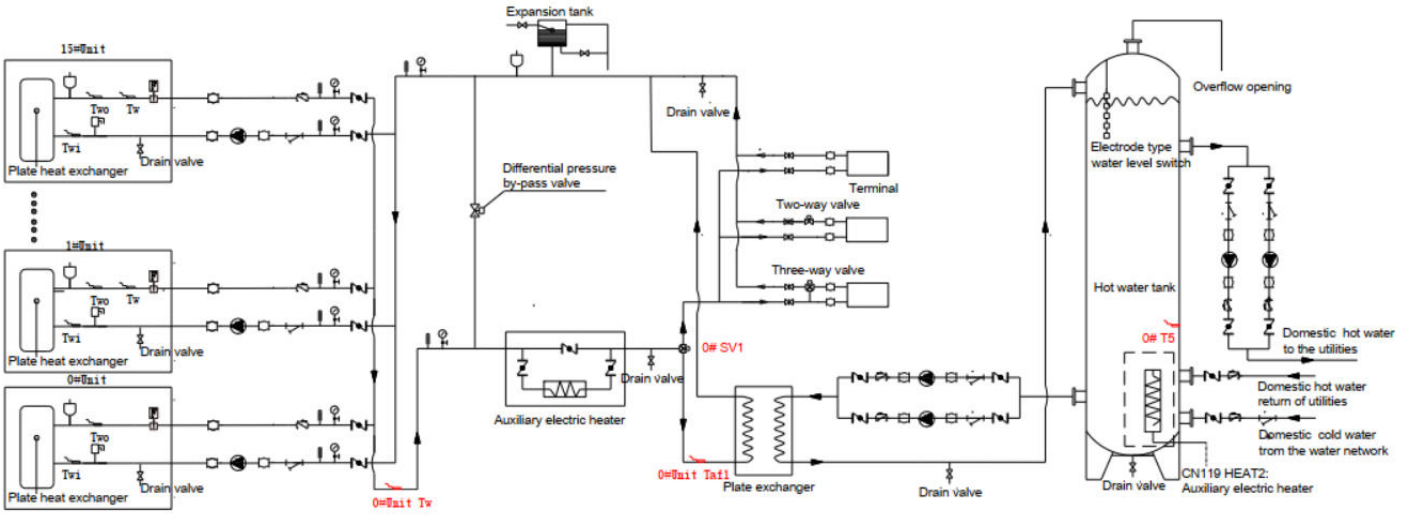
Note:

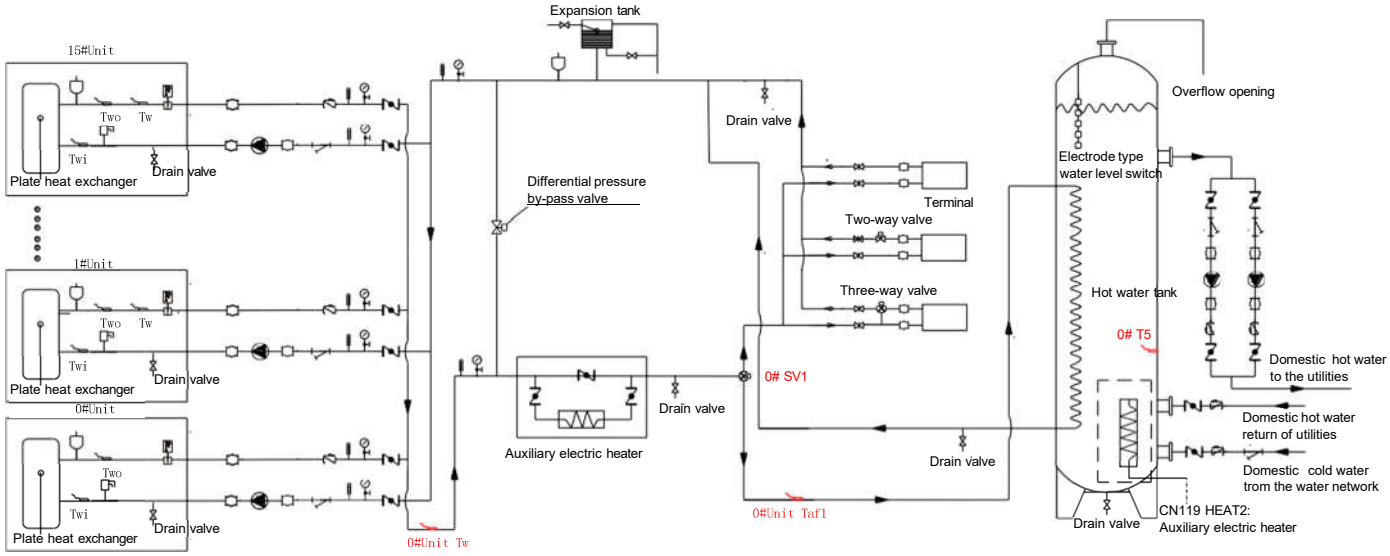
1. The ratio of the two - way valves on the terminal shall not exceed 50 percent.

2. The main outlet water temperature sensing (Tw) head of the unit at address 0 needs to be placed on the main outlet pipe.

3. The hot water tank and the hot water exchange pump of the unit use the CN125（220V） port control switch on the slave board of the 0 # unit, pump output is controlled through CN108（0-10V). (CN125 is a three-way valve control port for switching between hot water mode and air conditioning mode)

1.2.3 Air conditioning and hot water mode





Symbol explanation				
Drain vavle	Water pressure instrument	Water flow switch	Gate valve	Differential pressure by-pass valve
Y-filter	Thermometer	Pump	Check valve	Atmospheric exhaust valve
Expansion tank	Safety valve	Soft joint	Solenoid three-way valve	

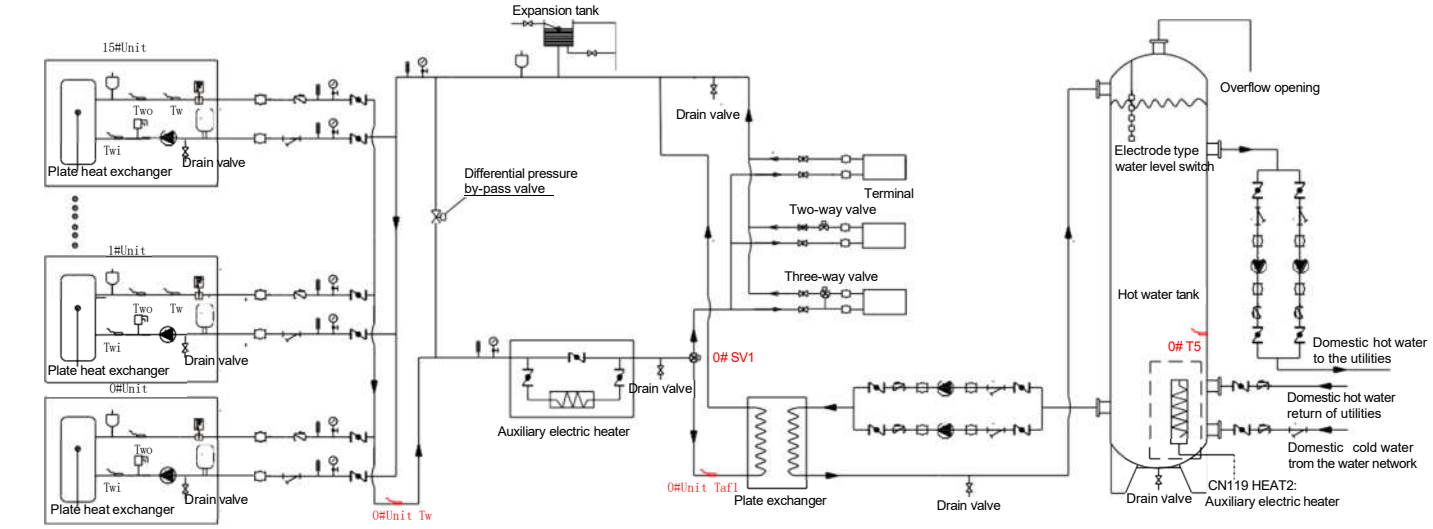
Note:

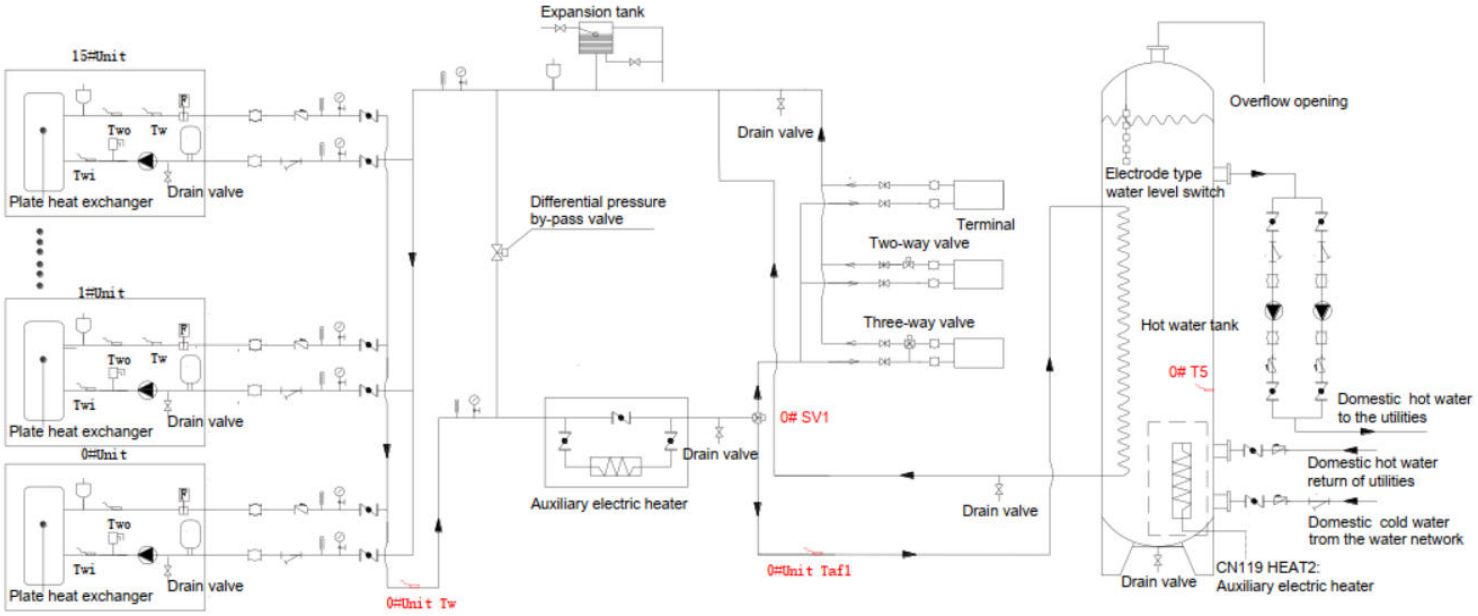
1. The ratio of the two - way valves on the terminal shall not exceed 50 percent.

2. The main outlet water temperature sensing (Tw) head of the unit at address 0 needs to be placed on the main outlet pipe.

3. The hot water tank and the hot water exchange pump of the unit use the CN125（220V） port control switch on the slave board of the 0 # unit, pump output is controlled through CN108（0-10V). (CN125 is a three-way valve control port for switching between hot water mode and air conditioning mode)

1.2.4 Air conditioning and hot water mode (unit with variable frequency pump)





Symbol explanation				
Drain vavle	Water pressure instrument	Water flow switch	Gate valve	Differential pressure by-pass valve
Y-filter	Thermometer	Pump	Check valve	Atmospheric exhaust valve
Expansion tank	Safety valve	Soft joint	Solenoid three-way valve	

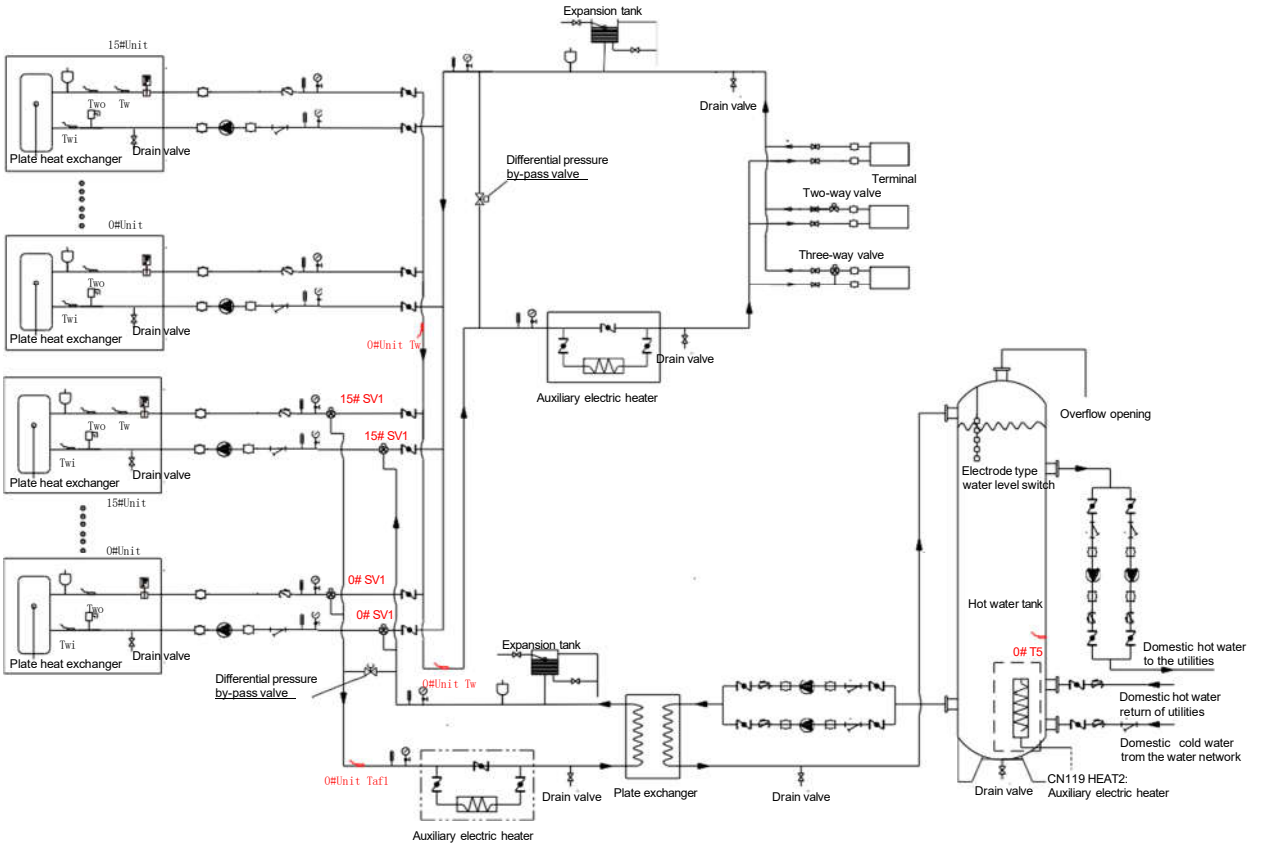
Note:

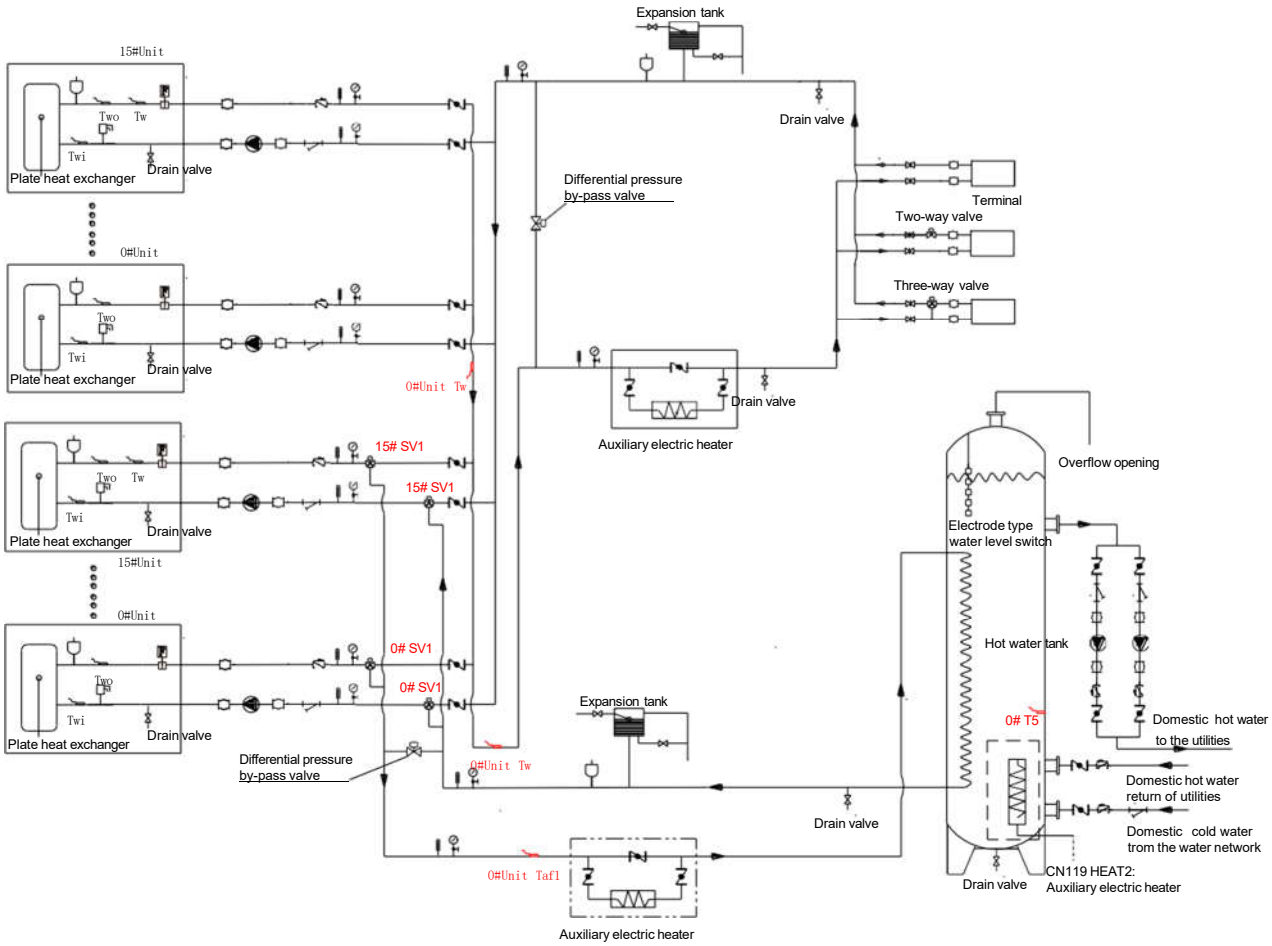
1. The ratio of the two - way valves on the terminal shall not exceed 50 percent.

2. The main outlet water temperature sensing (Tw) head of the unit at address 0 needs to be placed on the main outlet pipe.

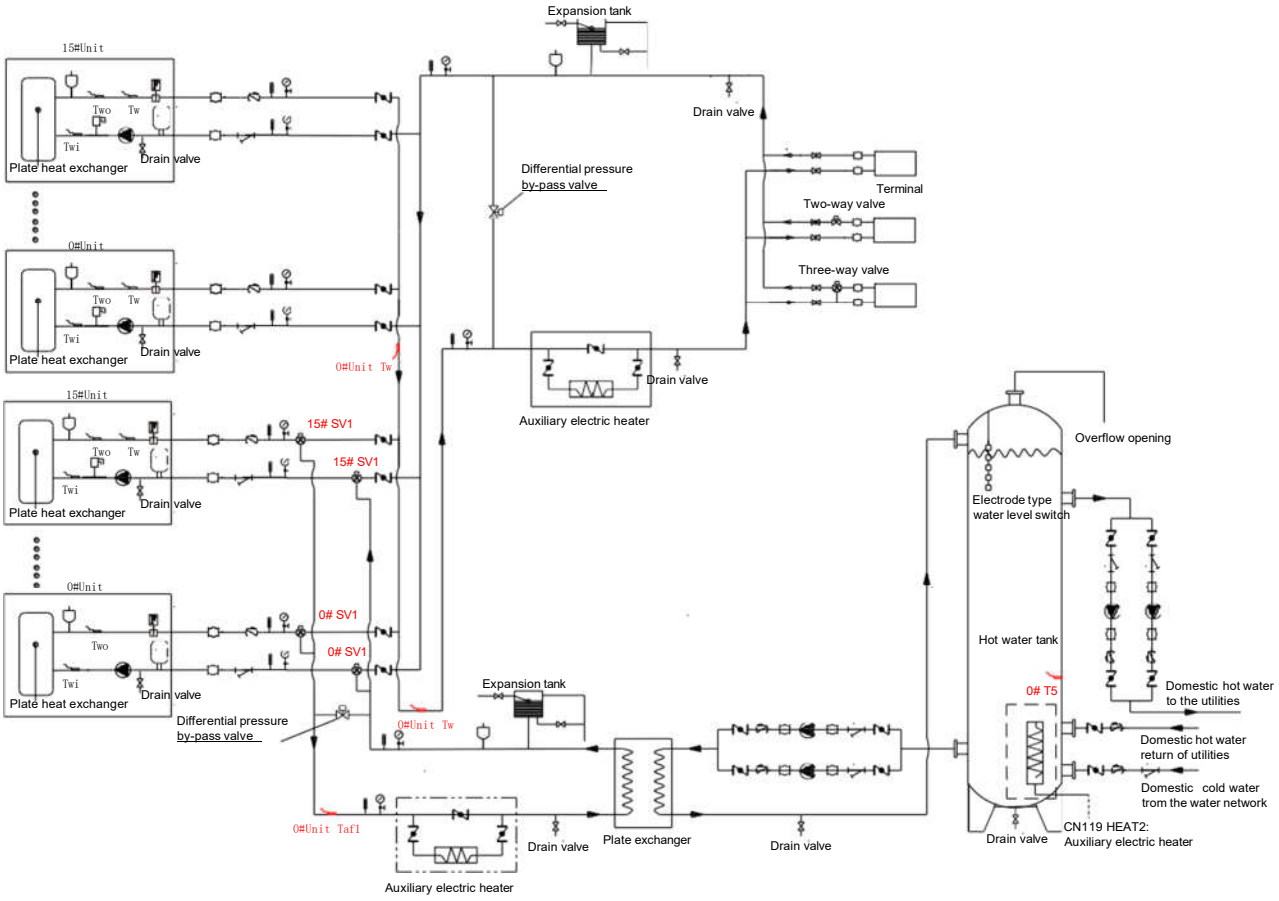
3. The hot water tank and the hot water exchange pump of the unit use the CN125（220V） port control switch on the slave board of the 0 # unit, pump output is controlled through CN108（0-10V). (CN125 is a three-way valve control port for switching between hot water mode and air conditioning mode)

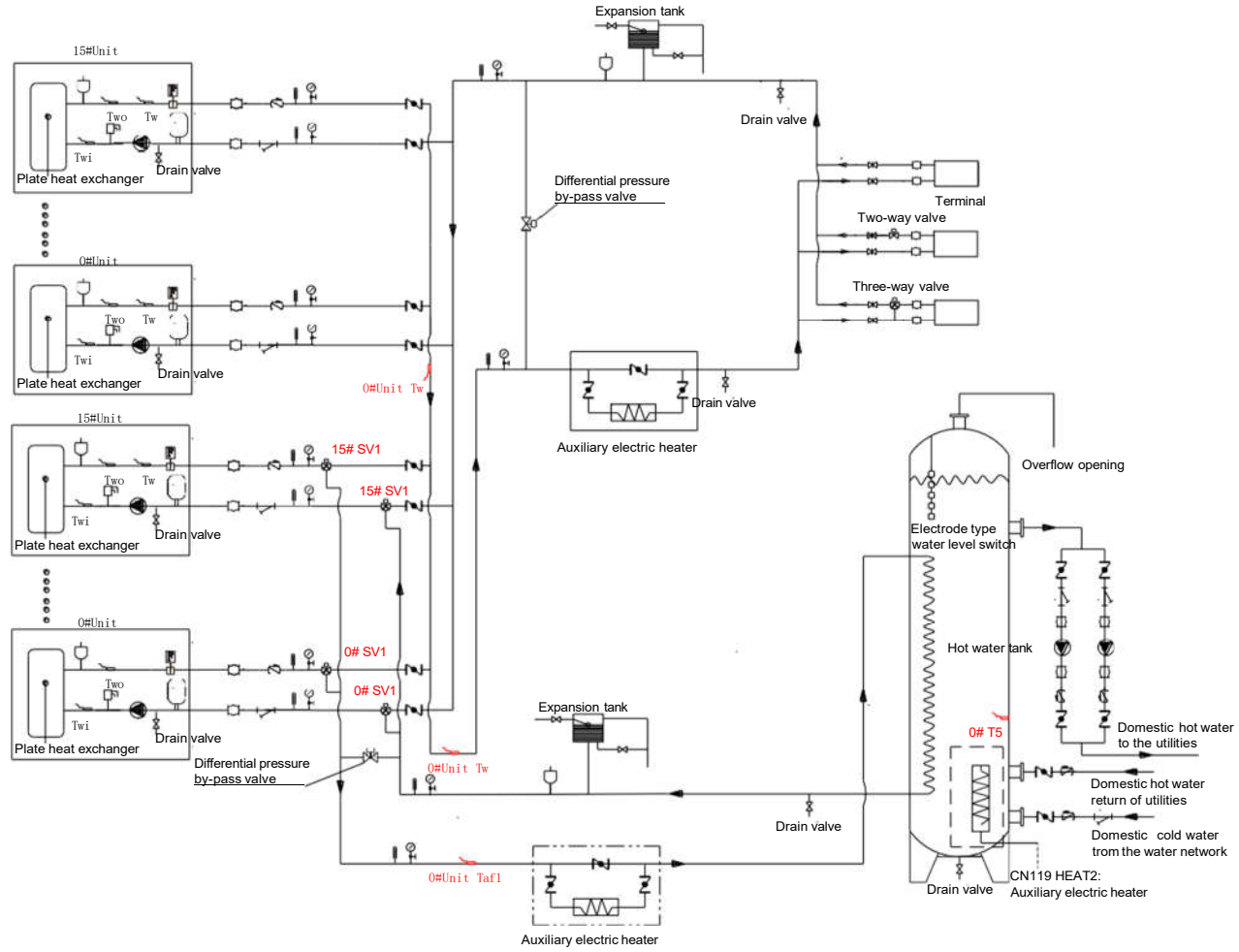
1.2.5 Cooling and hot water mode are operated simultaneously





1.2.6 Cooling and hot water mode are operated simultaneously (unit with variable frequency pump)





2 Product lineup

Model	SMHM-650B-3 SMHM-650BH-3 SMHM-750B-3 SMHM-750BH-3	SMHM-1100B-3 SMHM-1100BH-3 SMHM-1400B-3 SMHM-1400BH-3
Power supply	380-415V/3Ph/50Hz	380-415V/3Ph/50Hz
Appearance		

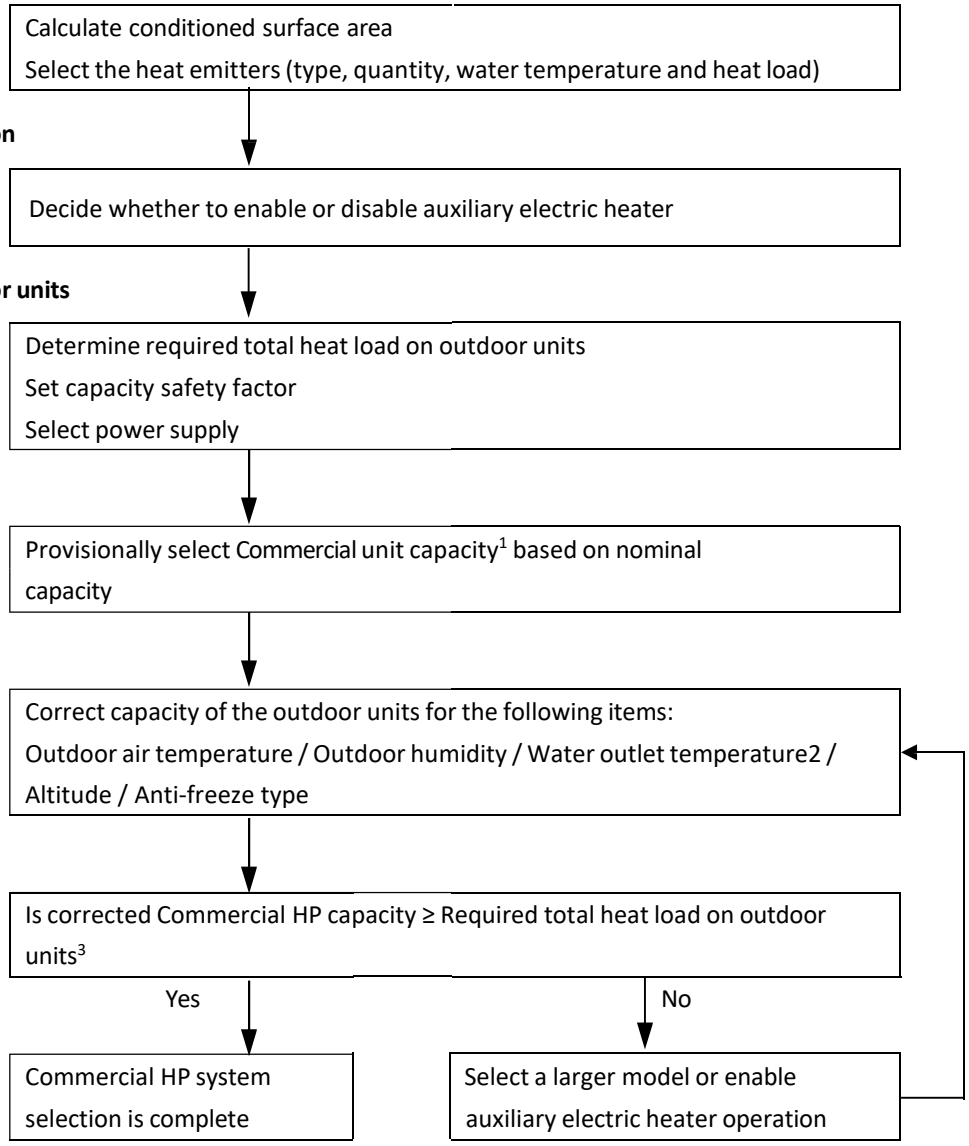
3 Nomenclature

S M H M - x x B H - 3

4 System Design and Unit Selection

4.1 Selection Procedure

Step 1: Total heat load calculation



Notes:

1. Up to 16 units can be connected together, giving a system cooling/heating capacity range from 65kW to 2240kW.
2. If the required water temperatures of the heat emitters are not all the same, the Commercial HP outlet water temperature setting should be set at the highest of the heat emitter required water temperatures. If the water outlet design temperature falls between two temperatures listed in the outdoor unit's capacity table, calculate the corrected capacity by interpolation.
3. Select commercial HP which satisfies both total heating and cooling load requirements.

4.2 Modular Chiller Leaving Water Temperature (LWT) Selection

The recommended design LTW ranges for different types of heat emitter are:

- For floor heating: 35 to 45°C
- For fan coil units: 40 to 45°C
- For low temperature radiators: 40 to 50°C

4.3 Optimizing System Design

To get the most comfort with the lowest energy consumption with Commercial heat pumps, it is important to take account of the following considerations:

- Choose heat emitters that allow the heat pump system to operate at as low a hot water temperature as possible whilst still providing sufficient heating.

4.4 Design of the buffer tank in the system

To prevent excessive temperature changes in the water system during the defrosting process of the unit, or frequent startup and shutdown during use, a buffer tank should be installed in the water system. The recommended calculation method for the volume of the buffer tank is as follows:

$$\mathrm{M} = \frac{k \times Q \times T}{C \times \Delta t \times \rho} - M1$$

- n: the equation,
- M: The volume of the buffer water tank, unit: L,
- k： Defrosting capacity coefficient, taken as 0.4 based on the test result,
- Q: Unit heating capacity, unit: kW,
- T: The maximum defrosting time, unit: S, taken as 240 based on the test result,
- C: Specific heat capacity of heat exchange liquid, unit: kJ/kg ℃,
- Δt: Allowable water temperature drop during defrosting process, unit: ℃, usually taken as 3,
- ρ： The density of the heat exchange liquid, in kg/L,
- M1: Pipeline volume, unit: L; need to consider the minimum amount of circulating water that can occur in the system.

The selection of k and T parameters is based on the test results of the unit. The refrigeration capacity of the unit during defrosting is 0.4. The time T is around 200S. To have margin, it is recommended to choose 240S. The Δt is recommended to choose 3℃ according to our company's standard.

For a single unit water system, it is recommended to add a buffer water tank in the waterway and select the type according to the above formula. For a water system with multiple units in parallel, the capacity selection of the buffer water tank can be based on a single unit.

Part 6

Engineering Data

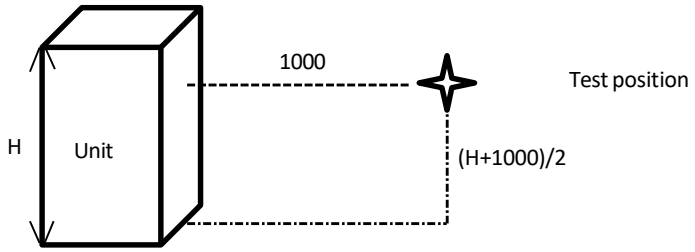
1 Specifications

Model			SMHM-650B-3	SMHM-750B-3	SMHM-1100B-3	SMHM-1400B-3
Power supply		V/Ph/Hz	380~415/3/50	380~415/3/50	380~415/3/50	380~415/3/50
Cooling(A35W7)	Capacity	kW	57	70	100	130
	Input	kW	19.00	26.80	32.78	50.00
	EER		3.00	2.61	3.05	2.60
Cooling(A35W18)	Capacity	kW	76	86	128	138
	Input	kW	20.27	23.12	33.70	36.32
	EER		3.75	3.72	3.80	3.80
SEER			5.00	5.00	4.80	4.80
Heating(A7W65)	Capacity	kW	60	61	100	110
	Input	kW	26.10	26.75	42.90	50.00
	COP		2.30	2.28	2.33	2.20
Heating(A7W55)	Capacity	kW	64	66	106	126
	Input	kW	21.33	22.15	35.30	49.22
	COP		3.00	2.98	3.00	2.56
Heating(A7W45)	Capacity	kW	65	75	110	140
	Input	kW	18.30	22.06	29.90	44.73
	COP		3.55	3.40	3.68	3.13
Heating(A7W35)	Capacity	kW	64	77	112	142
	Input	kW	15.24	19.74	27.00	38.17
	COP		4.20	3.90	4.15	3.72
SCOP(55)average			3.40	3.40	3.25	3.25
SCOP(35)average			4.50	4.50	4.25	4.25
Fan	Type		DC motor	DC motor	DC motor	DC motor
	Quantity		2	2	2	2
	Air flow rate	m^3/h	22000	28500	32500	50000
Air side heat exchanger	Type		Fin coil mode	Fin coil mode	Fin coil mode	Fin coil mode
	Row		2	2	2	2
	thickness	mm	0.095	0.095	0.095	0.095
	pipe diameter	mm	7	7	7	7
Water side heat exchanger	Type		Plate heat exchanger	Plate heat exchanger	Plate heat exchanger	Plate heat exchanger
	Water pressure drop	kPa	44	65	39	65
	Volume	L	5.17	5.17	11.1	11.1
	Rated water flow(cooling)	m^3/h	9.8	12.04	17.2	22.36
	Rated water flow(heating)	m^3/h	11.2	12.9	18.9	24.08
	Water flow range	m^3/h	3~14	3~14	5~26	5~26
Refrigerant system	Type		R32	R32	R32	R32
	Charge	kg	9	9	15.5	15.5

	Throttle type		EXV	EXV	EXV	EXV
Sound power level (A7W45)		dB(A)	80	86	80	92
Sound pressure level(1m) [1] (A7W45)		dB(A)	64	69	64	73
Silent mode sound power level(A7W45)		dB(A)	77	82	75	88
Super Silent mode sound power level(A7W45)		dB(A)	74	78	72	85
Net dimensions(W×H×D)		mm	2000X1770X960	2000X1770X960	2220×2300×1135	2220×2300×1135
Packed dimensions (W×H×D)		mm	2085X1890X1030	2085X1890X1030	2250×2445×1180	2250×2445×1180
Net / Gross weight		kg	440 / 455	440 / 455	670 / 690	670 / 690
Water pipe connection		mm	DN50	DN50	DN65	DN65
Ambient temperature range	Cooling	℃	-15 to 48	-15 to 48	-15 to 48	-15 to 48
	Heating	℃	-25 to 43	-25 to 43	-25 to 43	-25 to 43
	DHW	℃	-20 to 43	-20 to 43	-20 to 43	-20 to 43
Water outlet temperature range	Cooling[2]	℃	5 to 20	5 to 20	5 to 20	5 to 20
	Heating	℃	25 to 65	25 to 65	25 to 65	25 to 65
	DHW(Heat pump)	℃	30 to 62	30 to 62	30 to 62	30 to 62
	DHW[3]	℃	30 to 70	30 to 70	30 to 70	30 to 70

Notes:

1. Sound pressure level is the test average measured in a semi-anechoic chamber. The test position is 1m right in front of the unit for four sides and (1+H)/2m (where H is the height of the unit) above the floor. During in-situ operation, sound pressure levels may be higher as a result of ambient noise.



2. Antifreeze fluid is need when water temperature is less than 5℃.

3. Heat pump + Electric heater, Electric heater installed in the tank is field supplied.

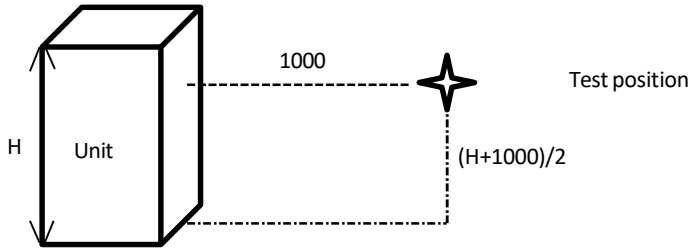
Model			SMHM-650BH-3	SMHM-750BH-3	SMHM-1100BH-3	SMHM-1400BH-3
Power supply		V/Ph/Hz	380~415/3/50	380~415/3/50	380~415/3/50	380~415/3/50
Cooling(A35W7)	Capacity	kW	56.68	69.29	99.33	129.29
	Input	kW	19.79	28.26	34.09	52.01
	EER		2.86	2.45	2.91	2.49
Cooling(A35W18)	Capacity	kW	75.30	85.07	127.26	137.06
	Input	kW	22.14	25.06	35.50	38.69
	EER		3.40	3.39	3.58	3.54
SEER			4.92	4.85	4.78	4.77
Heating(A7W65)	Capacity	kW	60.10	61.10	100.12	110.12
	Input	kW	26.24	26.89	43.27	50.37
	COP		2.29	2.27	2.31	2.19
Heating(A7W55)	Capacity	kW	64.15	66.15	106.32	126.37
	Input	kW	21.68	22.50	35.85	50.28
	COP		2.96	2.94	2.97	2.51
Heating(A7W45)	Capacity	kW	65.65	75.71	110.67	140.94
	Input	kW	19.43	23.51	31.21	47.10
	COP		3.38	3.22	3.55	2.99
Heating(A7W35)	Capacity	kW	64.65	77.70	113.14	142.94
	Input	kW	16.37	21.61	28.52	40.54
	COP		3.95	3.59	3.97	3.53
SCOP(55)average			3.36	3.36	3.23	3.23
SCOP(35)average			4.47	4.47	4.23	4.23
Fan	Type		DC motor	DC motor	DC motor	DC motor
	Quantity		2	2	2	2
	Air flow rate	m^3/h	22000	28500	32500	50000
Air side heat exchanger	Type		Fin coil mode	Fin coil mode	Fin coil mode	Fin coil mode
	Row		2	2	2	2
	thickness	mm	0.095	0.095	0.095	0.095
	pipe diameter	mm	7	7	7	7
Water side heat exchanger	Type		Plate heat exchanger	Plate heat exchanger	Plate heat exchanger	Plate heat exchanger
	head of delivery	m	23.0	17.3	18.0	11.7
	Volume	L	5.17	5.17	11.1	11.1
	Rated water flow(cooling)	m^3/h	9.8	12.04	17.2	22.36
	Rated water flow(heating)	m^3/h	11.2	12.9	18.9	24.08
	Water flow range	m^3/h	3~14	3~14	5~26	5~26
Refrigerant system	Type		R32	R32	R32	R32
	Charge	kg	9	9	15.5	15.5
	Throttle type		EXV	EXV	EXV	EXV
Water pump	Pump model		MHIE802-1/10/E/3-380-60-2		MHIE802-1/10/E/3-380-60-2	

					+ MHI802-1/10/E/3-380-50-2	
Expansion tank	Volume	L	12	12	22	22
	Precharge pressure	Mpa	0.15	0.15	0.15	0.15
	Test pressure	Mpa	1	1	1	1
Sound power level (A7W45)		dB(A)	80	86	80	92
Sound pressure level(1m) [1] (A7W45)		dB(A)	64	69	64	73
Silent mode sound power level(A7W45)		dB(A)	77	82	75	88
Super Silent mode sound power level(A7W45)		dB(A)	74	78	72	85
Net dimensions(W×H×D)		mm	2000X1770X960	2000X1770X960	2220×2300×1135	2220×2300×1135
Packed dimensions (W×H×D)		mm	2085X1890X1030	2085X1890X1030	2250×2445×1180	2250×2445×1180
Net / Gross weight		kg	475 / 490	475 / 490	746 / 767	746 / 767
Water pipe connection		mm	DN50	DN50	DN65	DN65
Ambient temperature range	Cooling	℃	-15 to 48	-15 to 48	-15 to 48	-15 to 48
	Heating	℃	-25 to 43	-25 to 43	-25 to 43	-25 to 43
	DHW	℃	-20 to 43	-20 to 43	-20 to 43	-20 to 43
Water outlet temperature range	Cooling[2]	℃	5 to 20	5 to 20	5 to 20	5 to 20
	Heating	℃	25 to 65	25 to 65	25 to 65	25 to 65
	DHW(Heat pump)	℃	30 to 62	30 to 62	30 to 62	30 to 62
	DHW[3]	℃	30 to 70	30 to 70	30 to 70	30 to 70

Water pump	Pump model		MHIE802-1/10/E/3-380-60-2	MHI802-1/10/E/3-380-50-2
	Power supply	V/Ph/Hz	380V ±10% 3P 50/60Hz	380V ±10% 3P 50Hz
	Rated power	KW	1.78	0.93
	Rated current	A	3.25	1.83
	Rated pump head	m	27.1	15.0
	Rated speed	r/min	3480	2825

Notes:

1. Sound pressure level is the test average measured in a semi-anechoic chamber. The test position is 1m right in front of the unit for four sides and (1+H)/2m (where H is the height of the unit) above the floor. During in-situ operation, sound pressure levels may be higher as a result of ambient noise.



2. Antifreeze fluid is need when water temperature is less than 5℃.

3. Heat pump + Electric heater, Electric heater installed in the tank is field supplied.

2 Electrical Characteristics

System	Outdoor unit				Power current		Compressor		Fan	
	Voltage	Hz	Min.	Max.	MCA	MOP	MSC	RLA	kW	FLA
	(V)		(V)	(V)	(A)	(A)	(A)	(A)		(A)
SMHM-650B-3 SMHM-650BH-3	380-415	50	342	456	46	54	-	34.09	0.39	1.4
SMHM-750B-3 SMHM-750BH-3	380-415	50	342	456	46	54	-	34.09	0.72	2.5
SMHM-1100B-3 SMHM-1100BH-3	380-415	50	342	456	90	106	-	34.09	0.68	1.7
SMHM-1400B-3 SMHM-1400BH-3	380-415	50	342	456	90	106	-	34.09	1.60	4.0

Note：

MCA: Min. Circuit Amps. (For wire diameter selection)

MOP: Maximum overcurrent protector

MSC : Max. Starting Amps.

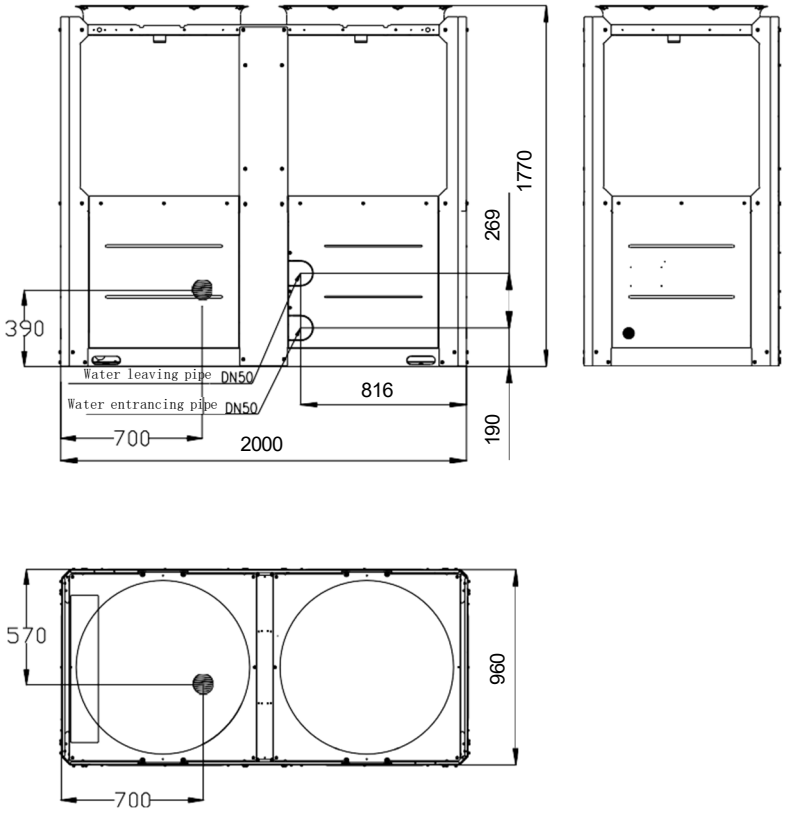
FLA: Full Load Amps.

KW: Rated Motor Output

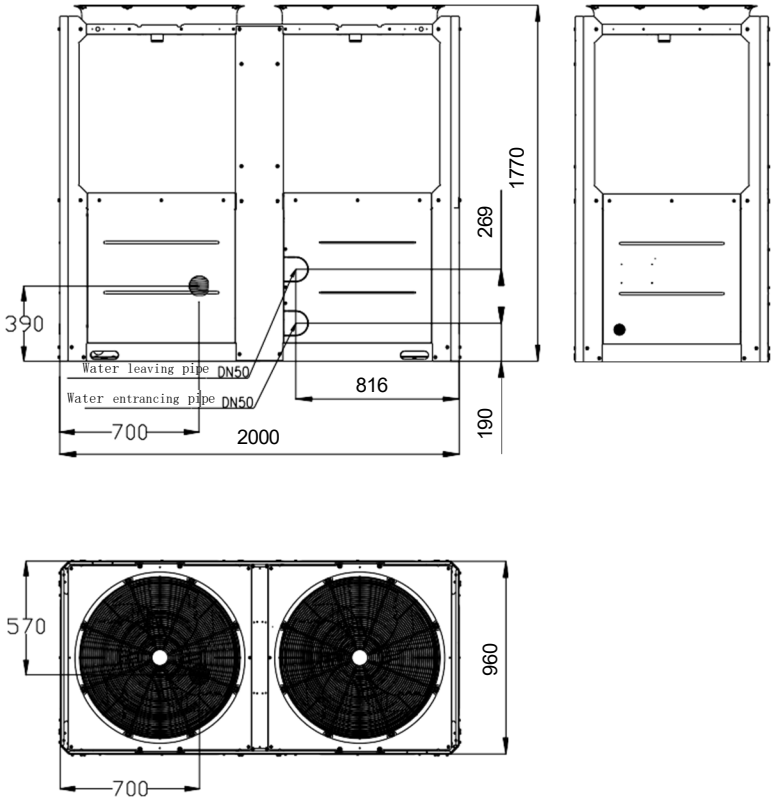
RLA: In nominal cooling or heating test condition, the input Amps of compressor where MAX. Hz can operate Rated Load Amps.

3 Dimensions and Center of Gravity

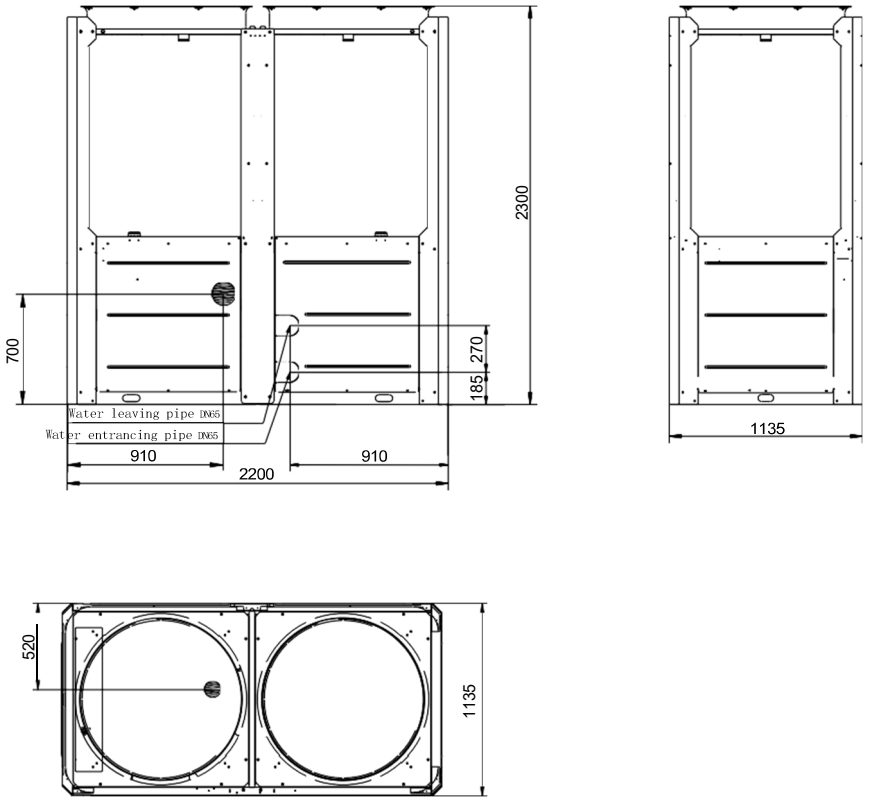
SMHM-650B-3 / SMHM-750B-3



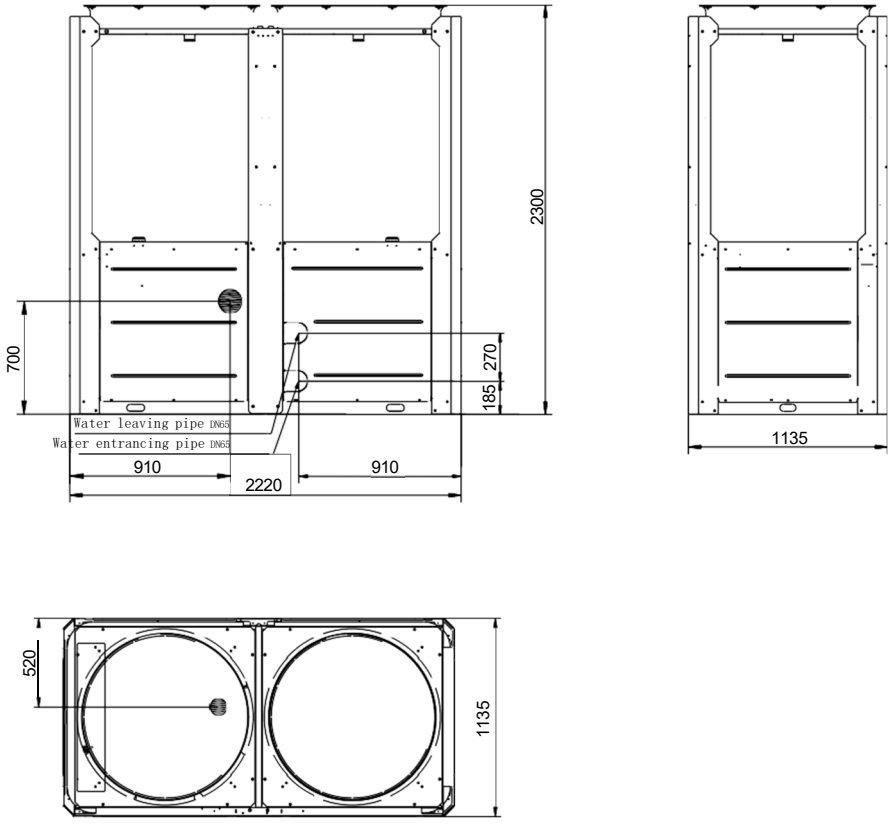
SMHM-650BH-3 / SMHM-750BH-3



SMHM-1100B-3 / SMHM-1400B-3



SMHM-1100BH-3 / SMHM-1400BH-3



4 Capacity Tables

(Test standard： EN14511)

Heating Capacity Tables

SMHM-650B-3

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	34.40	16.05	2.14	40.00	15.68	2.55	43.38	15.02	2.89	46.15	14.89	3.10	49.10	15.72	3.12	55.17	16.98	3.25
30	32.03	17.02	1.88	37.25	16.62	2.24	42.08	15.36	2.74	44.77	15.10	2.97	47.62	15.82	3.01	53.19	17.07	3.12
35	32.47	18.98	1.71	37.76	18.53	2.04	40.15	16.59	2.42	42.71	16.36	2.61	45.44	17.19	2.64	50.78	18.46	2.75
40	30.11	19.55	1.54	35.01	19.10	1.83	40.21	20.40	1.97	42.78	19.93	2.15	45.51	20.75	2.19	51.44	21.35	2.41
45	\	\	\	35.10	22.68	1.55	39.34	22.70	1.73	41.85	21.94	1.91	44.53	22.64	1.97	51.15	24.05	2.13
48	\	\	\	33.71	27.27	1.24	38.49	27.80	1.38	40.95	25.10	1.63	43.56	24.40	1.79	50.52	25.47	1.98
50	\	\	\	\	\	\	36.20	26.35	1.37	38.51	23.79	1.62	40.97	24.00	1.71	48.47	26.05	1.86
55	\	\	\	\	\	\	\	\	\	37.36	24.14	1.55	39.74	24.17	1.64	47.64	26.58	1.79
60	\	\	\	\	\	\	\	\	\	\	\	\	38.47	25.86	1.49	45.67	28.15	1.62
65	\	\	\	\	\	\	\	\	\	\	\	\	36.30	27.44	1.32	43.78	30.36	1.44

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	61.23	17.56	3.49	64.88	17.59	3.69	68.96	16.00	4.31	72.27	15.92	4.54	84.00	17.32	4.85	86.77	17.44	4.98
30	58.76	17.99	3.27	62.23	17.67	3.52	66.51	15.65	4.25	71.02	16.42	4.33	79.24	16.82	4.71	83.50	17.30	4.83
35	56.13	18.31	3.06	59.56	17.69	3.37	64.00	15.24	4.20	66.41	15.52	4.28	76.43	16.75	4.56	80.79	17.24	4.69
40	57.37	20.57	2.79	61.17	19.27	3.18	64.83	18.03	3.60	67.21	17.53	3.83	74.30	17.55	4.23	75.58	16.80	4.50
45	57.77	22.75	2.54	61.75	20.56	3.00	65.00	18.31	3.55	65.85	17.93	3.67	68.53	17.26	3.97	73.73	17.64	4.18
48	57.47	24.40	2.36	61.63	20.96	2.94	64.83	20.10	3.23	65.82	18.38	3.58	68.49	17.69	3.87	73.69	18.08	4.08
50	55.98	25.62	2.18	61.19	21.32	2.87	64.51	20.50	3.15	65.30	18.63	3.51	67.96	17.93	3.79	73.12	18.32	3.99
55	55.53	26.39	2.10	60.70	21.96	2.76	64.00	21.30	3.00	63.95	20.79	3.08	66.55	20.01	3.33	71.60	20.45	3.50
60	52.87	27.76	1.90	58.67	23.45	2.50	61.95	22.82	2.72	59.45	21.61	2.75	61.86	21.19	2.92	59.82	19.65	3.04
65	51.26	30.28	1.69	56.82	25.55	2.22	60.00	25.00	2.40	54.95	22.71	2.42	57.18	22.75	2.51	43.47	16.79	2.59

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	91.83	17.48	5.25	97.83	16.73	5.85	98.70	14.96	6.60	99.77	14.44	6.91	98.63	13.48	7.32
30	90.57	17.67	5.13	99.39	17.75	5.60	102.3	16.01	6.39	106.1	16.33	6.50	101.1	14.99	6.74
35	88.67	17.47	5.07	98.30	18.32	5.37	104.6	17.66	5.94	108.7	18.05	6.02	102.4	16.05	6.38
40	83.15	17.17	4.84	90.99	18.46	4.93	97.13	17.30	5.61	101.6	17.84	5.69	95.17	15.85	6.00
45	80.83	18.02	4.49	82.17	17.46	4.71	88.73	16.66	5.33	90.75	16.84	5.39	85.65	15.16	5.65
48	80.78	18.48	4.37	82.12	17.90	4.59	88.69	17.08	5.19	90.70	17.27	5.25	85.61	15.54	5.51
50	80.15	18.72	4.28	81.48	18.14	4.49	87.99	17.31	5.08	89.99	17.50	5.14	84.94	15.75	5.39
55	78.49	20.90	3.76	79.79	20.25	3.94	86.17	19.32	4.46	88.13	19.53	4.51	83.18	17.58	4.73
60	65.27	20.42	3.20	62.50	19.26	3.25	67.49	18.17	3.72	69.03	18.37	3.76	65.15	16.53	3.94
65	47.65	17.16	2.78	48.44	16.63	2.91	52.31	15.51	3.37	35.89	10.05	3.57	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	34.54	16.15	2.14	40.35	15.83	2.55	43.73	15.17	2.88	46.60	15.12	3.08	49.55	15.96	3.11	55.72	17.30	3.22
30	32.17	17.12	1.88	37.60	16.77	2.24	42.43	15.51	2.74	45.22	15.33	2.95	48.07	16.06	2.99	53.74	17.39	3.09
35	32.61	19.08	1.71	38.11	18.68	2.04	40.50	16.74	2.42	43.06	16.51	2.61	45.89	17.43	2.63	51.23	18.69	2.74
40	30.25	19.65	1.54	35.15	19.20	1.83	40.56	20.55	1.97	43.13	20.08	2.15	45.96	20.99	2.19	51.89	21.59	2.40
45	\	\	\	35.55	22.91	1.55	39.89	23.02	1.73	42.62	22.23	1.92	45.47	23.11	1.97	52.44	24.73	2.12
48	\	\	\	33.85	27.37	1.24	38.84	27.95	1.39	41.30	25.25	1.64	43.91	24.55	1.79	50.97	25.70	1.98
50	\	\	\	\	\	\	36.34	26.45	1.37	38.86	23.94	1.62	41.32	24.15	1.71	48.92	26.28	1.86
55	\	\	\	\	\	\	\	\	\	37.48	24.18	1.55	39.86	24.21	1.65	47.78	26.65	1.79
60	\	\	\	\	\	\	\	\	\	\	\	\	38.59	25.90	1.49	45.81	28.22	1.62
65	\	\	\	\	\	\	\	\	\	\	\	\	36.42	27.48	1.33	43.90	30.40	1.44

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	62.00	17.85	3.47	65.82	18.06	3.64	70.08	16.65	4.21	73.56	16.60	4.43	85.87	18.02	4.76	88.64	18.14	4.89
30	59.42	18.29	3.25	63.00	17.96	3.51	67.46	16.12	4.18	72.31	17.10	4.23	80.90	17.53	4.61	85.37	18.00	4.74
35	56.79	18.62	3.05	60.22	18.00	3.35	64.65	16.37	3.95	67.36	15.99	4.21	77.89	17.46	4.46	82.45	17.94	4.60
40	58.03	20.88	2.78	61.94	19.56	3.17	65.78	18.50	3.56	68.16	18.00	3.79	75.59	18.23	4.15	77.03	17.52	4.40
45	59.43	23.46	2.53	63.62	21.26	2.99	65.65	19.42	3.38	67.79	18.85	3.60	70.47	18.18	3.88	75.67	18.56	4.08
48	58.13	24.71	2.35	62.40	21.25	2.94	65.77	20.57	3.20	66.76	18.85	3.54	69.62	18.34	3.80	74.98	18.76	4.00
50	56.53	25.94	2.18	61.96	21.61	2.87	65.46	20.97	3.12	66.25	19.10	3.47	69.08	18.58	3.72	74.41	19.00	3.92
55	55.67	26.49	2.10	60.84	22.06	2.76	64.15	21.67	2.96	64.30	20.94	3.07	66.90	20.16	3.32	71.95	20.60	3.49
60	53.01	27.86	1.90	58.81	23.55	2.50	62.09	22.92	2.71	59.59	21.71	2.74	62.00	21.29	2.91	59.96	19.75	3.04
65	51.40	30.35	1.69	56.96	25.62	2.22	60.10	26.24	2.29	55.09	22.78	2.42	57.32	22.82	2.51	43.59	16.83	2.59

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	93.77	18.40	5.10	99.77	17.65	5.65	100.6	15.88	6.34	101.7	15.36	6.62	100.6	14.40	6.98
30	92.44	18.37	5.03	101.3	18.67	5.43	104.3	16.93	6.16	108.1	17.25	6.26	103.0	15.91	6.47
35	90.54	18.17	4.98	100.2	19.24	5.21	106.8	18.58	5.75	110.6	18.97	5.83	104.3	16.97	6.15
40	85.02	17.87	4.76	92.93	19.38	4.80	99.07	18.22	5.44	103.5	18.76	5.52	97.11	16.77	5.79
45	82.77	18.94	4.37	84.11	18.38	4.58	90.67	17.58	5.16	92.69	17.76	5.22	87.59	16.08	5.45
48	82.45	19.18	4.30	83.99	18.60	4.51	90.56	17.78	5.09	92.64	18.19	5.09	87.48	16.24	5.39
50	81.81	19.43	4.21	83.14	18.85	4.41	89.86	18.01	4.99	91.86	18.20	5.05	86.81	16.45	5.28
55	78.94	21.13	3.74	80.24	20.49	3.92	86.62	19.55	4.43	88.58	19.77	4.48	83.63	17.81	4.70
60	65.62	20.57	3.19	62.85	19.41	3.24	67.84	18.32	3.70	69.38	18.52	3.75	65.50	16.68	3.93
65	47.77	17.20	2.78	48.56	16.67	2.91	52.45	15.58	3.37	36.01	10.09	3.57	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

SMHM-750B-3

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	39.56	20.16	1.96	46.22	19.75	2.34	50.13	18.58	2.70	53.33	19.44	2.74	56.74	20.35	2.79	63.75	21.68	2.94
30	37.52	21.77	1.72	43.84	21.33	2.06	49.53	19.34	2.56	52.69	20.08	2.62	56.06	20.86	2.69	62.61	22.20	2.82
35	36.57	23.34	1.57	42.73	22.86	1.87	45.43	20.09	2.26	48.33	20.92	2.31	51.42	21.79	2.36	57.46	23.08	2.49
40	33.74	23.87	1.41	39.21	23.32	1.68	45.04	24.45	1.84	47.92	25.22	1.90	50.98	26.04	1.96	57.62	26.43	2.18
45	\	\	\	38.73	27.27	1.42	42.27	26.09	1.62	46.84	27.75	1.69	49.83	28.38	1.76	57.25	29.74	1.93
48	\	\	\	36.28	29.98	1.21	39.60	29.33	1.35	43.88	28.32	1.55	46.68	28.96	1.61	53.63	30.35	1.77
50	\	\	\	\	\	\	38.66	29.29	1.32	42.85	28.19	1.52	45.58	28.83	1.58	52.36	30.21	1.73
55	\	\	\	\	\	\	\	\	\	41.22	27.86	1.48	43.85	28.49	1.54	50.38	29.86	1.69
60	\	\	\	\	\	\	\	\	\	\	\	\	42.03	30.70	1.37	48.28	32.17	1.50
65	\	\	\	\	\	\	\	\	\	\	\	\	40.53	34.42	1.18	46.56	36.07	1.29

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	70.76	22.54	3.14	74.97	22.72	3.30	83.52	20.12	4.15	83.65	20.82	4.02	96.89	23.18	4.18	100.3	22.78	4.40
30	69.17	23.53	2.94	73.25	23.25	3.15	80.71	20.03	4.03	82.20	21.48	3.83	91.39	22.51	4.06	96.53	22.60	4.27
35	63.51	23.02	2.76	67.39	22.38	3.01	77.00	19.74	3.90	76.86	20.98	3.66	88.16	22.41	3.93	93.40	22.52	4.15
40	64.26	25.60	2.51	68.52	24.13	2.84	75.60	20.54	3.68	77.79	22.93	3.39	85.70	23.48	3.65	87.38	21.95	3.98
45	64.66	28.29	2.29	69.12	25.73	2.69	75.00	22.06	3.40	76.22	23.45	3.25	79.04	23.09	3.42	85.24	23.04	3.70
48	60.57	28.87	2.10	64.75	26.25	2.47	70.26	22.51	3.12	71.40	23.93	2.98	74.04	23.56	3.14	79.85	23.51	3.40
50	59.14	28.74	2.06	63.22	26.14	2.42	68.60	22.41	3.06	69.71	23.83	2.93	72.29	23.46	3.08	77.97	23.41	3.33
55	56.90	28.40	2.00	60.82	25.83	2.35	66.00	22.15	2.98	67.07	23.55	2.85	69.56	23.18	3.00	75.01	23.13	3.24
60	54.53	30.60	1.78	58.29	27.83	2.09	63.25	23.86	2.65	64.28	25.37	2.53	66.66	24.98	2.67	64.70	22.43	2.88
65	52.59	34.31	1.53	56.22	31.20	1.80	61.00	26.75	2.28	55.79	25.60	2.18	57.86	25.21	2.30	47.14	19.00	2.48

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	106.2	22.83	4.65	113.6	21.65	5.25	114.4	19.41	5.89	115.9	18.61	6.23	114.3	17.65	6.32
30	104.7	23.08	4.54	115.4	22.97	5.03	118.6	20.78	5.70	123.3	21.06	5.85	117.1	19.63	5.97
35	102.5	22.83	4.49	114.2	23.70	4.82	121.5	22.91	5.30	126.2	23.27	5.42	118.6	21.01	5.65
40	96.13	22.43	4.29	105.7	23.88	4.43	112.5	22.45	5.01	117.9	23.00	5.13	110.3	20.76	5.31
45	93.44	23.54	3.97	95.43	22.59	4.22	102.8	21.62	4.76	105.4	21.71	4.85	99.25	19.84	5.00
48	87.53	24.02	3.64	89.40	23.06	3.88	96.32	22.06	4.37	98.74	22.16	4.46	92.98	20.25	4.59
50	85.47	23.92	3.57	87.28	22.95	3.80	94.04	21.96	4.28	96.40	22.06	4.37	90.78	20.16	4.50
55	82.23	23.64	3.48	83.98	22.69	3.70	90.48	21.71	4.17	92.75	21.80	4.25	87.34	19.92	4.38
60	70.93	22.92	3.09	63.58	19.31	3.29	68.51	18.47	3.71	70.23	18.56	3.78	66.13	16.96	3.90
65	51.68	19.42	2.66	52.78	18.63	2.83	56.87	17.83	3.19	38.58	11.85	3.26	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	39.91	20.31	1.97	46.67	19.99	2.34	50.58	18.81	2.69	53.88	19.76	2.73	57.40	20.65	2.78	64.52	21.97	2.94
30	37.87	21.92	1.73	44.19	21.48	2.06	49.98	19.58	2.55	53.24	20.40	2.61	56.61	21.18	2.67	63.38	22.49	2.82
35	36.71	23.44	1.57	43.08	23.01	1.87	45.88	20.32	2.26	48.78	21.15	2.31	51.87	22.02	2.36	58.12	23.38	2.49
40	33.88	23.97	1.41	39.56	23.47	1.69	45.49	24.69	1.84	48.37	25.45	1.90	51.43	26.27	1.96	58.28	26.73	2.18
45	\	\	\	39.18	27.51	1.42	42.82	26.41	1.62	47.61	28.04	1.70	50.78	28.85	1.76	58.54	30.42	1.92
48	\	\	\	36.42	30.08	1.21	39.95	29.48	1.36	44.23	28.47	1.55	47.13	29.20	1.61	54.18	30.67	1.77
50	\	\	\	\	\	\	39.01	29.44	1.33	43.20	28.34	1.52	46.03	29.07	1.58	52.91	30.53	1.73
55	\	\	\	\	\	\	\	\	\	41.34	27.90	1.48	43.99	28.56	1.54	50.52	29.96	1.69
60	\	\	\	\	\	\	\	\	\	\	\	\	42.15	30.74	1.37	48.42	32.24	1.50
65	\	\	\	\	\	\	\	\	\	\	\	\	40.65	34.46	1.18	46.68	36.11	1.29

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	72.05	23.23	3.10	76.43	23.44	3.26	85.39	20.82	4.10	85.52	21.52	3.97	98.83	24.10	4.10	102.3	23.70	4.31
30	70.29	24.18	2.91	74.54	23.94	3.11	82.38	20.74	3.97	84.07	22.18	3.79	93.33	23.43	3.98	98.47	23.52	4.19
35	64.28	23.31	2.76	68.34	22.85	2.99	78.46	20.46	3.84	78.32	21.70	3.61	90.03	23.11	3.90	95.34	23.44	4.07
40	65.21	26.07	2.50	69.64	24.78	2.81	77.06	21.26	3.62	79.24	23.65	3.35	87.57	24.18	3.62	89.25	22.65	3.94
45	66.32	28.99	2.29	70.99	26.43	2.69	76.94	22.98	3.35	78.16	24.37	3.21	80.98	24.01	3.37	87.18	23.96	3.64
48	61.34	29.16	2.10	65.69	26.72	2.46	71.38	23.16	3.08	72.69	24.61	2.95	75.33	24.25	3.11	81.51	24.22	3.37
50	59.80	29.04	2.06	63.99	26.43	2.42	69.72	23.06	3.02	70.84	24.48	2.89	73.58	24.14	3.05	79.42	24.12	3.29
55	57.04	28.50	2.00	60.96	25.93	2.35	66.35	22.30	2.98	67.42	23.70	2.85	69.91	23.33	3.00	75.46	23.37	3.23
60	54.67	30.70	1.78	58.43	27.93	2.09	63.60	24.01	2.65	64.63	25.52	2.53	67.01	25.13	2.67	65.05	22.58	2.88
65	52.73	34.38	1.53	56.36	31.27	1.80	61.14	26.85	2.28	55.93	25.67	2.18	58.00	25.28	2.29	47.26	19.04	2.48

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	108.1	23.75	4.55	115.6	22.57	5.12	116.3	20.33	5.72	117.8	19.53	6.03	116.2	18.57	6.26
30	106.6	24.00	4.44	117.4	23.89	4.91	120.5	21.70	5.55	125.2	21.98	5.70	119.0	20.55	5.79
35	104.5	23.75	4.40	116.1	24.62	4.72	123.4	23.83	5.18	128.2	24.19	5.30	120.6	21.93	5.50
40	98.07	23.35	4.20	107.6	24.80	4.34	114.5	23.37	4.90	119.9	23.92	5.01	112.2	21.68	5.18
45	95.38	24.46	3.90	97.37	23.51	4.14	104.8	22.54	4.65	107.3	22.63	4.74	101.2	20.76	4.87
48	89.40	24.72	3.62	91.27	23.76	3.84	98.26	22.98	4.28	100.7	23.08	4.36	94.92	21.17	4.48
50	87.34	24.62	3.55	89.15	23.65	3.77	95.98	22.88	4.19	98.34	22.98	4.28	92.72	21.08	4.40
55	82.68	23.87	3.46	84.43	22.92	3.68	91.03	22.03	4.13	93.30	22.12	4.22	87.79	20.16	4.35
60	71.28	23.07	3.09	63.93	19.46	3.29	68.86	18.62	3.70	70.58	18.71	3.77	66.48	17.11	3.89
65	51.82	19.49	2.66	52.92	18.70	2.83	57.01	17.90	3.18	38.70	11.89	3.25	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

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LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	64.57	28.55	2.26	75.08	27.89	2.69	82.07	27.51	2.98	87.56	28.72	3.05	91.93	28.07	3.27	104.0	31.15	3.34
30	59.04	27.15	2.18	68.65	26.51	2.59	78.05	26.98	2.89	82.39	28.78	2.86	88.07	28.64	3.08	98.71	31.26	3.16
35	59.70	28.93	2.06	69.42	28.25	2.46	74.53	27.01	2.76	78.76	28.45	2.77	83.55	28.10	2.97	94.05	31.07	3.03
40	52.49	30.03	1.75	61.03	29.33	2.08	69.56	28.59	2.43	74.43	28.71	2.59	78.49	28.18	2.79	89.11	31.02	2.87
45	\	\	\	50.54	32.82	1.54	67.03	34.63	1.94	71.31	32.28	2.21	75.37	31.76	2.37	87.00	35.83	2.43
48	\	\	\	40.52	28.34	1.43	64.57	34.72	1.86	69.05	32.52	2.12	73.03	32.02	2.28	84.96	36.41	2.33
50	\	\	\	\	\	\	60.18	33.56	1.79	64.13	31.33	2.05	68.44	31.13	2.20	80.67	35.86	2.25
55	\	\	\	\	\	\	\	\	\	62.50	34.27	1.82	66.56	33.98	1.96	79.73	39.77	2.00
60	\	\	\	\	\	\	\	\	\	\	\	\	64.56	38.32	1.68	77.03	44.68	1.72
65	\	\	\	\	\	\	\	\	\	\	\	\	61.18	40.67	1.50	72.99	47.41	1.54

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	114.7	32.43	3.54	122.5	29.93	4.09	129.0	28.48	4.53	137.8	29.46	4.68	146.2	30.29	4.83	159.8	32.30	4.95
30	108.1	32.73	3.30	115.1	30.18	3.81	122.3	29.08	4.20	134.9	30.74	4.39	144.8	31.66	4.57	153.0	32.85	4.66
35	103.7	32.44	3.20	109.7	31.01	3.54	112.0	27.0	4.15	126.5	29.77	4.25	139.3	31.17	4.47	146.4	32.17	4.55
40	99.45	33.62	2.96	106.1	32.23	3.29	111.7	28.55	3.91	119.5	29.66	4.03	133.6	31.74	4.21	136.2	30.46	4.47
45	97.85	38.43	2.55	105.1	35.08	3.00	110.0	29.9	3.68	113.5	30.45	3.73	119.1	31.53	3.78	124.8	30.39	4.11
48	97.15	39.70	2.45	103.1	35.80	2.88	108.4	30.64	3.54	110.8	30.93	3.58	117.3	32.32	3.63	122.9	31.14	3.95
50	93.53	39.64	2.36	101.9	36.70	2.78	106.6	31.27	3.41	109.6	31.74	3.45	115.4	32.99	3.50	120.9	31.79	3.80
55	92.66	44.08	2.10	100.6	40.66	2.47	106.0	35.3	3.00	107.4	35.11	3.06	114.1	36.62	3.12	119.6	35.28	3.39
60	88.41	48.91	1.81	98.41	46.26	2.13	103.4	40.06	2.58	105.9	40.26	2.63	111.3	41.51	2.68	116.6	40.00	2.92
65	86.26	53.44	1.61	95.37	50.20	1.90	100.0	42.92	2.33	102.5	42.02	2.44	92.36	36.27	2.55	96.79	34.95	2.77

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	173.4	34.54	5.02	178.8	34.94	5.12	184.3	34.07	5.41	175.9	27.97	6.29	171.7	26.81	6.40
30	161.2	34.16	4.72	165.8	32.55	5.09	170.4	31.86	5.35	160.8	26.60	6.04	156.0	25.51	6.12
35	150.8	32.86	4.59	154.7	30.57	5.06	160.5	30.89	5.20	148.8	26.27	5.66	144.6	25.22	5.73
40	139.3	30.28	4.60	135.8	27.67	4.91	142.6	28.14	5.07	131.7	25.43	5.18	126.2	23.99	5.26
45	126.7	29.82	4.25	120.2	27.16	4.43	126.9	28.16	4.51	115.3	24.58	4.69	109.4	23.10	4.74
48	124.8	30.56	4.08	118.4	27.84	4.25	125.0	28.86	4.33	113.5	26.02	4.36	107.8	24.30	4.43
50	122.8	31.19	3.94	116.5	28.42	4.10	123.0	29.46	4.18	111.7	26.08	4.28	106.0	24.53	4.32
55	121.4	34.62	3.51	115.2	31.54	3.65	121.7	32.70	3.72	110.5	29.28	3.77	104.9	27.23	3.85
60	118.4	39.25	3.02	102.5	31.54	3.25	108.3	32.70	3.31	98.33	28.63	3.43	93.34	26.06	3.58
65	98.25	34.29	2.87	79.93	25.87	3.09	85.79	27.24	3.15	60.30	18.50	3.26	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	64.68	28.92	2.24	75.40	28.44	2.65	82.50	28.30	2.92	87.93	29.78	2.95	92.30	29.13	3.17	104.7	32.31	3.24
30	59.15	27.52	2.15	68.97	27.06	2.55	78.48	27.77	2.83	82.82	29.57	2.80	88.44	29.70	2.98	99.38	32.42	3.07
35	59.81	29.30	2.04	69.74	28.80	2.42	74.85	27.56	2.72	79.19	29.24	2.71	83.92	29.16	2.88	94.42	32.13	2.94
40	52.62	30.27	1.74	61.14	29.70	2.06	69.88	29.14	2.40	74.75	29.26	2.56	78.92	28.97	2.72	89.48	32.08	2.79
45	\	\	\	50.67	33.06	1.53	67.14	35.00	1.92	71.63	32.83	2.18	75.69	32.31	2.34	87.37	36.89	2.37
48	\	\	\	40.75	28.49	1.43	64.68	35.09	1.84	69.37	33.07	2.10	73.35	32.57	2.25	85.33	37.47	2.28
50	\	\	\	\	\	\	60.29	33.93	1.78	64.24	31.70	2.03	68.76	31.68	2.17	81.10	36.65	2.21
55	\	\	\	\	\	\	\	\	\	62.74	34.42	1.82	66.79	34.13	1.96	79.96	39.92	2.00
60	\	\	\	\	\	\	\	\	\	\	\	\	64.80	38.47	1.68	77.26	44.83	1.72
65	\	\	\	\	\	\	\	\	\	\	\	\	61.42	40.82	1.50	73.23	47.56	1.54

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	115.4	33.77	3.42	123.2	31.45	3.92	129.7	30.28	4.28	138.5	31.47	4.40	147.3	32.91	4.48	161.0	35.17	4.58
30	108.8	34.07	3.19	115.8	31.52	3.67	123.0	30.60	4.02	135.6	32.75	4.14	145.8	34.03	4.28	154.2	35.72	4.32
35	104.4	33.60	3.11	110.4	32.35	3.41	113.1	28.52	3.97	127.3	31.43	4.05	140.2	33.36	4.20	147.4	34.79	4.24
40	100.1	34.78	2.88	106.7	33.39	3.20	112.4	29.89	3.76	120.2	31.18	3.86	134.3	33.64	3.99	136.9	32.47	4.22
45	98.5	39.59	2.49	105.8	36.24	2.92	110.7	31.2	3.55	114.2	31.79	3.59	119.8	33.05	3.62	125.5	32.05	3.92
48	97.8	40.86	2.39	103.7	36.96	2.81	109.0	31.98	3.41	111.5	32.27	3.46	118.0	33.66	3.50	123.6	32.80	3.77
50	93.9	40.70	2.31	102.6	37.86	2.71	107.3	32.43	3.31	110.3	33.08	3.33	116.1	34.33	3.38	121.6	33.31	3.65
55	92.8	44.32	2.09	100.7	41.03	2.45	106.3	35.85	2.97	107.5	35.48	3.03	114.2	36.99	3.09	119.9	35.83	3.35
60	88.5	49.15	1.80	98.54	46.50	2.12	103.5	40.43	2.56	106.0	40.63	2.61	111.4	41.88	2.66	116.9	40.55	2.88
65	86.5	53.59	1.61	95.60	50.35	1.90	100.1	43.27	2.31	102.6	42.26	2.43	92.59	36.42	2.54	97.02	35.10	2.76

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	174.6	37.41	4.67	180.1	37.81	4.76	185.5	36.94	5.02	177.1	30.84	5.74	172.9	29.68	5.82
30	162.4	37.03	4.39	167.0	35.42	4.72	171.6	34.73	4.94	162.0	29.47	5.50	157.2	28.38	5.54
35	152.0	35.73	4.26	155.9	33.44	4.66	161.7	33.76	4.79	150.0	29.14	5.15	145.5	27.59	5.27
40	140.1	32.47	4.31	136.5	29.68	4.60	143.5	30.51	4.70	132.4	27.34	4.84	126.9	25.65	4.95
45	127.4	31.48	4.05	120.9	28.68	4.21	127.7	29.96	4.26	115.9	25.92	4.47	110.1	24.44	4.50
48	125.5	32.22	3.89	119.1	29.36	4.06	125.7	30.52	4.12	114.2	27.36	4.18	108.4	25.46	4.26
50	123.5	32.85	3.76	117.2	29.76	3.94	123.7	31.12	3.98	112.4	27.42	4.10	106.7	25.69	4.15
55	121.7	35.17	3.46	115.3	31.91	3.61	122.0	33.25	3.67	110.6	29.65	3.73	105.0	27.60	3.80
60	118.7	39.80	2.98	102.7	31.91	3.22	108.4	33.07	3.28	98.46	28.87	3.41	93.47	26.30	3.55
65	98.38	34.53	2.85	79.99	26.01	3.08	85.85	27.40	3.13	60.42	18.61	3.25	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

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LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	77.13	41.27	1.87	89.69	40.31	2.22	98.04	39.76	2.47	104.6	41.51	2.52	109.8	40.57	2.71	124.3	45.02	2.76
30	70.53	39.24	1.80	82.01	38.32	2.14	93.24	39.00	2.39	98.42	40.14	2.45	105.2	41.39	2.54	117.9	45.18	2.61
35	65.45	39.96	1.64	78.53	40.27	1.95	89.37	40.80	2.19	94.44	41.90	2.25	100.2	42.45	2.36	112.8	46.94	2.40
40	56.92	41.03	1.39	66.18	40.07	1.65	77.11	39.94	1.93	89.69	43.58	2.06	94.57	42.79	2.21	107.4	47.10	2.28
45	\	\	\	67.08	47.20	1.42	75.86	46.25	1.64	86.78	46.35	1.87	91.72	45.61	2.01	105.9	51.45	2.06
48	\	\	\	65.81	48.42	1.36	74.42	48.11	1.55	85.14	48.22	1.77	89.99	47.44	1.90	103.9	53.52	1.94
50	\	\	\	\	\	\	71.81	49.56	1.45	82.15	49.67	1.65	86.82	48.87	1.78	100.2	55.13	1.82
55	\	\	\	\	\	\	\	\	\	78.10	51.00	1.53	82.55	50.19	1.64	95.28	56.61	1.68
60	\	\	\	\	\	\	\	\	\	\	\	\	77.60	49.12	1.58	89.57	55.40	1.62
65	\	\	\	\	\	\	\	\	\	\	\	\	72.07	50.98	1.41	83.18	57.51	1.45

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	137.0	46.87	2.92	146.4	43.27	3.38	158.9	38.26	4.15	169.7	40.46	4.20	180.1	41.91	4.30	185.2	42.58	4.35
30	129.1	47.30	2.73	137.5	43.62	3.15	150.6	38.08	3.95	166.2	41.44	4.01	178.3	43.48	4.10	181.6	43.25	4.20
35	124.4	49.01	2.54	131.5	43.69	3.01	142.0	38.17	3.72	161.7	42.28	3.83	172.0	43.87	3.92	178.5	43.99	4.06
40	119.8	51.04	2.35	127.8	46.27	2.76	141.3	40.08	3.52	158.9	43.84	3.62	166.0	43.56	3.81	168.5	42.65	3.95
45	119.1	55.18	2.16	127.9	50.38	2.54	140.0	44.73	3.13	154.4	47.48	3.25	160.6	45.33	3.54	162.5	44.48	3.65
48	116.8	57.40	2.04	125.5	52.41	2.39	137.4	46.53	2.95	152.4	49.71	3.07	156.1	46.74	3.34	159.5	46.27	3.45
50	112.7	59.13	1.91	121.1	53.98	2.24	132.5	47.93	2.77	146.1	50.88	2.87	152.4	48.69	3.13	153.9	47.67	3.23
55	107.2	60.72	1.76	115.1	55.44	2.08	126.0	49.22	2.56	138.9	52.24	2.66	144.5	49.89	2.90	146.3	48.95	2.99
60	100.8	59.43	1.70	108.2	54.26	1.99	118.5	48.17	2.46	130.6	51.13	2.55	135.7	48.75	2.78	137.5	47.91	2.87
65	93.56	61.69	1.52	100.5	56.32	1.78	110.0	50.00	2.20	109.1	47.77	2.29	112.8	45.32	2.49	114.9	44.75	2.57

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	188.6	42.81	4.41	190.3	42.67	4.46	192.5	42.59	4.52	195.5	42.13	4.64	191.5	40.53	4.73
30	185.7	43.23	4.30	188.6	43.35	4.35	190.3	43.04	4.42	192.5	42.69	4.51	187.7	41.02	4.58
35	182.7	43.86	4.17	185.6	43.67	4.25	188.0	43.19	4.35	188.5	42.65	4.42	180.5	40.68	4.44
40	171.6	42.92	4.00	173.7	42.10	4.13	176.0	41.34	4.26	176.6	40.93	4.32	169.5	38.97	4.35
45	165.6	44.70	3.71	169.0	44.99	3.76	170.7	44.68	3.82	172.7	44.39	3.89	159.6	40.49	3.94
48	162.5	46.50	3.49	165.8	46.80	3.54	167.5	46.48	3.60	169.4	46.18	3.67	156.6	42.12	3.72
50	156.8	47.90	3.27	159.9	48.21	3.32	161.6	47.88	3.37	163.5	47.57	3.44	151.1	43.39	3.48
55	149.1	49.19	3.03	152.1	49.50	3.07	153.6	49.17	3.12	155.4	48.85	3.18	143.6	44.56	3.22
60	140.1	48.14	2.91	112.9	38.27	2.95	114.1	38.02	3.00	115.4	37.77	3.06	106.7	34.45	3.10
65	93.70	35.98	2.60	90.28	34.20	2.64	91.20	33.97	2.68	61.06	22.33	2.73	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-25			-20			-18			-15			-10			-5		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	77.45	41.82	1.85	90.06	41.37	2.18	98.71	40.92	2.41	105.3	42.67	2.47	110.5	41.91	2.64	125.0	46.68	2.68
30	70.85	39.79	1.78	82.44	39.11	2.11	93.61	40.06	2.34	99.09	41.30	2.40	105.9	42.55	2.49	118.6	46.52	2.55
35	65.56	40.33	1.63	78.96	41.06	1.92	89.74	41.86	2.14	94.81	42.96	2.21	100.9	43.61	2.31	113.5	48.28	2.35
40	57.05	41.27	1.38	66.29	40.44	1.64	77.43	40.49	1.91	90.06	44.64	2.02	94.94	43.85	2.17	108.1	48.26	2.24
45	\	\	\	67.19	47.57	1.41	76.18	46.80	1.63	87.15	47.41	1.84	92.09	46.67	1.97	106.5	52.61	2.03
48	\	\	\	65.92	48.79	1.35	74.74	48.66	1.54	85.51	49.28	1.74	90.36	48.50	1.86	104.5	54.68	1.91
50	\	\	\	\	\	\	72.13	50.11	1.44	82.58	50.46	1.64	87.19	49.93	1.75	100.9	56.29	1.79
55	\	\	\	\	\	\	\	\	\	78.33	51.15	1.53	82.78	50.34	1.64	95.41	56.85	1.68
60	\	\	\	\	\	\	\	\	\	\	\	\	77.83	49.27	1.58	89.70	55.64	1.61
65	\	\	\	\	\	\	\	\	\	\	\	\	72.31	51.13	1.41	83.41	57.66	1.45

LWT	DB																	
	0			5			7			10			15			20		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	137.7	48.88	2.82	147.4	45.89	3.21	160.1	41.13	3.89	170.9	43.33	3.95	181.3	44.78	4.05	186.5	45.45	4.10
30	129.9	49.10	2.64	138.2	45.63	3.03	151.8	40.95	3.71	167.4	44.31	3.78	179.6	46.35	3.87	182.8	46.12	3.96
35	125.1	50.67	2.47	132.2	45.60	2.90	142.9	40.54	3.53	162.9	45.15	3.61	173.2	46.74	3.71	179.8	46.86	3.84
40	120.5	52.56	2.29	128.5	48.07	2.67	142.1	42.27	3.36	160.1	46.71	3.43	167.2	46.43	3.60	169.8	45.52	3.73
45	119.8	56.70	2.11	128.7	52.18	2.47	140.8	46.92	3.00	155.6	50.35	3.09	161.8	48.20	3.36	163.8	47.35	3.46
48	117.5	58.74	2.00	126.2	54.07	2.33	138.1	48.54	2.84	153.6	52.58	2.92	157.3	49.61	3.17	160.7	49.14	3.27
50	113.4	60.47	1.88	121.8	55.50	2.19	133.2	49.83	2.67	147.2	53.50	2.75	153.6	51.56	2.98	155.1	50.54	3.07
55	107.3	61.09	1.76	115.2	55.81	2.07	126.3	49.77	2.54	139.3	53.03	2.63	144.9	50.95	2.84	146.7	50.01	2.93
60	100.9	59.80	1.69	108.3	54.63	1.98	118.8	48.72	2.44	130.9	51.68	2.53	136.1	49.54	2.75	138.0	48.70	2.83
65	93.79	61.84	1.52	100.6	56.56	1.78	110.1	50.24	2.19	109.3	48.01	2.28	112.9	45.56	2.48	115.1	44.99	2.56

LWT	DB														
	25			30			35			40			43		
	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER	HC	PI	EER
25	189.8	45.68	4.15	191.5	45.54	4.20	193.8	45.46	4.26	196.7	45.00	4.37	192.7	43.40	4.44
30	186.9	46.10	4.05	189.8	46.22	4.11	191.5	45.91	4.17	193.7	45.56	4.25	188.9	43.89	4.30
35	183.9	46.73	3.94	186.9	46.54	4.01	189.2	46.06	4.11	189.8	45.52	4.17	181.7	43.55	4.17
40	172.8	45.79	3.77	174.9	44.97	3.89	177.2	44.21	4.01	177.8	43.80	4.06	170.8	41.84	4.08
45	166.8	47.57	3.51	170.2	47.86	3.56	171.9	47.55	3.61	173.9	47.26	3.68	160.8	43.36	3.71
48	163.7	49.37	3.32	167.0	49.67	3.36	168.7	49.35	3.42	170.6	49.05	3.48	157.8	44.99	3.51
50	158.0	50.77	3.11	161.2	51.08	3.16	162.8	50.75	3.21	164.7	50.44	3.26	152.3	46.26	3.29
55	149.4	50.25	2.97	152.4	50.56	3.01	154.0	50.23	3.07	155.8	49.91	3.12	144.0	45.62	3.16
60	140.5	49.20	2.86	113.0	38.64	2.93	114.2	38.39	2.98	115.5	38.14	3.03	106.8	34.82	3.07
65	93.93	36.13	2.60	90.51	34.35	2.64	91.43	34.12	2.68	61.30	22.48	2.73	\	\	\

Abbreviations:
HC: Total heating capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Performance specifications measured with water pump operating at rated water flow rate.

Cooling Capacity Tables

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LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	45.35	10.26	4.42
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	50.22	10.87	4.62
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	53.33	11.42	4.67
10	50.41	7.14	7.06	49.81	7.27	6.85	49.20	7.74	6.36	47.51	8.28	5.74	46.12	8.78	5.25	56.65	11.51	4.92
15	57.64	7.20	8.01	56.96	7.32	7.78	56.15	8.16	6.88	53.59	8.03	6.67	52.72	8.14	6.48	61.52	9.84	6.25
20	63.88	7.89	8.10	63.12	7.95	7.94	62.55	8.48	7.38	61.65	8.64	7.14	59.94	8.51	7.05	71.25	10.25	6.95

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	50.13	12.47	4.02	49.40	12.77	3.87	48.73	13.18	3.70	48.00	15.73	3.05	46.37	17.25	2.69	42.66	17.22	2.48
5	58.24	13.32	4.37	57.13	13.63	4.19	55.00	14.08	3.91	53.62	16.80	3.19	52.34	18.43	2.84	48.15	18.39	2.62
7	62.53	14.27	4.38	61.65	14.46	4.26	60.43	15.11	4.00	58.38	17.06	3.42	57.00	19.00	3.00	51.87	18.89	2.75
10	66.16	14.63	4.52	65.37	14.95	4.37	64.53	15.06	4.29	62.60	17.55	3.57	61.00	19.24	3.17	54.29	18.44	2.94
15	73.04	12.99	5.62	72.24	13.79	5.24	70.63	14.71	4.80	67.99	16.24	4.19	64.16	17.39	3.69	58.21	16.92	3.44
20	84.80	14.13	6.00	84.01	15.19	5.53	82.54	16.48	5.01	81.66	17.87	4.57	78.52	18.05	4.35	68.31	16.65	4.10

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	40.34	18.11	2.23	37.10	17.40	2.13	27.36	17.24	1.59
5	46.06	19.57	2.35	41.35	18.35	2.25	28.79	16.60	1.73
7	49.02	19.11	2.57	43.89	18.25	2.40	30.21	15.37	1.97
10	51.24	18.85	2.72	46.36	18.03	2.57	31.11	13.59	2.29
15	48.76	15.07	3.23	41.70	13.72	3.04	31.44	10.96	2.87
20	57.32	15.47	3.70	50.25	14.91	3.37	36.12	11.79	3.06

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	45.59	10.71	4.26
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	50.46	11.32	4.46
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	53.65	11.97	4.48
10	50.64	7.59	6.67	50.04	7.72	6.48	49.43	8.19	6.04	47.75	8.73	5.47	46.35	9.23	5.02	56.95	12.17	4.68
15	57.87	7.65	7.57	57.19	7.77	7.36	56.39	8.61	6.55	53.83	8.48	6.34	52.87	8.49	6.23	61.76	10.29	6.00
20	64.20	8.44	7.61	63.44	8.50	7.46	62.87	9.03	6.97	61.88	9.09	6.81	60.17	8.96	6.72	71.56	10.91	6.56

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	50.36	12.92	3.90	49.64	13.22	3.76	48.97	13.63	3.59	48.24	16.18	2.98	46.61	17.70	2.63	42.81	17.57	2.44
5	58.55	13.98	4.19	57.44	14.29	4.02	55.32	14.63	3.78	53.94	17.35	3.11	52.66	18.98	2.77	48.39	18.84	2.57
7	62.82	15.04	4.18	61.94	15.23	4.07	60.72	15.88	3.82	58.68	17.72	3.31	56.68	19.82	2.86	52.19	19.44	2.68
10	66.63	15.58	4.28	65.84	15.90	4.14	65.00	16.00	4.06	62.89	18.32	3.43	61.29	20.01	3.06	54.61	18.99	2.88
15	73.33	13.76	5.33	72.53	14.56	4.98	70.93	15.37	4.61	68.30	16.90	4.04	64.48	17.94	3.59	58.45	17.37	3.36
20	85.45	15.26	5.60	84.66	16.32	5.19	83.19	17.60	4.73	82.31	18.99	4.33	78.99	19.00	4.16	68.61	17.31	3.96

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	40.49	18.46	2.19	37.25	17.75	2.10	27.43	17.38	1.58
5	46.29	20.02	2.31	41.50	18.70	2.22	28.86	16.74	1.72
7	49.26	19.56	2.52	44.04	18.60	2.37	30.31	15.51	1.95
10	51.47	19.30	2.67	46.59	18.48	2.52	31.21	13.73	2.27
15	48.91	15.42	3.17	41.80	13.86	3.02	31.51	11.10	2.84
20	57.55	15.92	3.61	50.40	15.26	3.30	36.22	11.93	3.04

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

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LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	52.04	14.50	3.59
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	60.51	15.88	3.81
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	64.30	16.33	3.94
10	62.61	10.17	6.16	61.88	10.34	5.98	60.97	10.96	5.56	58.95	11.74	5.02	57.22	12.47	4.59	68.25	15.84	4.31
15	71.60	10.25	6.99	70.75	10.42	6.79	69.58	11.56	6.02	66.49	11.40	5.83	65.41	11.56	5.66	75.21	13.85	5.43
20	79.35	11.23	7.07	78.41	11.31	6.93	77.52	12.01	6.46	76.49	12.25	6.24	74.37	12.08	6.15	82.54	13.92	5.93

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	61.13	18.90	3.23	60.47	19.26	3.14	59.87	19.97	3.00	59.37	23.80	2.49	56.90	25.99	2.19	45.05	18.83	2.39
5	68.99	18.90	3.65	68.25	19.26	3.54	67.57	19.97	3.38	67.01	23.80	2.82	64.22	25.99	2.47	51.09	20.34	2.51
7	75.51	20.25	3.73	75.08	20.43	3.68	74.24	21.43	3.47	70.76	24.16	2.93	70.00	26.82	2.61	54.77	21.16	2.59
10	82.29	20.75	3.97	81.21	21.11	3.85	79.27	21.36	3.71	77.42	24.85	3.12	74.84	27.14	2.76	57.76	20.98	2.75
15	90.84	18.43	4.93	87.99	19.48	4.52	86.77	20.87	4.16	82.41	23.00	3.58	78.72	24.53	3.21	61.94	19.19	3.23
20	95.92	18.60	5.16	94.49	19.62	4.82	93.54	21.34	4.38	91.62	22.95	3.99	87.45	23.23	3.77	72.34	18.92	3.82

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	42.36	19.57	2.16	38.95	18.80	2.07	28.73	18.62	1.54
5	47.90	20.96	2.29	43.00	19.65	2.19	29.94	17.78	1.68
7	50.74	20.28	2.50	45.43	19.37	2.34	31.27	16.31	1.92
10	52.78	19.85	2.66	47.75	18.99	2.51	32.04	14.31	2.24
15	49.98	15.78	3.17	42.74	14.37	2.98	32.22	11.48	2.81
20	57.37	15.84	3.62	50.30	15.26	3.30	36.15	12.07	3.00

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	52.36	15.05	3.48
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	60.80	16.65	3.65
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	64.77	17.28	3.75
10	62.90	10.94	5.75	62.17	11.11	5.60	61.26	11.73	5.22	59.25	12.40	4.78	57.52	13.13	4.38	68.90	16.96	4.06
15	71.89	11.02	6.53	71.06	11.08	6.41	69.89	12.22	5.72	66.81	11.95	5.59	65.73	12.11	5.43	75.50	14.62	5.16
20	79.82	12.17	6.56	78.88	12.26	6.44	77.99	12.95	6.02	76.78	13.02	5.89	74.66	12.85	5.81	83.19	15.05	5.53

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	61.42	19.67	3.12	60.76	20.03	3.03	60.16	20.74	2.90	59.68	24.46	2.44	57.20	26.65	2.15	45.29	19.28	2.35
5	69.64	20.02	3.48	68.90	20.38	3.38	68.22	21.09	3.23	67.48	24.74	2.73	64.69	26.94	2.40	51.32	20.79	2.47
7	76.22	21.70	3.51	75.79	21.88	3.46	74.93	22.72	3.30	71.44	25.45	2.81	70.65	27.94	2.53	55.09	21.71	2.54
10	82.99	22.62	3.67	81.91	22.78	3.60	79.98	23.02	3.47	78.14	26.31	2.97	75.56	28.60	2.64	58.07	21.64	2.68
15	91.56	19.88	4.60	88.67	20.77	4.27	87.45	22.16	3.95	83.06	24.12	3.44	79.19	25.48	3.11	62.17	19.64	3.17
20	96.63	20.26	4.77	95.20	21.29	4.47	94.26	22.80	4.13	92.33	24.41	3.78	88.13	24.52	3.59	72.63	19.69	3.69

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	42.51	19.92	2.13	39.10	19.15	2.04	28.80	18.76	1.53
5	48.13	21.41	2.25	43.15	20.00	2.16	30.04	17.92	1.68
7	50.97	20.73	2.46	45.66	19.82	2.30	31.37	16.45	1.91
10	53.10	20.40	2.60	47.98	19.44	2.47	32.14	14.45	2.22
15	50.13	16.13	3.11	42.84	14.51	2.95	32.29	11.62	2.78
20	57.61	16.29	3.54	50.45	15.61	3.23	36.25	12.21	2.97

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

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LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	77.82	18.98	4.10
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	90.04	20.84	4.32
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	94.88	21.42	4.43
10	88.94	16.30	5.46	88.06	16.63	5.30	86.83	16.70	5.20	85.66	16.93	5.06	84.50	17.18	4.92	97.30	20.61	4.72
15	114.8	18.49	6.21	113.7	18.86	6.03	112.0	18.81	5.95	110.9	18.96	5.85	109.9	19.11	5.75	109.2	19.36	5.64
20	124.2	17.55	7.08	123.0	17.90	6.87	121.6	18.25	6.66	120.3	18.40	6.54	119.1	18.56	6.42	118.7	18.78	6.32

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	89.20	24.70	3.61	88.12	26.17	3.37	87.00	26.64	3.27	82.39	28.91	2.85	80.94	32.37	2.50	70.92	30.60	2.32
5	104.1	26.23	3.97	100.1	27.08	3.70	99.20	27.35	3.63	95.84	30.38	3.15	93.72	34.38	2.73	80.59	32.59	2.47
7	109.5	26.78	4.09	106.8	27.36	3.90	105.5	27.50	3.84	101.7	31.11	3.27	100.0	32.78	3.05	85.94	32.34	2.66
10	110.3	26.43	4.17	108.1	27.07	3.99	107.1	27.79	3.85	105.0	30.90	3.40	103.0	33.11	3.11	92.61	32.57	2.84
15	126.8	26.58	4.77	124.3	27.73	4.48	123.1	28.27	4.36	120.8	32.31	3.74	118.4	32.98	3.59	108.5	34.75	3.12
20	89.20	24.70	3.61	88.12	26.17	3.37	87.00	26.64	3.27	82.39	28.91	2.85	80.94	32.37	2.50	70.92	30.60	2.32

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	67.47	31.76	2.12	59.26	29.56	2.00	45.23	26.64	1.70
5	77.46	33.93	2.28	67.34	31.31	2.15	51.63	27.18	1.90
7	82.97	34.50	2.41	71.73	31.34	2.29	52.71	23.93	2.20
10	88.76	34.31	2.59	76.87	30.55	2.52	57.47	24.15	2.38
15	92.62	30.78	3.01	78.88	26.98	2.92	58.57	21.58	2.71
20	67.47	31.76	2.12	59.26	29.56	2.00	45.23	26.64	1.70

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	78.25	19.77	3.96
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	90.41	21.90	4.13
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	95.25	22.48	4.24
10	89.31	17.36	5.14	88.43	17.69	5.00	87.20	17.76	4.91	86.03	17.99	4.78	84.87	18.24	4.65	97.97	21.77	4.50
15	115.2	19.55	5.89	114.0	19.92	5.73	112.4	19.87	5.65	111.3	20.02	5.56	110.2	20.17	5.46	109.6	20.42	5.37
20	124.9	18.71	6.68	123.7	19.06	6.49	122.3	19.41	6.30	121.0	19.56	6.19	119.7	19.72	6.07	119.4	19.94	5.99

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	89.57	25.76	3.48	88.49	27.23	3.25	87.37	27.70	3.15	82.82	29.70	2.79	81.37	33.16	2.45	71.24	31.15	2.29
5	104.8	27.39	3.83	100.8	28.24	3.57	99.87	28.51	3.50	96.21	31.44	3.06	94.09	35.44	2.65	81.02	33.38	2.43
7	110.2	28.12	3.92	107.4	28.52	3.77	106.1	28.66	3.70	99.33	34.09	2.91	56.68	19.79	2.86	86.31	33.40	2.58
10	111.0	27.77	4.00	108.8	28.41	3.83	107.7	28.95	3.72	105.7	32.06	3.30	103.6	34.27	3.02	92.98	33.63	2.76
15	127.5	27.74	4.59	125.0	28.89	4.33	123.8	29.43	4.21	121.4	34.79	3.49	119.1	19.25	6.18	108.9	35.81	3.04
20	141.4	29.54	4.79	138.6	30.35	4.57	137.3	30.99	4.43	134.7	35.07	3.84	132.0	19.75	6.69	113.1	33.50	3.38

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	67.58	32.13	2.10	59.37	29.93	1.98	45.46	26.79	1.70
5	77.78	34.48	2.26	67.45	31.68	2.13	51.76	27.42	1.89
7	83.34	35.56	2.34	72.05	31.89	2.26	52.84	24.17	2.19
10	89.13	35.37	2.52	77.19	31.10	2.48	57.60	24.39	2.36
15	92.94	31.33	2.97	78.99	27.35	2.89	58.70	21.82	2.69
20	92.25	28.25	3.27	80.91	25.90	3.12	52.24	17.85	2.93

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

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LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	105.2	31.59	3.33
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	120.0	33.68	3.56
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	128.2	34.33	3.73
10	115.5	25.09	4.60	114.4	25.59	4.47	112.8	25.71	4.39	111.3	26.06	4.27	109.7	26.44	4.15	133.3	33.59	3.97
15	135.1	25.78	5.24	133.7	26.29	5.09	131.8	26.23	5.02	130.5	26.43	4.94	129.2	26.65	4.85	138.2	29.10	4.75
20	146.2	24.47	5.97	144.7	24.96	5.80	143.1	25.44	5.62	141.6	25.65	5.52	140.1	25.87	5.41	146.6	27.90	5.25

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	117.4	38.02	3.09	111.5	38.75	2.88	110.1	40.47	2.72	108.4	44.51	2.44	106.5	47.14	2.26	74.89	33.46	2.24
5	135.2	40.36	3.35	128.4	41.14	3.12	125.6	43.28	2.90	124.5	46.75	2.66	121.7	49.48	2.46	85.51	36.05	2.37
7	142.2	41.22	3.45	136.9	41.56	3.29	133.5	45.26	2.95	132.1	47.87	2.76	130.0	50.00	2.60	90.76	36.22	2.51
10	146.5	41.62	3.52	144.0	42.74	3.37	142.1	44.20	3.22	138.8	44.40	3.13	135.6	45.06	3.01	98.53	37.06	2.66
15	155.0	37.58	4.13	151.0	39.47	3.83	148.3	40.58	3.65	144.6	40.56	3.56	137.5	39.84	3.45	115.5	39.42	2.93
20	156.3	35.10	4.45	152.9	37.02	4.13	150.2	37.08	4.05	146.6	36.77	3.99	145.6	37.24	3.91	119.4	36.86	3.24

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	71.25	34.73	2.05	62.58	32.32	1.94	47.76	29.13	1.64
5	82.19	37.54	2.19	71.45	34.64	2.06	54.78	30.07	1.82
7	87.62	38.63	2.27	75.74	35.10	2.16	55.66	26.80	2.08
10	94.44	39.04	2.42	81.79	34.77	2.35	61.15	27.48	2.23
15	98.55	34.91	2.82	83.93	30.61	2.74	62.32	24.48	2.55
20	97.35	31.47	3.09	85.56	29.00	2.95	55.08	20.12	2.74

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

SMHM-1400BH-3

LWT	DB																	
	-15			-10			-5			0			5			10		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	105.8	32.75	3.23
5	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	120.7	35.20	3.43
7	\	\	\	\	\	\	\	\	\	\	\	\	\	\	\	129.0	36.13	3.57
10	116.2	26.43	4.40	115.1	26.93	4.27	113.5	27.05	4.19	111.9	27.40	4.08	110.4	27.78	3.97	134.0	35.49	3.78
15	135.7	27.12	5.01	134.4	27.63	4.86	132.4	27.57	4.80	131.2	27.77	4.72	129.9	27.81	4.67	138.9	30.44	4.56
20	146.9	25.99	5.65	145.4	26.48	5.49	143.8	26.96	5.33	142.3	26.99	5.27	140.8	27.21	5.17	147.3	29.42	5.01

LWT	DB																	
	15			20			25			30			35			40		
	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	118.0	39.36	3.00	112.2	40.09	2.80	110.8	41.81	2.65	109.1	45.85	2.38	107.2	48.30	2.22	75.21	34.01	2.21
5	135.9	42.37	3.21	129.1	42.94	3.01	126.3	44.94	2.81	125.2	48.41	2.59	122.4	51.00	2.40	85.88	37.11	2.31
7	143.1	43.59	3.28	137.6	43.57	3.16	134.2	47.16	2.85	132.9	49.78	2.67	130.7	51.80	2.52	91.13	37.28	2.44
10	147.6	44.24	3.34	145.0	45.11	3.21	143.0	46.57	3.07	139.6	46.59	3.00	136.3	47.07	2.90	99.20	38.22	2.60
15	155.7	39.38	3.96	151.7	41.13	3.69	149.0	42.24	3.53	145.3	42.08	3.45	138.2	41.18	3.36	116.2	40.58	2.86
20	157.0	36.90	4.25	153.6	38.82	3.96	151.0	38.74	3.90	147.3	38.29	3.85	146.3	38.76	3.77	120.0	38.02	3.16

LWT	DB								
	43			45			48		
	CC	PI	EER	CC	PI	EER	CC	PI	EER
0	71.57	35.28	2.03	62.69	32.69	1.92	47.99	29.28	1.64
5	82.62	38.33	2.16	71.77	35.19	2.04	54.91	30.31	1.81
7	87.99	39.69	2.22	76.06	35.65	2.13	55.79	27.04	2.06
10	94.81	40.10	2.36	82.22	35.56	2.31	61.26	27.85	2.20
15	98.98	35.70	2.77	84.25	31.16	2.70	62.45	24.72	2.53
20	97.78	32.26	3.03	85.88	29.55	2.91	55.31	20.27	2.73

Abbreviations:
CC: Total cooling capacity (kW)
PI: Power input (kW)
LWT: Leaving water temperature (°C)
DB: Dry-bulb temperature for outdoor air temperature (°C)
Notes: Performance specifications measured with water pump operating at rated water flow rate.

Note:

Inlet and leaving water temperature mapping table											
Heating	Inlet(°C)	20	25	30	35	40	43	45	47	50	55
	Outlet(°C)	25	30	35	40	45	48	50	55	60	65
Cooling	Inlet(°C)	5	10	12	15	21	28	\	\	\	\
	Outlet(°C)	0	5	7	10	15	20	\	\	\	\

5 Performance Adjustment Factors

Ethylene and Propylene Glycol factors

The antifreeze must be required according to anyone condition as following:

- The ambient temperature is below 0 °C,
- The outlet water temperature is lower than 5 °C,
- Don't start up the unit for a long time,
- The power supply was cut off and needn't change the water in system.

A glycol solution is required when the unit with condition as mentioned. The use of glycol will reduce the performance of the unit depending on concentration.

Concentration of ethylene glycol (%)	Modification coefficient				Freezing point (°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.984	0.998	1.118	1.019	-4
20	0.973	0.995	1.268	1.051	-9
30	0.965	0.992	1.482	1.092	-16
40	0.960	0.989	1.791	1.145	-23
50	0.950	0.983	2.100	1.200	-37

Concentration of propylene glycol (%)	Modification coefficient				Freezing point (°C)
	Cooling capacity	Power input	Water resistance	Water flow	
0	1.000	1.000	1.000	1.000	0
10	0.976	0.996	1.071	1.00	-3
20	0.961	0.992	1.189	1.016	-7
30	0.948	0.988	1.380	1.034	-13
40	0.938	0.984	1.728	1.078	-22
50	0.925	0.975	2.150	1.125	-35

Evaporator temperature drop factors

Performance tables are based on a 5°C temperature drop through the evaporator. Temperature drops outside this range can affect the control system's capability to maintain acceptable control and are not recommended.

Altitude correction factors

Performance tables are based at sea level. Elevations other than sea level affect the performance of the unit. The decreased air density will reduce condenser capacity and reduce the unit's performance. Maximum allowable altitude is 1800meters.

Fouling factor

Fouling refers to the accumulation of unwanted material on solid surfaces, most often in an aquatic environment. The fouling material can consist of either living organisms (biofouling) or a non-living substance (inorganic or organic). Fouling is usually distinguished from other surface-growth phenomena in that it occurs on a surface of a component, system or plant performing a defined and useful function, and that the fouling process impedes or interferes with this function.

Other terms used in the literature to describe fouling include: deposit formation, encrustation, crudding, deposition, scaling,

scale formation, slagging, and sludge formation. The last six terms have a more narrow meaning than fouling within the scope of the fouling science and technology, and they also have meanings outside of this scope; therefore, they should be used with caution.

Fouling phenomena are common and diverse, ranging from fouling of ship hulls, natural surfaces in the marine environment (marine fouling), fouling of heat-transfer components through ingredients contained in the cooling water or gases, and even the development of plaque or calculus on teeth, or deposits on solar panels on Mars, among other examples.

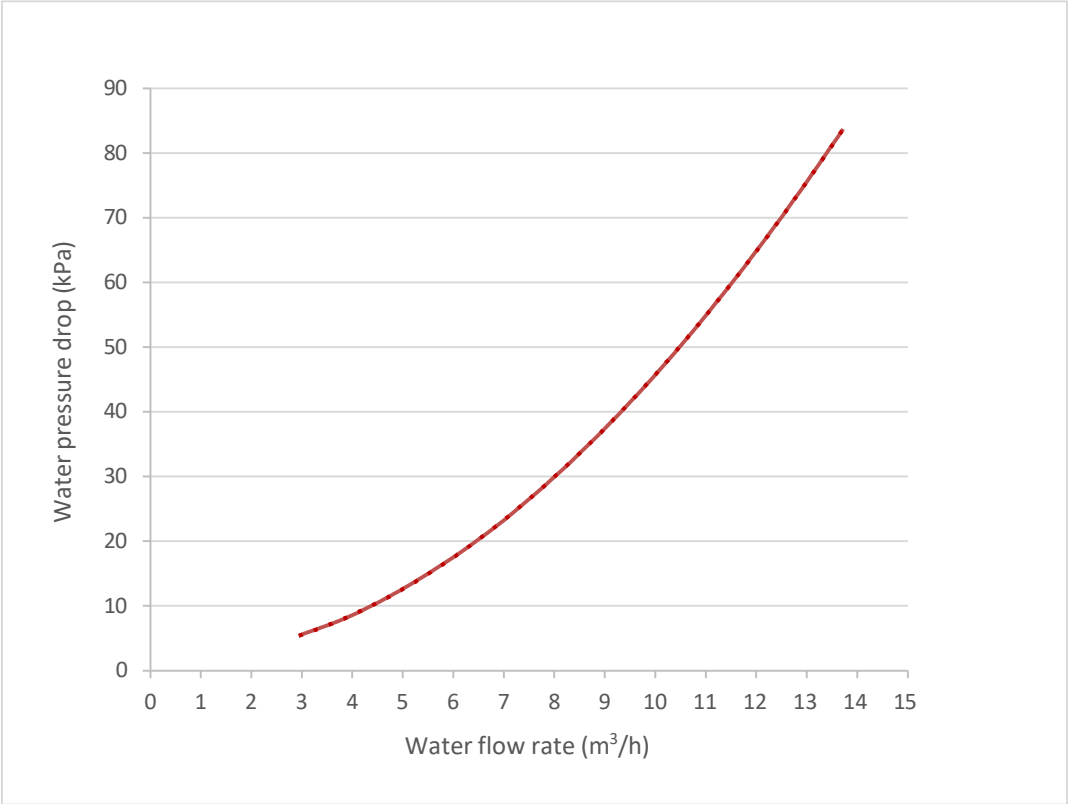
Foreign matter in the chilled water system will adversely affect the heat transfer capability of the evaporator, and could increase the pressure drop and reduce the water flow. To provide optimum unit operation, proper water treatment must be maintained. Refer to the able as following.

ALTITUDE (m)	Difference of water inlet and outlet temp. (°C)	Fouling Factor							
		0.018 m2. °C /kW		0.044 m2. °C /kW		0.086 m2. °C /kW		0.172 m2. °C /kW	
		C	P	C	P	C	P	C	P
Sea level	3	1.036	1.077	1.019	1.076	0.991	0.975	0.963	0.983
	4	1.039	1.101	1.022	1.080	0.994	0.996	0.971	0.984
	5	1.045	1.105	1.028	1.086	1.000	1.000	0.977	0.989
	6	1.051	1.109	1.034	1.093	1.006	1.004	0.983	0.994
600	3	1.024	1.087	1.008	1.064	0.980	0.984	0.951	0.991
	4	1.027	1.111	1.011	1.068	0.983	1.005	0.959	0.992
	5	1.034	1.115	1.017	1.074	0.989	1.009	0.965	0.997
	6	1.043	1.115	1.026	1.084	0.998	1.009	0.973	0.999
1200	3	1.013	1.117	0.996	1.052	0.969	1.011	0.942	1.002
	4	1.015	1.118	0.998	1.055	0.971	1.012	0.948	1.003
	5	1.023	1.122	1.006	1.063	0.979	1.015	0.955	1.005
	6	1.031	1.125	1.015	1.072	0.987	1.018	0.962	1.007
1800	3	1.002	1.128	0.986	1.042	0.959	1.021	0.935	1.007
	4	1.005	1.129	0.989	1.045	0.962	1.022	0.941	1.010
	5	1.012	1.132	0.995	1.051	0.968	1.024	0.945	1.012
	6	1.018	1.134	1.001	1.058	0.974	1.026	0.949	1.014

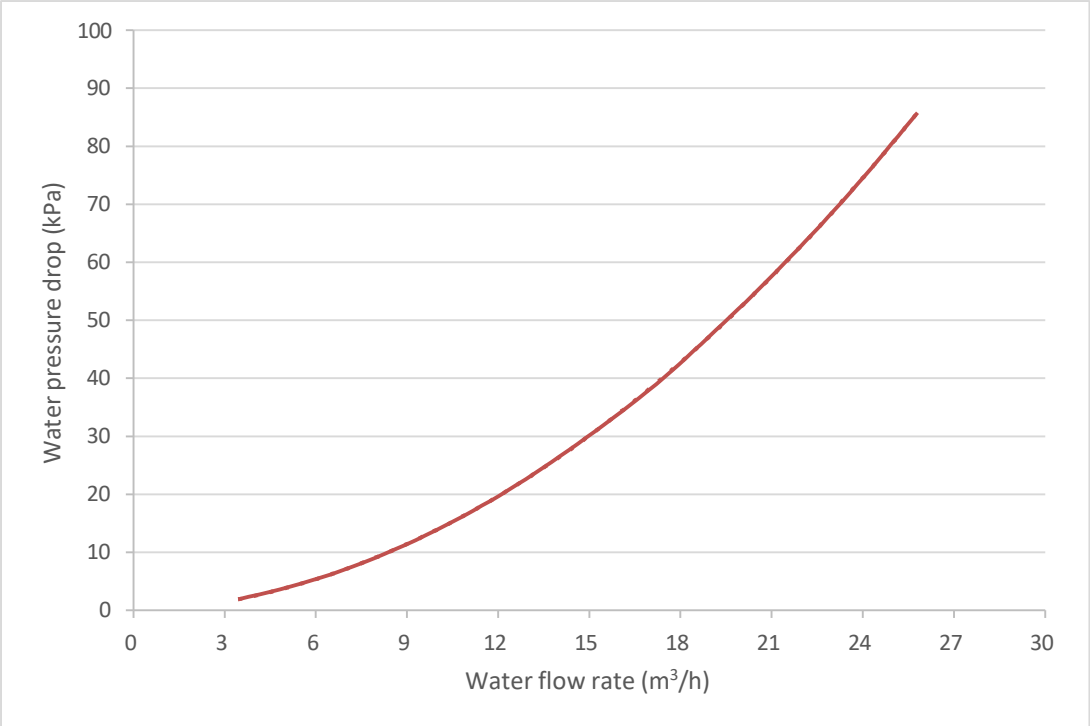
Abbreviations:
C: Cooling capacity
P: Power input

6 Hydronic Performance

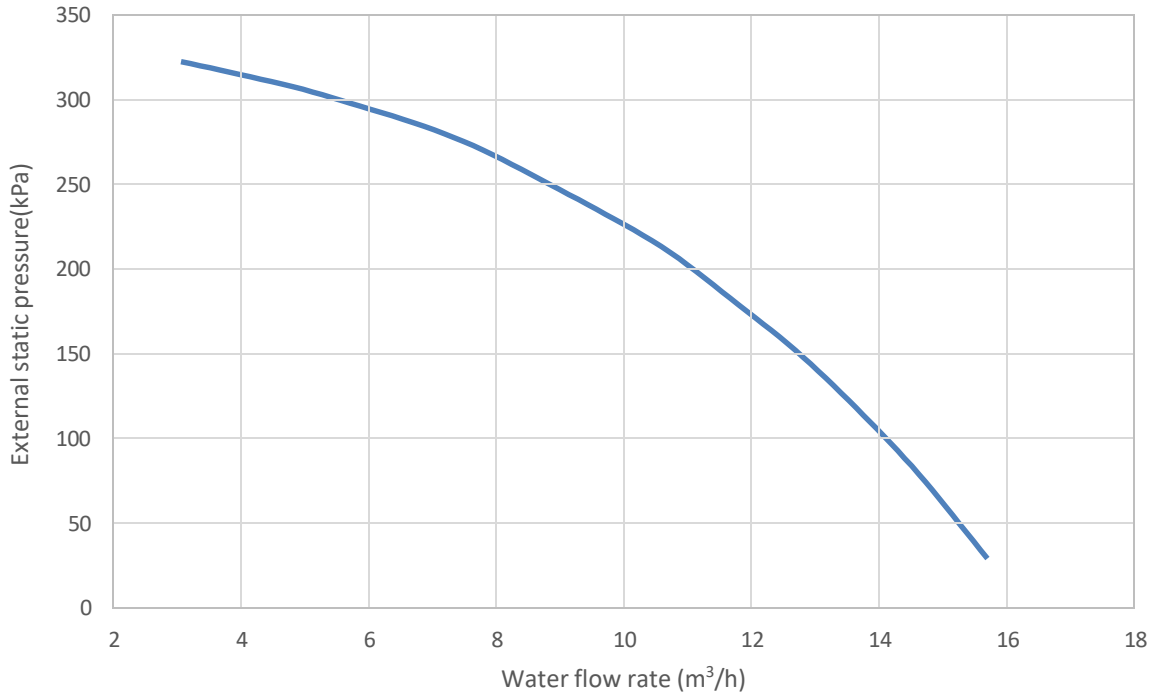
SMHM-650B-3 / SMHM-750B-3



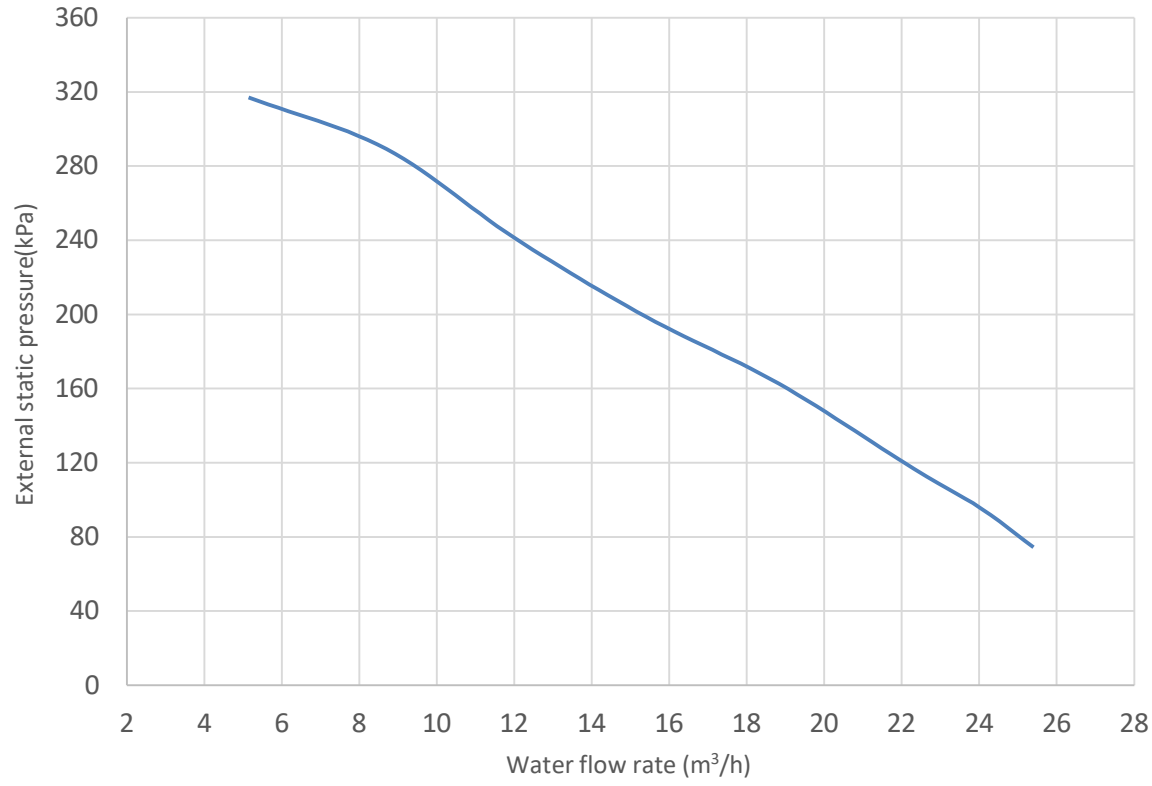
SMHM-1100B-3 / SMHM-1400B-3



SMHM-650BH-3 / SMHM-750BH-3

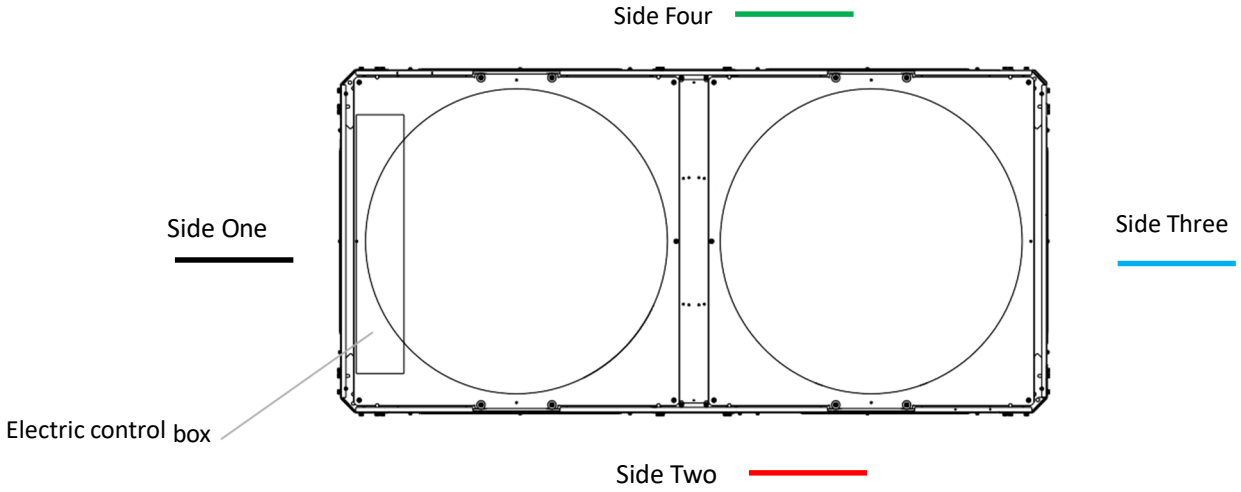


SMHM-1100BH-3 / SMHM-1400BH-3

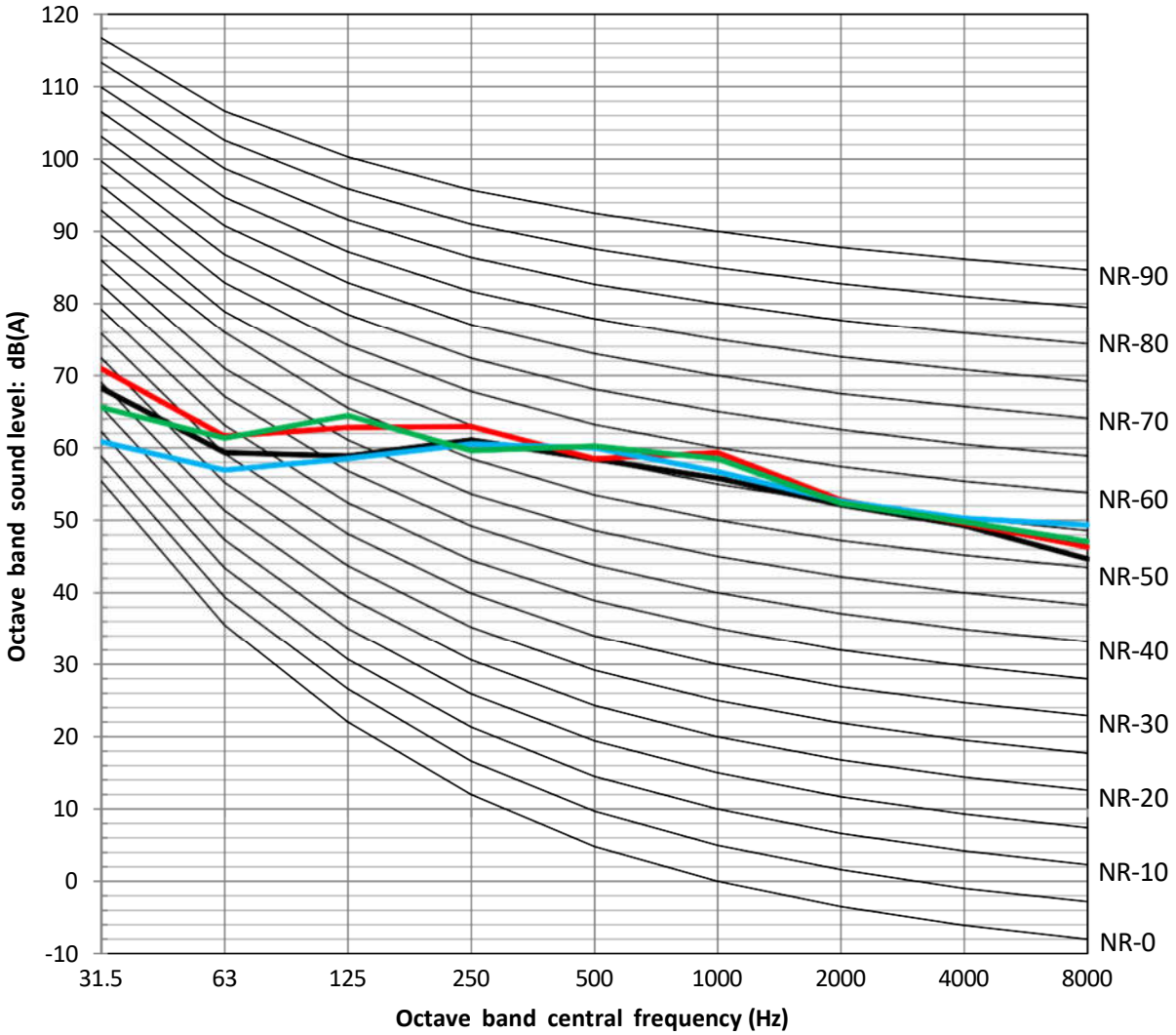


7 Octave Band Levels

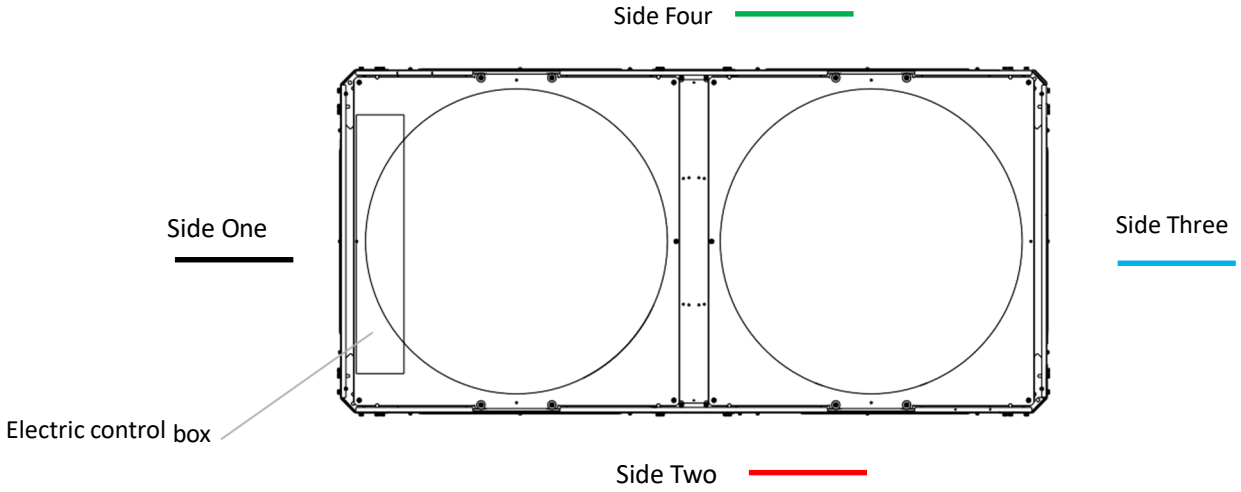
For 65/75kW



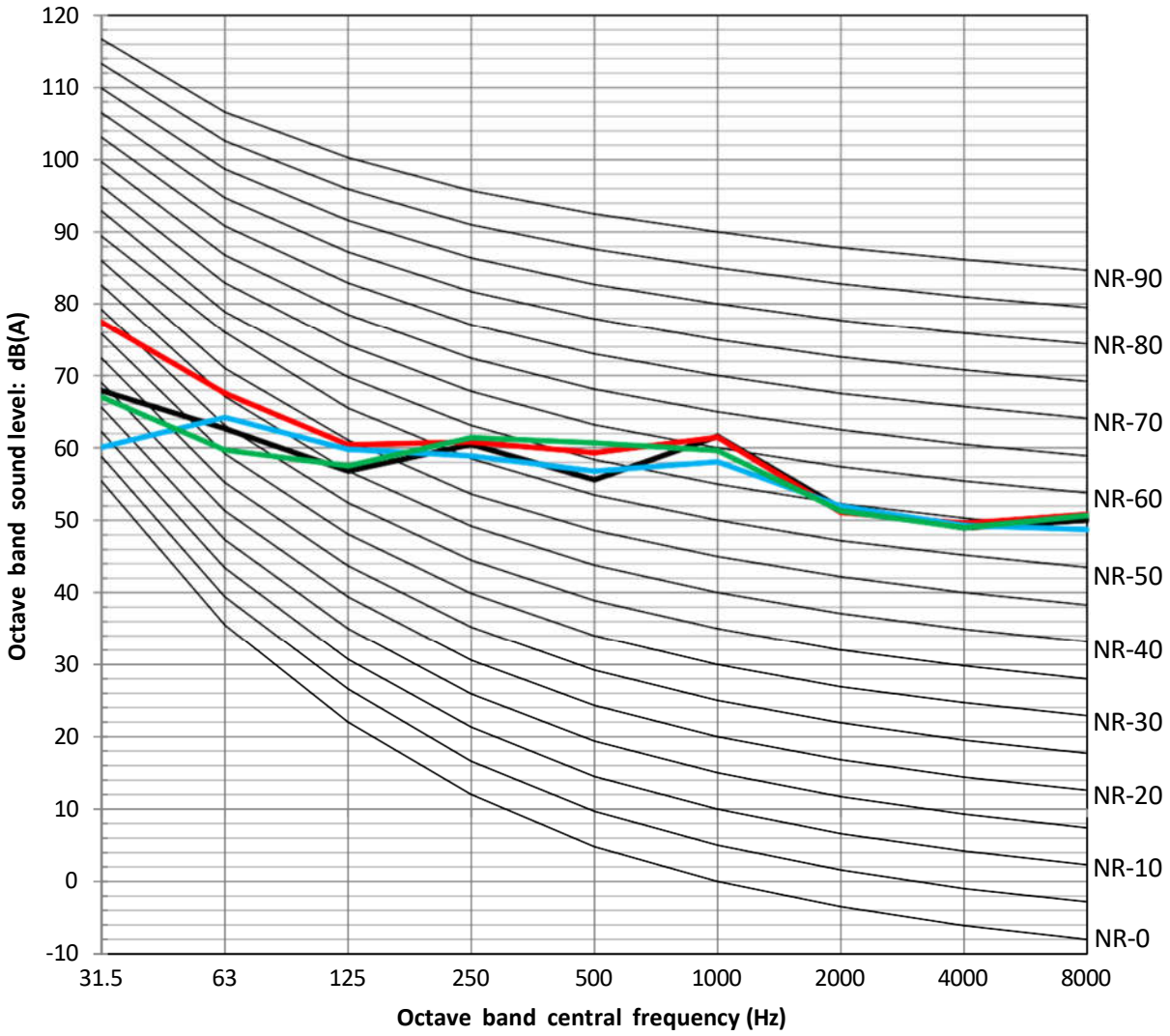
Test condition：Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C



For 110/140kW



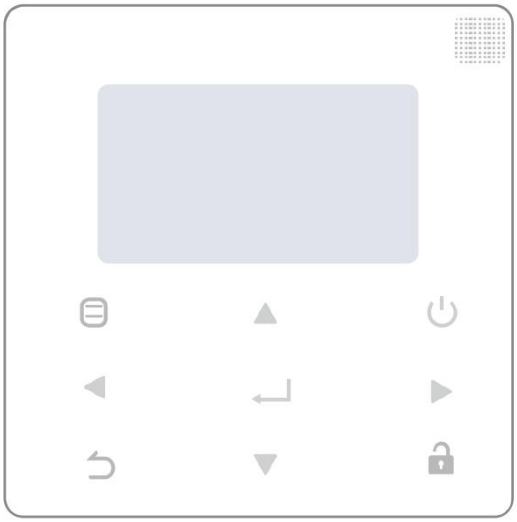
Test condition：Outdoor ambient temperature 35°C DB. EWT 12°C, LWT 7°C



Part 7
User Interface
Field Settings

1 Introduction

During installation, the unit's settings and parameters should be configured by the installer to suit the installation configuration, climate conditions and end-user preferences. The relevant settings are accessible and programmable through the SERVICE and PROJECT menu on the wired controller's user interface.



Icon	Function
	Enter the menu structure from the home page
	Navigate the cursor on the display/navigate in the menu structure/ adjust the settings
	Turn on or off the space operation mode
	Come back to the up level
	Long press for unlocking /locking the controller
	Go to the next step when programming a schedule in the menu structure / confirm a selection/enter a submenu in the menu structure

2 Service menu

2.1 Structure

For SERVICE Menu

1. STATE QUERY
2. CLEAR HSITORY ERRORS
3. SETTING ADDRESS
4. HEAT CONTROL
5. TEMPERATURE COMPENSATION
6. PUMP CONTROL
7. MANUAL DEFROST
8. LOW OUTLET WATER CONTROL
9. VACUMM SWITCH
10. ENERGY SAVING SWITCH
11. DHW ENABLE
12. FACTORY DATA RESET

1. STATE QUERY

2. CLEAR HISTORY ERRORS
CLEAR UNIT HISTORY ERRORS
CLEAR ALL HISTORY ERRORS
CLEAR LOCK ERRORR
CLEAR RUN TIME

3. SETTING ADDRESS
CONTROLLER ADDRESS
CONTROL ENABEL
MODBUS ENABLE
MODBUS ADDRESS

4. HEAT CONTROL
HEAT1
HEAT2
FORCED HEAT2 OPEN

5. TEMPERATURE COMPENSATION
COOL MODE ENABLE
T4_COOL_1
T4_COOL_2
OFFSET-C
HEAT MODE ENABLE
T4_HEAT_1
T4_HEAT_2

6. PUMP CONTROL
FORCED PUMP OPEN
INV PUMP SETTING
PUMP ON/OFF TIME

7. MANUAL DEFROST

8. LOW OUTLETWATER CONTROL

9. VACUUM SWITCH

10. ENERGY SAVING SWITCH

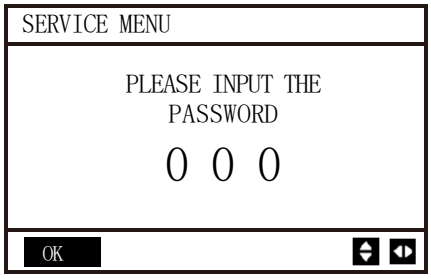
11. DHW ENABLE

12. FACTORY DATA RESET

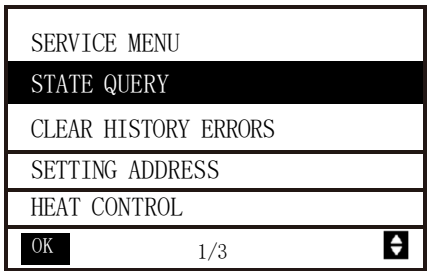
2.2 Service Menu

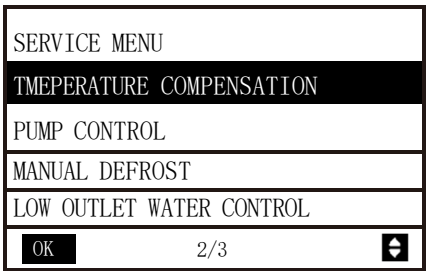
MENU > Service Menu

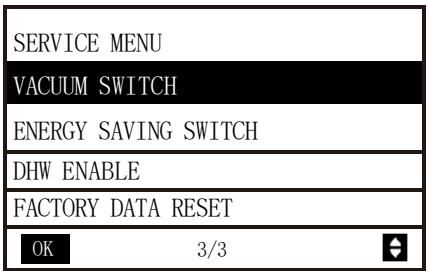
Service Menu allows installers to input the system configuration and set the system parameters. Enter the password, using ◄ ► to navigate between digits and using ▼ ▲ to adjust the numerical values, and then press ↵. The password is 234.



The following pages will be displayed after putting the password.

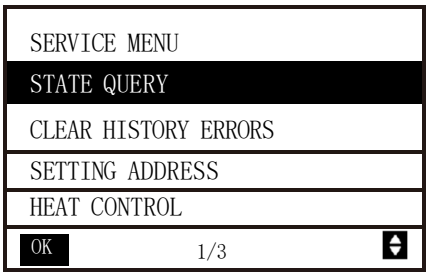




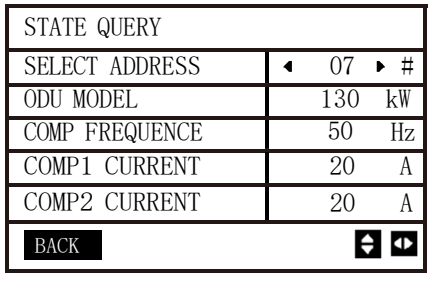


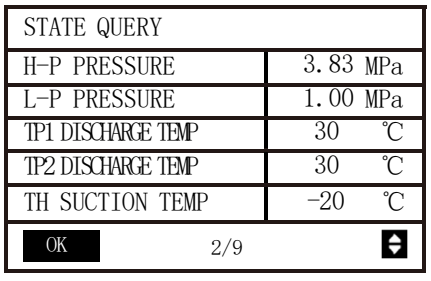
2.3 State query

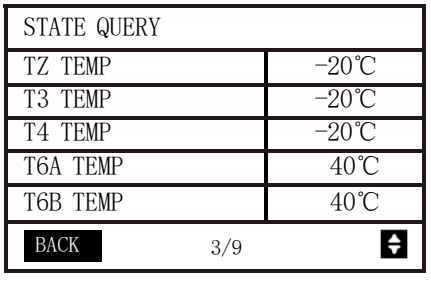
MENU > Service Menu > State query

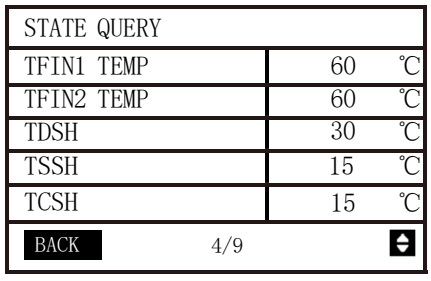


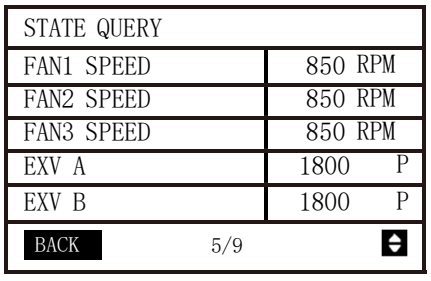
STATE QUERY allows installers to check the operation parameters. Press ◄ ► to select the address of units.

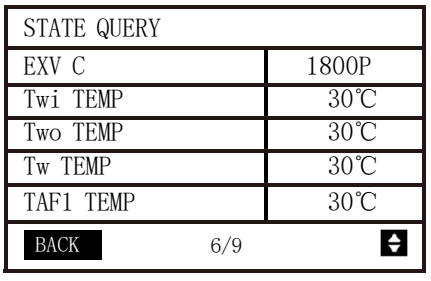


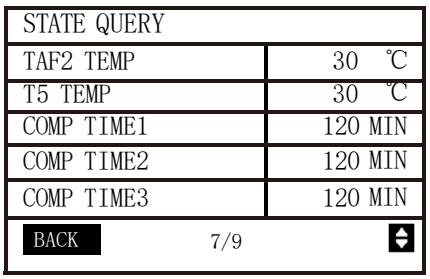


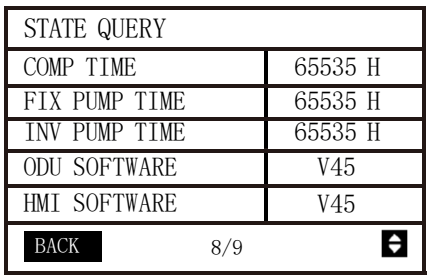


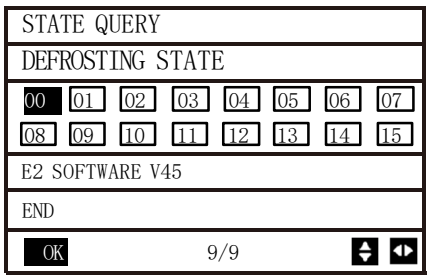










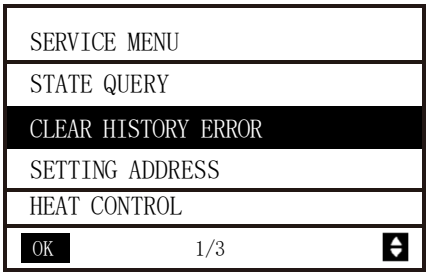


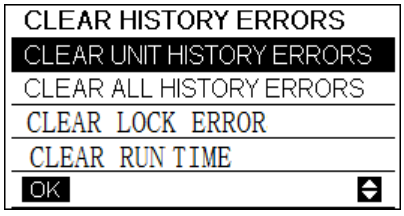
Note:

1. Tz plate heat exchanger outlet temperature
   T3 lowest temperature of condenser tube
   T4 ambient temperature
   T6A, T6B EVI plate heat exchanger refrigerant temperature
   Tfin1, Tfin2 inverter module temperature
   TDSH Discharge superheat temperature
   TSSH Suction superheat temperature
   TCSH Injection superheat temperature
   Twi Unit water inlet temperature
   Two Unit water outlet temperature
   Tw Total water outlet temperature
   Taf1 DHW water pipe antifreeze temperature
   Taf2 Water side antifreeze temperature
   T5 Water tank temperature
2. For ODU SOFWARE and HMI SOFTWARE, the version number will vary with product iterations.

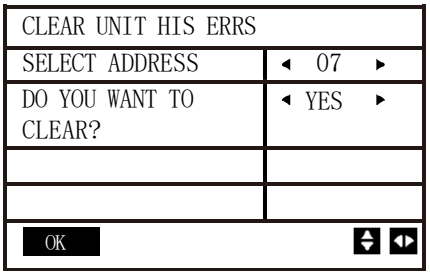
2.4 Clear history errors

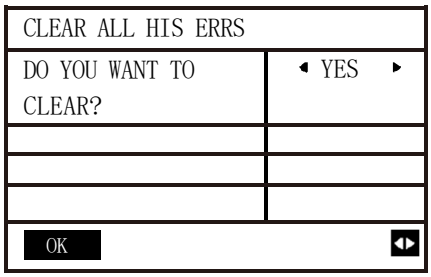
MENU > **Service Menu** > **Clear history errors**

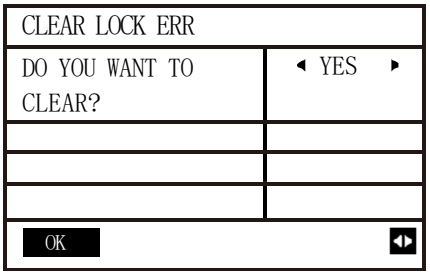


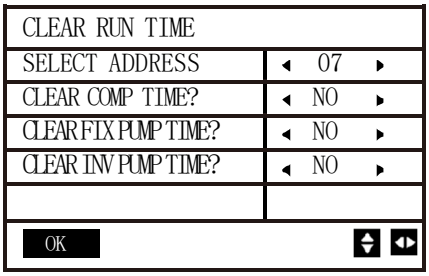


CLEAR HISTORY ERRORS is used to clear the history error codes and component operation time.



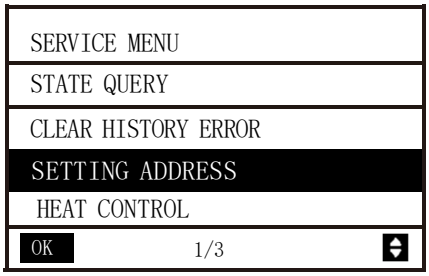




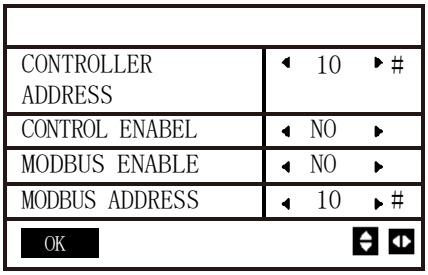


2.5 Setting address

MENU > **Service Menu** > **Setting address**



SETTING ADDRESS is used to set whether the unit can be controlled by wired controller and through MDOBUS. SETTING ADDRESS can also enter by combining buttons pressing, ► for 3s.



CONTROLLER ADDRESS selects the unit address then we can check the parameters about this unit.

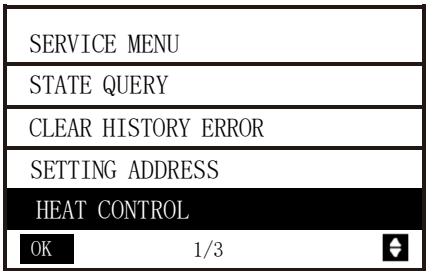
If CONTROL ENABLE sets as YES, it means the controller can set all the parameters; if CONTROL ENABLE sets as NO, it means the controller can only display the parameters.

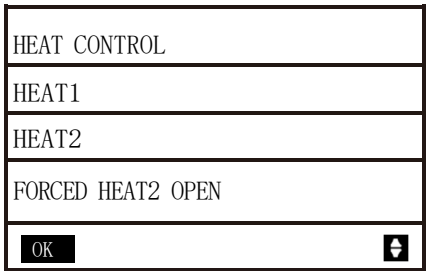
If the chiller system access to MODBUS system, MODBUS ENABLE should be set as YES. Please note that in this case, **COMTROL ENABLE** should be also set as YES, otherwise the units cannot be controlled.

MODBUS ADDRESS set the controller address if the Modbus system is available.

2.6 Heat control

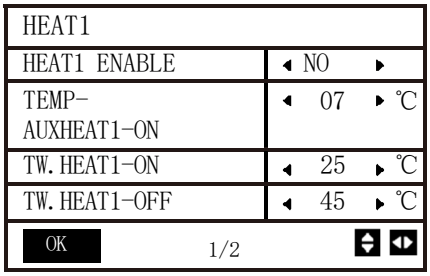
MENU > **Service Menu** > **Heat control**

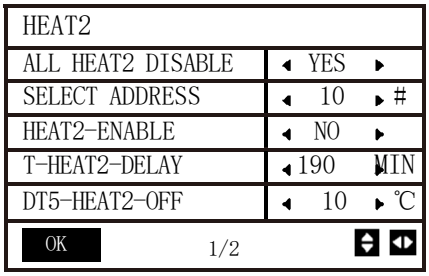


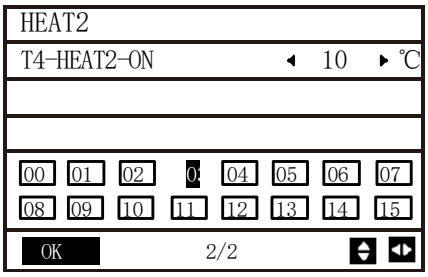


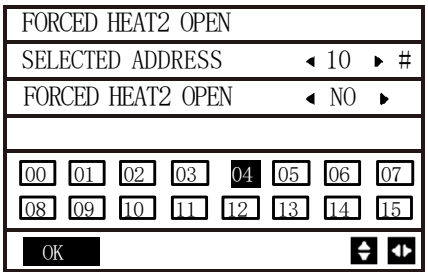
HEAT1 means pipe electric heating in heating mode.

HEAT2 means tank electric heating in DHW mode.





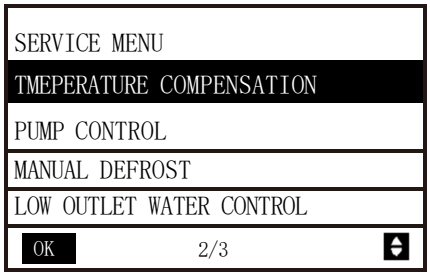




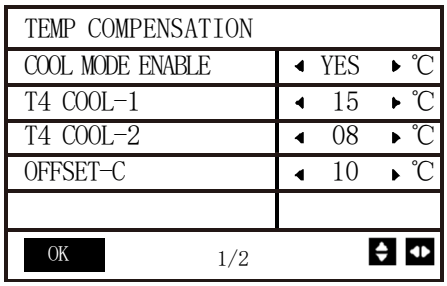
TEMP-AUXHEAT1-ON sets the ambient temperature below which the pipe heater (field supplied) turns on.
When the leaving water temperature reaches TW. HEAT1-ON, the pipe electric heater (field supplied) turns on automatically.
When the leaving water temperature reaches TW. HEAT1-OFF, the pipe electric heater (field supplied) turns off automatically.
If the system is installed with tank booster heater, ALL HEAT2 DISABLE should be set as YES.
HEAT2-ENABLE sets the state of tank booster heater of SELECT ADDRESS.
T-HEAT2-DELAY sets the delay time for tank booster heater to turn on after the compressor starts.
DT5-HEAT2-OFF sets the temperature difference between the actual water temperature and setting temperature above which the tank booster heater turns off.
T4_HEAT2_ON sets the ambient temperature that tank booster heater turns on. (00~15 means unit address)
If **FORCED HEAT2 OPEN** is set as YES, when T5<T5S-1, then tank electric heater turns on; when T5≥T5S, then tank electric heater off. (00~15 means unit address)

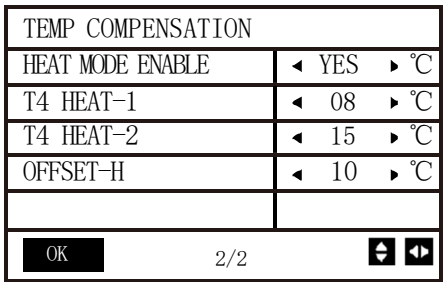
2.7 Temperature Compensation

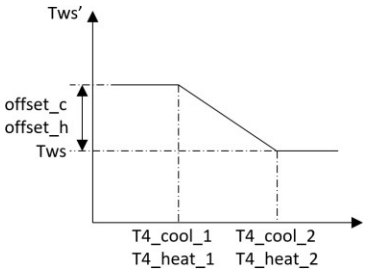
MENU > **Service Menu** > **Temperature Compensation**



With the help of **TEMPERATURE COMPENSATION**, water temperature will automatically change as outside air temperature changes. When outdoor air temperature increases/decreases, the heating load will decrease/increase and water temperature will decrease/increase automatically. When outdoor air temperature decreases/increases, the cooling load will decrease/increase and water temperature will increase/decrease automatically.



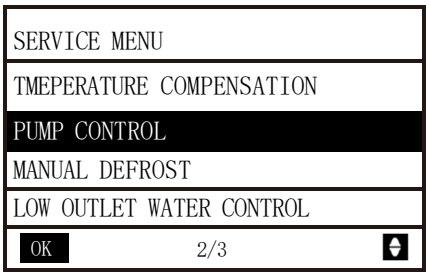


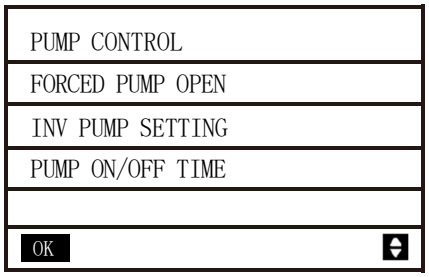


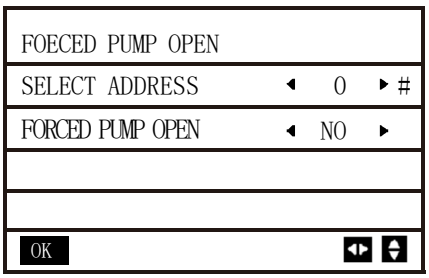
T4 COOL-1, **T4 COOL-2** set the ambient temperature for cooling mode.
T4 HEAT-1, **T4 HEAT-2** set the ambient temperature for heating mode.
Offset_c, **Offset_h** is the temperature difference between current water temperature and T4_cool_1, T4_heat_1 corresponding water temperature.

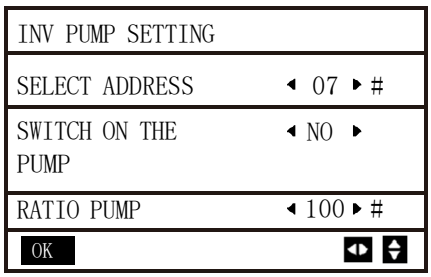
2.8 Pump Control

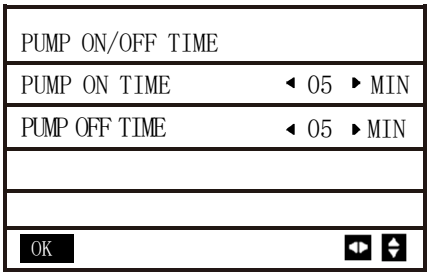
MENU > Service Menu > Pump Control











FORCED PUMP OPEN is used to control the fixed frequency pump (filed supplied) operation.

INV PUMP SETTING is used to control the inverter water pump (field supplied) operation, the setting range of RATIO-PUMP is 30%-100%. It should ensure its flow meet the requirement of whole unit, otherwise the unit may be damaged.

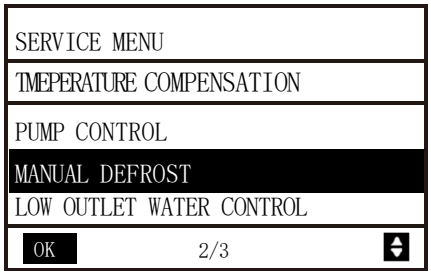
PUMP ON TIME sets the pump operation time after the unit stops.

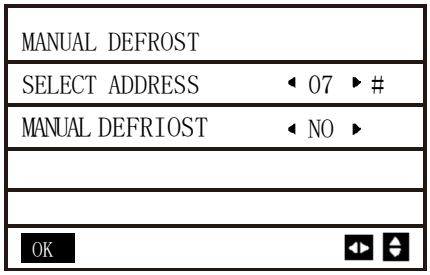
If PUMP OFF TIME sets as 0, the pump will run all the time. Otherwise, the pump will operate intermittently according to the PUMP ON TIME and PUMP OFF TIME setting.

	Set range	Default value	Adjustment range
PUMP ON TIME	5~60min	5	5
PUMP OFF TIME	0~60min	0	5

2.9 Manual Defrost

MENU > Service Menu > Manual Defrost



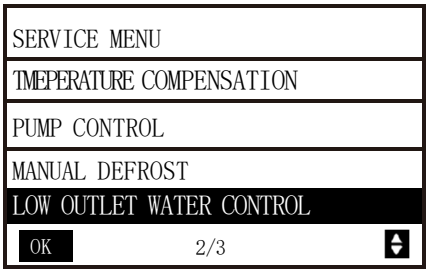


MANUAL DEFROST can force the unit to enter the defrost mode manually.

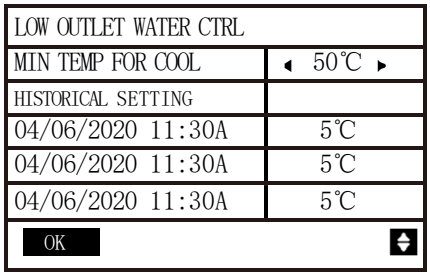
If the external unit successfully enters the defrost mode after the “MANUAL DEFROST” is turned on, the defrost icon will be displayed at homepage of the wired controller.

2.10 Low outlet water temperature control

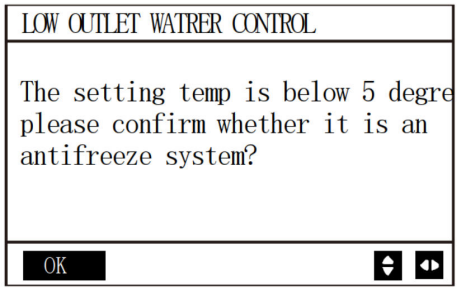
MENU > Service Menu > Low outlet water temperature control



At this page, the historical minimum water outlet temperature setting (setting range 0-20℃) can be viewed.

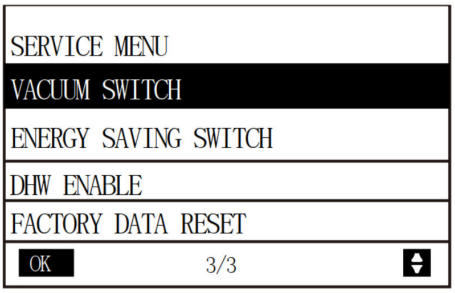


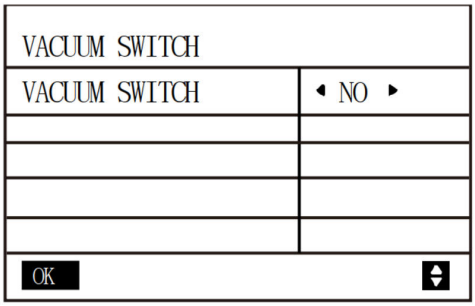
MIN TEMP FOR COOL sets the lowest water temperature for cooling mode. Please notice that When the setting temperature is less than 5℃, antifreeze liquid should be added in the water system.



2.11 Vacuum switch

MENU > Service Menu > Vacuum switch

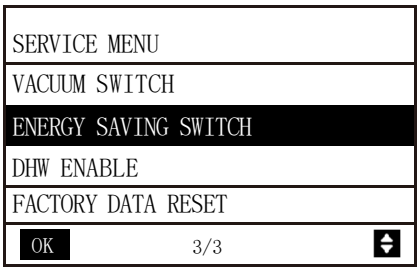


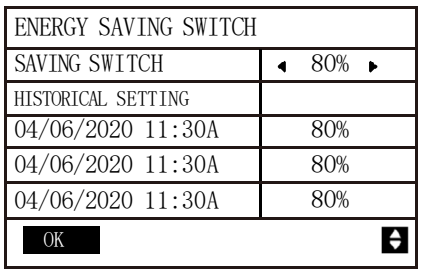


VACUUM SWITCH is used for vacuuming.

2.12 Energy saving mode

MENU > Service Menu > Energy saving mode



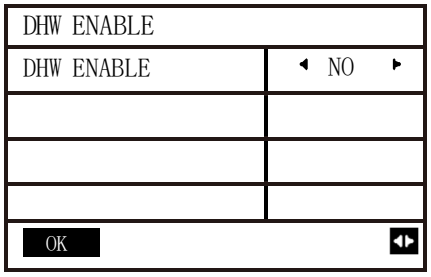


For projects with temporary electricity supply restrictions, the outdoor unit supports 7 levels of energy management which can be set to output 40-100% capacity. It prevents tripping during electricity supply restriction conditions and remains system continue to operate. The historical energy saving switch setting can be viewed.

2.13 DHW ENABLE

MENU > Service Menu > DHW ENABLE

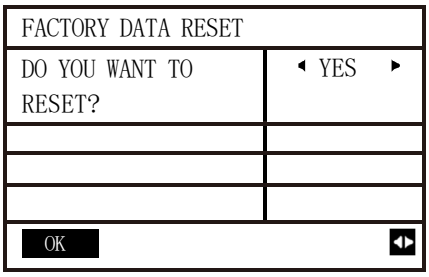
Domestic hot water function can be customized.



2.14 Factory data reset

MENU > Service Menu > Factory data reset

Factory data reset is used to reset all the data to the factory default setting.



3 Project menu

3.1 Structure

For PROJECT Menu

1. SET UNIT-AIRCONDITIONING
2. SET PARALLEL UNIT
3. SET UNIT PROTECTION
4. SET DEFROSTING
5. SET DHW TIME
6. SET E9 TIME
7. INV PUMP RATIO
8. CHECK PARTS

1. SET UNIT-AIRCONDITIONING
TWO_COOL_DIFF
TWO_HEAT_DIFF
DT5_ON
DTIS5
DtTws

2. SET PARALLEL UNIT
TIM_CAP_ADJ
TW_COOL_DIFF
TW_HEAT_DIF
RATIO_COOL_FIRST
RATIO_HEAT_FIRST

3. SET UNIT PROTECTION
T_DIFF_PRO
TWI_O_ABNORMAL

4. SET DEFROSTING
T_FROST
T_DEFROST_IN
T_DEFROST_OUT

5. SET DHW TIME
SELECT ADDRESS
COOL MIN TIME 0.5h
COOL MAX TIME
HEAT MIN TIME
HEAT MAX TIME
DHW MIN TIME
DHW MAX TIME

6. SET E9 TIME
E9 PROTECT TIME
E9 DETECTION METHOD

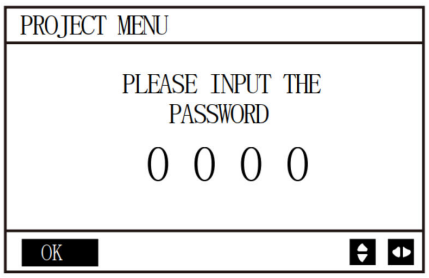
7. INV PUMP RATIO
MIN RATIO
MAX RATIO

8. INV PUMP RATIO
MIN RATIO
MAX RATIO

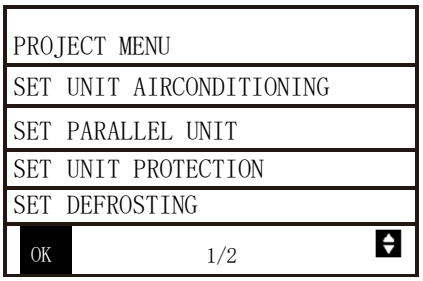
3.2 Project Menu

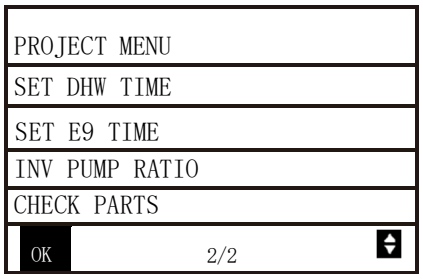
MENU > Project Menu

Project Menu allows installers to input the system configuration and set the system parameters. Enter the password, using ◄ ► to navigate between digits and using ▼ ▲ to adjust the numerical values, and then press **OK**. The password is 9877.



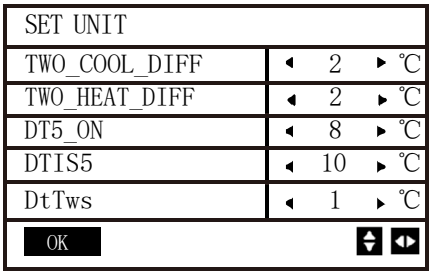
The following pages will be displayed after putting the password.





3.3 SET UNIT-AIRCONDITIONING

MENU > Project Menu > SET UNIT-AIRCONDITIONING



TWO_COOL_DIFF sets the minimum temperature difference between the leaving water temperature (Two) and the leaving water set temperature (TwoS) above which the unit will start for cooling mode. When Two - TwoS ≥ TWO_COOL_DIFF, unit starts. When TwoS - Two ≥ 2 lasts for 5s, unit stops.

TWO_HEAT_DIFF sets the minimum temperature difference between the leaving water temperature (Two) and the leaving water set temperature (TwoS) above which the unit will start for heating mode. When TwoS – Two ≥ TWO_HEAT_DIFF, unit starts. When Two - TwoS ≥ 2 lasts for 5s, unit stops.

If unit is customized with the DHW function, when TempW_heat_Min_n≤T5<Min(T5S, TempW_heat_Max_n)-dT5_ON and Two<Min(T5S, TempW_heat_Max_n)-2, then DHW mode is on.

Note:

The value of TempW_heat_Min_n, T5S, TempW_heat_Max_n are related to the ambient temperature, which are already fixed in the program.

T5 means the water tank temperature

T5S means the setting temperature of DHW mode

The target leaving water temperature of DHW mode is Twos=T5S+DT1S5. If Two>TempW_heat_Max_n, then DHW mode is off.

DtTws is reserved.

3.4 SET PARALLEL UNIT

MENU > Project Menu > SET PARALLEL UNIT

SET PAPALLEL UNIT		
TIM_CAP_ADJ	◂ 180 ▸	S
TW_COOL_DIFF	◂ 2 ▸	℃
TW_HEAT_DIFF	◂ 2 ▸	℃
RATIO_COOL_FIRST	◂ 0 ▸	%
RATIO_HEAT_FIRST	◂ 50 ▸	%
OK		

TIM_CAP_ADJ sets the period of capacity adjustment

TW_COOL_DIFF sets the minimum temperature difference between the total leaving water temperature (Tw) and the total leaving water set temperature (TwS) above which the unit will start for cooling mode. When Tw - TwS ≥ TW_COOL_DIFF + 1, unit starts. When TwoS - Tw ≥ 2 lasts for 5s, unit stops.

TW_HEAT_DIFF sets the minimum temperature difference between the total leaving water temperature (Tw) and the total leaving water set temperature (TwS) above which the unit will start for heating mode. When TwS – Tw ≥ TW_HEAT_DIFF + 1, unit starts. When Tw - TwS ≥ 1 lasts for 5s, unit stops.

RATIO_COOL_FIRST sets the number of initial startup units for cooling mode.

RATIO_HEAT_FIRST sets the number of initial startup units for heating mode.

3.5 SET UNIT PROTECTION

MENU > Project Menu > SET UNIT PROTECTION

SET UNIT PROTECTION		
T_DIFF_PRO	◂ 12 ▸	℃
TWI_O ABNORMAL	◂ 2 ▸	℃
OK		

T_DIFF_PRO set the absolute difference between entering water temperature (Twi) and leaving water temperature (Two). If ｜Twi - Two ｜≥ T_DIFF_PRO, unit stops and error code P9 appears. Normal heat pumps when ｜Twi-Two｜≥10℃ [T_DIFF_PRO], or high temperature heat pumps ｜Twi-Two｜≥15℃, error code disappears.

TWI_O_ABNORMAL sets the difference between Inlet water temperature (Twi) and Outlet water temperature (Two). For cooling mode, if Two – Twi ≥ TWI_O_ABNORMAL and lasts for 20min, unit stops and error code PA appears. If Two – Twi ≤ TWI_O_ABNORMAL – 1, error code disappears. For heating mode, if Twi – Two ≥ TWI_O_ABNORMAL and lasts for 20min, unit stops and error code PA appears. If Two – Twi ≤ TWI_O_ABNORMAL - 1, error code disappears.

3.6 SET DEFROSTING

MENU > **Project Menu** > **SET DEFROSTING**

SET DEFROSTING	
T_FROST	◂ 35 ▸min
T_DEFROST_IN	◂ 0 ▸℃
T_FROST_OUT	◂ 0 ▸℃
OK	

T_FROST sets the time between the end of the last defrost mode and the beginning of the next defrost mode.

T_DEFROST_IN sets the temperature for T3 of entering defrosting mode. When T3 reaches T_DEFROST_IN, unit enters defrosting mode.

T_FROST_OUT sets the temperature for T3 of exiting defrosting model. When T3 reaches T_DEFROST_IN, unit exits defrosting mode.

3.7 DHW time setting（Customized）

MENU > **Project Menu** > **SET DHW TIME**

SET DHW TIME	
SELECT ADDRESS	◂ 07 ▸#
COOL MAX TIME	◂ 08 ▸h
COOL MIN TIME	◂ 0.5 ▸h
HEAT MAX TIME	◂ 08 ▸h
HEAT MIN TIME	◂ 0.5 ▸h
OK	1/2

SET DHW TIME	
DHW MIN TIME	◂ 0.5 ▸h
DHW MAX TIME	◂ 08 ▸h
OK	2/2

COOL MAX TIME sets the maximum operation time for cooling mode when DHW requirement exists.

COOL MIN TIME sets the minimum operation time for cooling mode when DHW requirement exists.

HEAT MAX TIME sets the maximum operation time for heating mode when DHW requirement exists.

HEAT MIN TIME sets the minimum operation time for heating mode when DHW requirement exists.

DHW MIN TIME sets the minimum operation time for DHW mode.

DHW MAX TIME sets the maximum operation time for DHW mode.

3.8 SET E9 TIME

MENU > **Project Menu** > **SET E9 TIME**

SET E9 TIME	
E9 PROTECT TIME	◂ 10 ▸S
E9 DETECTION METHOD	◂ 1 ▸#
OK	

E9 PROTECT TIME sets the delay time of water flow detection. When unit starts, water flow will not be detected until at least (2+ **E9 PROTECT TIME/60**) minutes have elapsed.

E9 DETECTION METHOD sets the method of water flow detection. If “1” is selected, the water flow switch is detected after water pump starts. If “2” is selected, the water flow switch is both detected before and after the water pump starts.

3.9 INV PUMP RATIO

MENU > **Project Menu** > **INV PUMP RATIO**

INV PUMP RATIO	
MIN RATIO	◂ 70 ▸ %
MAX RATIO	◂ 100 ▸ %
OK	

MIN RATIO sets the minimum output ratio of inverter pump which is installed in the main water pipe.

MAX RATIO sets the maximum output ratio of inverter pump which is installed in the main water pipe.

3.10 CHECK PARTS

MENU > **Project Menu** > **CHECK PARTS**

State of different parts can be checked in this menu.

CHECK PARTS	
SELECT ADDRESS	◂ 07 ▸ #
FIX PUMP STATE	OFF
INV PUMP STATE	80%
FOUR-WAY VALVE	OFF
SV1 STATE	OFF
BACK	1/3

CHECK PARTS	
SV2 STATE	OFF
SV4 STATE	OFF
SV5 STATE	OFF
SV6 STATE	OFF
SV8A STATE	OFF
BACK	2/3

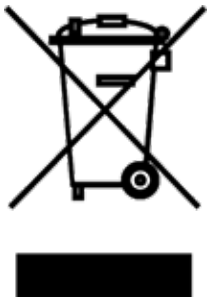
CHECK PARTS	
SV8B STATE	OFF
HEAT1 STATE	OFF
HEAT2 STATE	OFF
COIL VALVE	OFF
BACK	3/3

4 Parameters setting

Menu	Parameters	Setting range	Default value	Adjustment range
Service menu	TEMP_AUXHEAT_ON	0~10℃	5℃	1℃
	TW_HEAT1_ON	0~50℃	25℃	1℃
	TW_HEAT1_OFF	0~60℃	45℃	1℃
	T_HEAT2_DELAY	60~240min	90min	5min
	DT5_HEAT2_OFF	2~10℃	5℃	1℃
	T4_HEAT2_ON	-5~20℃	5℃	1℃
	T4_COOL_1	15~30℃	25℃	1℃
	T4_COOL_2	35~45℃	40℃	1℃
	OFFSET_C	0~15℃	10℃	1℃
	T4_HEAT_1	-10~10℃	2℃	1℃
	T4_ HEAT _2	15~30℃	15℃	1℃
	OFFSET_H	0~30℃	10℃	1℃
	RATIO_PUMP	30%~100%	100%	5%
	PUMP ON TIME	5~60min	5min	5min
	PUMP OFF TIME	0~60min	0min	5min
	MIN TEMP FOR COOL	0~20℃	7℃	1℃
	ENERGY SAVING SWITCH	40~100%	100%	10%

Menu	Parameters	Setting range	Default value	Adjustment range
Project menu	TWO_COOL_DIFF	1℃~5℃	2℃	1℃
	TWO_HEAT_DIFF	1℃~5℃	2℃	1℃
	TIM_CAP_ADJ	60~360s	80s	20s
	TW_COOL_DIFF	1℃~5℃	2℃	1℃
	TW_HEAT_DIFF	1℃~5℃	2℃	1℃
	RATIO_COOL_FIRST	0~100%	50%	5%
	RATIO_HEAT_FIRST	0~100%	50%	5%
	T_DIFF_PRO	Normal：8~15℃	Normal ：10℃	1℃
		Hot：8~20℃	Hot：15℃	
	TWI_O_ABNORMAL	1~5℃	2℃	1℃
	T_FROST	20~120 min	35 min	5min
	T_DEFROST_IN	-5~5℃	0℃	1℃
	T_FROST_OUT	-10~+10℃	0℃	1℃
	E9 PROTECT TIME	2~20s	5s	1
	E9 DETECTION METHOD	1~2	1	1
	MIN RATIO	Normal：40~100%	75%	5%
		Hot：25~100%	25%	5%
	MAX RATIO	70~100%	100%	5%
Project menu (customized with DHW)	dT5_ON	2~10℃	8℃	1℃
	dT1S5	5~20℃	10℃	1℃
	COOL MIN TIME	0.5~24h	0.5h	0.5h
	COOL MAX TIME	0.5~24h	8h	0.5h
	HEAT MIN TIME	0.5~24h	0.5h	0.5h
	HEAT MAX TIME	0.5~24h	8h	0.5h
	DHW MIN TIME	0.5~24h	0.5h	0.5h
	DHW MAX TIME	0.5~24h	8h	8h

NOTE CONCERNING PROTECTION OF ENVIRONMENT



This product must not be disposed of via normal household waste after its service life, but must be taken to a collection station for the recycling of electrical and electronic devices. The symbol on the product, the operating instructions or the packaging indicate such disposal procedures. The materials are recyclable in accordance with their respective symbols. By means of re-use, material recycling or any other form of recycling old appliances you are making an important contribution to the protection of our environment. Please ask your local council where your nearest disposal station is located.

INFORMATION CONCERNING USED REFRIGERANT MEDIUM

This unit is containing fluorinated gases included in the Kyoto protocol.
The maintenance and the liquidation must be carried out by qualified personnel.

Type of refrigerant: R32
The quantity of the refrigerant: Please see the unit label.
The value GWP: 675 (1 kg R32 = 0,675 t CO_2 eq)
GWP = Global Warming Potential

 Appliance filled with flammable gas R32.

In case of quality problem or other please contact your local supplier or authorized service center.
Emergency number: 112

PRODUCER

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This product was manufactured in China (Made in China).

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