



Service manual

WELLEA MAX

Air to Water heat pump

EN

Dear Customer,

Thank you for purchasing this device.

We invite you to read this manual carefully before using your appliance. Keep this document in a safe place for future reference.

To ensure safe and efficient operation, we recommend that you carry out the necessary maintenance operations regularly. Our After-Sales service can help you with these operations.

We hope that you will be satisfied with our services for many years.

AIRWELL

This manual is referring to the following unit :

Designation	Code
EDHX-500R-04T35	7MB140055
EDHX-600R-04T35	7MB140056
EDHX-700R-04T35	7MB140057

The data contained in this manual are not binding and may be modified by the manufacturer without prior notice.

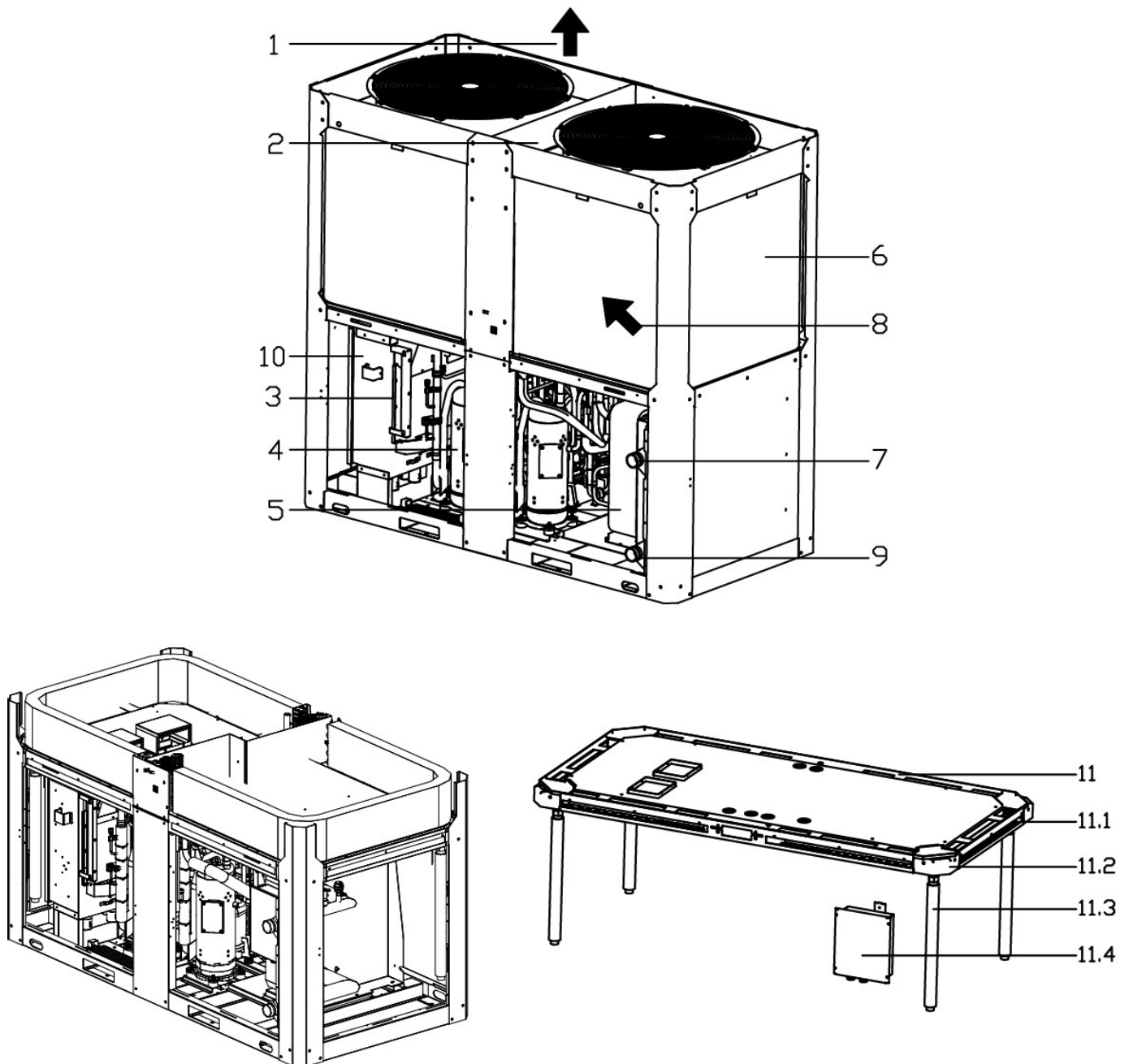
SUMMARY

1	COMPONENT LAYOUT	6
2	System diagram	8
2.1	Refrigerent diagram cooling	8
2.2	Refrigerent diagram heating.....	8
2.3	Full system diagram	10
2.4	Key components.....	12
3	CONTROL FUNCTION	15
3.1	Standy control	15
3.2	Startup Control	16
3.3	Normal operation control.....	19
3.4	Shutdown control.....	21
3.5	Defrosting control	21
3.6	Fan control	22
3.7	Variable-frequency water pump control	23
3.8	Forced exhaust fan control.....	25
3.9	Cooling fan control	26
3.10	Control of electronic expansion valves.....	27
3.11	Anti-freezing control	30
3.12	Energy saving mode	31
3.13	Remore function control	31
3.14	Temperature compensation control	31
3.15	Cascade control	32
3.16	Heater 1 control.....	34
3.17	Heater 2 control.....	34
4	DISPLAY READING VALUES	35
5	User interface field settings.....	37
5.1	Introduction.....	37
5.2	Service menu	38
5.3	Project menu	49
5.4	Parameters list	55
6	Electric wiring diagram	57
7	PCB	58
7.1	Main Control PCB.....	58
7.2	Expansion board	63
7.3	Fuse board	64
7.4	AC filter board	65
7.5	Compressor & fan driver board	66
7.6	PED board.....	67
8	ERROR CODE	68
9	TROUBLESHOOTING	70
9.1	Warning	70
9.2	E0, 1H9 Troubleshooting	71
9.3	E1 Troubleshooting	72

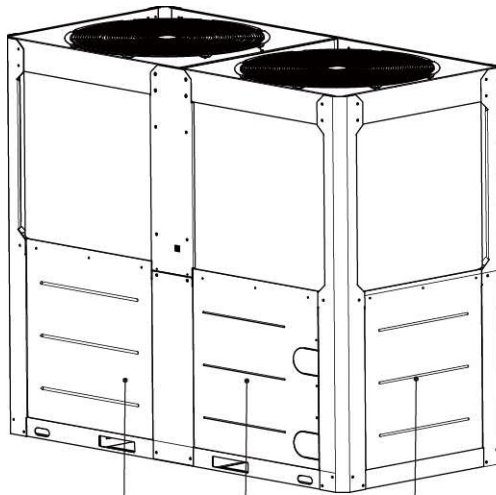
9.4	E2 Troubleshooting	73
9.5	E3 / E4 / 1E5 / E6 / E7 / 1Eb / 2Eb / Ed / 1EE / 2EE / EF / EP / EU / Fb / Fd Troubleshooting	75
9.6	E8 Troubleshooting	77
9.7	E9 Troubleshooting	79
9.8	EC Troubleshooting	80
9.9	P0 / 1P0 Troubleshooting.....	81
9.10	P1 Troubleshooting	83
9.11	1P4 / 2P4 Troubleshooting.....	85
9.12	P7 Troubleshooting	87
9.13	P9 Troubleshooting	89
9.14	Pb Troubleshooting	90
9.15	PC Troubleshooting	91
9.16	PH Troubleshooting	93
9.17	PE Troubleshooting.....	94
9.18	PL / C7 Troubleshooting	96
9.19	1PU / 1FF Troubleshooting	97
9.20	1F0 Troubleshooting	99
9.21	H5 Troubleshooting	101
9.22	1F6 Troubleshooting	102
9.23	1HE / 2HE / 3HE Troubleshooting	103
9.24	F2 Troubleshooting	104
9.25	1F4 Troubleshooting	106
9.26	FP Troubleshooting	106
9.27	bH Troubleshooting	107
9.28	HC Troubleshooting	108
9.29	P3 Troubleshooting	109
9.30	PA Troubleshooting.....	110
9.31	1L10 Troubleshooting	111
9.32	1L11 Troubleshooting	113
9.33	1L20 Troubleshooting	114
9.34	1L30 Troubleshooting	115
9.35	1L31 Troubleshooting	116
9.36	1L32 Troubleshooting	118
9.37	1L34 Troubleshooting	119
9.38	1L43 Troubleshooting	121
9.39	1L45 Troubleshooting	122
9.40	1L46 Troubleshooting	123
9.41	1L47 Troubleshooting	124
9.42	1L50 Troubleshooting	125
9.43	1L52 Troubleshooting	126
9.44	1L60 Troubleshooting	126
9.45	1L61 Troubleshooting	127

9.46	1L65 Troubleshooting	127
9.47	1L6b Troubleshooting	128
9.48	1L6C Troubleshooting	128
9.49	1L6d Troubleshooting	129
9.50	1L6E Troubleshooting	129
9.51	1L6E Troubleshooting	130
10	Compressor replacement procedure.....	131
10.1	Remove faulty compressor and remove oil.....	131
10.2	Inspect oil from faulty compressor	131
10.3	Check oil in other compressors in the system	131
10.4	Replace oil separator(s) and accumulator(s)	131
10.5	Check filters(s)	131
10.6	Replace the faulty compressor and re-fit the other compressors	131
10.7	Add compressor oil.....	131
10.8	Vacuum drying and refrigerant charging	131
11	Appendix	133
11.1	Temperature Sensor Resistance Characteristics	133

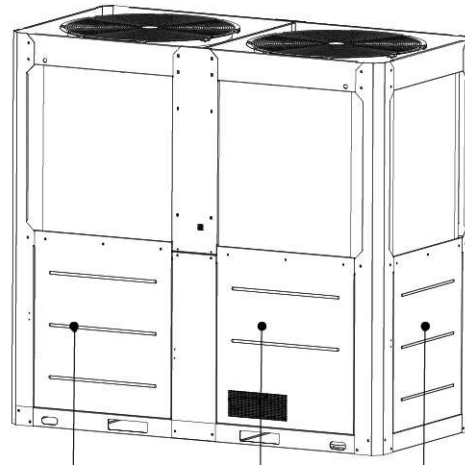
1 COMPONENT LAYOUT



NO.	NAME	NO.	NAME
1	Air outlet	9	Water inlet
2	Top cover	10	Wire controller (It can be placed indoors)
3	Electric control box	11	Centralized drainage selectionpiece
4	Compressor	11.1	Heater band
5	Plate heat exchanger	11.2	Defrosting pan
6	Heat exchanger	11.3	Drain-pipe
7	Water outlet	11.4	Tropical junction box
8	Air inlet		

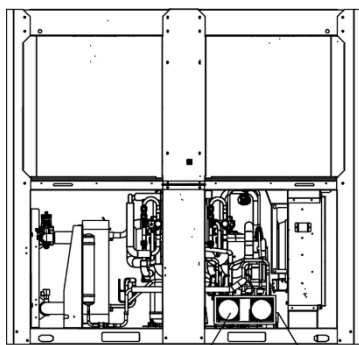


Cover 1 Cover 2 Cover 3

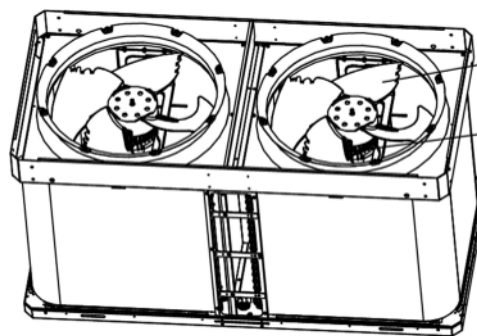


Cover 6 Cover 5 Cover 4

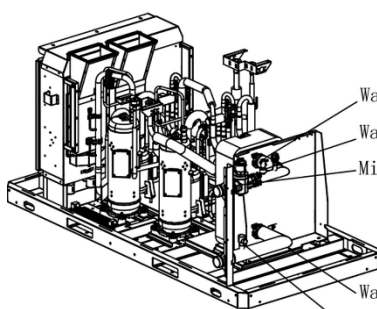
Panel	Used for
Cover 1-2-3	Access and maintain water pipes and water-side heat exchangers
Cover 4	Open and inspect the electric control box
Cover 5-6	Inspect the system pipelines



DC fan Gas Sensor



Axial Flow Fan
Brushless DC Motor



Water outlet pipe assembly
Water flow switch
Micro-bubble valve
Water inlet pipe part
Safety Valve

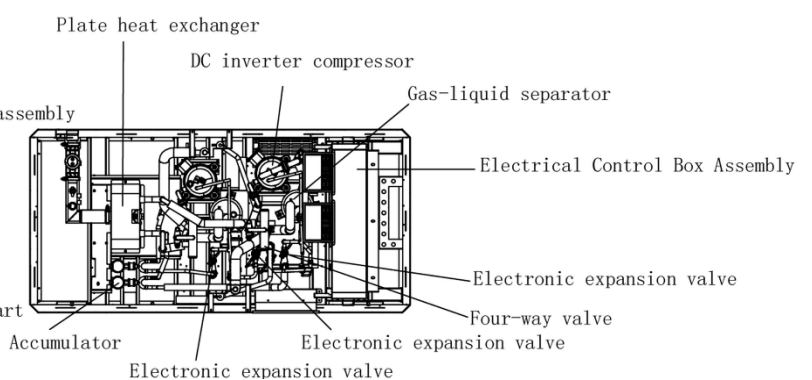
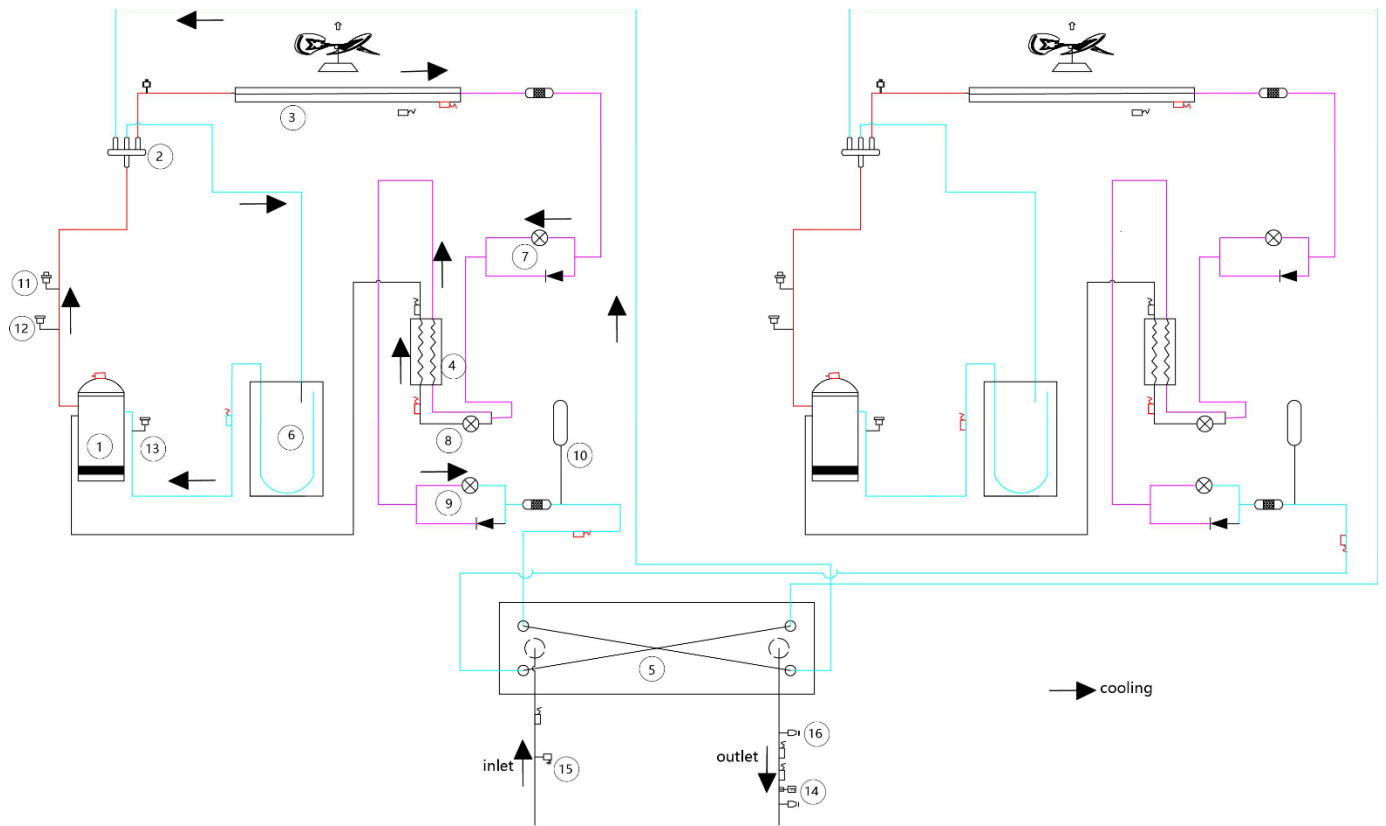


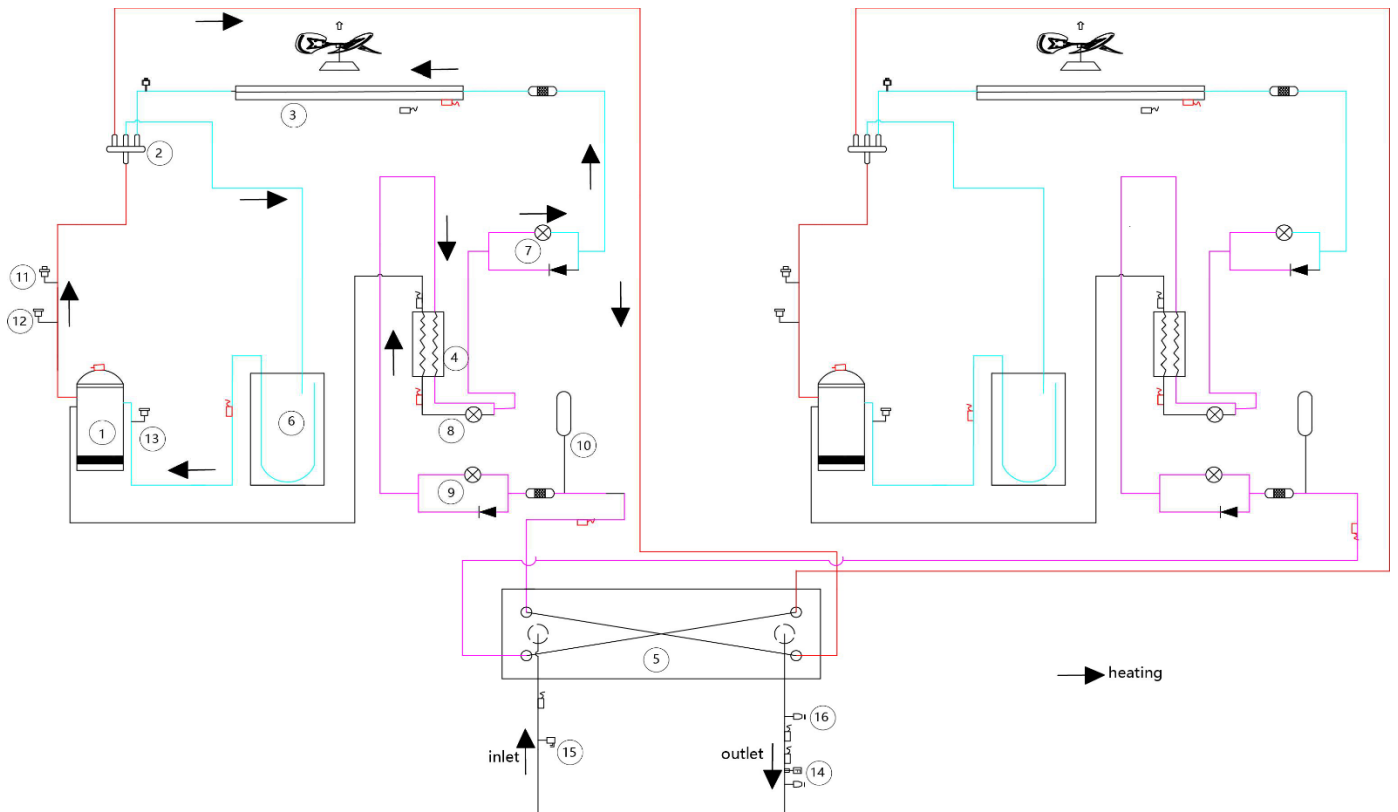
Plate heat exchanger
DC inverter compressor
Gas-liquid separator
Electrical Control Box Assembly
Electronic expansion valve
Four-way valve
Accumulator
Electronic expansion valve

2 SYSTEM DIAGRAM

2.1 Refrigerent diagram cooling

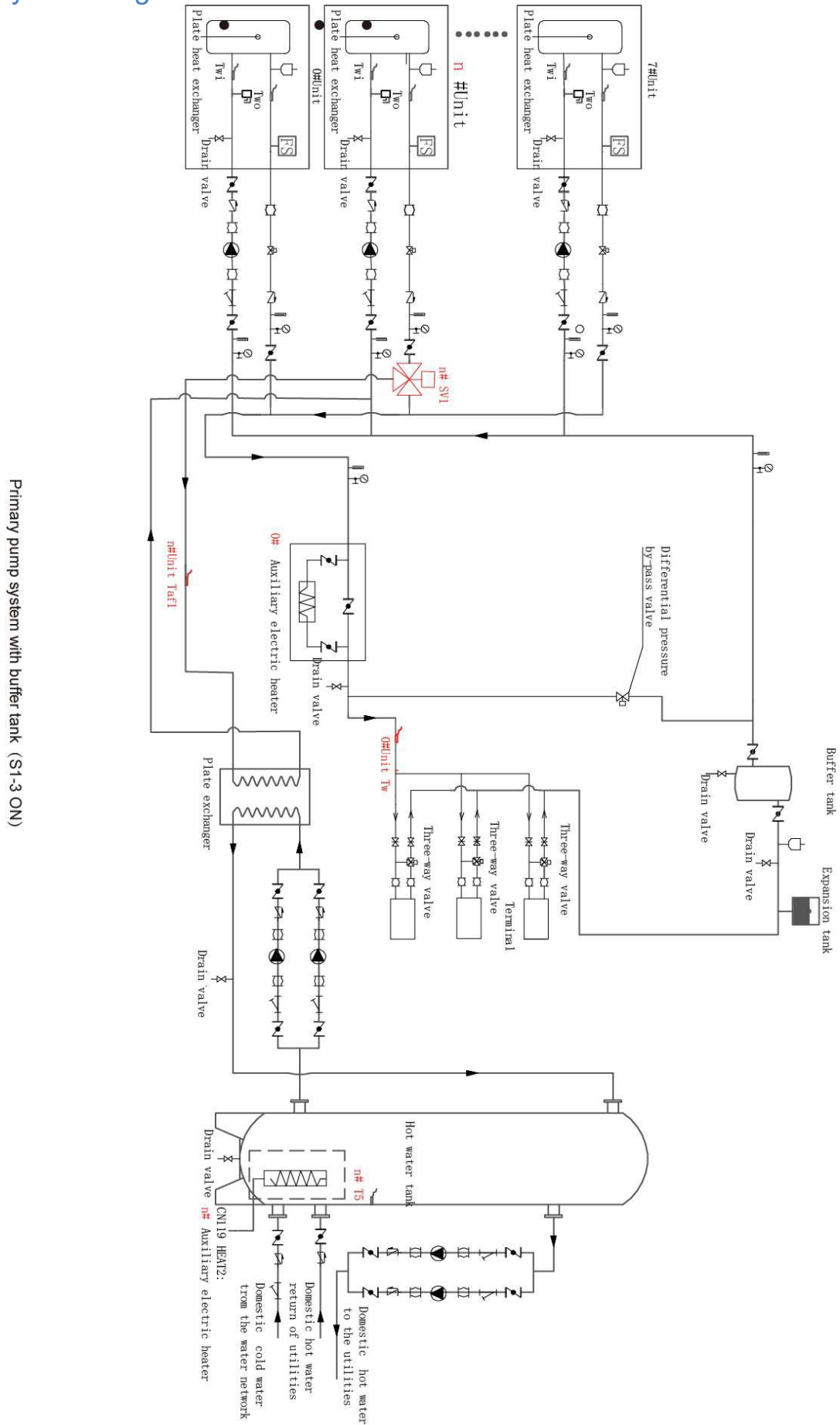


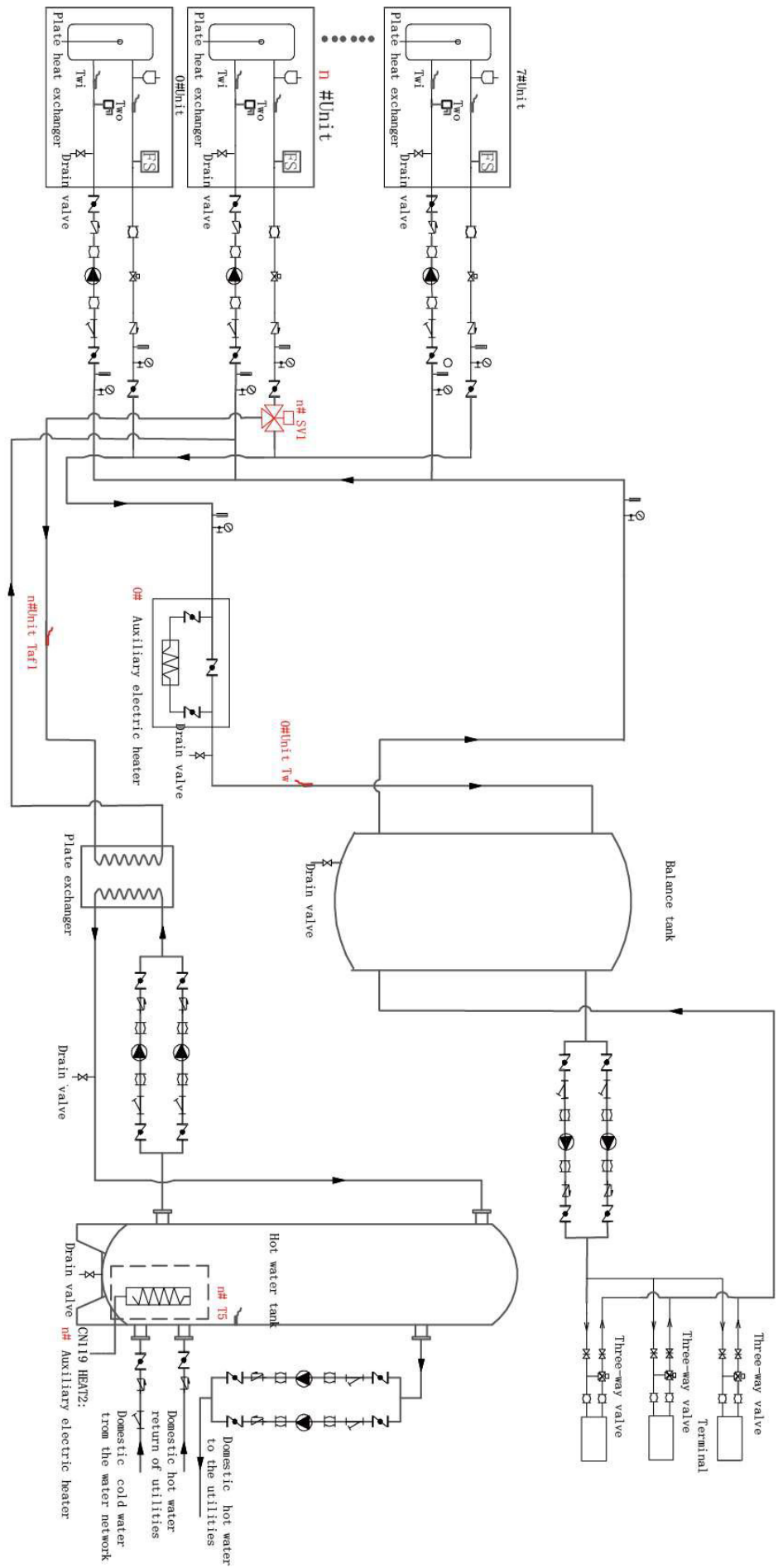
2.2 Refrigerent diagram heating



Item	Description	Function
1	Compressor	Provides circulation power for the heat pump system
2	Four-way valve	Switches refrigerant flow direction for cooling/heating
3	Fan	Provides forced airflow for heat exchange
4	Economizer	Heat exchanger for vapor injection (EVI)
5	Plate heat exchanger	Exchanges heat between water and refrigerant
6	Accumulator	Separates gas/liquid refrigerant; stores excess refrigerant
7	Electronic Expansion Valve (EEV)	Throttling during heating operation
8	Electronic Expansion Valve (EEV)	Throttling during vapor injection
9	Electronic Expansion Valve (EEV)	Throttling during cooling operation
10	Liquid receiver	Stores excess refrigerant during heating operation
11	High-pressure switch	Protects system against overpressure
12	High-pressure sensor	Monitors high-side pressure
13	Low-pressure sensor	Monitors low-side pressure
14	Water flow switch	Protects unit against low water flow
15	Safety valve	Relieves pressure if water-side pressure is too high
16	Micro-bubble valve	Efficiently separates gas from water

2.3 Full system diagram





Secondary pump system with buffer tank (S1-3 ON)

	Water flow switch		Gate valve		Safety valve		Drain valve		Auto vent valve
	Soft joint		Water pump		Shut off valve		Temperature sensor		Solenoid three-way valve
	Water pressure meter		Check valve		Thermometer		Y-type strainer		Expansion vessel

2.4 Key components

No.	component	function	specifications	
1	DC inverter compressor	Circulation power for heat pump systems	DKDA110DGB-SA1S	2
2	Compressor heating tape	Heating the oil pool at the bottom of the compressor	DJRD-520A-2400-50W-VHR	2
3	Discharge temperature Tp1	Measurement of compressor discharge temperature	CGQ-WD/PQ3950-L4000-XAP2-G3700	2
4	Discharge temperature switch	Protection of the system from exceeding the safe temperature range	PQWKQ-115/75-3100-AMP	2
5	High pressure switch	Protection of the system from exceeding the safe pressure range	YK-3.5/2.6-C-3000(UL)	2
6	Four-way valve	For switching refrigerant flow direction for refrigeration and heating	STFTJ-35-W-N1-220V-L3500-VHR, minimum 0.1MPa reversing differential pressure	2
7	DC Fan	Provide forced heat transfer power	ZKSN-920-10-2L-3 maximum speed 830r/min	2
	Wind turbine	Exhaust	ZL-750*210*20-4	2
8	Air side heat exchanger	Place of heat exchange with refrigerant	Number of rows/ row	3
			Pipe spacing/mm	21
			Row spacing/mm	19.4
			Fin spacing/mm	1.5
			Copper tube specification/mm	7
			D×H/mm	2395×798
			Number of condensers	2
			Number of flow paths (inlet×outlet)	19×19
			Number of U-tubes in a row	19
9	Outdoor coil temperature T3	Detecting fin type heat exchanger temperature	CGQ-WD/GW4100-L3300-XHB2R	2
10	Total heat exchanger outlet temperature Tz	Hot water side panel for refrigerant outlet	CGQ-WD/GW4100-L3300-XAP2	2
11	Electronic expansion valve front and rear filters	Prevents impurities from entering the electronic expansion valve	GLQ-64B 80 mesh	4

12	Electronic expansion valve EXVA	Throttling effect during cooling and heating operation	D32MISZ-1R 3.2mm	2
13	EXVA parallel connection check valves	Bypass function in refrigeration	DXF-41A	2
14	Electronic expansion valve EXVB	Throttling effect during cooling and heating operation	UKV-H40DU14 4.0mm	2
15	EXVB parallel connection check valves	Bypass function during heating	DXF-41A	2
16	Liquid storage tank	Storage of excess refrigerant	ZYT-9.52×64×V1.1A 1.1L	2
17	Plate exchange heating tape	Heating for plate heat exchanger	DJRD-200X80D-4200-25W-VHR	2
18	Water-side anti-freezing temperature Taf1/2	Taf1: Water tank anti-freezing temperature	Taf1 : WD/SWD3970-L10000-AMP2(RSG)	customizable
		Taf2: Plate exchange anti-freezing temperature	Taf2 : CGQ-WD/SWD3970-L3200-AMP2	1
19.1	Pressure sensors	Detecting high pressure	CGQ-YL-4.6MPa-L3000-L	2
19.2	Pressure sensors	Detecting low pressure	CGQ-YL-2.0M-L-3000	2
20	Gas-liquid separator	Storage of excess refrigerant	QYFLQ-22×22×2.1×127×V7.2, 7.2L , Pipe diameter 22, oil return hole 2.1	2
21	Return gas temperature Th	/	CGQ-WD/GW4100-L3300-XAP2	2
22	Outdoor ambient temperature T4	Detection of outdoor ambient temperature	CGQ-WD/SW4100-L2600-XHB2B	1
23	Inlet water temperature Twi	/	CGQ-WD/GW3970-L4500-AMP2-P4420	1
24	Water-side safety valve	Pressure relief when water-side pressure is too high	AQF-06B-G1/2	1
25	Discharge valve	Discharge of water-side air	PQF-03	1
26	Outlet temperature Two	/	CGQ-WD/SWD3970-L3200-AMP2	1
27	Water flow switch	Protection in case of low water flow	SLKG-65-68-4000	1
28	Total outlet temperature Tw	/	CGQ-WD/GW3970-L4500-AMP2-P4420	1
29	Plate heat exchanger	Heat exchange between water and refrigerant	HBL133-54D-V	1
30	Target flow electric heating belt	Water-side anti-freezing heating	DJRD-200X80D-4200-25W-VHR	1
31	High and low pressure pin valve	For refrigerant charging	/	4
32	Tank temperature T5	Detecting the hot water temperature in the tank	WD/SWD3970-L10000-AMP2(RSG)	1
33	Wired Controller	/	KJRM-120H3/BMWK0-E	1
34	Economizer	Heat exchanger for gas injection	C12L-EZ-20	2

35	Injection electronic expansion valve EXVC	Throttling effect during jet enthalpy increase	D16MISZ-1R 1.6mm	2
36	Auxiliary entry temperature sensor T6A	/	CGQ-WD/GW4100-L2500-XHP4-P2250-2	2
37	Auxiliary out temperature sensor T6B	/	CGQ-WD/GW4100-L2500-XHP4-P2250-2	2
38	Power Module	Supplies power to cooling fan and forced exhaust fan	V-COH-DXX-A[DC FAN POWER 24V	2
39	Micro-Bubble Valve	Efficiently separates gas from water	PQF-VPKP-1	1

Compressor:

The refrigerant is compressed which also raise its temperature. The refrigerant enters the compressor as a low-pressure, low-temperature gas and exits the compressor as a high-pressure, high-temperature gas.

Fan:

Ventilates the air side heat exchanger.

Air side heat exchanger:

Heat is transferred from the refrigerant into the surrounding air by first passing through the tube coils where the heat is transferred to the fins via conduction. It then dissipates into the air forced through the heat exchanger.

Plate heat exchanger:

Facilitates transfer of heat between two fluids. This type of exchange offers a significant advantage over conventional heat exchangers as fluids are exposed to a much larger surface area which better facilitates the transfer of heat while greatly accelerating temperature increase.

4-way valve:

To better control refrigerant flow, Mars series features an upgraded 4-way valve default position which remains closed in heating mode (no electrical signal) and open in cooling mode. When closed, the air-side heat exchanger functions as an evaporator and water side heat exchanger functions as a condenser; when open, the air side heat exchanger functions as a condenser and water side heat exchanger function as an evaporator.

Electronic expansion valve (EXV):

Controls refrigerant flow and reduces refrigerant pressure as necessary.

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.

Water flow switch:

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

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.

3 CONTROL FUNCTION

3.1 Standby control

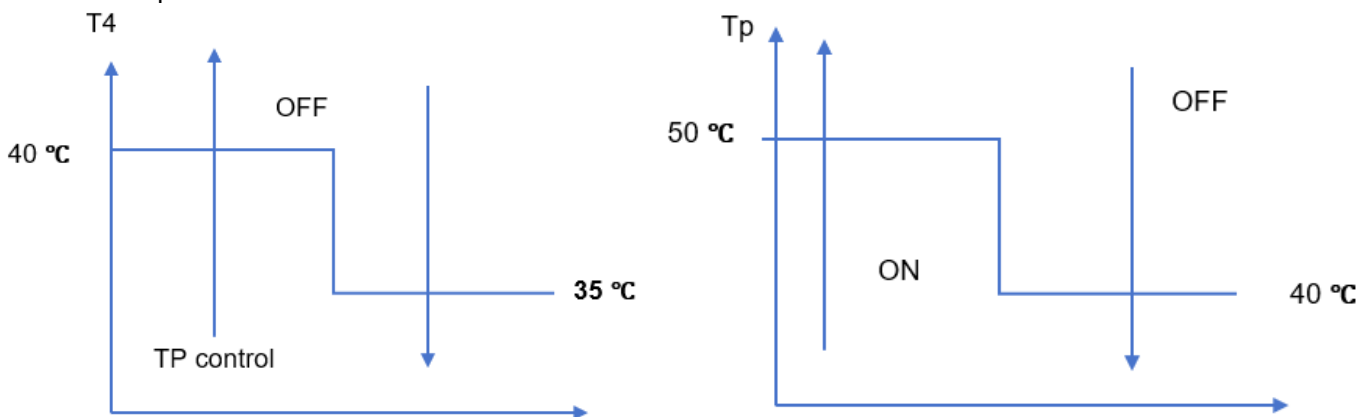
3.1.1 Control of first start and restart after shutdown

In order to prevent frequent start and stop of the compressor and balance the pressure inside the cooling system, the compressor shall be forcibly stopped for 7 min (except for special controls such as defrosting) before restart.

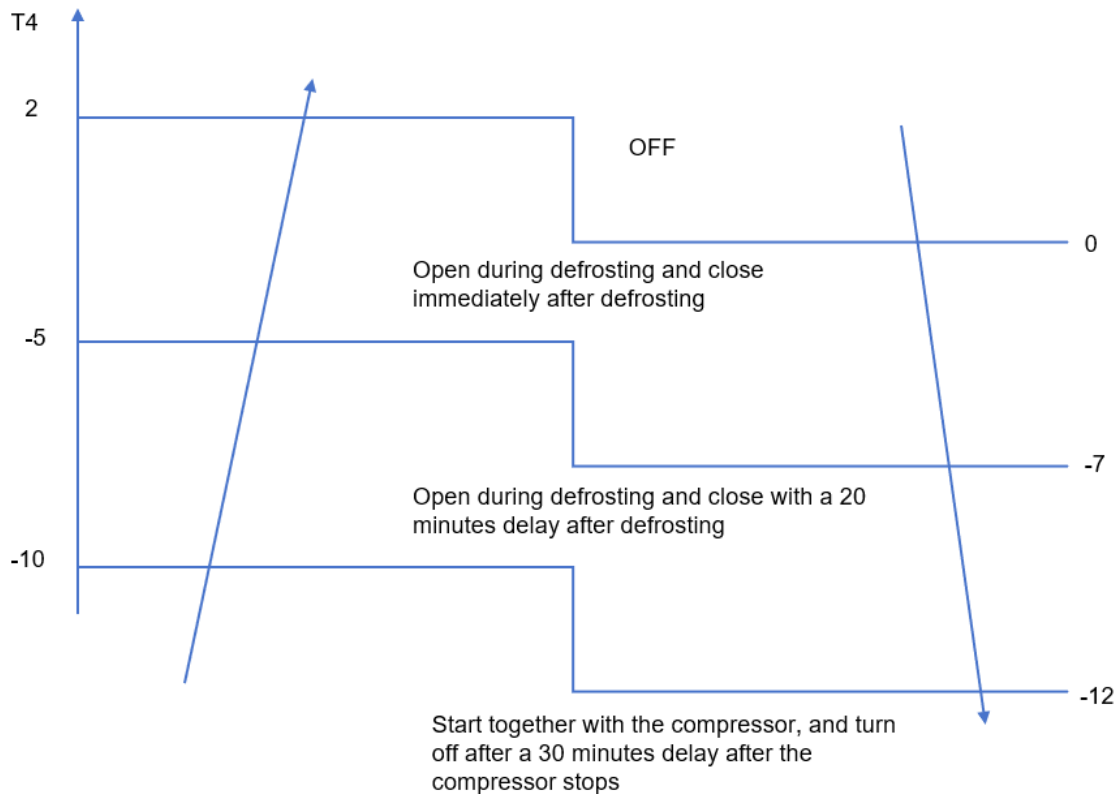
3.1.2 Control of heating tape of crankcase

In order to prevent the refrigerant from dissolving in the cooling oil of the compressor during shutdown, this mode is used to control the heating tape of the crankcase.

For the outdoor unit, the working mode of the heating tape of the crankshaft shall be determined as per the outdoor environmental temperature firstly, based on the compressor temperature after entering the temperature judgment control state of the compressor.



3.1.3 Central drainage heater control



3.1.4 Plate heat exchanger heater control

When the unit is in standby or shutdown mode, it runs at $T_{af2} \leq 4\text{ }^{\circ}\text{C}$ and stops at $T_{af2} \geq 10\text{ }^{\circ}\text{C}$

3.1.5 Water flow switch electric heater control

Opening conditions: $T_4 < 3\text{ }^{\circ}\text{C}$ and $\min(T_{wi}, T_{wo}) < 5\text{ }^{\circ}\text{C}$

Stop condition: $T_4 \geq 5\text{ }^{\circ}\text{C}$ or $\min(T_{wi}, T_{wo}) \geq 10\text{ }^{\circ}\text{C}$

3.1.6 Water pump control

3.1.6.1 Water pump control during cooling or heating

1) When the system is powered on, after the water pump receives the startup instruction, the water flow switch is checked first, the water flow is checked 1 min 45s after the water pump starts, and the water flow failure is triggered when it occurs. When the water flow is normal, the water pump remains on during operation; if a water flow fault occurs, the water pump stops immediately.

2) Upon shutdown, water pumps of the master unit and slave units stop after a 2 min delay once all modular units have stopped.

3) When the unit reaches the set temperature, unloads, or enters standby, the master unit pump remains running; the slave unit pump stops after a 2 min delay, then runs for 2 min every 20 min (invalid in DHW mode). After the master unit enters standby upon the system water temperature (T_w) reaching the set temperature, or when all compressors in the system are shut down, the water pump stops after a delay of PUMP ON TIME (set via wired controller, default 5 min). After the pump remains off for PUMP OFF TIME (set via wired controller, default 0 min), it restarts and runs for PUMP ON TIME (default 5 min), repeating this cycle. The pump runs continuously when system operating conditions are met.

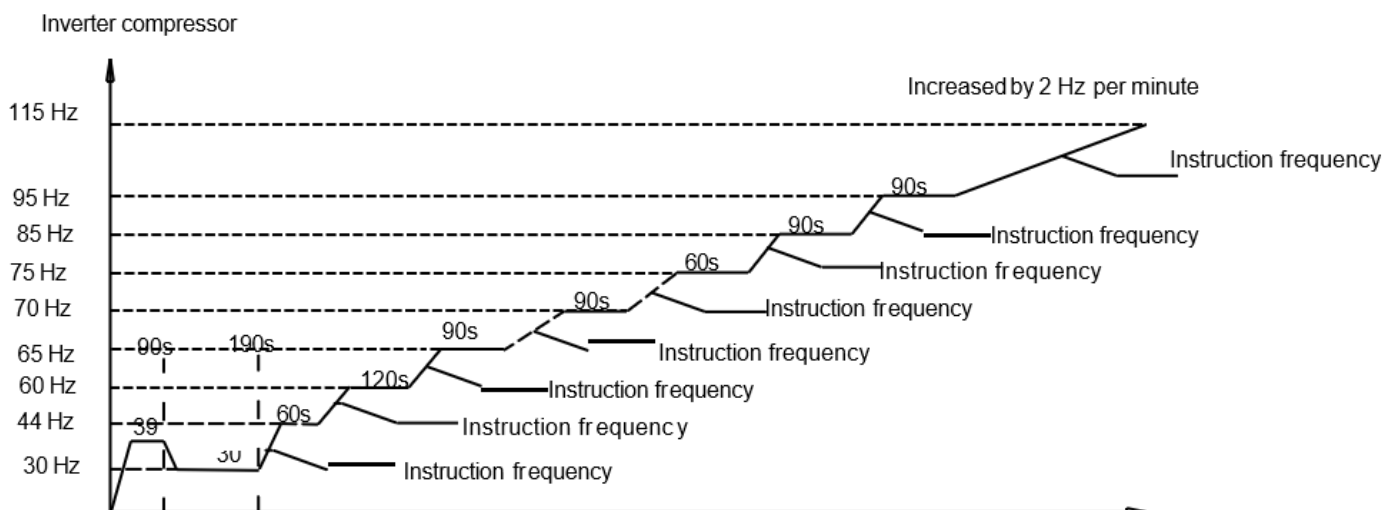
3.1.6.2 Water pump control for DHW

1) When the system is powered on, after the water pump receives the startup instruction, the water flow switch is checked first, the water flow is checked 2 min after the water pump starts, and the water flow failure is triggered when it occurs. When the water flow is normal, the water pump remains on during operation; if a water flow fault occurs, the water pump stops immediately.

2) Upon shutdown, the pump stops after a 2 min delay. When the DHW water temperature shutdown condition is met, the pump stops after a 2 min delay.

3.2 Startup Control

3.2.1 Cooling start frequency-raising control



3.2.2 Cooling start control

Component Name	Electrical Symbol	50/60/70	Functions of Functional Components
Water pump	PUMP	•	After the water pump started for 1 minute and 45 s, the water flow switch is continuously detected. If the water flow switch is not closed, and the operation of the pump is stopped, a water flow fault is displayed. The compressor can be started after the water flow becomes normal.
Variable-frequency compressor	BP1	•	Control of water outlet temperature. The operating frequency is increased or reduced by 1 Hz/s, and the implementation is carried out as per the start platform.
Variable-frequency fan	FAN1	•	The fan is started 60 s before the compressor, which is controlled as per the exhaust pressure of the outdoor unit after the fan operates for 120 s at the initial target air speed.
Electronic expansion valve	EXV-A	•	The opening is fixed at 480P.
Electronic expansion valve	EXV-B	•	The opening is between 0 and 480P, which is controlled as per the superheat of the return air.
Electronic expansion valve	EXV-C	•	Enhanced vapor injection EXV, with an opening of 0-480P, which is control based on the inlet and outlet temperature difference of the economy.
Four-way valve	ST1	•	Power-on

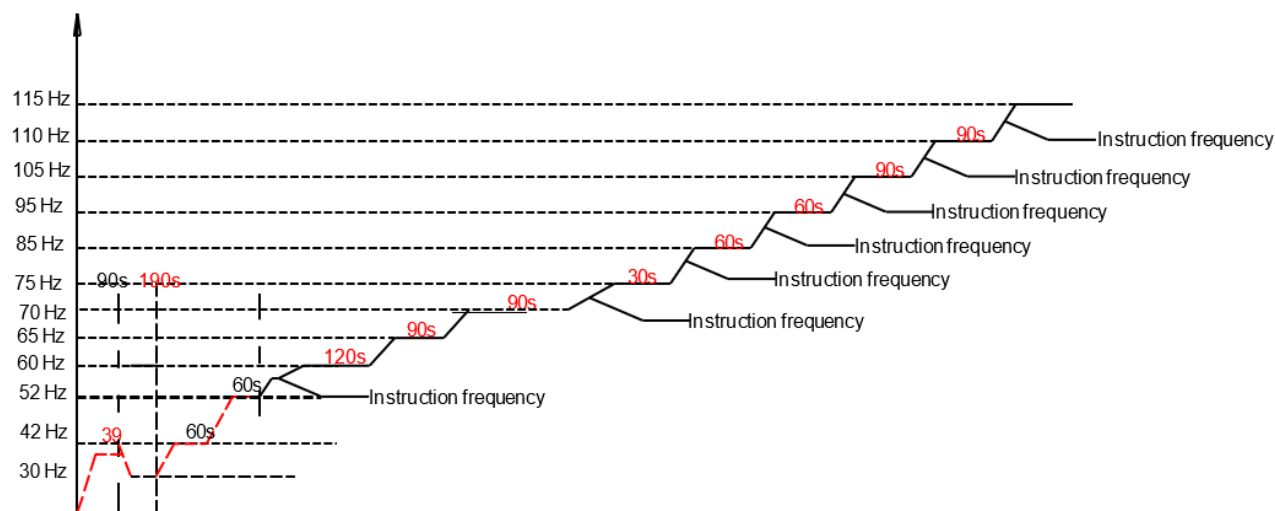
3.2.2.1 Cooling Single Unit Capacity Output Control

When the compressor operating frequency (running at the initial frequency if not limited, or at the limited frequency if the limited frequency is lower than the initial frequency) remains stable for 5 minutes [Tim_Fqc_Stable] without any changes, the following adjustments will be made: increase the frequency once every 60 seconds [Tim_Fqc_Ups], and decrease the frequency once every 60 seconds [Tim_Fqc_Downs].

	Two
Tws+2	+8 Hz
Tws+1.5	+6 Hz
Tws+1	+4 Hz
Tws+0.5	+2 Hz
Tws	0 Hz
Tws-0.5	-2 Hz
Tws-1	-4 Hz
Tws-1.5	-6 Hz
Tws-2	-8 Hz
	Shutdown

3.2.3 Heating start frequency-raising control

Inverter compressor



3.2.4 Heating/DHW start control

Component Name	Electrical Symbol	50/60/70	Functions of Functional Components
Water pump	PUMP		After the water pump started for 1 min 45s, the water flow switch is continuously detected. If the water flow switch is not closed, and the operation of the pump is stopped, a water flow fault is displayed. The compressor can be started after the water flow becomes normal.
Inverter compressor	BP1	•	Control of water outlet temperature. The operating frequency is increased or reduced by 1 Hz/s, according to the startup platform instructions.
Inverter fan	FAN1		The fan is started 60s before the compressor, which is controlled as per the evaporation pressure after the fan operates for 360s at the initial target fan speed.
Electronic expansion valve	EXV-A	•	The opening is between 0 and 480P, which is controlled as per the discharge superheat.
Electronic expansion valve	EXV-B	•	The opening is fixed at 480P.
Electronic expansion valve	EXV-C	•	Enhanced vapor injection (EXV), opening of 0-480P, which is control based on the inlet and outlet temperature difference of the economizer.
Four-way valve	ST1	•	Power-off, and power-on during defrosting
Switching of three-way electromagnetic valve for heating/water heating	SV1	•	The valve is opened in the DHW mode.

3.2.4.1 Single unit capacity output control

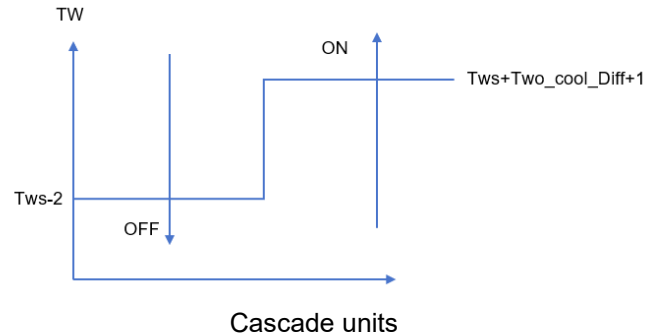
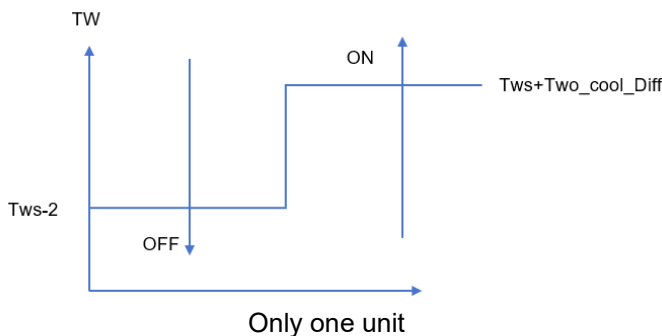
When the compressor operating frequency (running at the initial frequency if not limited, or at the limited frequency if the limited frequency is lower than the initial frequency) remains stable for 5 min [Tim_Fqc_Stable] without any changes, the following adjustments will be made: increase the frequency once every 60s [Tim_Fqc_Up], and decrease the frequency once every 60s [Tim_Fqc_Down].

	Two
Tws+2	Shutdown
Tws+1.5	-8 Hz
Tws+1	-6 Hz
Tws+0.5	-4 Hz
Tws	-2 Hz
Tws-0.5	0 Hz
Tws-1	+2 Hz
Tws-1.5	+4 Hz
Tws-2	+6 Hz
	+8 Hz

3.3 Normal operation control

3.3.1 Cooling operation control

Component Name	Electrical Symbol	70/60/50 kW	Functions of Functional Components
Water pump	PUMP	•	On
Inverter compressor	BP1	•	Control of water outlet temperature. The operating frequency is increased or reduced by 1 Hz/s.
Inverter fan	FAN1	•	The fan is controlled as per the discharge pressure of the ODU, and is adjusted every 60s from 0 to 32 positions.
Electronic expansion valve	EXV-A	•	The opening is fixed at 480P.
Electronic expansion valve	EXV-B	•	The opening is between 0 and 480P, which is controlled as per the return air superheat.
Electronic expansion valve	EXV-C	•	Enhanced vapor injection (EXV), with an opening of 0-480P, which is control based on the inlet and outlet temperature difference of the economizer.
Four-way valve	ST1	•	Power-on

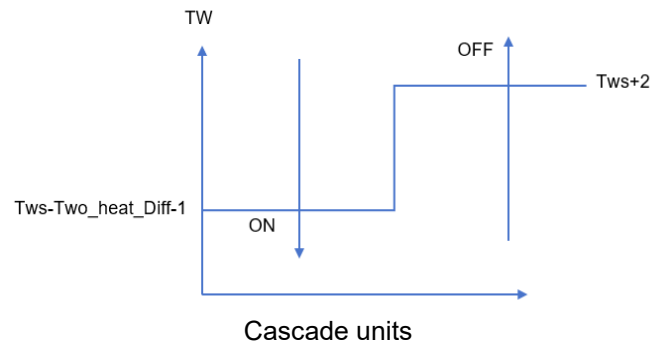
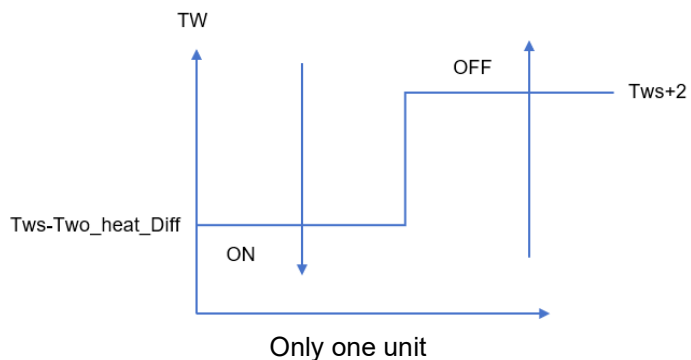


Two_cool_Diff can be set on the wired controller and default is 2.

$$Tws = \text{Max}(Tws, Tstopc)$$

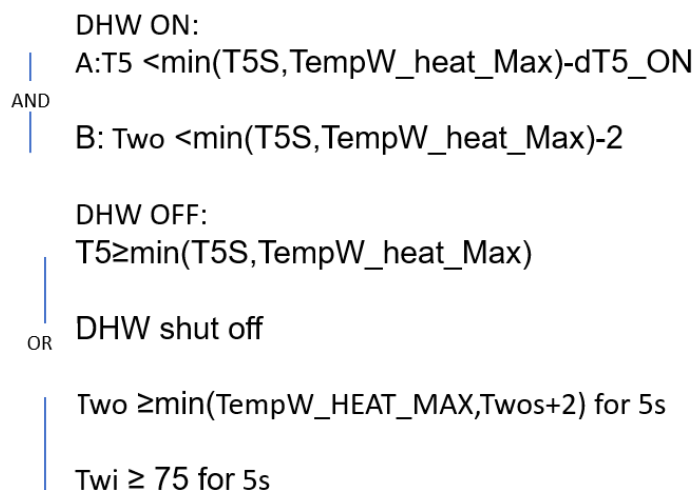
3.3.2 Heating / DHW operation control

Component Name	Electrical Symbol	70/60/50 kW	Functions of Functional Components
Water pump	PUMP	•	On
Inverter compressor	BP1	•	Control of water outlet temperature. The operating frequency is increased or reduced by 1 Hz/s, according to the startup platform instructions.
Inverter fan	FAN1	•	The fan is adjusted as per the evaporation pressure P_e during operation.
Electronic expansion valve	EXV-A	•	The opening is between 0 and 480P, which is controlled as per the discharge superheat.
Electronic expansion valve	EXV-B	•	The opening is fixed at 480P.
Electronic expansion valve	EXV-C	•	Enhanced vapor injection (EXV), with an opening of 0-480P, which is control based on the inlet and outlet temperature difference of the economizer.
Four-way valve	ST1	•	Power-off, and power-on during defrosting
Switching heating/DHW Solenoid three-way valve	SV1	•	The valve is opened in the DHW mode.



Two_heat_Diff can be set on the wired controller and default is 2

$Tws = \min(Tws, TempW_HEAT_MAX)$



$$Twos = T5s + dT1S5 \leq TempW_HEAT_MAX$$

3.4 Shutdown control

3.4.1 Fault shutdown

In order to protect the compressor, in case of any abnormal conditions, the system will shut down (the compressor/fan will stop).

3.4.2 Shutdown

After the unit is shut down through the wired controller, the compressor fan stops running, the four-way valve is in the OFF state after shutdown, and the electronic expansion valve (EXV) is in standby state. The standby opening of the AB valve is 320P, and the standby opening of the C valve is 0P.

3.4.3 Temperature reaching shutdown

The system will shut down after the water outlet temperature reaches the set temperature.

3.5 Defrosting control

To prevent poor heat exchange due to frosting of the heat exchanger (i.e., evaporator) of the ODU during heating operation, defrosting is carried out through these control procedures to restore the heating capacity.

Defrosting entry conditions: The parameters of the ODU for defrosting entering and exiting include outdoor ambient temperature, temperature of the outdoor heat exchanger, water inlet temperature, operating time of the ODU, and defrosting time of the ODU.

Component Name	Electrical Symbol	70/60/50 kW	Functions of Functional Components
Water pump	PUMP	●	On
Inverter compressor	BP1	●	Defrosting instruction frequency operation
Inverter fan	FAN1	●	Off
Electronic expansion valve	EXV-A	●	With a maximum opening of 480P
Electronic expansion valve	EXV-B	●	With a maximum opening of 480P
Electronic expansion valve	EXV-C	●	The opening is fixed at 96P.
Four-way valve	ST1	●	Power-on

First time power on

Condition 1: in $T4 \leq 10^{\circ}\text{C}$, the unit running for 15mins, if $T3 < -5^{\circ}\text{C}$, the unit will be defrosting immediately.

Condition 2: $T3 < \min(-20, T4 - 14)$ for 5 minutes.

Normal operation

Step 1: Accumulate the $T3 \leq 0^{\circ}\text{C}$ time (default; can be set by $T_DEFROST_IN$: -5°C to 5°C) more than 35 min (default; can be set by controller T_FROST : 20min to 120min), then entering the next step.

Step 2: Accumulate the time up to 75-110min determined by different $T4$ and $T3$ values, T_{wi} , then entering to defrosting.

Exit operation

Detect the $T3$ (default; can be set by T_FROST_OUT : -10°C to 10°C), and exit defrost via exit condition table.

Meet any of the conditions:

- Condition 1: defrost time for 10 min
- Condition 2: see table below
- Condition 3: $T_{wo} \leq 5^{\circ}\text{C}$

T_{wi} Temp	$T3$ Temp	Description
$T_{wi} \leq 30^{\circ}\text{C}$	$5^{\circ}\text{C} \leq T3 < 10^{\circ}\text{C}$	Exit after 180s
	$10^{\circ}\text{C} \leq T3 < 15^{\circ}\text{C}$	Exit after 120s
	$T3 \geq 15^{\circ}\text{C}$	Exit immediately
$30^{\circ}\text{C} < T_{wi} \leq 40^{\circ}\text{C}$	$5^{\circ}\text{C} \leq T3 < 7^{\circ}\text{C}$	Exit after 150s
	$7^{\circ}\text{C} \leq T3 < 12^{\circ}\text{C}$	Exit after 120s
	$T3 \geq 12^{\circ}\text{C}$	Exit immediately
$T_{wi} > 40^{\circ}\text{C}$	$5^{\circ}\text{C} \leq T3 < 7^{\circ}\text{C}$	Exit after 120s
	$7^{\circ}\text{C} \leq T3 < 10^{\circ}\text{C}$	Exit after 90s
	$T3 \geq 10^{\circ}\text{C}$	Exit immediately

Cascade installation

When in cascade installation, the system will not enter defrosting for all the units, and just make part of the combination enter defrosting process to make sure there is no big influence on the water temperature. For default setting, only 50% will enter the defrosting process. And this percentage can be changed.

Frequency

Before defrosting process, unit will reduce the frequency first to 38Hz and then switch the 4-way valve direction to make sure the water temperature not with a big influence and the noise is not so high.

Defrosting recycle frequency

We have made a design to change the defrosting recycle frequency based on the water temperature and to make sure the system running more stainable and more reasonable.

Monitoring

Unit will monitor the condensation pressure /evaporation pressure/ real time water temperature /current to change the defrosting control to make sure the system running in a stainable condition.

3.6 Fan control

3.6.1 Cooling control

- 1) The initial fan speed is determined based on the ambient temperature
- 2) The rotating speed is controlled through the high pressure P_c during operation. If P_c is too high, the fan speed will increase; if P_c is too low, the fan speed will be reduced

3.6.2 Heating control

1)The initial fan speed is determined based on the ambient temperature

2)The rotating speed is controlled through the low pressure P_e during operation. If P_e is too high, the fan speed will be reduced; if P_e is too low, the fan speed will increase.

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

3.6.3 Maximum fan speed control

Fan Mode		50/60/70 kW	Implementation Condition	Description	Note:
Silent Mode Selection	Standard mode	32	This mode is set through the wired controller (factory default)		
	Night silent mode 1	24	The night silent mode is set through the wired controller, which is entered after several hours when T_4 detected by the master unit is lower than the maximum temperature recorded. The mode will exit forcibly when $T_{3min} \geq 40^\circ\text{C}$. The mode can be entered when $T_{3min} \leq 35^\circ\text{C}$.	6/10h	The "standard mode + silent mode" can be achieved through time combination.
	Night silent mode 2			6/12h	
	Night silent mode 3			8/10h	
	Night silent mode 4			8/12h	
	Silent mode	22	This mode is set through the wired controller	Frequency output Max $\leq$ Power_Silence_Max 70 kW: 70 Hz	
	Super silent mode			Frequency output Max $\leq$ Power_SuperSilence_Max 70 kW: 60 Hz	

3.7 Variable-frequency water pump control

3.7.1 Description

1)When receiving the opening signal of the main water pump, the inverter water pump outputs as per the following control.

2)The adjustment range of the inverter water pump: 25–100% [min ratio-max ratio]. The range can be adjusted through the wired controller. The main control adjustment range is 5%. The default value is 25–100%. The range 0–100% corresponds to the main control output voltage 0–10 V.

3)Notes for input and output of the control logic:

Input	
Control logic input	Remarks:
Machine address	The machine containing the address 0# is the master unit, and the machine without the address 0# is the slave unit
Selection of inverter water pump control	In case of S1-4=OFF, the control is of single inverter pump for the unit (by default) In case of S1-4=ON, the control is of parallel connection of inverter pump and fixed-frequency pump for the unit
Single pump/multiple pumps	In case of S1-3=OFF, single-pump control (one main water pump for each system, controlled through the master unit) In case of S1-3=ON, multiple-pump control (one water pump for each ODU, controlled respectively)
Opening signal of main water pump	CN123 on the expansion board is a passive port for controlling the fixed-speed water pump.
Ratio_pum	Manual frequency control of the inverter water pump, set through the wired controller
min ratio	The minimum value in the adjustment range of the inverter water pump is set through the wired controller, and 25% for main control by default
max ratio	The maximum value in the adjustment range of the inverter water pump is set through the wired controller, and 100% for main control by default

3.7.2 Temperature difference control of inverter water pump

3.7.2.1 Control of target water temperature difference

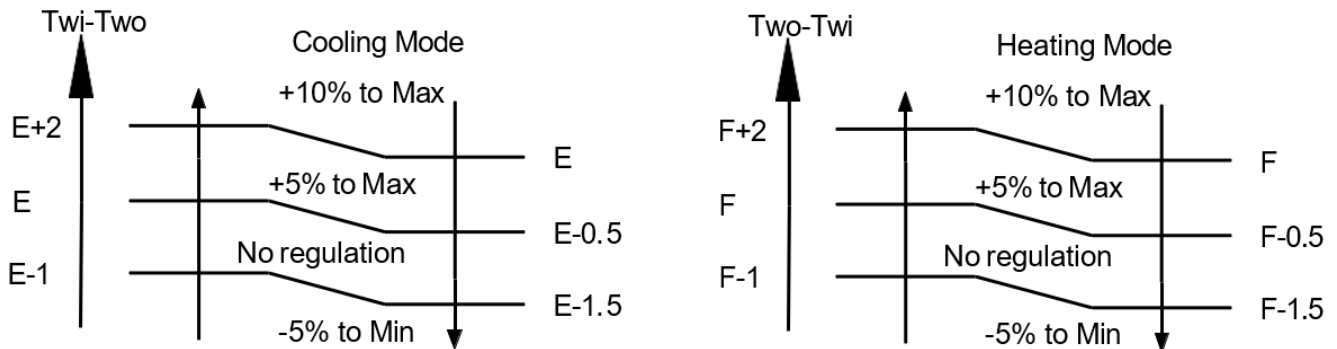
3.7.2.1.1 Cooling/heating

Twi E	< 15°C	15 ≤ Twi < 18°C	18 ≤ Twi < 25°C	≥ 25°C	
	5.5	5.5	6.5	8.5	
Initial output of single inverter pump	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: MIN (70%, max ratio)	
Twi F	< 35°C	35 ≤ Twi < 47°C	47 ≤ Twi < 55°C	55 ≤ Twi < 62°C	≥ 62°C
	5.5	7.5	9.5	11.5	14.5
Initial output of single variable-frequency pump	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: MIN (60%, max ratio)	Inverter water pump: MIN (60%, max ratio)	Inverter water pump: MIN (60%, max ratio)

3.7.2.1.2 DHW

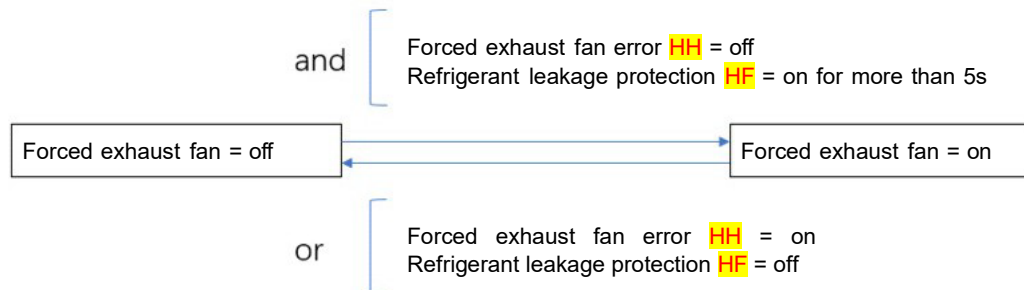
F	$T_{wi} < 35^{\circ}\text{C}$	$35 \leq T_{wi} < 47^{\circ}\text{C}$	$47 \leq T_{wi} < 60^{\circ}\text{C}$	$60 \leq T_{wi} < 70^{\circ}\text{C}$	$T_{wi} \geq 70^{\circ}\text{C}$
$T_4 \geq 15$	3.5	3.5	3.5	3.5	3.5
$15 > T_4 \geq -7$	3.5	3.5	3.5	3.5	5
$-7 > T_4 \geq -16$	3.5	3.5	3.5	3.5	4
$-16 > T_4$	3.5	3.5	3.5	4	4
Initial output of single inverter pump	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: max ratio	Inverter water pump: max ratio

3.7.2.2 Temperature difference control of inverter water pump output



3.8 Forced exhaust fan control

3.8.1 Forced exhaust fan normal control



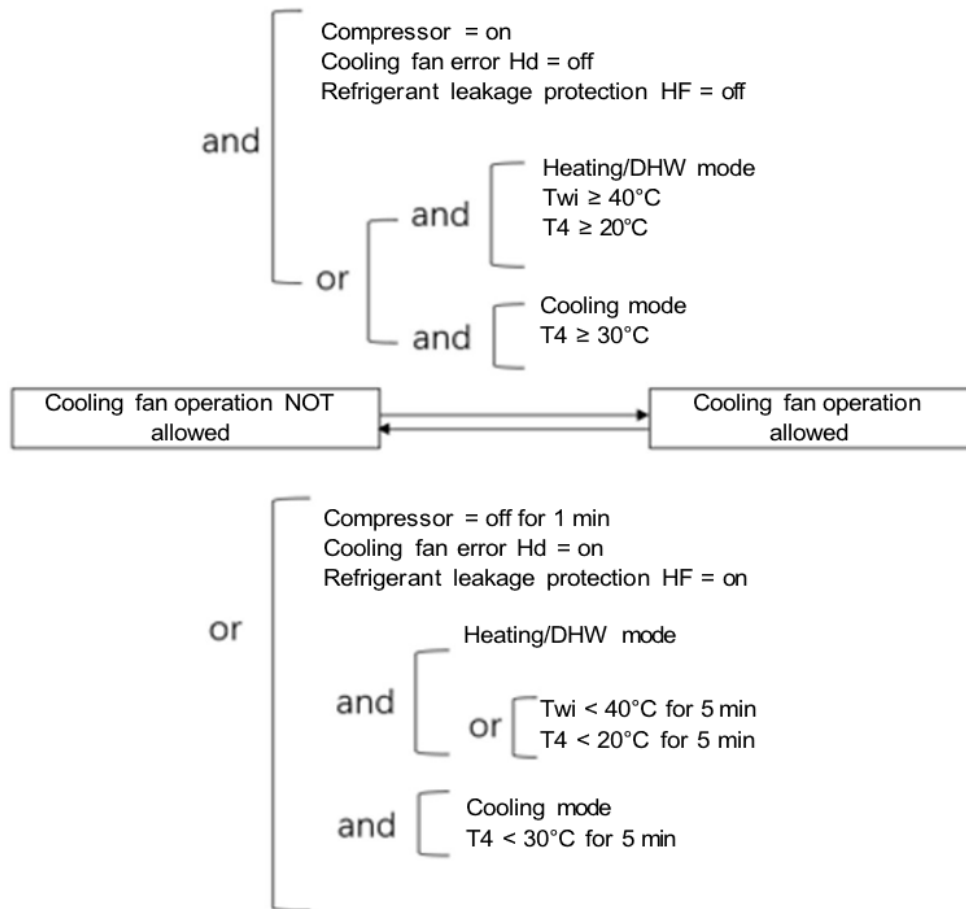
3.8.2 Forced exhaust fan abnormal control

The forced exhaust fan detects the fan port feedback signal 10s after receiving the start signal. If the feedback signal remains at 0 for more than 10s, the fan stops running and the abnormality counter N increases by one. After a 30s stop, the start signal is sent again, and the above detection procedure is repeated. The counter N will be cleared under the following conditions:

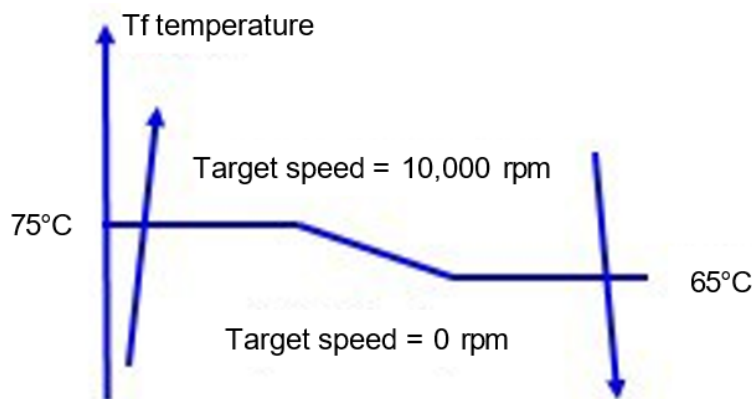
- 1) The feedback signal remains at 1 for more than 1 min after the fan start signal is valid;
- 2) The unit is powered on again.

3.9 Cooling fan control

3.9.1 Module cooling fan normal control



When the cooling fan is allowed to operate, its speed is regulated according to module temperature T_f :



NOTE

If the cooling fan is running and temperature drop of T_f causes a temperature range switch, the fan will maintain the target speed of the original range for no less than 10 min before switching to a new speed. However, if temperature rise of T_f triggers a range switch, the target speed will switch immediately. For example, when T_f rises from 70°C to 76°C , the cooling fan target speed changes instantly from 0 to 10,000 rpm; when T_f drops from 76°C to 64°C and the fan has run continuously for no less than 10 min, the cooling fan speed switches back from 10,000 rpm to 0.

3.9.2 Module cooling fan abnormal control

The module cooling fan detects the fan port feedback signal 10s after receiving the start signal. If the feedback signal remains at 0 for more than 10s, the fan stops running and the abnormality counter M increases by one. After a 30s stop, the start signal is sent again, and the above detection procedure is repeated.

The counter M will be cleared under the following conditions:

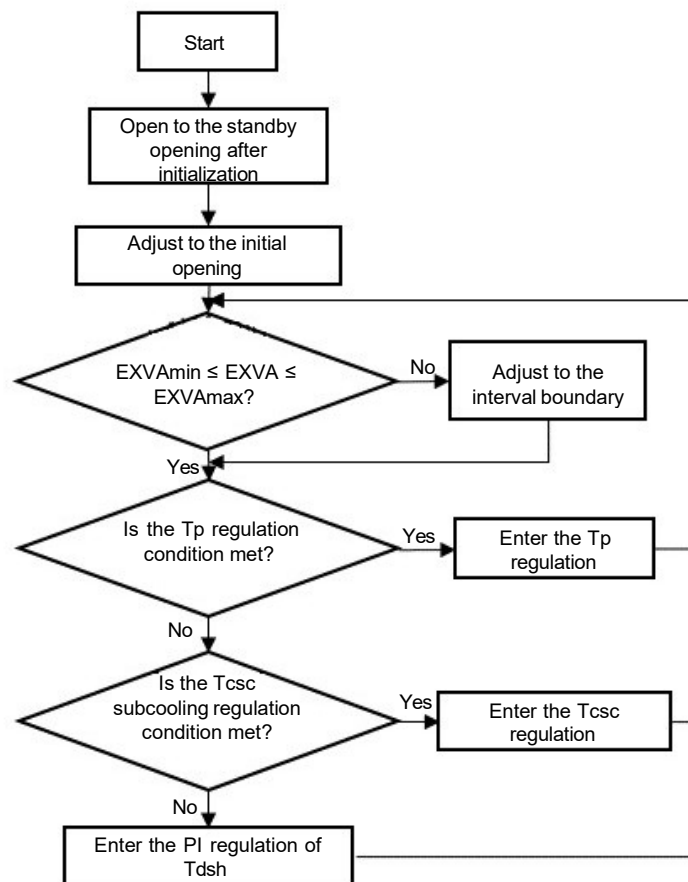
- 1) The feedback signal remains at 1 for more than 1 min after the fan start signal is valid;
- 2) The unit is powered on again.

3.10 Control of electronic expansion valves

3.10.1 Control of EXVA

EXVA remains at 480P during cooling.

The overall framework for control during heating operation is shown in the following figure:

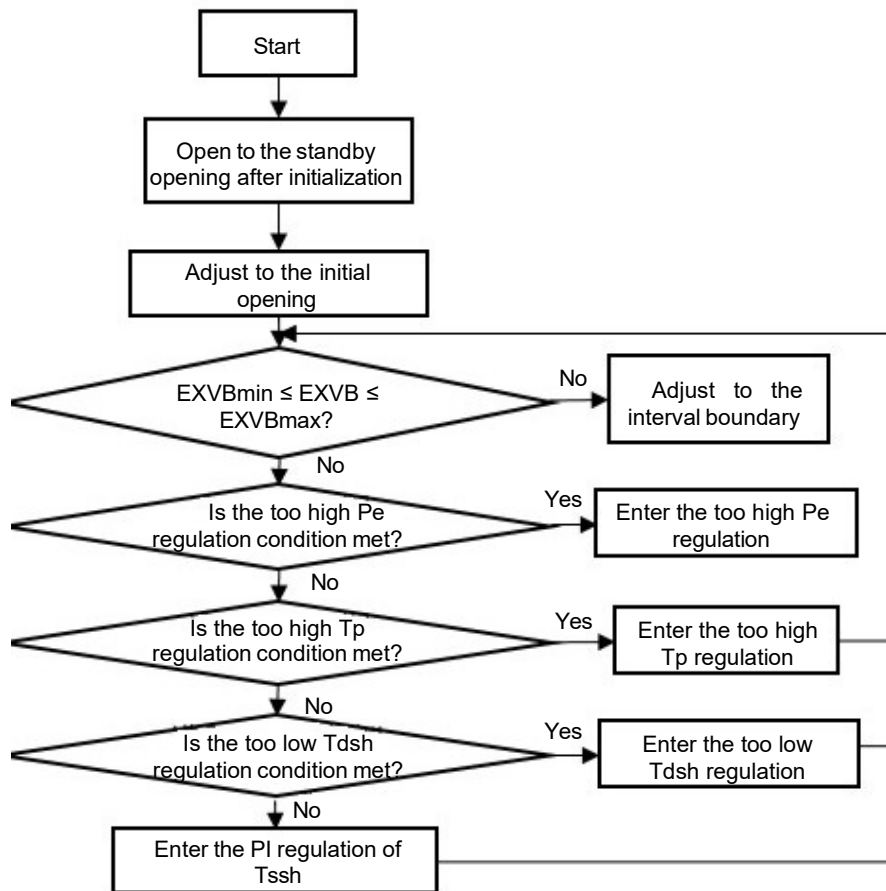


- Different values will be distinguished for the initial opening based on the T4 and Twi:
- Similarly, for the minimum and maximum opening of EXVA, different values will also be distinguished based on T4, Twi and Fx:
- Tp regulation is a control that forces the EXVA to be turned on or off when the exhaust temperature Tp is high, to avoid protection due to high exhaust temperature;
- Tcsc super cooling (Tc-Tz) control is a basic control, aimed at ensuring that EXVA is not turned off too small and ensuring the energy efficiency of the unit; different control target values are also distinguished based on on T4, Twi and Fx;
- Tdsh superheat (Tp1-Tc) control is a basic control, aimed at ensuring that the liquid refrigerant does not enter the compressor too much and dilute the lubricating oil, avoiding poor lubrication and compressor wear. Different control target values are distinguished based on the T4 and Two
- TC : Condensation temperature corresponding to discharge pressure

3.10.2 Control of EXVB

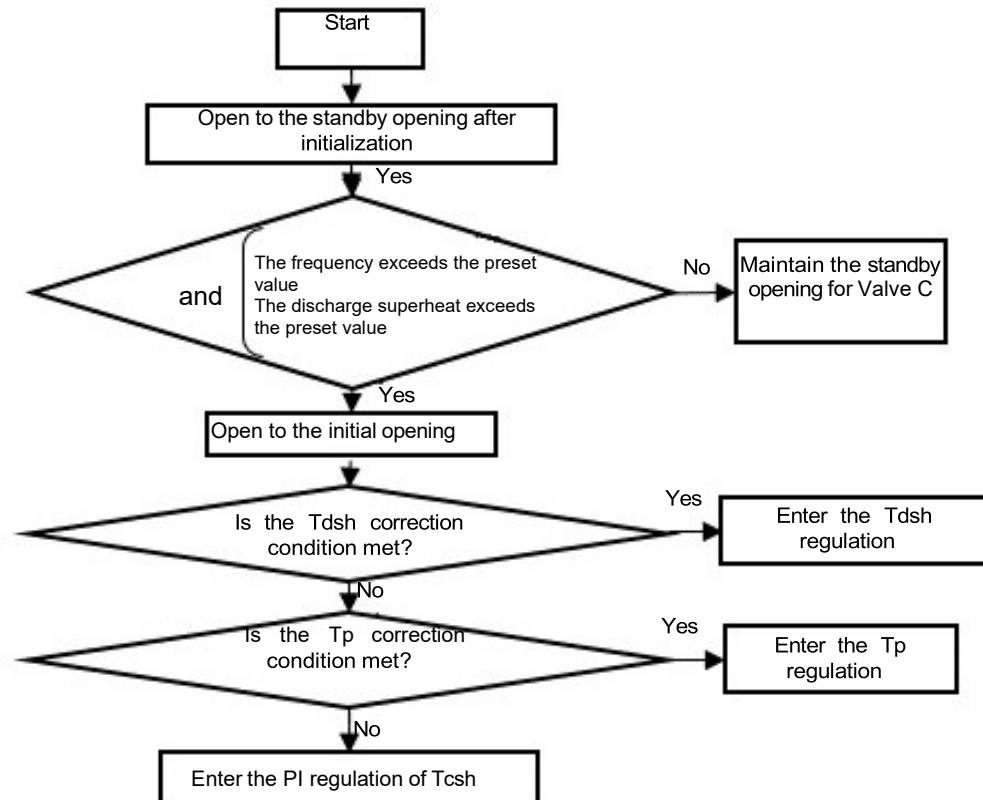
EXVB remains at 480P during heating.

The overall framework for control during heating operation is shown in the following figure:



- Different values will be distinguished for the initial opening based on the T4 and Twi:
- Through adjustment of the too high evaporation pressure of Pe, it is ensured that the operating low pressure does not exceed the operating range of the compressor; if the low pressure exceeds the preset value, EXVB will be turned off;
- If the exhaust temperature Tp exceeds the preset value, EXVB will open up to prevent the exhaust temperature from being too high for protection;
- Tdsh superheat (Tp1-Tc) control is a basic control, aimed at ensuring the reliability of the compressor. When Tdsh is less than the preset value, EXVB is turned off to ensure that liquid refrigerant does not enter the compressor too much and dilute the lubricating oil, avoiding poor lubrication and compressor wear.
- Tssh superheat (Th-Te) control is a basic control, aimed at ensure the energy efficiency of the unit during free operation; different control target values are distinguished based on the environmental temperature and water temperature frequency; when Tssh is less than the preset value, EXVB will turn down.

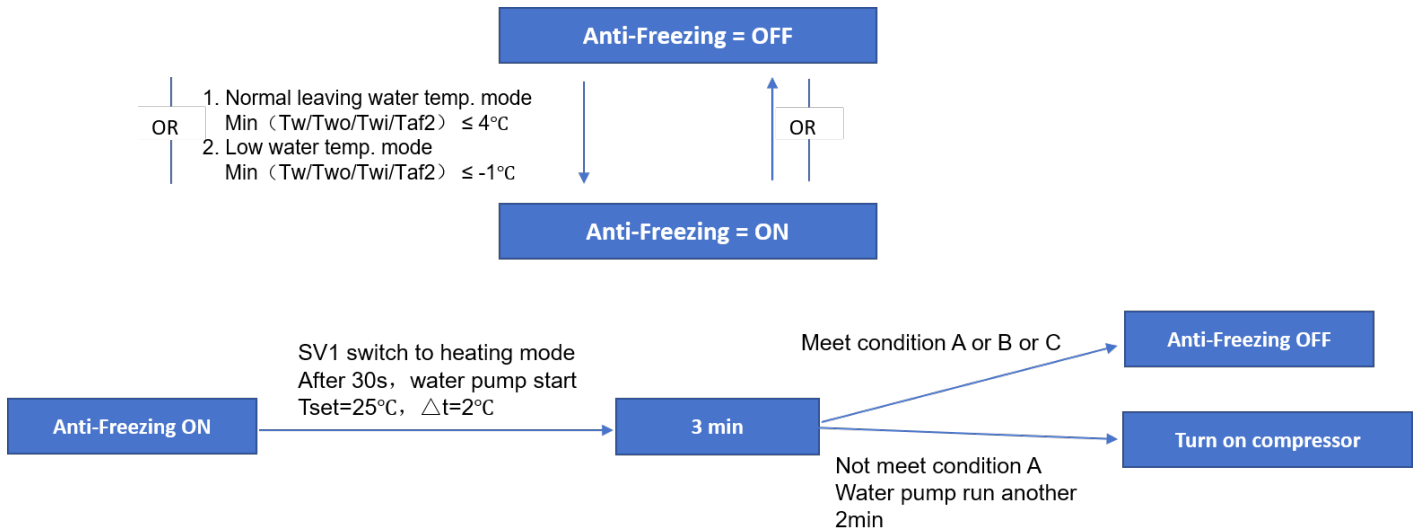
3.10.3 Control of EXVC



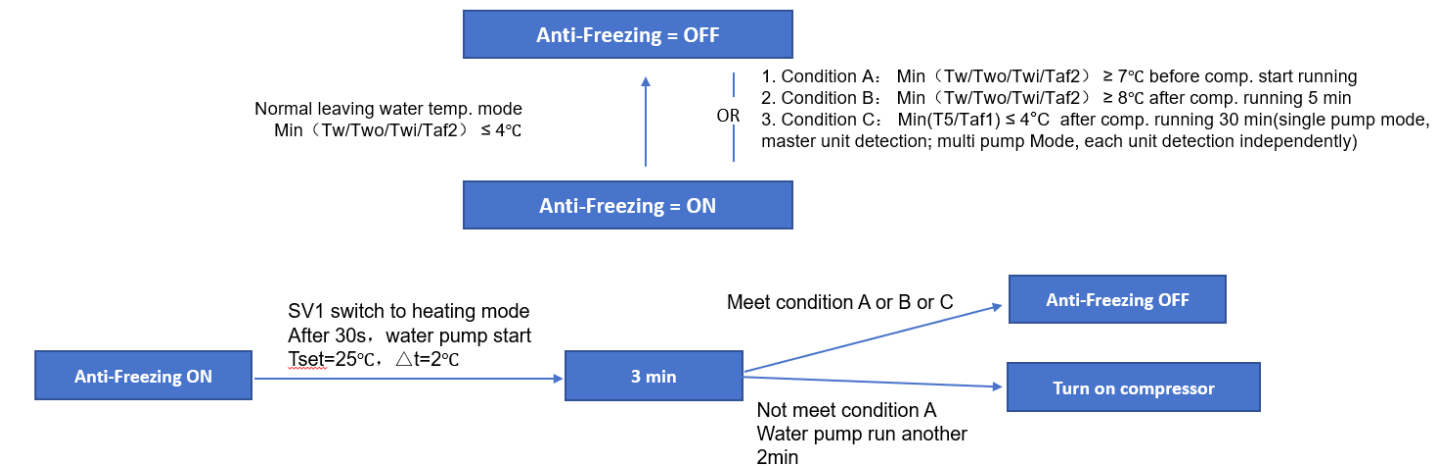
- EXVC is an injection valve that may open for both cooling and heating. The standby opening is set to 0. After the compressor frequency is detected, and the conditions such as exhaust superheat etc. are met, EXVC will open to the initial opening, and then corrected as per the connection of Tdsh, Tp and Tcsh (T6B-T6A) ;
- The purpose of correction of the Tdsh exhaust superheat is to reduce the injection volume when the EXVC is turned on too much, the injection volume is too high, and Tdsh is small;
- Tp correction is to control EXVC regulation when the exhaust temperature is high, in order to avoid protection from high exhaust temperature;
- For regulation of the auxiliary circuit superheat (T6B-T6A) of Tcsh, the flow rate, that is, the injection amount, of the auxiliary circuit is adjusted through the regulation of the temperature difference between the inlet and outlet of the auxiliary circuit refrigerant in the economizer, so as to achieve a good state of the capacity and energy efficiency of the unit.

3.11 Anti-freezing control

3.11.1 Heating / DHW



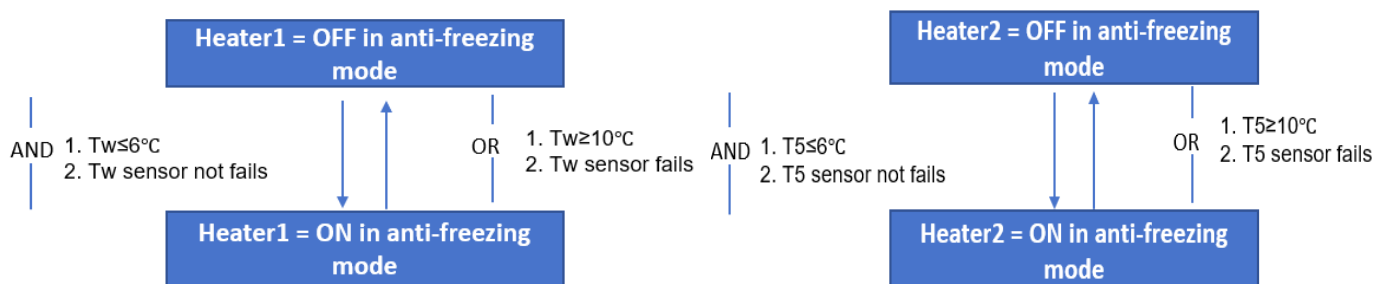
3.11.2 Cooling



NOTE

It is important to note that when the wired controller is set to the low water outlet mode (antifreeze mode), considering the reliability of the unit and the user's usage conditions, the unit does not check the conditions for entering antifreeze mode when it is shut down or in cooling standby mode. Therefore, the manual clearly specifies the antifreeze concentration requirements.

3.11.3 Heater1 & Heater2



3.12 Energy saving mode

By setting the energy saving switch ratio through the wired controller, the maximum current during the unit's free operation can be determined. The wired controller offers seven options: 100%, 90%, 80%, 70%, 60%, 50%, and 40%. The smaller the ratio setting, the lower the maximum current limit during operation.

SERVICE MENU		ENERGY SAVING SWITCH	
VACUUM SWITCH		SAVING SWITCH	◀ 80 ▶ %
ENERGY SAVING SWITCH		HISTORICAL SETTING	
DHW ENABLE		04/06/2020 11:30A	80 %
FACTORY DATA RESET		04/06/2020 11:30A	80 %
OK 3/3		OK	◀ ▶

3.13 Remote function control

When using the remote switch function, you first need to set the S1-1 DIP switch on the main board at address 0# to ON (default is OFF, controlled by the wired controller).

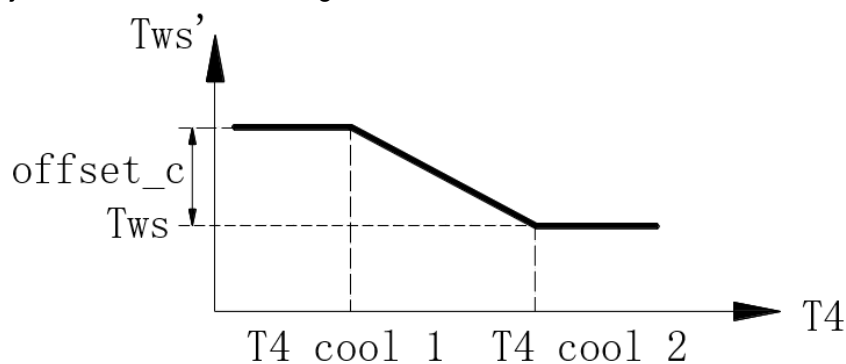
When S1-1 is set to ON for remote control:

- 1) The system's power on/off is controlled by the ON/OFF port. Short-circuiting the ON/OFF port turns the system on, while disconnecting the ON/OFF port turns the system off.
- 2) The cooling/heating mode is controlled by the H/C port. Disconnecting the H/C port sets the system to cooling mode, with an internal default set temperature of 7°C and an internal default hysteresis (δ) of 2°C. Short-circuiting the H/C port sets the system to heating mode, with an internal default set temperature of 45°C and an internal default hysteresis (δ) of 2°C.
- 3) If a wired controller is also connected, the set temperature, hysteresis, and other parameters can be adjusted through the wired controller.

3.14 Temperature compensation control

3.14.1 Cooling mode

When the user enables this function on the wired controller, the parameters T4_cool_1, T4_cool_2, and offset_c are set. The machine updates the target water temperature every 5 min based on the detected T4 temperature. The target water temperature is adjusted as shown in the diagram below:



When $T_4 < T_{4_cool_1}$: $T_{ws}' = T_{ws} + offset_c$

When $T_{4_cool_1} \leq T_4 \leq T_{4_cool_2}$:

$$T_{ws}' = T_{ws} + offset_c - \frac{offset_c}{T_{4_cool_2} - T_{4_cool_1}} \cdot (T_4 - T_{4_cool_1})$$

When $T_4 > T_{4_cool_2}$: $T_{ws}' = T_{ws}$

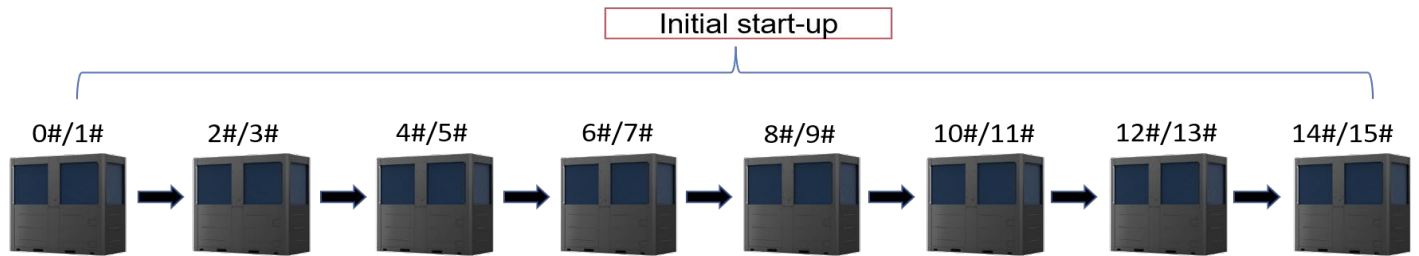
NOTE

When the set temperature is lower than the minimum water outlet temperature limit, the system operates at the minimum water outlet temperature.

3.14.2 Heating mode

The same principle applies to the heating mode

3.15 Cascade control

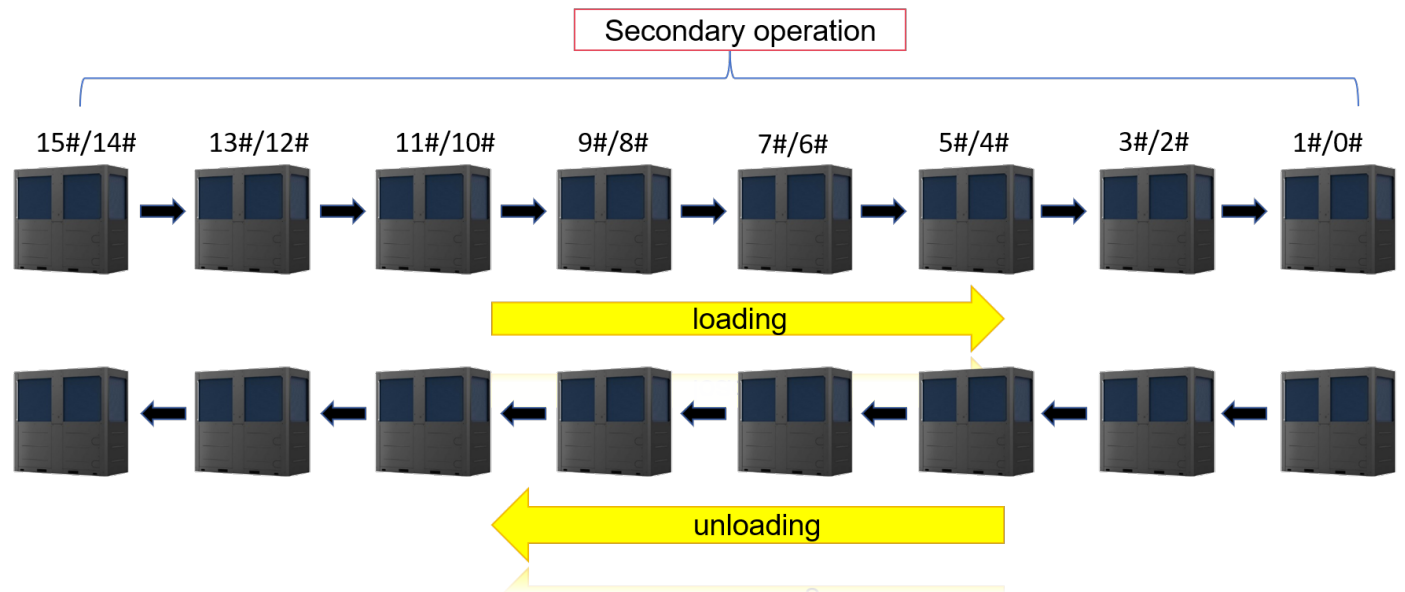


After receiving the power on command from the wired controller, the system determines whether the system meets the startup conditions based on the total water outlet T_w . If it meets the requirements, the 0 #master will be turned on first and then in ascending order of address.

During the normal operation of the unit, the system adjusts the start and stop of the unit according to the total water outlet T_w : when there is a loading demand for the unit, the principle of loading the machine that is turned off first (except for the first power on start-up) and loading the machine that is turned off later shall be followed; When there is a need to unload a unit, follow the principle of unloading the machine that starts first and then the machine that starts later.

The cascade system first turned on :

1. When $|T_{ws} - T_w| \geq 10^\circ\text{C}$, the ratio of starting units is 50% (can be changed on wired controller).
2. When $|T_{ws} - T_w| < 10^\circ\text{C}$, the units will start one by one. Detection time is every 80s.



For Second circulation, there is no prestart function, all the units will be started one by one. From the last one to master, and the unloading sequence is from master to slave.

3.15.1 Cooling control in cascade

Tvc	$-2 \leq Tvc < 0$	$0 \leq Tvc < 1$	$1 \leq Tvc < 3$	$3 \leq Tvc < 5$	$5 \leq Tvc < 7$	$7 \leq Tvc$
Adjust interval	1*T	4*T	4*T	2*T	1*T	1*T

T: Adjust interval time, default value is 80s and can be set on wired controller.

	$-2 \leq Tvc < 0$	$0 \leq Tvc < 1$	$1 \leq Tvc < 3$	$3 \leq Tvc < 5$	$5 \leq Tvc < 7$	$Tvc \geq 7$
$Tv \geq 4$	↘	↘	↘	↘	↘	=
$3 \leq Tv < 4$	↘	↘	↘	↘	=	=
$2 \leq Tv < 3$	↘	↘	↘	=	=	=
$1 \leq Tv < 2$	↘	↘	=	=	=	↗
$0.5 \leq Tv < 1$	↘	=	=	=	↗	↗
$0 \leq Tv < 0.5$	=	=	=	↗	↗	↗
$-0.5 \leq Tv < 0$	=	=	↗	↗	↗	↗
$-1 \leq Tv < -0.5$	=	↗	↗	↗	↗	↗
$-2 \leq Tv < -1$	↗	↗	↗	↗	↗	↗
$-3 \leq Tv < -2$	↗	↗	↗	↗	↗	↗
$Tv < -3$	↗	↗	↗	↗	↗	↗

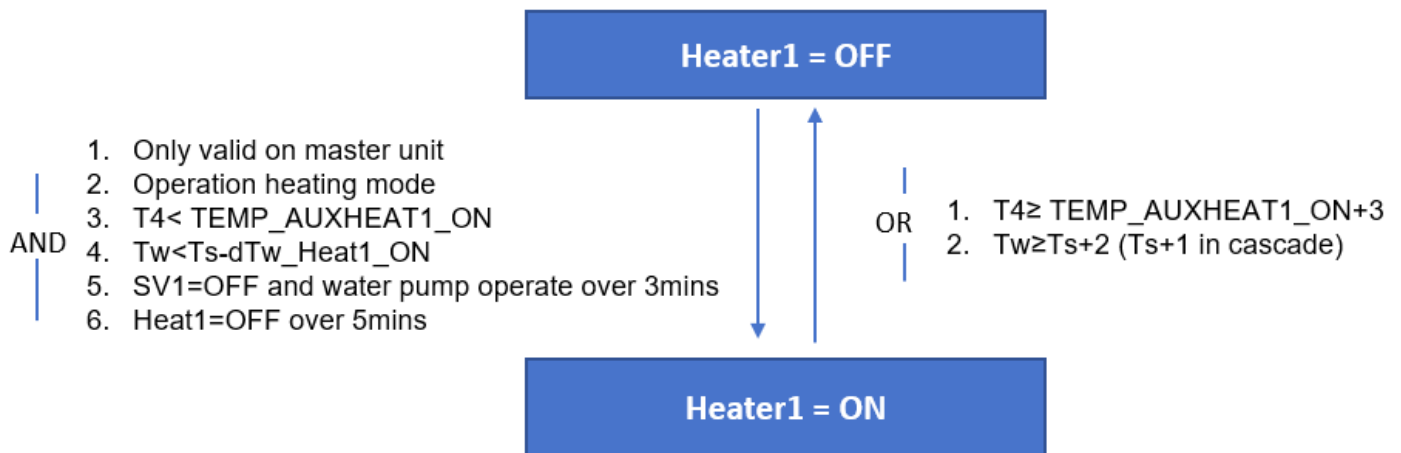
↗---- unit loading

↘---- unit unloading

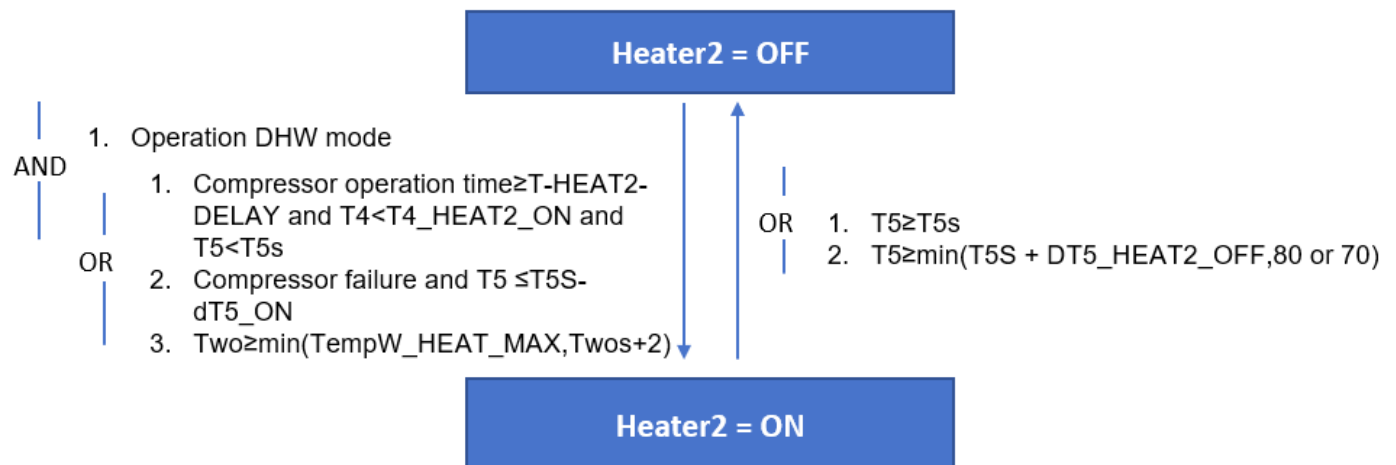
= ---- unit no changing

Tw	Total water outlet temperature
TwS	Setting temperature
Tvc	Tw-Tws
Tw_a	Tw value before loading cycle
Tw_b	Tw value after loading cycle
Tv	Tw_a-Tw_b

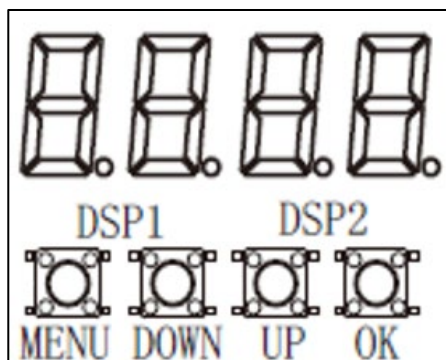
3.16 Heater 1 control



3.17 Heater 2 control



4 DISPLAY READING VALUES



Number	Display	Description
0		Standby: Main unit address (left 88) + Online units (right 88), Power on: Display frequency Defrost: dFdF (alternately displayed with current operating frequency)
1	0.xx	Host address
2	1.xx	Outdoor unit matching (e.g.R290 model: display 70/60/50)
3	2.xx	Online units (effective host)
4	3.xx	T4 capacity correction (reserved display "1")
5	4.xx	Operating mode (8 shutdown, 1 cooling, 2 heating, 4 hot water)
6	5.xx	Fan speed (0-35)
7	6.xx	Fan speed (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 cooling outlet temperature (for heating water side plate exchange refrigerant outlet temperature)
17	16.xx	THeatR heat recovery sensor temperature (reserved display "--")
18	17.xx	Discharge temperature 1
19	18.xx	Exhaust temperature 2 (reserved display "--")
20	19.xx	Radiator temperature 1
21	20.xx	Radiator temperature 2 (reserved display "--")
22	21.xx	Discharge superheat Tdsh
23	22.xx	Compressor A current
24	23.xx	Compressor B current (reserved display "--")
25	24.xx	--
26	25.xx	Electronic expansion valve A opening degree (percentage, maximum value is 100%)
27	26.xx	Electronic expansion valve B opening degree (percentage, maximum value is 100%)
28	27.xx	Electronic expansion valve C opening degree (percentage, maximum value is 100%)
29	28.xx	High pressure (heating mode) (cooling and heating effective)
30	L.xx	Low pressure (display with decimal places - displayed during cooling or standby) (cooling and heating effective)
31	30.xx	Cooling return air superheat Tssh
32	31.xx	Return air temperature Th
33	32.xx	First digital tube on the right: mute selection (0: night mute 1: mute 2: super mute 3: no mute (default)) Second digital tube on the right: mute time selection (0-3) value depends on the line controller parameters
34	33.xx	Static pressure selection (default 0 static pressure)
35	34.xx	DC voltage A (actual value * 10)
36	35.xx	DC voltage B (reserved display "--")

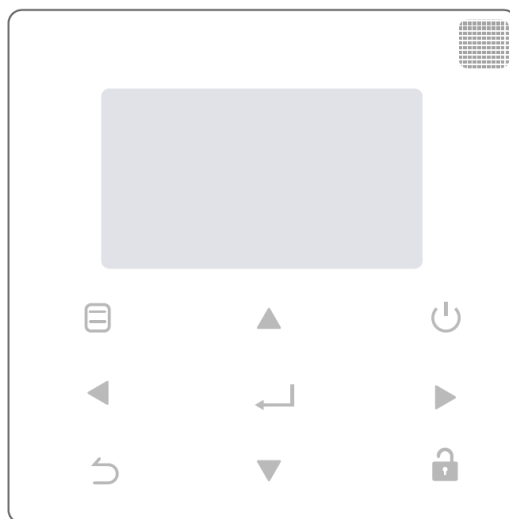
Number	Display	Description
37	36.xx	Frequency limit number (reserved) 0: no frequency limit; 1: T4 frequency limit; 2: Tp exhaust frequency limit; 3: Tz total cooling frequency limit (refrigeration high pressure frequency limit); 4: Tf module temperature frequency limit; 5: Two outlet water frequency limit 6: pressure frequency limit; 7: current frequency limit; 8: voltage frequency limit
38	37.xx	Defrosting process status (first digit: T4 selection scheme; second digit: interval in the scheme; the third and fourth digits together indicate the defrosting timing)
39	38.xx	E fault: 1 for fault, 0 for no fault (reserved for 90kw)
40	39.xx	Defrosting scheme
41	40.xx	Initial frequency
42	41.xx	Tc (saturated temperature corresponding to high pressure) point inspection value +30
43	42.xx	Te (saturated temperature corresponding to low pressure) point inspection value +30
44	43.xx	T6a
45	44.xx	T6b
46	45.xx	Main control software version number
47	46.xx	Expansion board software version number
48	47.xx	Last first fault
49	48.xx	Last second fault
50	49.xx	Last third fault
51	50.xx	Last fourth fault
52	51.xx	Last fifth fault
53	52.xx	Last sixth fault
54	53.xx	--

* If the displayed value is below -9, the preceding digit is not shown. For example, if the value is -15, the main board will display -15. If the displayed value exceeds 100, the hundreds digit is not shown. For example, if the 18th value is 115, the main board will display 18.15.

5 USER INTERFACE FIELD SETTINGS

5.1 Introduction

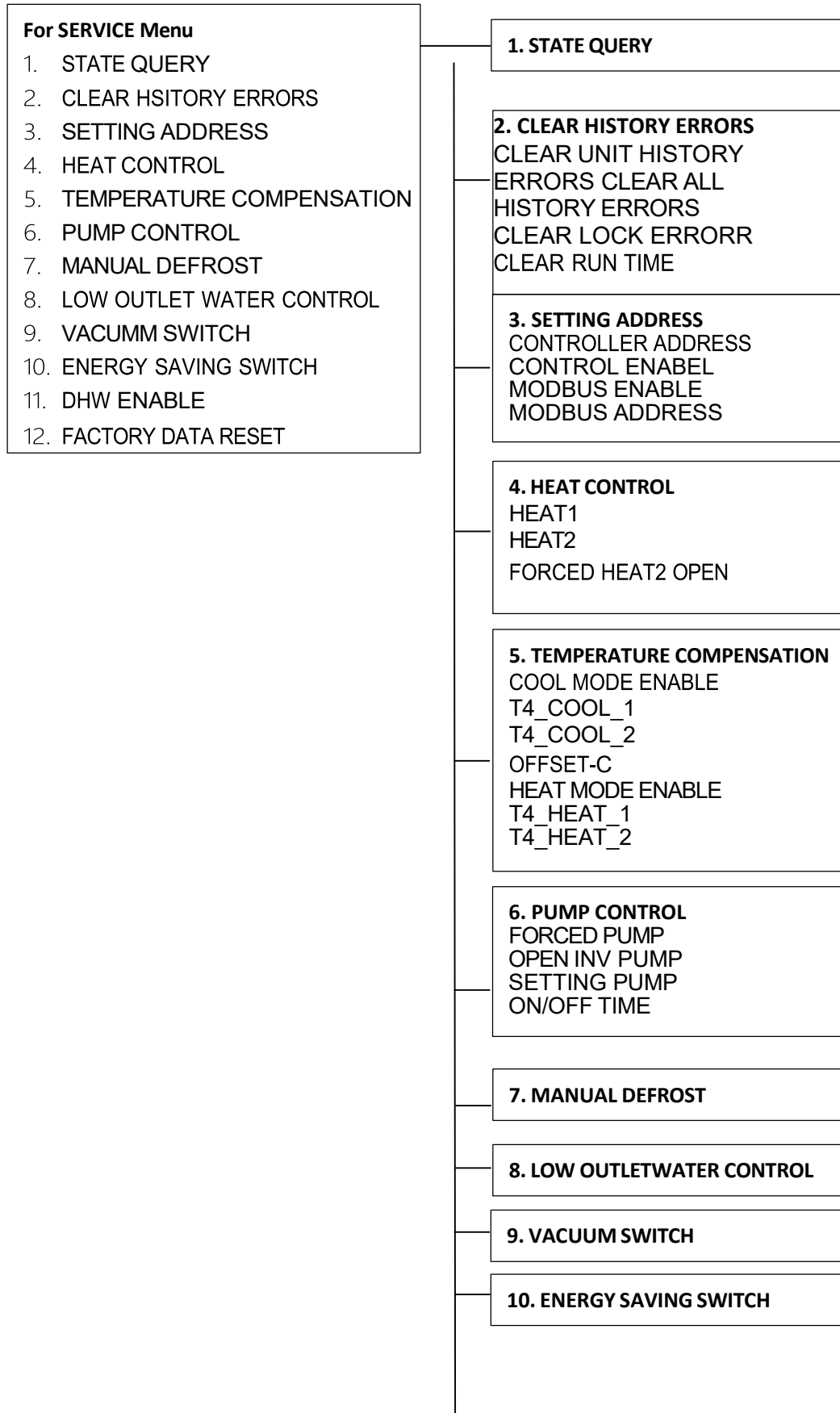
During installation, the parameters setting should be configured by the installer to suit the installation configuration, climate conditions and end-user preferences. The relevant settings are accessible and programmable through the **FOR SERVICEMAN** menu on the user interface. The user interface menus and settings can be navigated using the touch-sensitive keys.



Icon	Name	Definition
	Menu	Enter the menu structure from the home page
	Confirm	Go to the next step when programming a schedule in the menu structure / confirm a selection/enter a submenu in the menu structure
	ON/OFF	Turn on or off the space operation mode
	Unlock	Long press for unlocking /locking the controller
		Come back to the up level
	Navigation: upward, downward leftward, rightward	Press to navigate the cursor to adjust settings (holding it for 1 second can start quick adjustment)

5.2 Service menu

5.2.1 Struture



5.2.2 Password

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.

SERVICE MENU	
PLEASE INPUT THE PASSWORD 0 0 0	
OK	▼ ▲

The following pages will be displayed after putting the password.

SERVICE MENU	
STATE QUERY	
CLEAR HISTORY ERRORS	
SETTING ADDRESS	
HEAT CONTROL	
OK	1/3 ▼ ▲

SERVICE MENU	
TEMPERATURE COMPENSATION	
PUMP CONTROL	
MANUAL DEFROST	
LOW OUTLET WATER CONTROL	
OK	2/3 ▼ ▲

SERVICE MENU	
VACUUM SWITCH	
ENERGY SAVING SWITCH	
DHW ENABLE	
FACTORY DATA RESET	
OK	3/3 ▼ ▲

5.2.3 State query

SERVICE MENU	
STATE QUERY	
CLEAR HISTORY ERRORS	
SETTING ADDRESS	
HEAT CONTROL	
OK	1/3 ▼ ▲

STATE QUERY allows installers to check the operation parameters. Press ◀ ▶ to select the address of units.

STATE QUERY	
SELECT ADDRESS	◀ 07 ▶ #
ODU MODEL	130 kW
COMP FREQUENCY	50 Hz
COMP1 CURRENT	20 A
COMP2 CURRENT	20 A
BACK	▼ ▲

STATE QUERY	
H-P PRESSURE	3.83 MPa
L-P PRESSURE	1.00 MPa
TP1 DISCHARGE TEMP	30 °C
TP2 DISCHARGE TEMP	30 °C
TH SUCTION TEMP	-20 °C
OK	2/9 ▼ ▲

STATE QUERY	
TZ TEMP	-20°C
T3 TEMP	-20°C
T4 TEMP	-20°C
T6A TEMP	40°C
T6B TEMP	40°C
BACK	3/9 ▼ ▲

STATE QUERY	
TFIN1 TEMP	60 °C
TFIN2 TEMP	60 °C
TDSH	30 °C
TSSH	15 °C
TCSH	15 ▼ ▲
BACK	4/9

STATE QUERY	
FAN1 SPEED	850 RPM
FAN2 SPEED	850 RPM
FAN3 SPEED	850 RPM
EXV A	1800 P
EXV B	1800 ▼ ▲
BACK	5/9

STATE QUERY	
EXV C	1800P
Tw1 TEMP	30°C
Two TEMP	30°C
Tw TEMP	30°C
TAF1 TEMP	30°C ▼ ▲
BACK	6/9

STATE QUERY	
TAF2 TEMP	30 °C
T5 TEMP	30 °C
COMP TIME1	120 MIN
COMP TIME2	120 MIN
COMP TIME3	120 MIN
BACK 7/9	

STATE QUERY	
COMP TIME	65535 H
FIX PUMP TIME	65535 H
INV PUMP TIME	65535 H
ODU SOFTWARE	V45
HMI SOFTWARE	V45
BACK 8/9	

STATE QUERY	
DEFROSTING STATE	
00	01
02	03
04	05
06	07
08	09
10	11
12	13
14	15
E2 SOFTWARE V45	
END	
OK 9/9	

Tz plate heat exchanger outlet temperature	TSSH Suction superheat temperature
T3 lowest temperature of condenser tube	TCSH Injection superheat temperature
T4 ambient temperature	Tw Unit water inlet temperature
T6A, T6B EVI plate heat exchanger refrigerant temperature	Two Unit water outlet temperature
Tfin1, Tfin2 inverter module temperature	Tw Total water outlet temperature
TDSH Discharge superheat temperature	Taf1 DHW water pipe antifreeze temperature
T5 Water tank temperature	Taf2 Water side antifreeze temperature

For ODU SOFTWARE and HMI SOFTWARE, the version number will vary with product iterations.

5.2.4 Clear history errors

SERVICE MENU
STATE QUERY
CLEAR HISTORY ERROR
SETTING ADDRESS
HEAT CONTROL
OK 1/3

CLEAR HISTORY ERRORS	
CLEAR UNIT HISTORY ERRORS	
CLEAR ALL HISTORY ERRORS	
CLEAR LOCK ERROR	
CLEAR RUN TIME	
OK	

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

CLEAR UNIT HIS ERRS	
SELECT ADDRESS	◀ 07 ▶
DO YOU WANT TO CLEAR?	◀ YES ▶
OK	

CLEAR ALL HIS ERRS	
DO YOU WANT TO CLEAR?	◀ YES ▶
OK	

CLEAR LOCK ERR	
DO YOU WANT TO CLEAR?	◀ YES ▶
OK	

CLEAR RUN TIME	
SELECT ADDRESS	◀ 07 ▶
CLEAR COMP TIME?	◀ NO ▶
CLEAR FIX PUMP TIME?	◀ NO ▶
CLEAR INV PUMP TIME?	◀ NO ▶
OK	

5.2.5 Setting address

SERVICE MENU		
STATE QUERY		
CLEAR HISTORY ERROR		
SETTING ADDRESS		
HEAT CONTROL		
OK	1/3	⬆

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

CONTROLLER ADDRESS	◀ 10 ▶ #
CONTROL ENABEL	◀ NO ▶
MODBUS ENABLE	◀ NO ▶
MODBUS ADDRESS	◀ 10 ▶ #
OK	⬆ ⬅

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, **CONTROL 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.

5.2.6 Heat control

SERVICE MENU		
STATE QUERY		
CLEAR HISTORY ERROR		
SETTING ADDRESS		
HEAT CONTROL		
OK	1/3	⬆

HEAT CONTROL	
HEAT1	
HEAT2	
FORCED HEAT2 OPEN	
OK	⬆

HEAT1 means pipe electric heating in heating mode.
HEAT2 means tank electric heating in DHW mode.

HEAT1	
HEAT1 ENABLE	◀ NO ▶
TEMP-AUXHEAT1-ON	◀ 07 ▶ °C
TW. HEAT1-ON	◀ 25 ▶ °C
TW. HEAT1-OFF	◀ 45 ▶ °C
DTW-HEAT1-ON	◀ 2 ▶ °C
	1/2

HEAT1	
T-HEAT1-DELAY	◀ 30 ▶ MIN
T4-HEATPUMP-OFF1	-30.0 °C
FORCE0-HEAT1-OPEN	NO
OK	2/2

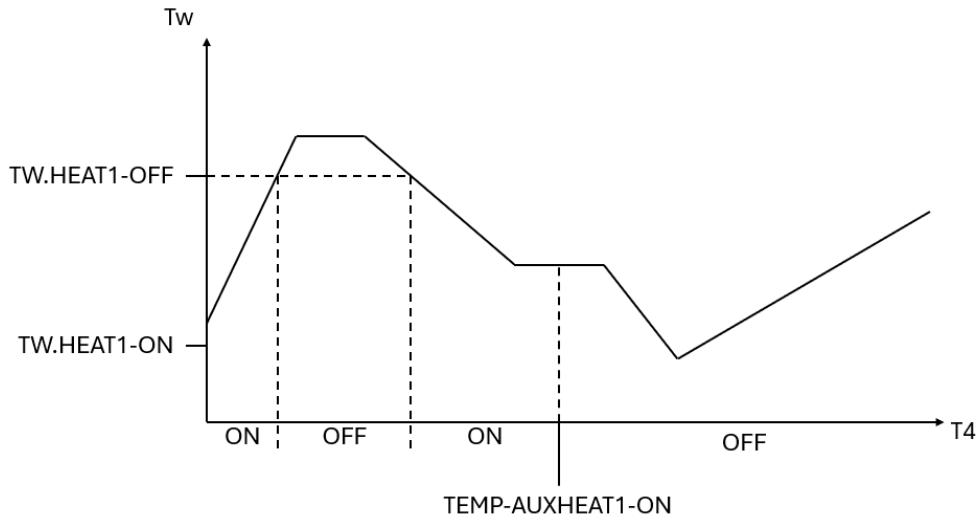
TEMP-AUXHEAT1-ON sets the ambient temperature below which the pipe heater turns on.

When the leaving water temperature does not reach **TW. HEAT1-ON**, the pipe electric heater turns on automatically.

When the leaving water temperature reaches **TW. HEAT1-OFF**, the pipe electric heater turns off automatically.

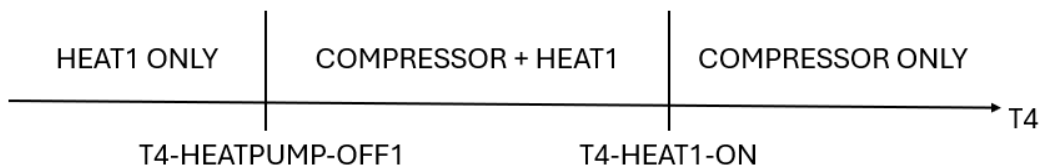
DTW-HEAT1-ON is total outlet water temperature hysteresis allowing the electric auxiliary heating HEAT1 to be activated

$$DTWHEAT1ON = Tws - Tws$$

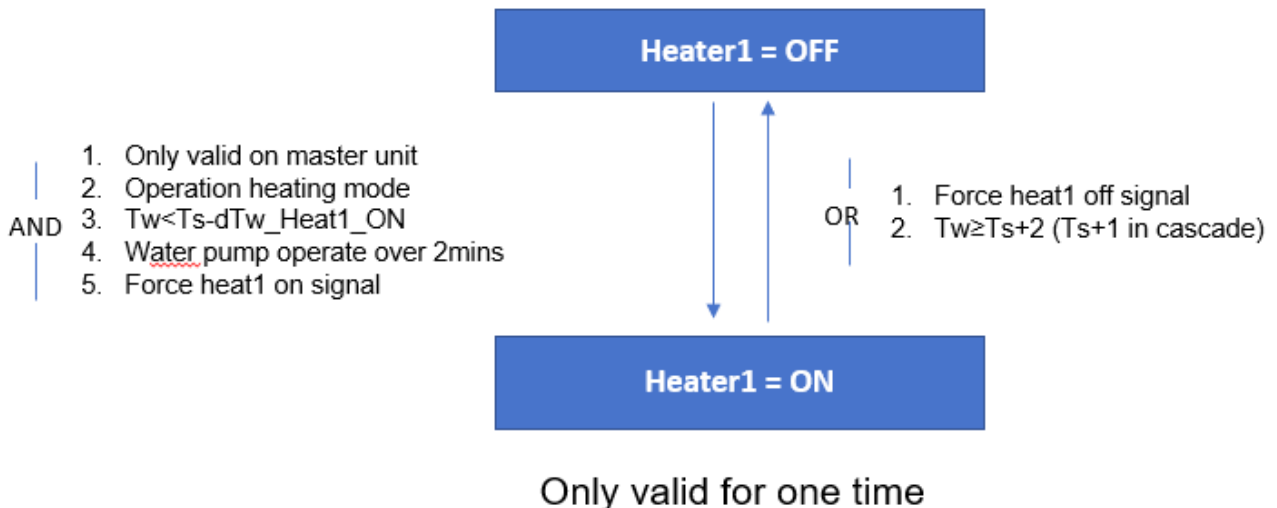


T-HEAT1-DELAY sets the delay time for pipe heater to turn on after the compressor starts.

T4_HEATPUMP-OFF1 below this outdoor temperature the compressor will turn OFF.



If **FORCED HEAT1 OPEN** is set as YES, then pipe electric heater turns on if $T_w < T_s - dT_{w_Heat1_ON}$.



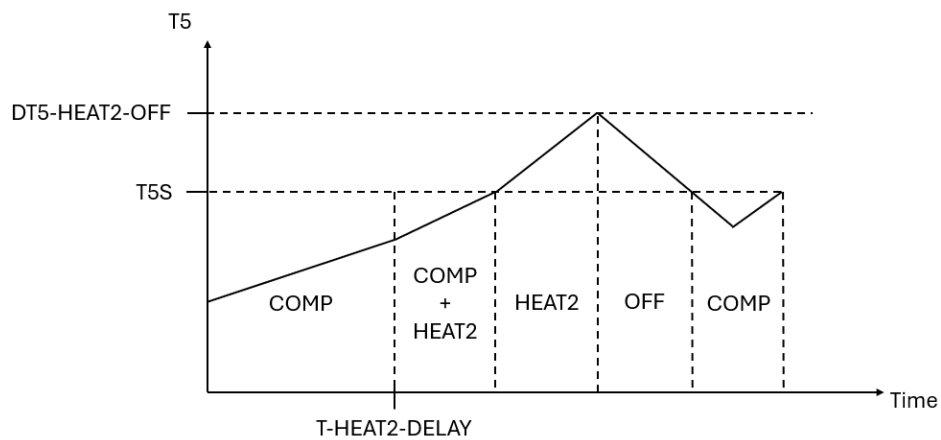
HEAT2		HEAT2	
ALL HEAT2 DISABLE	◀ YES ▶	T4-HEAT2-ON	◀ 10 ▶ °C
SELECT ADDRESS	◀ 10 ▶ #	T4-HEATPUMP-OFF2	-30.0 °C
HEAT2-ENABLE	◀ NO ▶		
T-HEAT2-DELAY	◀ 190 ▶ MIN	00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15	
DT5-HEAT2-OFF	◀ 10 ▶ °C		
OK	1/2	OK	2/2

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.

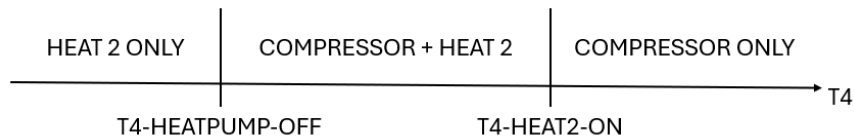
T-HEAT2-DELAY sets the delay time for tank booster heater to turn on after the compressor starts.

DT5-HEAT2-OFF sets the temperature difference between the actual water temperature and setting temperature above which the tank booster heater turns off.



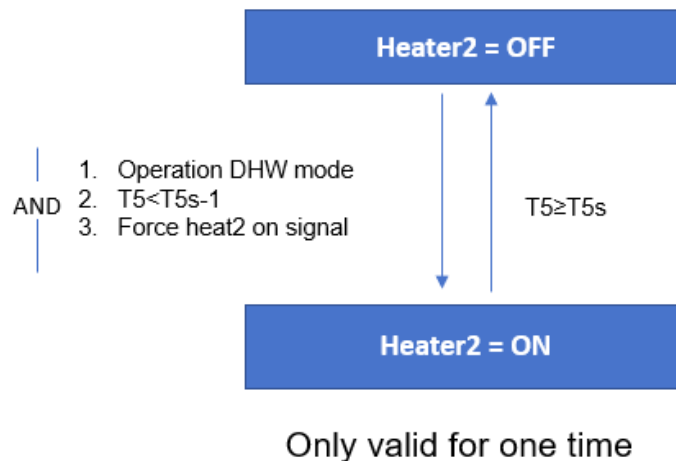
T4-HEAT2-ON sets the ambient temperature below which the tank booster heater turns on. (00~15 means unit address)

T4-HEATPUMP-OFF sets the ambient temperature below which compressor stop. (00~15 means unit address)



FORCED HEAT2 OPEN							
SELECTED ADDRESS	◀ 10 ▶ #						
FORCED HEAT2 OPEN	◀ NO ▶						
00	01	02	03	04	05	06	07
08	09	10	11	12	13	14	15
OK							

If **FORCED HEAT2 OPEN** is set as YES, when $T5 < T5S-1$, then tank electric heater turns on; when $T5 \geq T5S$, then tank electric heater off. (00~15 means unit address)

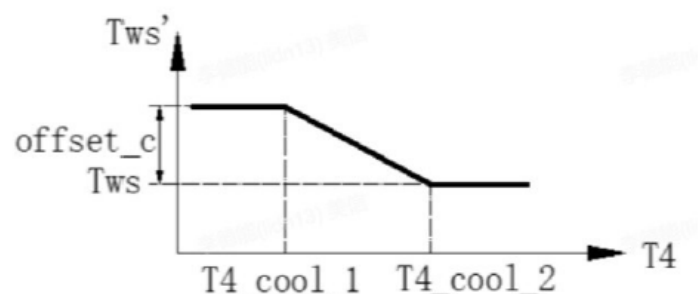


5.2.7 Temperature compensation

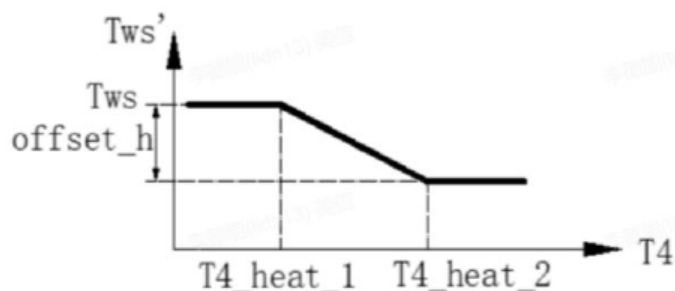
SERVICE MENU	
TEMPERATURE COMPENSATION	
PUMP CONTROL	
MANUAL DEFROST	
LOW OUTLET WATER CONTROL	
OK	2/3

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.

TEMP COMPENSATION	
COOL MODE ENABLE	◀ YES ▶ °C
T4 COOL-1	◀ 15 ▶ °C
T4 COOL-2	◀ 08 ▶ °C
OFFSET-C	◀ 10 ▶ °C
OK	1/2



TEMP COMPENSATION	
HEAT MODE ENABLE	◀ YES ▶ °C
T4 HEAT-1	◀ 08 ▶ °C
T4 HEAT-2	◀ 15 ▶ °C
OFFSET-H	◀ 10 ▶ °C
OK 2/2	



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.

5.2.8 Pump control

SERVICE MENU
TEMPERATURE COMPENSATION
PUMP CONTROL
MANUAL DEFROST
LOW OUTLET WATER CONTROL
OK 2/3

PUMP CONTROL
FORCED PUMP OPEN
INV PUMP SETTING
PUMP ON/OFF TIME
OK

FORCED PUMP OPEN
SELECT ADDRESS ◀ 0 ▶ #
FORCED PUMP OPEN ◀ NO ▶
OK

INV PUMP SETTING
SELECT ADDRESS ◀ 07 ▶ #
SWITCH ON THE PUMP ◀ NO ▶
RATIO PUMP ◀ 100 ▶ #
OK

PUMP ON/OFF TIME
PUMP ON TIME ◀ 05 ▶ MIN
PUMP OFF TIME ◀ 05 ▶ MIN
OK

FORCED PUMP OPEN is not used.

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

5.2.9 Manual defrost

SERVICE MENU	MANUAL DEFROST
TEMPERATURE COMPENSATION	SELECT ADDRESS ◀ 07 ▶ #
PUMP CONTROL	MANUAL DEFROST ◀ NO ▶
MANUAL DEFROST	
LOW OUTLET WATER CONTROL	
OK 2/3	OK

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.

5.2.10 Low outlet water temperature control

SERVICE MENU	LOW OUTLET WATER CTRL
TEMPERATURE COMPENSATION	MIN TEMP FOR COOL ◀ 50°C ▶
PUMP CONTROL	HISTORICAL SETTING
MANUAL DEFROST	04/06/2020 11:30A 5°C
LOW OUTLET WATER CONTROL	04/06/2020 11:30A 5°C
OK 2/3	OK

MIN TEMP FOR COOL sets the lowest water temperature for cooling mode.

WARNING

Please notice that When the setting temperature is less than 5°C, antifreeze liquid should be added in the water system.

Tsafe=MIN TEMP FOR COOL

LOW OUTLET WATER CONTROL
The setting temp is below 5 degree please confirm whether it is an antifreeze system?
OK

5.2.11 Vaccum switch

WARNING

Use this function only when you need to repair the refrigerant circuit. Only authorized personnel must activate this function.

SERVICE MENU		
VACUUM SWITCH		
ENERGY SAVING SWITCH		
DHW ENABLE		
FACTORY DATA RESET		
OK	3/3	⬆

VACUUM SWITCH	
VACUUM SWITCH	◀ NO ▶
OK	⬆

VACUUM SWITCH is used for vacuuming.

5.2.12 Energy saving mode

SERVICE MENU		
VACUUM SWITCH		
ENERGY SAVING SWITCH		
DHW ENABLE		
FACTORY DATA RESET		
OK	3/3	⬆

ENERGY SAVING SWITCH	
SAVING SWITCH	◀ 80% ▶
HISTORICAL SETTING	
04/06/2020 11:30A	80%
04/06/2020 11:30A	80%
04/06/2020 11:30A	80%
OK	⬆

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.

The input and output capacities can be check in “**TECHNICAL MANUAL**”.

5.2.13 DHW enable

DHW ENABLE	
DHW ENABLE	◀ NO ▶
OK	⬆

Select if you want to activate the DHW function on this project.
Select **YES** will unlock additional **MENU** in “**PROJECT MENU**”.

5.2.14 Factory data reset

FACTORY DATA RESET	
DO YOU WANT TO RESET?	◀ YES ▶
OK ▶▶	

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

5.3 Project menu

5.3.1 Struture

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. CHECK PARTS

5.3.2 Password

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.

PROJECT MENU	
PLEASE INPUT THE PASSWORD	
0 0 0 0	
OK	▼ ▲

The following pages will be displayed after putting the password.

PROJECT MENU	
SET UNIT AIRCONDITIONING	
SET PARALLEL UNIT	
SET UNIT PROTECTION	
SET DEFROSTING	
OK	1/3 ▼ ▲

PROJECT MENU	
SET DHW TIME	
SET E9 TIME	
INV PUMP RATIO	
CHECK PARTS	
OK	2/3 ▼ ▲

PROJECT MENU	
PERCENT OF GLYCOL	
WATER COIL CONTROL	
OK	3/3 ▼ ▲

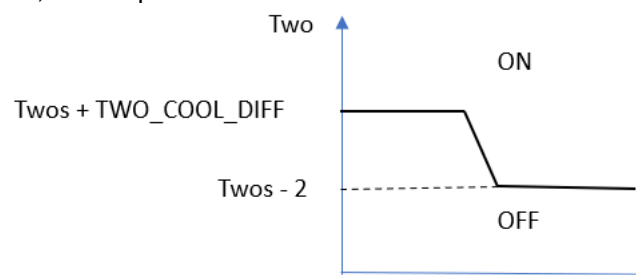
5.3.3 Set unit airconditioning

SET UNIT	
TWO_COOL_DIFF	◀ 2 ▶ °C
TWO_HEAT_DIFF	◀ 2 ▶ °C
DT5_ON	◀ 8 ▶ °C
DTIS5	◀ 10 ▶ °C
DtTws	◀ 1 ▶ °C
OK	▼ ▲

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 $Two - TwoS \geq TWO_COOL_DIFF$, unit starts.

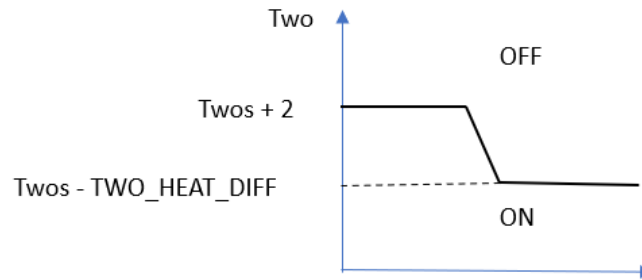
When $TwoS - Two \geq 2$ lasts for 5s, unit stops.



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 $TwoS - Two \geq TWO_HEAT_DIFF$, unit starts.

When $Two - TwoS \geq 2$ lasts for 5s, unit stops.

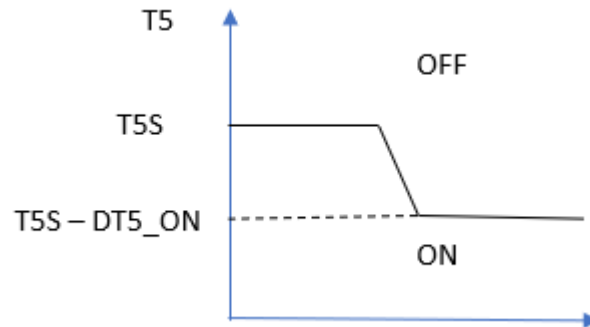


DT5_ON is the hysteresis to turn ON DHW, when $T5 < T5s - DT5_ON$, DHW function turn ON.

DTIS5 is the hysteresis for water leaving temperature for DHW mode.

In DHW mode $Tw = T5 + DTIS5$

DtTws interal use only. Don't modify it !



5.3.4 Set parallel unit

SET PAPALLEL UNIT		
TIM_CAP_ADJ	◀ 180 ▶	S
TW_COOL_DIFF	◀ 2 ▶	°C
TW_HEAT_DIFF	◀ 2 ▶	°C
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 $Tw - TwS \geq TW_COOL_DIFF + 1$, unit starts.

When $TwoS - Tw \geq 2$ 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 $TwS - Tw \geq TW_HEAT_DIFF + 1$, unit starts.

When $Tw - TwS \geq 1$ 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.

Total units	RATIO_xxx_FIRST	Starting units
6	50%	3
6	30%	2

5.3.5 Set unit protection

SET UNIT PROTECTION	
T_DIFF_PRO	◀ 12 ▶ °C
TWI_O ABNORMAL	◀ 2 ▶ °C
OK ⬆ ⬇ ⬇ ⬆	

T_DIFF_PRO set the absolute difference between entering water temperature (Twi) and leaving water temperature (Two).

If $|Twi - Two| \geq T_DIFF_PRO$, unit stops and error code P9 appears.

Normal heat pumps when $|Twi - Two| \geq 10^\circ C$ [T_DIFF_PRO], or high temperature heat pumps $|Twi - Two| \geq 15^\circ C$, error code disappears.

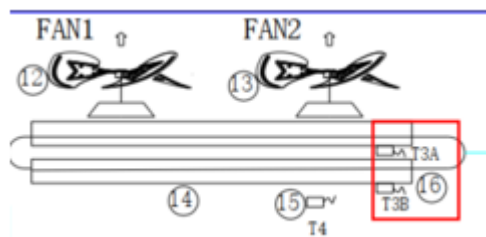
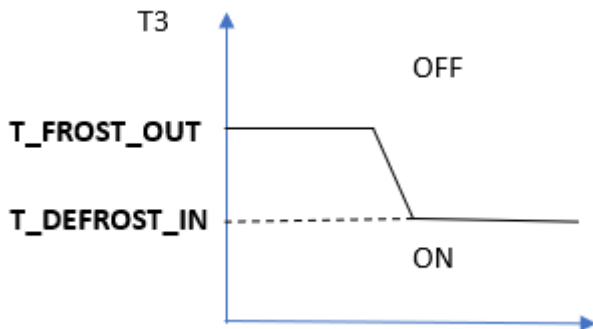
TWI_O_ABNORMAL sets the difference between Inlet water temperature (Twi) and Outlet water temperature (Two).

For cooling mode, if $Two - Twi \geq TWI_O_ABNORMAL$ and lasts for 20min, unit stops and error code PA appears. If $Two - Twi \leq TWI_O_ABNORMAL - 1$, error code disappears.

For heating mode, if $Twi - Two \geq TWI_O_ABNORMAL$ and lasts for 20min, unit stops and error code PA appears. If $Twi - Two \leq TWI_O_ABNORMAL - 1$, error code disappears.

5.3.6 Set Defrost

SET DEFROSTING	
T_FROST	◀ 35 ▶ min
T_DEFROST_IN	◀ 0 ▶ °C
T_FROST_OUT	◀ 0 ▶ °C
OK	



T_FROST : When the running time of heating/hot water production exceeds this set value, then select different defrosting schemes; However, this cannot be understood as the minimum defrosting period, because there are other special cases of defrosting control that do not follow this time.

T_DEFROST_IN : When the running time of heating/hot water production exceeds t_{frost} , and the T3 temperature is less than this set value, then select different defrosting schemes.

T_FROST_OUT : This setting can adjust the required T3 defrosting exit temperature. T3 has a default defrosting exit temperature in the program. This setting changes the frost exit time by + or - a temperature above the default value.

5.3.7 DHW time setting

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.

5.3.8 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 2min + E9 PROTECT TIME/60 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

5.3.9 Inv pump ration

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.

5.3.10 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 ⬆ ⬇ ⬅	

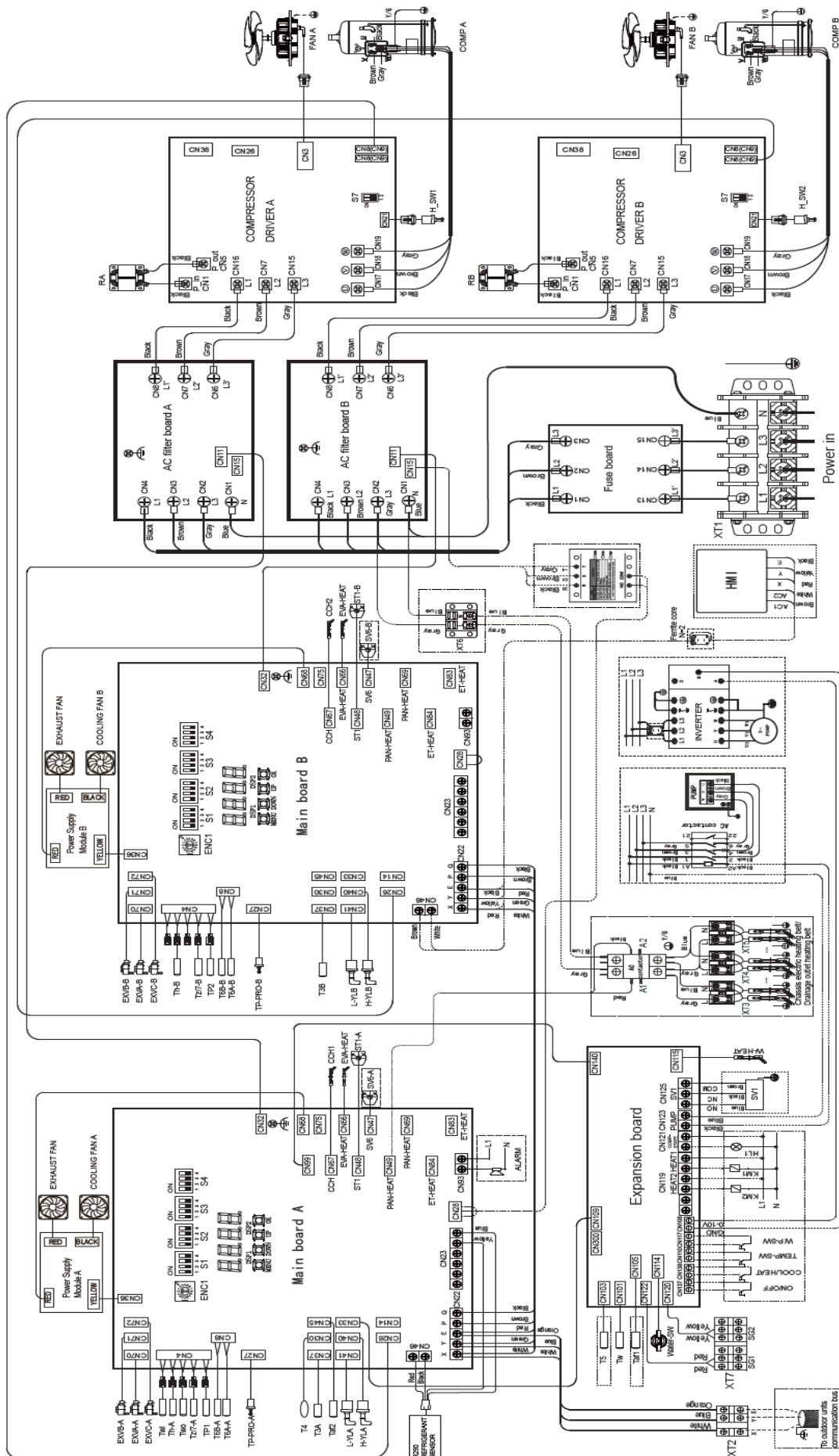
CHECK PARTS	
SV8B STATE	OFF
HEAT1 STATE	OFF
HEAT2 STATE	OFF
COIL VALVE	OFF
BACK 3/3 ⬆ ⬇ ⬅	

5.4 Parameters list

Parameters	Setting range	Default value	Adjustment range
t_frost	20 ~ 120 min	35 min	5 min
T_defrost_in	-5~5°C	0°C	0.5°C
T_defrost_out	-10~+10°C	0°C	0.5°C
Tim_Cap_adj	60~360 s	80 s	20 s
Two_cool_Diff	1°C~5°C	2°C	0.5°C
Two_heat_Diff	1°C~5°C	2°C	0.5°C
Tw_cool_Diff	1°C~5°C	2°C	0.5°C
Tw_heat_Diff	1°C~5°C	2°C	0.5°C
Heat1 ENABLE	Yes/No	No	/
Temp_AuxHeat1_On	-15°C~10°C	-5°C	0.5°C
dTw_heat1_ON	1°C~10°C	2°C	0.5°C
t_HEAT1_DELAY	15~120 min	30 min	5 min
T4_HEATPUMP_OFF1	-30°C~10°C	-30°C	0.5°C
Unit_select	PI/SI	--	--
T_diff_Pro	Normal 8°C~15°C	12°C	0.5°C
	High temp.8°C~25°C	20°C	0.5°C
TWI-O ABNORMAL	1°C~5°C	2°C	0.5°C
Ratio_cool_First	0~100%	50%	5%
Ratio_heat_First	0~100%	50%	5%
Heat2 ENABLE	Yes/No	No	/
dT5_ON	2°C~10°C	8°C	0.5°C
dT1S5	5°C~20°C	10°C	0.5°C
t_HEAT2_DELAY	60~240 min	90 min	5 min
dT5_HEAT2_OFF	2°C~10°C	5°C	0.5°C
T4_HEAT2_ON	-15°C~20°C	-5°C	0.5°C
T4_HEATPUMP_OFF2	-30°C~10°C	-30°C	0.5°C
Double Set Point	Yes/No	No	/
Set Point 1	Cooling -10°C~25°C	Cooling 7°C	0.5°C
	Heating 25°C~60°C	Heating 35°C	0.5°C
Set Point 2	Cooling -10°C~25°C	Cooling 10°C	0.5°C
	Heating 25°C~60°C	Heating 30°C	0.5°C
Temp_Compensation	Yes/No	No	/
T4_cool_1	15°C~30°C	25°C	0.5°C
T4_cool_2	35°C~45°C	40°C	0.5°C
Offset_C	0°C~15°C	10°C	0.5°C
T4_heat_1	-25°C~15°C	5°C	0.5°C
T4_heat_2	15°C~30°C	15°C	0.5°C
Offset_H	0°C~30°C	10°C	0.5°C
RATIO_PUMP	30%~100%	100%	5%
PUMP ON TIME	5~60 min	5 min	5 min
PUMP OFF TIME	0~60 min	0 min	5 min
MIN TEMP FOR COOL	-10°C~25°C	7°C	0.5°C
ENERGY SAVING SWITCH	40~100%	100%	10%
DHW ENABLE	Yes/No	No	/
DHW SWITCH	Yes/No	No	/
DHW FIRST	Yes/No	No	/

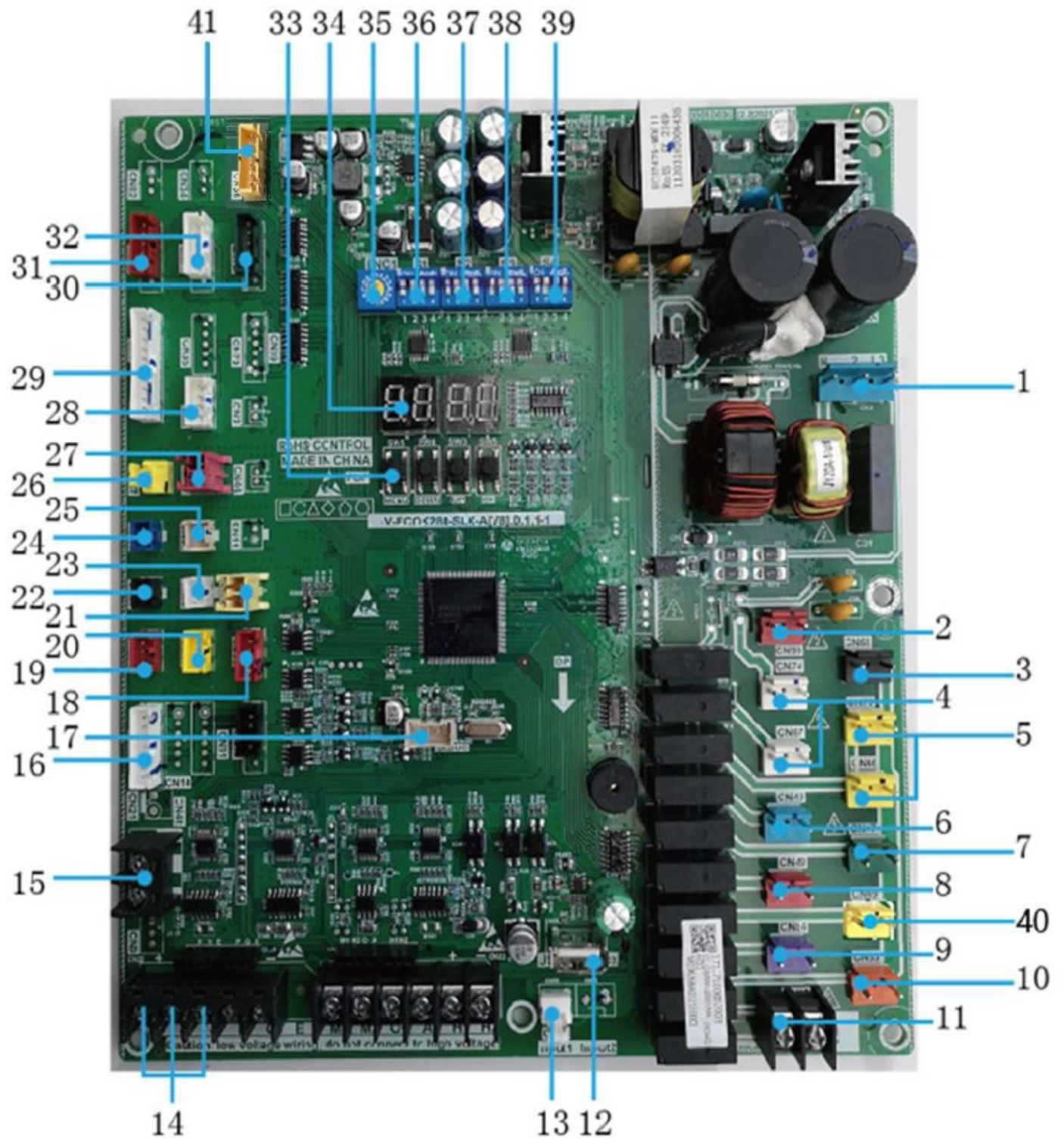
Parameters	Setting range	Default value	Adjustment range
COOL MIN TIME	0.5~24 h	0.5 h	0.5 h
COOL MAX TIME	0.5~24 h	8 h	0.5 h
HEAT MIN TIME	0.5~24 h	0.5 h	0.5 h
HEAT MAX TIME	0.5~24 h	8 h	0.5 h
DHW MIN TIME	0.5~24 h	0.5 h	0.5 h
DHW MAX TIME	0.5~24 h	8 h	0.5 h
E9 PROTECT TIME	2~20 s	5 s	1s
MIN RATIO	25~100%	25%	5%
MAX RATIO	70~100%	100%	5%

6 ELECTRIC WIRING DIAGRAM



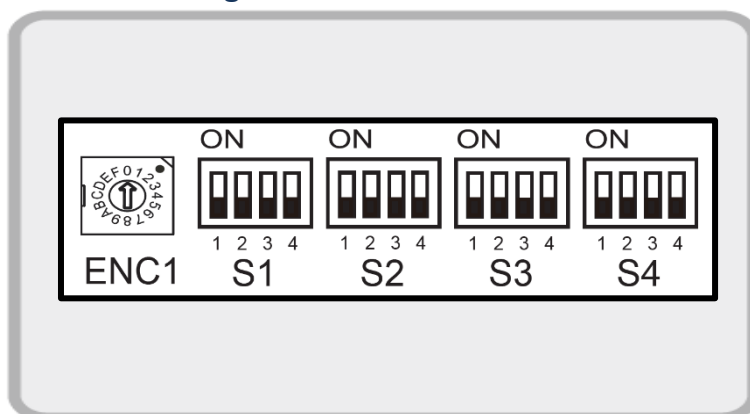
7 PCB

7.1 Main Control PCB

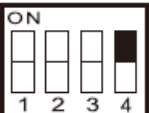
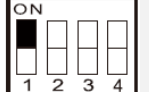
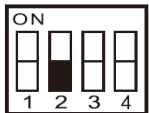
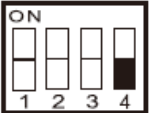


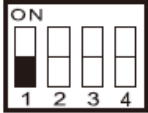
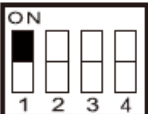
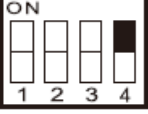
N°	Port	Code	Description	Voltage
1	CN32	POWER	Main board power supply	230V AC
2	CN99		Expansion board power supply	230V AC
3	CN68		Cooling fan and exhaust fan power supply	230V AC
4	CN74/CN67	CCH	Reserved / Crankcase Heater	230V AC
5	CN75/CN66	EVA-HEAT	Reserved / Electronic heating belt for plate heat exchanger	230V AC
6	CN48	ST1	Four-way valve	230V AC
7	CN47	SV6	Solenoid valve	230V AC
8	CN49	PAN-HEAT1	Water tray electric heating belt Water pipe electric heating belt	230V AC
9	CN84	SV8A	Reserved	0V
10	CN83	SV8B	Reserved	0V
11	CN93	ALARM	The alarm signal output of the unit (ON/OFF signal)	
12	CN65	USB	Program burn in port(USB)	5V DC
13	CN28	PH-PRO	Three-phase protector output switch	12V DC
14	CN22	XYE	Outdoor units communication and wired controller communication port	5V DC
15	CN46		The power supply port of the wired controller	12V DC
16	CN26	O-Motor	Compressor inverter module and Fan inverter module communication ports	12V / 5V DC
17	CN300	DEBUG	Program burn in port	3.3V DC
18	CN33	MS	Communicate with slave board	12V / 3.3V DC
19	CN41	L-YLA	System low pressure sensor	5V DC
20	CN40	H-YLA	System high pressure sensor	5V DC
21	CN45	Taf2	Probe of outlet water side antifreeze temp	3.3V DC
22	CN37	T3	Pipe temperature sensor of the condenser	3.3V DC
23	CN30	T4	Outdoor ambient temperature sensor	3.3V DC
24	CN16		Reserved	3.3V DC
25	CN38		Reserved	3.3V DC
26	CN27	TP-PRO	Discharge temperature switch protection	3.3V DC
27	CN42	L-PRO	Reserved	3.3V DC
28	CN8	T6A / T6B	Refrigerant inlet temperature of EVI plate heat exchanger / Refrigerant outlet temperature of EVI plate heat exchanger	3.3V DC
29	CN4	TwI	Unit water inlet temperature sensor	3.3V DC
		Th	System suction temperature sensor	
		Two	Unit water outlet temperature sensor	
		Tz/7	Coil final outlet temperature sensor	
		TP	DC inverter compressor discharge temperature sensor	
30	CN72	EXVC	Port for electrical expansion valve C	12V DC
31	CN70	EXVA	Port for electrical expansion valve A	12V DC
32	CN71	EXVB	Port for electrical expansion valve B	12V DC
33	SW3	UP	Up button	3.3V DC
	SW4	DOWN	Down button	
	SW5	MENU	Menu Buttons	
	SW6	OK	Confirm button	
34	DSP1/DSP2		Digital tube	3.3V DC
35	ENC1		ENC1 : NET_ADDRESS	3.3V DC
36	S1	S1	Dip switch	3.3V DC
37	S2	S2	Reserved	3.3V DC
38	S3	S3	Dip switch	3.3V DC
39	S4	S4	Dip switch	3.3V DC
40	CN69	PAN-HEAT2	Reserved	230V AC
41	CN36		Power supply module communication port	3.3V DC

7.1.1 Main board DIP switch setting

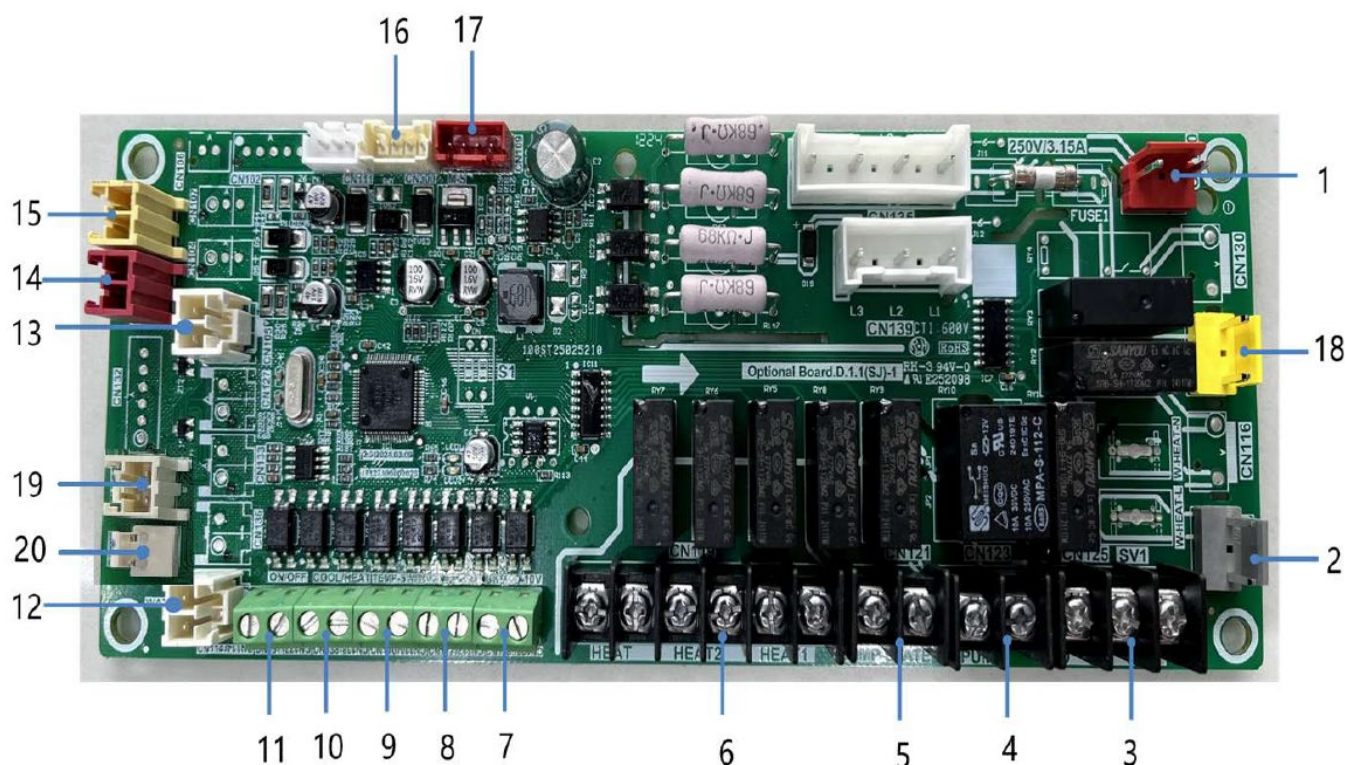


Settings			Description	Notes
ENC1 System address		0-F	Each unit is composed of two independent refrigerant circulation systems, each corresponding to its own address DIP switch. Specially, address 0 corresponds to the System A of the main unit, address 1 corresponds to the System B of the main unit, and the address DIP switch settings of other unit control systems shall be carried out in ascending order.	Set the address DIP switch of the main unit system A to 0#; each refrigerant circulation system needs to set the address DIP switch separately; the address DIP switch of different systems must not be repeated.
S1-1 Remote control		OFF	When the DIP switch is off, the device cannot use the remote control function and can only be controlled by the wired controller (factory default).	This adjustment is only applicable to Main Unit 0# and is invalid for other addresses.
		ON	When the DIP switch is turned on, the remote control function of the unit will take effect. 1. The start and stop of the unit can be controlled through the ON/OFF port on the main board expansion board: shorting-circuit starts the unit, while disconnecting shuts down the unit. 2. The running mode of the unit can be adjusted through the H/C port on the expansion board: shorting-circuit for heating mode and disconnecting it for cooling mode. 3. If the unit is connected to a wired controller, the wired controller can only change parameters such as the set temperature and recovery from startup errors (if not connected to a wired controller, the default values will control).	
S1-2		OFF	When the DIP switch is off, the maximum temperature for the heating mode can be set to 75°C (factory default).	In a system controlled by the same wired controller, each subsystem needs to select the S1-2 setting, and all subsystems shall maintain the same selection.
		ON	When the DIP switch is turned on, the maximum temperature for the heating mode can be set to 85°C.	

Settings		Description	Notes
S1-3 Pump		OFF	When all units controlled by the same wired controller share the same main water pump, this dial code should be OFF.
		ON	When each unit in a system controlled by the same wire is equipped with a separate water pump, this dial should be ON (factory default).
S1-4		OFF	When a single unit is matched with a single fixed-speed water pump or a single variable-frequency water pump, this DIP switch shall be set to OFF (factory default).
		ON	When the hydraulic equipment of a single unit adopts a combination of fixed-speed pumps and parallel variable-frequency pumps, this switch shall be set to ON. When the DIP switch is turned on, the system will perform coordinated regulation of the constant-speed water pump and the variable-frequency water pump.
S2-1		OFF	No water pressure switch detection function. (factory default)
		ON	Enable water pressure switch detection function.
S2-2		OFF	No refrigerant leakage detection function.
		ON	Enable refrigerant leakage detection function. (factory default)
S2-3		OFF	Factory default
S2-4		OFF	Heating and cooling model. (factory default)
		ON	Cooling only

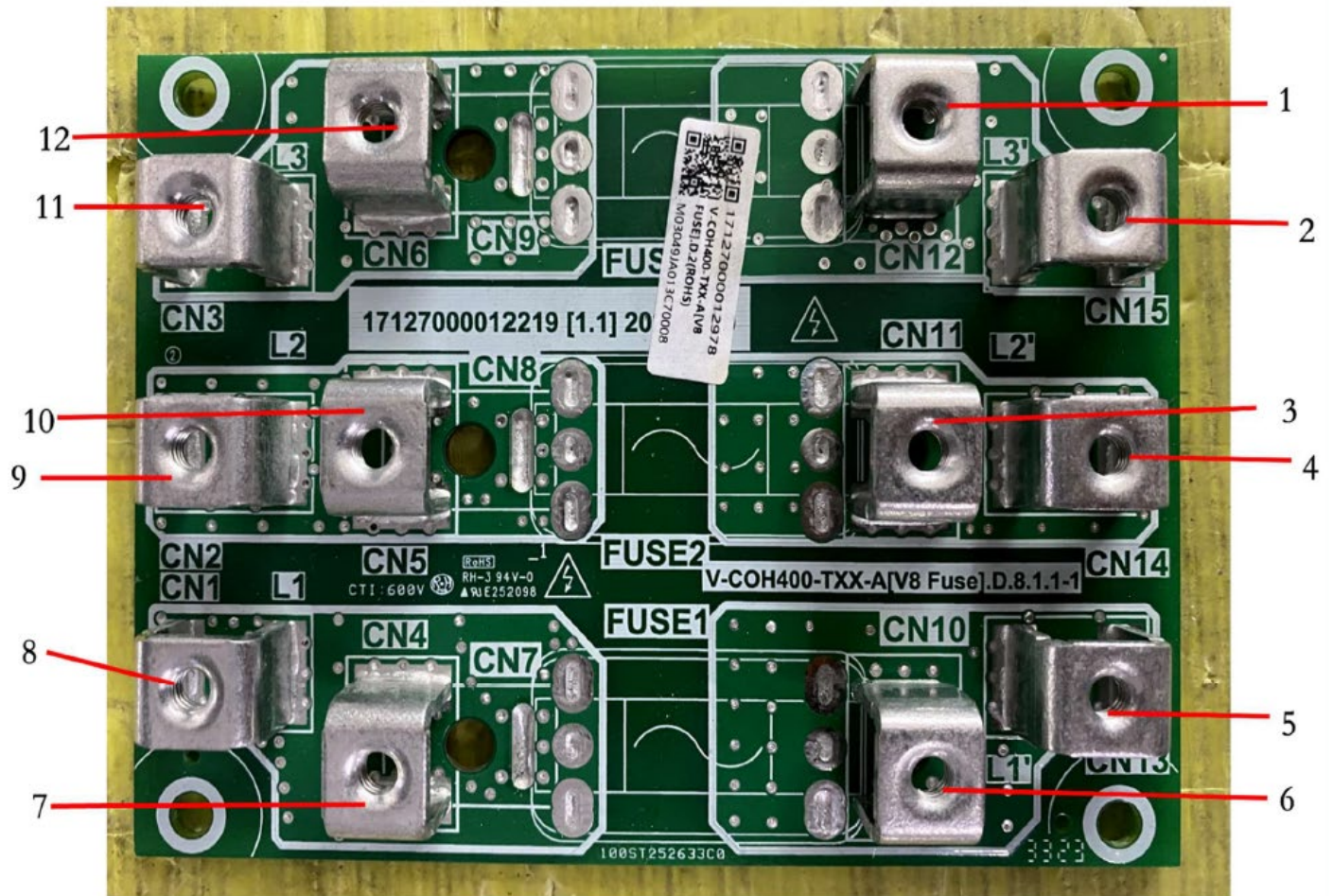
Settings		Description		Notes
S3-1		OFF	This DIP switch is used to distinguish between System A and System B within a single unit. When the DIP switch is in the off position, the system will be System A; when the DIP switch is on, the system will be System B.	This DIP switch has been pre-set and does not need to be changed during installation and commissioning. If a fault occurs, check whether the DIP switch settings are correct.
		ON		
S3-2		ON	Factory default	Reserved
S3-3		OFF	Factory default	Reserved
S3-4		ON	Factory default	Reserved
S4			70KW unit select 0000	Only when replacing a PCB
			60KW unit select 0001	
			50KW unit select 0010	

7.2 Expansion board



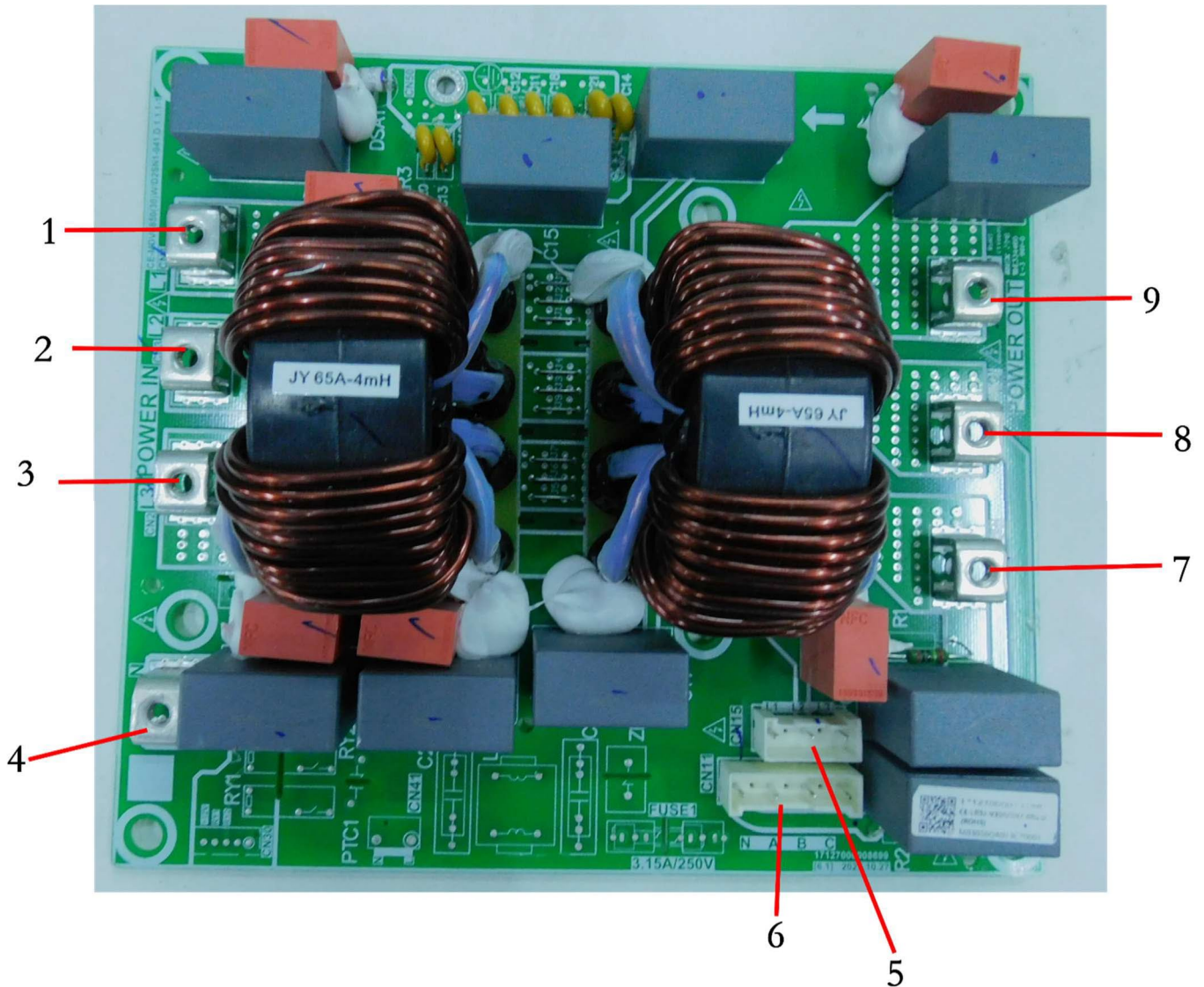
N°	Port	Code	Description	Voltage
1	CN140	POWER	Expansion board power supply	230V AC
2	CN115	W-HEAT	Electric heater of water flow switch	230V AC
3	CN125	SV1	Three-way valve (domestic hot-water valve)	230V AC
4	CN123	PUMP	Port controlled by the contactor of the constant speed water pump	
5	CN121	COMP-STATE	Compressor status indication	
6	CN119	HEAT1 HEAT2	Pipeline Auxiliary Heater Hot Water Tank Auxiliary Heater	
7	CN108	PUMP-V	Inverter pump 0-10V output control signal	0-10V DC
8	CN117	W.P-SW	Water pressure switching port	12V DC
9	CN110	TEMP-SW	Target water temperature switch	12V DC
10	CN138	COOL/ HEAT	Remote function of cool/heat signal	12V DC
11	CN137	ON/OFF	Remote function of on/off signal	12V DC
12	CN114	WATER-SWITCH	Water flow switch signal	12V DC
13	CN105	Taf1	Probe of inlet water side antifreeze temp	3.3V DC
14	CN101	TW	Probe of finaunit water outlet temp	3.3V DC
15	CN103	T5	Probe of water tank	3.3V DC
16	CN300	DEBUG	Program burn in port	3.3V DC
17	CN109	MS	Communicate with main board	12V / 3.3V DC
18	CN118		Reserved	230V AC
19	CN122		SG Ready 3.0 SG1 port	
20	CN120		SG Ready 3.0 SG2 port	230V AC

7.3 Fuse board



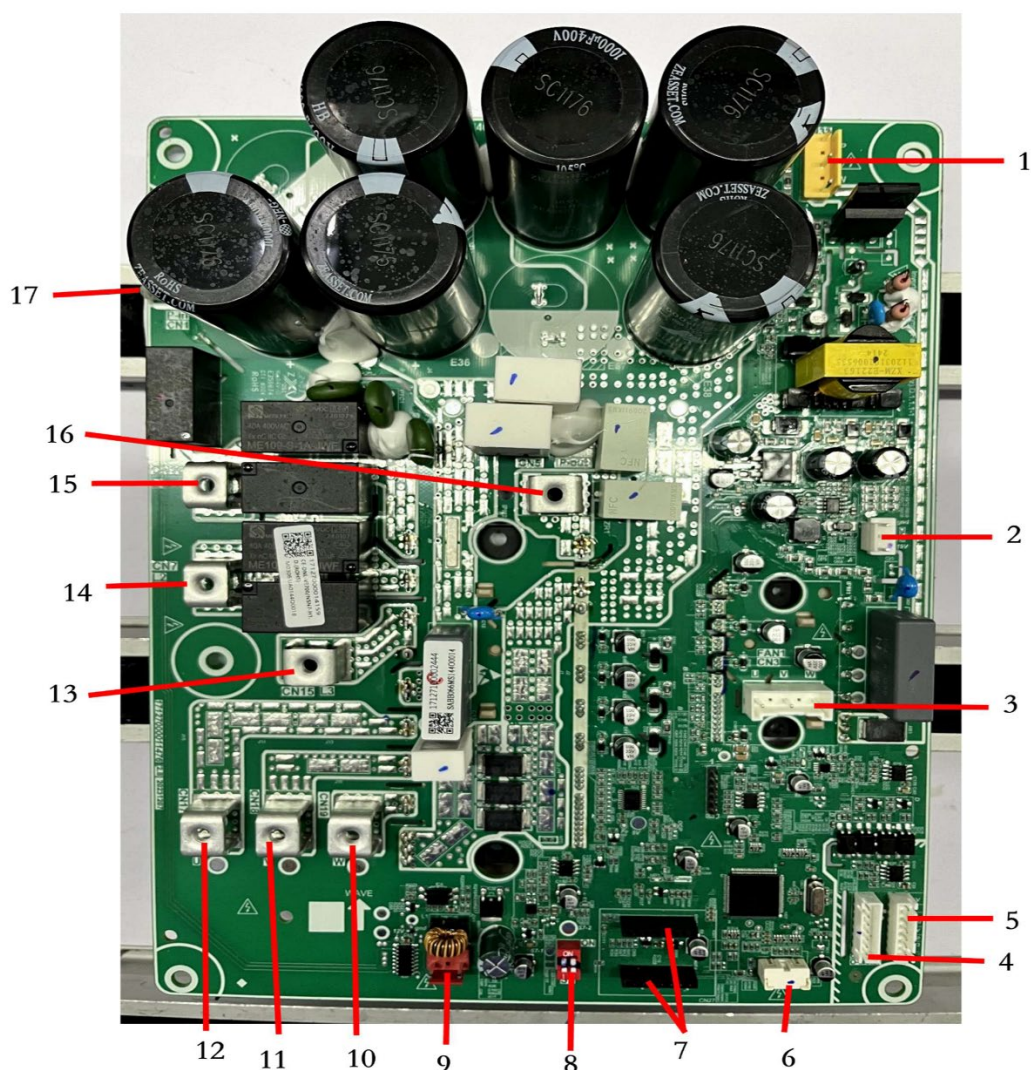
No.	Port	Code	Content	Voltage
1	CN12	/	Fuse 1-1	AC230V
2	CN15	L3'	Input power L3'	AC230V
3	CN11	/	Fuse 2-1	AC230V
4	CN14	L2'	Input power L2'	AC230V
5	CN13	L1'	Input power L1'	AC230V
6	CN10	/	Fuse 3-1	AC230V
7	CN4	/	Fuse 3-2	AC230V
8	CN1	L1	Output power L1	AC230V
9	CN2	L2	Output power L2	AC230V
10	CN5	/	Fuse 2-2	AC230V
11	CN3	L3	Output power L3	AC230V
12	CN6	/	Fuse 1-2	AC230V

7.4 AC filter board



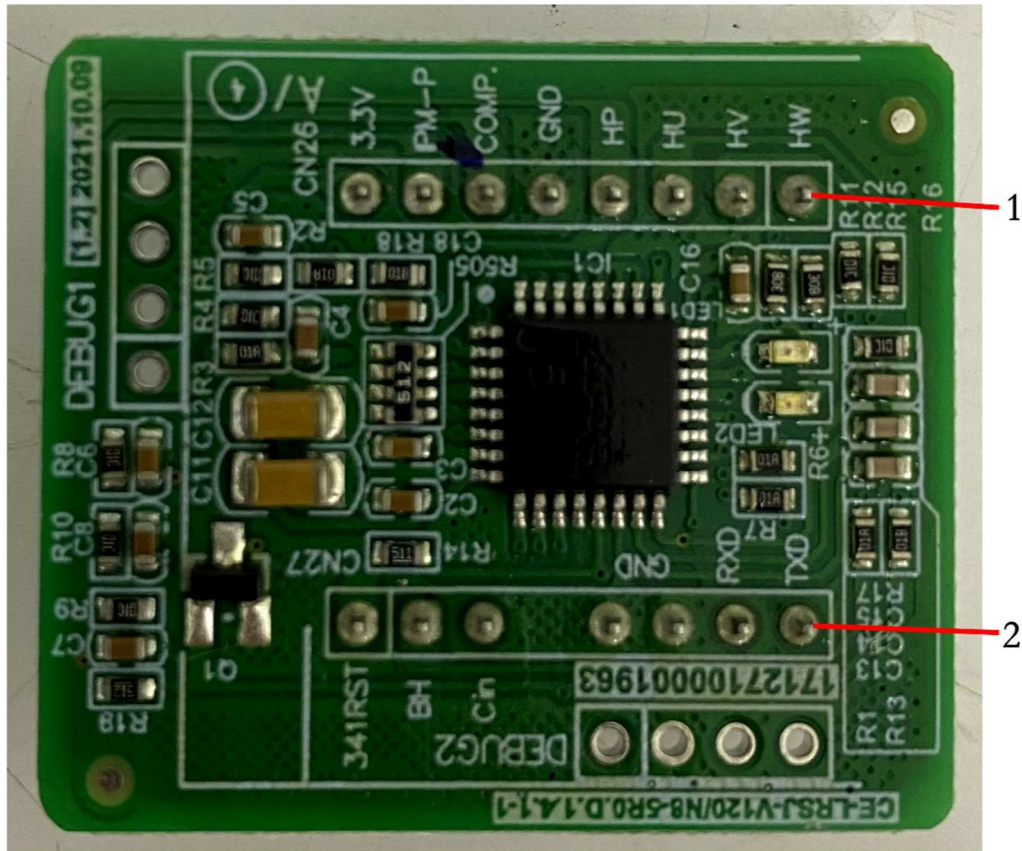
No.	Port	Code	Content	Voltage
1	CN4	L1	Power input L1	AC380-415V
2	CN3	L2	Power input L2	
3	CN2	L3	Power input L3	
4	CN1	N	Reserved	
5	CN15	L1 L2 L3	Reserved	AC380-415V
6	CN11	N A B C	Reserved	AC380-415V
7	CN6	L3'	Output power L3'	AC380-415V
8	CN7	L2'	Output power L2'	
9	CN8	L1'	Output power L1'	

7.5 Compressor & fan driver board



No.	Port	Code	Content	Voltage
1	CN38	P N	DC fan power output port	DC565V
2	CN26	19V GND	Fan module board power supply port	DC19V
3	CN3	UVW	Port output for fan	Phase to phase voltage 46-460VAC
4	CN8	O-Motor	PTC relay control port/communication port	DC12V/DC5V
5	CN9	O-Motor	PTC relay control port/communication port	DC12V/DC5V
6	CN25	/	Reserved	/
7	CN27	/	PED board socket	DC5V
8	S7	S7	Module address DIP switch	/
9	CN21	H-Pro	High pressure switch	/
10	CN19	W	Power output for compressor	Phase to phase voltage 46-460VAC
11	CN18	V		Phase to phase voltage 46-460VAC
12	CN17	U		Phase to phase voltage 46-460VAC
13	CN15	L3	Power input port	AC380-415V
14	CN7	L2		
15	CN16	L1		
16	CN5	P-out	Output for reactor	/
17	CN1	P-in	Input from reactor	/

7.6 PED board



No.	Port	Content
1	CN26	Connect to compressor & fan drive board PCB
2	CN27	Connect to compressor & fan drive board PCB

8 ERROR CODE

No	Code	Content	Note
1	E0	Wrong capacity selection	Modify DIP SWITCH accordingly and restart
2	E1	Phase sequence error of main control board check	Recovered upon failure recovery
3	E2	Communication failure between master and the HMI or master and slave	Recovered upon failure recovery
	2E2	Communication failure between main control and extension board	Recovered upon failure recovery
	3E2	Communication failure between master and slave in a unit	Recovered upon failure recovery
4	E3	Total water outlet temperature sensor failure	Recovered upon failure recovery
5	E4	Unit water outlet temperature sensor failure	Recovered upon failure recovery
6	1E5	Condenser tube temperature sensor T3A failure	Recovered upon failure recovery
7	E6	Water tank temperature sensor T5 failure	Recovered upon failure recovery
8	E7	Ambient temperature sensor failure	Recovered upon failure recovery
9	E8	Power supply phase sequence protector output error	Recovered upon failure recovery
10	E9	Water flow detection failure	Failure locking for 3 times in 60 minutes (Recovered by power off or Wired controller clear fault)
11	1Eb	Taf1 the pipe of the tank antifreeze protection sensor failure	Recovered upon failure recovery
12	2EB	Taf2 cooling evaporator low-temperature antifreeze protection sensor failure	Recovered upon failure recovery
13	Ed	System discharge temperature sensor failure	Recovered upon failure recovery
14	1EE	EV1 plate heat exchanger refrigerant temperature T6A sensor failure	Recovered upon failure recovery
	2EE	EV1 plate heat exchanger refrigerant temperature T6B sensor failure	Recovered upon failure recovery
15	EF	Unit water return temperature sensor failure	Recovered upon failure recovery
16	EP	Discharge sensor failure alarm	Recovered upon failure recovery
17	EU	Tz sensor failure	Recovered upon failure recovery
18	P0	System high-pressure protection or discharge temperature protection	for 3 times in 60 minutes (Recovered by power off)
	1P0	System high-pressure switch disconnect protection	Recovered upon failure recovery
19	P1	System low pressure protection (or severe refrigerant leakage protection)	for 3 times in 60 minutes (Recovered by power off)
20	P3	T4 ambient temperature too high in cooling mode	Recovered upon failure recovery
21	1P4	System A current protection	for 3 times in 60 minutes (Recovered by power off)
	2P4	System A DC bus current protection	
22	P6	Inverter module failure	Recovered upon error recovery
23	P7	High temperature protection of system condenser	for 3 times in 60 minutes (Recovered by power off)
24	P9	Water inlet and outlet temperature difference protection	Recovered upon failure recovery
25	PA	Abnormal water inlet and outlet temperature difference protection	Recovered upon failure recovery
26	PC	Cooling evaporator pressure too low	Recovered upon error recovery
27	PE	Cooling evaporator low temperature antifreeze protection	Recovered upon error recovery
28	PH	Heating T4 too high temperature protection	Recovered upon error recovery
29	PL	Tfin module temperature too high protection	for 3 times in 100 minutes (Recovered by power off)
	1PU	DC fan A module protection	Recovered upon failure recovery
30	1bh	Module 1 failure	Recovered upon error recovery
31	H5	Voltage too high or too low	Recovered upon error recovery
32	1H9	Compressor inverter module is not matched	Recovered upon error recovery
33	HC	High pressure sensor failure	Recovered upon error recovery
34	1HE	No inset A valve error	Recovered upon error recovery
	2HE	No inset B valve error	Recovered upon error recovery
	3HE	No inset C valve error	Recovered upon error recovery
35	1F0	IPM module A transmission error	Recovered upon error recovery
36	F2	Superheat insufficient	Wait at least 20min before recovering

No	Code	Content	Note
37	F4	1F4 module 1L0 or 1LE protection occurs for 3 times in 60 minutes	Recovered by power off
38	1F6	A system bus voltage error (PTC)	Recovered upon error recovery
39	Fb	Low pressure sensor error	Recovered upon error recovery
40	Fd	Suction temperature sensor error	Recovered upon error recovery
41	1FF	DC fan A error	Recovered by power off
42	FP	DIP switch inconsistency of multiple water pumps	Recovered by power off
43	1HA	Variable frequency module board is not matched	Recovered by power off
44	H6	Refrigerant concentration sensor error	Recovered upon error recovery
45	H1	Refrigerant concentration sensor communication error	Recovered upon error recovery
46	H2	The refrigerant concentration sensor has reached the end of its lifespan	Recovered upon error recovery
47	H3	DIP switch inconsistency of refrigerant concentration sensor	Recovered by power off
48	HF	Refrigerant leakage protection	Recovered by power off
49	Hd	1Hd/2Hd cooling fan error	Recovered upon error recovery for 10 times in 60 minutes (Recovered by power off)
50	HH	1HH/2HH exhaust fan error	Recovered upon error recovery for 10 times in 60 minutes (Recovered by power off)
51	1L10	Hardware overcurrent protection	Overcurrent type fault
	1L11	Instantaneous overcurrent protection for phase current	
	1L12	Continuous 30s overcurrent protection for phase current	
52	1L20	Module over-temperature protection	Over-temperature type fault
53	1L30	Too low busbar voltage fault	Power supply type fault
	1L31	Too high busbar voltage fault	
	1L32	Severely too high busbar voltage fault	
	1L34	Three-phase power input phase loss fault	
54	1L43	Abnormal current sampling bias	Hardware type fault
	1L45	Motor code mismatch	
	1L46	IPM protection (FO)	
	1L47	Module model mismatching (after module resistance detection)	
55	1L50	Start failure	Control type fault
	1L51	Step-out fault (reserved)	
	1L52	Stalling protection	
56	1L60	Motor phase loss protection	Diagnosis type fault
	1L65	IPM short circuit protection	
	1L66	FCT detection fault	
	1L6A	IPM U-phase upper tube open circuit	
	1L6B	IPM U-phase lower tube open circuit	
	1L6C	IPM V-phase upper tube open circuit	
	1L6D	IPM V-phase lower tube open circuit	
	1L6E	IPM W-phase upper tube open circuit	
	1L6F	IPM W-phase lower tube open circuit	

9 TROUBLESHOOTING

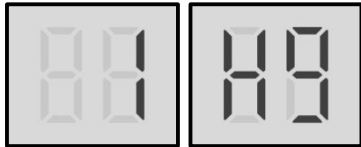
9.1 Warning

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.

9.2 E0, 1H9 Troubleshooting

9.2.1 Digital display output



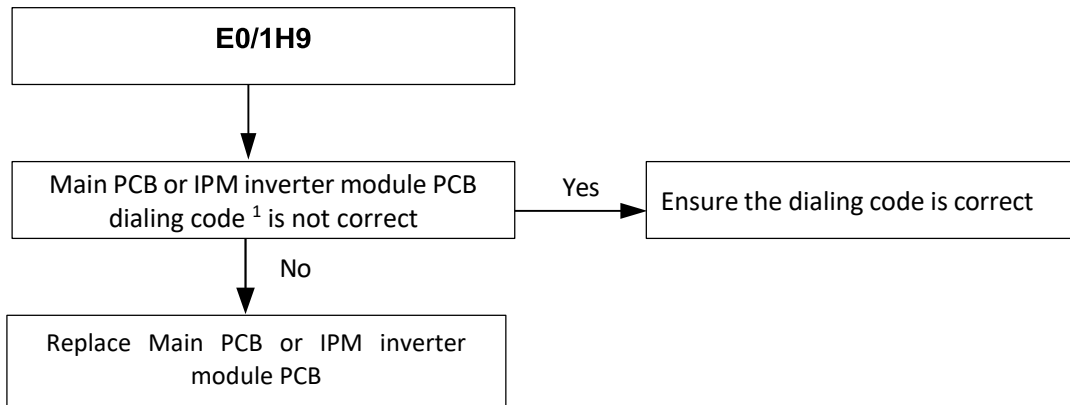
9.2.2 Description

- 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) does not match
- All units stop running
- Error code is displayed on main PCB and user interface

9.2.3 Possible causes

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

9.2.4 Procedure



NOTE

1. Main PCB capability dialing code is designated S4 on the main PCBs.
 Main PCB refrigerant dialing code is designated S3-2 on the main PCBs.
 Compressor inverter module PCB address dialing code is designated S7 on compressor inverter module PCB.

9.3 E1 Troubleshooting

9.3.1 Digital display output



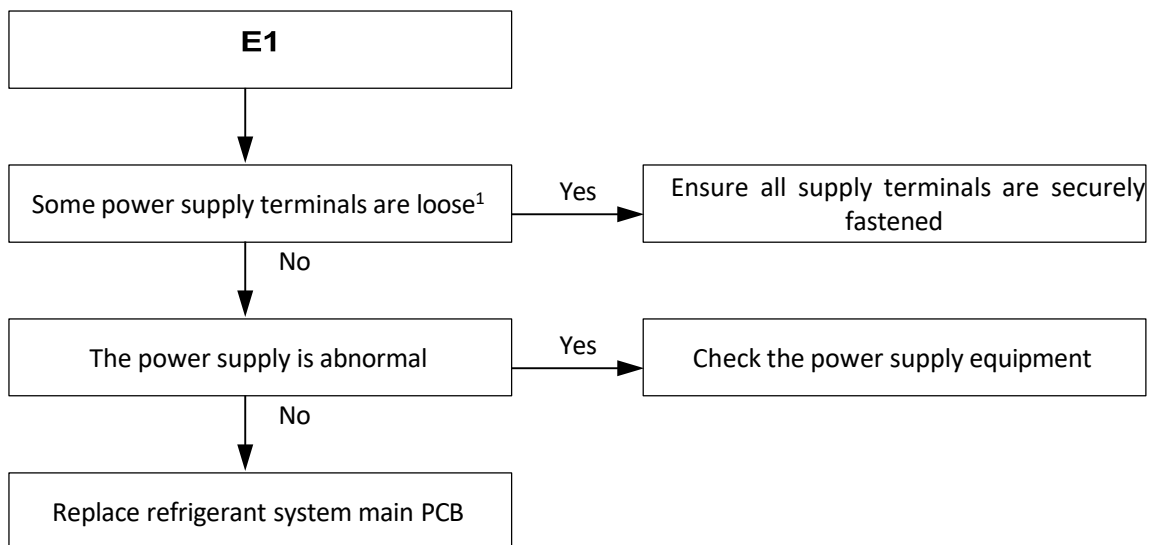
9.3.2 Description

- Phase sequence error
- All Units stops running
- Error code is displayed on main PCB and user interface

9.3.3 Possible causes

- Power supply terminals loose
- Power supply abnormal
- Main PCB damaged

9.3.4 Procedure



NOTE

1. Loose power supply terminals can cause the compressor to operate abnormally and compressor current to be very large.

9.4 E2 Troubleshooting

9.4.1 Digital display output



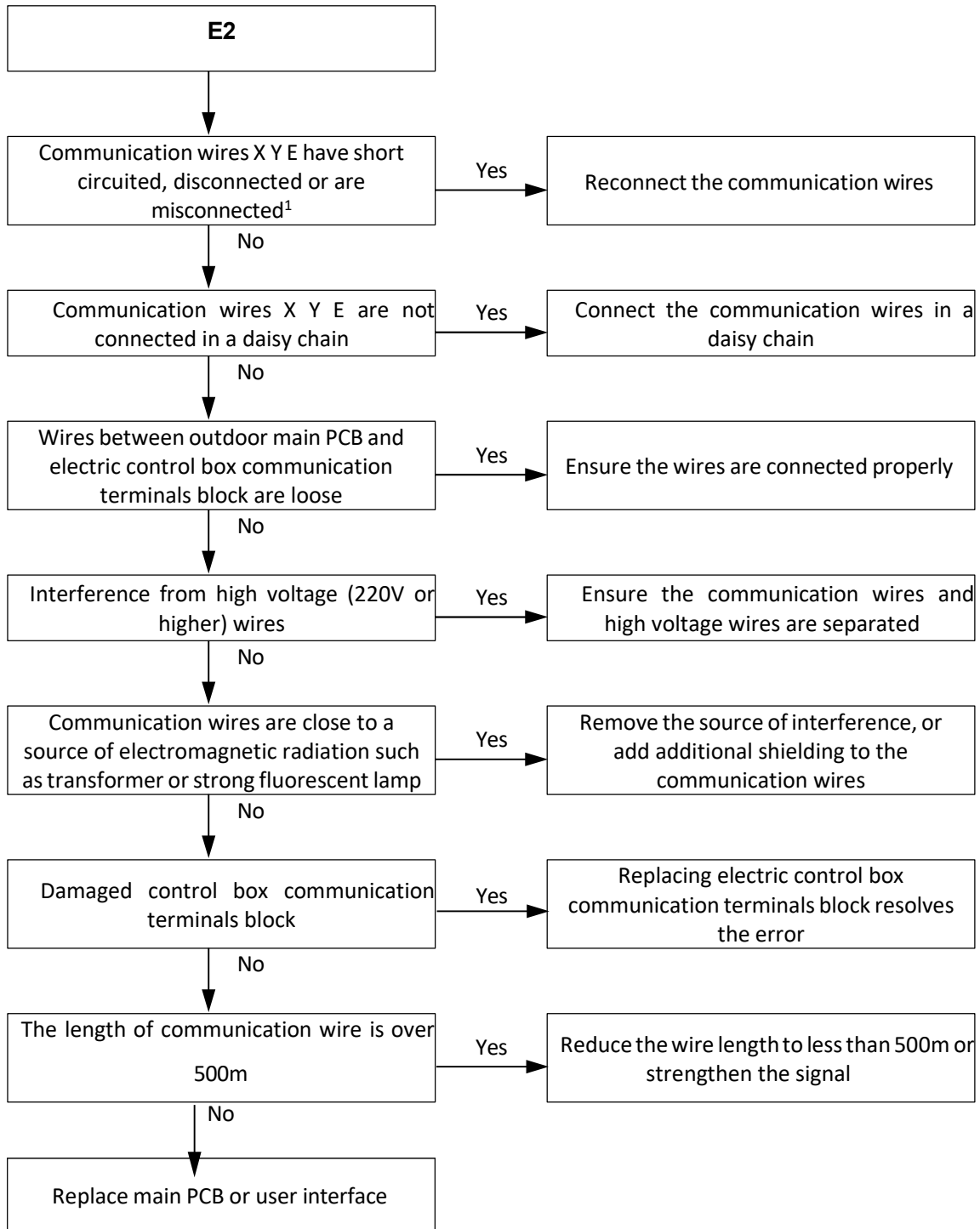
9.4.2 Description

- Communication error between outdoor unit and user interface
- Communication failure between master and slave units
- All units stop running
- Error code is displayed on main PCB and user interface

9.4.3 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.

9.4.4 Procedure

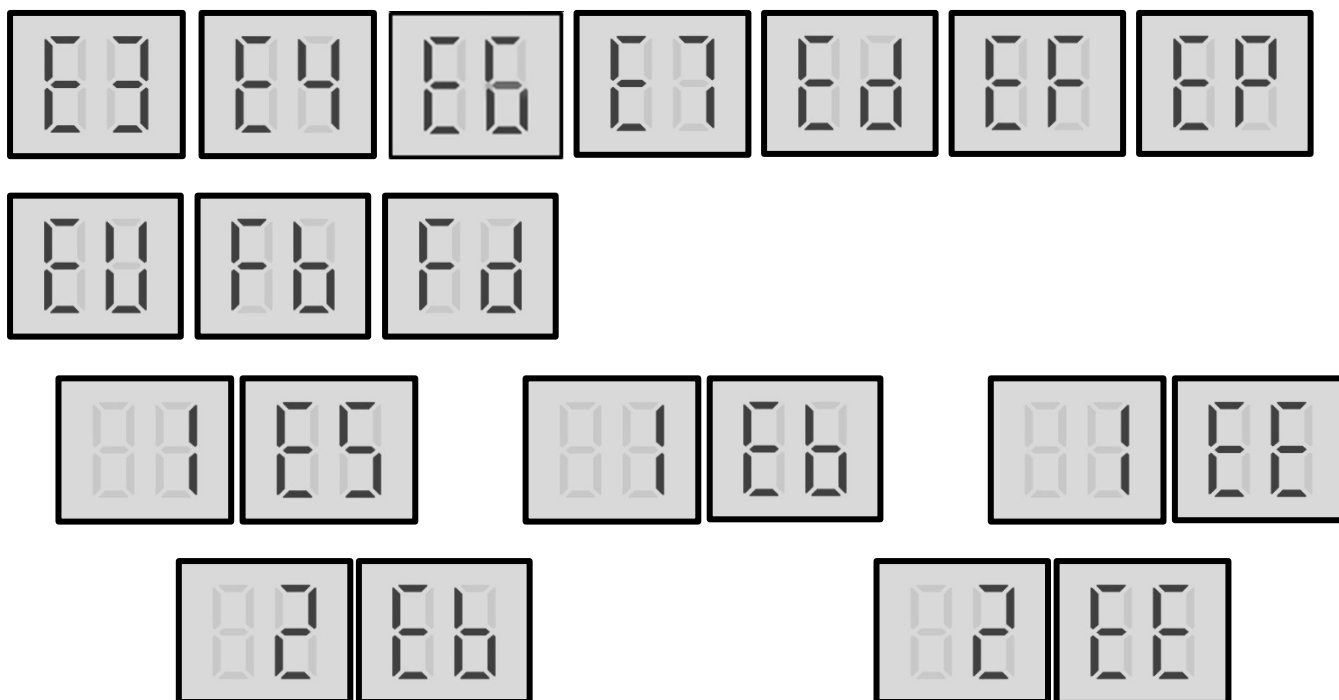


NOTE

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.

9.5 E3 / E4 / 1E5 / E6 / E7 / 1Eb / 2Eb / Ed / 1EE / 2EE / EF / EP / EU / Fb / Fd Troubleshooting

9.5.1 Digital display output



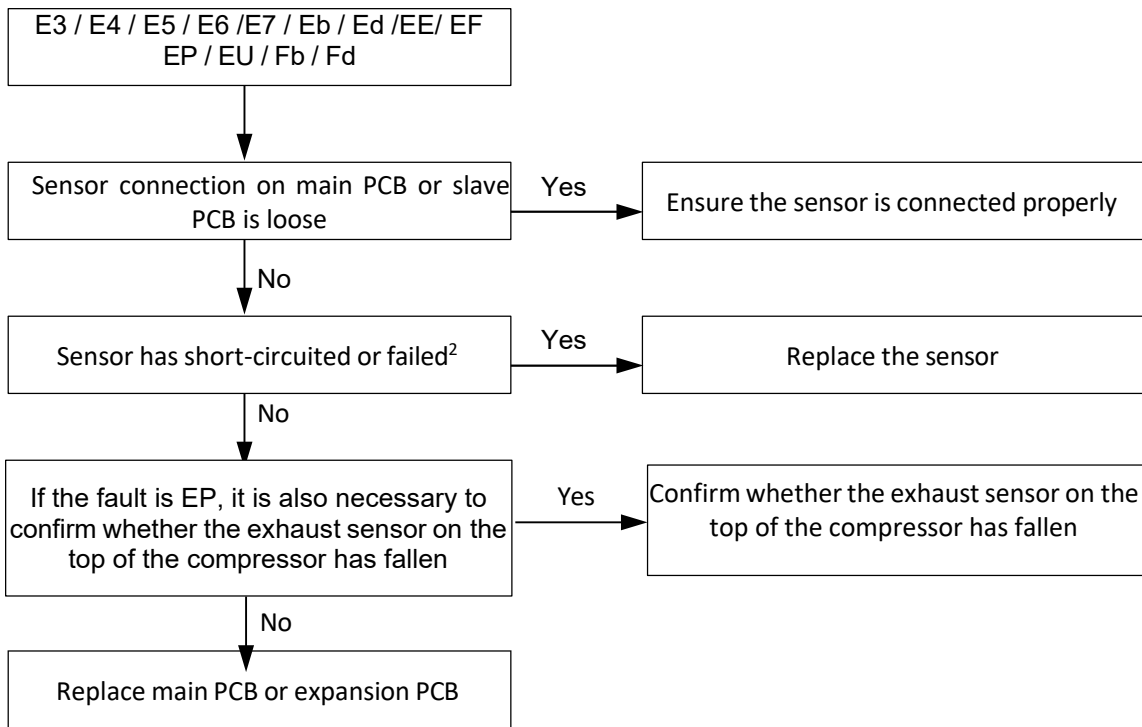
9.5.2 Description

- 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
- E6 Water tank temperature sensor T5 failure
- E7 indicates ambient temperature sensor error
- 1Eb indicates pipe of the tank antifreeze protection sensor Taf1 error
- 2Eb indicates cooling evaporator low-temperature antifreeze protection sensor Taf2 error
- Ed indicates discharge pipe temperature sensors Tp1 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 units stop running(E3,E6,1Eb).
- Error code is displayed on main PCB and user interface.

9.5.3 Possible causes

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

9.5.4 Procedure



NOTE

1. Most sensors are connected to ports CN4 (E4), CN37 (1E5), CN30 (E7), CN45 (2Eb), CN4 (Ed), CN8 (EE), CN4 (EF), CN4 (EP), CN4 (EU), CN41 (Fb), CN4 (Fd), on the main PCB. A few sensors are connected to ports CN101 (E3), CN103 (E6), CN105 (1Eb), on the slave PCB.

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.

9.6 E8 Troubleshooting

9.6.1 Digital display output



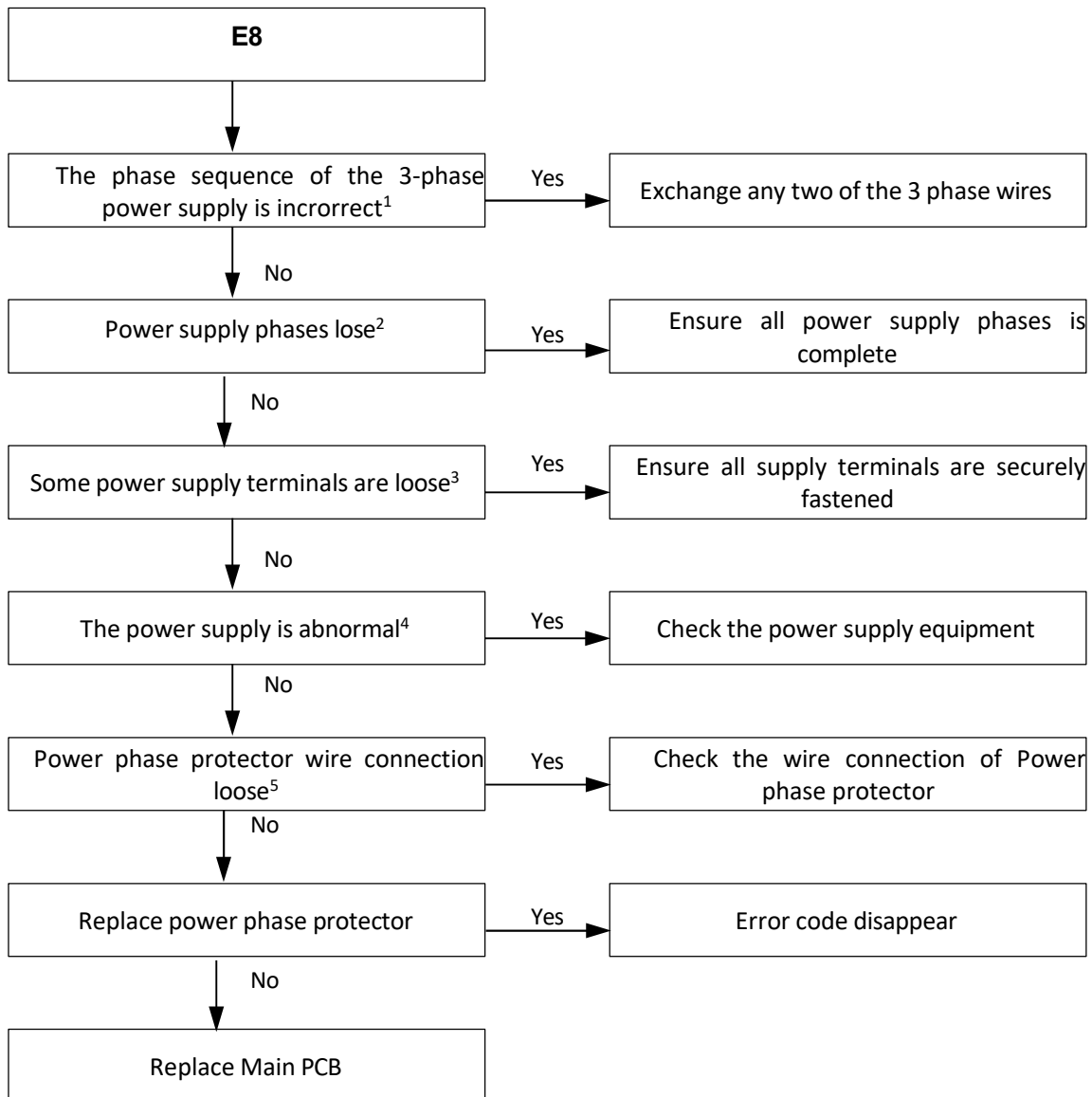
9.6.2 Description

- Power supply phase sequence protector output error
- All units stop running.
- Error code is displayed on main PCB and user interface.

9.6.3 Possible causes

- Power supply phases not connected in correct sequence or lose.
- Power supply terminals or Power phase protector wire connection loose(If the model does not have a three-wire protector, the CN28 terminal on the main control board needs to be shorted with a jumper).
- Power supply abnormal.
- Damaged main PCB.
- Damaged power phase protector.

9.6.4 Procedure



NOTE

1. For some models that do not have a three-phase protector, the CN28 terminal on the main control board needs to be shorted with a jumper.

2. The red LED on the power phase protector will on.

3. The red LED on the power phase protector will flash with 1HZ.

4. 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.

5. 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.

6. Wire connected to port CN28 on the main PCB (Main PCB component)

9.7 E9 Troubleshooting

9.7.1 Digital display output



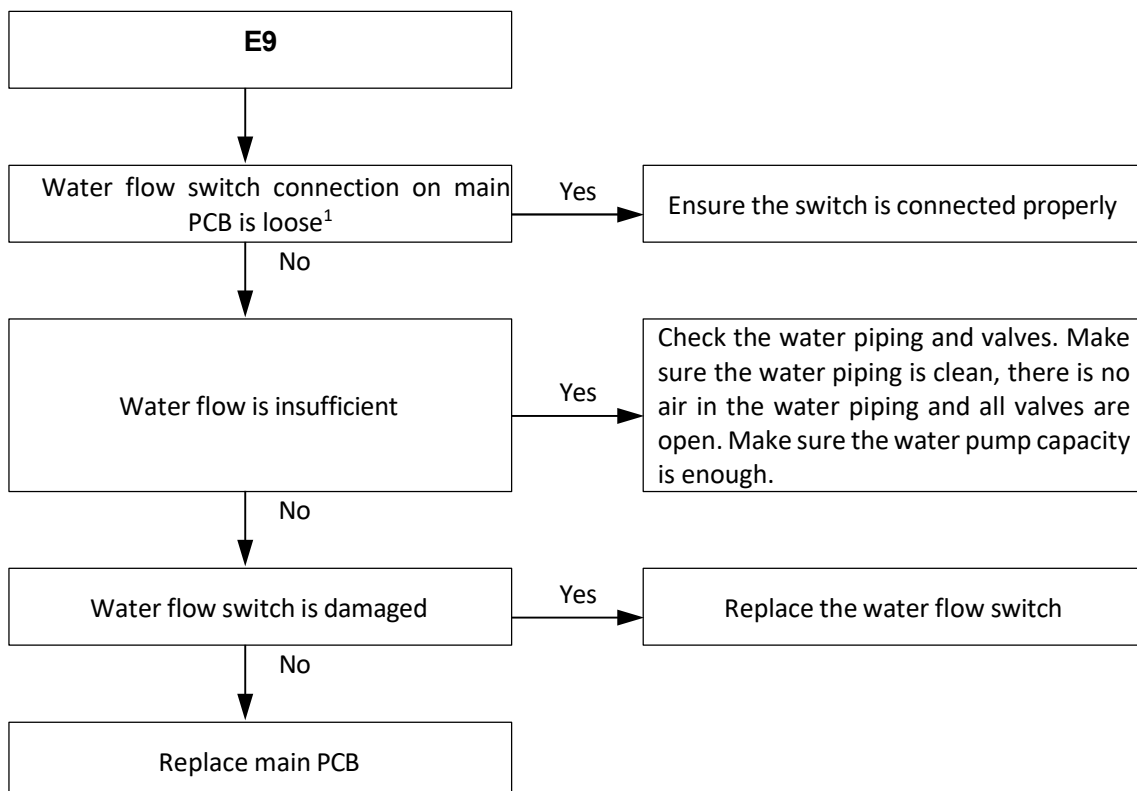
9.7.2 Description

- 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.
- All units stop running.
- Error code is displayed on main PCB and user interface.

9.7.3 Possible causes

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

9.7.4 Procedure



NOTE

1. Water flow switch connection is port CN114 on the slave PCB.

9.8 EC Troubleshooting

9.8.1 Digital display output



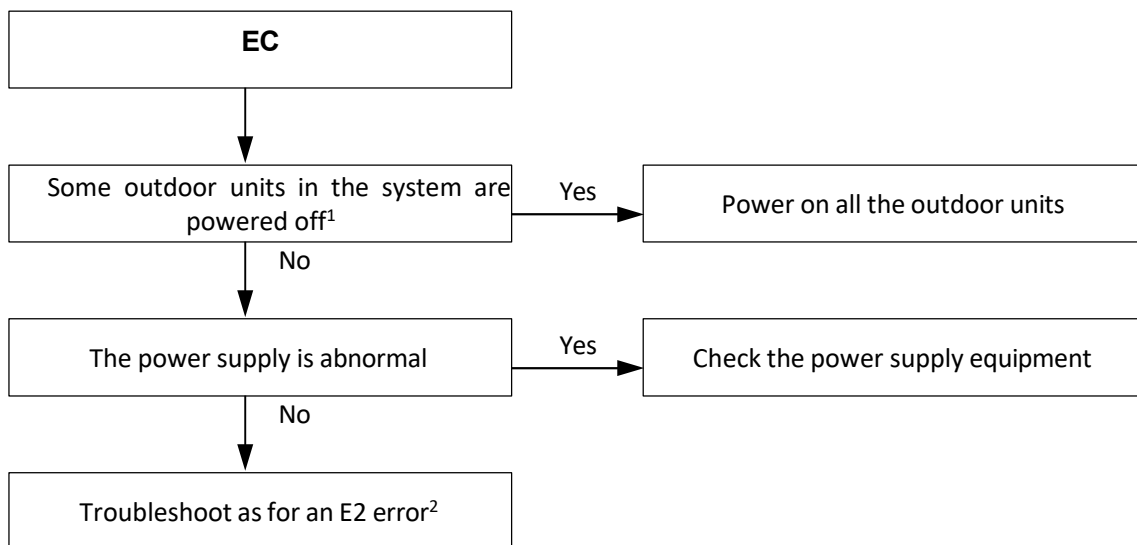
9.8.2 Description

- EC indicates that the number of slave units detected by master unit has decreased.
- Unit stop running.
- Error code is only displayed on the user interface.

9.8.3 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.

9.8.4 Procedure



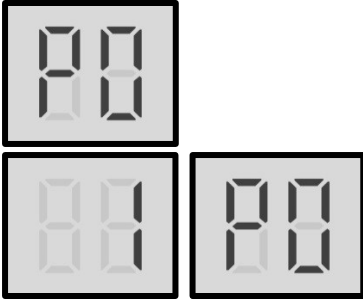
NOTE

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.

2. See "E2 Troubleshooting".

9.9 P0 / 1P0 Troubleshooting

9.9.1 Digital display output



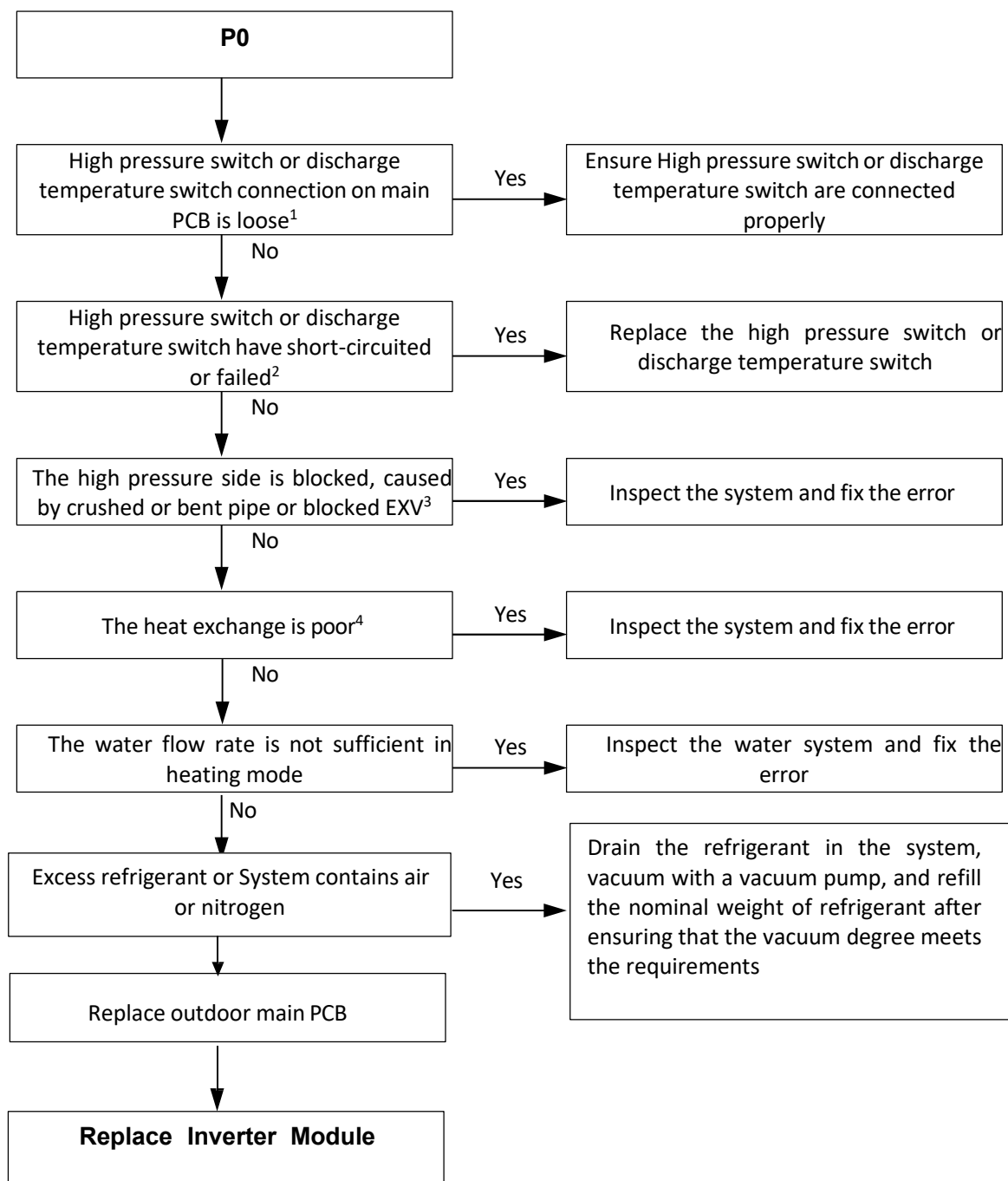
9.9.2 Description

- Discharge pipe high pressure or discharge temperature switch protection. When the discharge pressure rises above 3.4MPa or discharge temperature rises above 115°C, the system displays P0 protection and unit stop running. When the discharge pressure falls below 2.9MPa 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.

9.9.3 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.

9.9.4 Procedure



NOTE

1.Discharge temperature switch connection is port CN27 on the main PCB .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.

9.10 P1 Troubleshooting

9.10.1 Digital display output



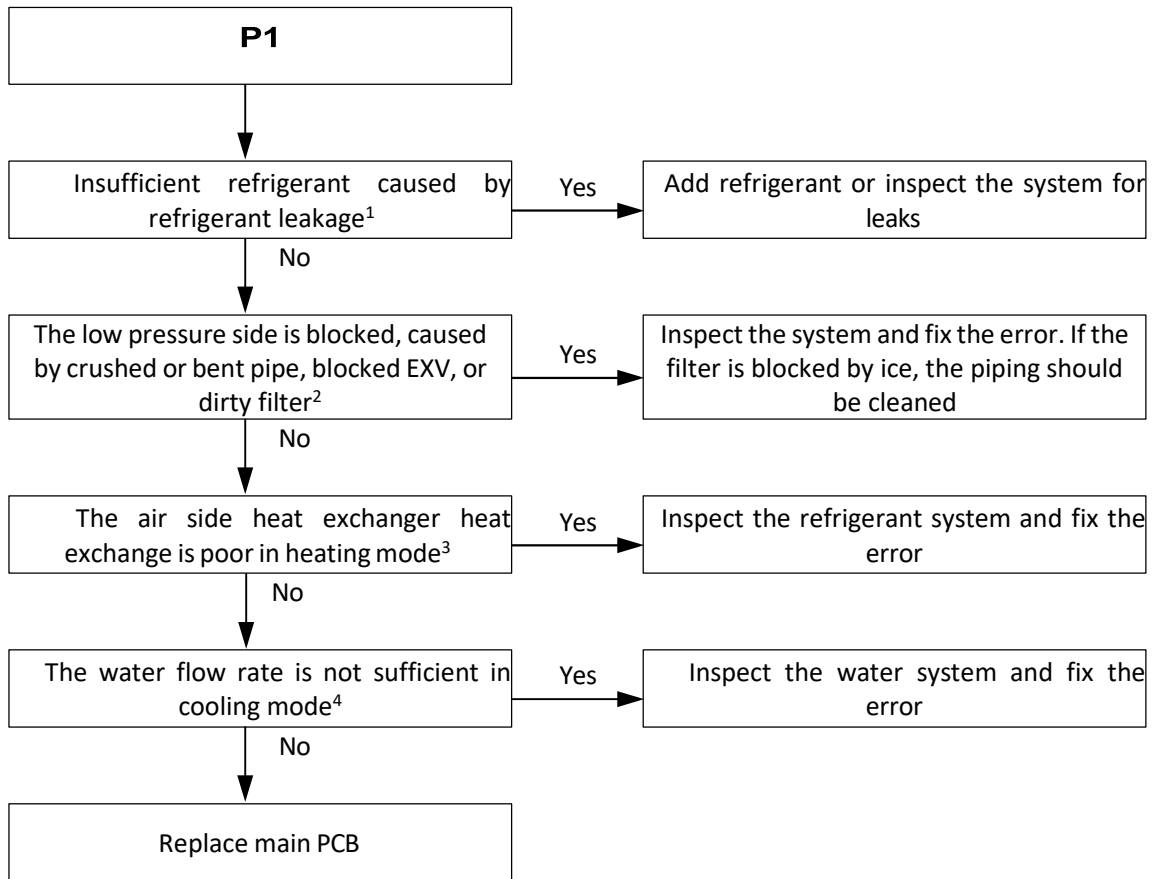
9.10.2 Description

- P1 indicates suction pipe low pressure protection. When the suction pressure falls below 0.03MPa, the system displays P1 protection and unit stop running. When the pressure rises above 0.1MPa, 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 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 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.

9.10.3 Possible causes

- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in heating mode.
- Insufficient water flow in cooling mode.
- Main PCB damaged.

9.10.4 Procedure



NOTE

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.

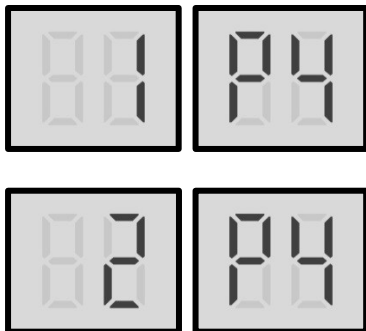
2. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters.

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.

9.11 1P4 / 2P4 Troubleshooting

9.11.1 Digital display output



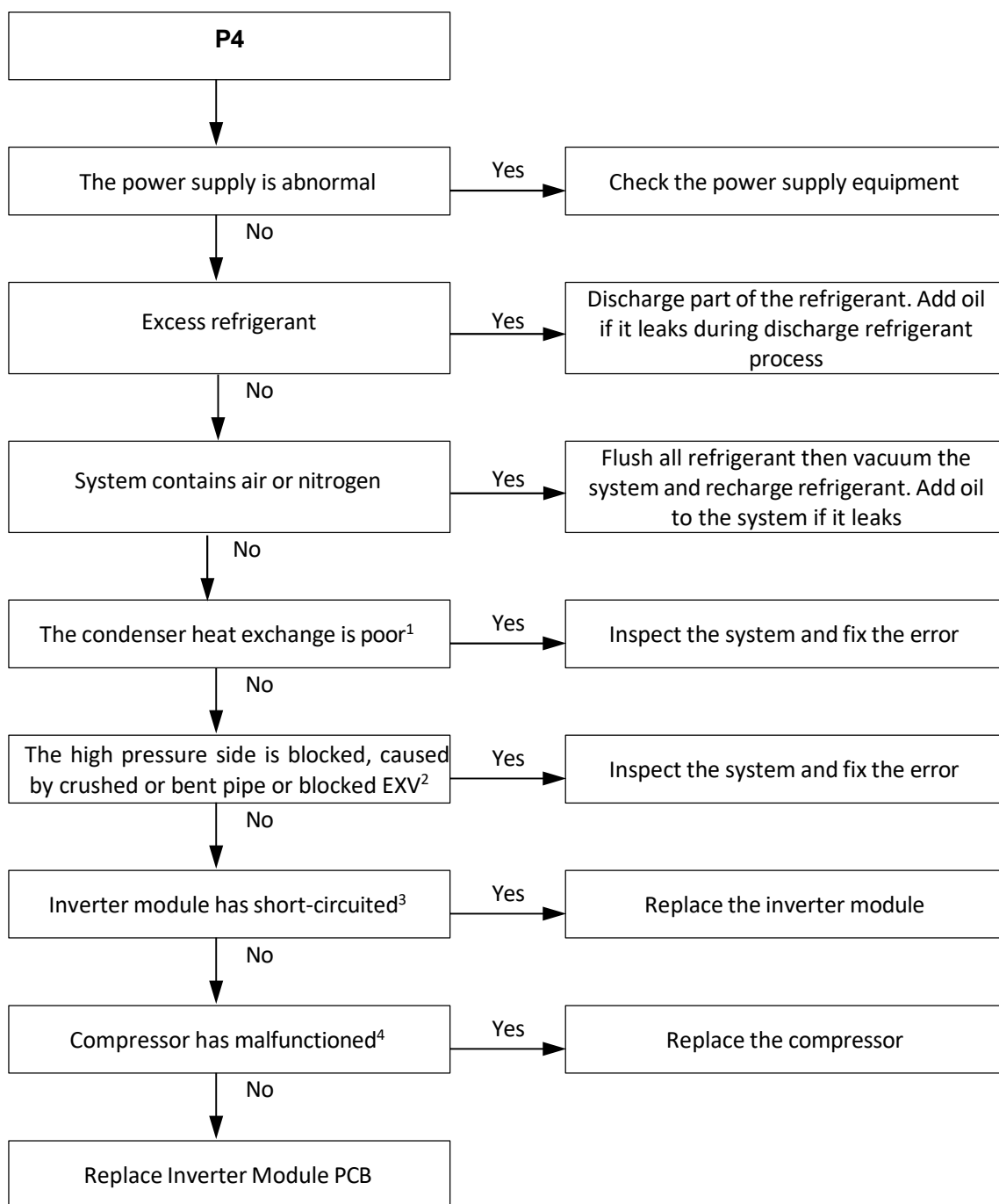
9.11.2 Description

- 1 P4 indicates system current protection
- 2 P4 indicates system DC bus current protection
- When the compressor current rises above the protection value 35A (DC bus current rises above 35A), the system displays P4 protection and unit stop running. When the current returns to the normal range, P4 is removed and normal operation resumes. When P4 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.

9.11.3 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.

9.11.4 Procedure



NOTE

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 0.139Ω (at 20°C 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.

9.12 P7 Troubleshooting

9.12.1 Digital display output



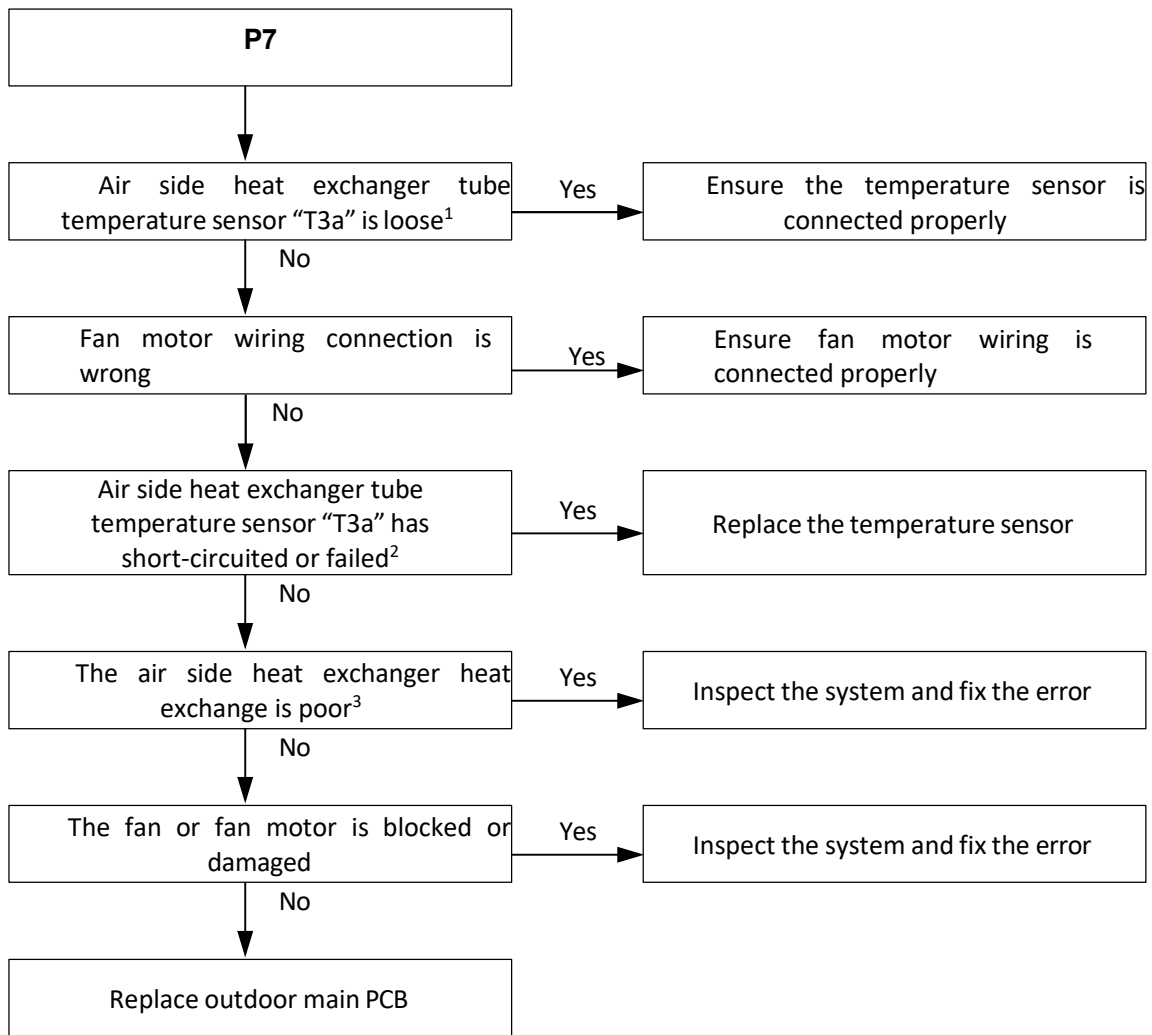
9.12.2 Description

- High temperature protection of air side heat exchanger tube temperature sensor “T3a” in cooling mode. When the tube temperature of air side heat exchanger is higher than 80°C, the system displays P7 protection and unit stop running. When the tube temperature of air side heat exchanger returns drops below 72°C, P7 is removed and normal operation resumes.
- Unit stop running.
- Error code is displayed on main PCB and user interface.

9.12.3 Possible causes

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

9.12.4 Procedure



NOTE

1. Air side heat exchanger tube temperature sensor "T3a" connection port is CN37 on the main PCB.

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.

3. Check air side heat exchanger, fan(s) and air outlets for dirt/blockages.

9.13 P9 Troubleshooting

9.13.1 Digital display output



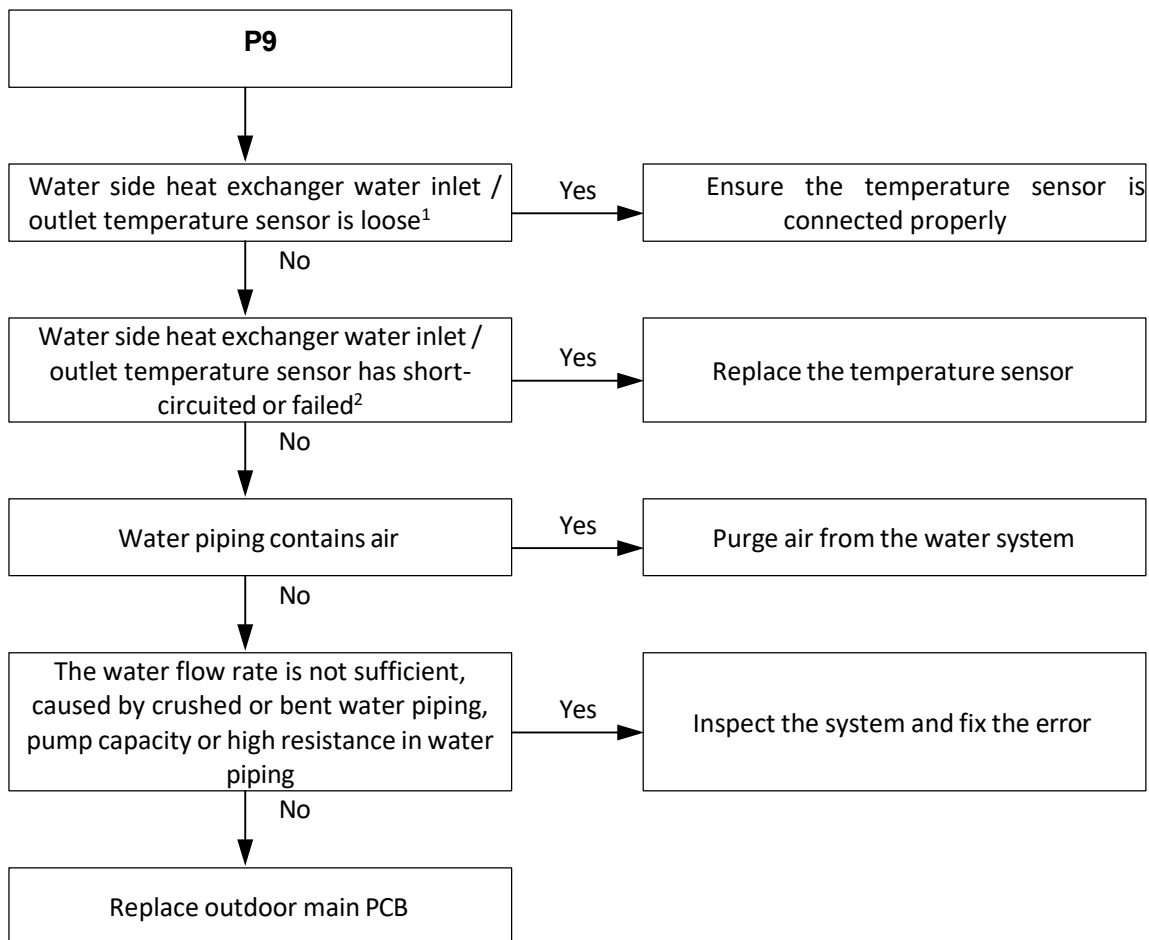
9.13.2 Description

- Water inlet and outlet temperature difference protection
- Unit stop running.
- Error code is displayed on main PCB and user interface.

9.13.3 Possible causes

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

9.13.4 Procedure



NOTE

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.

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.

9.14 Pb Troubleshooting

9.14.1 Digital display output



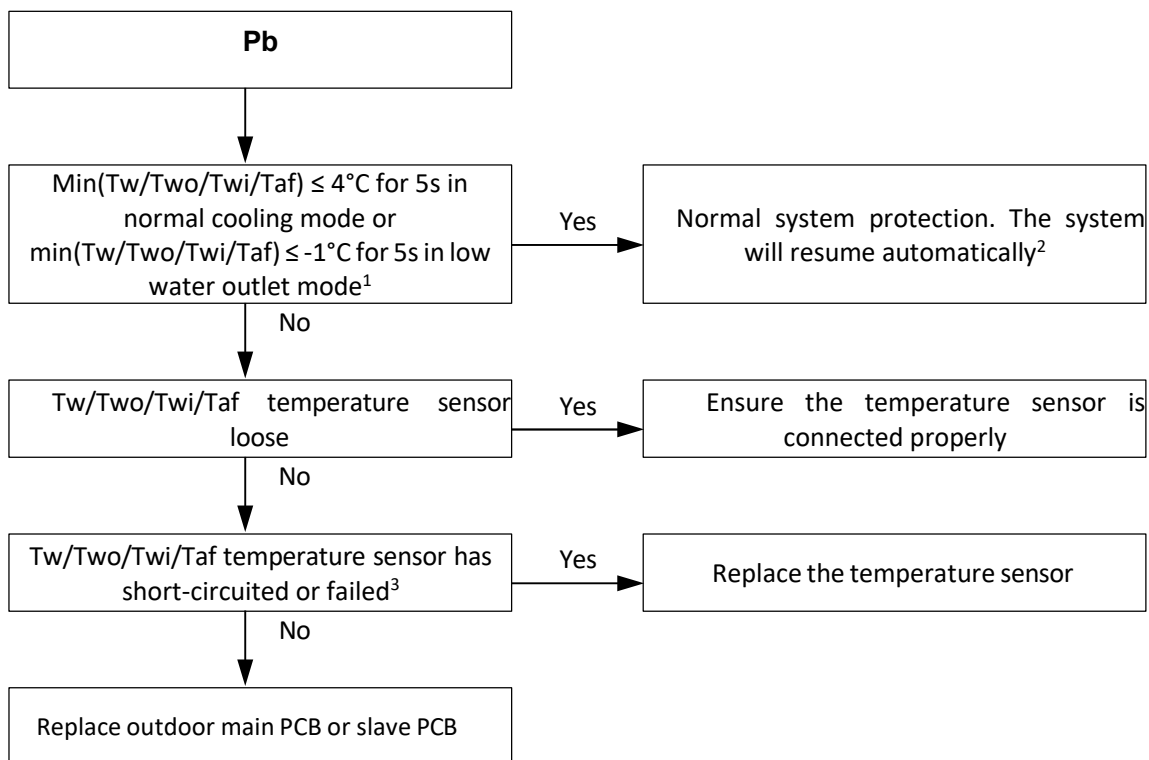
9.14.2 Description

- Water side heat exchanger anti-freeze protection.
- Error code is displayed on main PCB and ANTI.FREEZE icon is displayed on user interface.

9.14.3 Possible causes

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

9.14.4 Procedure



NOTE

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”.

9.15 PC Troubleshooting

9.15.1 Digital display output



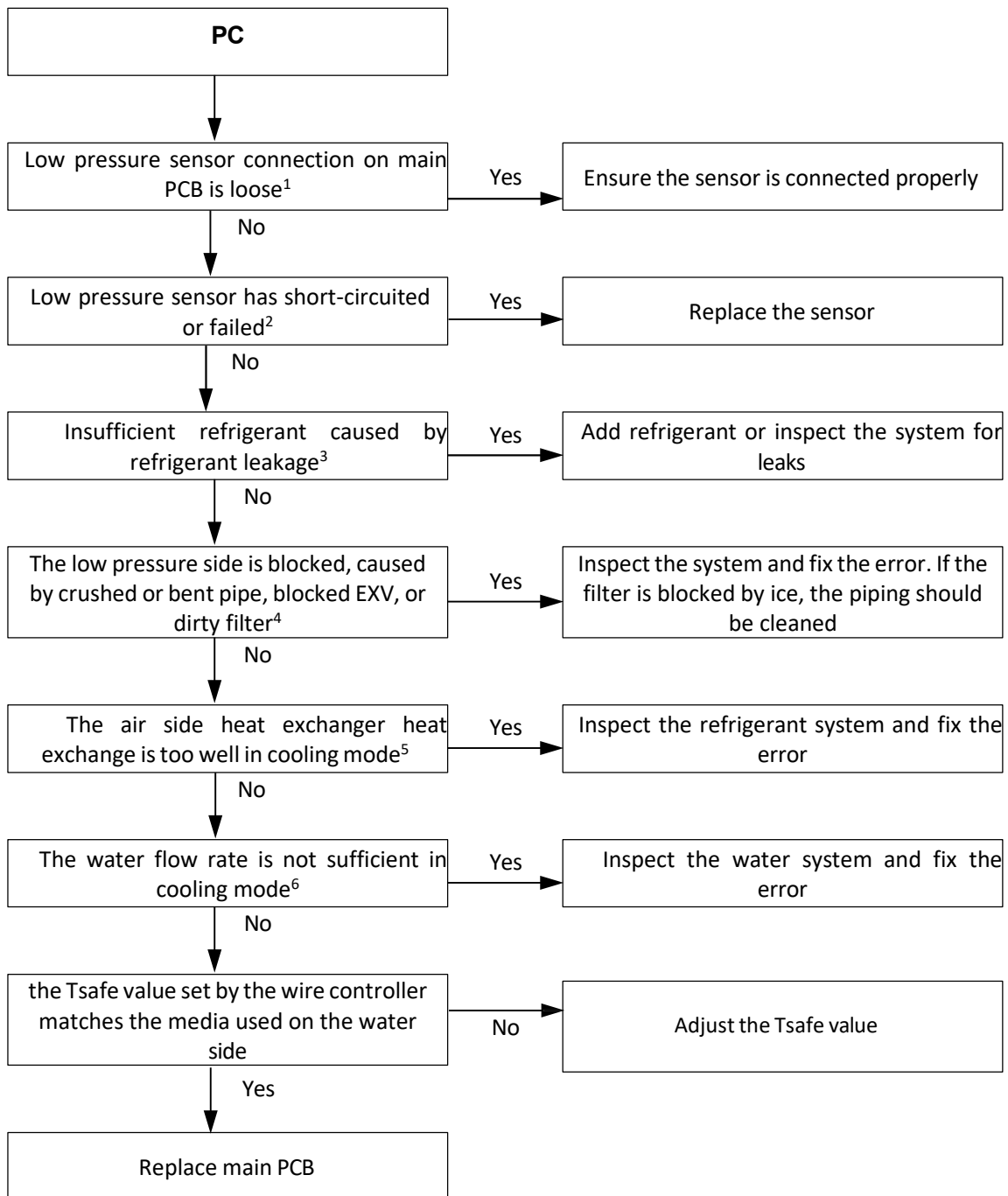
9.15.2 Description

- Water side heat exchanger low pressure protection.
- Unit stop running.
- Error code is displayed on main PCB and user interface.

9.15.3 Possible causes

- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange in cooling mode.
- Insufficient water flow in cooling mode.
- Main PCB damaged.

9.15.4 Procedure



NOTE

1.Low pressure sensor connection is port CN42 on the main PCB.

2.Measure the resistance among the three terminals of the pressure sensor. If the resistance is in 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, discharge and suction pressures to be lower and compressor current to be lower, 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, suction pressure to be lower and compressor current to be lower, and may cause frosting to occur on the suction pipe.

5.Check the environment where the air side heat exchanger is placed, whether the air temperature is too low, or there is strong wind.

6.Check water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

9.16 PH Troubleshooting

9.16.1 Digital display output



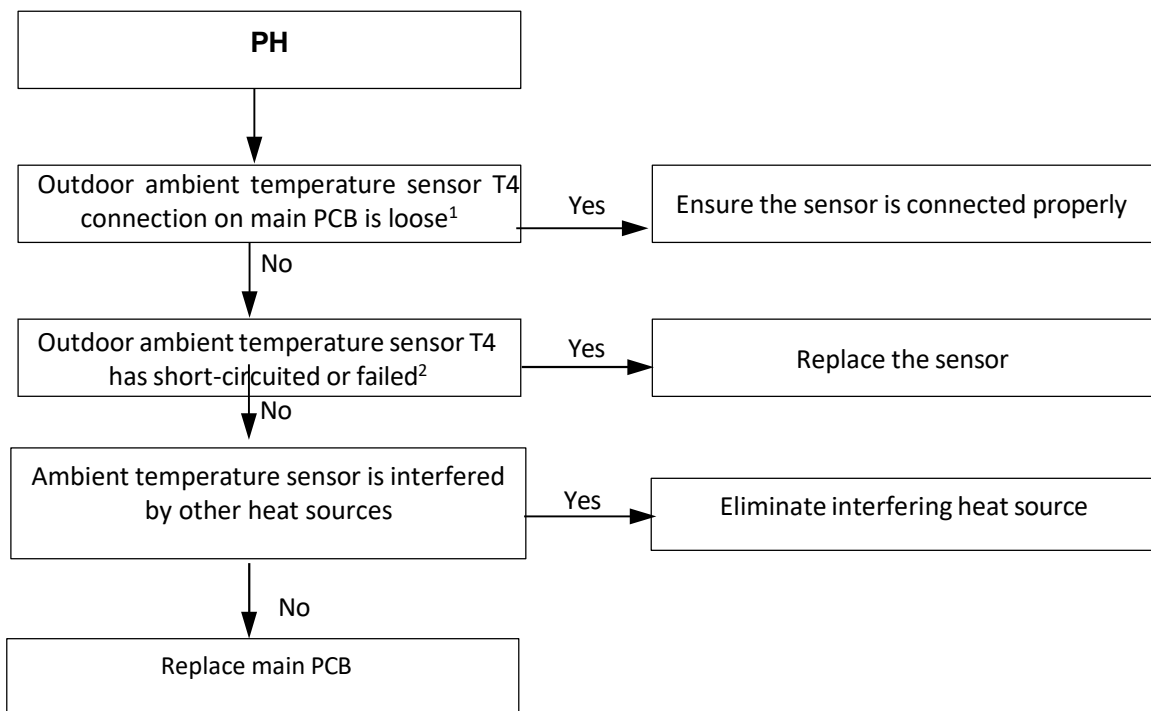
9.16.2 Description

- Ambient temperature too high protection in heating mode.
- Unit stop running.
- Error code is displayed on main PCB and user interface.

9.16.3 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.

9.16.4 Procedure



NOTE

1. T4 temperature sensor connection is port CN30 on the main PCB.

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.

9.17 PE Troubleshooting

9.17.1 Digital display output



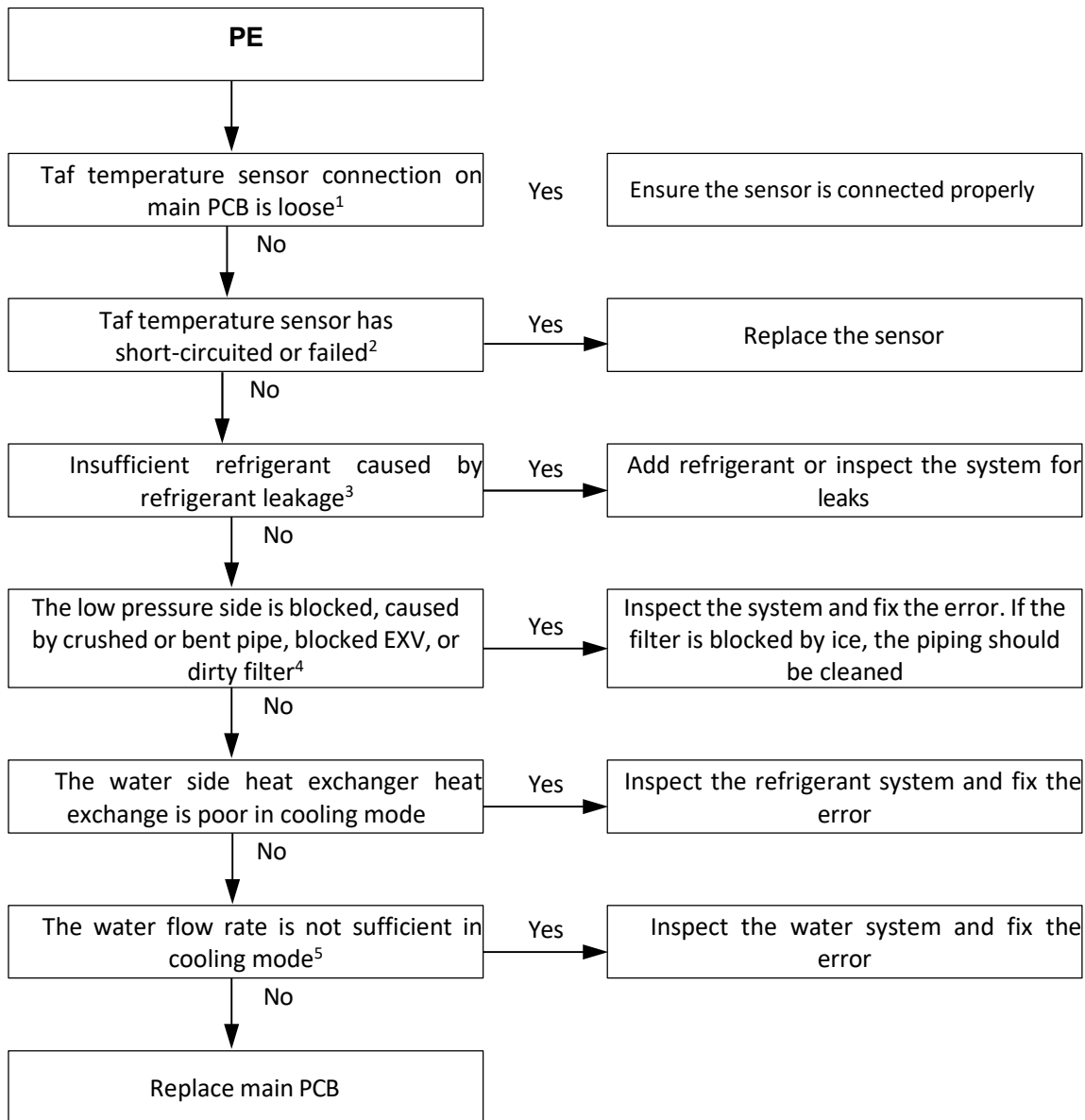
9.17.2 Description

- Water side heat exchanger low temperature antifreeze protection.
- Unit stop running.
- Error code is displayed on main PCB and user interface.

9.17.3 Possible causes

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

9.17.4 Procedure



NOTE

1. Water side heat exchanger anti-freezing temperature sensor (Taf2) connection are ports CN45 on the main PCB.

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".

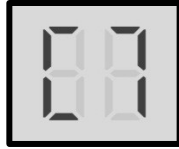
3. To check for insufficient refrigerant: an insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These 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 water side heat exchanger, water piping, circulator pumps and water flow switch for dirt/blockages.

9.18 PL / C7 Troubleshooting

9.18.1 Digital display output



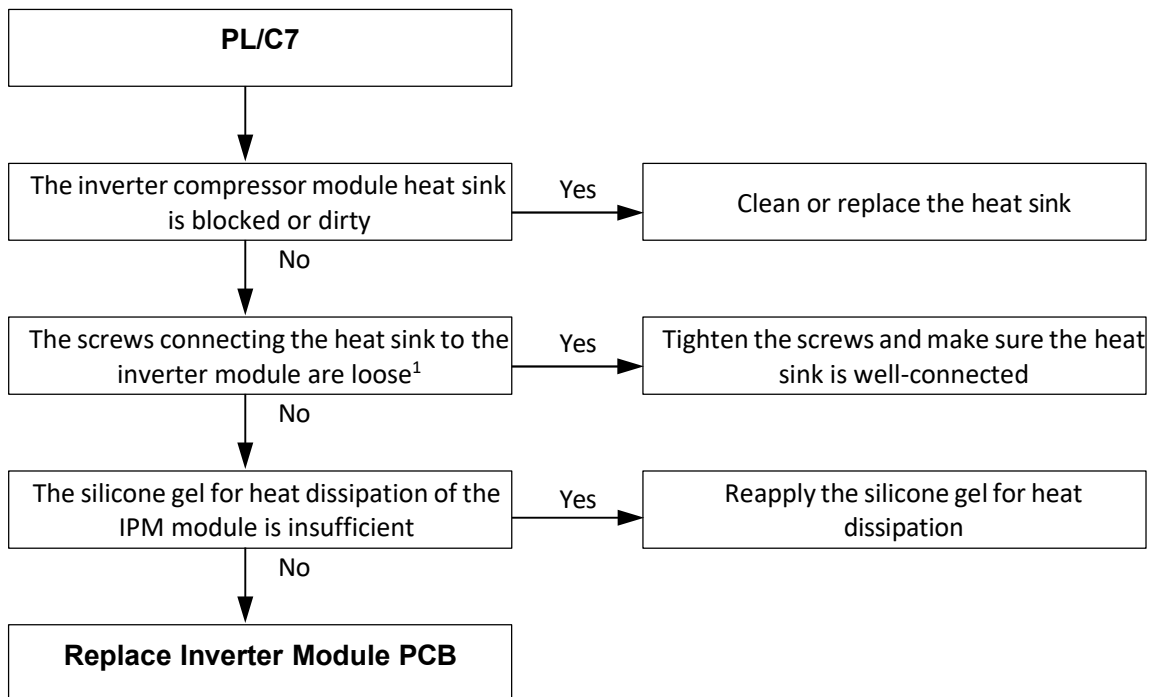
9.18.2 Description

- 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.

9.18.3 Possible causes

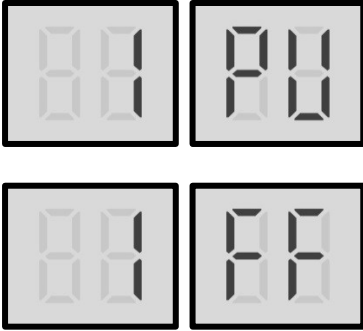
- Blocked, dirty or loose heat sink.
- Screws securing the IPM module of the compressor are loose
- The silicone gel for heat dissipation of the IPM module is insufficient.
- Main PCB damaged.

9.18.4 Procedure



9.19 1PU / 1FF Troubleshooting

9.19.1 Digital display output



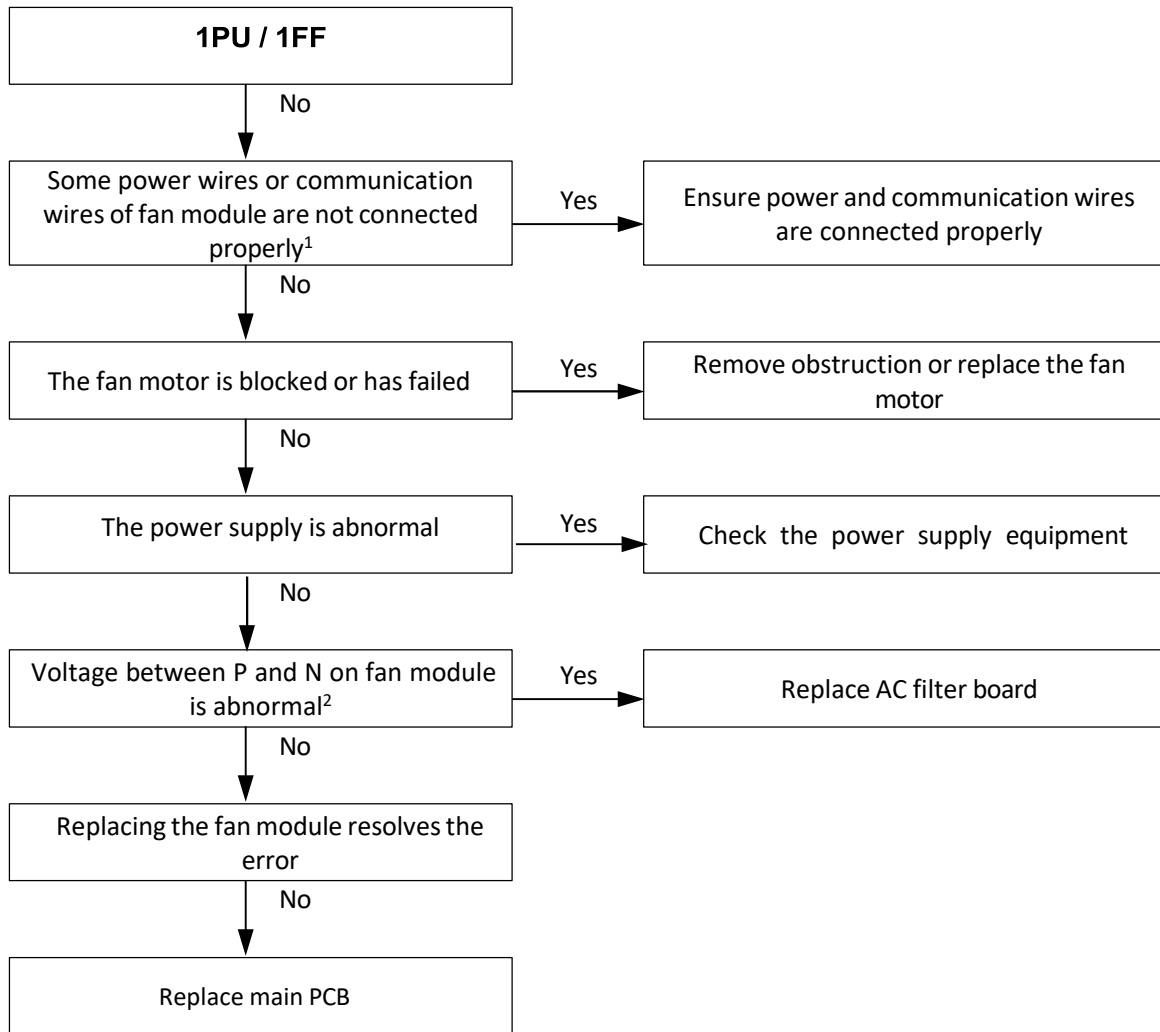
9.19.2 Description

- 1PU/1FF indicates fan A 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.
- Unit stop running.
- Error code is only displayed on the main PCB and user interface.

9.19.3 Possible causes

- 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.

9.19.4 Procedure



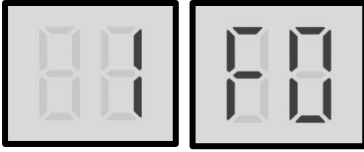
NOTE

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 485-645V DC.

9.20 1F0 Troubleshooting

9.20.1 Digital display output



9.20.2 Description

- 1F0 indicates a communication error between the main control chip and the compressor inverter driver chip.
- Unit stop running
- Error code is only displayed on the unit with the error.

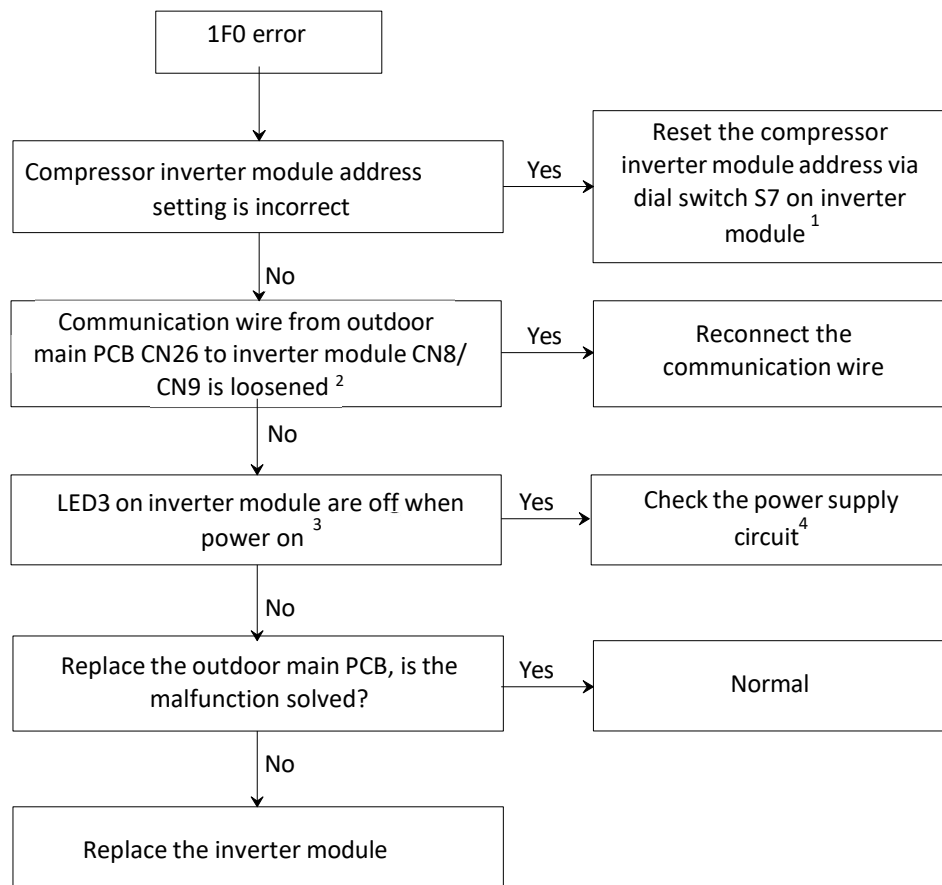
9.20.3 Trigger / recover condition

- 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.

9.20.4 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.

9.20.5 Procedure

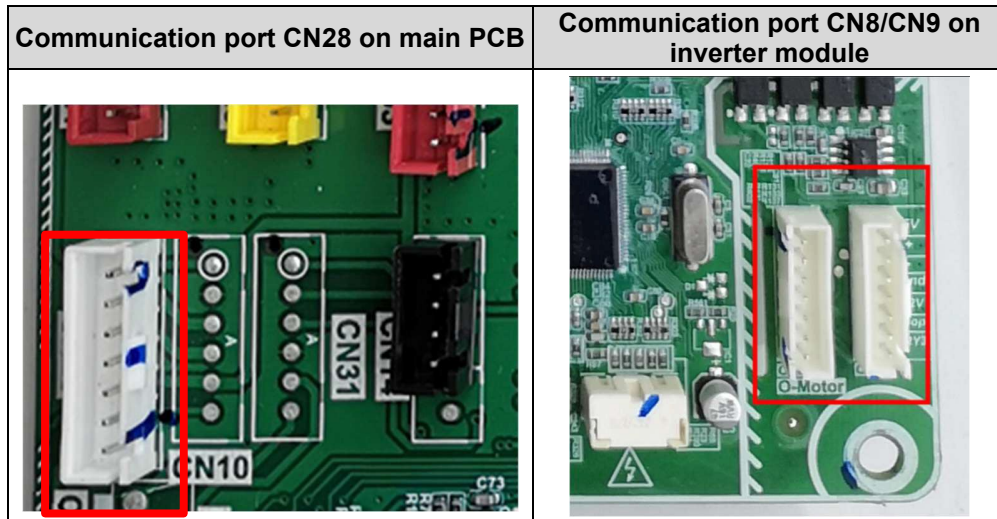


NOTE

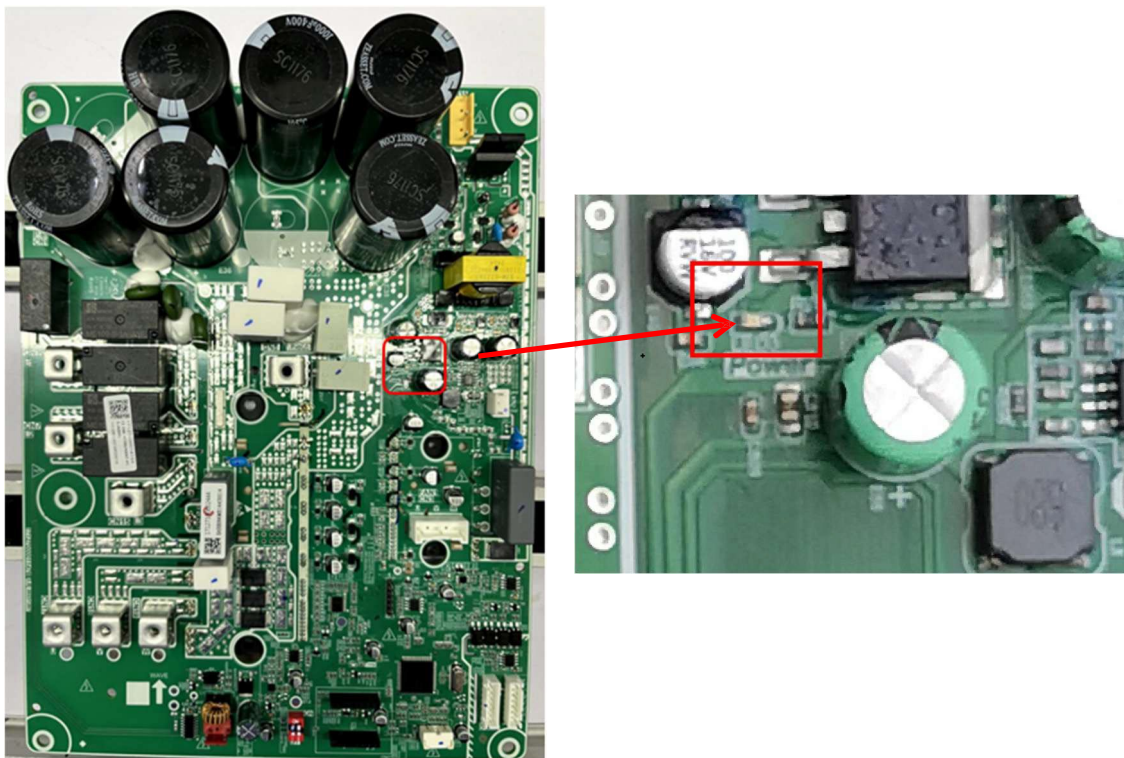
1. Compressor inverter module address is set through dial switch S7 on the inverter module. The compressor inverter module A/B location refers to the wiring diagram.

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

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



3. LED3 on inverter module



4. Check the wired connection between CN6/CN7/CN8 of filter board and CN7/CN15/CN16 of compressor module board, the normal voltage should be 342-456VAC

9.21 H5 Troubleshooting

9.21.1 Digital display output



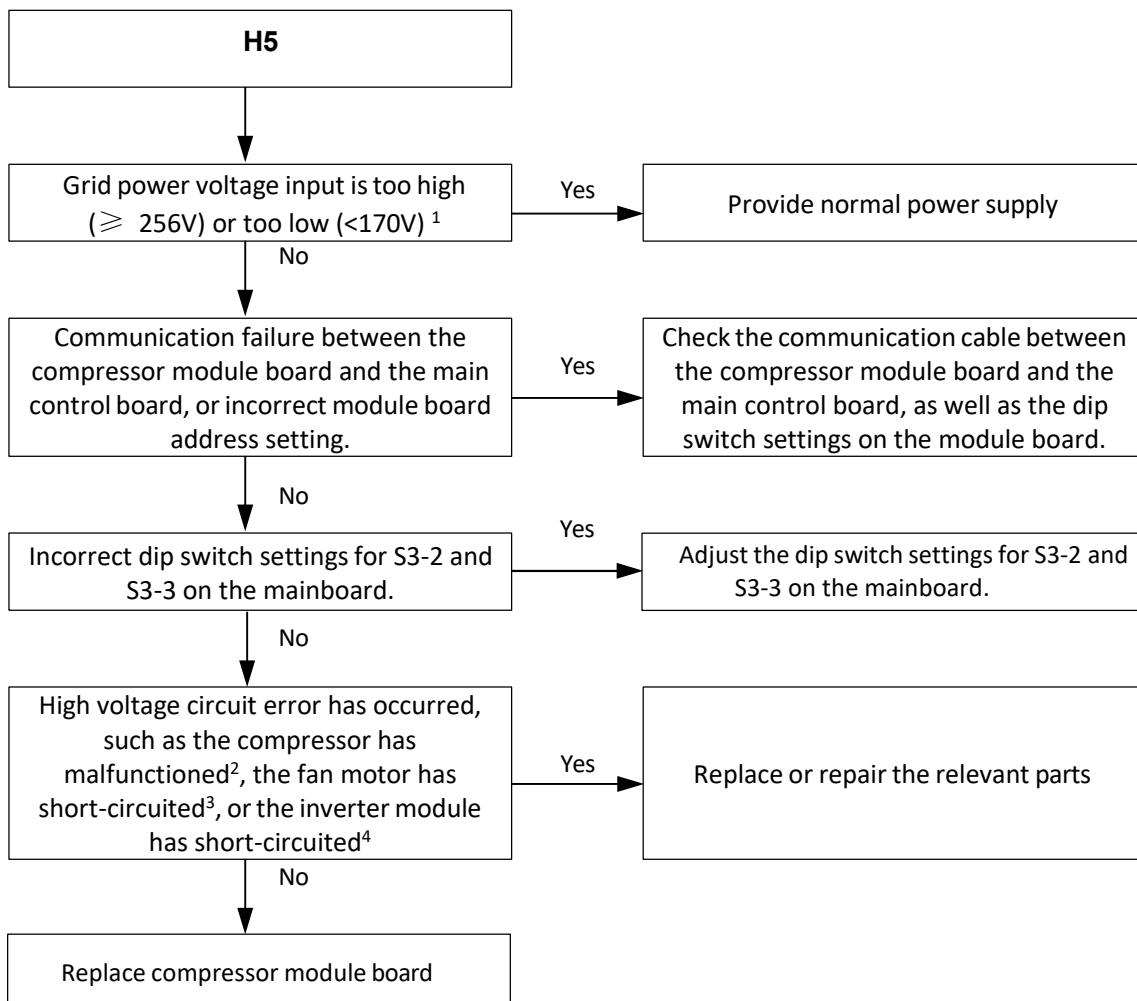
9.21.2 Description

- Abnormal power supply voltage.
- All units stop running.
- Error code is only displayed on main PCB and user interface.

9.21.3 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.
- Incorrect compressor inverter module address setting.
- Main PCB damaged.

9.21.4 Procedure



NOTE

1. The voltage is detected by the compressor module board and then sent to the main control board. The main control board determines whether there is a fault based on the voltage value sent by the compressor module board (fault is reported if voltage is $\geq 256V$ or $< 170V$).

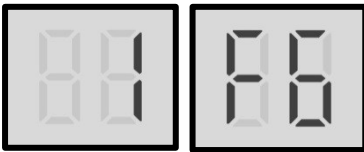
2. The normal resistances of the inverter compressor is 0.139Ω (at $20^{\circ}C$ ambient temperature) among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.

3. 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.

4. 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".

9.22 1F6 Troubleshooting

9.22.1 Digital display output



9.22.2 Description

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

9.22.3 Possible causes

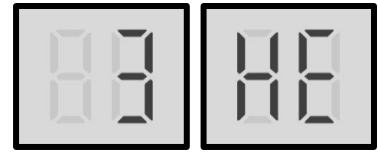
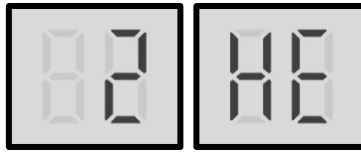
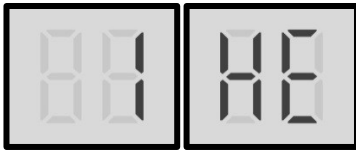
- Abnormal power supply voltage
- Loosened wiring within electric control box.
- High voltage circuit error.
- AC filter board damaged.
- 3-phase bridge rectifier damaged.
- Compressor Inverter module damaged.

9.22.4 Procedure

- Refer to P6 protection troubleshooting: xL1 and xL2.

9.23 1HE / 2HE / 3HE Troubleshooting

9.23.1 Digital display output



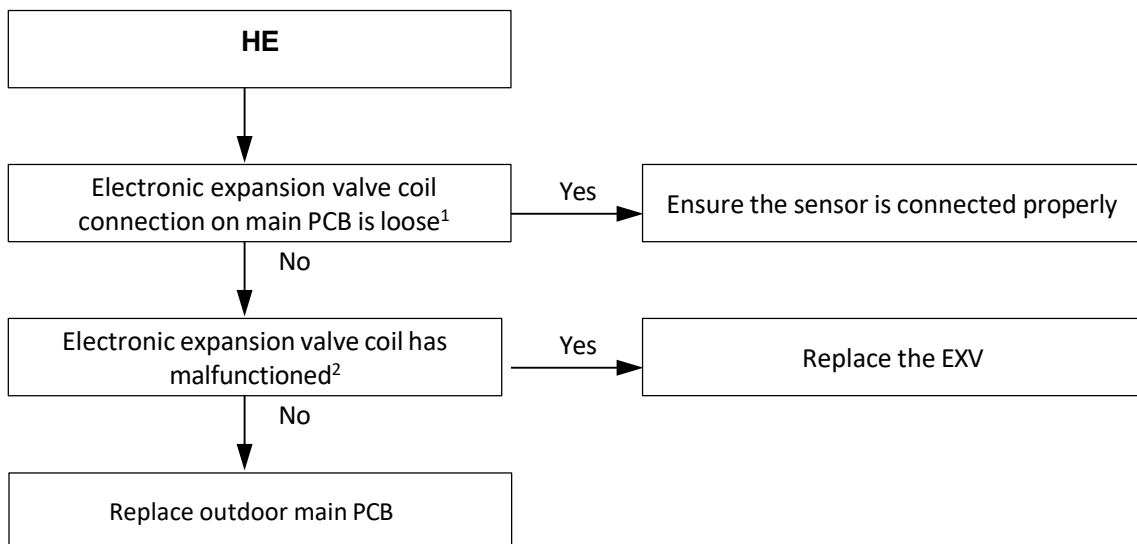
9.23.2 Description

- Electronic expansion valve connection error.
- Unit stop running.
- Error code is only displayed on the unit with the error.

9.23.3 Possible causes

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

9.23.4 Procedure



NOTE

1. Electronic expansion valve coil connections are port CN70, CN71 and CN72 on the main PCB

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.

9.24 F2 Troubleshooting

9.24.1 Digital display output



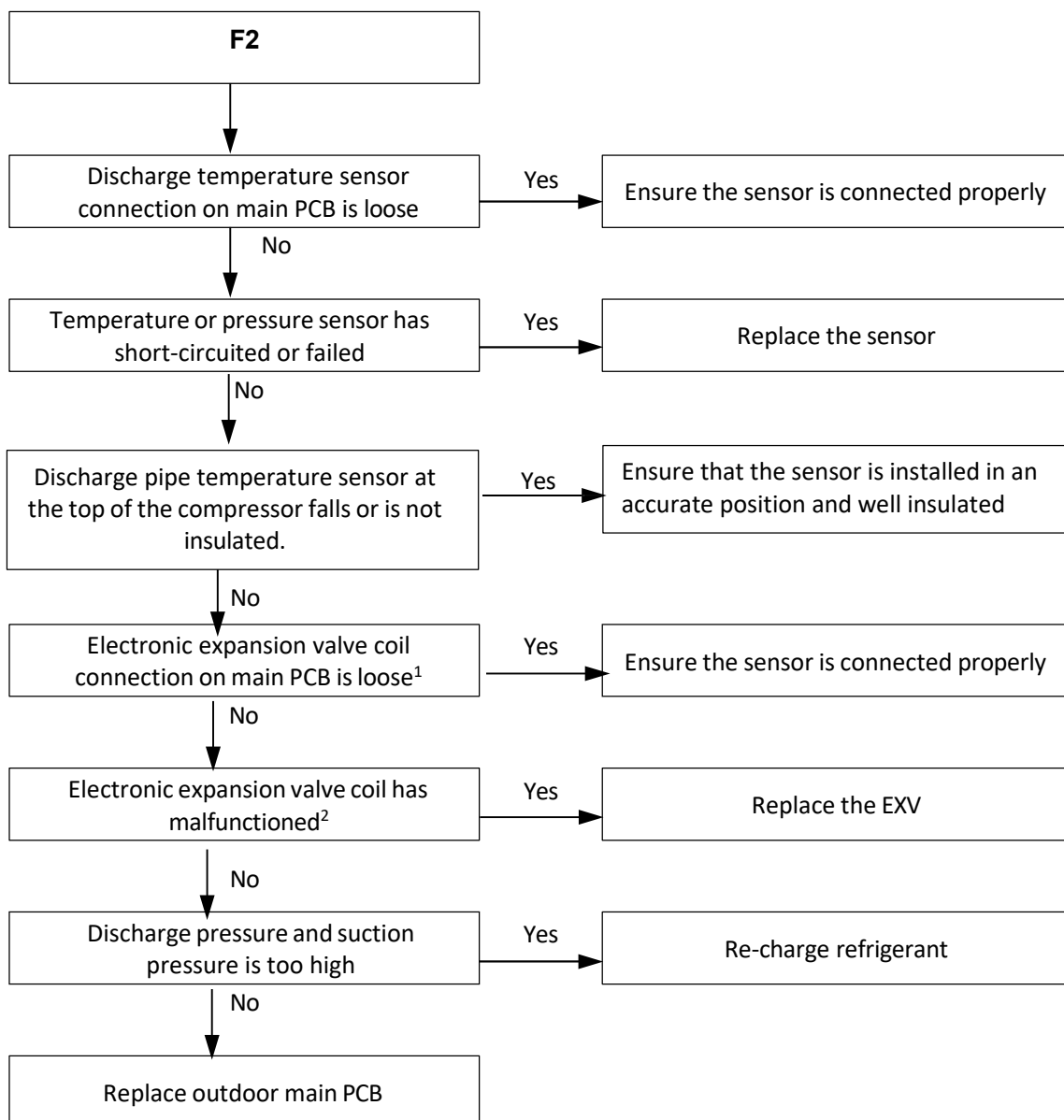
9.24.2 Description

- Insufficient protection of exhaust superheat.
- Unit stop running.
- Error code is only displayed on main PCB and user interface.

9.24.3 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.
- Excessive refrigerant charge
- Damaged main PCB.

9.24.4 Procedure



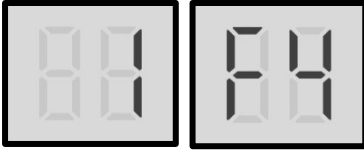
NOTE

1. Electronic expansion valve coil connections are port CN70, CN71 and CN72 on the main PCB.

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.

9.25 1F4 Troubleshooting

9.25.1 Digital display output



9.25.2 Description

- 1F4 module A L10/L11/L12/L20/L30/L34 protection occurs for 3 times in 60 minutes.
- When F4 displays, a manual system restart is required before the system can resume operation.

9.25.3 Possible causes

- Refer to L10/L11/L12/L20/L30/L34 error troubleshooting.

9.25.4 Procedure

- Refer to L10/L11/L12/L20/L30/L34 error troubleshooting.

9.26 FP Troubleshooting

9.26.1 Digital display output



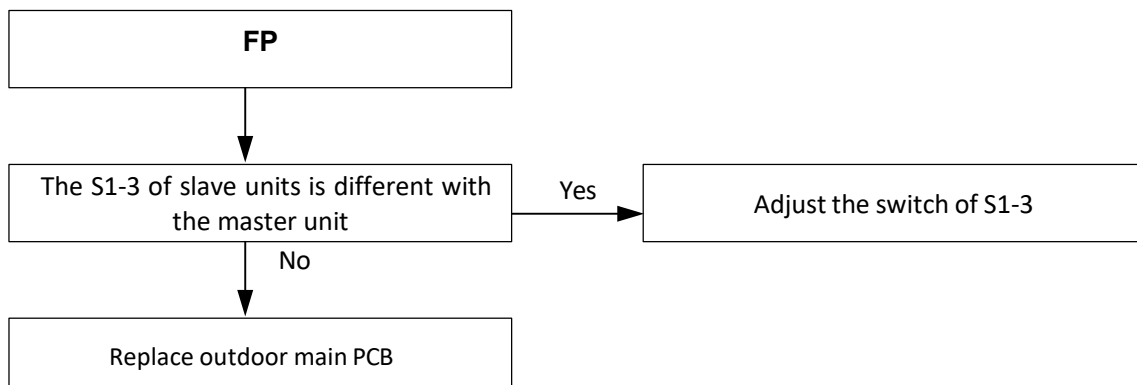
9.26.2 Description

- 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.
- All units stop running.
- Error code is only displayed on main PCB and user interface.

9.26.3 Possible causes

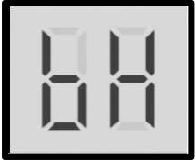
- The S1-3 of slave units is different with the master unit.
- Main PCB damaged.

9.26.4 Procedure



9.27 bH Troubleshooting

9.27.1 Digital display output



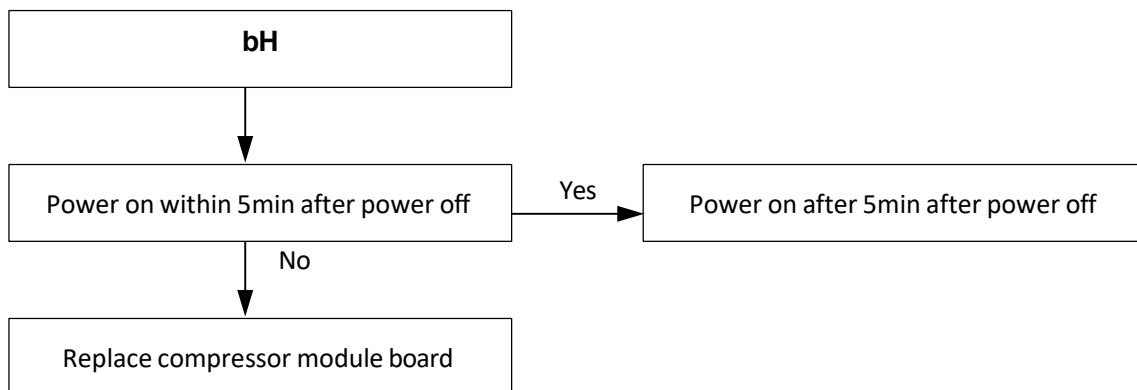
9.27.2 Description

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

9.27.3 Possible causes

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

9.27.4 Procedure



9.28 HC Troubleshooting

9.28.1 Digital display output



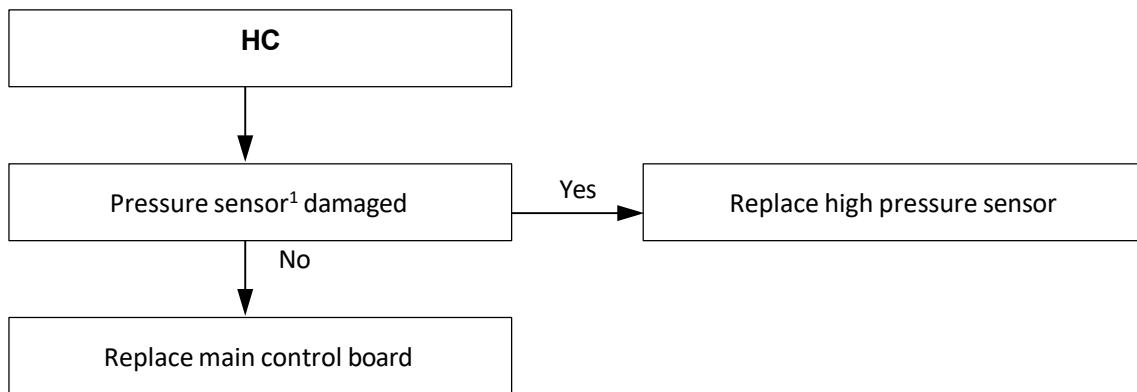
9.28.2 Description

- HC indicates high pressure sensor error
- Unit stop running.
- Error code is only displayed on main PCB and user interface.

9.28.3 Possible causes

- Pressure sensor damaged
- Main control board damaged

9.28.4 Procedure



NOTE

1. Pressure sensor connection is port CN40 on the main PCB. 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.

9.29 P3 Troubleshooting

9.29.1 Digital display output



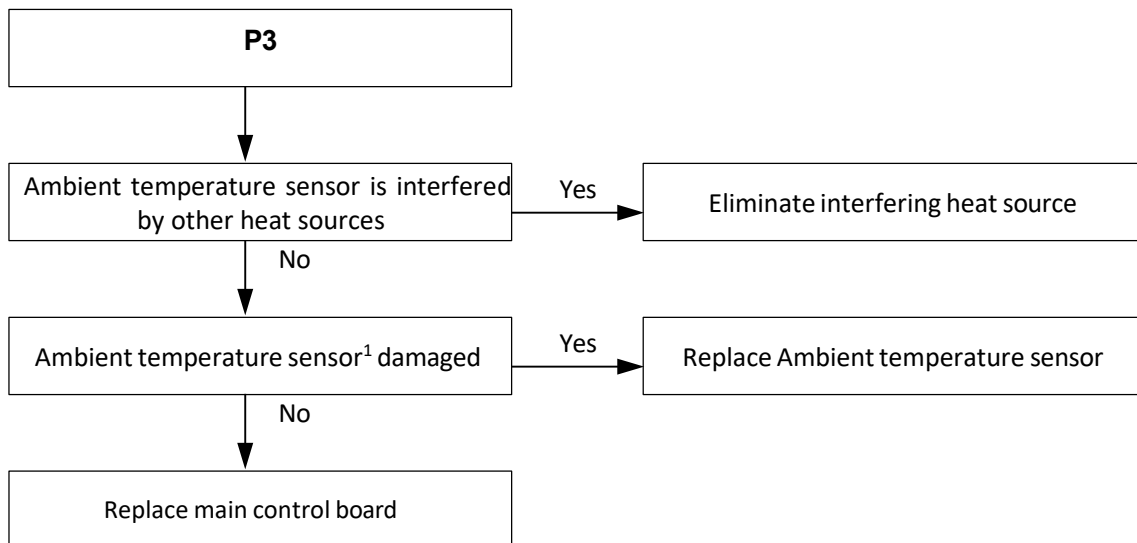
9.29.2 Description

- P3 indicates ambient temperature too high for cooling mode
- Unit stop running.
- Error code is only displayed on main PCB and user interface.

9.29.3 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

9.29.4 Procedure



NOTE

1.Ambient temperature sensor connection port is CN30 on the main PCB. 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.

9.30 PA Troubleshooting

9.30.1 Digital display output



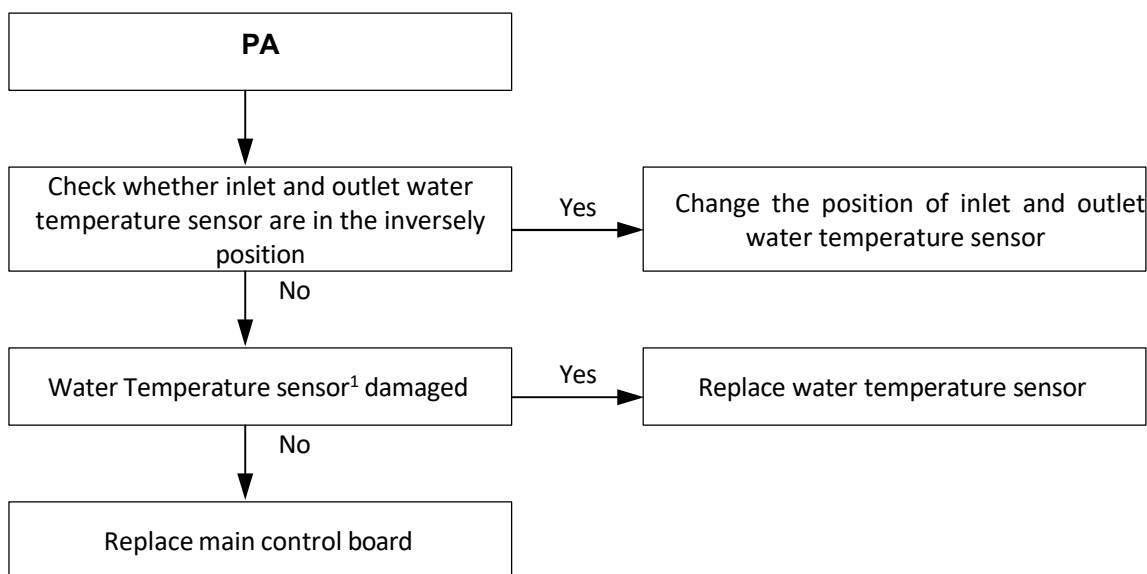
9.30.2 Description

- PA indicates abnormal water inlet and outlet temperature difference protection
- Unit stop running.
- Error code is only displayed on main PCB and user interface.

9.30.3 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

9.30.4 Procedure



NOTE

1. Inlet and outlet water temperature sensor connection port is CN4 on the main PCB. 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.

9.31 1L10 Troubleshooting

9.31.1 Description

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

9.31.2 Trigger / recover condition

1)The current reaches the OCP protection value:

- Triggering conditions: The current reaches the OCP protection value.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met.
- Reset method: The compressor will recover one minute after the fault exit conditions are met.

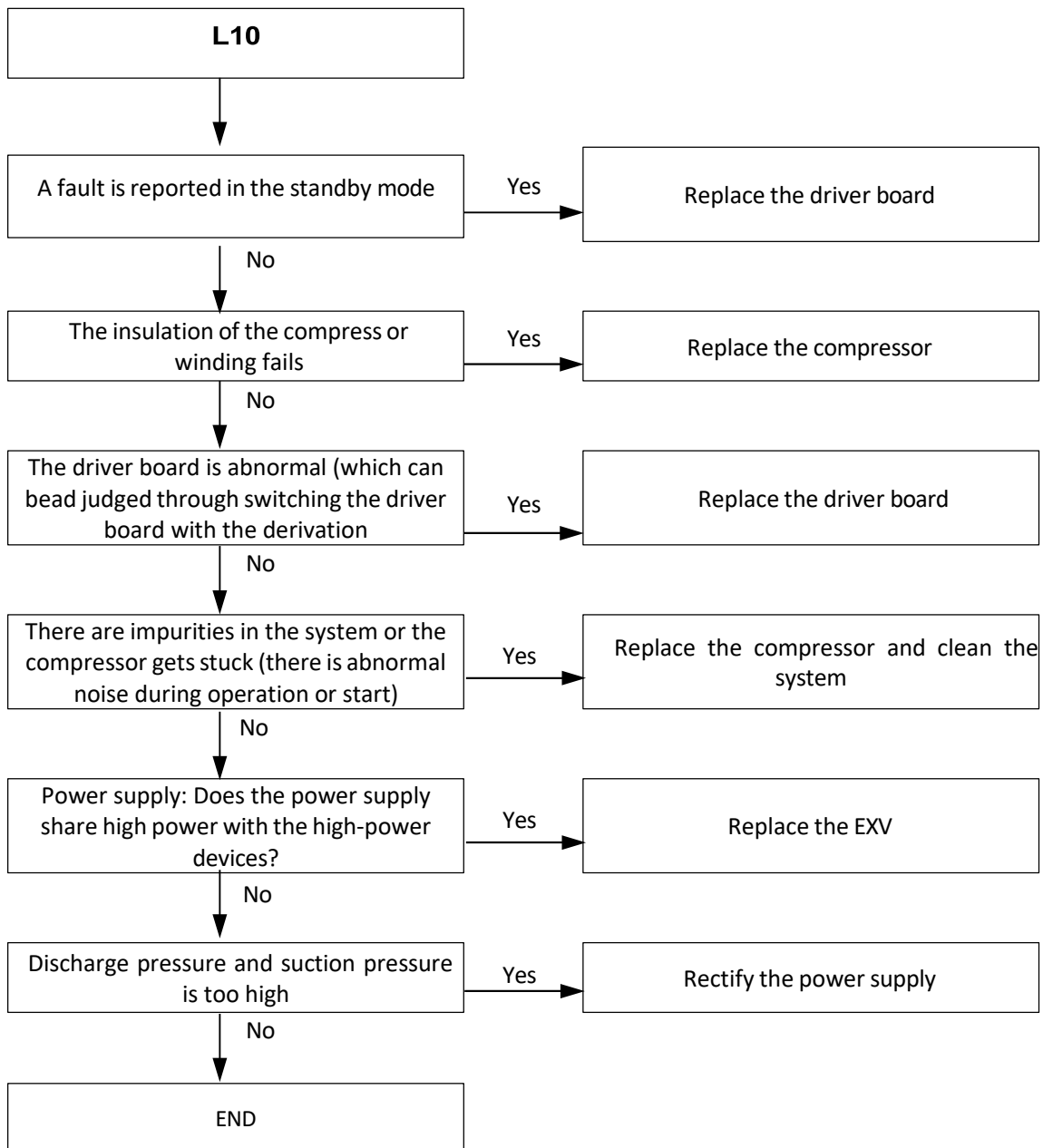
2)The dropping edge or sustained low level of the FO signal is detected:

- Triggering conditions: The dropping edge or sustained low level of the FO signal is detected.
- Recovery conditions: The FO signal becomes high level.
- Reset method: The compressor will recover one minute after the fault exit conditions are met.

9.31.3 Possible causes

- There are impurities in the refrigerant system or the compressor suddenly gets stuck, causing a surge in current and triggering OCP;
- Short circuit occurs between the phases in the compressor winding, generating instantaneous high current to trigger OCP or FO;
- The voltage of the power supply for the system drops or is interrupted for a short time, causing an instantaneous surge in current and triggering OCP;
- Condensation occurs to the IPM module, causing a short circuit between control pins;
- Fluid returns in the system;
- When the compressor starts, the rotor has a certain speed (commonly found when a compressor has already started or the master unit has been started, and the refrigerant drives the compressor rotor that is about to start when the four-way valve is reversed);
- The module board is abnormal (Idc operational amplifier circuit, OCP comparison circuit, PWM circuit, IPM, and IGBT drive power circuit), causing control step-out, generating high current to trigger OCP;

9.31.4 Procedure



9.32 1L11 Troubleshooting

9.32.1 Description

- The current exceeds the OCP protection value set for the software.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

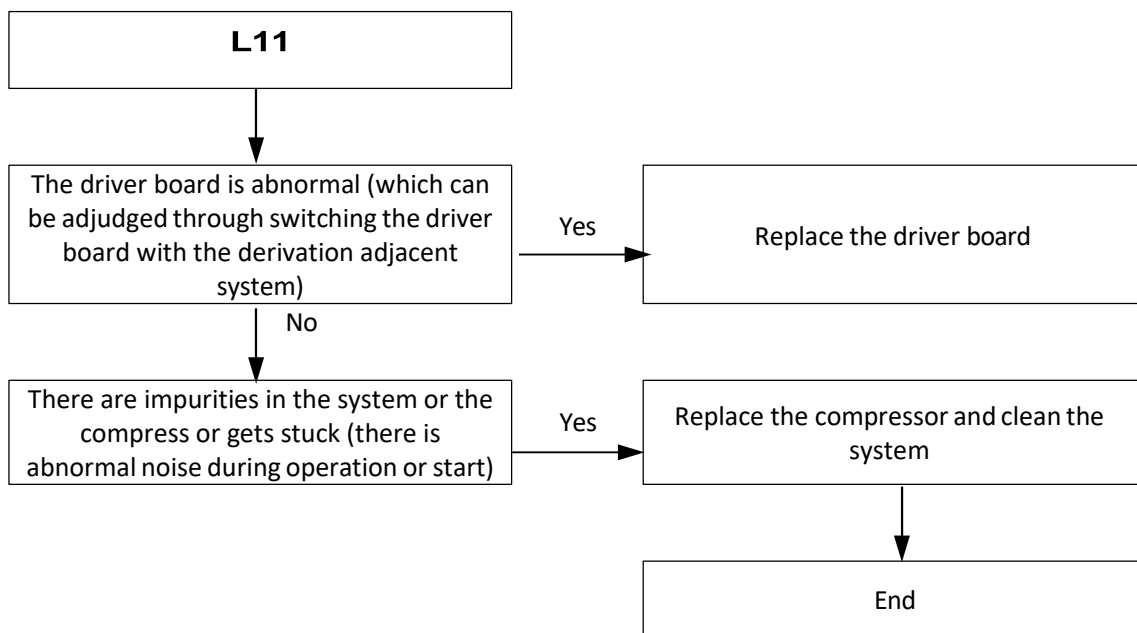
9.32.2 Trigger / recover condition

- Triggering conditions: The current of the compressor is detected to exceed the OCP protection value set for the software for three consecutive carrier cycles.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.32.3 Possible causes

- There are impurities in the refrigerant system or the compressor suddenly gets stuck;
- The Idc operational amplifier sampling circuit of the module board is abnormal;

9.32.4 Procedure



9.33 1L20 Troubleshooting

9.33.1 Description

- The temperature of the IPM module exceeds 100°C.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

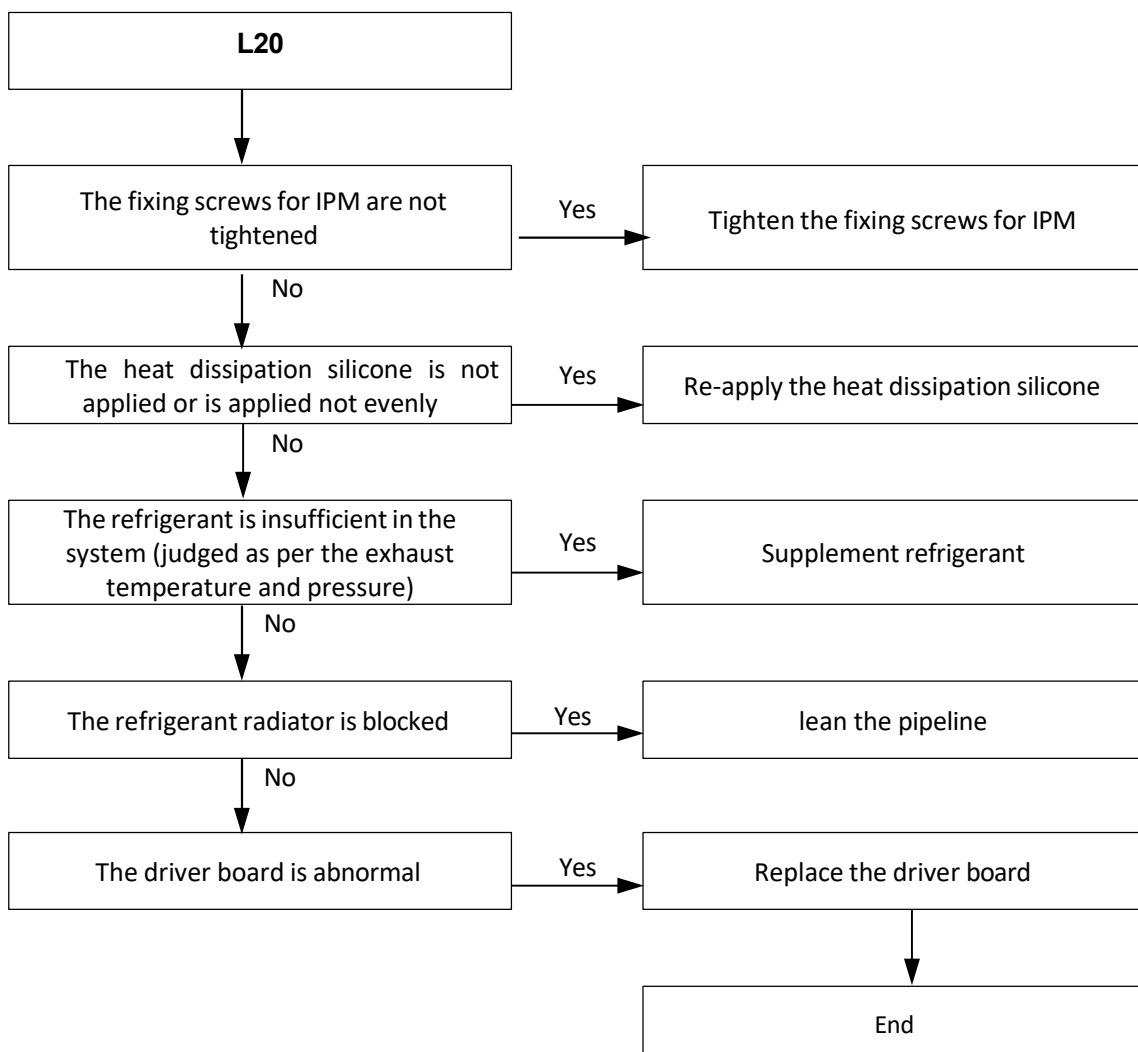
9.33.2 Trigger / recover condition

- Triggering conditions: The temperature of the IPM module exceeds 100°C.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met (the module temperature is less than 100°C).
- Reset method: The compressor will recover after the fault exit conditions are met.

9.33.3 Possible causes

- The fixing screws for IPM are not tightened, resulting in poor heat dissipation;
- The heat dissipation silicone for the IPM module is not evenly applied, resulting in poor heat dissipation;
- The refrigerant is insufficient in the system or the pipeline of the refrigerant radiator is blocked, causing poor heat dissipation of the refrigerant radiator;
- The refrigerant radiator in the system is abnormally welded, causing excessive thermal resistance and poor heat dissipation;
- The IPM temperature detection circuit for the module board is abnormal;

9.33.4 Procedure



9.34 1L30 Troubleshooting

9.34.1 Description

- The voltage of the busbar is lower than the too low voltage protection threshold of the busbar set for the software (350V DC).
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

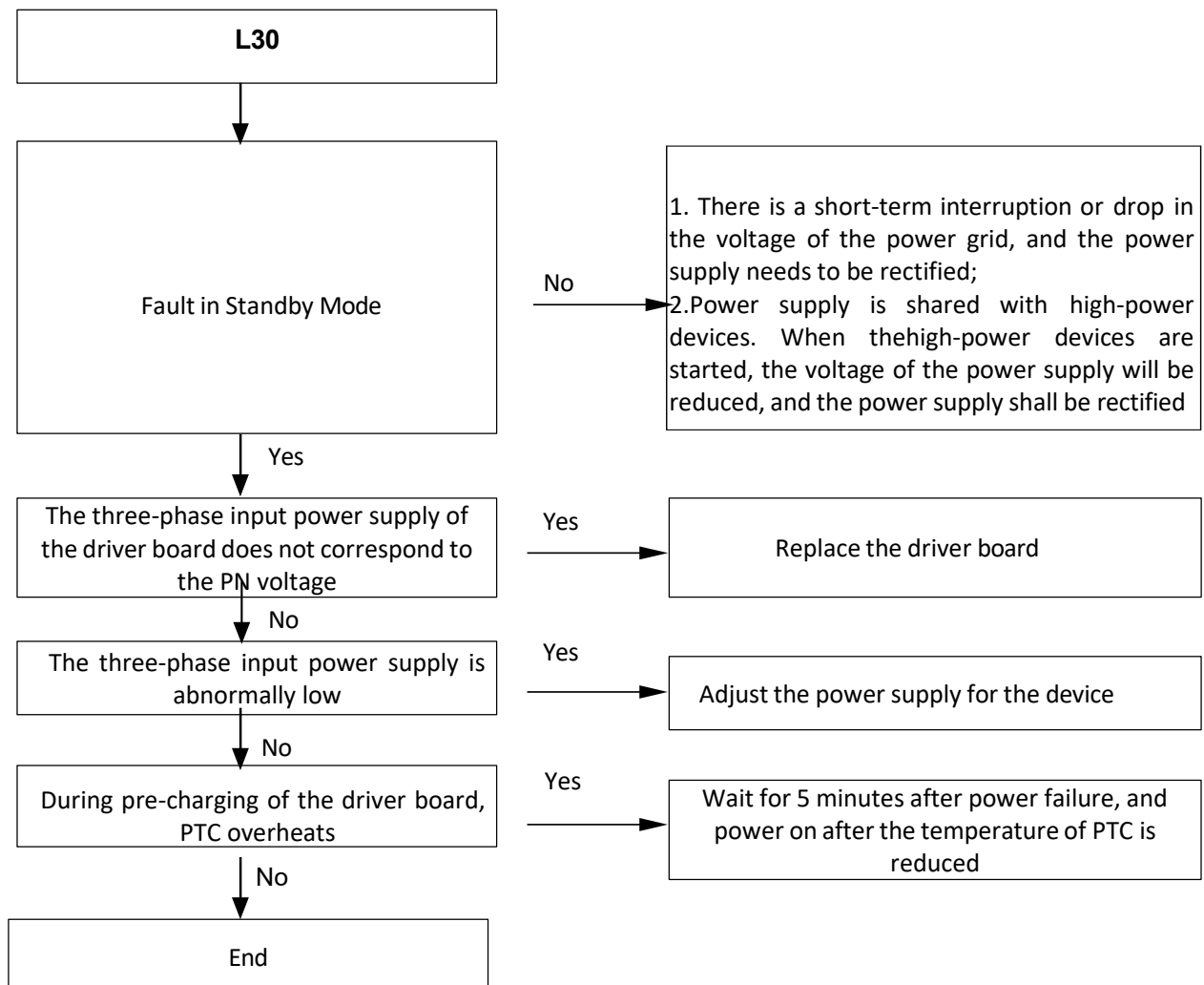
9.34.2 Trigger / recover condition

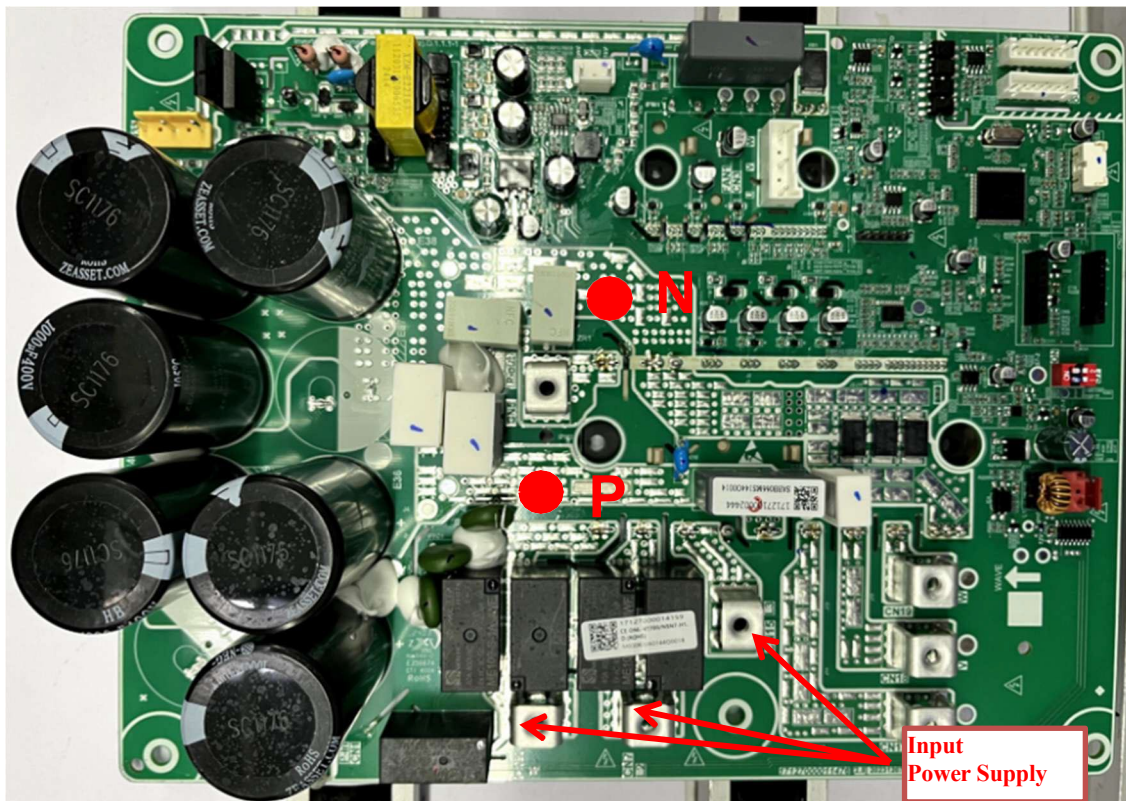
- Triggering conditions: The busbar voltage is too low, being lower than the too low busbar voltage protection threshold set for the software.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met (the voltage of the busbar is higher than the too low voltage protection threshold of the busbar set for the software).
- Reset method: The compressor will recover after the fault exit conditions are met.

9.34.3 Possible causes

- The input voltage is too low, causing too low voltage of the busbar;
- The voltage of the power supply drops or is interrupted for a short time, causing too low instantaneous busbar voltage;
- The busbar voltage detection circuit of the module board is abnormal;

9.34.4 Procedure





9.35 1L31 Troubleshooting

9.35.1 Description

- The voltage of the busbar is higher than the too high voltage protection threshold of the busbar set for the software (800V DC).
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

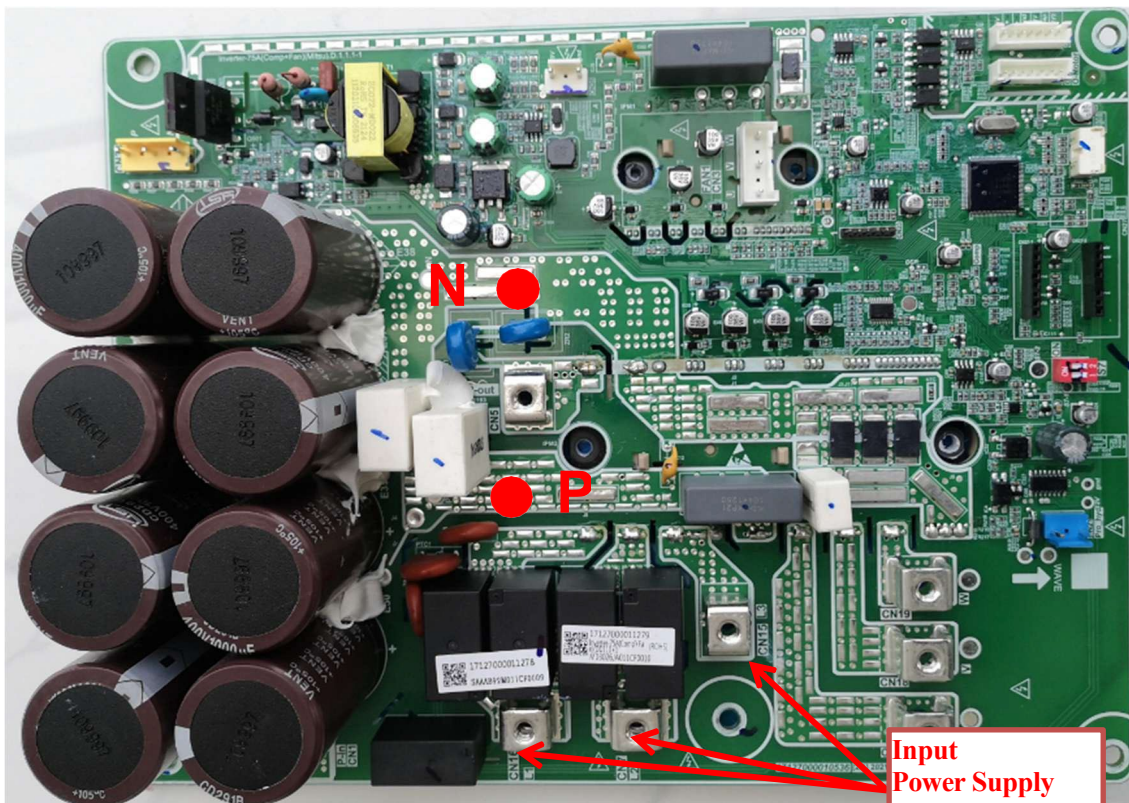
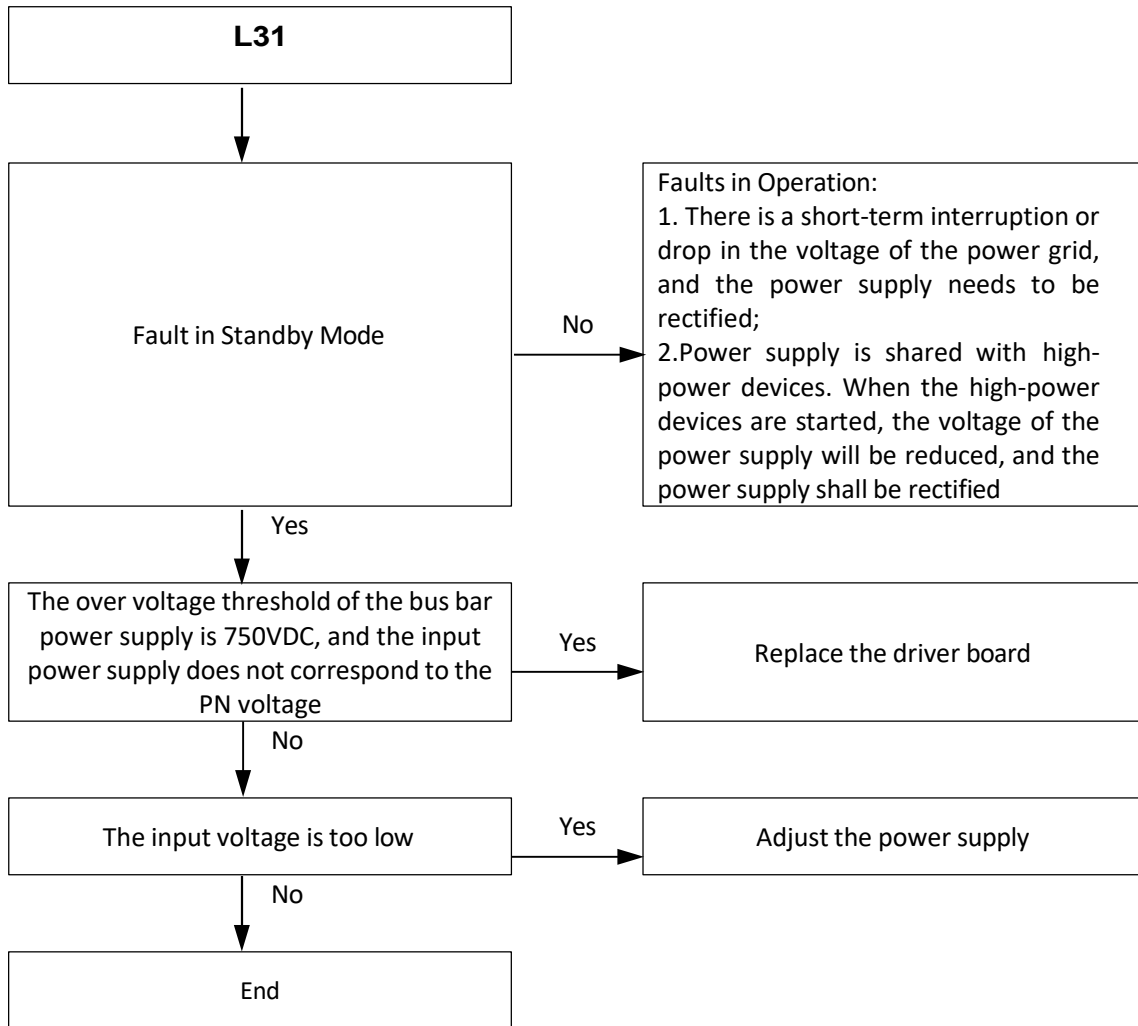
9.35.2 Trigger / recover condition

- Triggering conditions: The busbar voltage is too high, being higher than the too high busbar voltage protection threshold set for the software.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met (the voltage of the busbar is lower than the too high voltage protection threshold of the busbar set for the software).
- Reset method: The compressor will recover after the fault exit conditions are met.

9.35.3 Possible causes

- The input voltage is too low, causing too low voltage of the busbar;
- The voltage in the power grid is instantaneously too high abnormally;
- The busbar voltage detection circuit of the module board is abnormal;

9.35.4 Procedure



9.36 1L32 Troubleshooting

9.36.1 Description

- The voltage of the busbar is higher than the severe over-voltage protection threshold of the busbar set for the software (820V).
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

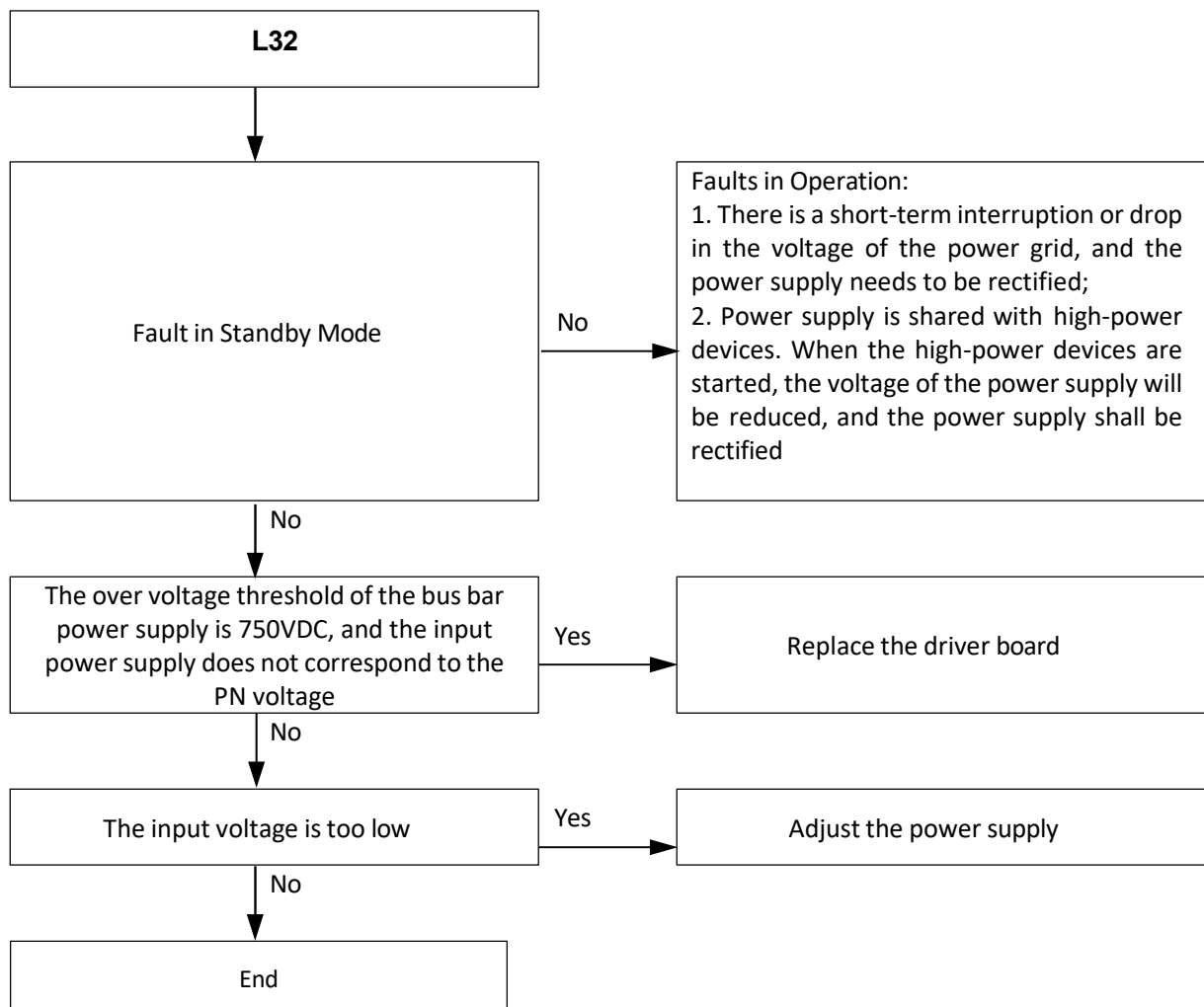
9.36.2 Trigger / recover condition

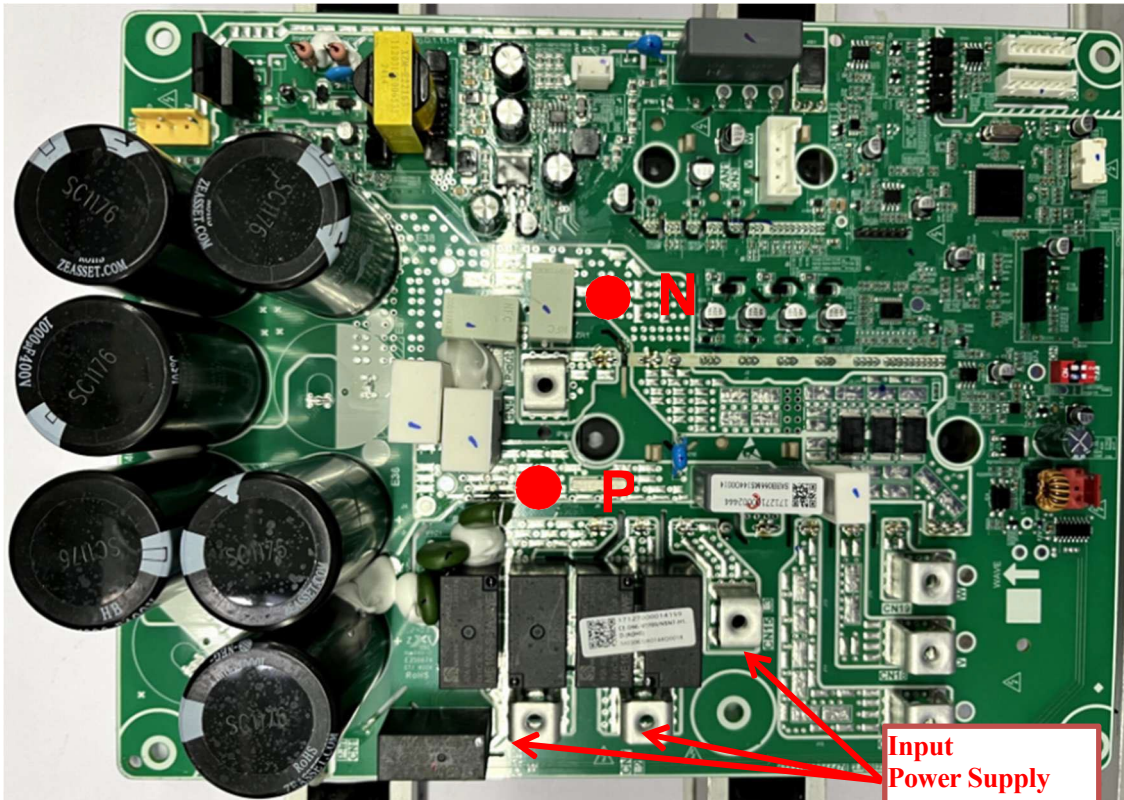
- Triggering conditions: The busbar voltage is too high, being higher than the severe busbar over-voltage protection threshold set for the software.
- Recovery conditions: The compressor shuts down after the fault occurs, and recovers one minute after the fault exit conditions are met (the voltage of the busbar is lower than the severe busbar over-voltage protection threshold of the busbar set for the software).
- Reset method: The compressor will recover after the fault exit conditions are met.

9.36.3 Possible causes

- The input voltage is too low, causing too low voltage of the busbar;
- The voltage in the power grid is instantaneously too high abnormally;
- The busbar voltage detection circuit of the module board is abnormal;

9.36.4 Procedure





9.37 1L34 Troubleshooting

9.37.1 Description

- The power input is out of phase or the three-phase power supply is severely unbalanced.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

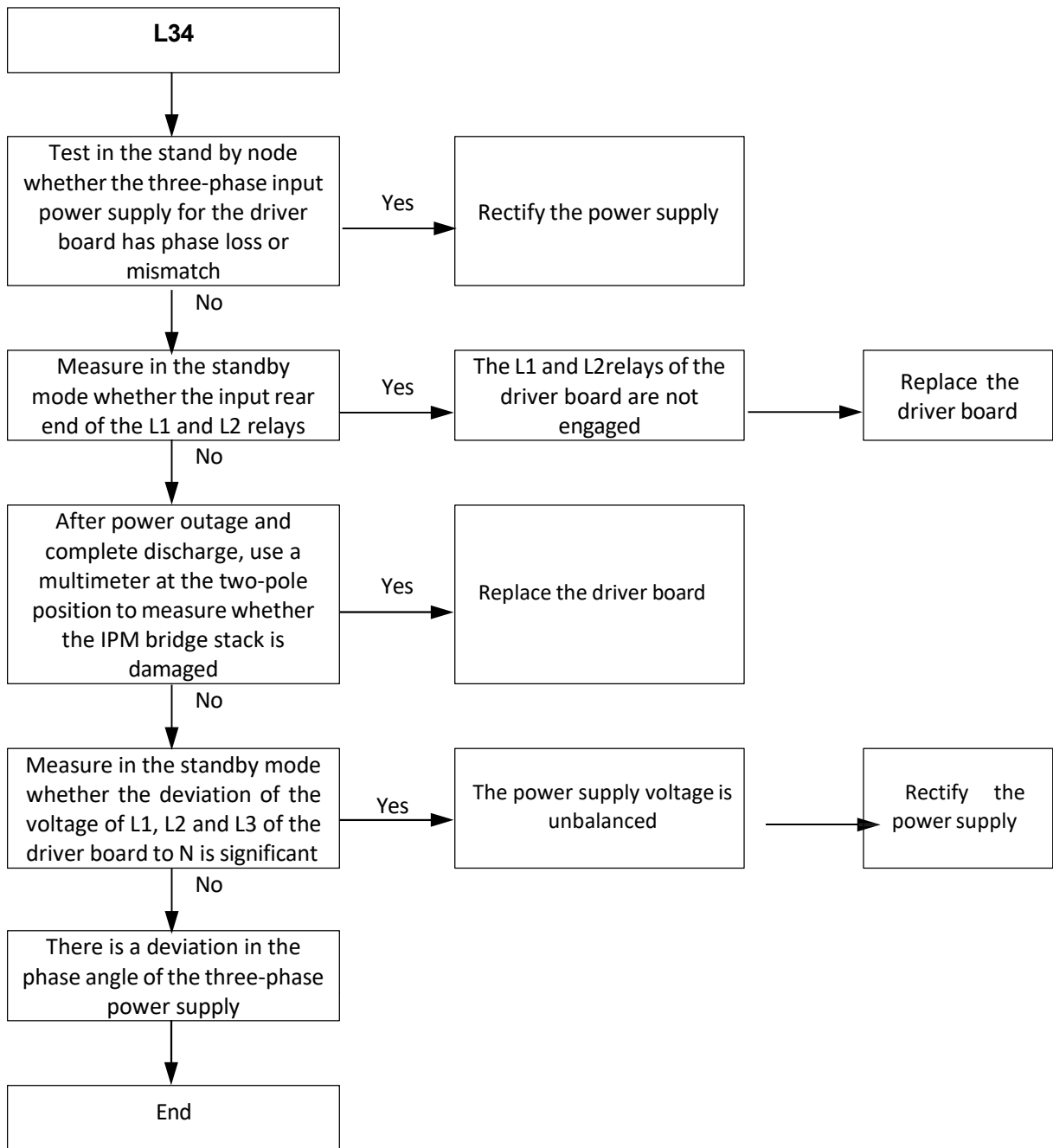
9.37.2 Trigger / recover condition

- Triggering conditions: The power input is out of phase or the three-phase power supply is severely unbalanced.
- Recovery conditions: The factors that cause phase loss are detected during power outage, such as poor power input wiring or loosened terminal screws, or disconnection of other electrical devices that share power supply with this model.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.37.3 Possible causes

- The wiring of the system power supply is abnormal, causing phase loss, or the N line is connected in reverse with the phase line;
- The wiring of the power line of the system is poor or the screws are not tightened properly;
- The module board is abnormal (one phase relay is not engaged);
- One or two phases of the power supply for the system have high load, resulting in imbalanced power supply voltage;
- The imbalance degree of the power grid distribution phase exceeds 3% (the phase angle is unbalanced, three-phase voltage is unbalanced, or both);

9.37.4 Procedure



9.38 1L43 Troubleshooting

9.38.1 Description

- The bias calibration of the current sampling circuit has malfunctioned.
- After this fault occurs, the compressor cannot be started, and it is necessary to check if there is a problem with the driver board.

9.38.2 Trigger / recover condition

- Triggering conditions: The AD bias value of the current sampling circuit is detected to reach half of the full range of AD.
- Recovery conditions: When this fault occurs, the compressor cannot be started and it is necessary to check whether there is a problem with the drive board. After troubleshooting, the current sampling circuit is powered on again and it is detected that the AD bias value is less than half of the full range of the AD, so this fault will not occur again.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.38.3 Possible causes

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

9.38.4 Procedure

- Replace the module board

9.39 1L45 Troubleshooting

9.39.1 Description

- The parameters do not match.
- After this fault occurs, the compressor cannot be started, and it is necessary to check if there is a problem with the driver board.

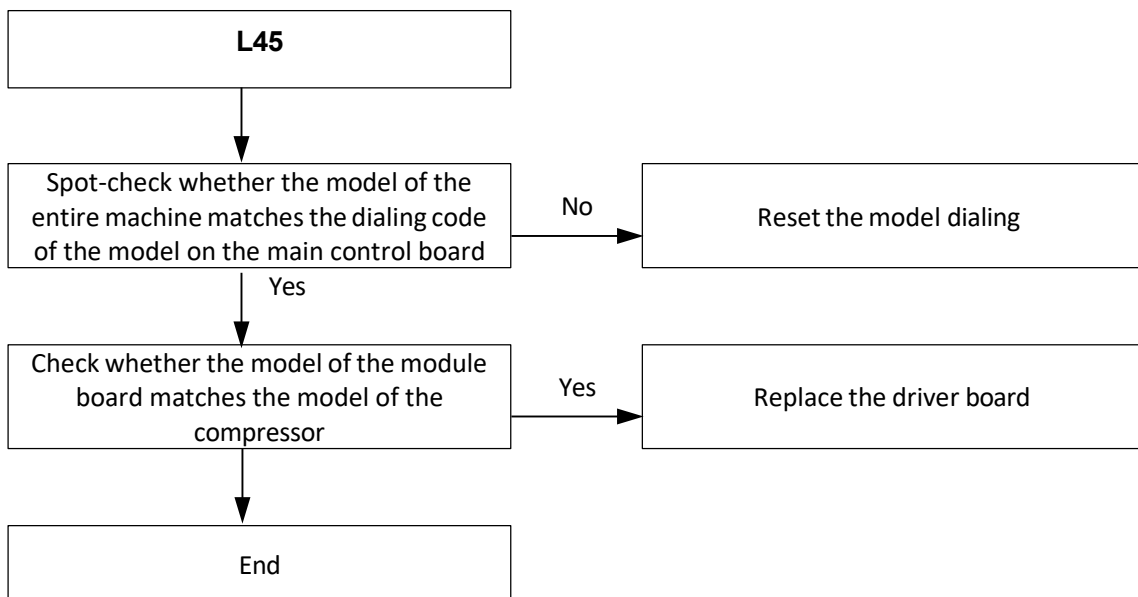
9.39.2 Trigger / recover condition

- Triggering conditions: The model of the compressor selected by the main controller through communication does not match the driving parameters of the compressor in the driver.
- Recovery conditions: Check whether the model is dialed incorrectly and select the corresponding model dial again.
- Reset method: Reselect the dialing code of the corresponding model and then power off and restart.

9.39.3 Possible causes

- The ability dialing or model dialing setting of the main controller is incorrect;
- The matching model of the module board is incorrectly selected;
- The main board circuit is abnormal or the module board circuit is abnormal;

9.39.4 Procedure



9.40 1L46 Troubleshooting

9.40.1 Description

- The dropping edge or sustained low level of the FO signal of the IPM Module is detected.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

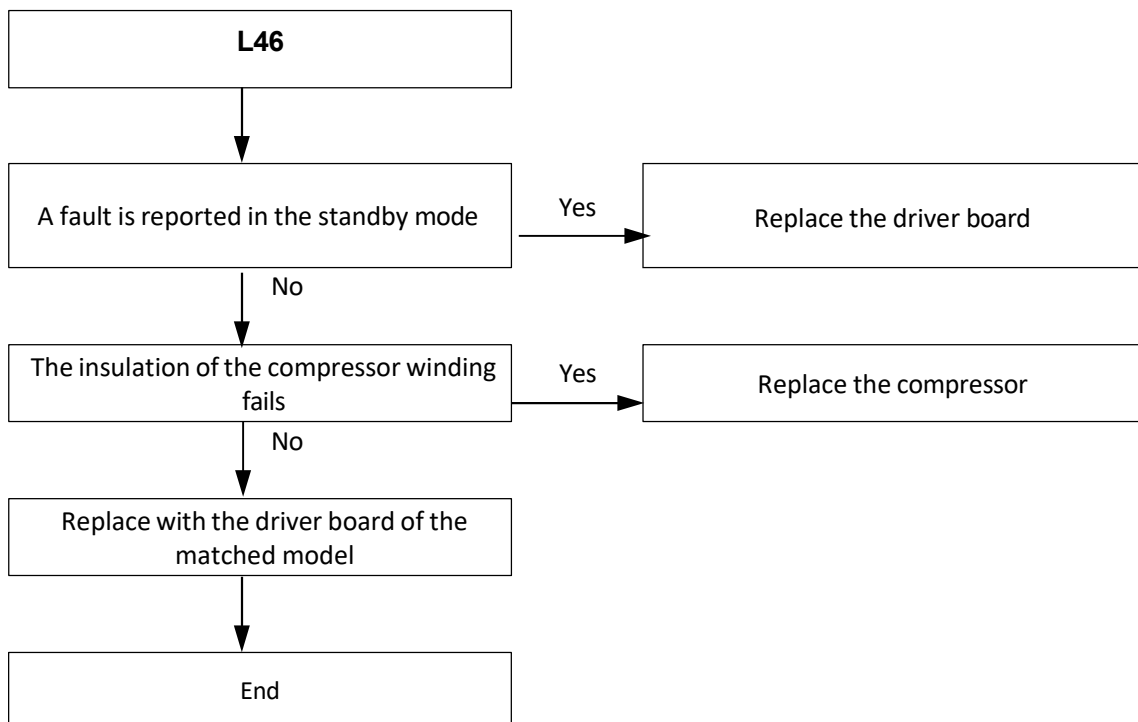
9.40.2 Trigger / recover condition

- Triggering conditions: The dropping edge or sustained low level of the FO signal of the IPM Module is detected.
- Recovery conditions: The FO signal of the IPM module is recovered to high level
- Reset method: The compressor will recover after the fault exit conditions are met.

9.40.3 Possible causes

- The IPM module is internally short-circuited;
- The compressor winding is short-circuited;
- Condensation occurs to the system, causing a short circuit between the pins of the IPM module;
- The driving voltage of the lower bridge IGBT of the IPM module is lower than 10.3V;
- The module board is abnormal;

9.40.4 Procedure



9.41 1L47 Troubleshooting

9.41.1 Description

- The driver board detected through the detection resistor of the module does not match the settings in the table of driver parameters.

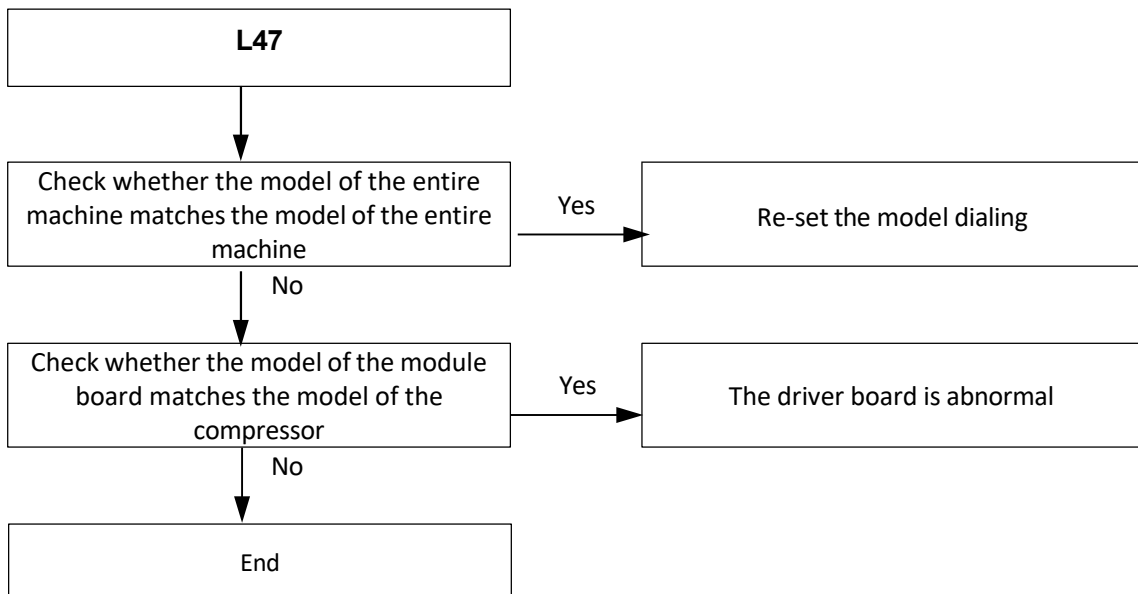
9.41.2 Trigger / recover condition

- Triggering conditions: The current level of the driver board detected through the detection resistor of the module and the information of the compressor do not match the settings in the table of driver parameters.
- Recovery conditions: The module board is incorrectly configured for this model, and the corresponding module board shall be replaced.
- Reset method: Reselect the module board of the corresponding model and then power off and restart.

9.41.3 Possible causes

- The ability dialing or model selection of the main controller is incorrect.
- The module board that does not match the model is used.
- The module board is faulty;

9.41.4 Procedure



9.42 1L50 Troubleshooting

9.42.1 Description

- The compressor fails to start.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

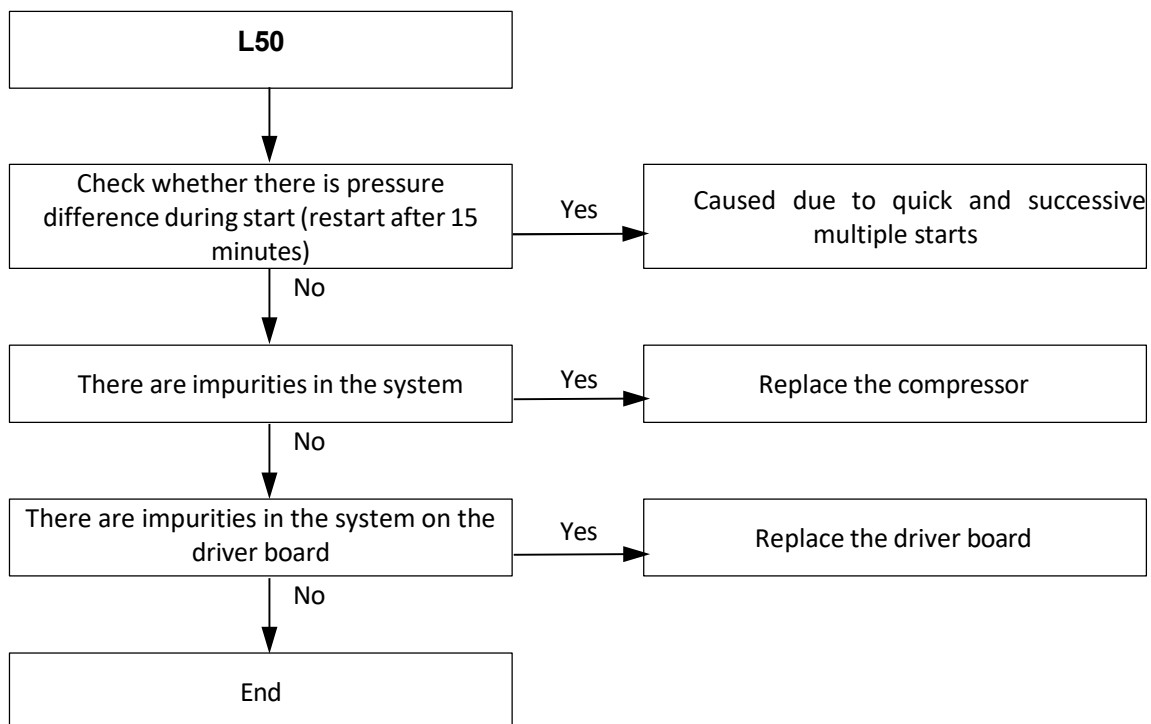
9.42.2 Trigger / recover condition

- Triggering conditions: The compressor fails to start.
- Recovery conditions: After the compressor fails to start, the compressor is restarted again. If the fault disappears after one minute, the fault is resolved after the compressor is successfully restarted.
- Reset method: After the compressor fails to start, the fault will automatically resolve after a successful restart.

9.42.3 Possible causes

- There is a pressure difference during system start;
- The compressor gets stuck;

9.42.4 Procedure



9.43 1L52 Troubleshooting

9.43.1 Description

- The compressor is stuck.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.43.2 Trigger / recover condition

- Triggering conditions: The compressor is stuck.
- Recovery conditions: The stalling fault is solved.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.43.3 Possible causes

- There are impurities in the system, causing that the compressor gets stuck.

9.43.4 Procedure

- If possible, the compressors are switched to start. If the problem persists, the dual compressor is replaced;

9.44 1L60 Troubleshooting

9.44.1 Description

- The phase loss protection occurs to the compressor.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.44.2 Trigger / recover condition

- Triggering conditions: The compressor is not wired or wiring contact is poor.
- Recovery conditions: The wiring of the compressor is checked. If the wiring is in good condition, the phase loss protection fault is eliminated and the fault is resolved.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.44.3 Possible causes

- The wiring of the compressor is poor or the terminal screws are not tightened properly.
- The module board is abnormal;

9.44.4 Procedure

- ① Check the UVW output connection line of the driver board of the compressor and the UVW wiring of the compressor;
- ② If possible, the lines of the compressors are switched, to confirm if the driver board is working properly, otherwise the drive board shall be replaced.

9.45 1L61 Troubleshooting

9.45.1 Description

- The short-circuit-to-ground protection occurs to the compressor.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.45.2 Trigger / recover condition

- Triggering conditions: The short-circuit-to-ground protection occurs to the compressor.
- Recovery conditions: Check if the compressor casing is damaged, resulting in poor insulation
- Reset method: The compressor will recover after the fault exit conditions are met.

9.45.3 Possible causes

- The insulation of the compressor casing is poor;

9.45.4 Procedure

- Remove the compressor line, measure the ground resistance of the compressor UVW, confirm and replace the compressor.

9.46 1L65 Troubleshooting

9.46.1 Description

- Short circuit protection occurs to IPM corresponding to the compressor.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.
-

9.46.2 Trigger / recover condition

- Triggering conditions: Short circuit protection occurs to IPM corresponding to the compressor.
- Recovery conditions: Replace the driver module without any issues.
- Reset method: The compressor will recover after the fault exit conditions are met.

9.46.3 Possible causes

- The driver board is faulty and needs to be replaced.

9.46.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

9.47 1L6b Troubleshooting

9.47.1 Description

- Open circuit occurs to the U-Phase lower tube of IPM.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.47.2 Trigger / recover condition

- Triggering conditions: Open circuit occurs to the U-Phase lower tube of IPM corresponding to the compressor.
- Recovery conditions: Check whether the IPM module is normal
- Reset method: Replace the module board, re-power on and start.

9.47.3 Possible causes

- The IPM module is damaged, and the driver board needs to be replaced.

9.47.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

9.48 1L6C Troubleshooting

9.48.1 Description

- Open circuit occurs to the IPM V-Phase upper tube.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.48.2 Trigger / recover condition

- Triggering conditions: Open circuit occurs to the V-Phase upper tube of IPM corresponding to the compressor.
- Recovery conditions: Check whether the IPM module is normal
- Reset method: Replace the module board, re-power on and start.

9.48.3 Possible causes

- The IPM module is damaged, and the driver board needs to be replaced.

9.48.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

9.49 1L6d Troubleshooting

9.49.1 Description

- Open circuit occurs to the U-Phase lower tube of IPM.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.49.2 Trigger / recover condition

- Triggering conditions: Open circuit occurs to the U-Phase lower tube of IPM corresponding to the compressor.
- Recovery conditions: Check whether the IPM module is normal
- Reset method: Replace the module board, re-power on and start.

9.49.3 Possible causes

- The IPM module is damaged, and the driver board needs to be replaced.

9.49.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

9.50 1L6E Troubleshooting

9.50.1 Description

- Open circuit occurs to the IPM W-Phase upper tube.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.50.2 Trigger / recover condition

- Triggering conditions: Open circuit occurs to the W-Phase upper tube of IPM corresponding to the compressor.
- Recovery conditions: Check whether the IPM module is normal
- Reset method: Replace the module board, re-power on and start.

9.50.3 Possible causes

- The IPM module is damaged, and the driver board needs to be replaced.

9.50.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

9.51 1L6E Troubleshooting

9.51.1 Description

- Open circuit occurs to the IPM W-Phase lower tube.
- After the fault, the compressor stops running. If the fault disappears after one minute, the compressor is started again.

9.51.2 Trigger / recover condition

- Triggering conditions: Open circuit occurs to the W-Phase lower tube of IPM corresponding to the compressor.
- Recovery conditions: Check whether the IPM module is normal
- Reset method: Replace the module board, re-power on and start.

9.51.3 Possible causes

- The IPM module is damaged, and the driver board needs to be replaced.

9.51.4 Procedure

- Check whether there is false welding of IPM, and whether the PWM related transmission circuits of MCU are welded;

10 COMPRESSOR REPLACEMENT PROCEDURE

10.1 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.

10.2 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.)

10.3 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.

10.4 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.

10.5 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.

10.6 Replace the faulty compressor and re-fit the other compressors

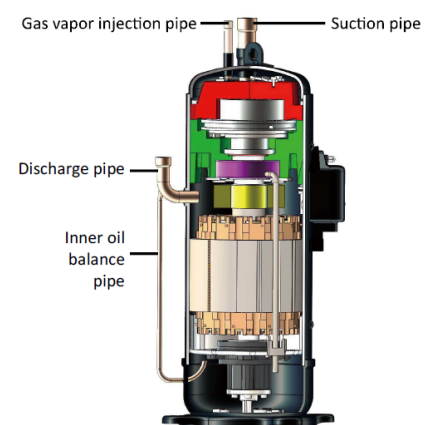
- Replace the faulty compressor.
- If the oil had been spoiled and was drained from the non-faulty compressors in Step 3, use clean oil to clean them before re-fitting them into the units. To clean, add oil into the compressor through the discharge pipe using a funnel, shake the compressor, and then 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.)

10.7 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.

10.8 Vacuum drying and refrigerant charging

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

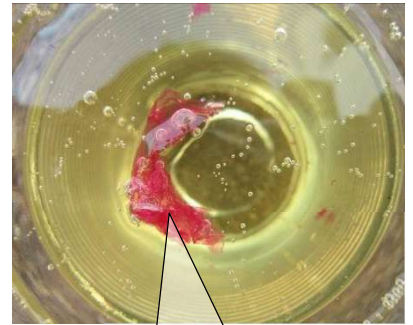


Inspecting compressor oil

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



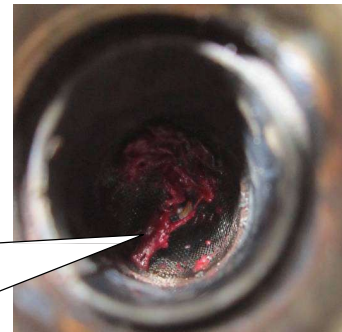
This oil contains particles of copper

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



11 APPENDIX

11.1 Temperature Sensor Resistance Characteristics

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

TP1/TP2 exhaust temperature sensor

R90=5K Ω ±3%, B25/50=3950K±3%

Temp		Resistance (K Ω)		Resist.tol(%)		Temp.tol(°C)	
°C	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)

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(°C)	
°C	Rmax	R(t) Normal	Rmin	°C	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)

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=10K Ω $\pm$ 3%, B25/50=4100K $\pm$ 3%

Temp		Resistance (K Ω)		Resist.tol(%)		Temp.tol($^{\circ}$ C)	
$^{\circ}$ C	Rmax	R(t) Normal	Rmin	$^{\circ}$ C	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



GROUPE AIRWELL
10 RUE DU FORT DE SAINT CYR
78180 MONTIGNY LE BRETONNEUX
FRANCE
www.airwell.com