Inverter Air Conditioner

Service Manual

Models:

DYC024GCSI18RD **DYC036GCSI18RD**

DYC048GCSI18RD **DYC060GCSI18RD**

CONTENTS

1. Product Series

1.1 Model

	Model	Model Description
Outdoor Unit	YD2436GCSI18RD	208-230V, 1N, 60Hz, DC inverter compressor, DC motor
		208-230V, 1N, 60Hz, DC inverter compressor, DC motor
	YD4860GCSI18RD	208-230V, 1N, 60Hz, DC inverter compressor, DC motor
		208-230V, 1N, 60Hz, DC inverter compressor, DC motor
Indoor Unit (Air Handler)	DC024GCSICDHRT	208-230V, 1N, 60Hz, DC motor
	DC036GCSICDHRT	208-230V, 1N, 60Hz, DC motor
	DC048GCSICDHRT	208-230V, 1N, 60Hz, DC motor
	DC060GCSICDHRT	208-230V, 1N, 60Hz, DC motor

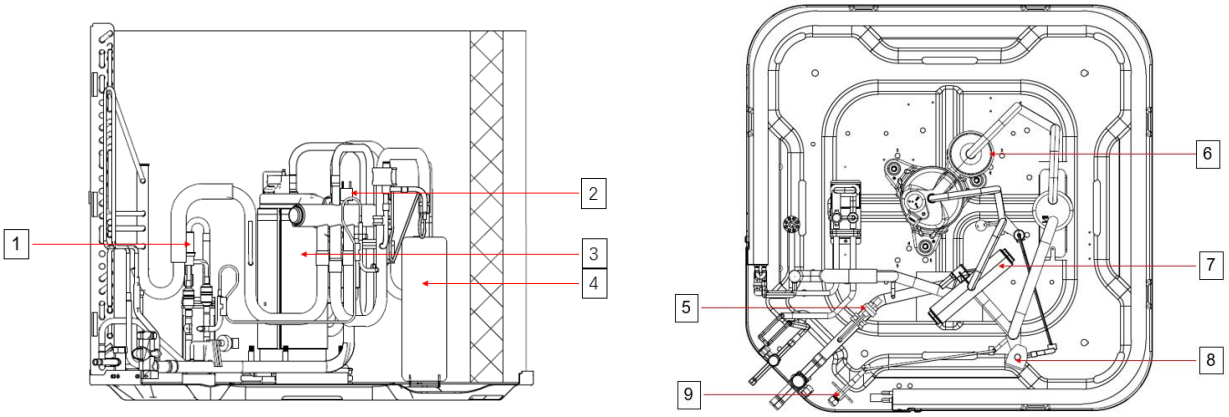
1.2 Appearance

Outdoor Unit	
Photo	
Model	YD2436GCSI18RD YD4860GCSI18RD
Indoor Unit	
Photo	
Model	DC024GCSICDHRT DC036GCSICDHRT DC048GCSICDHRT DC060GCSICDHRT

2. Product Structure

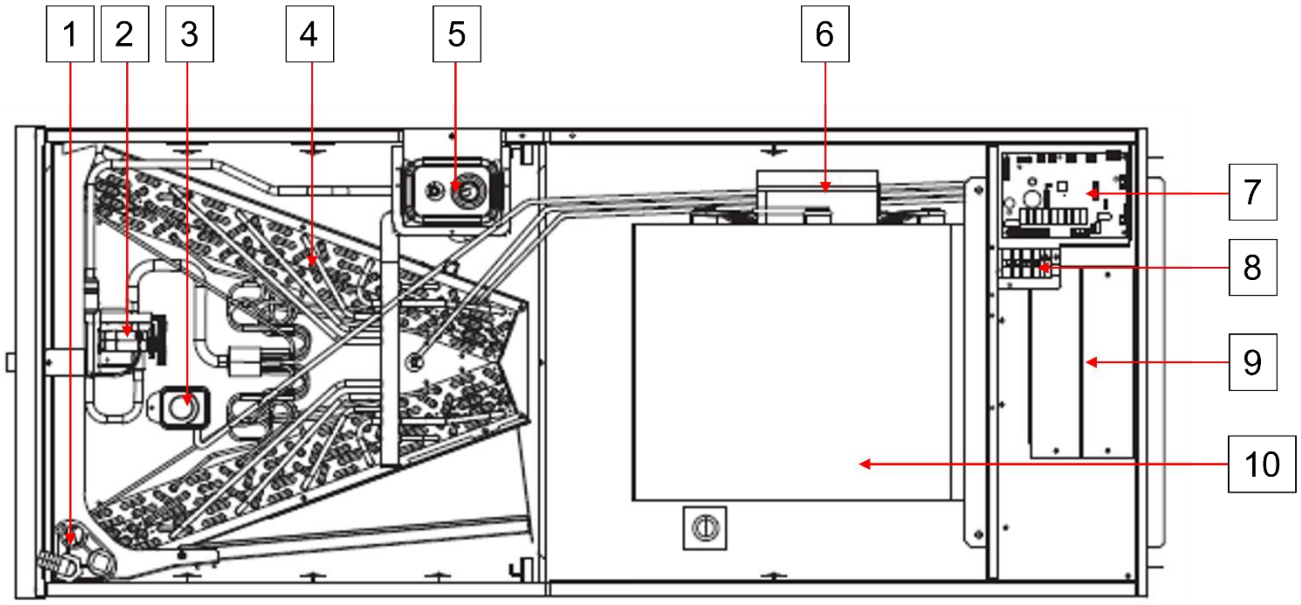
2.1 Structural Diagram

Outdoor Unit



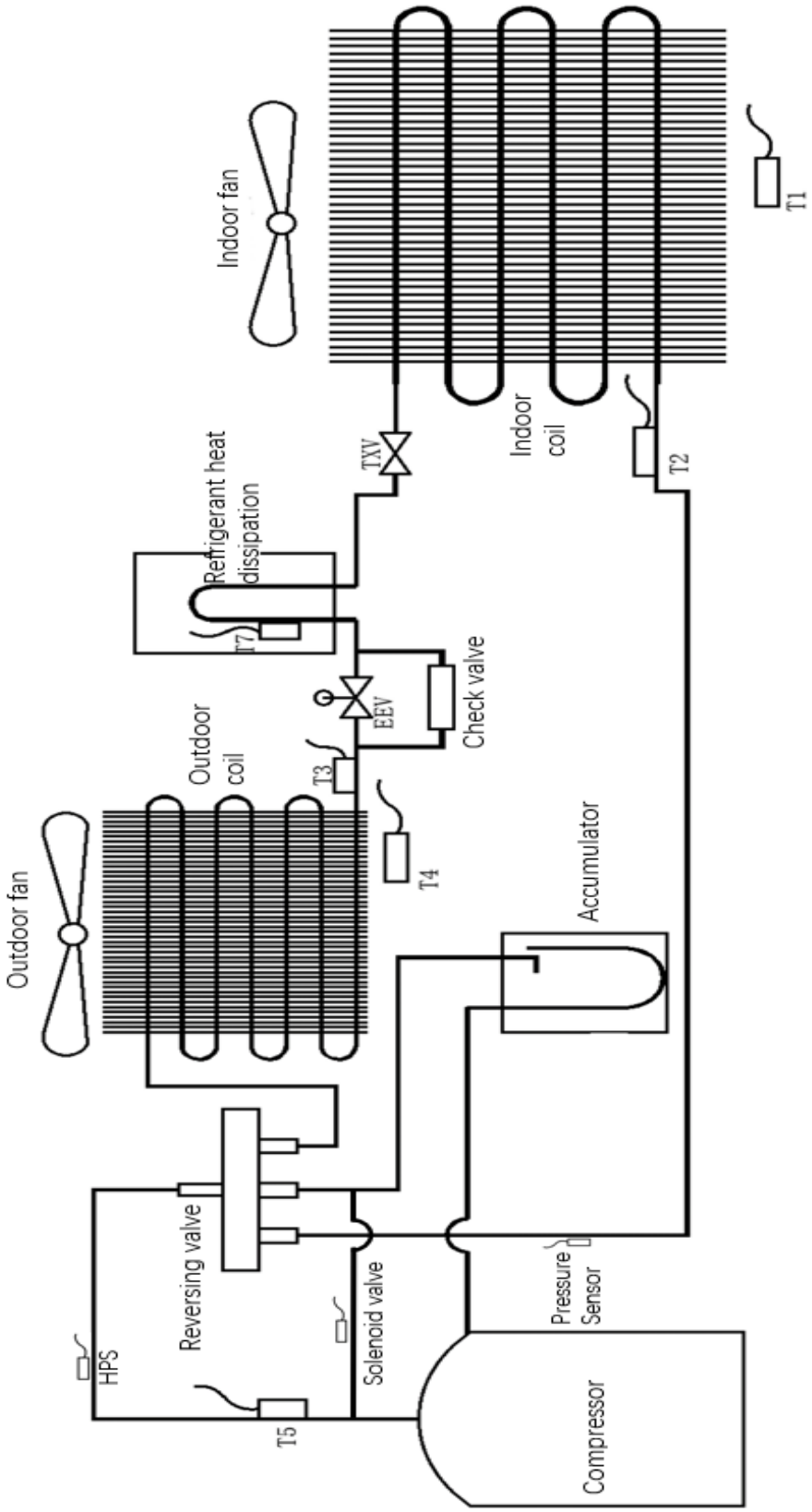
1	EXV
2	High-pressure switch
3	Compressor
4	Accumulator
5	Pressure sensor
6	Oil separator
7	Reversing valve
8	Solenoid valve
9	Service valve

Indoor Unit



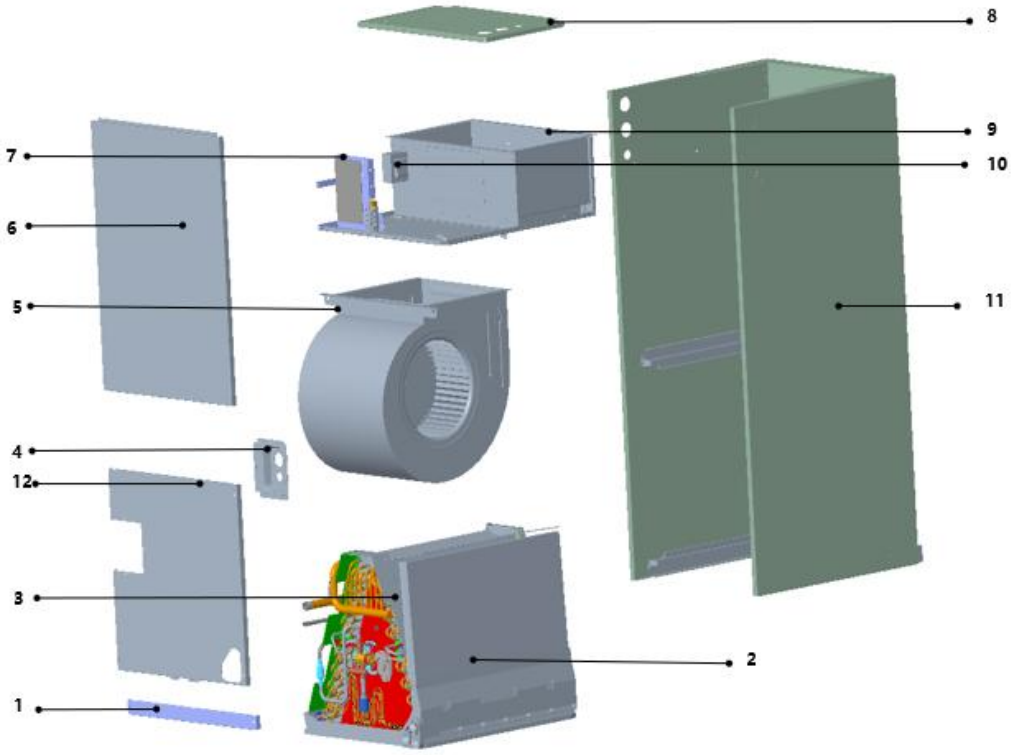
1	Drain
2	TXV
3	Refrigerant leakage sensor
4	Indoor coil
5	Suction line / Liquid line
6	Fan motor
7	Control board
8	High voltage connection
9	Electric heater slot cover plate
10	Fan volute

2.2 Pipeline System Diagram



2.3 Exploded Diagram

AHU



60K

No.	Part Name	Quantity	BOM Code
1	Filter cover plate	1	801239390088
2	Drain pan assembly	1	801235000123
3	Evaporator components	1	801535000049
4	Pipe cover plate assembly	1	801235000073
5	Volute casing with impeller	1	801200200040
6	Upper side plate assembly	1	801243100007
7	Indoor electric control box assembly	1	803344000321
8	Control box cover assembly	1	801235000131
9	Duct assembly	1	801235000176
10	Transformers	1	802311300001
11	Rear enclosure assembly	1	801235000151
12	Down side plate assembly	1	801243100008
	Refrigerant leakage sensor	1	802301800001
	Temp. sensor (T1)	1	802301500028
	Temp. sensor (T2)	1	802300400181
	DC motor	1	802401700428

48K

No.	Part Name	Quantity	BOM code
1	Filter cover plate	1	801239390088
2	Drain pan assembly	1	801235000123
3	Evaporator components	1	801535000049
4	Pipe cover plate assembly	1	801235000073
5	Volute casing with impeller	1	801200200040
6	Upper side plate assembly	1	801243100007
7	Indoor electric control box assembly	1	803344000321
8	Control box cover assembly	1	801235000131
9	Duct assembly	1	801235000176
10	Transformers	1	802311300001
11	Rear enclosure assembly	1	801235000151
12	Down side plate assembly	1	801243100008
	Refrigerant leakage sensor	1	802301800001
	Temp. sensor (T1)	1	802301500028
	Temp. sensor (T2)	1	802300400181
	DC motor	1	802401700428

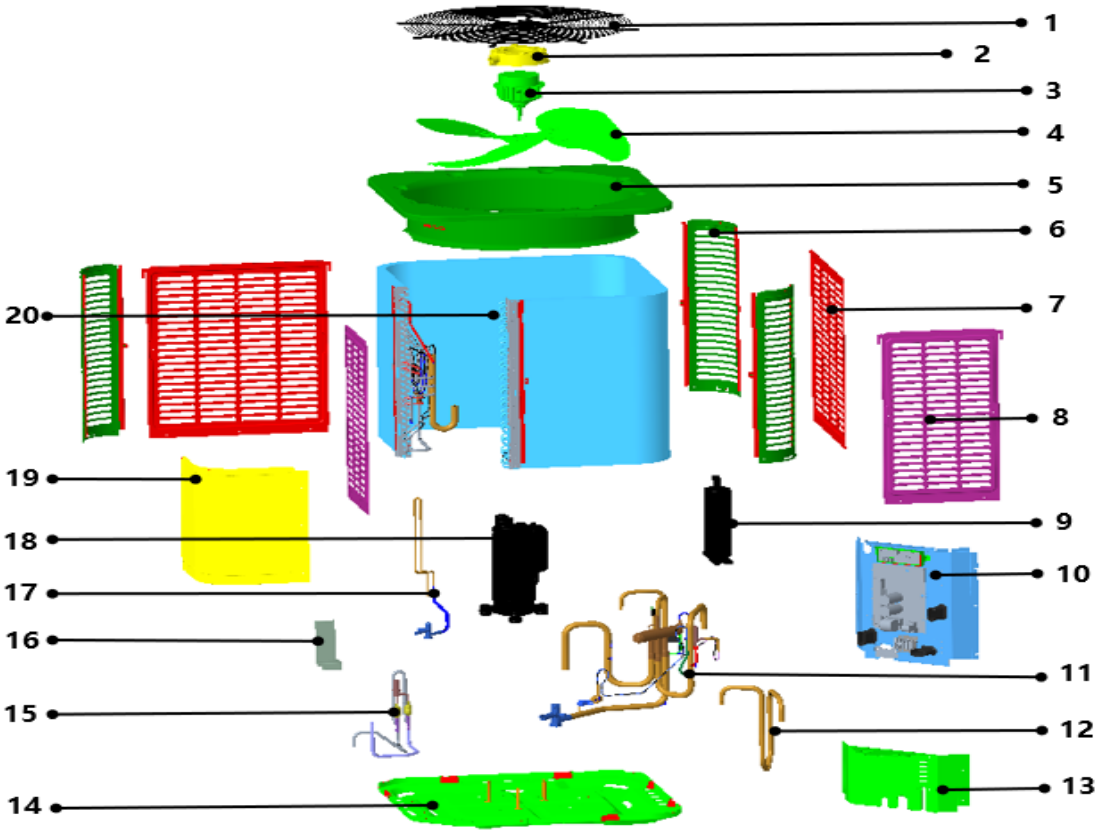
36K

No.	Part Name	Quantity	BOM code
1	Filter cover plate	1	801233590166
2	Drain pan assembly	1	801134590006
3	Evaporator components	1	801535000050
4	Pipe cover plate assembly	1	801235000073
5	Volute casing with impeller	1	801200200040
6	Upper side plate assembly	1	801235000146
7	Indoor electric control box assembly	1	803344000321
8	Control box cover assembly	1	801235000148
9	Duct assembly	1	801235000172
10	Transformers	1	802311300001
11	Rear enclosure assembly	1	801235000155
12	Refrigerant leakage sensor	1	802301800001
	Temp. sensor (T1)	1	802301500028
	Temp. sensor (T2)	1	802300400181
	DC motor	1	802401700430

24K

No.	Part Name	Quantity	BOM Code
1	Filter cover plate	1	801233590166
2	Drain pan assembly	1	801134590006
3	Evaporator components	1	801535000050
4	Pipe cover plate assembly	1	801235000073
5	Volute casing with impeller	1	801200200040
6	Upper side plate assembly	1	801235000146
7	Indoor electric control box assembly	1	803344000321
8	Control box cover assembly	1	801235000148
9	Duct assembly	1	801235000172
10	Transformers	1	802311300001
11	Rear enclosure assembly	1	801235000155
12	Refrigerant leakage sensor	1	802301800001
	Temp. sensor (T1)	1	802301500028
	Temp. sensor (T2)	1	802300400181
	DC motor	1	802401700427

Outdoor Unit



60K

No.	Part Name	Quantity	BOM Code
1	Grill	1	802935000004
2	DC motor mount	1	801139090007
3	Outdoor motor	1	802401700429
4	Axial-flow fan	1	801200200055
5	Top cover assembly	1	801235000118
6	Support board	3	801235000117
7	Rear side panel	2	801235000121
8	Right side panel	2	801235000122
9	Accumulator	1	801605000009

10	Electronic control board	1	803335000017
11	4-way valve assembly	1	801635000099
12	Suction line assembly	1	801635000109
13	Bottom side panel	1	801235000115
14	Chassis assembly	1	801235000112
15	Electronic expansion valve Assemblies	1	801634000167
16	Valve support plate	1	801235000139
17	High pressure valve assembly	1	801635000114
18	Compressor	1	801403200021
19	Top panel	1	801234000060
20	Condenser assembly	1	801535000046
	Temperature sensor (T7)	1	802301500050
	Pressure sensor	1	802301600011
	Temperature sensor group (T3/T4/T5)	1	802301500049
	High-pressure switch	1	802405F00002

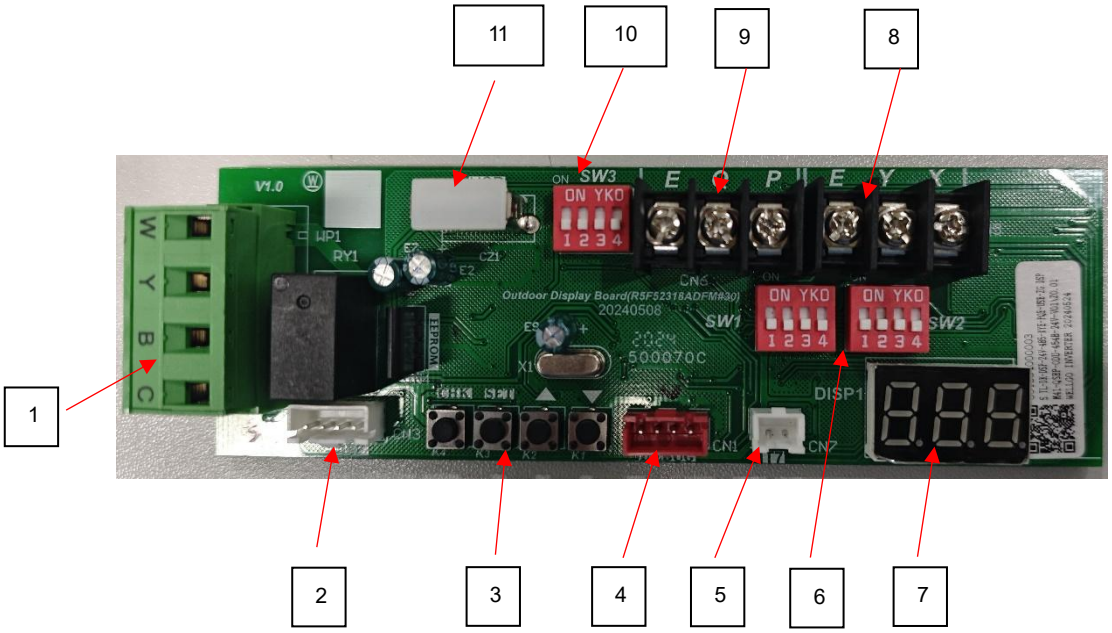
36K

No.	Part Name	Quantity	BOM Code
1	Grill	1	802935000004
2	DC motor mount	1	801139090007
3	Outdoor motor	1	802401700429
4	Axial-flow fan	1	801200200055
5	Top cover assembly	1	801235000118

6	Support board	3	801235000137
7	Rear side panel	2	801235000135
8	Right side panel	2	801235000136
9	Accumulator	1	801605000010
10	Electronic control board components	1	803335000019
10.1	Main control board	1	801306300007
10.2	Display board	1	801334000003
11	4-way valve assembly	1	801635000123
12	Suction line assembly	1	801635000120
13	Bottom side panel	1	801235000138
14	Chassis assembly	1	801235000112
15	Electronic expansion valve assemblies	1	801634000167
16	Valve support plate	1	801235000139
17	High pressure valve assembly	1	801635000129
18	Compressor	1	801403200022
19	Top panel	1	801234000060
20	Condenser assembly	1	801535000051
	Temperature sensor (T7)	1	802301500050
	Pressure sensor	1	802301600011
	Temperature sensor group (T3/T4/T5)	1	802301500049
	High-pressure switch	1	802405F00002

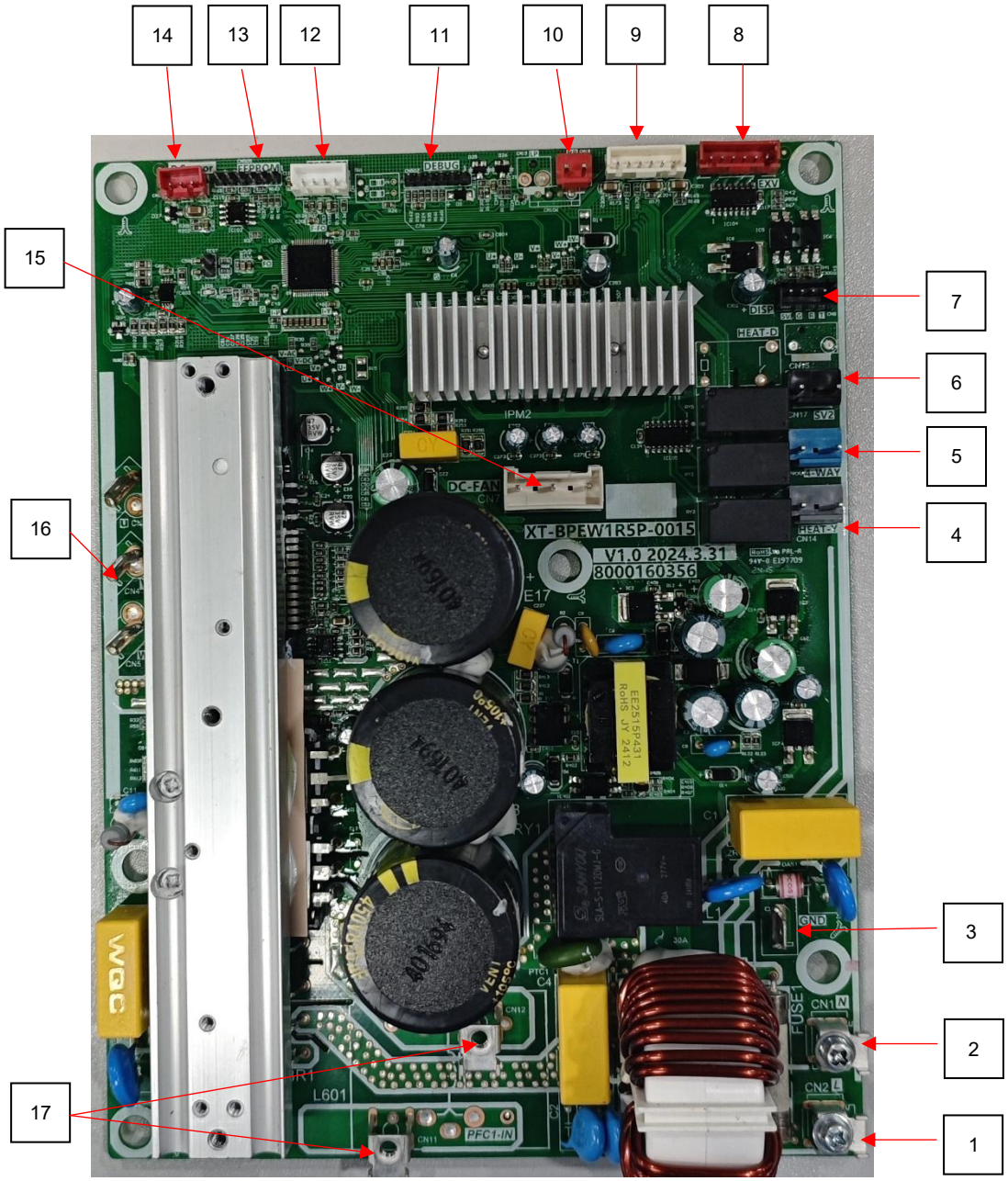
3. Electric Control Component

3.1 Display Board



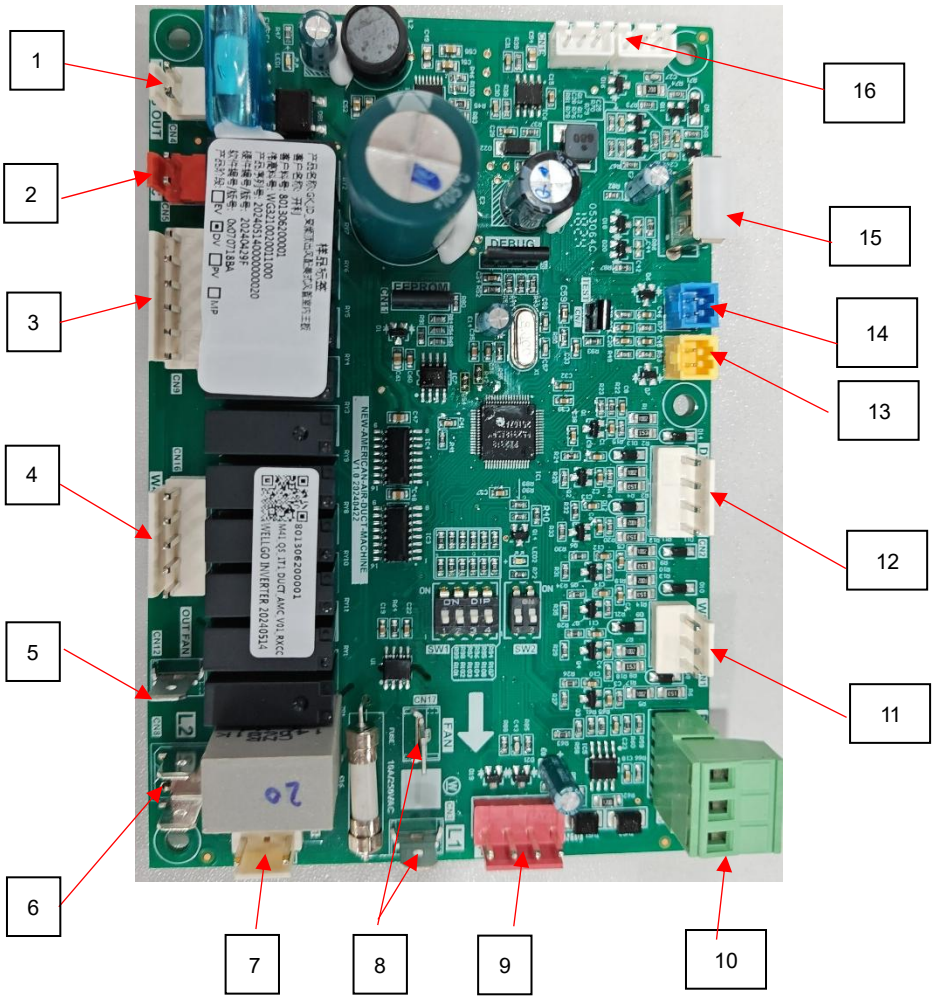
No.	Port Definition	Description
1	24V Thermostat connection	Connected to the 24V thermostat
2	Communication port with the main board	Communicate with the main control board
3	Function buttons	View parameters, adjust parameters, select functions, etc
4	Reserve ports	Reserve
5	T7 sensor port	Detect the outlet temperature of the condenser
6	SW1 and SW2 dip switch	Adjusting function parameters through the dip switch
7	Display screen	Display parameter information or fault codes
8	Reserve ports	Reserve
9	PQE communication with the indoor unit	Only effective in RS485 communication mode
10	SW3 dip switch	Adjust function parameters through the dip switch
11	USB debug port	Can be used to update the main control board program

3.2 Outdoor Unit Main Board



No.	Port Definition	No.	Port Definition
1	Power supply L (L1)	**10**	High-pressure switch port
2	Power supply N (L2)	**11**	DEGUG (Reserved)
3	Ground wire	**12**	Test port (Reserved)
4	Crankshaft heating port	**13**	E-part program burning port
5	4-way valve port	**14**	Pressure sensor port
6	Solenoid valve port	**15**	DC fan port
7	Display board ports	**16**	Compressor terminal U V W
8	Electronic expansion valve port	**17**	Reactor port
9	T3/T4/TP port		

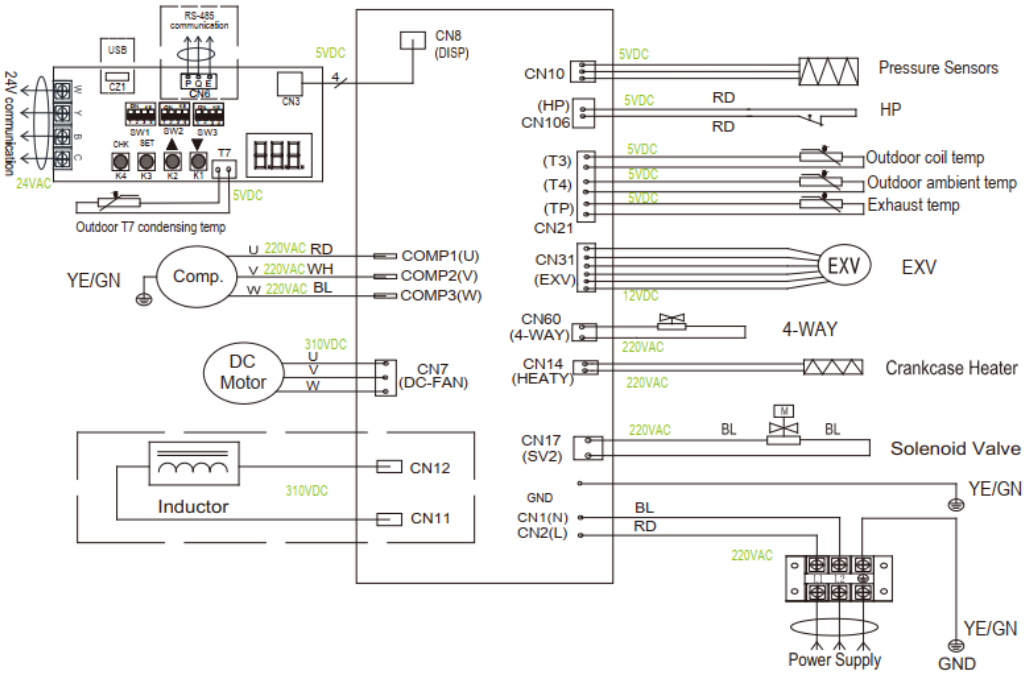
3.3 Indoor Unit Control Board



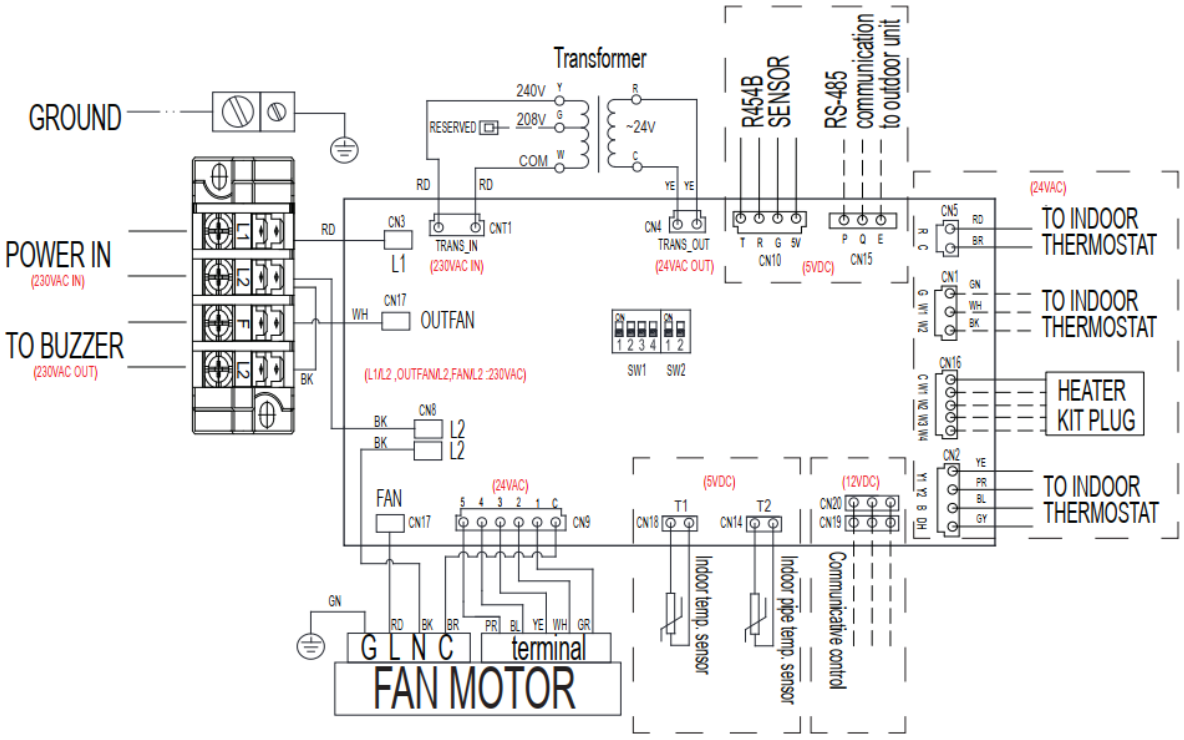
No.	Port Definition	No.	Port Definition
1	Transformer output (24V)	**9**	Refrigerant leakage sensor
2	24V thermostat power supply R, C	**10**	PQE indoor and outdoor communication
3	DC motor communicate port	**11**	Electric heater port (to 24V thermostat)
4	Electric heater port (connected to the electric heater)	**12**	24V terminal connected to 24V thermostat
5	Power supply of the control board and DC motor N (L2)	**13**	T1 sensor
6	Power supply (L2)	**14**	T2 sensor
7	Transformer input (230v)	**15**	Debug port
8	Power supply of the control board and DC motor L (L1)	**16**	Smart controller port (only active function in RS485 communication mode)

3.4 Wiring Diagram

Outdoor Unit

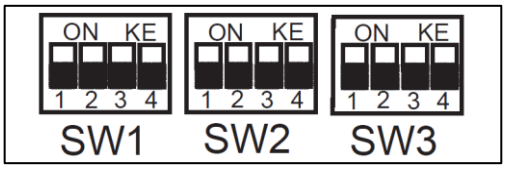


Indoor Unit



3.5 Meaning of the Dip Switch

Dip switch on the display board
(Button in the Up position indicates its on)

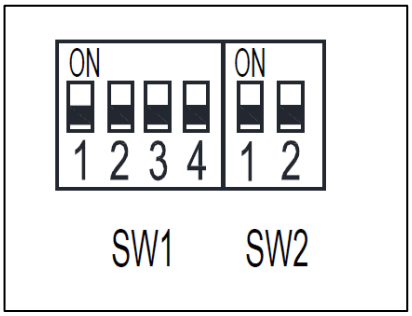


Mode		SW3-1	
		On	Off
SW3-2	On	5 Ton	3 Ton
	Off	4 Ton	2 Ton

SW1-1	On	RS-485 communication mode
	Off	24V control (factory default)
SW1-2	On	Display unit: °C and Mpa
	Off	Display unit: °F and PSI (factory default)
SW1-3	On	System operation mode: Cooling only
	Off	System operation mode: Heat pump (factory default)
SW1-4	On	USB upgrade
	Off	Reserved (factory default)
SW2-1	On	Fix timed defrost
	Off	Auto Defrost (factory default)
SW2-2	On	Timer 30 min
	Off	Timer 60 min (factory default)
SW2-3	On	Powerful defrosting
	Off	Normal (factory default)
SW2-4	On	O/B terminal energized in Cooling mode
	Off	O/B terminal energized in Heating mode (factory default)
SW3-3	On	Accelerated cooling
	Off	Normal cooling (factory default)
SW3-4	On	Accelerated heating
	Off	Normal heating (factory default)

Dip Switch on the Indoor Control Board
(Button in the Up position indicates its on)

SW1-1	RS-485 communication mode
	24V thermostat control
SW1-2	Heating fan delay 90s
	Anti-cooling fan delay
SW1-3	T1 temp. sensor from the thermostat
	T1 temp .sensor from the AHU return
SW1-4	USB port software update
	Reserved



SW2-1	SW2-2	High Speed Taps	Low Speed Taps
Off	Off	3 --- Medium	1 --- Low
On	Off	4 --- Medium High	2 --- Medium Low
Off	On	4 --- Medium High	3 --- Medium
On	On	5 --- High	4 --- Medium High

4. Function Introduction

4.1 Electrical Components Description

Temperature Sensor
T1: IDU Ambient Temperature
— Capacity demand control (R485 mode)
— Defrost control (Heating mode)

T2: Indoor Coil Temperature
— Anti-cold air function (Heating mode)
— Anti-freezing function

T3: Outdoor Coil Temperature
— High/Low temperature protection
— Outdoor fan control (Cooling mode)
— Defrost control (Heating mode)

T4: ODU Ambient Temperature
— Operating condition permission
— Defrosting condition (Heating mode)
— Outdoor fan control (Heating mode)

T5: Compressor Discharge Temperature
— High temperature / Low superheat protection
— Electronic Expansion Valve (EEV) control

Tfin: Inverter Board Heat Sink Temperature Sensor
— Protection against overheating of the inverter board

T7: Control board Heat Pipe Temperature
— Control board anti-condensed

Pressure Transducer:
Evaporating pressure in Cooling mode and condensing pressure in Heating mode.
— Compressor frequency control
— Electronic Expansion Valve (EEV) control
— High pressure protection (Heating mode)
— Low pressure protection (Cooling mode)

Pressure Equalizer Value (PEV
— Used to balance the pressure in the system before the compressor starts.

Reversing value operation
— Reversing value energizes during Heating mode and de-energizes in Cooling mode.

Compressor Crankcase Heater Description
— Refrigerant migration during the Off cycle can result in noisy start-ups, therefore a Crankcase Heater (CCH) is used to minimize refrigeration migration. This will minimize start-up noise and/or bearing "wash out."
All CCHs must be installed around the lower half of the compressor shell. This helps warm the compressor during the Off cycle, driving refrigerant from the compressor. After extended shutdown periods in cold weather, it is recommended to allow the CCH to be energized for at least 12 hours prior to compressor operation by applying line voltage to the heat pump with the thermostat off.

CCH operation energizes:
First time line voltage is applied and the compressor discharge temperature is T5 < 73.4°F(23°C)
Compressor stops running for 3 hours (outdoor ambient temperature T4 < 50°F(10°C) or T5 < 73.4°F(23°C)

CCH operation de-energizes:
Compressor discharge temperature T5 > 82°F(27.8°C)

4.2 Control Logic Description

The variable speed system is applicable with the same 24V thermostat control as any conventional heat pump.

The compressor's speed is controlled based on coil pressures, which is monitored by the unit's pressure transducer and various temperature sensors. To ensure stable and adequate capacity, the compressor speed will modulate relative to the evaporator pressure during Cooling mode and the condensing pressure during Heating mode.

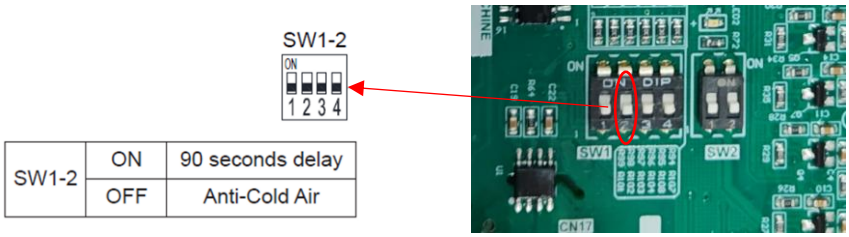
After the system starts and enters a stable operating stage, the system software will continuously be monitored by the sensor input and adjust the compressor speed adaptively, so that it can provide enough stable output capacity.

4.3 Anti-Cold Air and Heating Fan Delay Function

Anti-Cold Air Function (Only effective in Heating mode)
When the SW1-2 is in the Off position and running in Heating mode, the fan will not start when the coil temperature (T2) < 82.4°F(28°C).

When T2 > 82.4°F(28°C), the fan will start immediately. When the electric heat kit is manually turned on, the fan will also start immediately.

Heating Fan Delay Function
When the dip switch SW1-2 is set to the On position and the indoor unit is in Heating mode, the fan will operate with a 90s delay each time it starts. The fan speed is determined by the Y1/Y2 signal from the thermostat.



SW1-2	ON	90 seconds delay
	OFF	Anti-Cold Air

4.4 Indoor Coil Anti-Freezing Function

This function utilizes the indoor coil sensor (T2) to determine whether the indoor coil is freezing or not. This feature prevents the unit from running at low evaporating temperatures, as well as low suction superheat.

When all the following conditions are met, the Anti-Freezing function will activate and the compressor will turn off:

1) T2 < 32°F(0°C) duration exceeding 1 min.
2) T2 ≤ 26.6°F(-3°C) duration exceeding 30s
3) When T2 ≥ 42.8°F(6°C), the Anti-Freezing function will deactivate.

4.5 R454B Leakage Detection Function

This function utilizes a R454B refrigerant sensor to detect the R454B concentration. The terminal F/L2 is reserved for connecting the buzzer if needed.

When R454B leakage occurs in the indoor coil and the concentration is above 10% LEF, the unit will perform as the following:

1) Cut off the power to the thermostat to stop the operation of the compressor.
2) The electric heat kit will be turned off.
3) High voltage will be output between the terminal F and terminal L2.
4) The indoor fan is running at high wind speed. At the same time, the fault light on the indoor control board is flashing.

4.6 Accelerated Operation Mode

Through manually adjusting the target outdoor coil temperature setting (SW3-3&4), you can achieve improved cooling and capacity demands.

	SW3-3	SW3-4
On	Accelerated cooling	Accelerated heating
Off	Normally cooling (factory default)	Normally cooling (factory default)

Accelerated cooling / heating function changes the initial target coil temperature to provide "enhanced comfort" by increasing the unit capacity.

In the Accelerated mode, the unit sets the target evaporation temperature to ±41°F(5°C). Provide a higher or lower target evaporation temperature or condensation temperate than normal mode, providing further cooling or heating effects. The compressor frequency is still adjusted by variable frequency.

4.7 Defrost Description

According to the actual situation on the site, the unit has multiple defrost modes to choose from:

Auto Defrost
The unit measures the ambient temperature and the temperature of the outdoor coil through sensors, calculating the condensation pressure and unit running time to determine whether to enter Defrost mode. When the temperature of the coil exceeds the set value, the unit automatically exits Defrosting mode.

Manual Forced Defrosting Mode
Press the "▼" button on the display board for about 5s to enter manual defrost. The LED display will show "dF" (shows the frequency of the compressor in Hz).

1. Manual defrosting can only be engaged after 5 min of operation following the system being powered on for the first time. Also the system must operate in Heating mode.
2. The system will exit manual defrosting by the same condition of the normal defrosting cycles.
3. After the manual defrosting cycle finishes, the system will return to the previous operation mode.

Fixed-Time Defrosting:
You can activate the defrost function every 30-60 min. When the temperature of the coil exceeds the set value, the unit automatically exits Defrosting mode.

Powerful Defrosting：
Heating operating time is reduced by 10% and defrosting extends for 60s

Defrosting Choice	SW2-1	SW2-2	SW2-3
On	Fix-timed defrost	Timer 30 min	Powerful defrosting
Off	Auto Defrost (factory default)	Timer 60 min (factory default)	Normal (factory default)
Remark	Defrosting: Control mode selection	Cycle time selection	Only applicable to fix-timed defrosting timer and the minimum runtime timer.

If the SW2-1 is on, the fixed defrost time is determined by the SW2-2 dial selection.

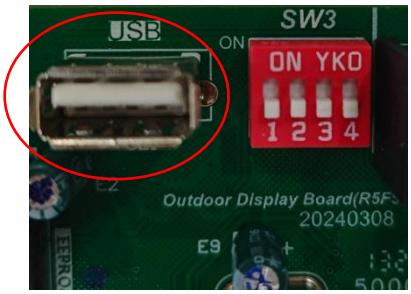
4.8 Forced Operating Mode

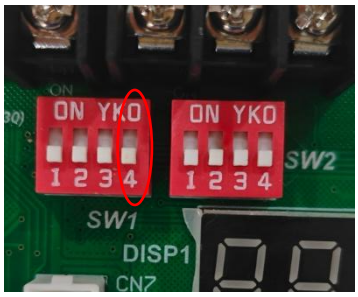
Forced Cooling Mode: Press the “K3” button on the display board for about 5s to enter Forced Cooling mode. The LED display will show “dC”.

Forced Heating Mode: Press “▲” button on the display board for about 5s to enter Forced Heating mode. The LED display will show “dH”.

4.9 Use the USB to Update the ODU Program

The USB can be used on the display board to update the main control program. The USB is used in conjunction with the SW1-4.





Operation Steps:

1) Power off the unit.
2) Switch the SW1-4 to the On position.
3) Insert the USB flash drive.
4) Power on the unit. The display board will show No. 1.
5) Switch the SW1-4 to the Off position. The display board will show No. 2.
6) Subsequently, the display board will show No. 3, indicating that it is burning.
7) The display board will show No. 888 to indicate the program was successfully burned and entered normal operation.
8) Unplug the USB drive.

4.10 Capacity Model Selection

System software will recall performance settings parameters according to the DIP switch selection. The DIP should be set according to the matched IDU.

	**SW3-1**	**SW3-2**	**Remark**
2 Ton Mode	Off	Off	
3 Ton Mode	Off	On	Factory default
4 Ton Mode	On	Off	
5 Ton Mode	On	On	Factory default

5. Troubleshooting

5.1 Parameter Check Table

To display system parameters, press the "Check" (K4) button to index through the series of parameters available. The first time you press the "Check" button, it will display the sequence, and after 1s it will display the value of the parameter. If you press the "Check" button again, it will display the next sequence.

- Refer to the picture below for the location of the Check button on the display board.

▲: Check button, and set the parameter "+"

▼: Check button, and set the parameter "-"

After 20s on the same parameter, the display will revert back to normal status.

Check Table			
No.	**Display Content**	**20**	AC current (A; Actual value)
00	Outdoor mode (0: Standby mode / 2: Cooling mode / 3: Heating mode)	**21**	Compressor current
01	Outdoor power (model)	**22**	Oil output (CC; Actual value)
02	Running mode (0: Standby mode / 2: Cooling mode / 3: Heating mode)	**23**	T1 indoor ambient temp. (°F; Actual value)
03	Target frequency (Hz; Actual value)	**24**	T2 indoor evaporator temp. (°F; Actual value)
04	Actual frequency (Hz; Actual value)	**25**	Concentration value
05	Running frequency (Hz; Actual value)	**26**	Enter PI control sign (0 or 1)
06	T3 condensing temp. (°F; Actual value)	**27**	Enter defrosting type
07	T4 outdoor ambient temp. (°F; Actual value)	**28**	Test mode (1-40; Mode gear)
08	T5 exhaust temp. (°F; Actual value)	**29**	Frequency increase (Shift; Actual value)
09	Temp. transform by pressure sensor (°F; Actual value)	**30**	△EV (Step; Actual value)
10	IPM modular temp. (°F; Actual value)	**31**	PFC control state
11	Target temp. Tes / Tcs (°F; Actual value)	**32**	Frequency limit item
12	Discharge temp. superheat (°F; Actual value)	**33**	Driving failure code subdivision 1
13	Target superheat (°F; Actual value)	**34**	Driving failure code subdivision 2
14	Fan speed (Actual value / 10)	**35**	Last failure or protection code
15	EXV opening degree (Step; Actual value)	**36**	Software version number (1-255)
16	Pressure value (PSI; Actual value * 25)	**37**	T7 condensing temp. (°F; Actual value)
17	Pressure valve transform by T3 (PSI; Actual value * 25)	**38**	T30 temp. (°F; Actual value)
18	AC voltage (VAC; Actual value)	**39**	Compression ratio
19	DC voltage (VDC; Actual value)		

5.2 Error Code Tables

Outdoor Unit

Code	Failure or Protection Definition	Code	Failure or Protection Definition
E1	Communication error (indoor unit)	**P7**	T2 freeze protection
E2	T1 sensor error	**P8**	IPM high temp. protection (Ft)
E3	T2 sensor error	**P9**	DC fan motor error
E4	Indoor refrigerant sensor detecting leakage error	**PC**	Wet operation error
E6	Refrigerant leakage error	**PD**	High pressure abnormal error (Heating mode)
E7	EEPROM failure (indoor unit)	**H0**	Communication fault of the master board and driver chip
E8	Fan motor error (indoor unit)	**H1**	T3 sensor high temp. error (Cooling mode) (3 times P5 error within 180 min)
E9	Communication fault of smart control	**H2**	High pressure switch error (3 times P1 error within 150 min)
F0	Communication failure (outdoor unit)	**H3**	High pressure abnormal (Heating mode) (3 times PD error within 180 min)
F4	T4 outdoor ambient temp. sensor error	**H4**	IPM modular high temp. error (3 times P8 within 120 min)
F5	T5 exhaust temp. sensor error	**H5**	Low pressure error (5 times P2 within 240 min)
F6	T3 condensing temp. sensor error	**H6**	Discharge temp. abnormal error (3 times P4 within 100 mins)
F7	T7 temp. sensor error	**H7**	Wet operation error (3 times PC within 200 min)
F8	T7 temp. sensor error in detecting condensation risks	**H8**	T3 condenser sensor disconnect error (3 times FE within 120 min)
F9	AC over-voltage / under-voltage protection	**HC**	Discharge temp. sensor disconnect error (3 times FE within 180 min)
FA	EEPROM failure (outdoor unit)	**HE**	Condensate error (3 times within 60 min)
FB	EEPROM failure of the driver chip	**L0**	DC cable bus low-voltage protection
FC	IPM modular sensor error	**L1**	DC cable bus high-voltage protection
FD	HLP pressure sensor failure	**LA**	Frequency limitation by voltage
FE	T3 or T5 sensor disconnect error	**LB**	Frequency limitation or decline by high pressure
FF	HPS condenser sensor disconnected	**LC**	Frequency limitation by condenser temp.
P1	High pressure switch error	**LD**	Frequency limitation by discharge temp.
P2	Low pressure protection	**LE**	Frequency limitation by IPM modular high temp.
P3	Inverter overcurrent protection	**LF**	Frequency limitation by current
P4	T5 exhaust temp. sensor high temp. protection	**d0**	Oil return mode
P5	T3 condenser sensor high temp. protection (Cooling mode)	**df**	Defrost mode
P6	IPM protection	**dC**	Force Cooling mode
		ATL	Overtemperature protection

Indoor Unit

Number of Green Light Flashes	Fault Description	Code
2	T1 sensor fault	E2
3	T2 sensor fault	E3
4	Refrigerant concentration sensor fault	E4
5	Refrigerant leakage	E6
6	Anti-freeze protection	P7
7	Control board chip fault	E7
8	Motor protection	E8
9	IDU and ODU unit communication fault (RS485 communication mode)	E1
10	Smart controller communication fault (RS485 communication mode)	E9

5.3 Meaning of Item 33 in the Parameter Check Table

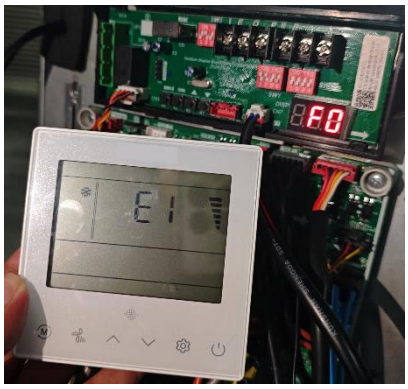
Display Information	Meaning	Remarks
1	Compressor overcurrent (triggered by the internal comparator of the chip)	Lower-level code of P6
2	Compressor hardware overcurrent (triggered by the IPM module FO or external comparator)	
3	Compressor stall protection	
4	Compressor blockage protection	
5	Compressor overcurrent (software detection)	
7	Compressor sampling circuit abnormality (bias)	
8	Compressor phase loss protection	
9	Compressor weak magnetic voltage protection	
21	Drive E fault	FB
22	Module temperature sensor malfunction	FD
61	Bus voltage low protection	L0
62	Bus voltage high protection	L1

5.4 Meaning of Item 34 in the Parameter Check Table

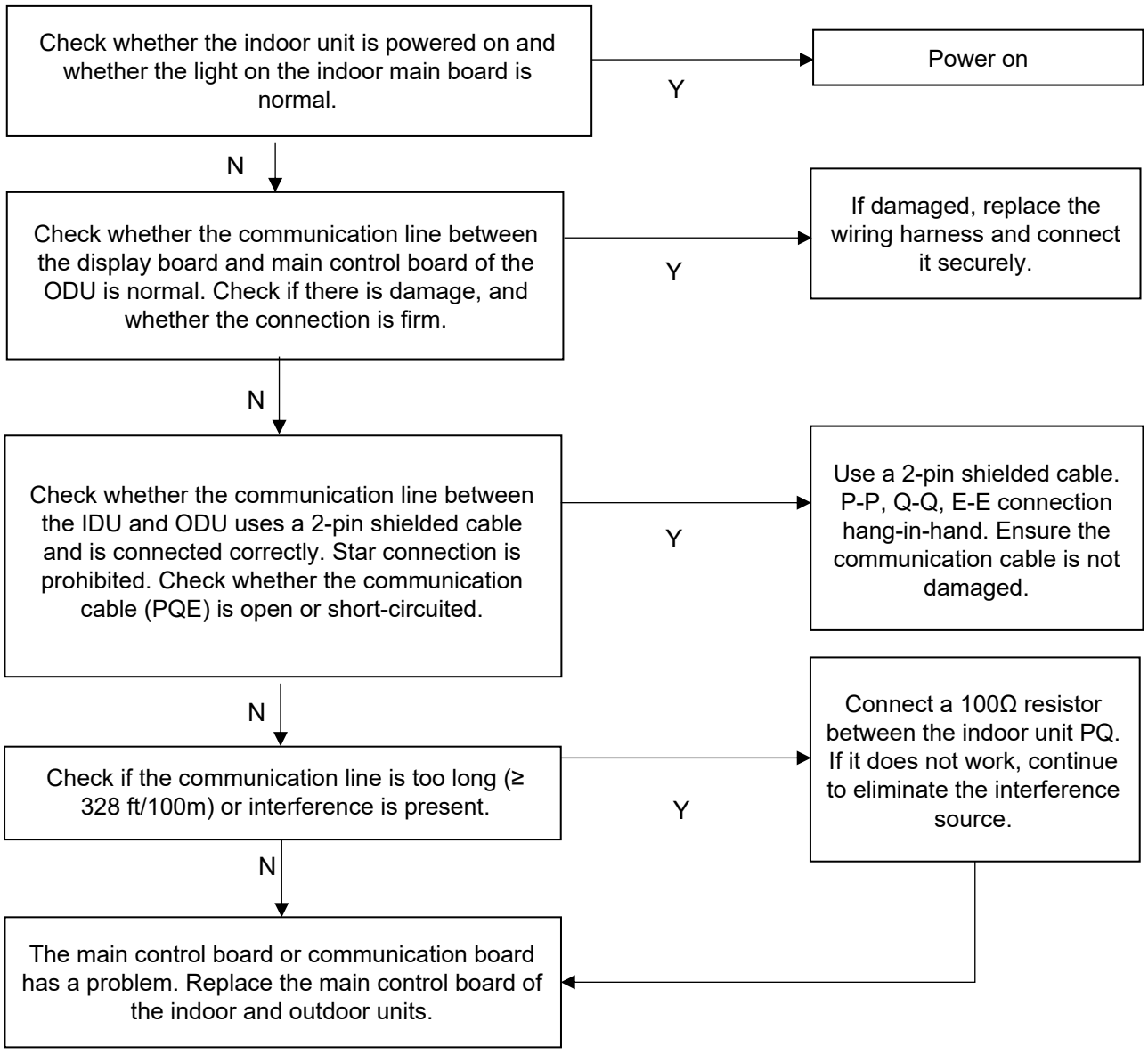
Display Information	Meaning	Remarks
1-8	Specific causes of faults in fans	Lower-level code of P9
11-14	Sensor malfunction	Reference Outdoor Unit Error Code table

5.5 Troubleshooting

1) E1, F0 (Only Displayed in RS485 Communication Mode):
The communication between the outdoor unit and indoor unit fails. The smart controller displays E1 and the outdoor unit displays F0.



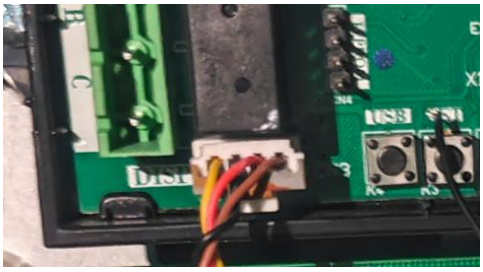
Error Code: Communication error between the outdoor unit and indoor unit



- Use a multimeter to measure the power supply voltage to see if it is between 208-230V to ensure the voltage is normal and stable.
- Check whether the power terminals are secure and connected properly.

- Check whether the communication cables PQE correspond one to one. Measure whether there is a short circuit or an open circuit between the communication lines PQ.

- Check whether the communication cable between the outdoor unit display board and main control board is normal. Confirm the wiring is firm and the wiring harness is not damaged. Proceed to the next step.



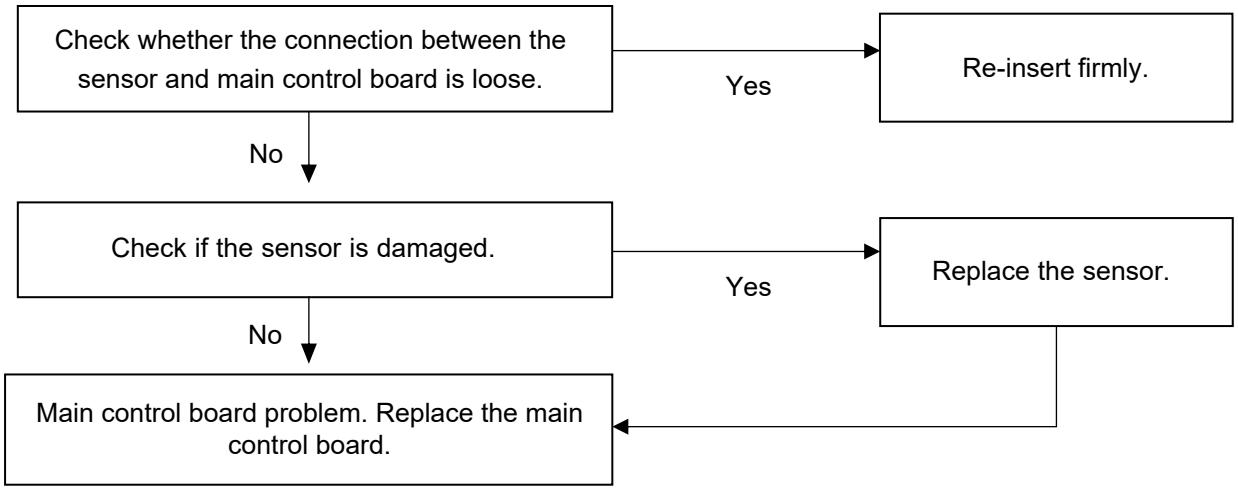
- If there are no problems with the above steps, it may be a communication interference. Connect a 100Ω resistor between the indoor unit PQ. If the problem still cannot be solved, check the interference source and eliminate it. If it still cannot be solved, replace the display board and main control board.

2) E2/E3/E4 (Wired Controller Display): Indoor Unit Sensor Failure

3) F4/F5/F6/F7 (Display Board Shows): Outdoor Unit Sensor Failure

E2: T1 sensor | **E3:** T2 sensor | **E4:** R454b sensor
F4: T4 outdoor ambient temperature sensor | **F5:** T5 discharge temperature sensor | **F6:** T3 condensing temperature sensor | **F7:** T7 temperature sensor

Cause: Sensor reading error.



- Confirm whether the sensor is firmly connected and check the sensor connector to ensure it is firmly connected.
- Unplug the sensor and use a multimeter to measure the resistance to check whether it is open circuit and short circuit. If so, replace the sensor. If not, replace the main control board.

- Check the Sensor Resistance table. See Appendix 1.

4) E6 (Wired Controller Shows): Refrigerant Leakage Fault

Cause: Refrigerant leakage detected.

- Begin by opening the windows for ventilation and extinguish indoor open flames.
- Check if there is any leakage in the copper pipe. If it is confirmed to be leaking, the pipe needs to be repaired by welding.
- If no leakage is found, it may be a false alarm fault on the main control board. Replace the indoor board first. If the fault is not resolved, replace the refrigerant sensor.

5) E7 (Wired Controller Shows): Indoor Control Board Chip Failure

Cause: The indoor unit's control board chip is broken.

- Replace the indoor unit's control board.

6) E8 (Smart Controller Shows): Indoor Fan Protection

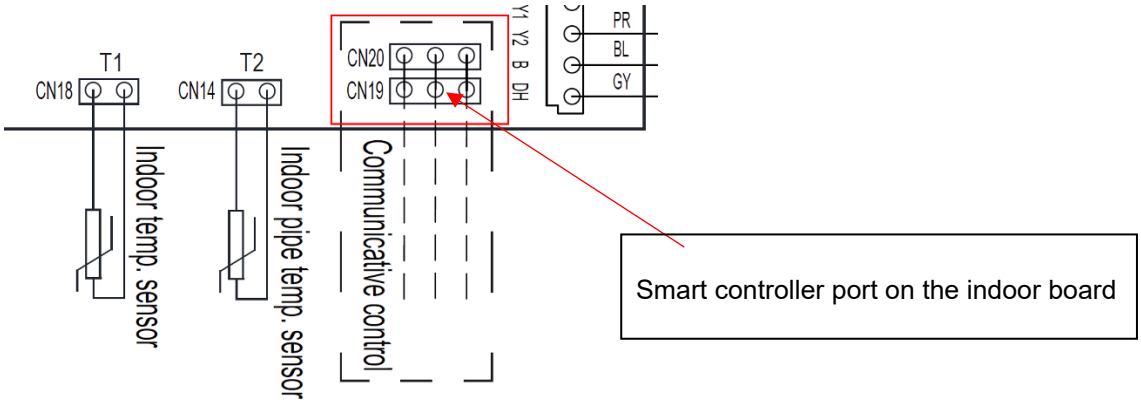
Cause: The DC fan motor of the indoor unit has an issue.

- Replace the indoor unit's control board.
- If not resolved, replace the motor.

7) E9 (Smart Controller Shows): Smart Controller Communication Error

Cause: The communication between the smart controller and indoor control board is not functioning properly.

- Check if the communication cable is plugged in tightly. Use a multimeter to measure if the 3-pin cable is broken.



- Check if the dip switch has selected the R458 communication mode. The SW1-1 of the outdoor and indoor units should be in the On position.

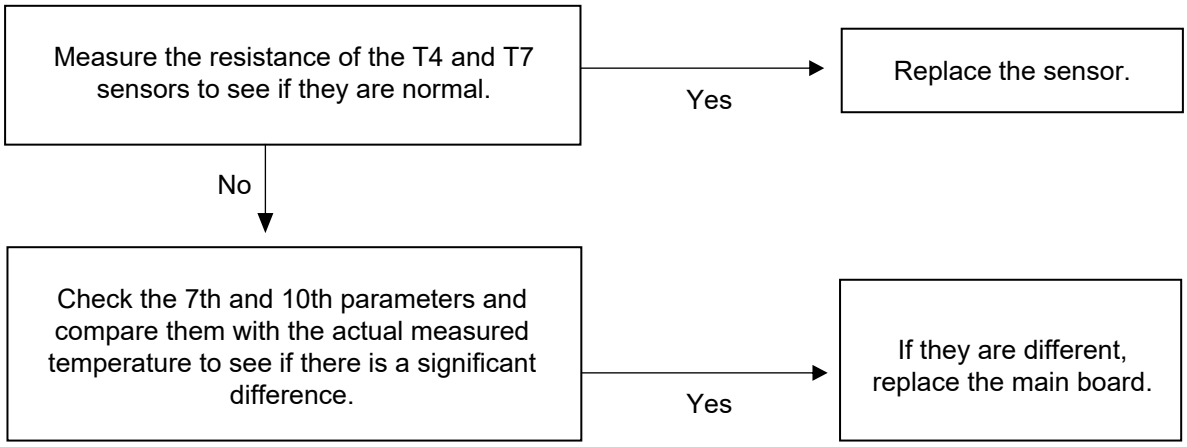
SW1-1	ON	RS-485 communication mode
	OFF	24V control (factory default)

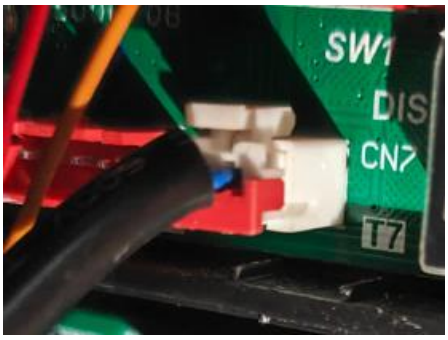
- Power off and restart. If the fault is still the same, then replace the smart controller.
- If replacing the smart controller does not solve the problem, then replace the indoor unit control board.

8) F8/HE: T7 Temperature Sensor Error in Detecting Condensation Risks

Cause: T7 ≤ T4 28.4°F(-2°C), and lasts for 15 min.
Exit Condition: T7 ≥ T4 33.8°F(1°C), and lasts for 10s.

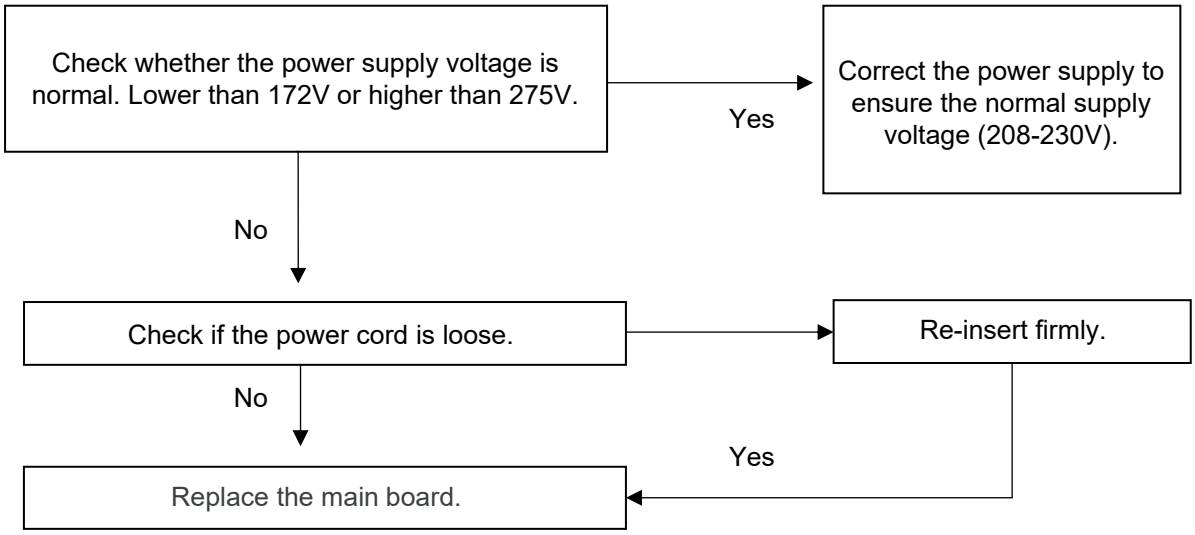
There is a risk of condensation on the refrigerant cooling cover plate.





9) F9: AC Voltage Under-Voltage and Over-Voltage Protection

Cause: AC power supply voltage problem.



- Use a multimeter to measure the power supply voltage and confirm the voltage is normal (Abnormal: Lower than 172V or higher than 275V).

- If the power supply voltage is OK, replace the main board.

10) FA/FB: The Chip of the Outdoor Unit Main Board is Faulty

Cause: The E-side chip of the main board is faulty.

- Replace the main board of the outdoor unit.

11) FC: IPM Module Temperature Fault

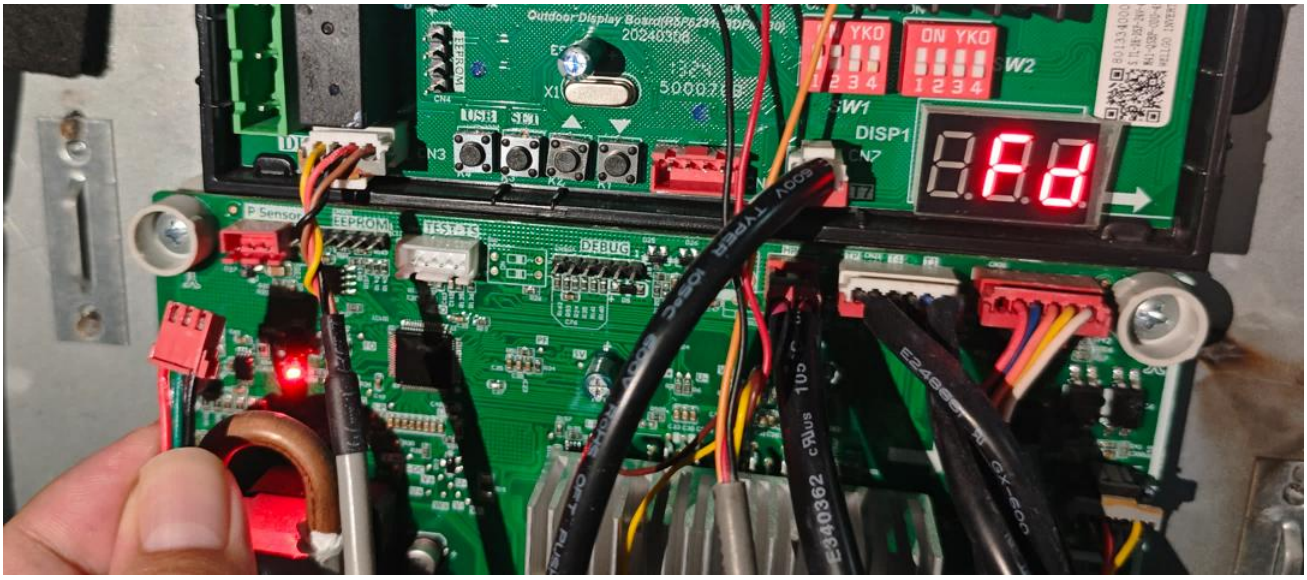
Cause: Communication between the outdoor main board and module temperature sensor is lost.

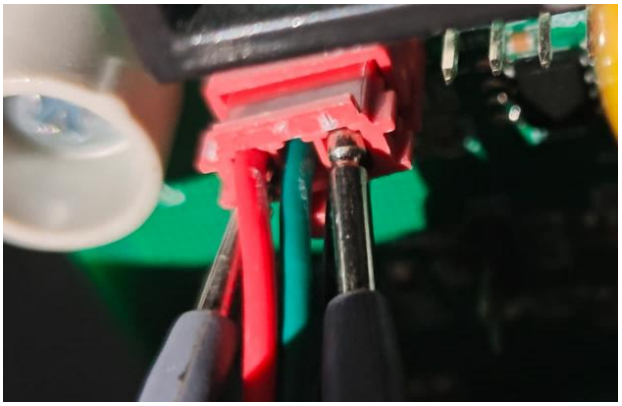
- The module temperature sensor is built-in and can only be replaced with the main board.

12) FD: Pressure Sensor Error

Cause: The main board did not recognize the pressure sensor.

- Begin by checking if the pressure sensor is securely plugged in.
- Measure whether there is a 5VDC voltage output (red and black wire) from the output port of the main board. If there is no voltage output, replace the main board.
- If there is, replace the pressure sensor.
- Replace the main board.





13) FE, H8: T3 or T5 Sensor Disconnect Error

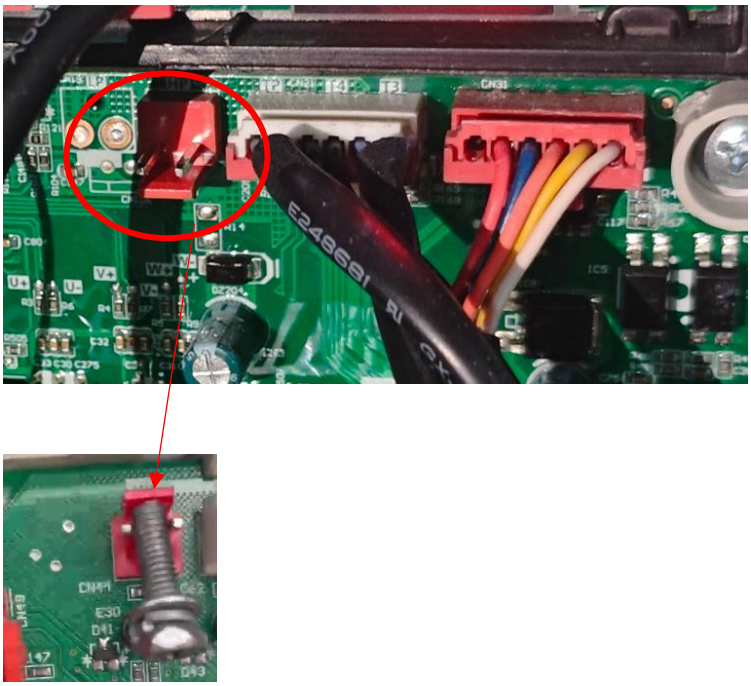
Cause: The probe is in the wrong position.

- Check whether the positions of the T3 and T5 probes have changed. For example, if the exhaust probe T5 falls out, the measured temperature is not the real exhaust temperature.
- Check whether the T3 and T5 probes are installed in the correct position on the pipe. Eliminate the possibility of a wrong installation.
- Use a multimeter to measure the sensor resistance to see if the sensor is damaged. See the Appendix for the R-T table.
- If all the above are OK, replace the main control board of the external unit.

14) FF: HPS Disconnected

Cause: The high-pressure switch is continuously in the disconnected state.

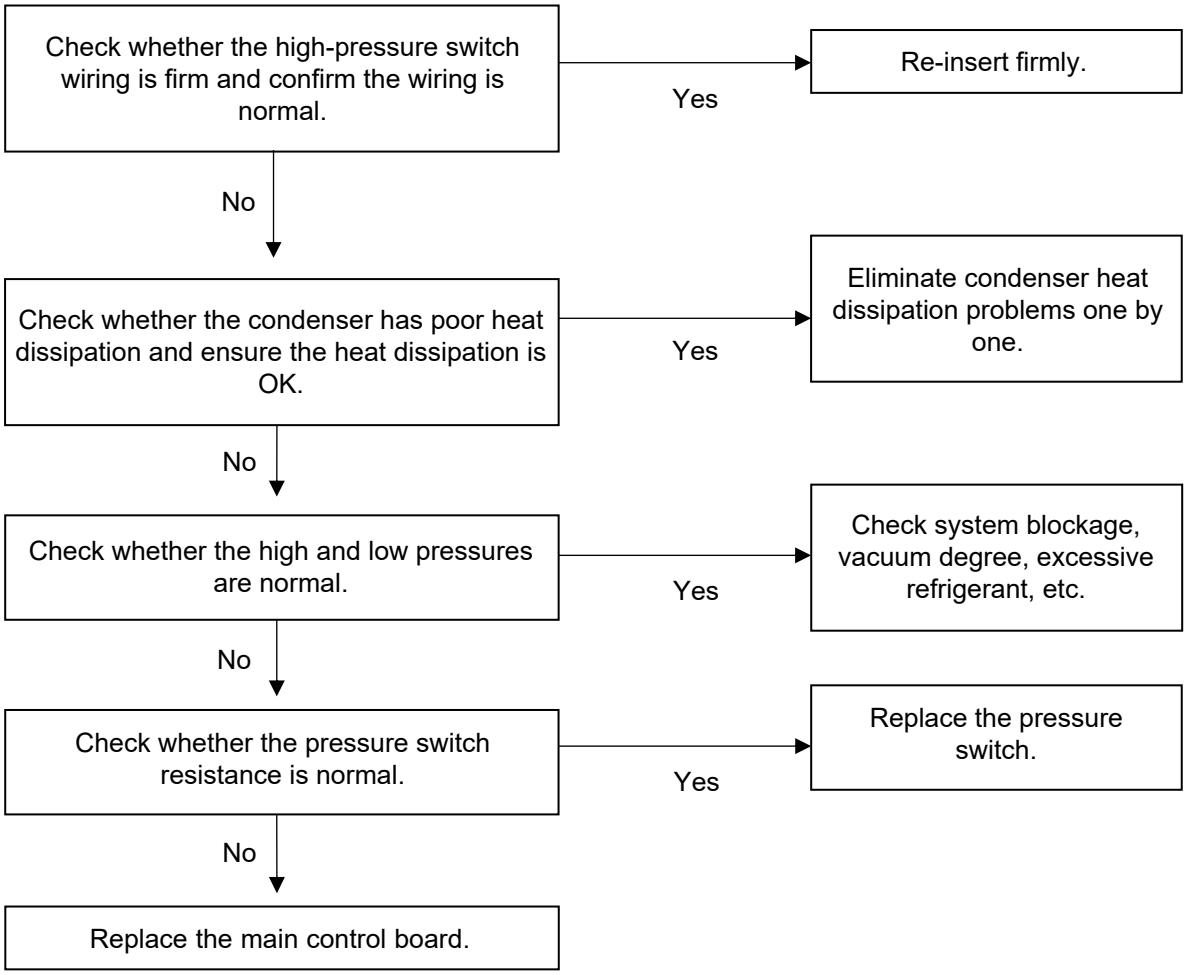
- Begin by checking if the pressure switch is securely plugged in.
- Use a jump cap or metal short-circuit to connect the high-pressure switch port of the electronic control board, then turn off the power and restart the machine. Observe whether the fault disappears.
- If the fault is resolved, replace the pressure switch.
- If the fault is not resolved, replace the main control board.



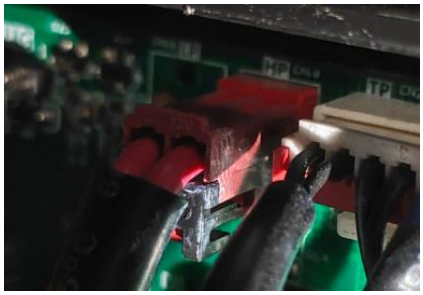
Note: The high-pressure switch port can be short-circuited by using a screw clamped between two pins.

15) P1, H2: High-Pressure Switch Protection

Cause: The high-pressure port is an open circuit.



- Check whether the high-pressure switch wiring is firm and confirm the wiring is normal.

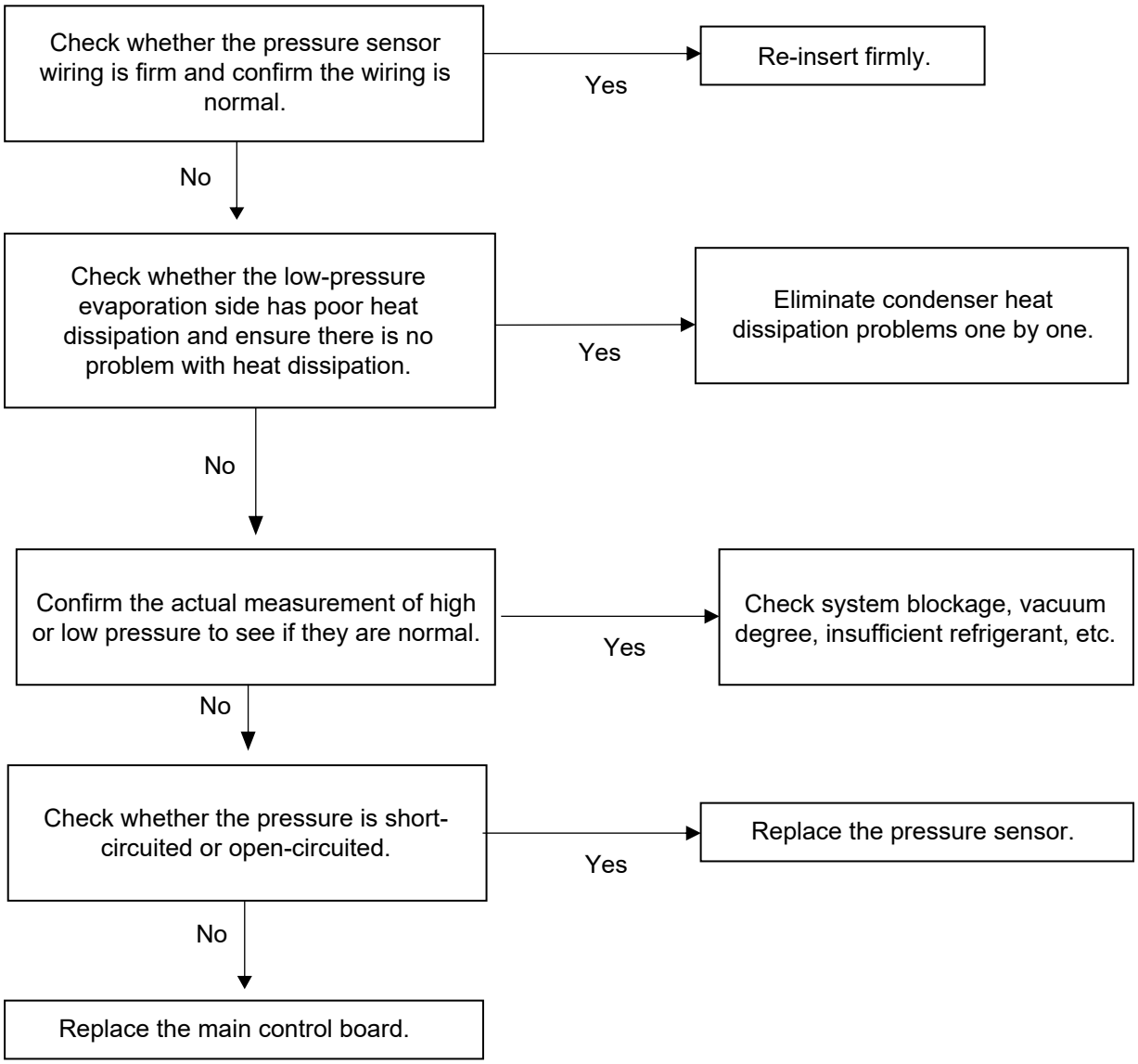


- Check whether the condenser has poor heat dissipation and ensure there is no problem with heat dissipation.
- Connect the pressure gauge, run the unit, and check the high and low pressures. If the pressure is normal, unplug the pressure switch and measure the resistance. If it's infinite, replace the pressure switch. If the resistance of the pressure switch is 0, replace the main control board.

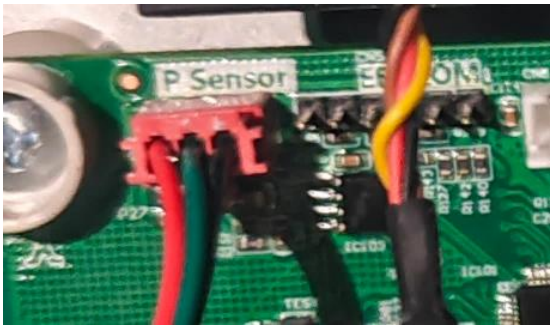
- When connecting the pressure gauge for testing, if the pressure gauge pressure is too high, it is a system problem. Check for system blockage and excessive refrigerant, as well as vacuum.

16) P2, H5: Low pressure abnormality (Cooling mode) < 0.2Mpa
PD, H3: Abnormal high pressure (Heating mode) > 3.6Mpa

Cause: The pressure value checked by the pressure sensor exceeds the protection value.



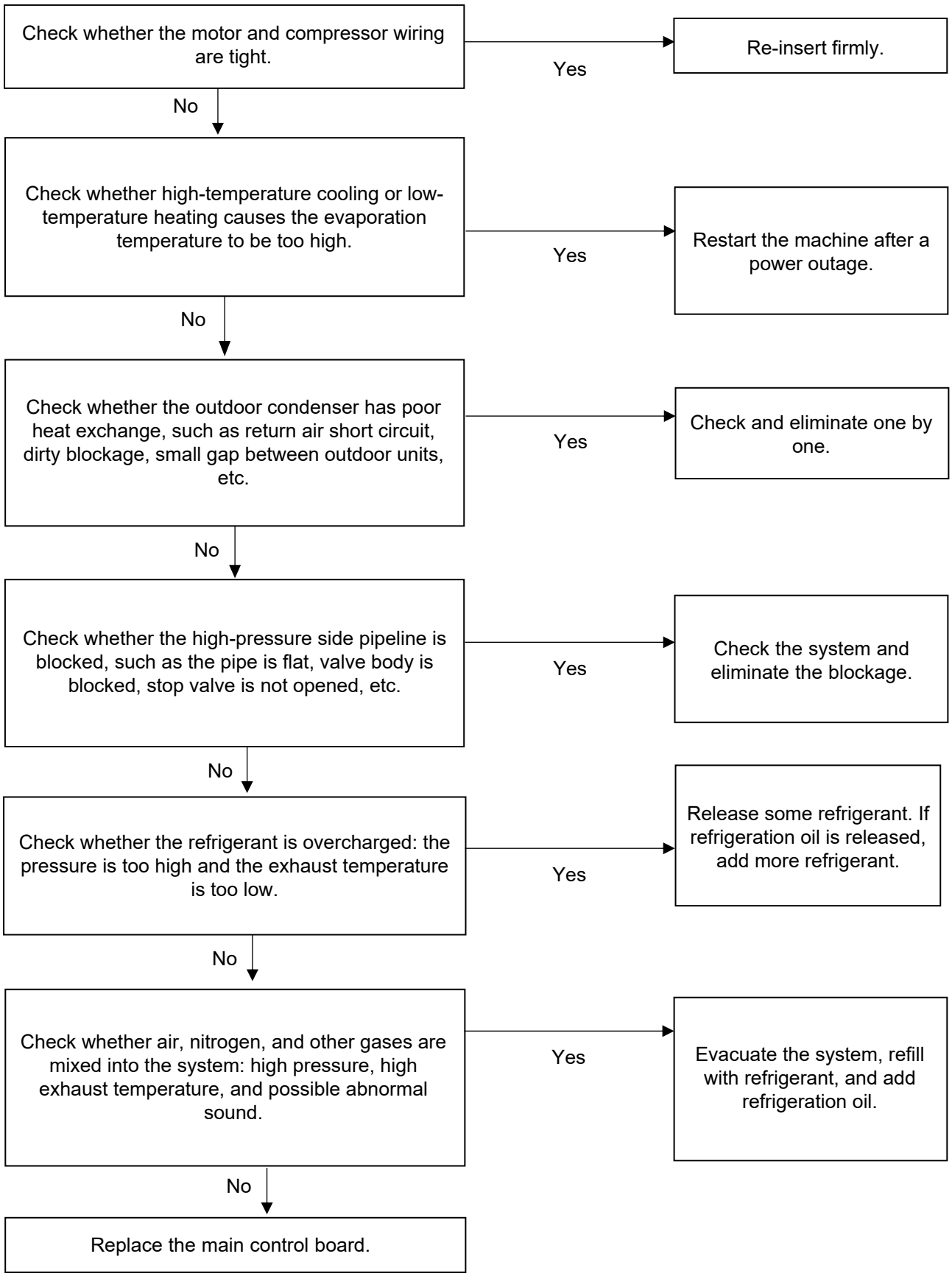
- Check whether the pressure sensor wiring is firm and confirm the wiring is normal.



- Check whether the indoor coil side has poor dissipation and ensure there is no problem with heat dissipation. Connect the pressure gauge, operate the unit, measure the actual pressure value, and check the 16th parameter on the display board. Compare the measured value with the spot check value.
- If the measured value is different from the spot check value and the difference is too large, replace the pressure sensor.
- If the measured value is the same as the spot check value and does not exceed the protection range, replace the main control board.
- If the measured value is the same as the spot check value and exceeds the protection range, it is a system problem and you need to check for system blockage, leakage, insufficient refrigerant, etc.

17) P3: Overcurrent Protection

Cause: The main control board detects the operating current is too large.



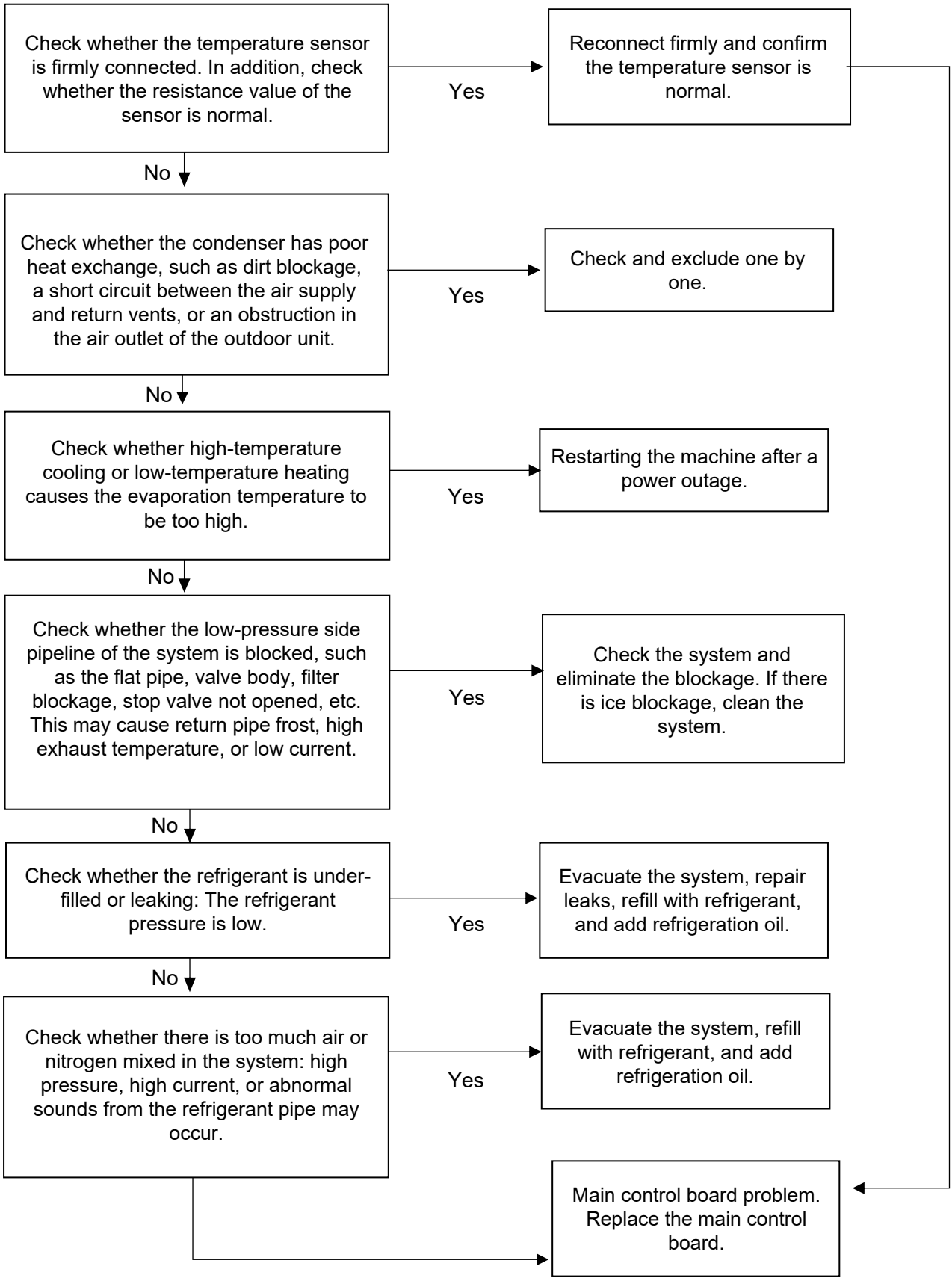
- Use a clamp meter to confirm the AC current, and check item 20. Compare the difference between the check value and clamp meter. If the difference is large, the main control board has a problem and the main board must be replaced.

- If the difference between the clamp meter and check value is not large, the compressor or system has a problem.

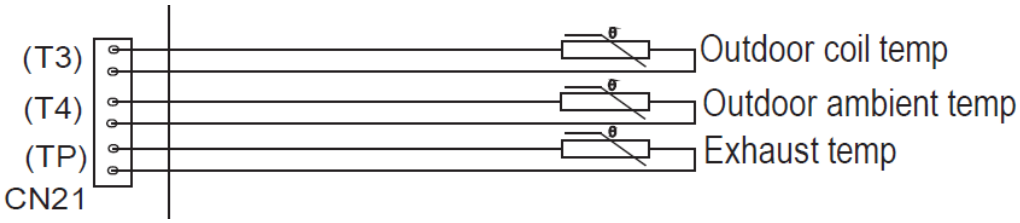
Model	24K	36K	48K	60K
Protection Current Value (A)	26	26	32	32

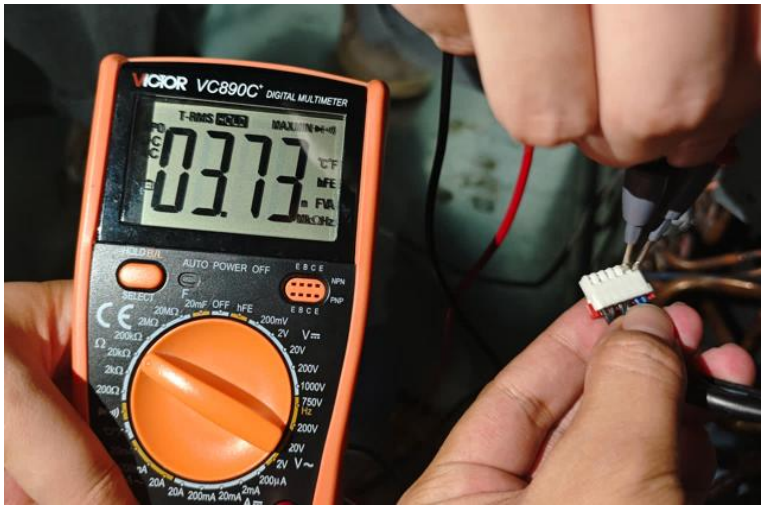
18) P4, H6: Exhaust Temperature Too High Protection > 239°F / 115°C

Cause: The exhaust temperature sensor reads a temperature that is too high.



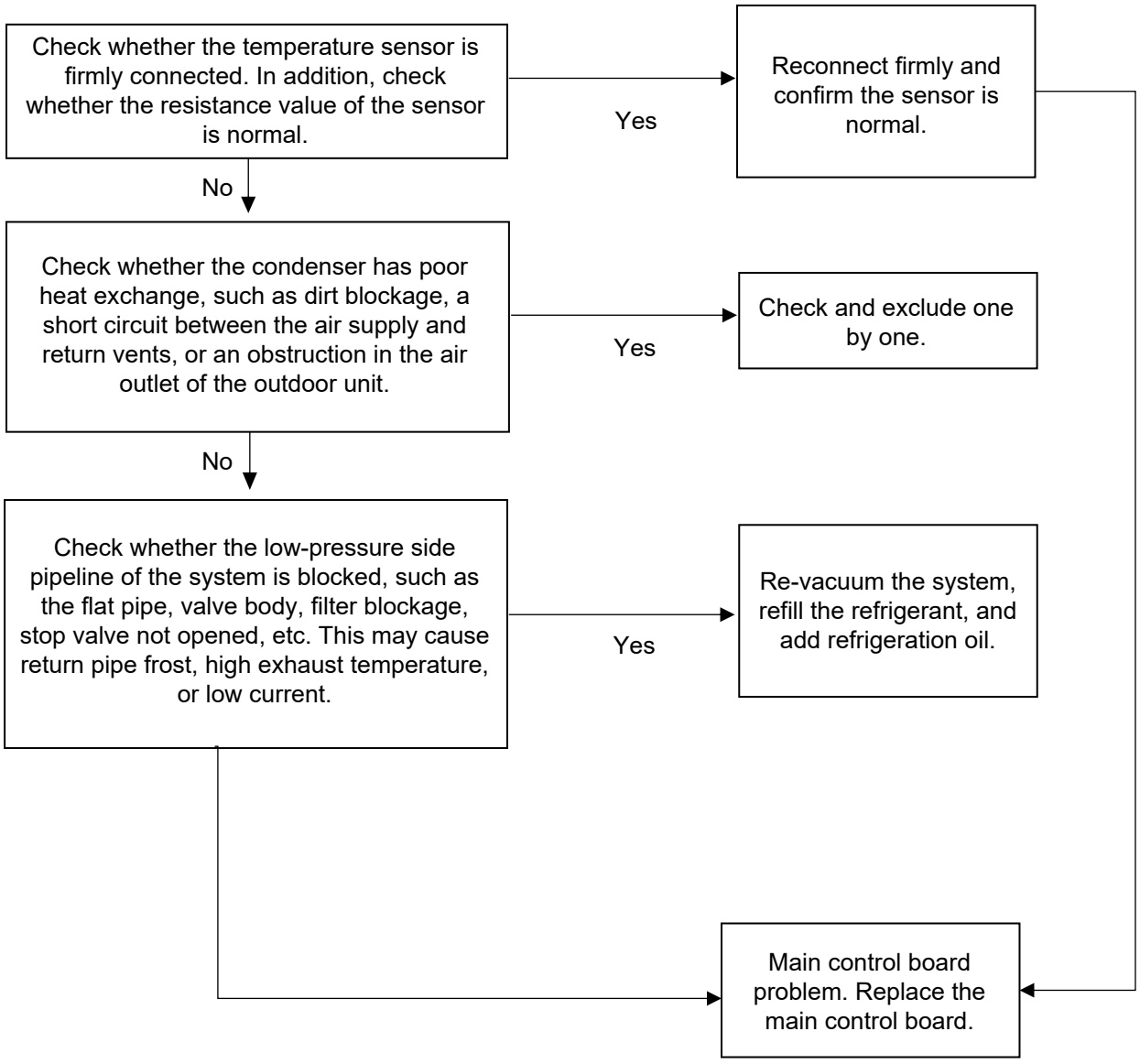
- Connect a pressure gauge to measure whether the return gas pressure is too low (normally 0.7-0.9 Mpa). If the pressure is too low, add refrigerant.
- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. See the Appendix for the R-T table.
- If the temperature sensor resistance is normal, check the exhaust in item 8 and compare it with the actual exhaust temperature. Use an infrared thermometer to measure the exhaust temperature. If the temperature of the main control board is unreasonable, replace the main control board.
- If the above steps are normal, check whether the refrigerant system is normal, such as return air blockage, poor evaporation, compressor wear, etc.





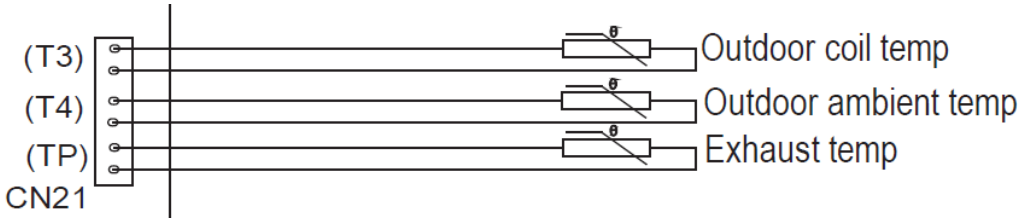
19) P5: Outdoor Coil Temperature Over-High Protection (Cooling Mode) > 140°F / 60°C

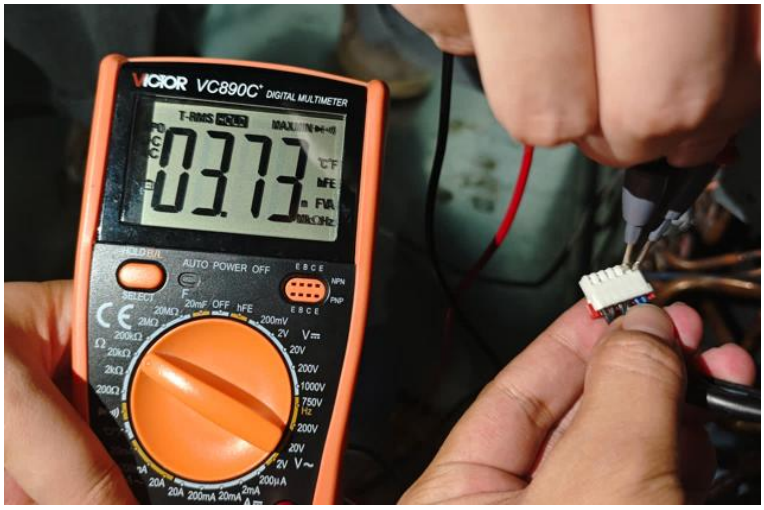
Cause: The condenser temperature sensor detects the temperature was too high.



- Check if the heat dissipation of the condenser is normal, ensuring there are no dirty blockages, short circuits in the air supply and return ports, etc.

- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. See the Appendix for the R-T table.



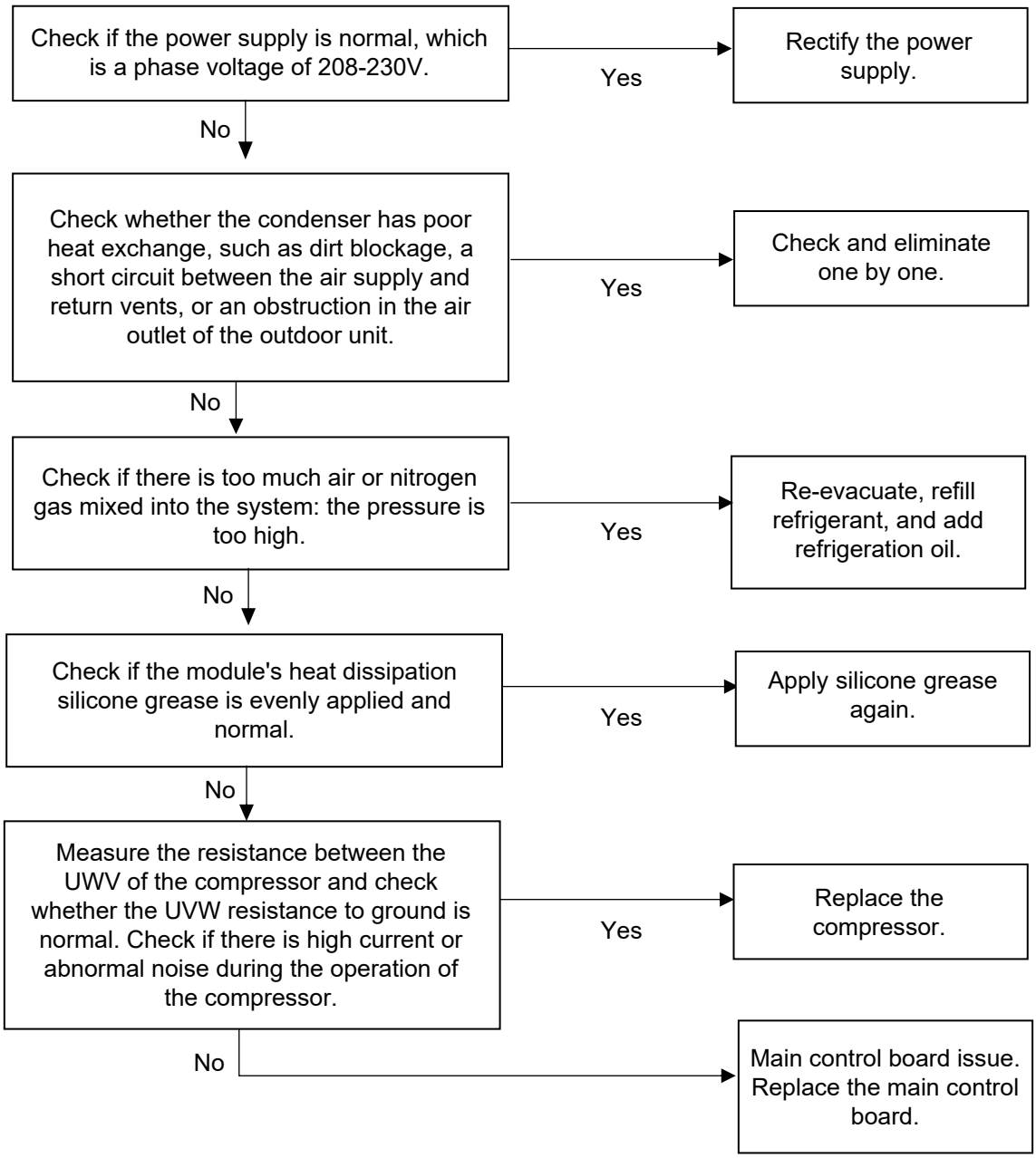


- If the temperature sensor resistance is normal, check the exhaust temperature in item 8 and compare it with the actual exhaust temperature. Use an infrared thermometer to measure the exhaust temperature. If the temperature of the main control board is unreasonable, replace the main control board.

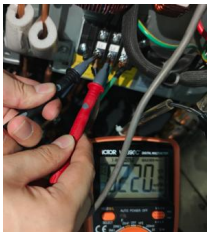
- If the above steps are normal, check whether the refrigerant system is normal, such as return air blockage, poor evaporation, compressor wear, etc.

20) P6: IPM Module Protection

Cause: The compressor drive module abnormality.

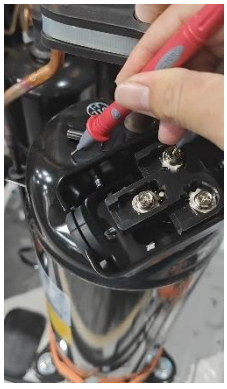


- Check whether the power supply is normal. The power supply voltage is 208-230V.

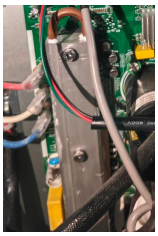


- Check if the heat dissipation of the condenser is normal, ensuring there are no dirty blockages, short circuits in the air supply and return ports, etc.

- Measure the resistance between the compressor UWV (normal is within 20Ω), and the resistance between the UVW and ground (normal is infinite, MΩ level). If the compressor resistance is abnormal, replace the compressor, otherwise proceed to the next step.



- Open the refrigerant heat dissipation cover and check whether the heat dissipation silicone grease is evenly applied. If abnormal, reapply the silicone grease. Otherwise, proceed to the next step.

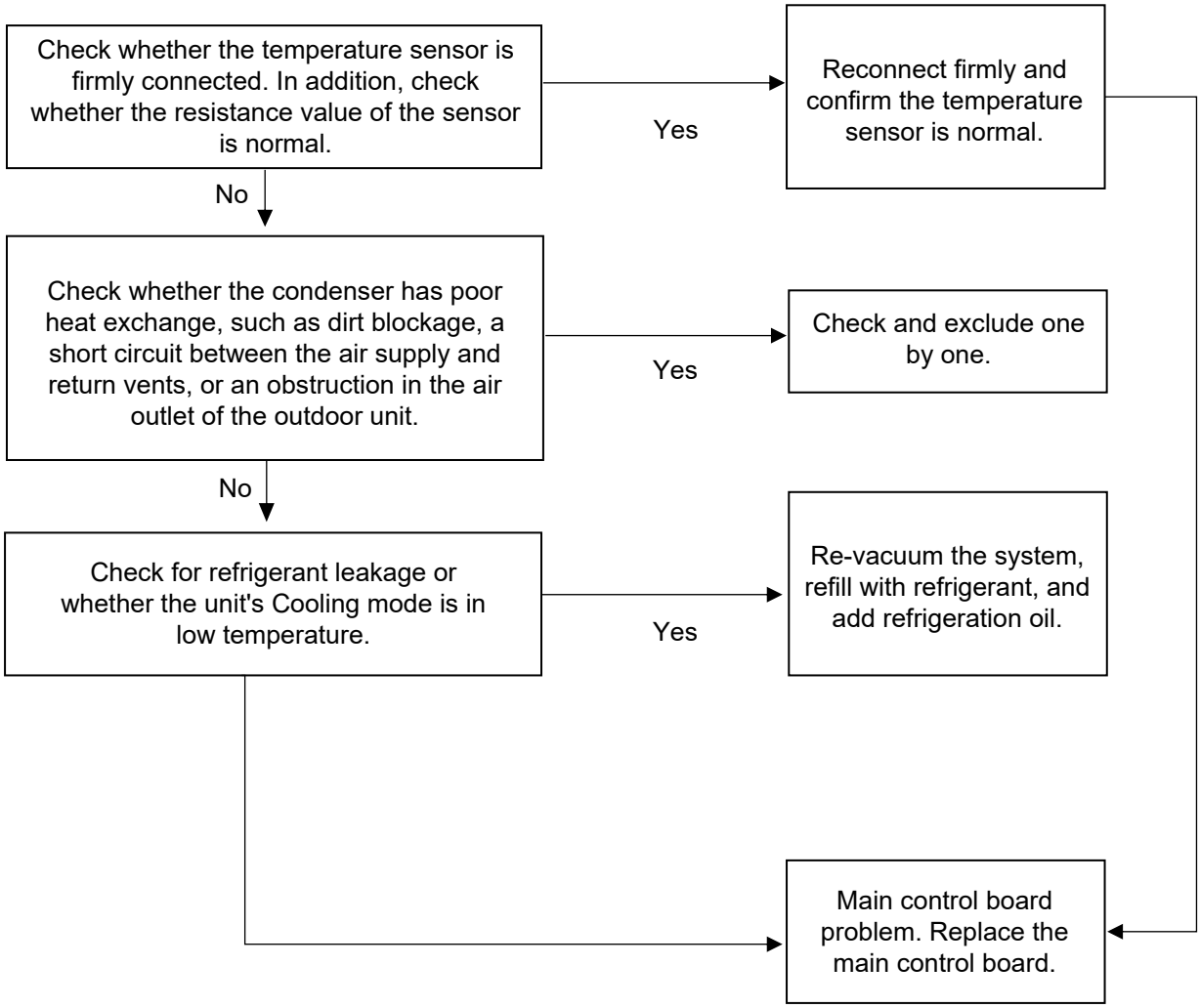


- If the above steps are normal, run the unit and observe whether the compressor is abnormal, such as a abnormal sound, excessive current, etc. If not, replace the compressor.

- Check whether the system has poor heat dissipation. In addition, check whether the module is overheating or overcurrent due to the mixing of incompressible gas, etc. If not, replace the main control board.

21) P7: T2 Freeze Protection

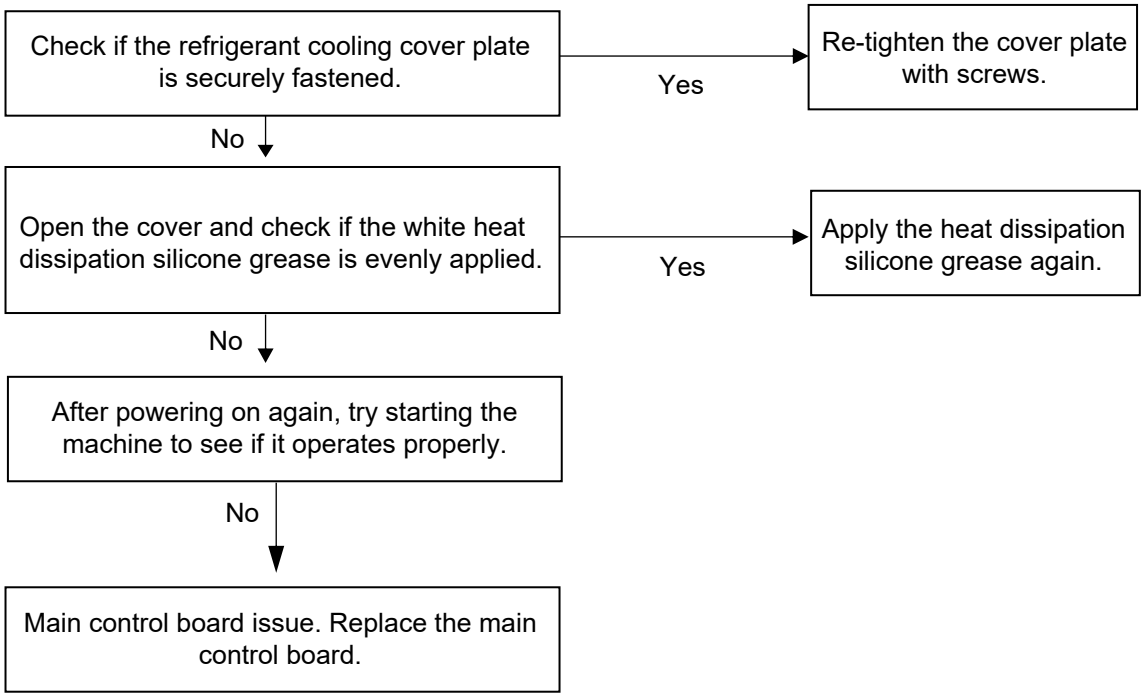
Cause: The T2 detection temperature is too low (T2 < 32°F/0°C).



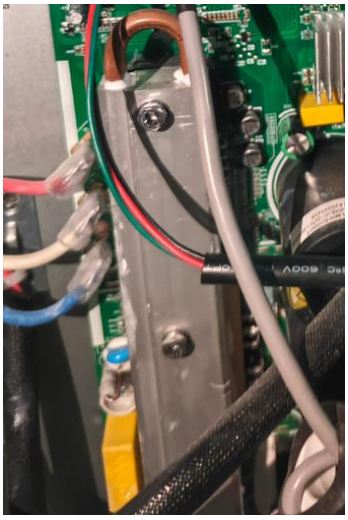
- Begin by confirming whether the indoor coil is frozen. If it is frozen, check the pipe system. If there is no icing, check the T2 sensor or the indoor board.
- Measure the resistance of the T2 temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. See the Appendix for the R-T table.
- Replace the indoor board.

22) P8, H4: IPM High-Temperature Protection (Ft) > 194°F / 90°C

Cause: The temperature sensor detects the IPM module temperature is too high.

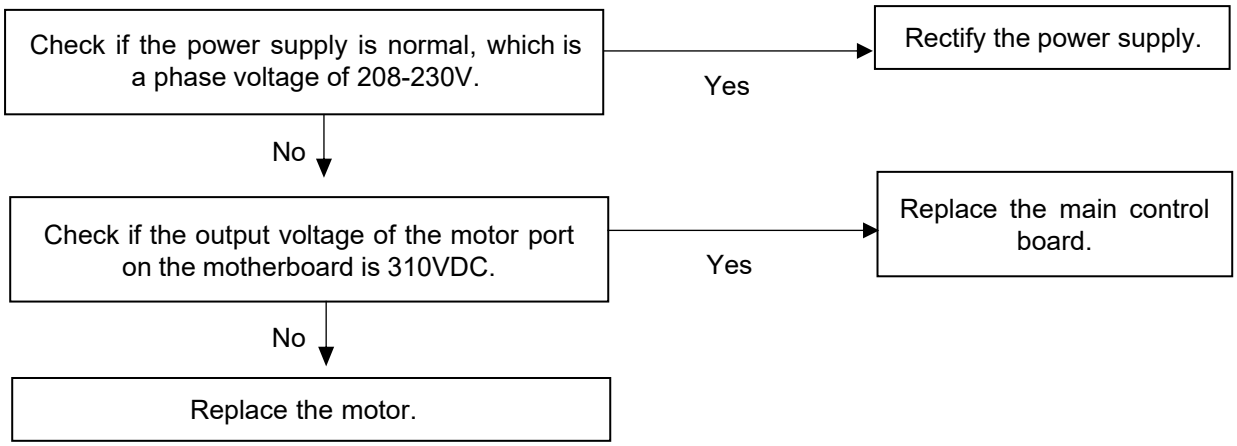


- Fasten the IPM heat sink cover plate.

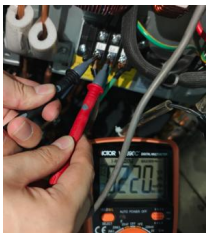


23) P9: DC Fan Malfunction

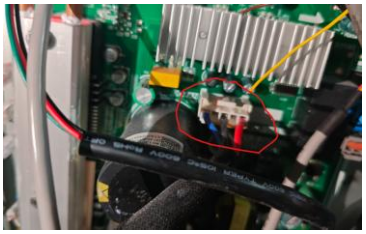
Cause: The fan drive module is experiencing abnormal detection.



- Check if the power supply is normal, which is a phase voltage of 208-230V. Confirm that the power supply is properly functioning.

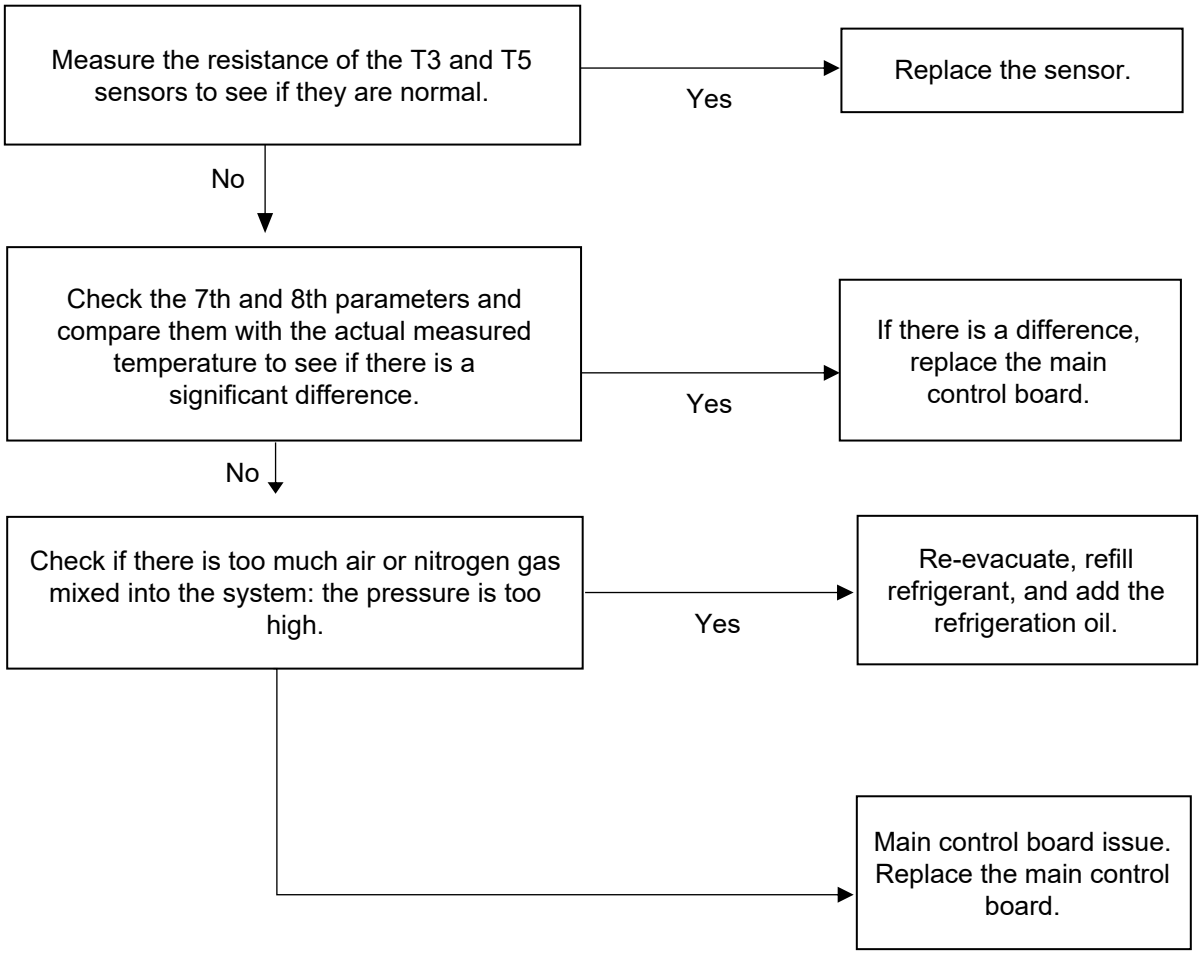


- Check if the output voltage of the motor port on the main board is 310VDC.

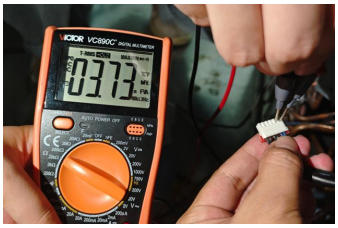


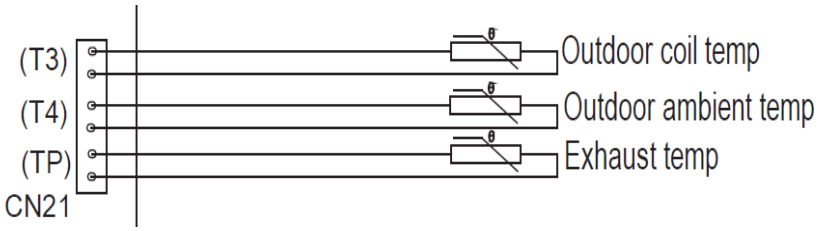
24) PC, H7: Wet Operation Error

Cause: The superheat T5-T3 ≤ 41°F/5°C.



- Measure the resistance of the T3 and T5 sensors to see if they're normal.





- Power off and restart the machine. When the machine is running, use an infrared thermometer to measure the actual T3 and T5 temperatures. At the same time, check the 6th and 8th parameters on the display board. Measure and check every minute, recording everything until the machine stops.
- Observe whether the measured values are consistent with the spot check values. If they're not consistent, replace the main control board.
- When the measured value is consistent with the spot check value, observe whether T3-T5 is less than 41° F(5°C). If it's not less than 41°F(5°C), replace the main control board.
- If T3-T5 is indeed less than 41°F(5°C), then there is a problem with the system. Check the system installation, such as pipeline blockage, air mixing in the pipeline, etc.

25) H0: Communication Fault of the Master Board and Driver Chip

Cause: A communication failure between the chips on the main control board.

- Replace the main control board.

26) L0, L1: DC Cable Bus Voltage Protection

Cause: DC voltage abnormal.

- Measure the power supply voltage. If there is no problem with the power supply voltage, replace the main control board of the outdoor unit.

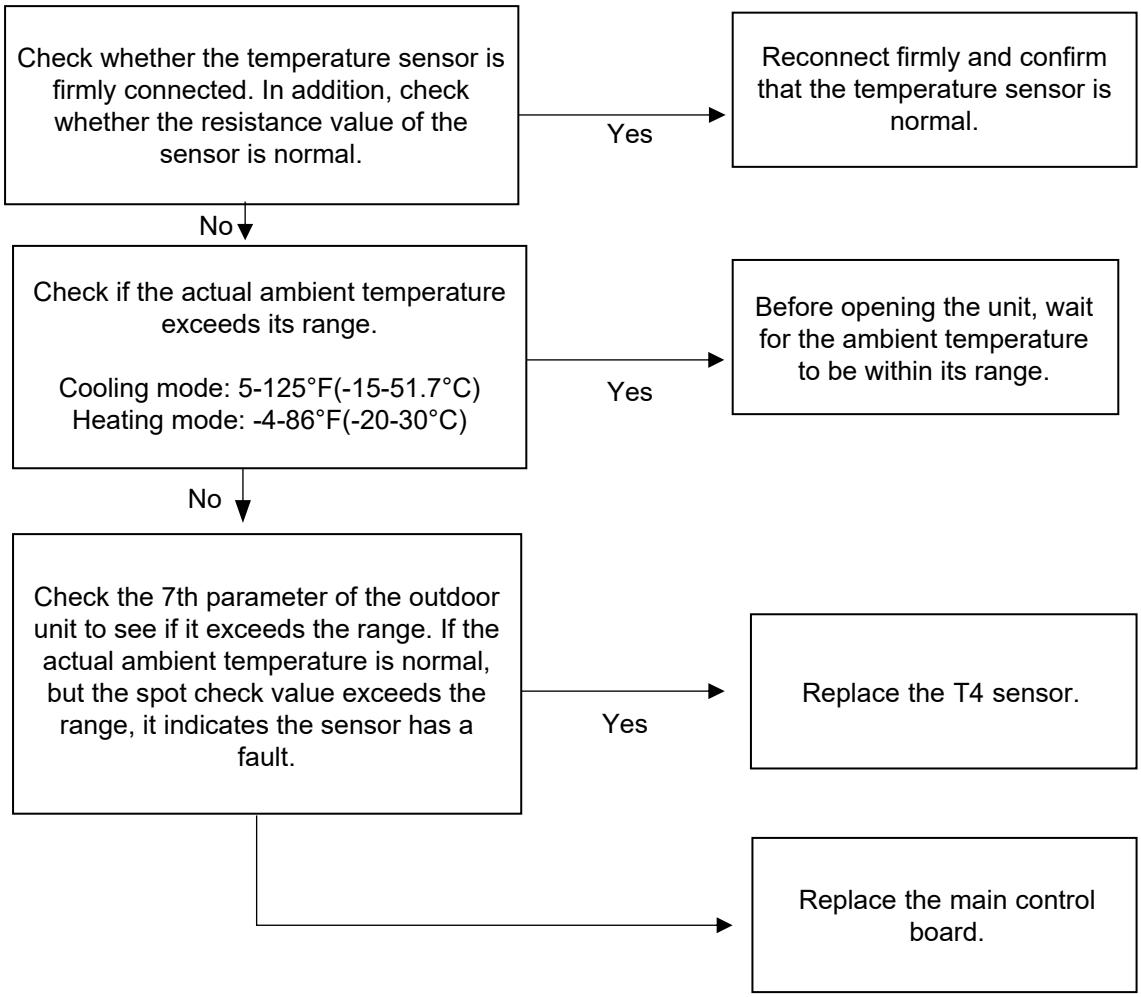
27) LA, LB, LC, LD, LE, LF: DC

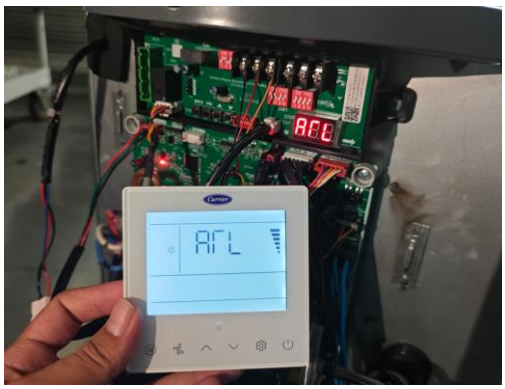
Cause: For compressor frequency limitation.

- This is not an error code. No maintenance is required.

28) ATL: Over-Temperature Protection

Cause: The outdoor sensor T4 detects the ambient temperature is exceeding its range.





29) df: Defrost mode
30) d0: Oil Return mode
31) dC: Force Cooling mode
32) dH: Force Heating mode

Appendix: R-T Table
5K: Applicable T1/T2/T3/T4/T7 Temperature Sensor

Temp.	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)	Temp.	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)
-22°F / -30°C	51.159	52.84	54.521	79°F / 26°C	4.771	4.821	4.871
-20°F / -29°C	48.659	50.232	51.805	81°F / 27°C	4.599	4.649	4.699
-18°F / -28°C	46.299	47.772	49.248	82°F / 28°C	4.434	4.485	4.535
-17°F / -27°C	44.071	45.452	46.832	84°F / 29°C	4.277	4.327	4.377
-15°F / -26°C	41.968	43.261	44.554	86°F / 30°C	4.126	4.176	4.226
-13°F / -25°C	39.981	41.193	42.405	88°F / 31°C	3.981	4.031	4.081
-11°F / -24°C	38.102	39.238	40.375	90°F / 32°C	3.842	3.892	3.942
-9°F / -23°C	36.326	37.391	38.457	91°F / 33°C	3.709	3.759	3.808
-8°F / -22°C	34.646	35.645	36.645	93°F / 34°C	3.581	3.631	3.68
-6°F / -21°C	33.055	33.993	34.931	95°F / 35°C	3.495	3.508	3.557
-4°F / -20°C	31.55	32.43	33.31	97°F / 36°C	3.34	3.389	3.438
-2°F / -19°C	30.097	30.923	31.748	99°F / 37°C	3.226	3.275	3.323
0°F / -18°C	28.722	29.497	30.271	100°F / 38°C	3.117	3.165	3.213
1°F / -17°C	27.42	28.147	28.873	102°F / 39°C	3.012	3.06	3.107
3°F / -16°C	26.186	26.868	27.55	104°F / 40°C	2.912	2.959	3.006
5°F / -15°C	25.017	25.657	26.297	106°F / 41°C	2.815	2.861	2.908
7°F / -14°C	23.908	24.509	25.11	108°F / 42°C	2.722	2.768	2.814
9°F / -13°C	22.857	23.421	23.985	109°F / 43°C	2.633	2.678	2.724
10°F / -12°C	21.859	22.389	22.918	111°F / 44°C	2.547	2.592	2.637
12°F / -11°C	20.912	21.409	21.907	113°F / 45°C	2.464	2.509	2.553
14°F / -10°C	20.013	20.48	20.917	115°F / 46°C	2.385	2.429	2.473
16°F / -9°C	19.116	19.584	20.023	117°F / 47°C	2.308	2.352	2.395
18°F / -8°C	18.322	18.734	19.146	118°F / 48°C	2.235	2.278	2.231
19°F / -7°C	17.54	17.927	18.314	120°F / 49°C	2.164	2.207	2.249
21°F / -6°C	16.797	17.16	17.524	122°F / 50°C	2.096	2.138	2.18
23°F / -5°C	16.09	16.431	16.733	124°F / 51°C	2.03	2.071	2.112
25°F / -4°C	15.418	15.739	16.06	126°F / 52°C	1.966	2.006	2.047
27°F / -3°C	14.779	15.08	15.382	127°F / 53°C	1.904	1.944	1.984
28°F / -2°C	14.17	14.454	14.737	129°F / 54°C	1.844	1.884	1.923
30°F / -1°C	13.591	13.857	14.124	131°F / 55°C	1.787	1.826	1.865
32°F / 0°C	13.04	13.29	13.54	133°F / 56°C	1.732	1.77	1.809
34°F / 1°C	12.505	12.739	12.974	135°F / 57°C	1.679	1.717	1.754
36°F / 2°C	11.995	12.215	12.436	136°F / 58°C	1.628	1.665	1.702
37°F / 3°C	11.509	11.717	11.924	138°F / 59°C	1.579	1.615	1.652
39°F / 4°C	11.047	11.241	11.436	140°F / 60°C	1.531	1.567	1.603
41°F / 5°C	10.606	10.789	10.971	142°F / 61°C	1.485	1.521	1.556
43°F / 6°C	10.186	10.357	10.529	144°F / 62°C	1.441	1.476	1.511
45°F / 7°C	9.785	9.945	10.107	145°F / 63°C	1.399	1.433	1.467
46°F / 8°C	9.403	9.554	9.705	147°F / 64°C	1.357	1.391	1.425
48°F / 9°C	9.038	9.18	9.322	149°F / 65°C	1.318	1.351	1.384
50°F / 10°C	8.69	8.823	8.956	151°F / 66°C	1.279	1.312	1.344
52°F / 11°C	8.357	8.482	8.607	153°F / 67°C	1.242	1.274	1.306
54°F / 12°C	8.04	8.157	8.274	154°F / 68°C	1.206	1.237	1.269
55°F / 13°C	7.736	7.816	7.957	156°F / 69°C	1.171	1.202	1.233
57°F / 14°C	7.446	7.55	7.653	158°F / 70°C	1.137	1.168	1.199
59°F / 15°C	7.169	7.266	7.363	160°F / 71°C	1.105	1.135	1.165
61°F / 16°C	6.9	6.991	7.082	162°F / 72°C	1.074	1.103	1.133
63°F / 17°C	6.644	6.729	6.814	163°F / 73°C	1.043	1.072	1.101
64°F / 18°C	6.398	6.478	6.558	165°F / 74°C	1.014	1.043	1.071
66°F / 19°C	6.163	6.238	6.313	167°F / 75°C	0.986	1.014	1.042
68°F / 20°C	5.938	6.008	6.078	169°F / 76°C	0.959	0.986	1.014
70°F / 21°C	5.723	5.789	5.854	171°F / 77°C	0.932	0.959	0.986
72°F / 22°C	5.517	5.578	5.64	172°F / 78°C	0.907	0.933	0.96
73°F / 23°C	5.32	5.377	5.484	174°F / 79°C	0.882	0.908	0.934
75°F / 24°C	5.131	5.185	5.238	176°F / 80°C	0.858	0.884	0.91
77°F / 25°C	4.95	5	5.05				

50K: Applicable Exhaust Temperature Sensor (T5/TP)

Temp.	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)	Temp.	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)
32°F / 0°C	157.7	161.2	164.7	133°F / 56°C	14.16	14.48	14.81
34°F / 1°C	150.2	153.4	156.7	135°F / 57°C	13.65	13.96	14.28
36°F / 2°C	142.9	145.9	148.9	136°F / 58°C	13.15	13.46	13.77
37°F / 3°C	136.1	138.9	141.7	138°F / 59°C	12.69	12.99	13.30
39°F / 4°C	129.7	132.3	134.9	140°F / 60°C	12.23	12.53	12.83
41°F / 5°C	123.6	126.0	128.4	142°F / 61°C	11.80	12.09	12.39
43°F / 6°C	117.8	120.0	122.3	144°F / 62°C	11.39	11.67	11.96
45°F / 7°C	112.2	114.3	116.4	145°F / 63°C	10.98	11.26	11.54
46°F / 8°C	107.1	109.0	111.0	147°F / 64°C	10.60	10.87	11.15
48°F / 9°C	102.1	103.9	105.7	149°F / 65°C	10.23	10.50	10.77
50°F / 10°C	97.42	99.08	100.8	151°F / 66°C	9.880	10.14	10.41
52°F / 11°C	92.97	94.51	96.06	153°F / 67°C	9.537	9.792	10.05
54°F / 12°C	88.74	90.17	91.61	154°F / 68°C	9.211	9.460	9.715
55°F / 13°C	84.73	86.05	87.38	156°F / 69°C	8.897	9.141	9.391
57°F / 14°C	80.92	82.14	83.37	158°F / 70°C	8.595	8.834	9.078
59°F / 15°C	77.29	78.42	79.56	160°F / 71°C	8.306	8.539	8.778
61°F / 16°C	73.84	74.89	75.95	162°F / 72°C	8.028	8.256	8.490
63°F / 17°C	70.57	71.54	72.51	163°F / 73°C	7.759	7.983	8.212
64°F / 18°C	67.46	68.35	69.25	165°F / 74°C	7.501	7.720	7.944
66°F / 19°C	64.49	65.32	66.15	167°F / 75°C	7.254	7.468	7.687
68°F / 20°C	61.68	62.44	63.20	169°F / 76°C	7.016	7.225	7.440
70°F / 21°C	59.00	59.70	60.40	171°F / 77°C	6.786	6.991	7.201
72°F / 22°C	56.44	57.09	57.74	172°F / 78°C	6.565	6.765	6.971
73°F / 23°C	54.02	54.61	55.20	174°F / 79°C	6.352	6.548	6.749
75°F / 24°C	51.70	52.25	52.80	176°F / 80°C	6.147	6.339	6.536
77°F / 25°C	49.50	50.00	50.50	178°F / 81°C	5.950	6.138	6.331
79°F / 26°C	47.37	47.87	48.37	180°F / 82°C	5.761	5.944	6.133
81°F / 27°C	45.34	45.84	46.34	181°F / 83°C	5.578	5.757	5.942
82°F / 28°C	43.41	43.91	44.41	183°F / 84°C	5.401	5.577	5.758
84°F / 29°C	41.59	42.08	42.57	185°F / 85°C	5.231	5.403	5.580
86°F / 30°C	39.84	40.33	40.82	187°F / 86°C	5.069	5.237	5.410
88°F / 31°C	38.18	38.66	39.15	189°F / 87°C	4.912	5.076	5.245
90°F / 32°C	36.59	37.07	37.55	190°F / 88°C	4.760	4.921	5.087
91°F / 33°C	35.07	35.55	36.03	192°F / 89°C	4.615	4.772	4.934
93°F / 34°C	33.64	34.11	34.58	194°F / 90°C	4.474	4.628	4.787
95°F / 35°C	32.27	32.73	33.20	196°F / 91°C	4.338	4.489	4.645
97°F / 36°C	30.95	31.41	31.87	198°F / 92°C	4.207	4.354	4.506
99°F / 37°C	29.70	30.15	30.61	199°F / 93°C	4.081	4.225	4.374
100°F / 38°C	28.50	28.95	29.40	201°F / 94°C	3.958	4.099	4.245
102°F / 39°C	27.37	27.81	28.25	203°F / 95°C	3.840	3.978	4.121
104°F / 40°C	26.29	26.72	27.16	205°F / 96°C	3.726	3.861	4.001
106°F / 41°C	25.24	25.67	26.10	207°F / 97°C	3.616	3.748	3.885
108°F / 42°C	24.25	24.67	25.09	208°F / 98°C	3.509	3.639	3.773
109°F / 43°C	23.31	23.72	24.14	210°F / 99°C	3.407	3.534	3.665
111°F / 44°C	22.41	22.81	23.22	212°F / 100°C	3.308	3.432	3.560
113°F / 45°C	21.53	21.93	22.33	214°F / 101°C	3.212	3.333	3.459
115°F / 46°C	20.71	21.10	21.50	216°F / 102°C	3.119	3.238	3.361
117°F / 47°C	19.92	20.30	20.69	217°F / 103°C	3.030	3.146	3.267
118°F / 48°C	19.16	19.54	19.92	219°F / 104°C	2.942	3.056	3.174
120°F / 49°C	18.44	18.81	19.18	221°F / 105°C	2.858	2.970	3.086
122°F / 50°C	17.75	18.11	18.48	223°F / 106°C	2.778	2.887	3.000
124°F / 51°C	17.08	17.44	17.80	225°F / 107°C	2.699	2.806	2.917
126°F / 52°C	16.44	16.79	17.14	226°F / 108°C	2.623	2.728	2.837
127°F / 53°C	15.84	16.18	16.53	228°F / 109°C	2.549	2.652	2.758
129°F / 54°C	15.26	15.59	15.93	230°F / 110°C	2.479	2.579	2.683
131°F / 55°C	14.69	15.02	15.35				

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