

# Inverter Air Conditioner **Service Manual**

**Models:**

**DYC024GCSI18RD**

**DYC036GCSI18RD**

**DYC048GCSI18RD**

**DYC060GCSI18RD**

## CONTENTS

|                                                      |           |
|------------------------------------------------------|-----------|
| <b>1. Product Series .....</b>                       | <b>2</b>  |
| 1.1 Model .....                                      | 2         |
| 1.2 Appearance .....                                 | 2         |
| <b>2. Product Structure .....</b>                    | <b>3</b>  |
| 2.1 Structural Diagram .....                         | 3         |
| 2.2 Pipeline System Diagram .....                    | 5         |
| 2.3 Exploded Diagram .....                           | 6         |
| <b>3. Electric Control Component .....</b>           | <b>12</b> |
| 3.1 Display Board .....                              | 12        |
| 3.2 Outdoor Unit Main Board .....                    | 13        |
| 3.3 Indoor Unit Control Board .....                  | 14        |
| 3.4 Wiring Diagram .....                             | 15        |
| 3.5 Meaning of the Dip Switch .....                  | 16        |
| <b>4. Function Introduction .....</b>                | <b>18</b> |
| 4.1 Electrical Components Description .....          | 18        |
| 4.2 Control Logic Description .....                  | 19        |
| 4.3 Anti-Cold Air & Heating Fan Delay Function ..... | 19        |
| 4.4 Indoor Coil Anti-Freezing Function .....         | 20        |
| 4.5 R454B Leakage Detection Function .....           | 20        |
| 4.6 Accelerated Operation Mode .....                 | 20        |
| 4.7 Defrost Description .....                        | 21        |
| 4.8 Forced Operating Mode .....                      | 22        |
| 4.9 Use the USB to Update the ODU Program .....      | 22        |
| 4.10 Capacity Model Selection .....                  | 22        |
| <b>5. Troubleshooting .....</b>                      | <b>23</b> |
| 5.1 Parameter Check Table .....                      | 23        |
| 5.2 Error Code Table .....                           | 24        |
| 5.3 Meaning of Item 33 .....                         | 25        |
| 5.2 Meaning of Item 34 .....                         | 25        |
| 5.5 Troubleshooting .....                            | 26        |

## 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<br>(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                         |

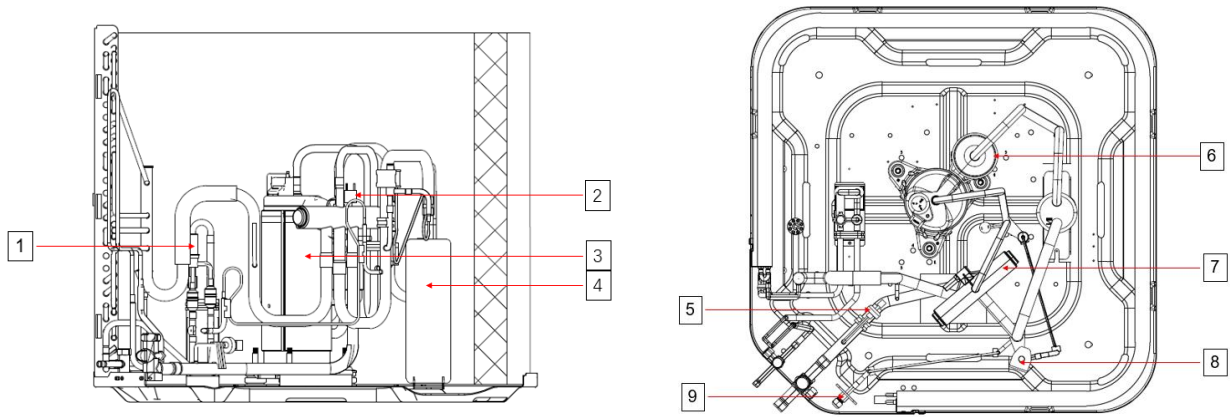
### 1.2 Appearance

| Outdoor Unit |                                                                                     |
|--------------|-------------------------------------------------------------------------------------|
| Photo        |   |
| Model        | YD2436GCSI18RD<br>YD4860GCSI18RD                                                    |
| Indoor Unit  |                                                                                     |
| Photo        |  |
| Model        | DC024GCSICDHRT      DC048GCSICDHRT<br>DC036GCSICDHRT      DC060GCSICDHRT            |

## 2. Product Structure

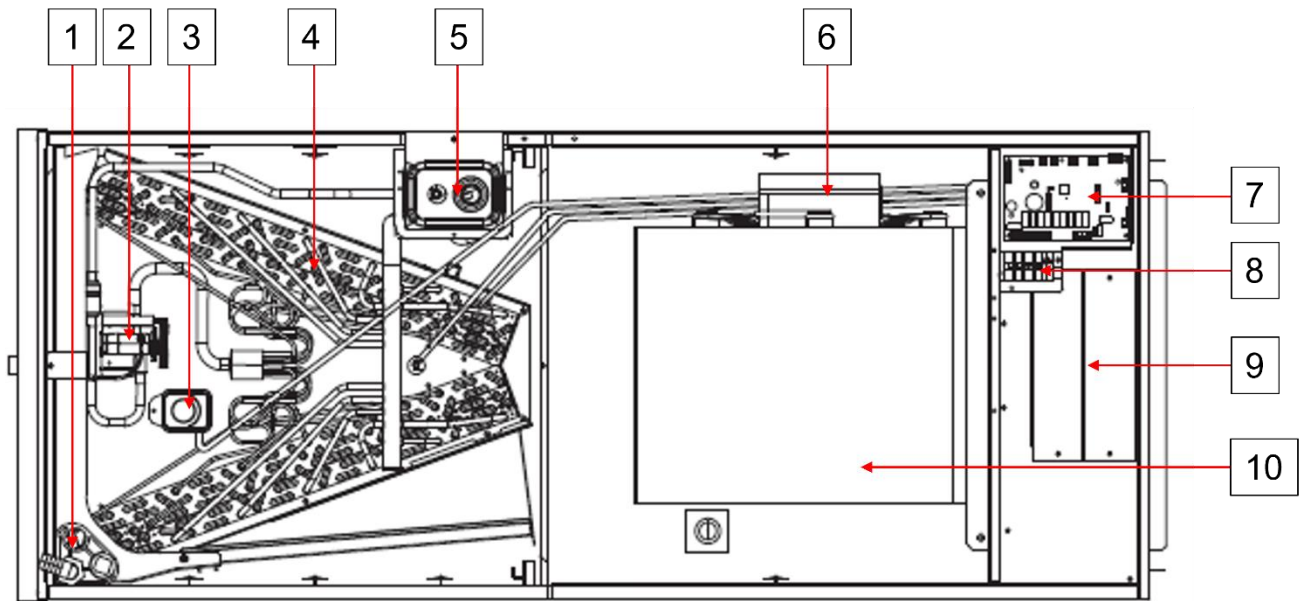
### 2.1 Structural Diagram

#### Outdoor Unit



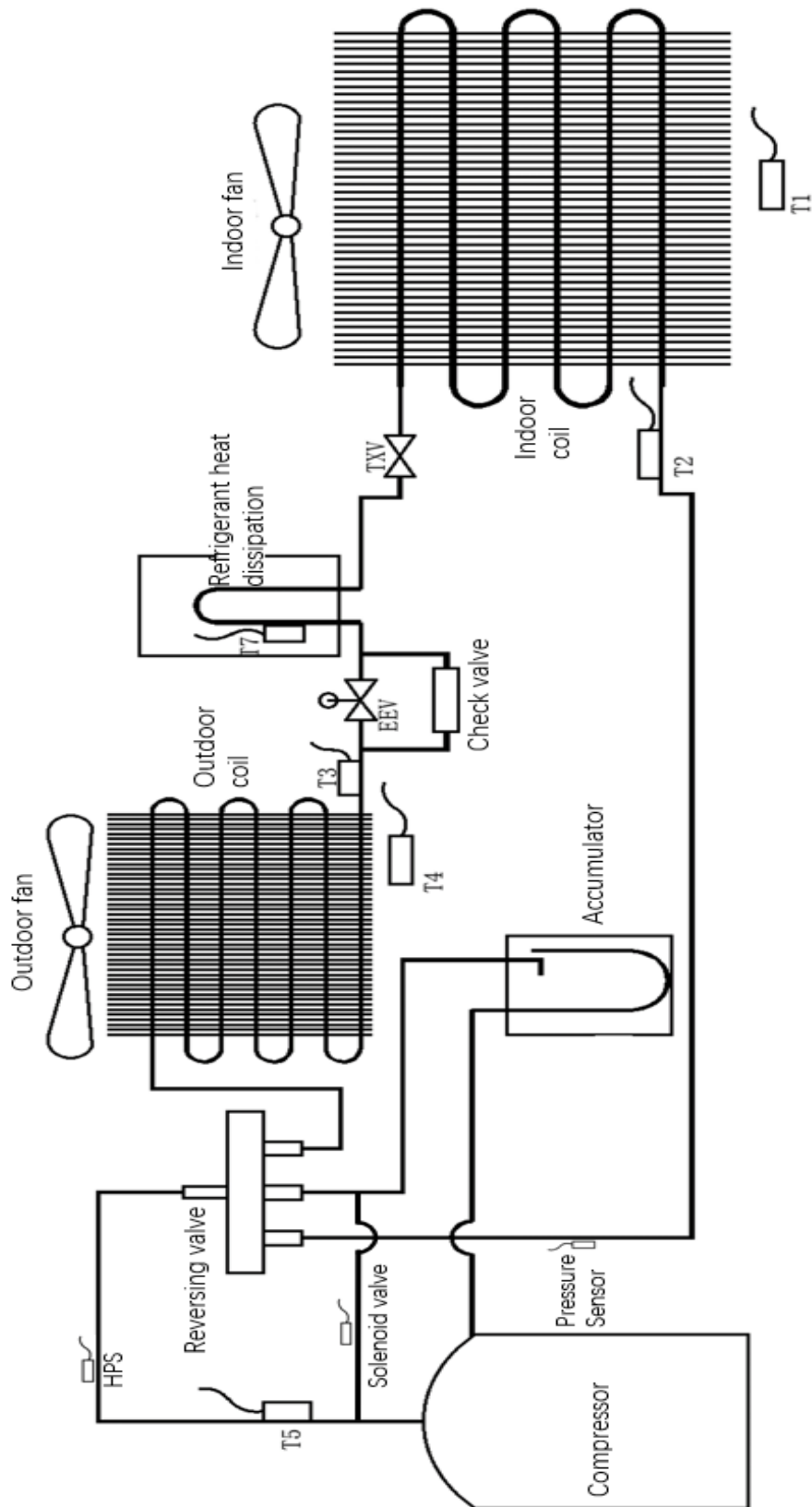
|   |                      |
|---|----------------------|
| 1 | EXV                  |
| 2 | High-pressure switch |
| 3 | Compressor           |
| 4 | Accumulator          |
| 5 | Pressure sensor      |
| 6 | Oil separator        |
| 7 | Reversing valve      |
| 8 | Solenoid valve       |
| 9 | Service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

## Indoor Unit



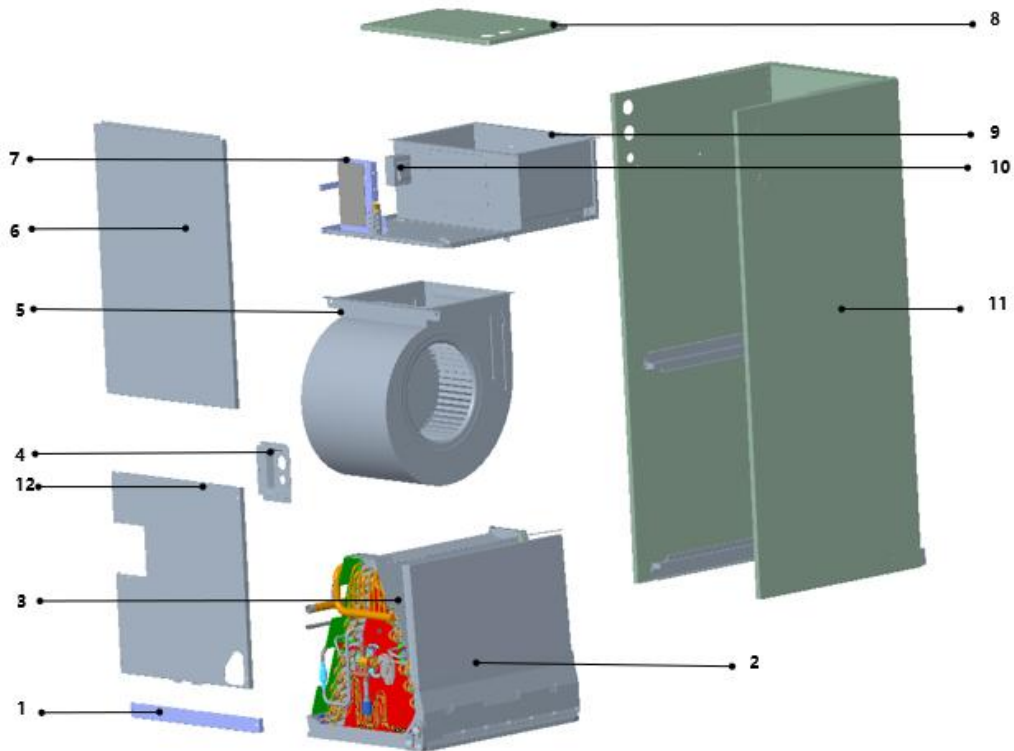
|    |                                  |
|----|----------------------------------|
| 1  | Drain                            |
| 2  | TXV                              |
| 3  | Refrigerant leakage sensor       |
| 4  | Indoor coil                      |
| 5  | Suction line / Liquid line       |
| 6  | 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 |

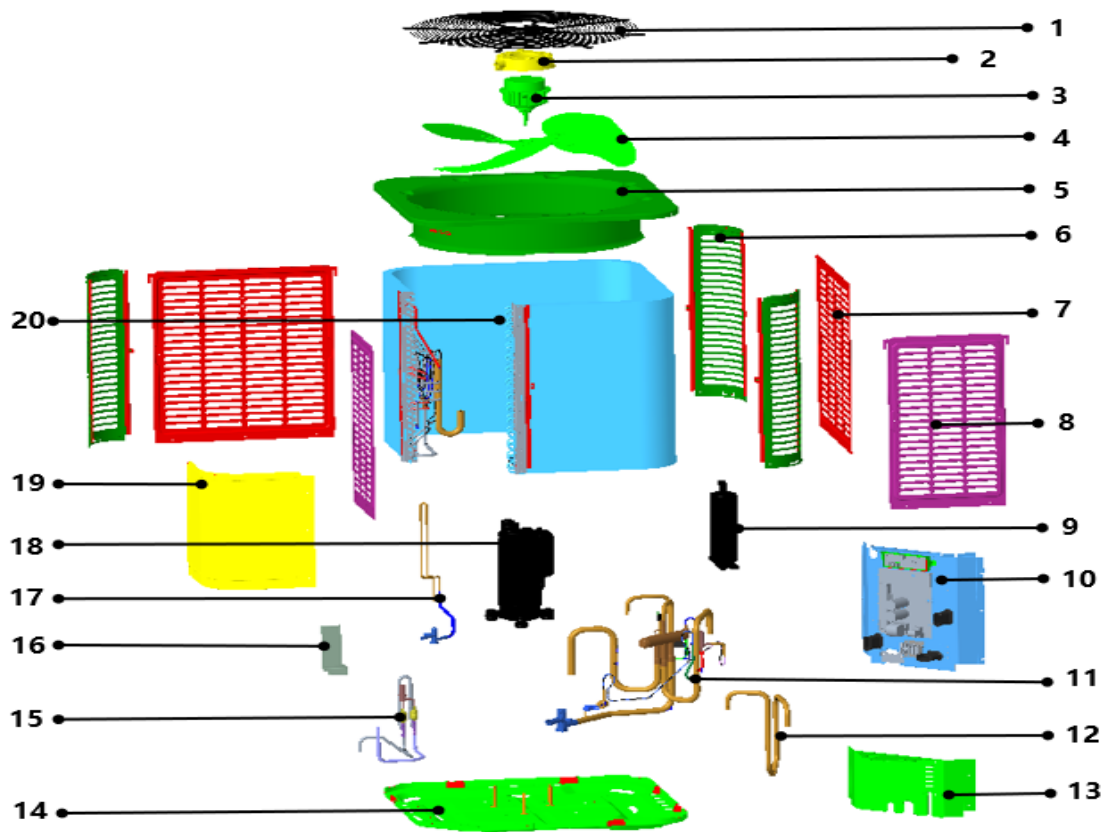
**36K**

| 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**

| <b>No.</b> | <b>Part Name</b>                     | <b>Quantity</b> | <b>BOM Code</b> |
|------------|--------------------------------------|-----------------|-----------------|
| <b>1</b>   | Filter cover plate                   | 1               | 801233590166    |
| <b>2</b>   | Drain pan assembly                   | 1               | 801134590006    |
| <b>3</b>   | Evaporator components                | 1               | 801535000050    |
| <b>4</b>   | Pipe cover plate assembly            | 1               | 801235000073    |
| <b>5</b>   | Volute casing with impeller          | 1               | 801200200040    |
| <b>6</b>   | Upper side plate assembly            | 1               | 801235000146    |
| <b>7</b>   | Indoor electric control box assembly | 1               | 803344000321    |
| <b>8</b>   | Control box cover assembly           | 1               | 801235000148    |
| <b>9</b>   | Duct assembly                        | 1               | 801235000172    |
| <b>10</b>  | Transformers                         | 1               | 802311300001    |
| <b>11</b>  | Rear enclosure assembly              | 1               | 801235000155    |
| <b>12</b>  | 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<br>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<br>(T3/T4/T5)   | 1 | 802301500049 |
|    | High-pressure switch                     | 1 | 802405F00002 |

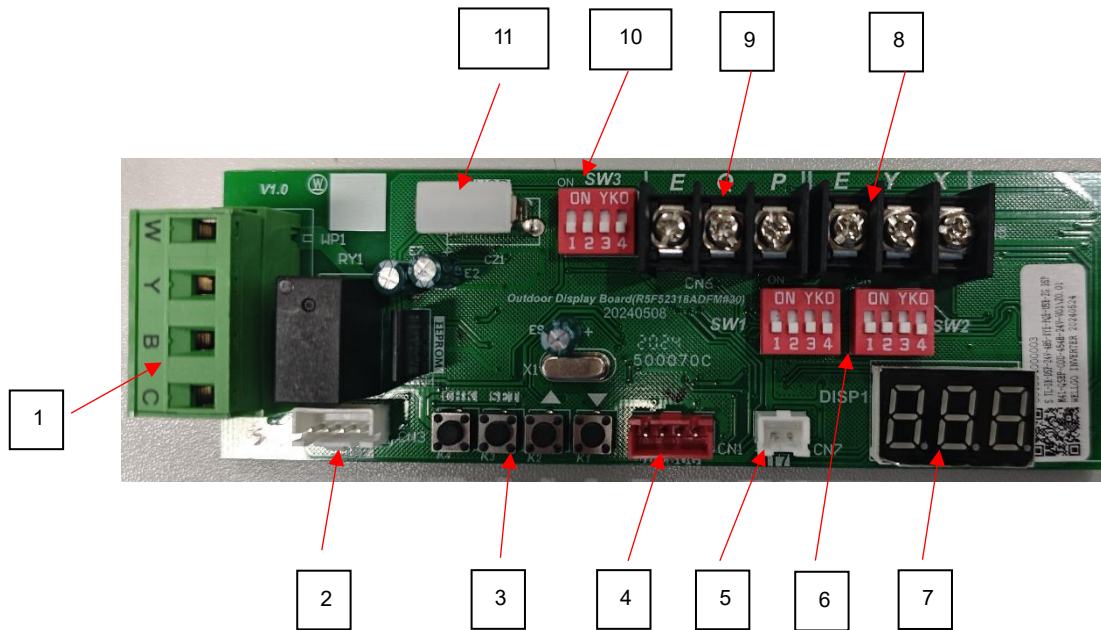
**36K**

| 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 |

|             |                                       |   |              |
|-------------|---------------------------------------|---|--------------|
| <b>6</b>    | Support board                         | 3 | 801235000137 |
| <b>7</b>    | Rear side panel                       | 2 | 801235000135 |
| <b>8</b>    | Right side panel                      | 2 | 801235000136 |
| <b>9</b>    | Accumulator                           | 1 | 801605000010 |
| <b>10</b>   | Electronic control board components   | 1 | 803335000019 |
| <b>10.1</b> | Main control board                    | 1 | 801306300007 |
| <b>10.2</b> | Display board                         | 1 | 801334000003 |
| <b>11</b>   | 4-way valve assembly                  | 1 | 801635000123 |
| <b>12</b>   | Suction line assembly                 | 1 | 801635000120 |
| <b>13</b>   | Bottom side panel                     | 1 | 801235000138 |
| <b>14</b>   | Chassis assembly                      | 1 | 801235000112 |
| <b>15</b>   | Electronic expansion valve assemblies | 1 | 801634000167 |
| <b>16</b>   | Valve support plate                   | 1 | 801235000139 |
| <b>17</b>   | High pressure valve assembly          | 1 | 801635000129 |
| <b>18</b>   | Compressor                            | 1 | 801403200022 |
| <b>19</b>   | Top panel                             | 1 | 801234000060 |
| <b>20</b>   | 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 |

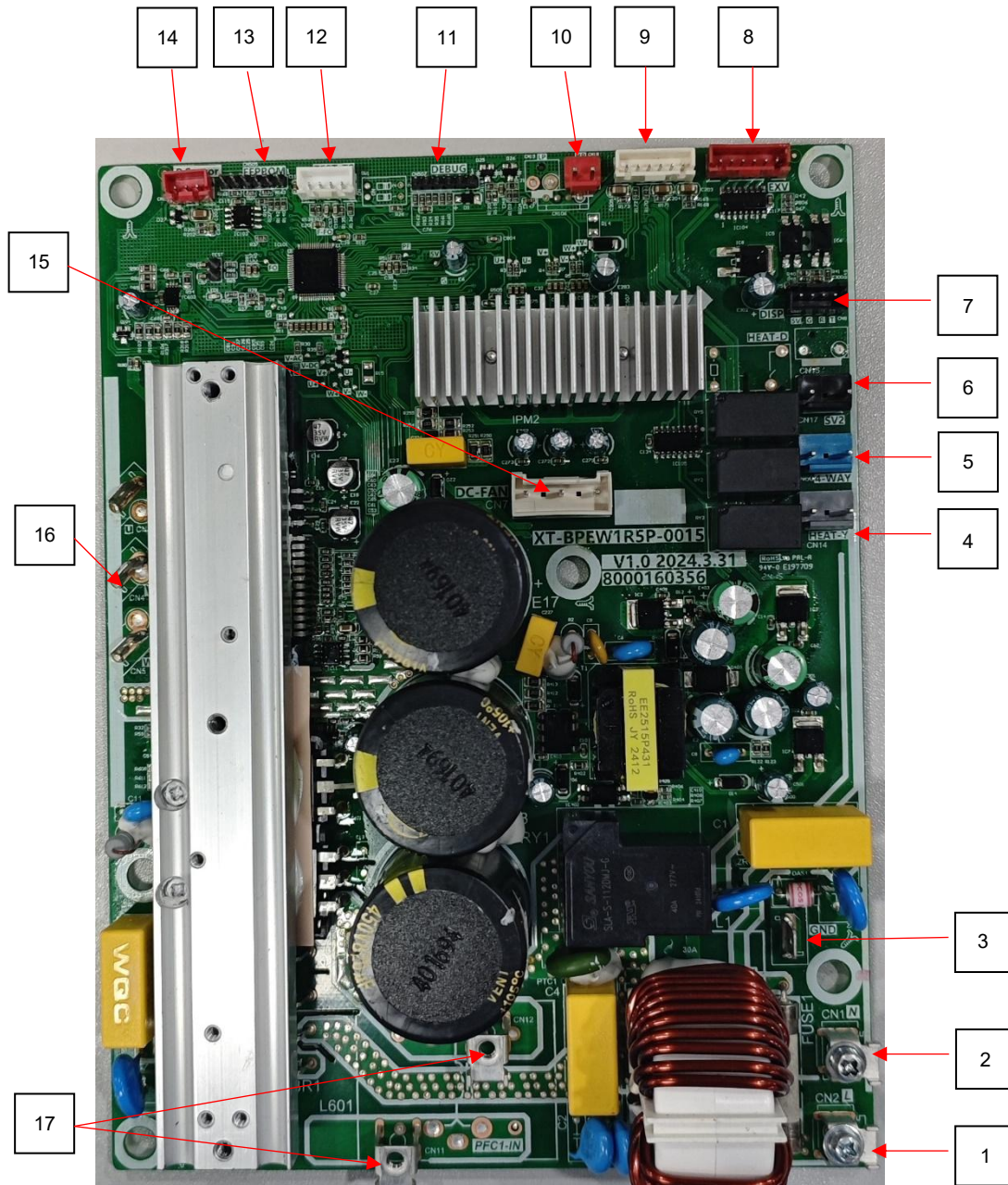
### 3. Electric Control Component

#### 3.1 Display Board



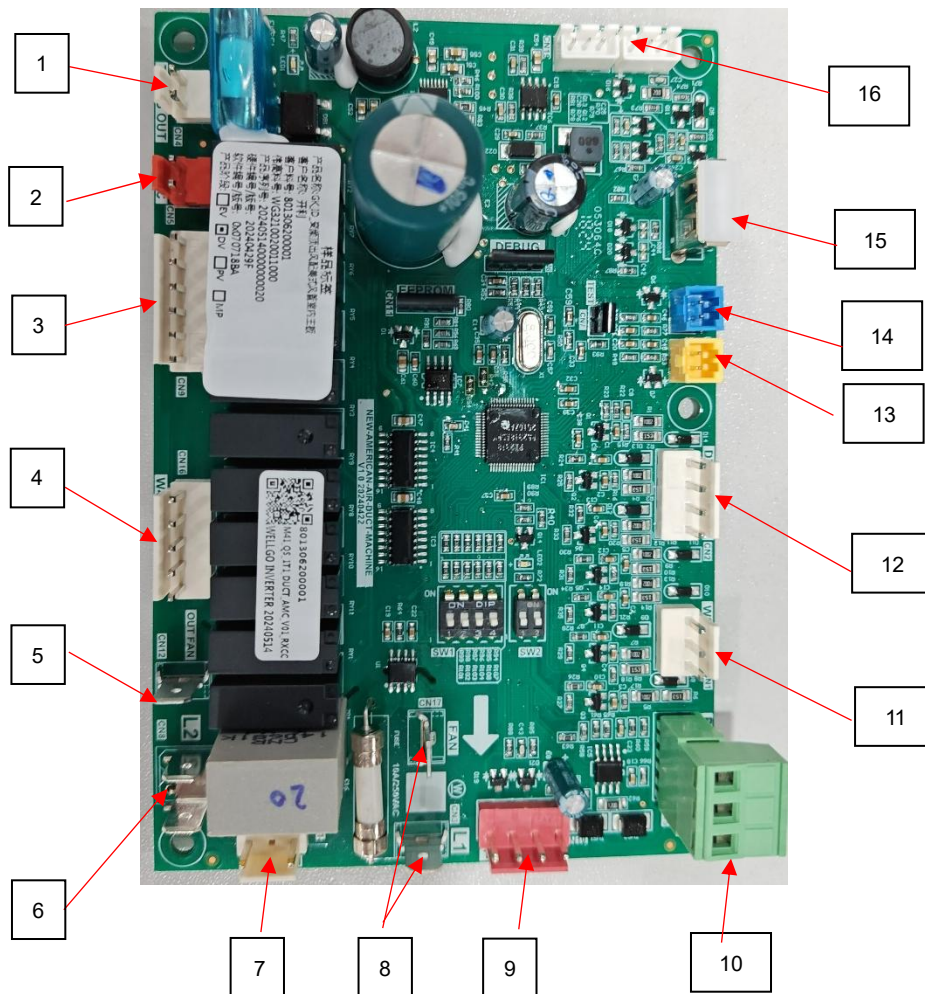
| No. | Port Definition                        | Description                                               |
|-----|----------------------------------------|-----------------------------------------------------------|
| 1   | 24V Thermostat connection              | Connected to the 24V thermostat                           |
| 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                   |     |                             |

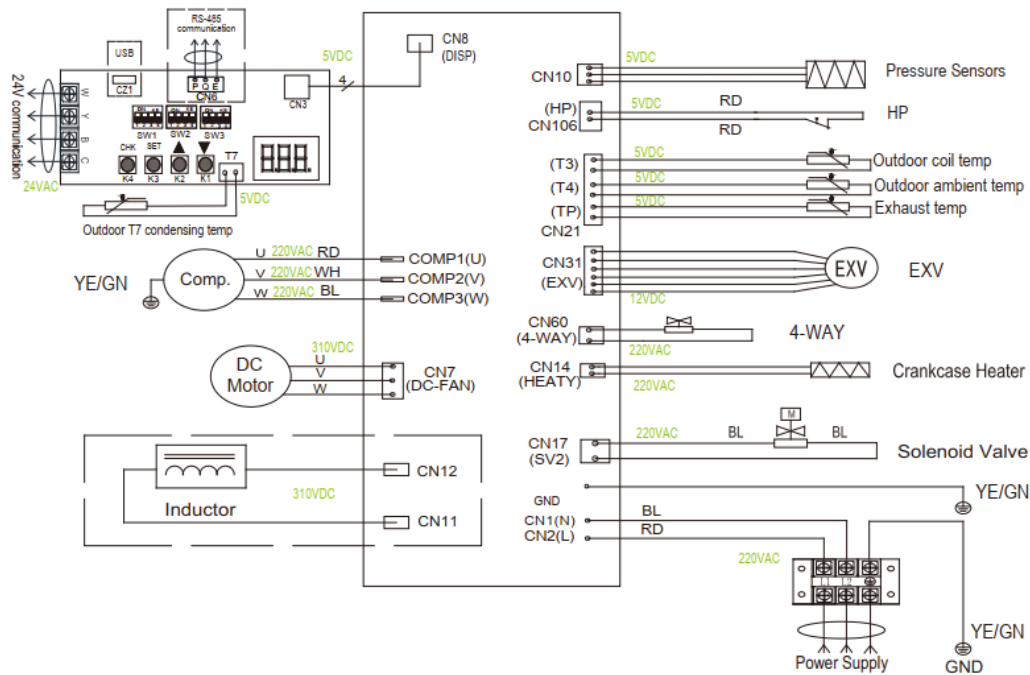
### 3.3 Indoor Unit Control Board



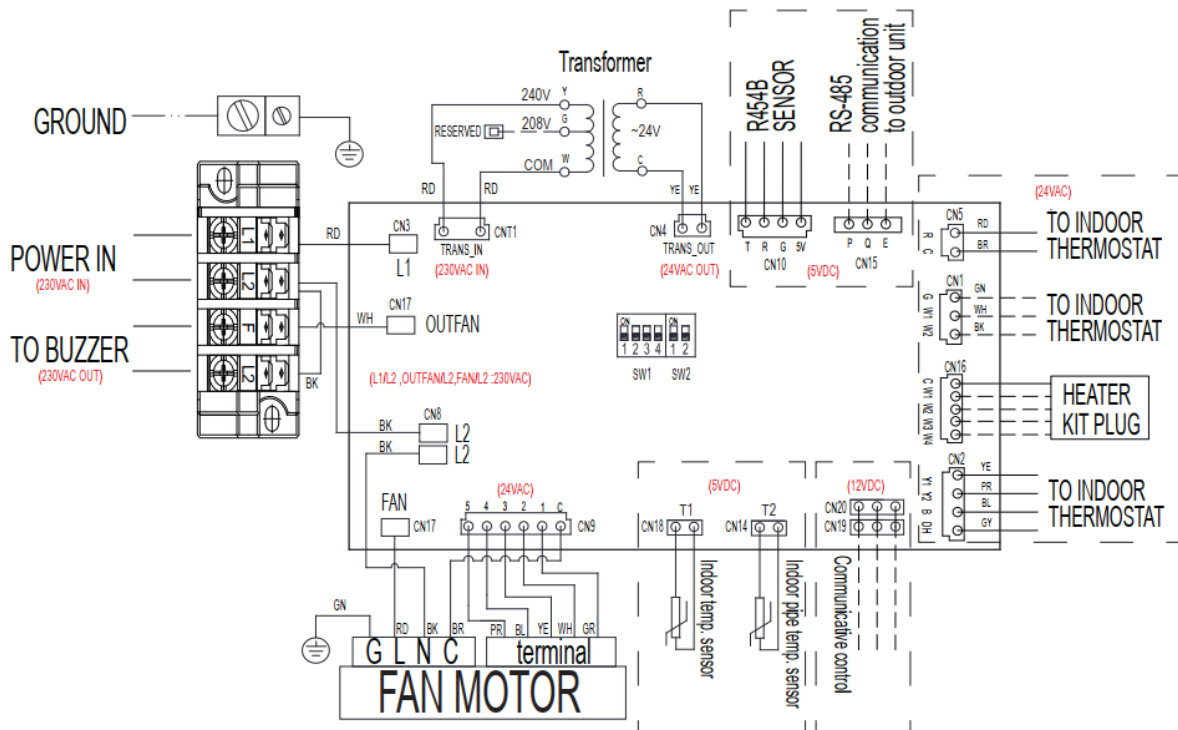
| No. | Port Definition                                         | No. | Port Definition                                                          |
|-----|---------------------------------------------------------|-----|--------------------------------------------------------------------------|
| 1   | 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



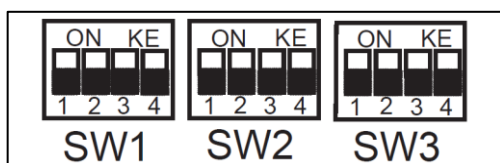
## Indoor Unit



### 3.5 Meaning of the Dip Switch

Dip switch on the display board

(Button in the Up position indicates its on)



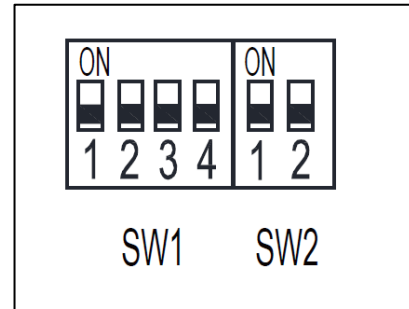
| Mode  |     | SW3-1 |       |
|-------|-----|-------|-------|
|       |     | On    | Off   |
| SW3-2 | On  | 5 Ton | 3 Ton |
|       | Off | 4 Ton | 2 Ton |

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

**Dip Switch on the Indoor Control Board**

(Button in the Up position indicates its on)

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



| <b>SW2-1</b> | <b>SW2-2</b> | <b>High Speed Taps</b> | <b>Low Speed Taps</b> |
|--------------|--------------|------------------------|-----------------------|
| 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  $T5 < 73.4^{\circ}\text{F}(23^{\circ}\text{C})$   
Compressor stops running for 3 hours (outdoor ambient temperature  $T4 < 50^{\circ}\text{F}(10^{\circ}\text{C})$  or  $T5 < 73.4^{\circ}\text{F}(23^{\circ}\text{C})$ )

#### CCH operation de-energizes:

Compressor discharge temperature  $T5 > 82^{\circ}\text{F}(27.8^{\circ}\text{C})$

## 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

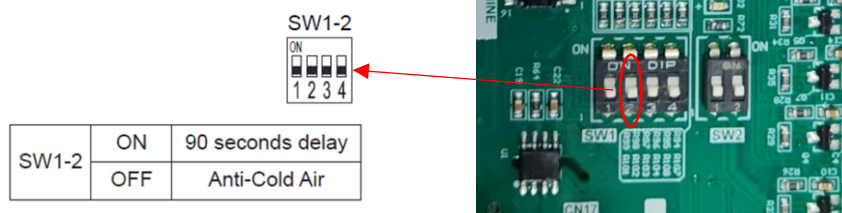
### Anti-Cold Air Function (Only effective in Heating mode)

When the SW1-2 is in the Off position and running in Heating mode, the fan will not start when the coil temperature ( $T_2$ ) < 82.4°F(28°C).

When  $T_2 > 82.4^\circ\text{F}(28^\circ\text{C})$ , 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.



#### 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 temperature, 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)  $T2 < 32^{\circ}\text{F}(0^{\circ}\text{C})$  duration exceeding 1 min.
- 2)  $T2 \leq 26.6^{\circ}\text{F}(-3^{\circ}\text{C})$  duration exceeding 30s
- 3) When  $T2 \geq 42.8^{\circ}\text{F}(6^{\circ}\text{C})$ , 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 compressor operation.
- 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<br>(factory default) | Normally cooling<br>(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  $\pm 41^{\circ}\text{F}(5^{\circ}\text{C})$ . Provide a higher or lower target evaporation temperature or condensation temperature 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 and calculates 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 after the system is powered on for the first time. Also the system should 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.

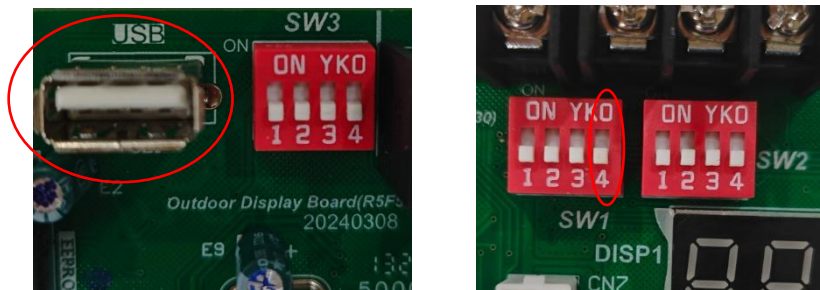
## 4.8 Forced Operating Mode

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

**Forced Heating Mode:** Press “▲” button on the display board for about 5s to enter. 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, and then the display board will show No. 1.
- 5) Switch the SW1-4 to the Off position, and then the display board will show No. 2.
- 6) Subsequently, the display board will show No. 3, indicating that it is burning.
- 7) The program was successfully burned and entered normal operation after the display board displayed No. 888.
- 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          |
|-------------------------------------------------------------------------------------|-------|-------|-----------------|
| <b>2 Ton Mode</b>                                                                   | Off   | Off   |                 |
| <b>3 Ton Mode</b>                                                                   | Off   | On    | Factory default |
| <b>4 Ton Mode</b>                                                                   | On    | Off   |                 |
| <b>5 Ton Mode</b>                                                                   | 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 Table

### Outdoor Unit

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

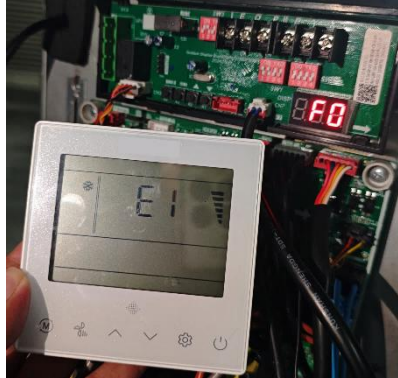
## 5.4 Meaning of Item 34 in the Parameter Check Table

| 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 |

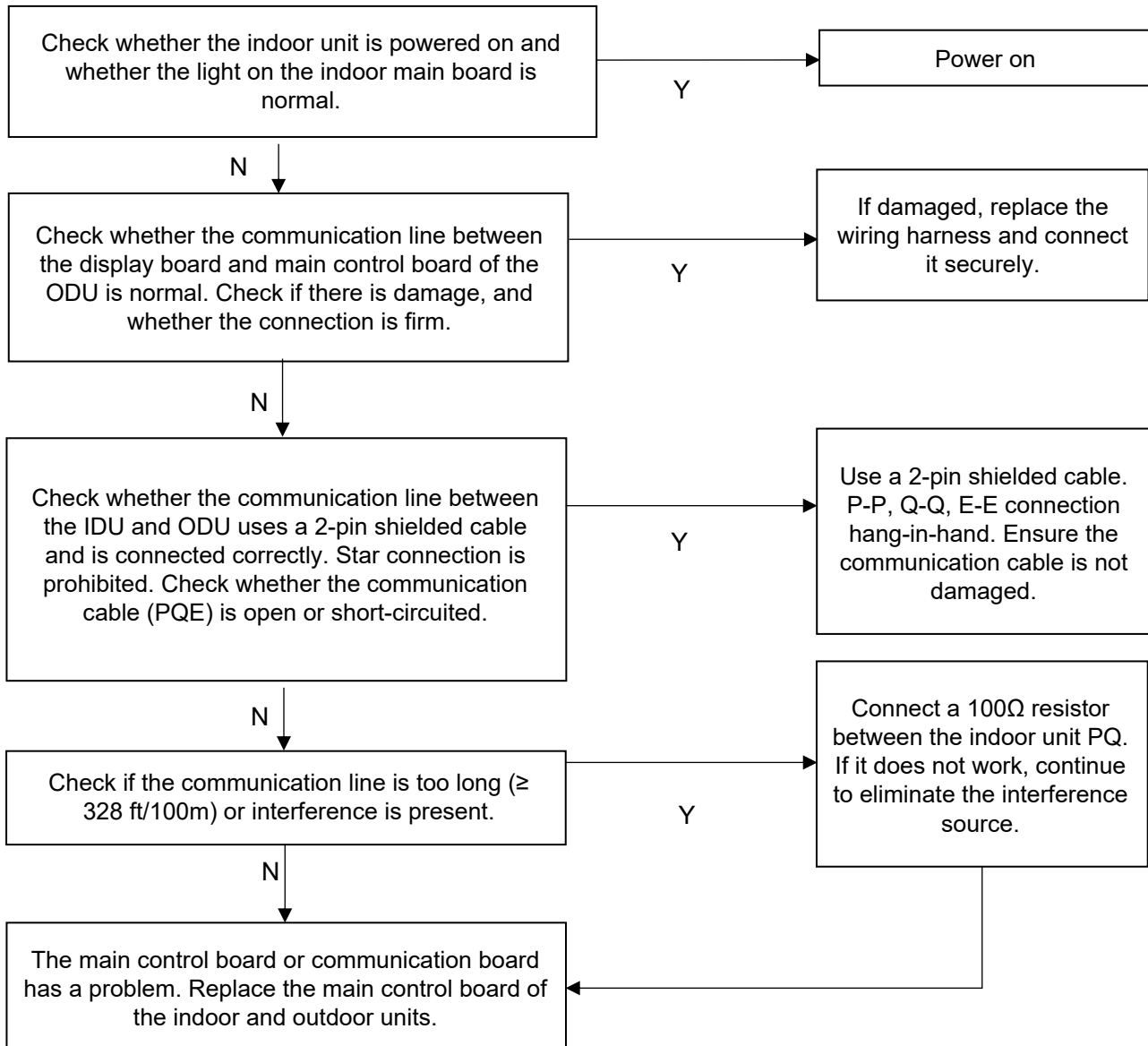
## 5.5. Troubleshooting

### 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.



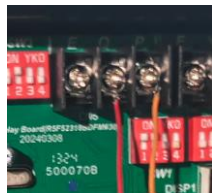
#### Error Code: Communication error between the outdoor unit and indoor unit



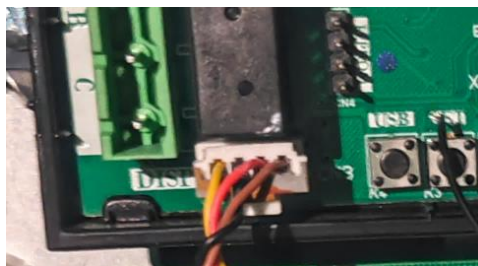
- Use a multimeter to measure the power supply voltage to see if it is between 208-230V to ensure the voltage is normal and stable.
- Check whether the power terminals are secure and connected properly.



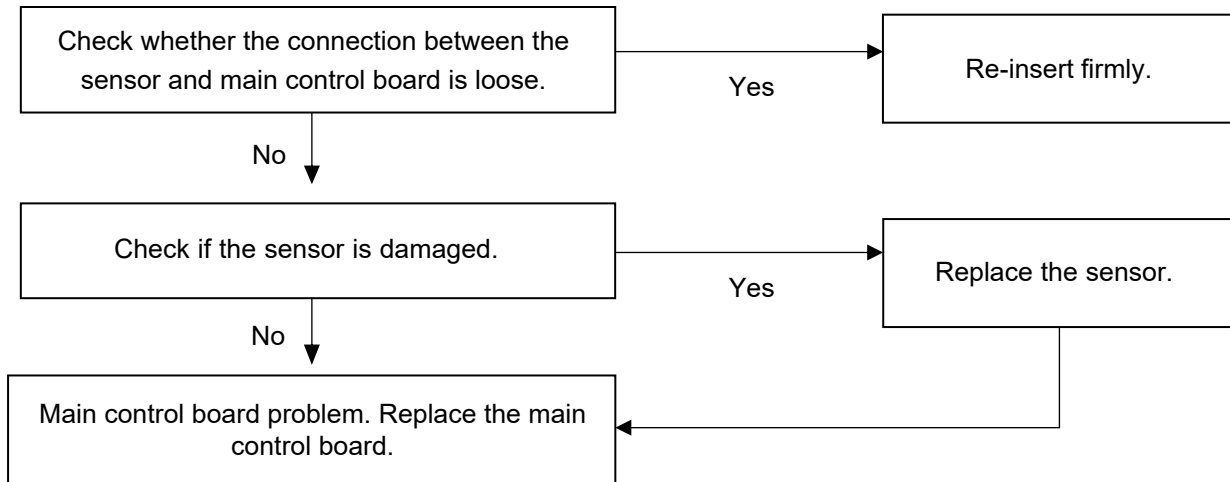
- Check whether the communication cables PQE correspond one to one. Measure whether there is a short circuit or an open circuit between the communication lines PQ.



- 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

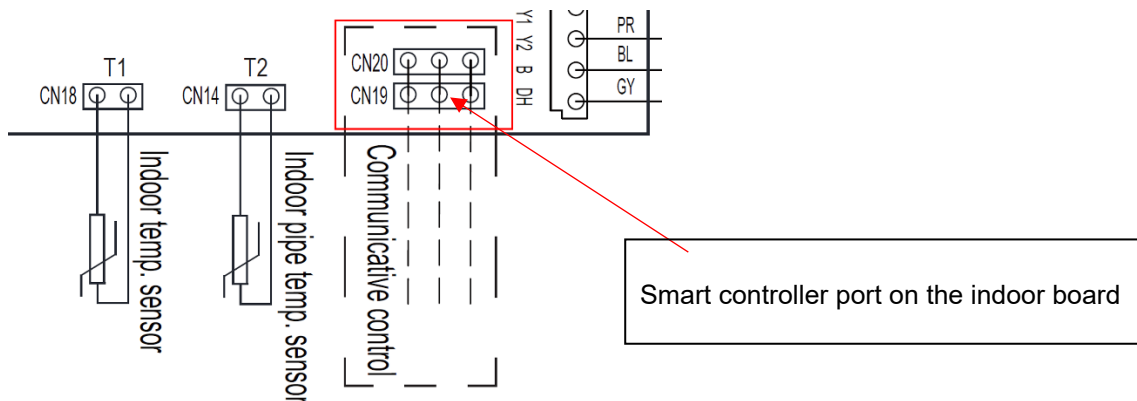
**Cause:** The DC fan motor of the indoor unit has an issue.

- 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) |

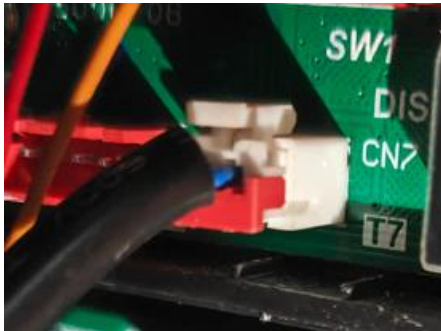
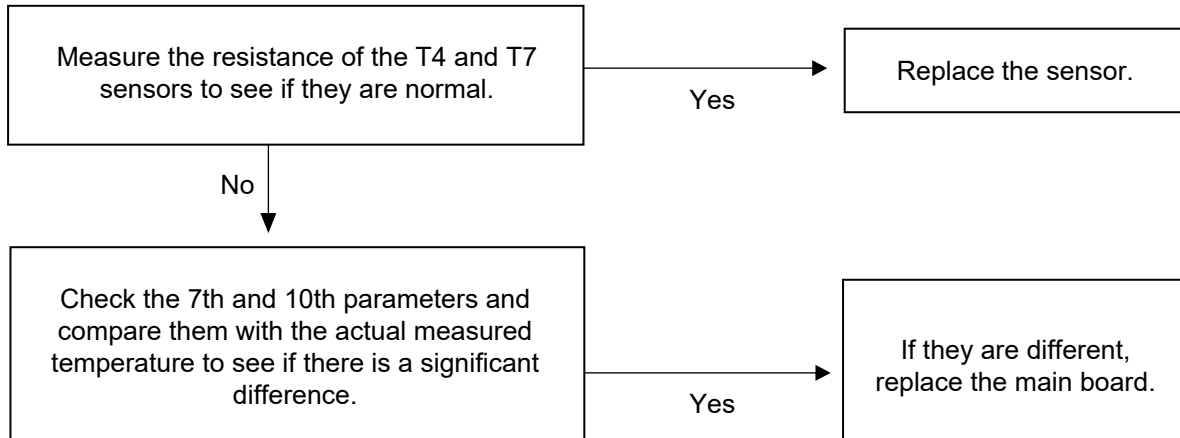
- Power off and restart. If the fault is still the same, then replace the smart controller.
- If replacing the smart controller does not solve the problem, then replace the indoor unit control board.

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

**Cause:**  $T7 \leq T4 \text{ } 28.4^{\circ}\text{F}(-2^{\circ}\text{C})$ , and lasts for 15 min.

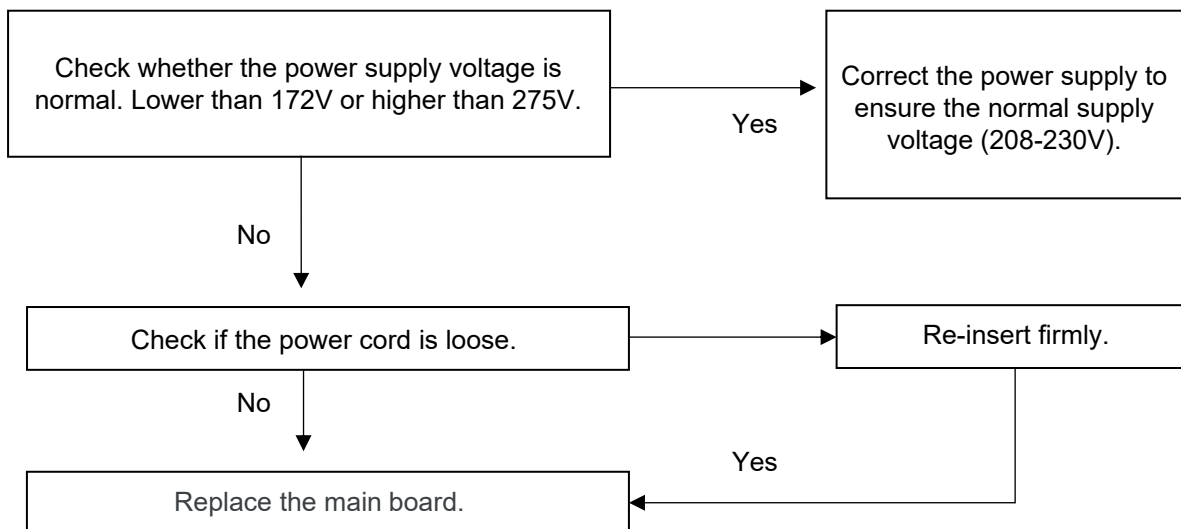
**Exit Condition:**  $T7 \geq T4 \text{ } 33.8^{\circ}\text{F}(1^{\circ}\text{C})$ , and lasts for 10s.

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

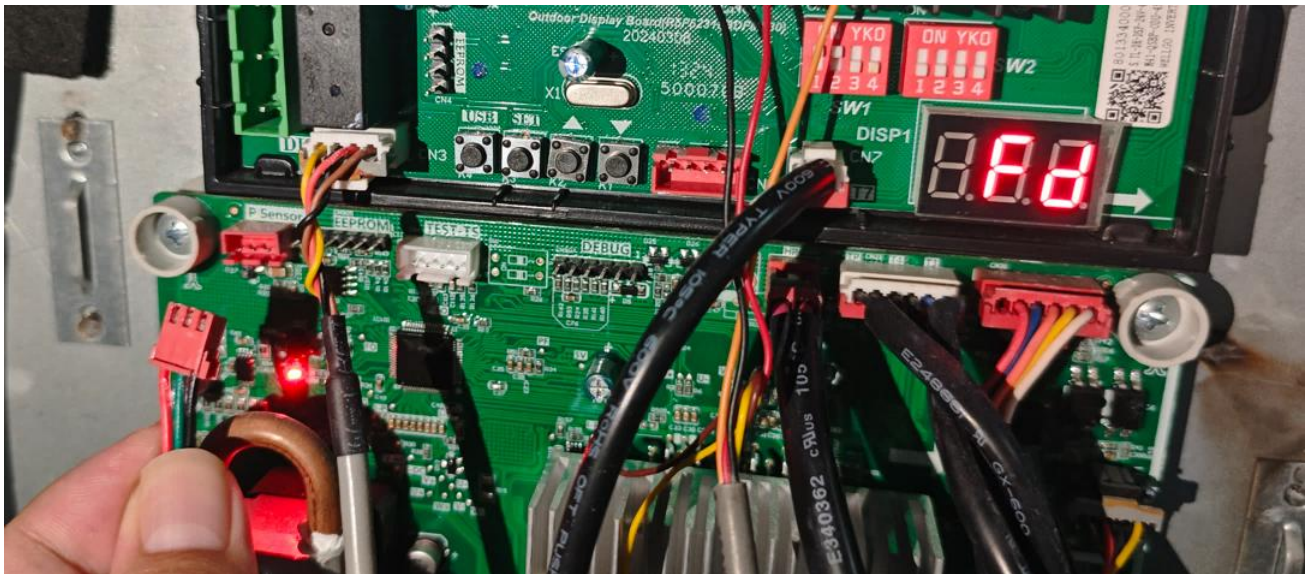
**Cause:** Communication between the outdoor main board and module temperature sensor is lost.

- 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**

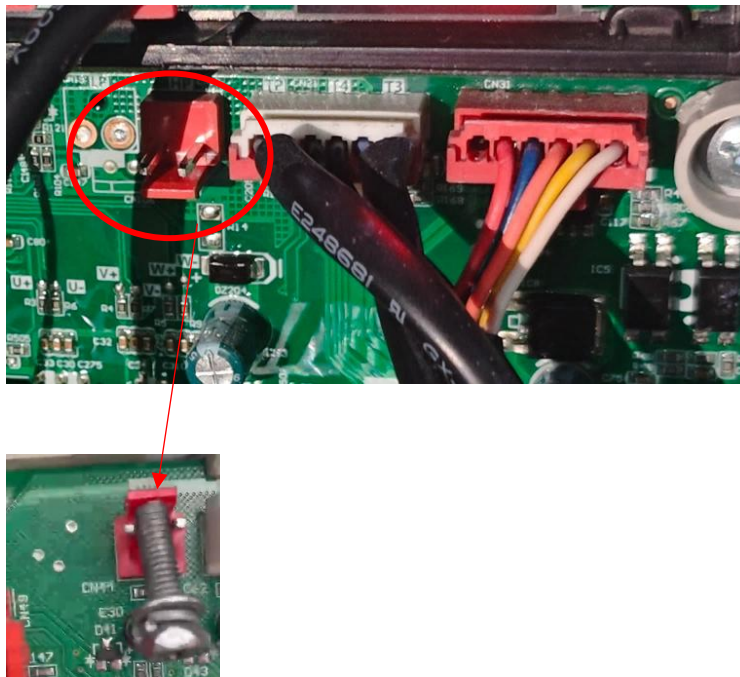
**Cause:** The probe is in the wrong position.

- 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.

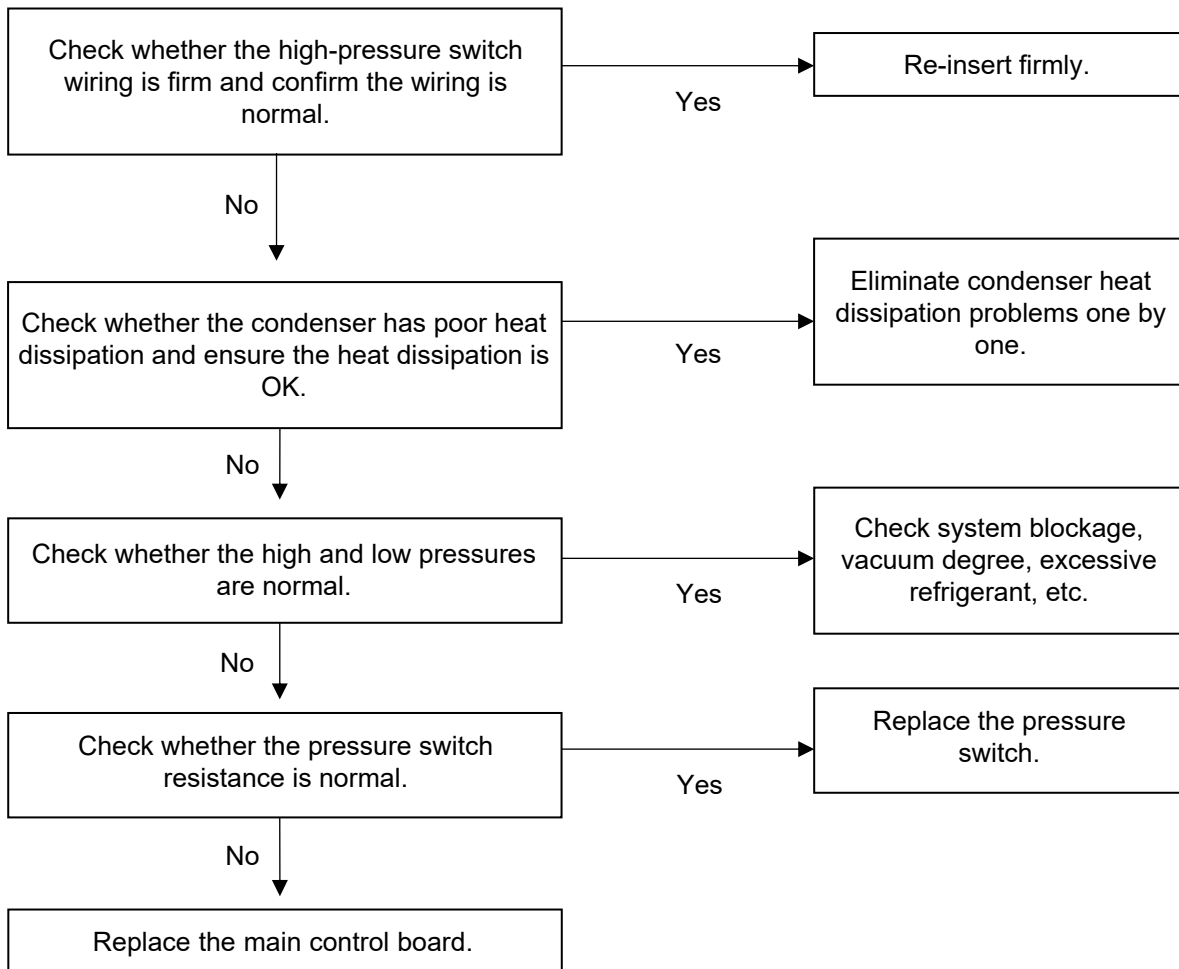
- Begin by checking if the pressure switch is securely plugged in.
- Use a jump cap or metal short-circuit to connect the high-pressure switch port of the electronic control board, then turn off the power and restart the machine. Observe whether the fault disappears.
- If the fault is resolved, replace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



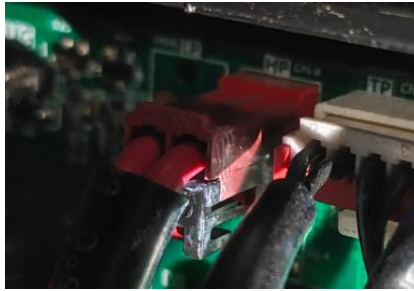
**Note:** The high-pressure switch port can be short-circuited by using a screw clamped between two pins.

**15) P1, H2: High-Pressure Switch Protection**

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



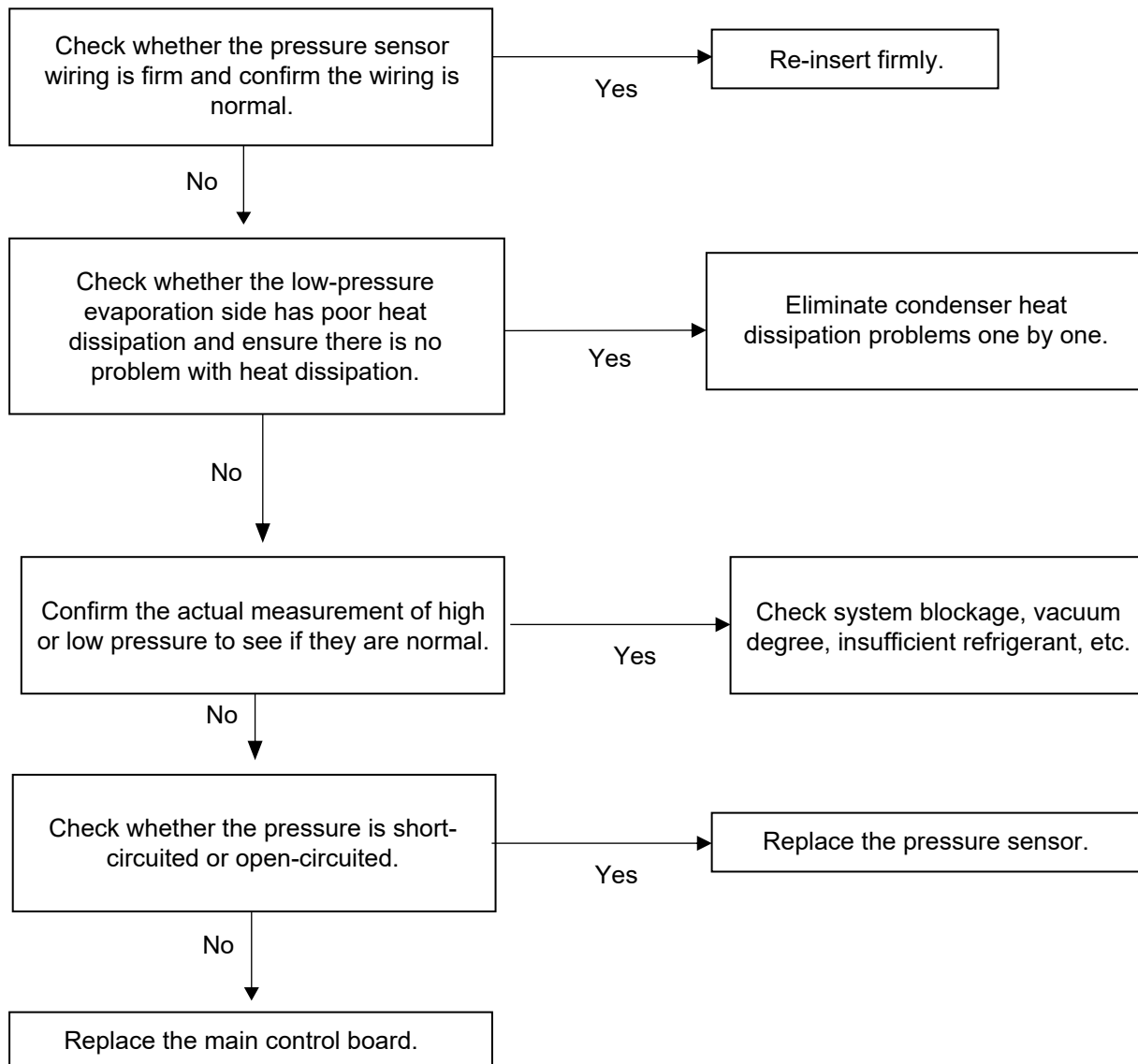
- Check whether the high-pressure switch wiring is firm and confirm the wiring is normal.



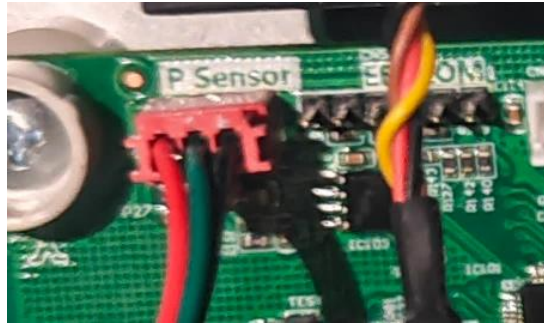
- Check whether the condenser has poor heat dissipation and ensure there is no problem with heat dissipation.
- Connect the pressure gauge, run the unit, and check the high and low pressures. If the pressure is normal, unplug the pressure switch and measure the resistance. If it's infinite, replace the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

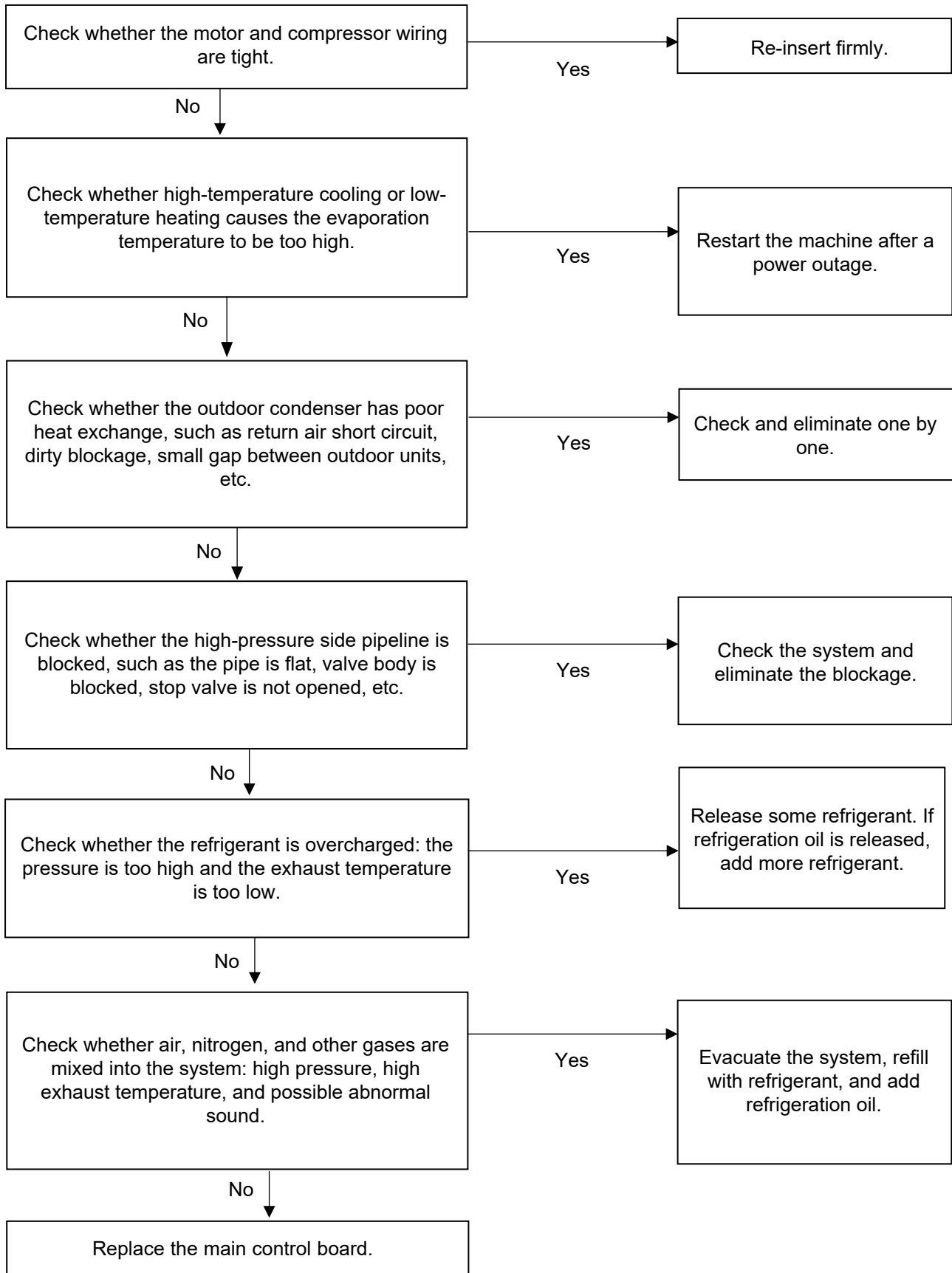
- Check whether the pressure sensor wiring is firm and confirm the wiring is normal.



- 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.

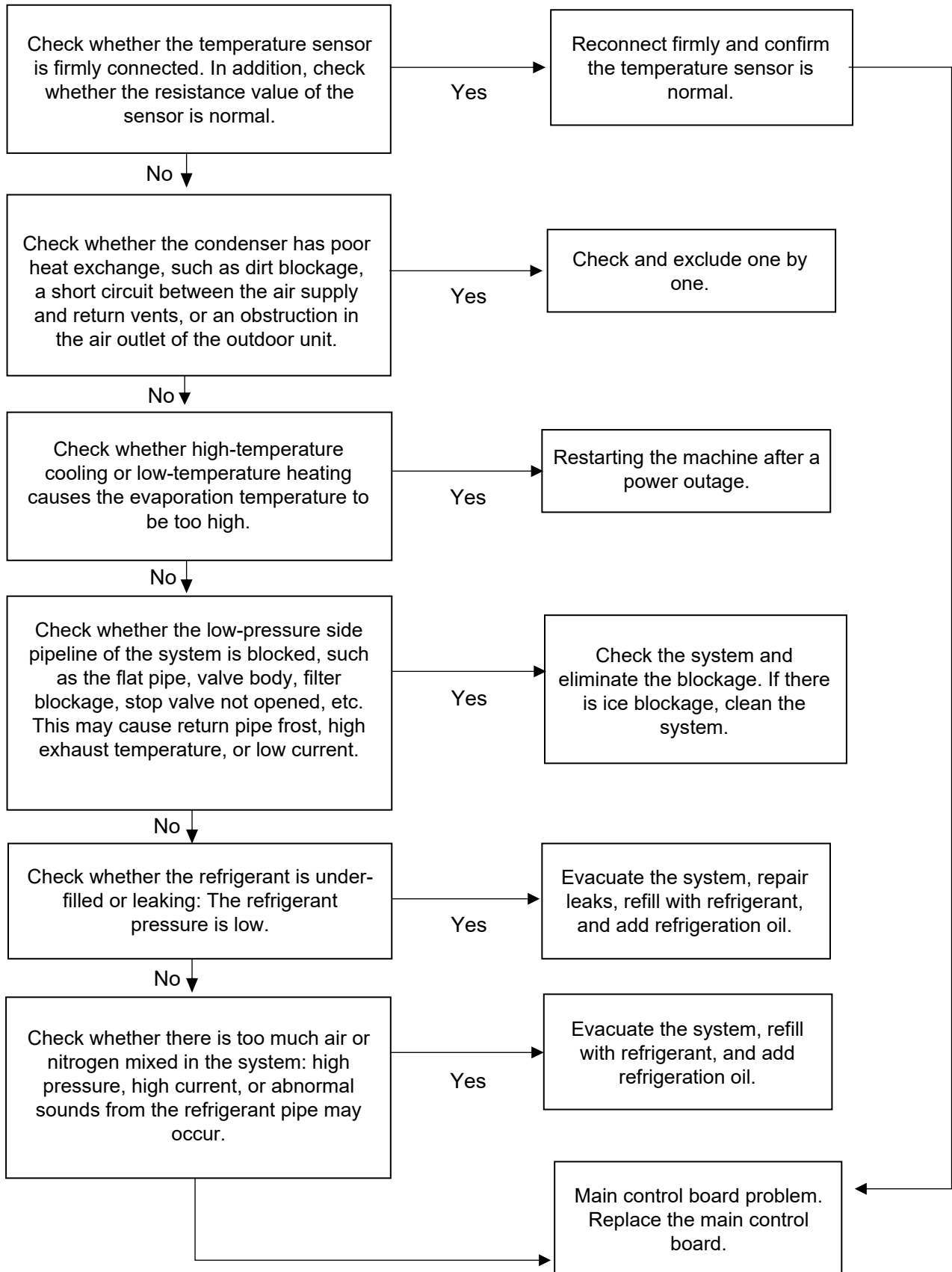


- Use a clamp meter to confirm the AC current, and check item 20. Compare the difference between the check value and clamp meter. If the difference is large, the main control board has a problem and the main board must be replaced.
- If the difference between the clamp meter and check value is not large, the compressor or system has a problem.

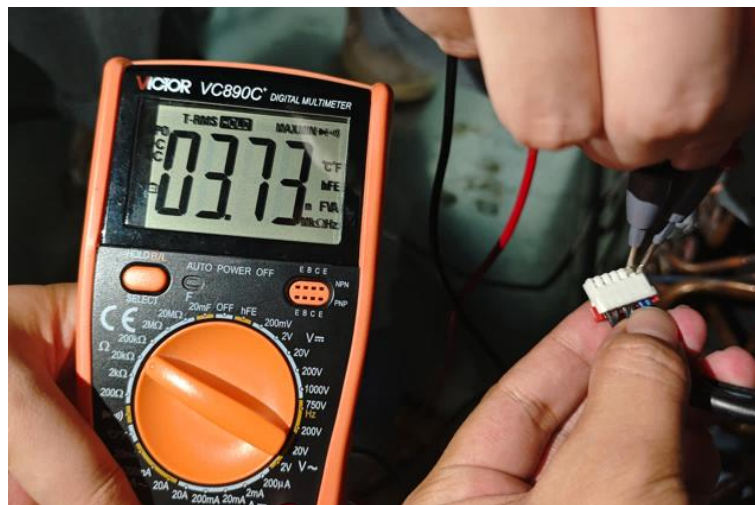
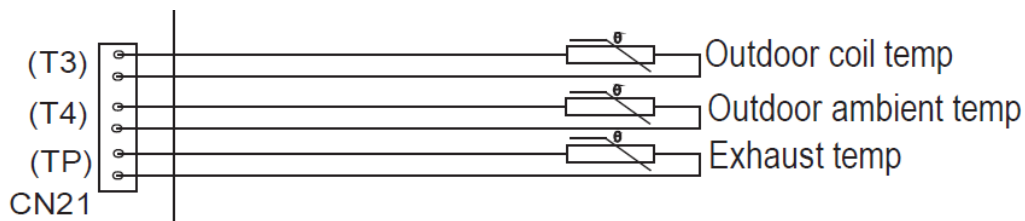
| Model                        | 24K | 36K | 48K | 60K |
|------------------------------|-----|-----|-----|-----|
| Protection Current Value (A) | 26  | 26  | 32  | 32  |

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

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

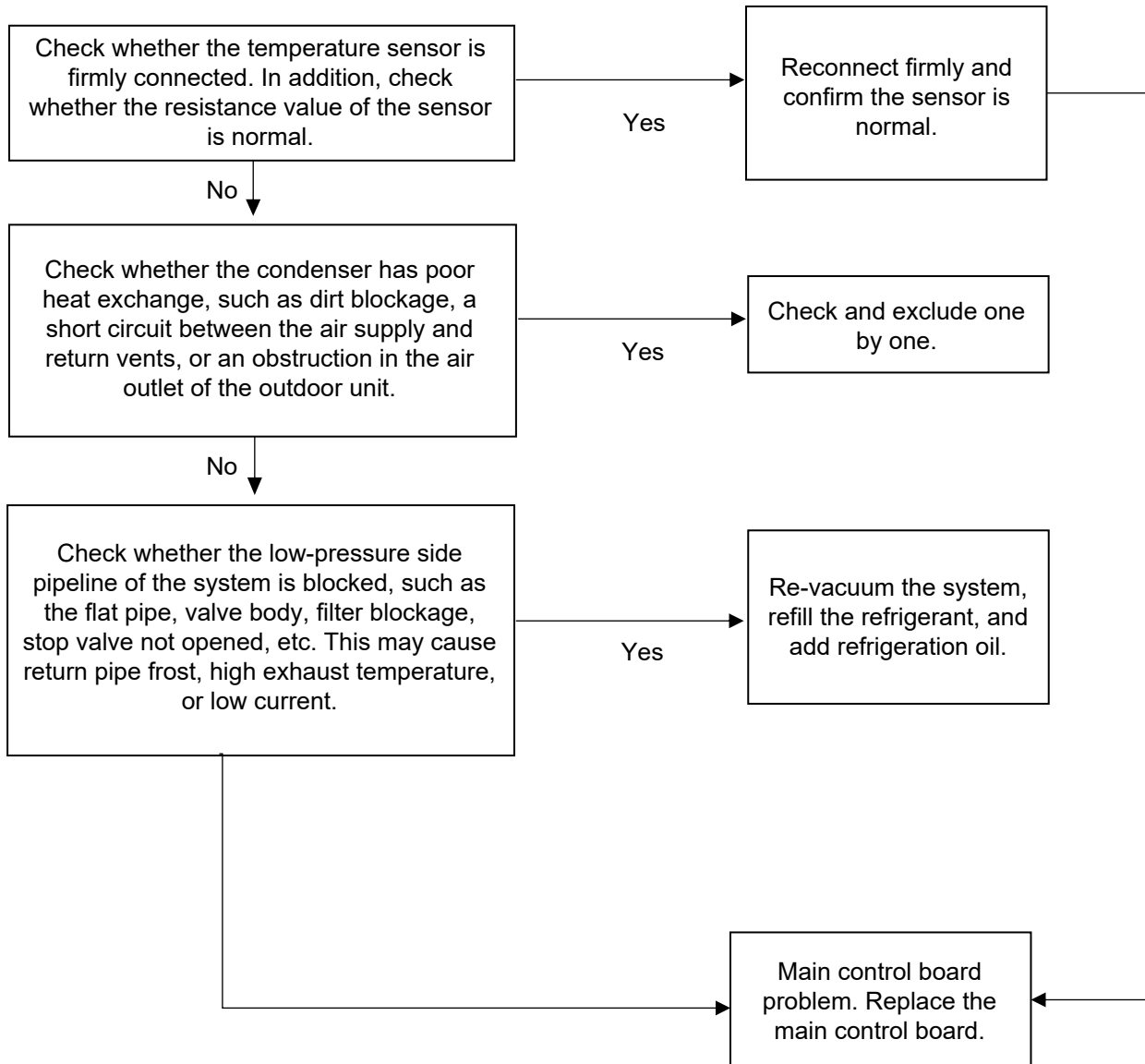


- Connect a pressure gauge to measure whether the return gas pressure is too low (normally 0.7-0.9 Mpa). If the pressure is too low, add refrigerant.
- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. 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.

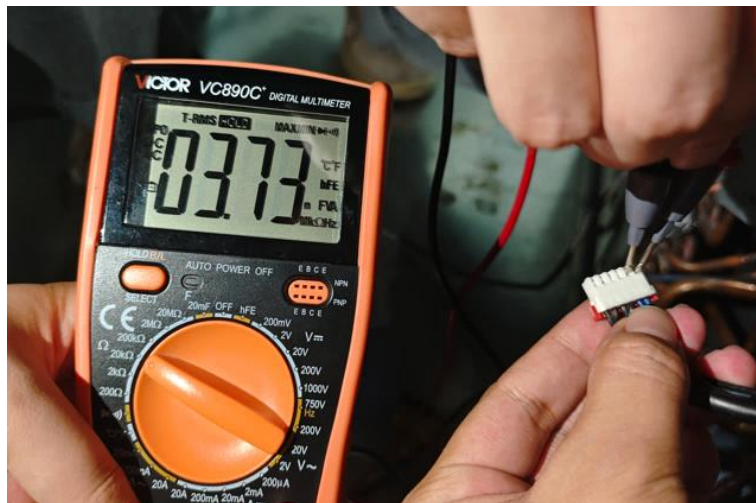
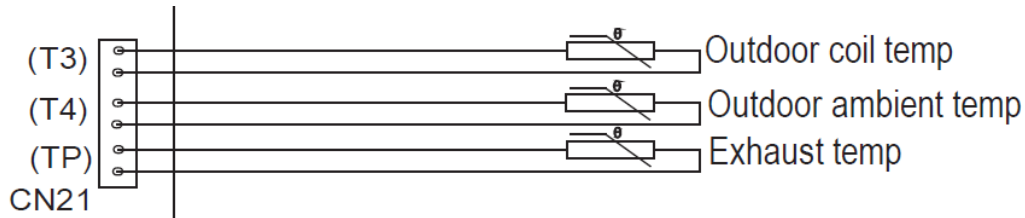


**19) P5: Outdoor Coil Temperature Over-High Protection (Cooling Mode) > 140°F / 60°C**

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



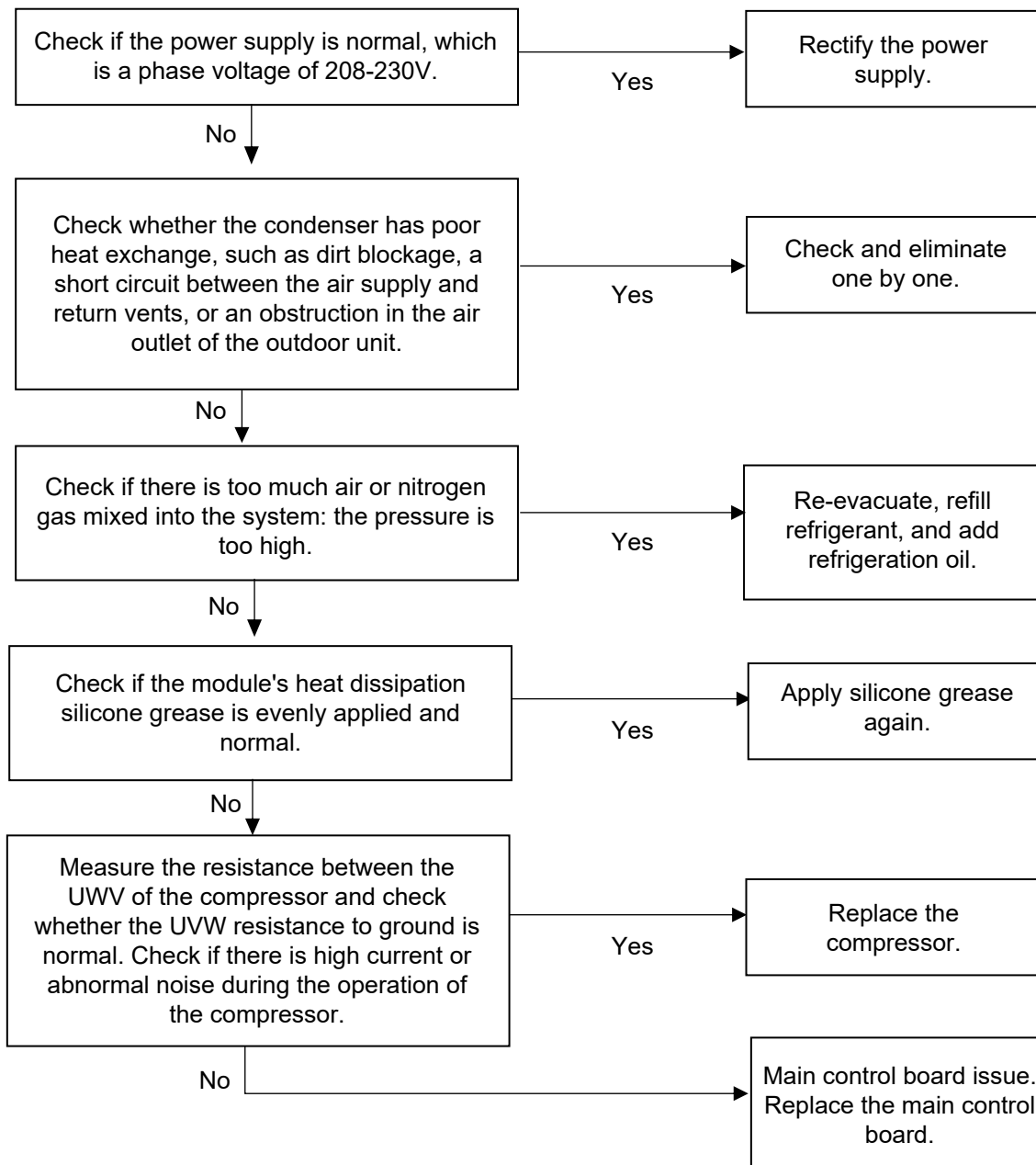
- Check if the heat dissipation of the condenser is normal, ensuring there are no dirty blockages, short circuits in the air supply and return ports, etc.
- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the 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**

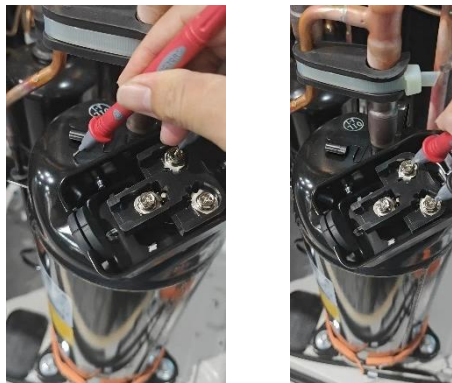
**Cause:** The compressor drive module abnormality.



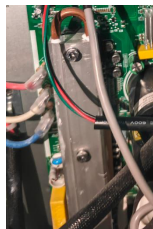
- Check whether the power supply is normal. The power supply voltage is 208-230V.



- 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  $20\Omega$ ), and the resistance between the UVW and ground (normal is infinite,  $M\Omega$  level). If the compressor resistance is abnormal, replace the compressor, otherwise proceed to the next step.



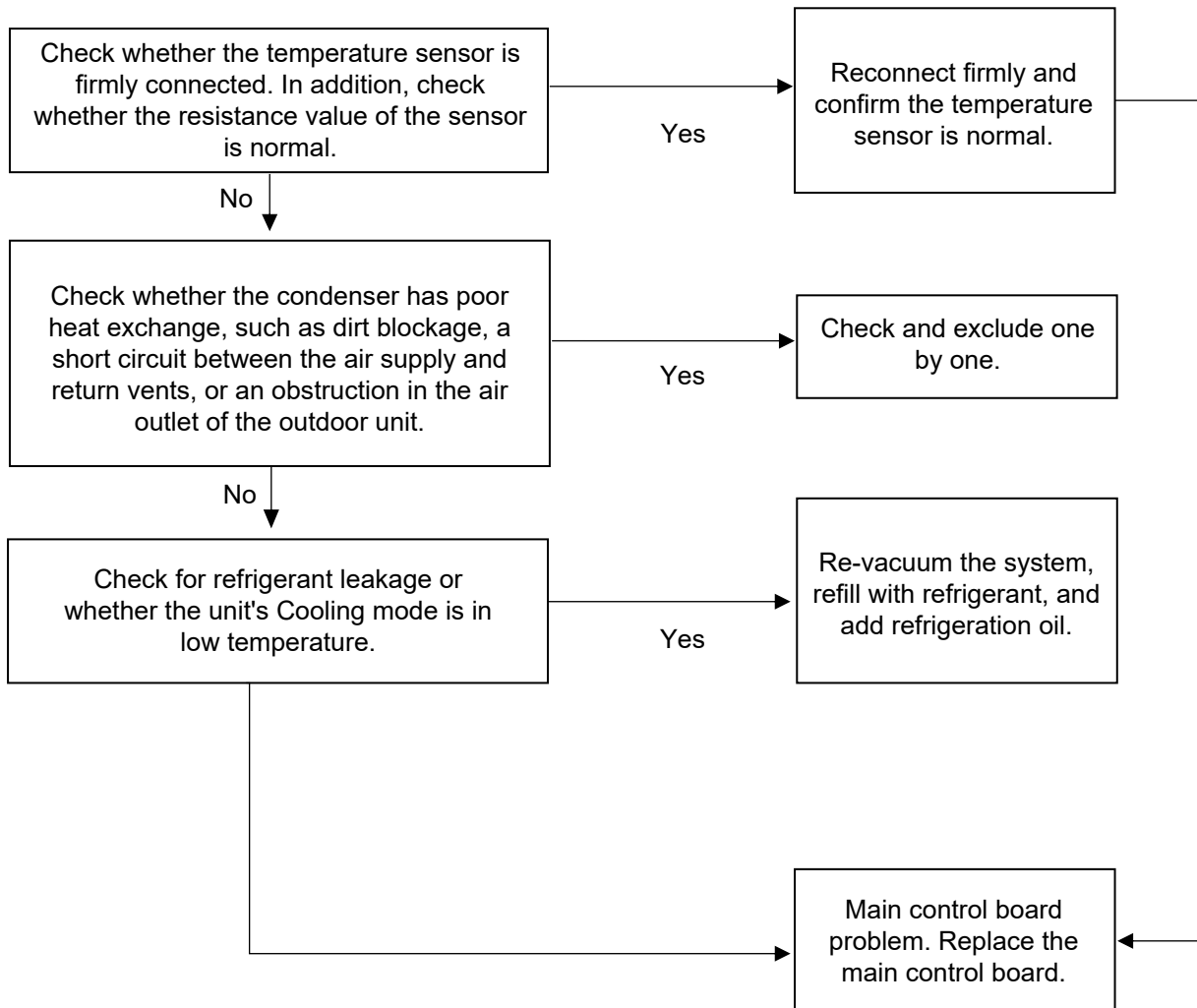
- Open the refrigerant heat dissipation cover and check whether the heat dissipation silicone grease is evenly applied. If abnormal, reapply the silicone grease. Otherwise, proceed to the next step.



- 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**

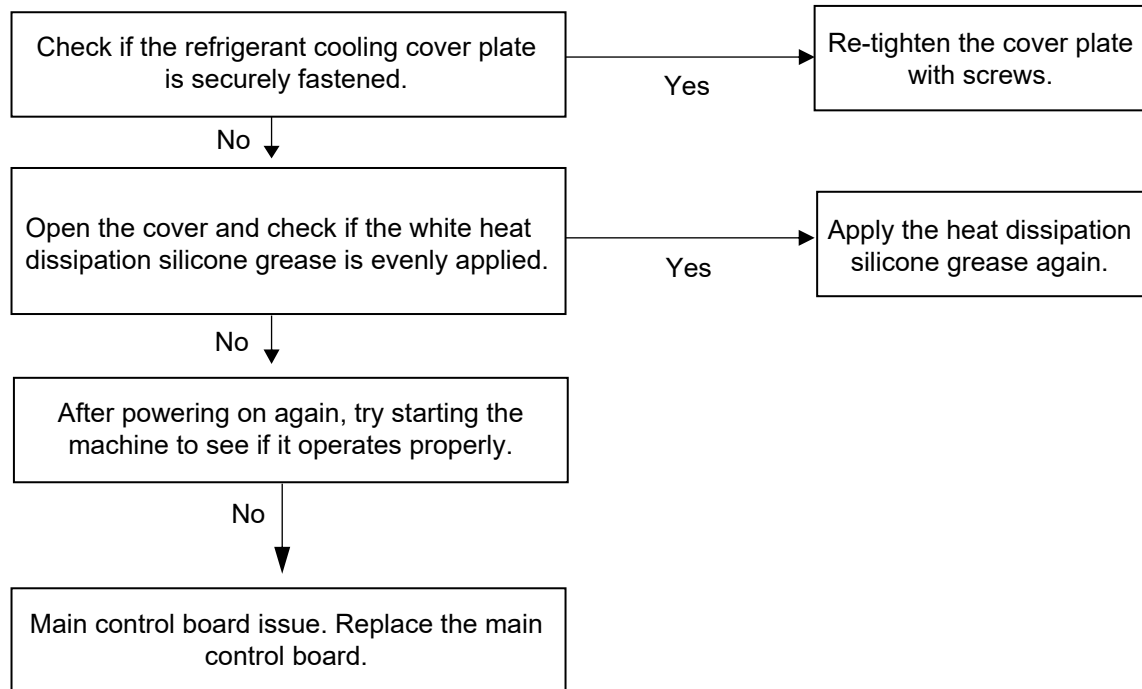
**Cause:** The T2 detection temperature is too low ( $T2 < 32^{\circ}\text{F}/0^{\circ}\text{C}$ ).



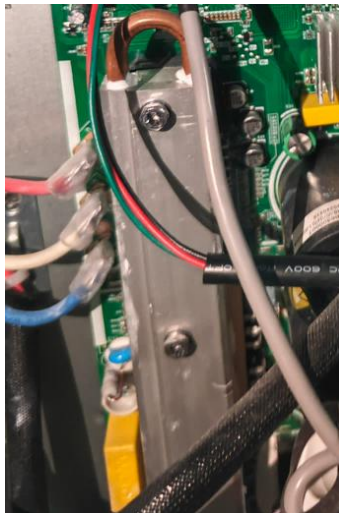
- Begin by confirming whether the indoor coil is frozen. If it is frozen, check the pipe system. If there is no icing, check the T2 sensor or the indoor board.
- Measure the resistance of the T2 temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace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

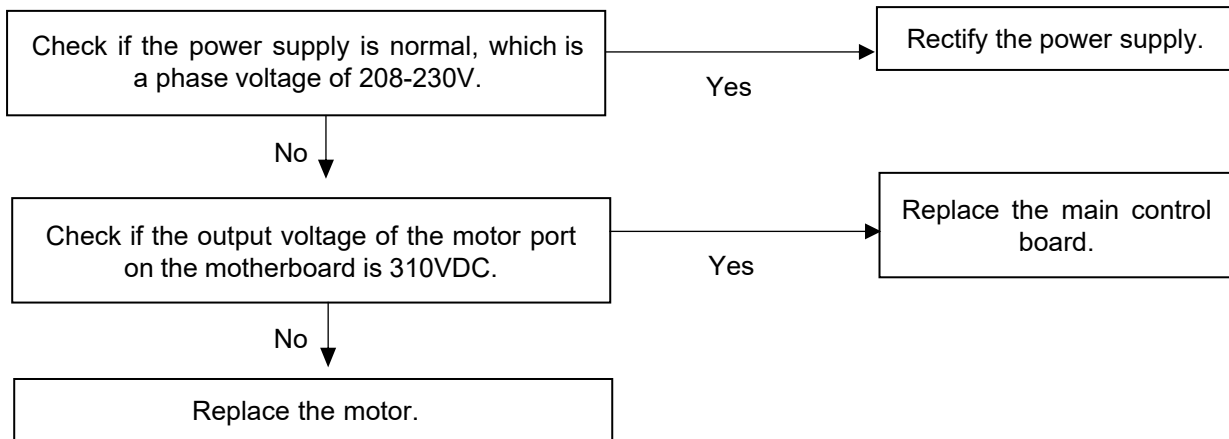


- Fasten the IPM heat sink cover plate.

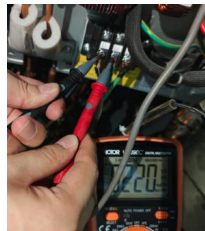


**23) P9: DC Fan Malfunction**

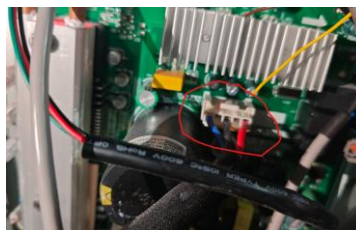
**Cause:** The fan drive module is experiencing abnormal detection.



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

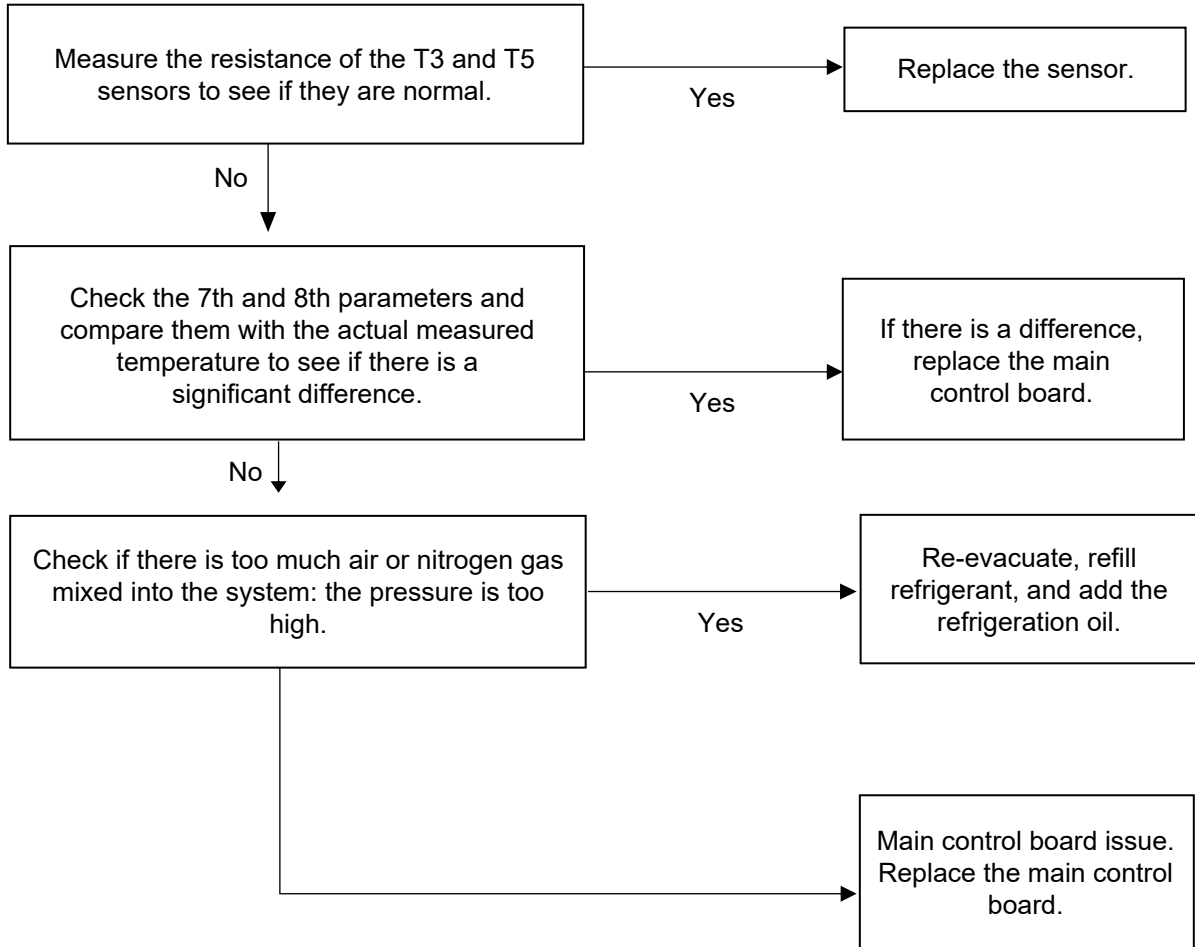


- Check if the output voltage of the motor port on the main board is 310VDC.

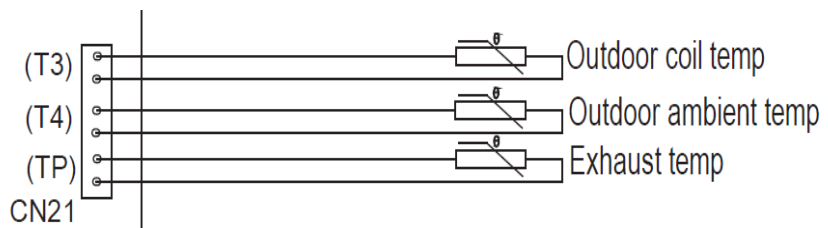
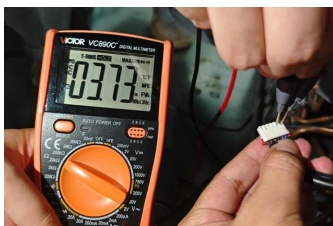


## 24) PC, H7: Wet Operation Error

**Cause:** The superheat  $T5-T3 \leq 41^{\circ}\text{F}/5^{\circ}\text{C}$ .



- 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  $41^{\circ}\text{F}(5^{\circ}\text{C})$ . If it's not less than  $41^{\circ}\text{F}(5^{\circ}\text{C})$ , replace the main control board.
- If  $T3-T5$  is indeed less than  $41^{\circ}\text{F}(5^{\circ}\text{C})$ , 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.

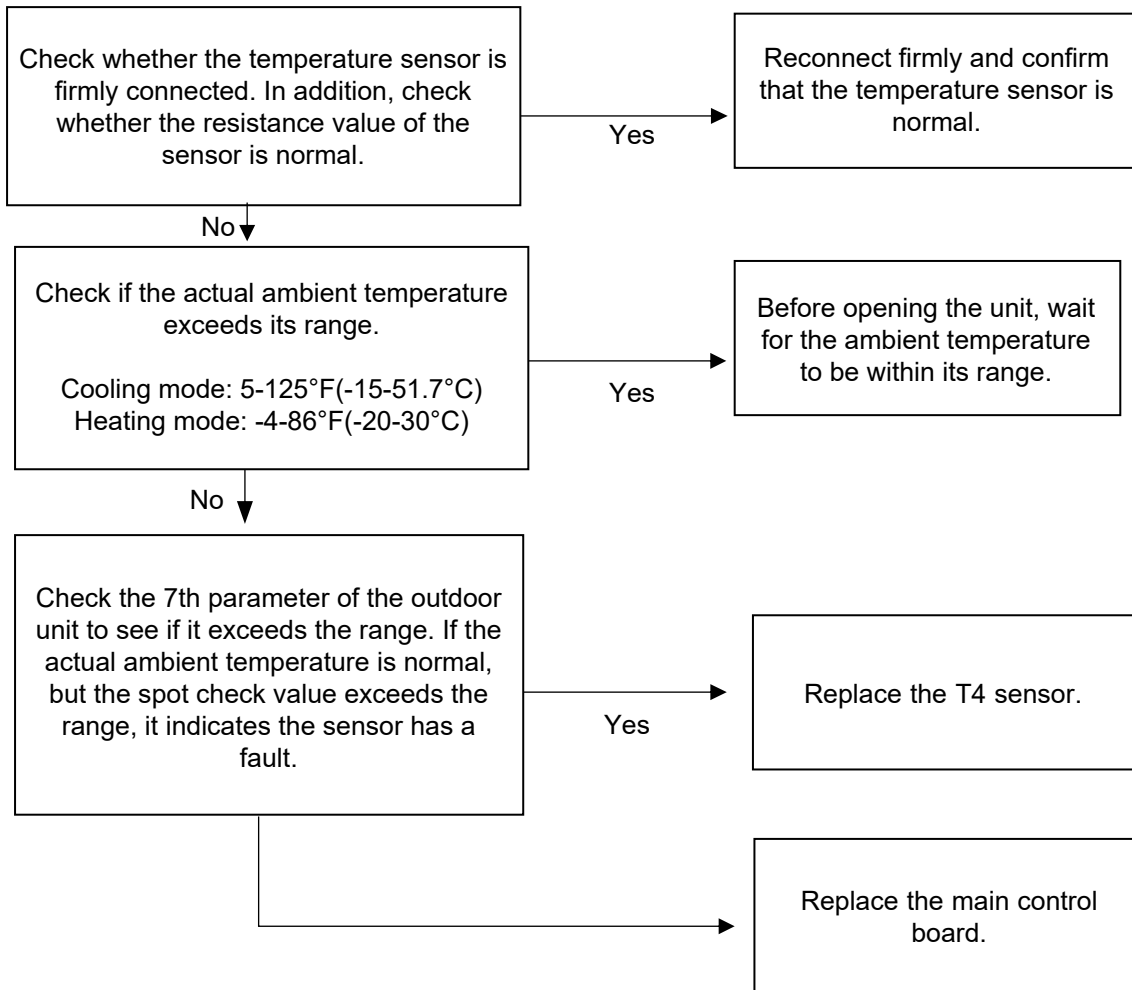
**27) LA, LB, LC, LD, LE, LF: DC**

**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     |               |           |           |           |

The design and specifications of this product are subject to change without prior notice as development continues. Consult with the sales agency or manufacturer for details. Refer to the equipment nameplate for all other applicable specifications.



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