



R410A

Commercial Air Conditioners

Service Manual

Mini TVR Individual **Series**



4TVH0068BK000AA

4TVH0076BK000AA

4TVH0089BK000AA

4TVH0136BK000AA

4TVH0153BK000AA

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Part 1

General Information

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1 Indoor and Outdoor Unit Capacities

1.1 Indoor Units

Table 1-1.1: Indoor unit abbreviation codes

Abbreviation code	Type
Q1	One-way Cassette
Q2	Two-way Cassette
Q4C	Compact Four-way Cassette
Q4	Four-way Cassette
T2	Medium Static Pressure Duct

Abbreviation code	Type
T1	High Static Pressure Duct
G	Wall-mounted
DL	Ceiling & Floor
F	Floor Standing

Table 1-1.2: Indoor unit capacity range

Capacity			Capacity index	Q1	Q2	Q4C	Q4	T2	T1	G	DL	F
kW	kBtu/h	HP										
1.8	5	0.6	18	18	—	—	—	—	—	—	—	—
2.2	7	0.8	22	22	22	22	—	22	—	22	—	22
2.8	9	1	28	28	28	28	28	28	—	28	—	28
3.6	12	1.25	36	36	36	36	36	36	—	36	36	36
4.5	15	1.6	45	45	45	45	45	45	—	45	45	45
5.6	19	2	56	56	56	—	56	56	—	56	56	56
7.1	24	2.5	71	71	71	—	71	71	71	71	71	71
8.0	27	3	80	—	—	—	80	80	80	80	80	80
9.0	30	3.2	90	—	—	—	90	90	90	90	90	—
10.0	34	3.6	100	—	—	—	100	—	—	—	—	—
11.2	38	4	112	—	—	—	112	112	112	—	112	—
14.0	48	5	140	—	—	—	140	140	140	—	140	—
16.0	55	6	160	—	—	—	—	—	160	—	160	—
20.0	68	7	200	—	—	—	—	—	200	—	—	—
25.0	85	9	250	—	—	—	—	—	250	—	—	—
28.0	96	10	280	—	—	—	—	—	280	—	—	—
40.0	136	14	400	—	—	—	—	—	400	—	—	—
45.0	154	16	450	—	—	—	—	—	450	—	—	—
56.0	191	20	560	—	—	—	—	—	560	—	—	—

1.2 Heat recovery ventilator

Table 1-1.4: Heat recovery ventilator capacity range

Capacity	m ³ /h	200	300	400	500	800	1000	1500	2000
	CFM	120	180	240	300	470	590	880	1180

1.3 Outdoor Units

Table 1-1.5: Outdoor unit capacity range

Capacity	Model Name
7HP	4TVH0068BK000AA
8HP	4TVH0076BK000AA
9HP	4TVH0089BK000AA
14HP	4TVH0136BK000AA
16HP	4TVH0153BK000AA










Notes:

1. Individual Series outdoor units could not be combined.

2 External Appearance

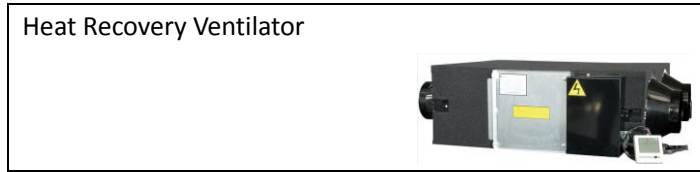
2.1 Indoor Units

Table 1-2.1: Indoor unit appearance

<p>One-way Cassette</p> <p>Q1</p> 	<p>Two-way Cassette</p> <p>Q2</p> 
<p>Compact Four-way Cassette</p> <p>Q4C</p> 	<p>Four-way Cassette</p> <p>Q4</p> 
<p>Medium Static Pressure Duct</p> <p>T2</p> 	<p>High Static Pressure Duct</p> <p>T1</p> 
<p>Wall-mounted</p> <p>G</p> 	<p>Ceiling & Floor</p> <p>DL</p> 
<p>Floor Standing</p> <p>F</p> 	

2.2 Heat Recovery Ventilator

Table 1-2.3: Heat recovery ventilator appearance



2.3 Outdoor Units

Table 1-2.4: Outdoor unit appearance

7/8/9HP	14/16HP
	

3 Combination Ratio

$$\text{Combination ratio} = \frac{\text{Sum of capacity indexes of the indoor units}}{\text{Capacity index of the outdoor unit}}$$

Table 1-4.1: Indoor and outdoor unit combination ratio limitations

Type	Minimum combination ratio	Maximum combination ratio
outdoor units	50%	130%

Table 1-4.2: Combinations of Indoor and outdoor units

Outdoor unit capacity			Sum of capacity indexes of connected indoor units (standard indoor units only)	Sum of capacity indexes of connected indoor units (fresh air processing units and standard indoor units together)	Maximum number of connected indoor units
kW	HP	Capacity index			
20	7	200	100 to 260	100 to 200	10
22.4	8	224	112 to 291.2	112 to 224	11
26	9	260	130 to 338	130 to 260	12
40	14	400	200 to 520	200 to 400	14
45	16	450	225 to 585	225 to 450	15

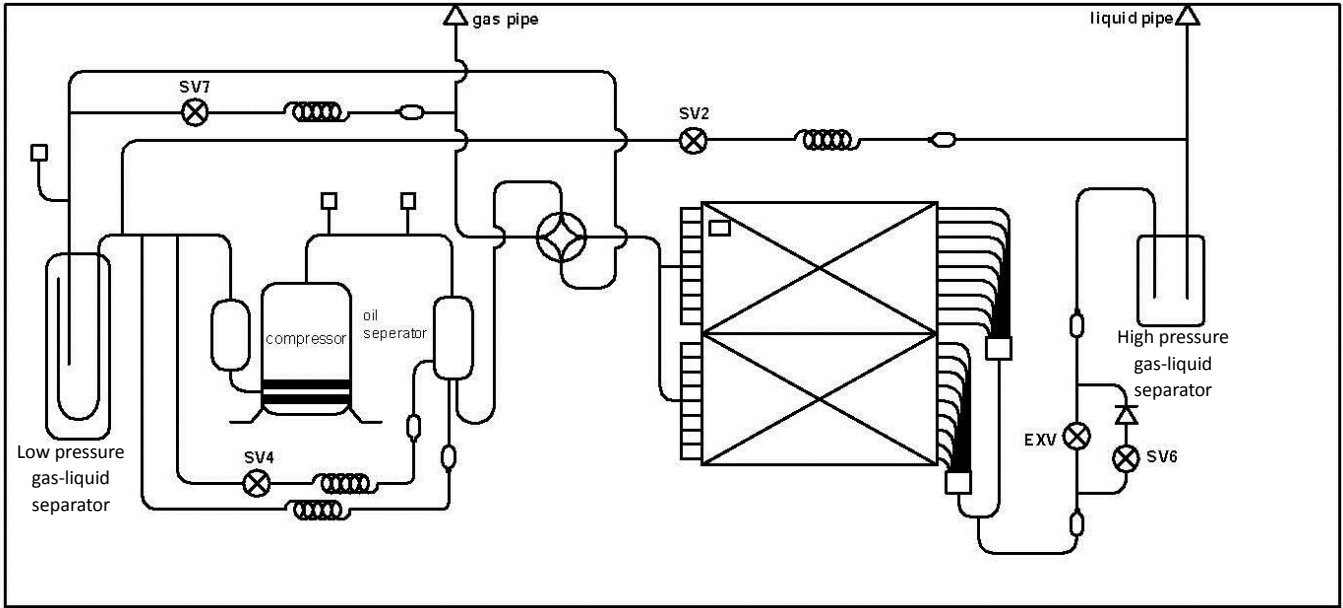
Part 2

Component Layout and Refrigerant Circuits

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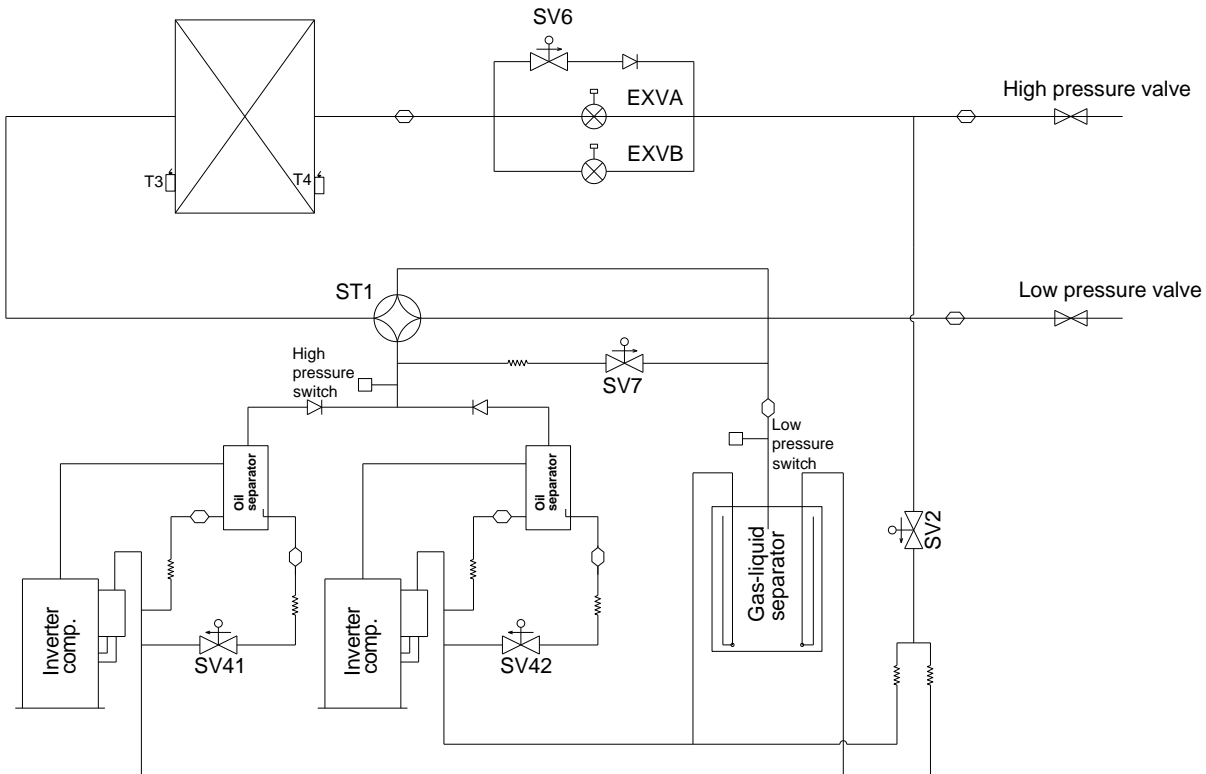
1 Piping Diagrams

Figure 2-1.1: 7/8/9HP piping diagram



Notes:
20Kw doesn't have SV6

Figure 2-1.2: 14/16HP piping diagram



Key components:

- Oil separator:**
 Separates oil from gas refrigerant pumped out of the compressor and quickly returns it to the compressor. Separation efficiency is up to 99%.
- Accumulator:**
 Stores liquid refrigerant and oil to protect compressor from liquid hammering.

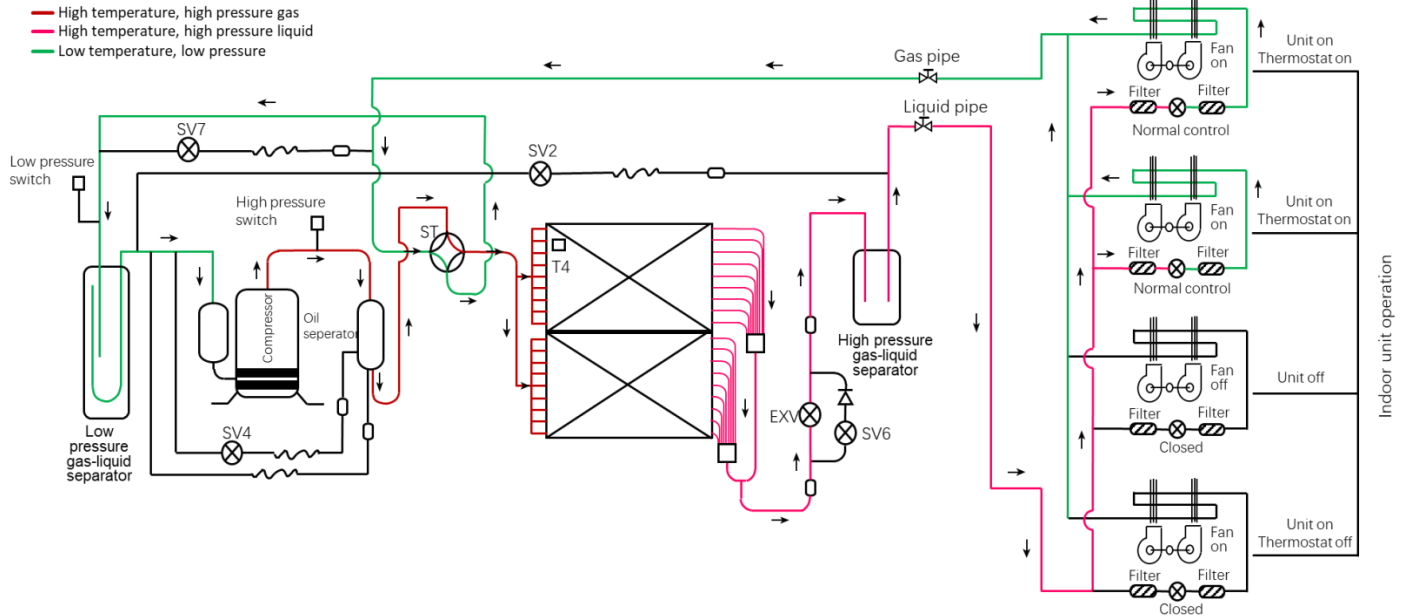
3. **Electronic expansion valve (EXV):**
Controls refrigerant flow and reduces refrigerant pressure.
4. **Four-way valve(ST1):**
Controls refrigerant flow direction. Closed in cooling mode and open in heating mode. When closed, the heat exchanger functions as a condenser; when open, the heat exchanger functions as an evaporator.
5. **Solenoid valve SV2:**
Protects the compressor. If compressor discharge temperature rises above 98°C, SV2 opens and sprays a small amount of liquid refrigerant to cool the compressor. SV2 closes again once the discharge temperature has fallen below 85°C.
6. **Solenoid valve SV4:**
Returns oil to the compressor. Opens once the compressor has run for 200 seconds and closes 600 seconds later and then opens for 3 minutes every 20 minutes.
7. **Solenoid valve SV6**
By-pass the refrigerant. It will be closed in heating and standby mode. It will be open in forced cooling and oil return mode. In cooling mode, it will be open or closed according to discharge pressure.
8. **Solenoid valve SV7:**
Allows refrigerant return to the compressor directly. Opens when indoor air temperature is close to the set temperature to avoid frequent compressor on/off.
9. **High and low pressure switches:**
Regulate system pressure. When system pressure rises above the upper limit or falls below the lower limit, the high or low pressure switches turn off, stopping the compressor. After 5 minutes, the compressor restarts.

2 Refrigerant Flow Diagrams

2.1 7/8/9 HP refrigerant Flow Diagrams

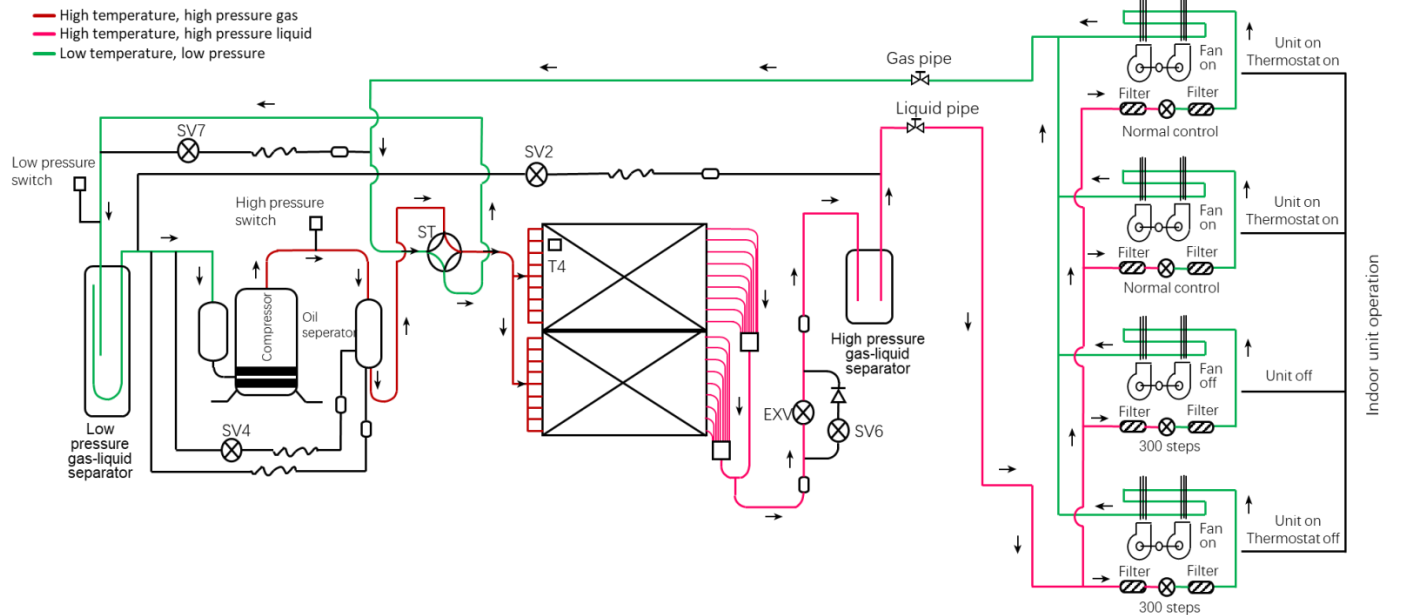
Cooling operation

Figure 2-3.1: 7/8/9HP refrigerant flow during cooling operation



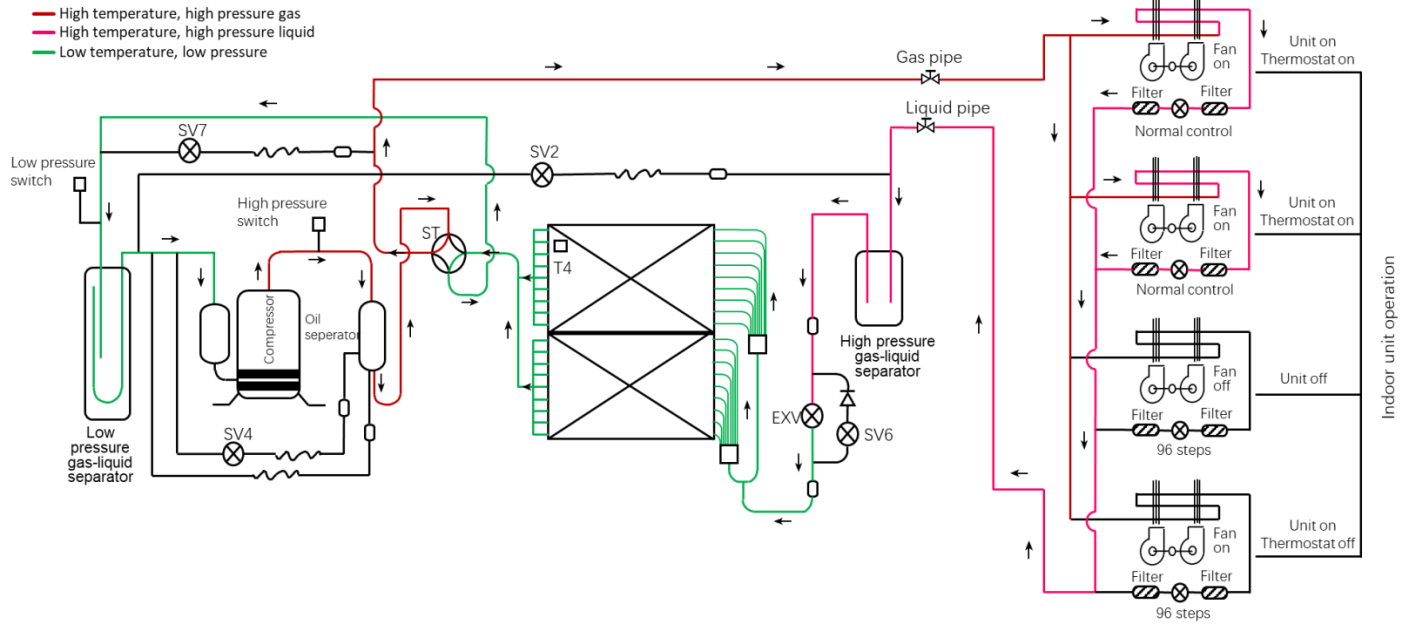
Oil return operation in cooling mode

Figure 2-3.2: 7/8/9HP refrigerant flow during oil return operation in cooling mode



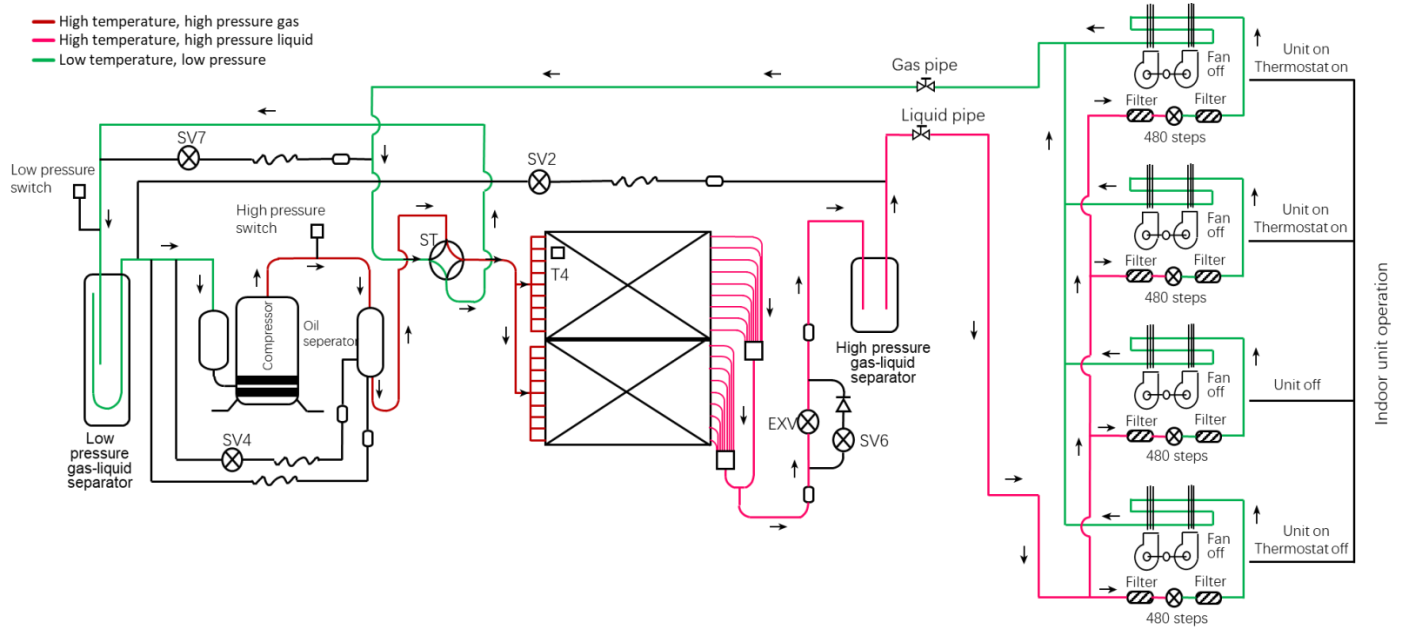
Heating operation

Figure 2-3.3: 7/8/9HP refrigerant flow during heating operation



Oil return operation in heating mode and defrosting operation

Figure 2-3.4: 7/8/9HP refrigerant flow during oil return operation in heating mode



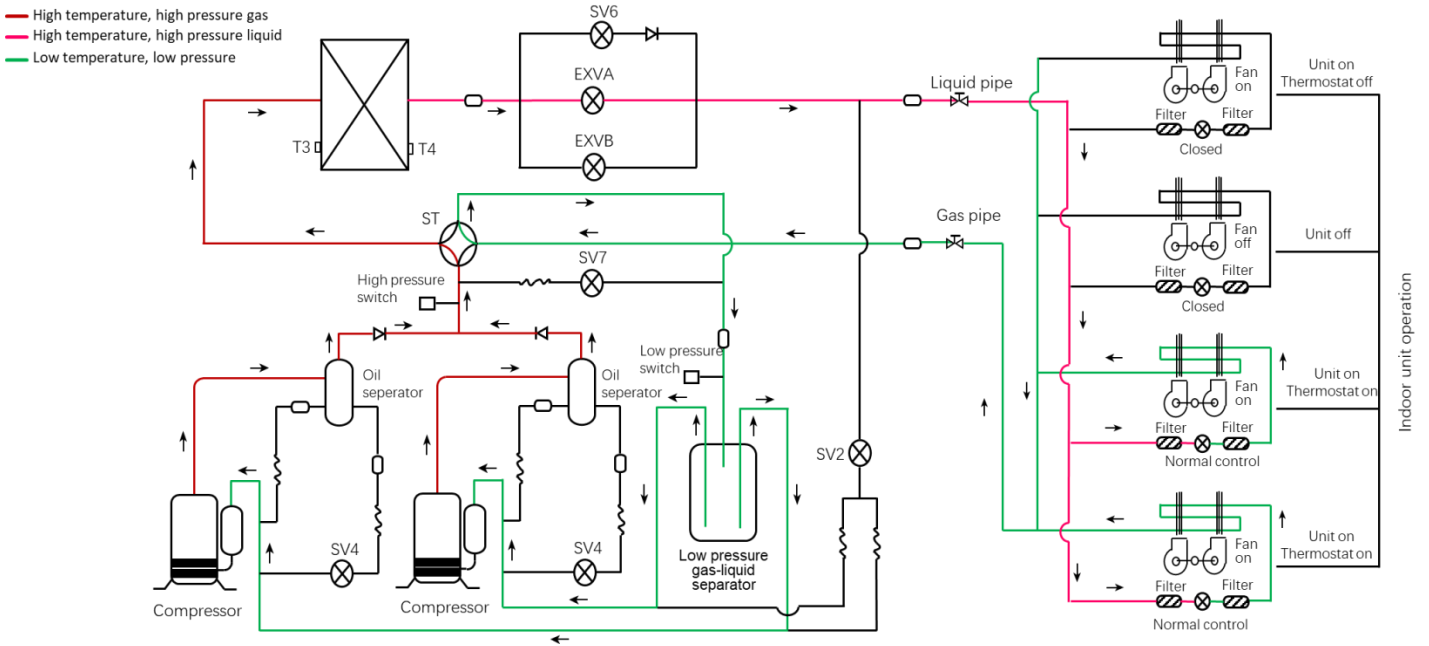
Mini TVR Individual 60Hz



2.2 14/16 HP refrigerant Flow Diagrams

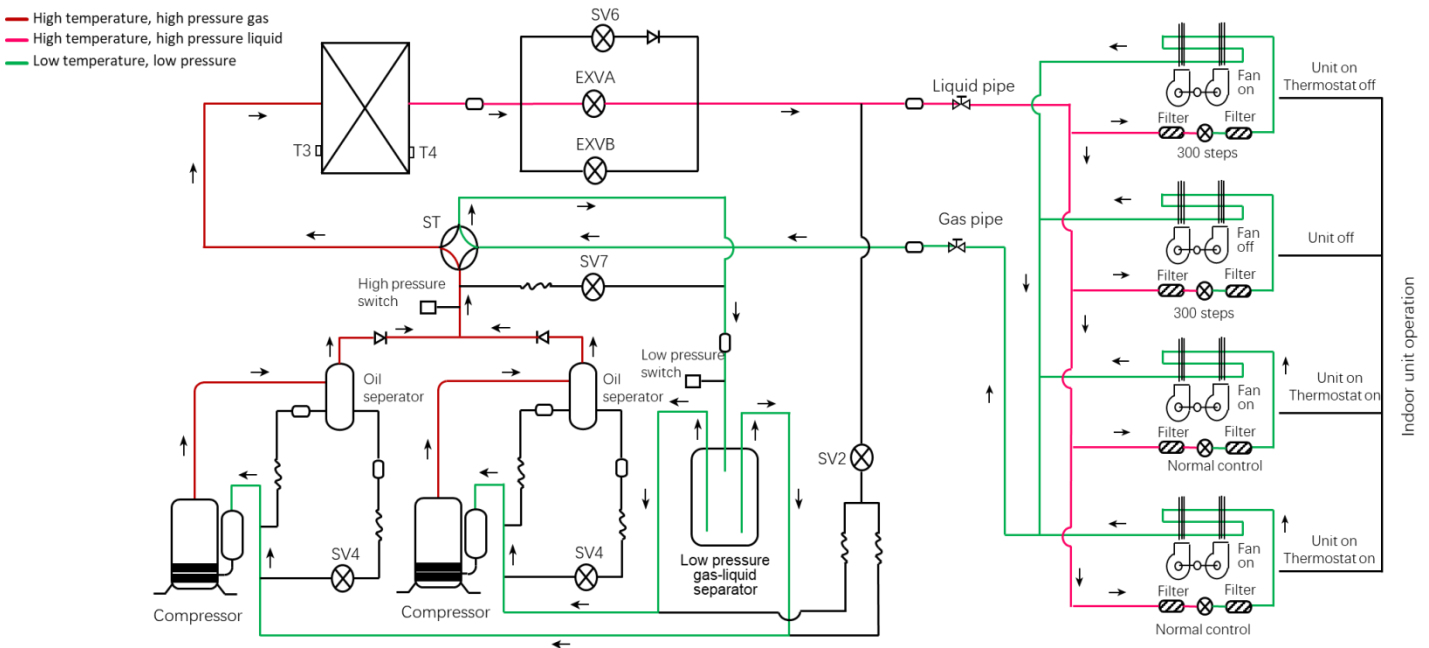
Cooling operation

Figure 2-3.5: 14/16HP refrigerant flow during cooling operation



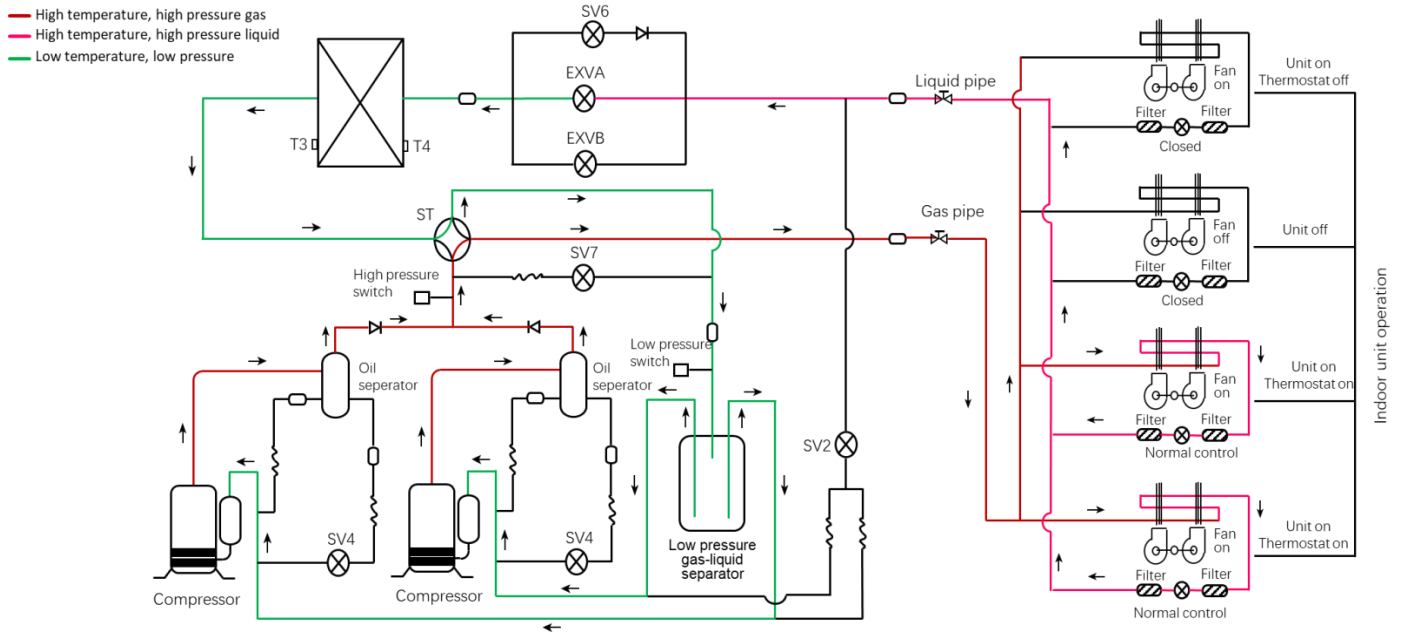
Oil return operation in cooling mode

Figure 2-3.6: 14/16HP refrigerant flow during oil return operation in cooling mode



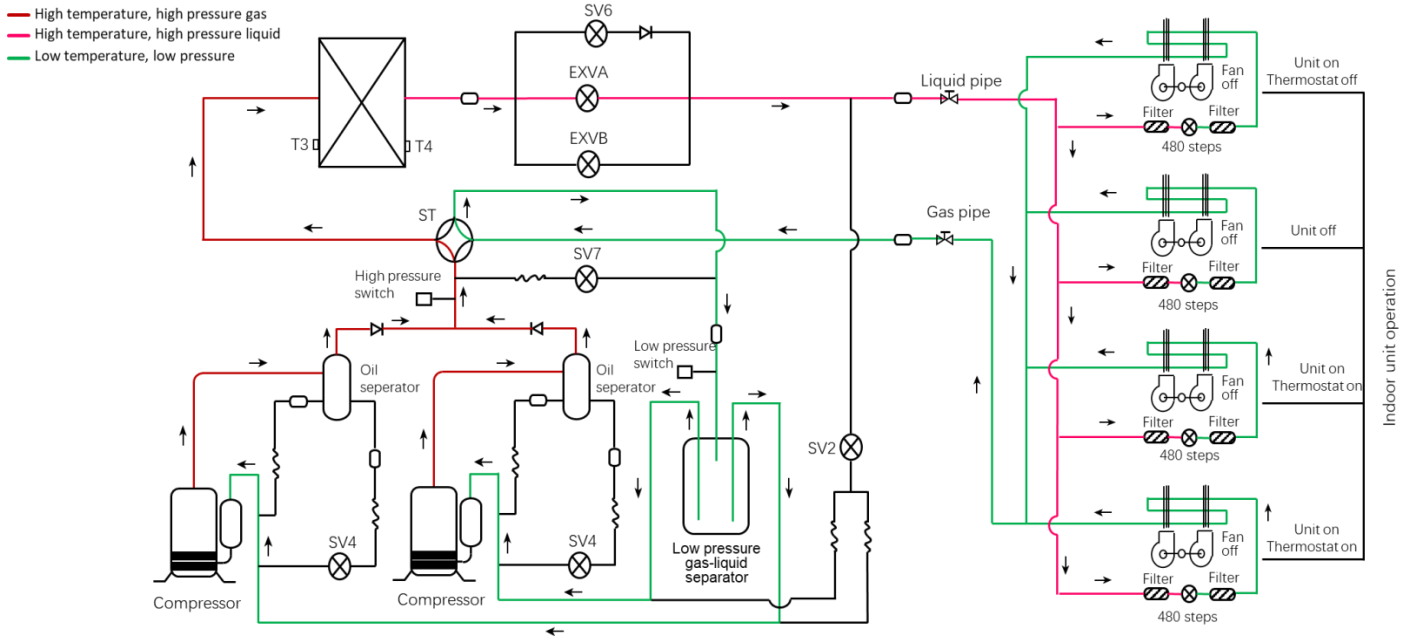
Heating operation

Figure 2-3.7: 14/16HP refrigerant flow during heating operation



Oil return operation in heating mode and defrosting operation

Figure 2-3.8: 14/16HP refrigerant flow during oil return operation in heating mode



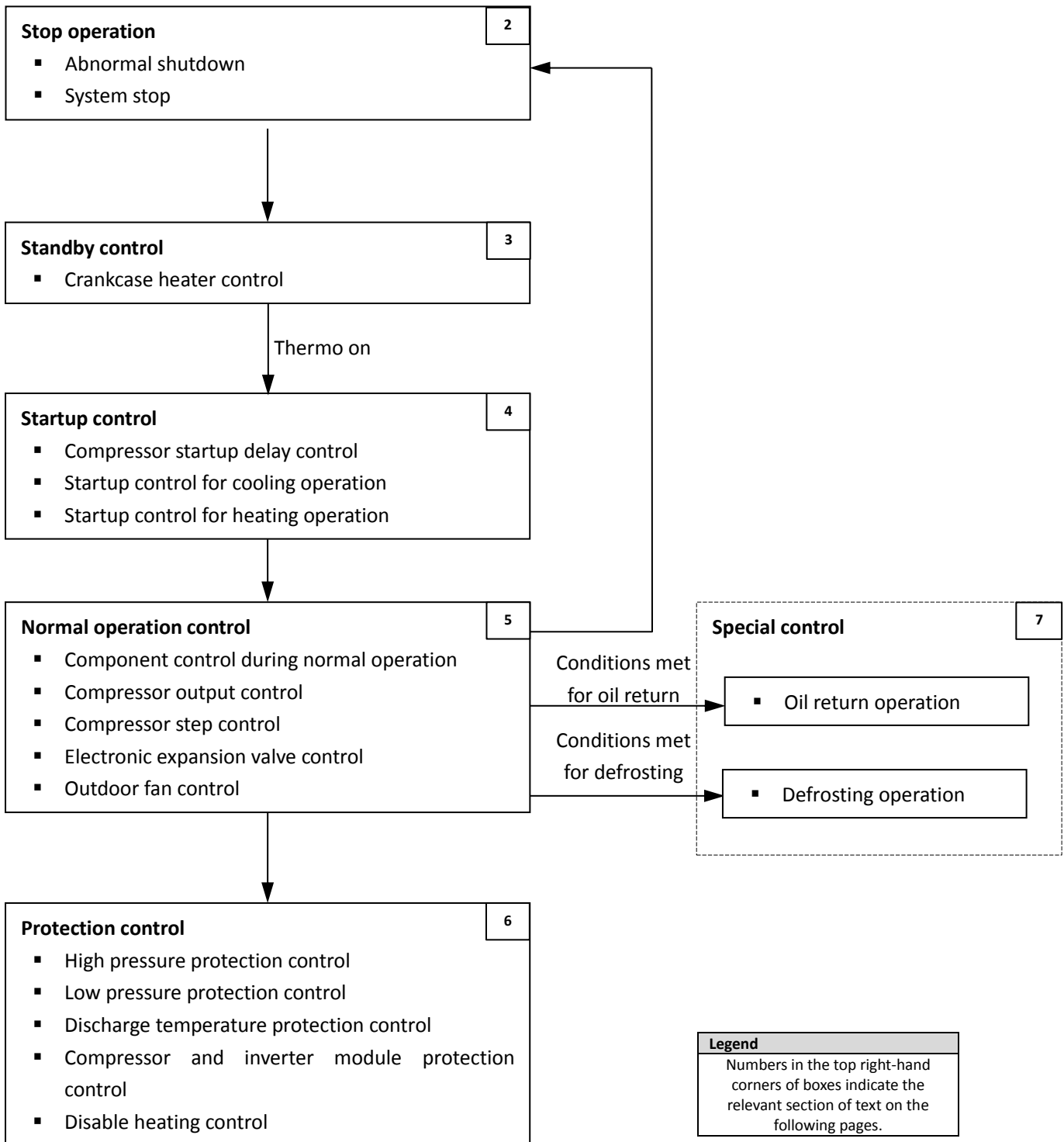
Part 3

Control

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1 General Control Scheme Flowchart

Sections 3-2 to 3-7 on the following pages detail when each of the controls in the flowchart below is activated.



2 Stop Operation

The stop operation occurs for one of the two following reasons:

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

3 Standby Control

3.1 Crankcase Heater Control

The crankcase heater is used to prevent refrigerant from mixing with compressor oil when the compressor is stopped. The crankcase heater is controlled according to outdoor ambient temperature and the compressor on/off state. When the outdoor ambient temperature is above 8°C or the compressor is running, the crankcase heater is off; when the outdoor ambient temperature is at or below 8°C and either the compressor has been stopped for more than 3 hours or the unit has just been powered-on (either manually or when the power has returned following a power outage), the crankcase heater turns on.

4 Startup Control

4.1 Compressor Startup Delay Control

In initial startup control and in restart control (except in oil return operation and defrosting operation), compressor startup is delayed such that a minimum of 5 minutes has elapsed since the compressor stopped, in order to prevent frequent compressor on/off and to equalize the pressure within the refrigerant system.

4.2 Startup Control for Cooling Operation

Table 3-4.1: Component control during startup in cooling mode

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement, operating frequency increased by 1 step / sec
Upper DC fan motor	FAN_UP	•	At initial speed for 20 seconds, then fan speed ¹ controlled according to outdoor ambient temperature (T4) and compressor frequency.
Lower DC fan motor	FAN_DOWN	•	
Electronic expansion valve	EEV	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature
Four-way valve	ST1	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	Off
Solenoid valve (oil balance)	SV4	•	Open for 120 secs, closed for 180 secs, then open
Solenoid valve (liquid refrigerant passby)	SV6	•	On
Solenoid valve (indoor units bypass)	SV7	•	Off

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.5 "Outdoor Fan Control".
2. 7Hp doesn't have SV6

4.3 Startup Control for Heating Operation

Table 3-4.2: Component control during startup in heating mode

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement, operating frequency increased by 1 step / sec
Upper DC fan motor	FAN_UP	•	At initial speed for 20 seconds, then fan speed ¹ controlled according to outdoor ambient temperature (T4) and compressor frequency.
Lower DC fan motor	FAN_DOWN	•	
Electronic expansion valve	EEV	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge superheat temperature
Four-way valve	ST1	•	On
Solenoid valve (liquid refrigerant injection)	SV2	•	Off
Solenoid valve (oil balance)	SV4	•	Open for 120 secs, closed for 180 secs, then open
Solenoid valve (liquid refrigerant passby)	SV6	•	Off
Solenoid valve (indoor units bypass)	SV7	•	When T4 < 3°C and compressor frequency is ≥ 52Hz, open for 10 minutes and then closed

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.5 "Outdoor Fan Control".
2. 7Hp doesn't have SV6

5 Normal Operation Control

5.1 Component Control during Normal Operation

Table 3-5.1: Component control during normal cooling operation

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	●	Controlled according to load requirement
Upper DC fan motor	FAN_UP	●	Fan speed ¹ controlled according to heat exchanger temperature (T3) and compressor frequency: <ul style="list-style-type: none"> T3 checked every 20 seconds: <ul style="list-style-type: none"> T3 ≤ 34°C => 1 step decrease. 37°C ≤ T3 ≤ 40°C => 1 step increase. T3 ≥ 40°C=> speed 1.
Lower DC fan motor	FAN_DOWN	●	
Electronic expansion valve	EEV	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature
Four-way valve	ST1	●	Off
Solenoid valve (liquid refrigerant injection)	SV2	●	Open when compressor discharge temperature rises above 98°C, closes again once the discharge temperature has fallen below 85°C
Solenoid valve (oil balance)	SV4	●	Open for 3 minutes every 20 minutes
Solenoid valve (liquid refrigerant passby)	SV6	●	Open when T5 ≥ 95°C or T3 ≥ 55°C, close when T5 ≤ 89°C or T3 ≤ 50°C
Solenoid valve (indoor units bypass)	SV7	●	Off

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.5 "Outdoor Fan Control".
2. 7Hp doesn't have SV6

Table 3-5.2: Component control during heating operation

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	●	Controlled according to load requirement
Upper DC fan motor	FAN_UP	●	Fan speed ¹ controlled according to outdoor unit heat exchanger refrigerant temperature (T3) <ul style="list-style-type: none"> T3 checked every 20 seconds: <ul style="list-style-type: none"> T3 ≤ 15°C => 1 step increase. T3 ≥ 18°C => 2 step decrease.
Lower DC fan motor	FAN_DOWN	●	
Electronic expansion valve	EEV	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge superheat temperature
Four-way valve	ST1	●	On
Solenoid valve (liquid refrigerant injection)	SV2	●	Open when compressor discharge temperature rises above 98°C, closes again once the discharge temperature has fallen below 85°C
Solenoid valve (oil balance)	SV4	●	Opens for 3 minutes every 20 minutes
Solenoid valve (liquid refrigerant passby)	SV6	●	Off
Solenoid valve (indoor units bypass)	SV7	●	Open after oil return operation and defrost operation, controlled according to compressor running time and frequency

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.5 "Outdoor Fan Control".
2. 7Hp doesn't have SV6

5.2 Compressor Output Control

The compressor rotation speed is controlled according to the load requirement. Before compressor startup, the outdoor unit first estimates the indoor unit load requirement according to the nominal capacity of indoor units currently running, and then correct for ambient temperature. The compressors then start up according to the corrected load requirement.

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During operation the compressors are controlled according to the nominal capacity of indoor units currently running and the indoor unit heat exchanger temperatures.

5.3 Compressor Step Control

The running speed of the compressors in rotations per second (rps) is one third of the frequency (in Hz) of the electrical input to the compressor motors. The compressor speed can be altered in increments of 1 rps.

5.4 Electronic Expansion Valve Control

The position of electronic expansion valves EXV is controlled in steps from 0 (fully closed) to 480 (fully open).

In cooling mode:

- When the outdoor unit is in standby:
 - EXV is at position 350 (steps).
- When the outdoor unit is running:
 - EXV is controlled according to discharge temperature.

In heating mode:

- When the outdoor unit is in standby:
 - EXV is at position 350 (steps).
- When the outdoor unit is running:
 - EXV is controlled according to discharge superheat.

5.5 Outdoor Fan Control

The speed of the outdoor unit fans is adjusted in steps, as shown in Table 3-5.3.

Table 3-5.3: Outdoor fan speed steps

Fan speed index	7/8/9Hp		14/16Hp	
	Upper fan ¹	Lower fan ²	Upper fan ¹	Lower fan ²
1	310	0	330	/
2	340	310	420	/
3	400	380	530	/
4	480	460	590	/
5	560	540	340	480
6	640	620	440	480
7	760	740	530	480
8	860	840	620	480
9	900	880	700	730
10	/	/	750	730

Notes:

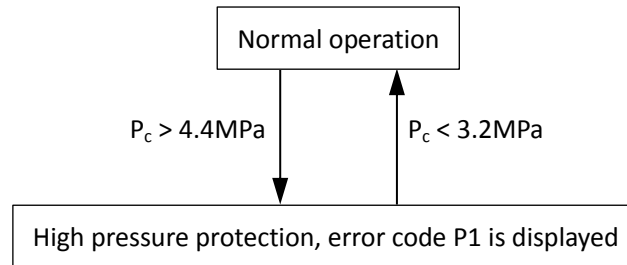
1. The upper fan is labelled FAN_UP in the wiring diagram. Refer to the MINI TVR INDIVIDUALi Engineering Data Book Part 2, 5 "Wiring diagram".
2. The lower fan is labelled FAN_DOWN in the wiring diagram. Refer to the MINI TVR INDIVIDUALi Engineering Data Book Part 2, 5 "Wiring diagram".

6 Protection Control

6.1 High Pressure Protection Control

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

Figure 3-6.1: High pressure protection control



Notes:

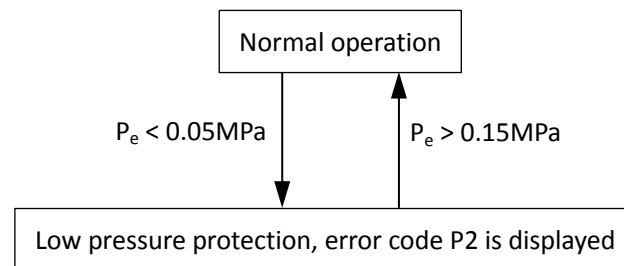
1. P_c : Discharge pressure

When the discharge pressure rises above 4.4MPa the system displays P1 protection and the unit stops running. When the discharge pressure drops below 3.2MPa, the compressor enters re-start control.

6.2 Low Pressure Protection Control

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

Figure 3-6.2: Low pressure protection control



Notes:

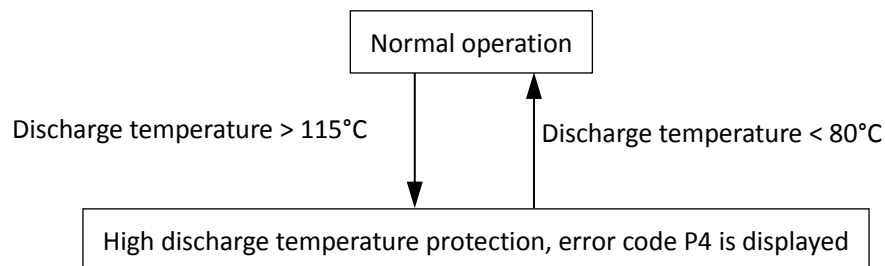
1. P_e : Suction pressure

When P2 protection occurs 3 times in 30 minutes (60 minutes for 14/16Hp), the H5 error is displayed. When an H5 error occurs, a manual system restart is required before the system can resume operation.

6.3 Discharge Temperature Protection Control

This control protects the compressors from abnormally high temperatures and transient spikes in temperature. It is performed for each compressor.

Figure 3-6.3: High discharge temperature protection control



When the discharge temperature rises above 115°C the system displays P4 protection and the unit stops running. When the discharge temperature drops below 80°C, the compressor enters re-start control.

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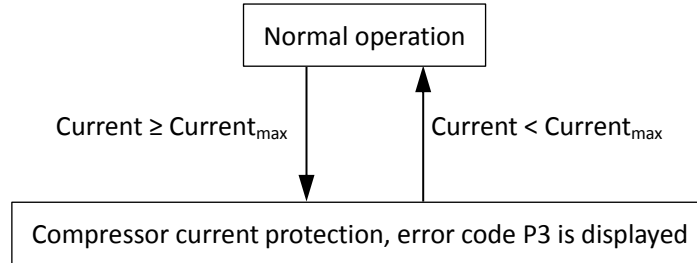


When P4 protection occurs 3 times in 100 minutes, the H6 error is displayed (only for 14/16Hp). When an H6 error occurs, a manual system restart is required before the system can resume operation.

6.4 Compressor and Inverter Module Protection Control

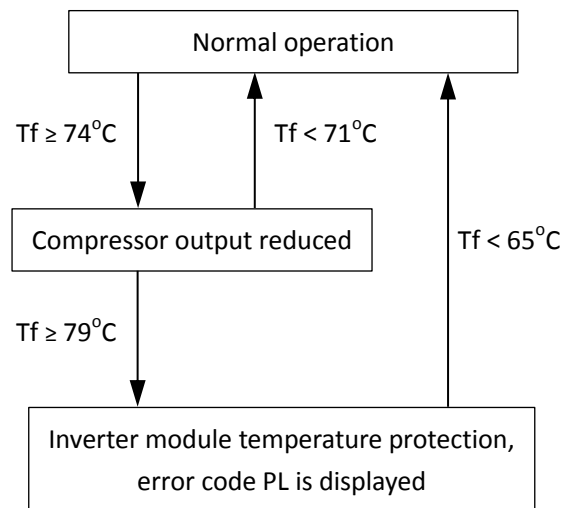
This control protects the compressors from abnormally high currents and protects the inverter modules from abnormally high temperatures.

Figure 3-6.4: Compressor current protection control



Compressor model	LNB42FSAMC	LNB53FCAMC
Current _{max}	18A	23A

Figure 3-6.5: Inverter module temperature protection control

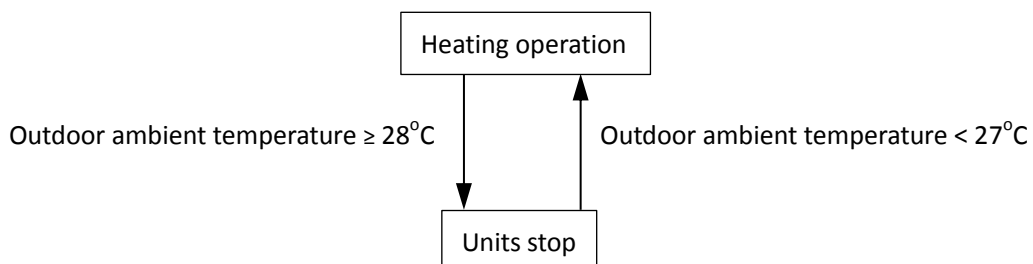


- Notes:
1. Tf: Heat sink temperature

6.5 Disable Heating Control

When the outdoor ambient temperature rises above or equal to 28°C heating mode is disabled to prevent the mechanical load on compressors becoming too high and to prevent low compression ratios which can result in insufficient compressor internal oil lubrication. When the outdoor ambient temperature drops below 27°C, the compressor enters re-start control.

Figure 3-6.6: Disable heating control



7 Special Control

7.1 Oil Return Operation

In order to prevent compressors from running out of oil, the oil return operation is conducted to recover oil that has flowed out of the compressor(s) and into the piping system. This operation is performed for all units including units that are in standby.

Timing of oil return operation:

- When the initial cumulative operating time reaches 140 minutes and then every 8 hours.

Tables 3-7.1 and 3-7.2 show component control during oil return operation in cooling mode.

Table 3-7.1: Outdoor unit component control during oil return operation in cooling mode

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	•	Controlled according to load requirement
Upper DC fan motor	FAN_UP	•	Fan speed controlled according to heat exchanger temperature (T3) and compressor frequency
Lower DC fan motor	FAN_DOWN	•	
Electronic expansion valve	EEV1	•	Position 300 (steps)
Four-way valve	ST1	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	Normal control
Solenoid valve (oil balance)	SV4	•	Normal control
Solenoid valve (liquid refrigerant passby)	SV6	•	Normal control
Solenoid valve (indoor units bypass)	SV7	•	Normal control

Notes:

1. 7Hp doesn't have SV6

Table 3-7.2: Indoor unit component control during oil return operation in cooling mode

Component	Unit state	Control functions and states
Fan	Thermo on	Remote controller setting
	Standby	Off
	Thermo off	Off
Electronic expansion valve	Thermo on	Normal control
	Standby	300 (steps)
	Thermo off	300 (steps)

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Tables 3-7.3 and 3-7.4 show component control during oil return operation in heating mode.

Table 3-7.3: Outdoor unit component control during oil return operation in heating mode

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	●	Controlled according to load requirement
Upper DC fan motor	FAN_UP	●	Fan speed controlled according to heat exchanger temperature (T3) and compressor frequency
Lower DC fan motor	FAN_DOWN	●	
Electronic expansion valve	EEV1	●	Position 350 (steps)
Four-way valve	ST1	●	Off
Solenoid valve (liquid refrigerant injection)	SV2	●	Normal control
Solenoid valve (oil balance)	SV4	●	Normal control
Solenoid valve (liquid refrigerant passby)	SV6	●	Normal control
Solenoid valve (indoor units bypass)	SV7	●	Normal control

Notes:

1. 7Hp doesn't have SV6

Table 3-7.4: Indoor unit component control during oil return operation in heating mode

Component	Unit state	Control functions and states
Fan	Thermo on	Off
	Standby	Off
	Thermo off	Off
Electronic expansion valve	Thermo on	Normal control
	Standby	480 (steps)
	Thermo off	480 (steps)

7.2 Defrosting Operation

In order to recover heating capacity, the defrosting operation is conducted when the outdoor unit heat exchanger is performing as an evaporator. The defrosting operation is controlled according to outdoor ambient temperature, outdoor heat exchanger temperature, indoor heat exchanger temperature and outdoor unit running time. When the outdoor unit is running in defrosting, the digital display on outdoor main PCB will display "df".

Table 3-7.5: Outdoor unit component control during defrosting operation

Component	Wiring diagram label	7/8/9/14/16Hp	Control functions and states
Inverter compressor	COMP	●	Controlled according to load requirement
Upper DC fan motor	FAN_UP	●	Off
Lower DC fan motor	FAN_DOWN	●	
Electronic expansion valve	EEV1	●	Position 480 (steps)
Four-way valve	ST1	●	Off
Solenoid valve (liquid refrigerant injection)	SV2	●	Normal control
Solenoid valve (oil balance)	SV4	●	Normal control
Solenoid valve (liquid refrigerant passby)	SV6	●	Normal control
Solenoid valve (indoor units bypass)	SV7	●	Normal control

Notes:

1. 7Hp doesn't have SV6

Table 3-7.6: Indoor unit component control during defrosting operation

Component	Unit state	Control functions and states
Fan	Thermo on	Off
	Standby	Off
	Thermo off	Off
Electronic expansion valve	Thermo on	480 (steps)
	Standby	480 (steps)
	Thermo off	480 (steps)

Part 4

Field Settings

1 Outdoor Unit Field Settings 29

1 Outdoor Unit Field Settings

1.1 PCB Switches and Switch Settings

Figure 4-1.1: 7/8/9Hp outdoor unit main PCB switches

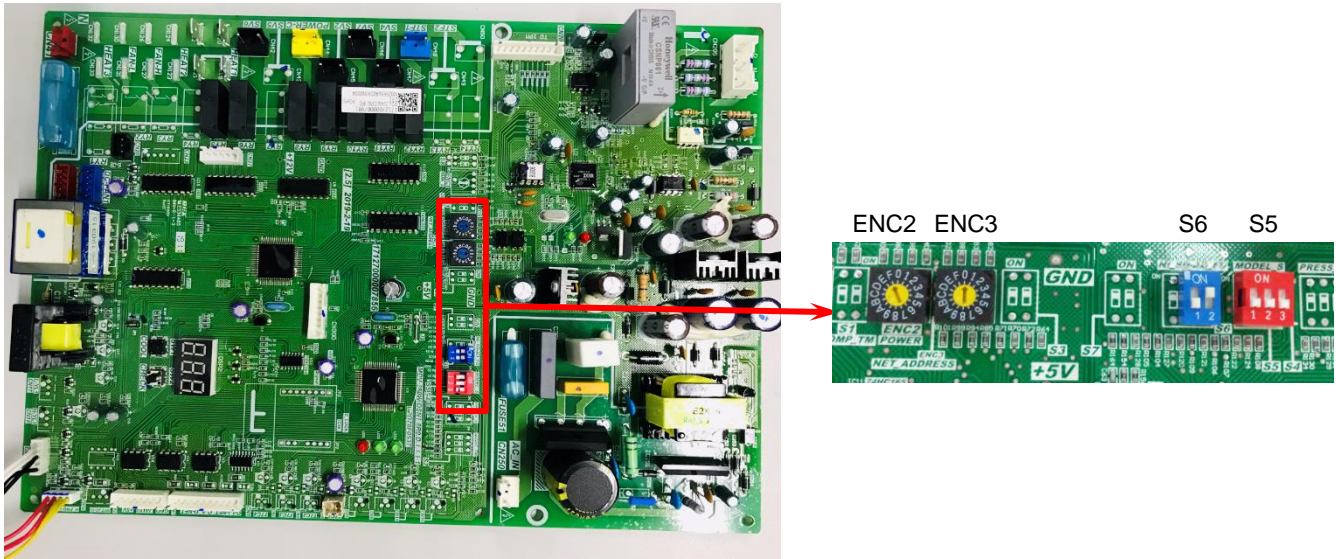


Table 4-1.1: 7/8/9Hp outdoor unit main PCB switch settings

Switch	Setting	Switch positions ¹	Description
	Outdoor unit capacity		Only 22.4/26kW units have ENC2 dial switch. ENC2 is used for outdoor unit capacity setting (F refer to 22.4kW; 0 refer to 26kW)
	Network address		Only 22.4/26kW units have ENC3 dial switch. ENC3 is used for outdoor unit address setting (0-F refer to 0-15)
	Priority mode ²		Heating priority mode (factory default)
			Cooling priority mode
			Initial-start priority mode
			Only response to heating mode
			Only response to cooling mode
	Addressing mode		Auto addressing mode
			Manual addressing mode (factory default)
			Clean the indoor unit address (only available for auto searching new indoor unit)

Notes:

1. Black denotes the switch position.
2. Refer to Part 4, 1.2.1 "Priority mode setting".

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Figure 4-1.2: 14/16Hp outdoor unit main PCB switches

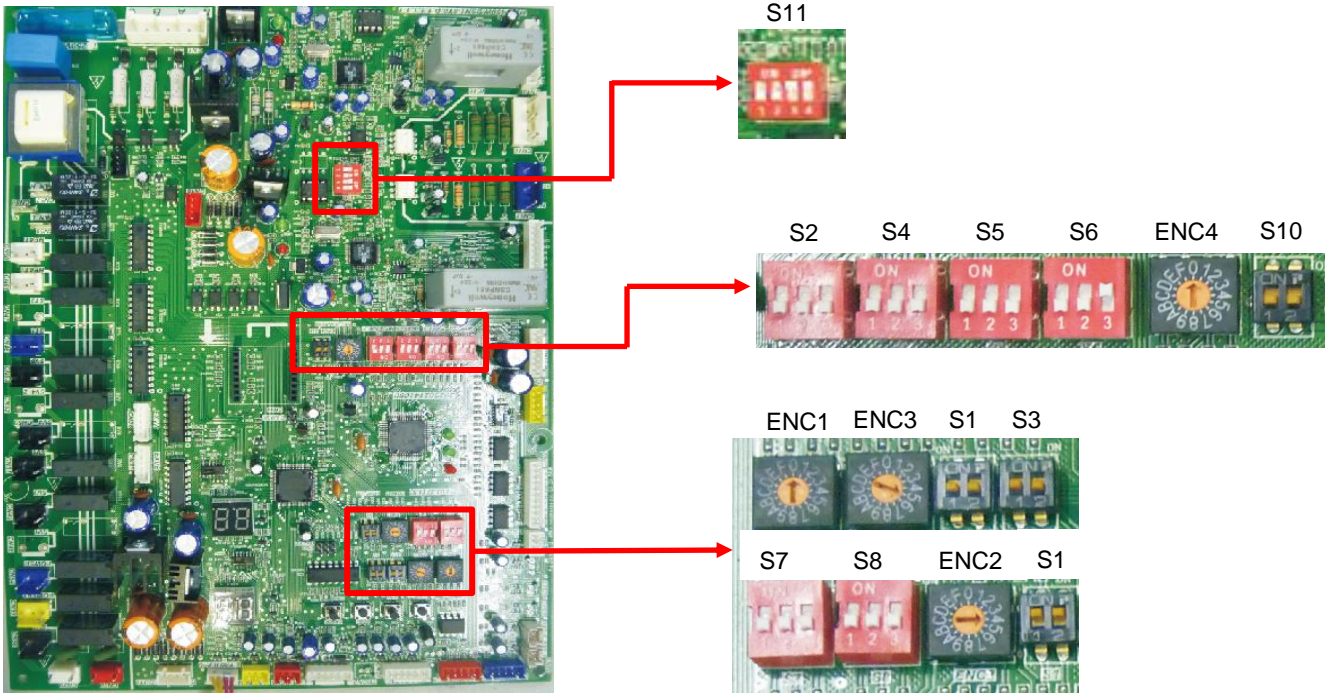
































Table 4-1.2: 14/16Hp outdoor unit main PCB switch settings

Switch	Setting	Switch positions ¹	Description
	Reserved		Reserved
	Outdoor unit capacity		Outdoor unit capacity setting: 4-5 are available (capacity code 4—40kW; capacity code 5—45kW)
	Network address		Outdoor unit network address setting (0-7 is effective)
	Quantity of indoor units		The quantity of indoor unit is 0-15. 0~9 on ENC3 refer to 0~9 indoor units; A~F on ENC3 refer to 10~15 indoor units.
			The quantity of indoor unit is 16-31. 0~9 on ENC3 refer to 16~25 indoor units; A~F on ENC3 refer to 26~31 indoor units.
			The quantity of indoor unit is 32-47. 0~9 on ENC3 refer to 32~41 indoor units; A~F on ENC3 refer to 42~47 indoor units.
			The quantity of indoor unit is 48-63. 0~9 on ENC3 refer to 48~57 indoor units; A~F on ENC3 refer to 58~63 indoor units.
	Starting time setting		Starting time is 5 minutes
			Starting time is 12 minutes (factor default)
	Night silent time		Nighttime silent time 6h/10h (factory default)
			Nighttime silent time 6h/12h
			Nighttime silent time 8h/10h
			Nighttime silent time 8h/10h

Table continued on next page ...

Table 4-1.2: 14/16Hp outdoor unit main PCB switch settings(continued)

Switch	Setting	Switch positions ¹	Description
	Silent mode		Nighttime silent mode (factory default)
			Silent mode
			Super silent mode
			No silent mode
	Static pressure mode		No static pressure mode (factory default)
			Low static pressure mode (should be customized)
			Medium static pressure mode (should be customized)
			High static pressure mode (should be customized)
	Priority mode ²		Heating priority mode(factory default)
			Cooling priority mode
			Initial-start priority mode
			Only response to heating mode
			Only response to cooling mode
	Addressing mode selection		Auto addressing mode
			Manual addressing mode (factory default)
			Indoor unit address reset (only available for auto searching new indoor unit)
	ON/OFF for indoor unit quantity		Indoor unit quantity setting function is open(factory default)
			Indoor unit quantity setting function is closed
	Factory default		Factory default
	Reserved		Reserved
	Outdoor unit capacity		6-10HP Outdoor unit settings
			12-18HP Outdoor unit settings

Notes:

1. Black denotes the switch position.
2. Refer to Part 4, 1.2.1 "Priority mode setting".

1.2 Modes Set on Main PCB

1.2.1 Priority mode setting

Priority mode can only be set on the outdoor unit. When an indoor unit is in mode conflict with the outdoor units the unit displays the mode conflict error. The digital display on indoor main PCB will display error code E0.

Figure 4-1.3: Indoor unit digital displays



There are five priority mode options:

1. Heating priority mode (default):

- a) **During cooling operation:** If an indoor unit requests heating, the outdoor unit stops and then restarts in heating mode after 5 minutes. Indoor units requesting heating then start in heating mode and indoor units requesting cooling display the mode conflict error.
- b) **During heating operation:** If an indoor unit requests cooling, the outdoor unit ignores the request and continues to run in heating mode. The indoor unit requesting cooling displays the mode conflict error. If all the indoor units requesting heating are later turned off and one or more indoor units are still requesting cooling, the outdoor unit restarts in cooling mode after 5 minutes and any indoor units requesting cooling then start in cooling mode.

2. Cooling priority mode:

- a) **During heating operation:** If an indoor unit requests cooling, the outdoor unit stops and then restarts in cooling mode after 5 minutes. Indoor units requesting cooling then start in cooling mode and indoor units requesting heating display the mode conflict error.
- b) **During cooling operation:** If an indoor unit requests heating, the outdoor units ignore the request and continue to run in cooling mode. The indoor unit requesting heating displays the mode conflict error. If all the indoor units requesting cooling are later turned off and one or more indoor units are still requesting heating, the outdoor unit restarts in heating mode after 5 minutes and any indoor units requesting heating then start in heating mode.

3. **First on priority mode:** The outdoor unit operates in the mode of the first on indoor unit is being requested. Indoor units that are in a mode different to the first on unit display the mode conflict error.

4. **Heating only mode:** The outdoor unit only operates in heating mode. Indoor units requesting heating operate in heating mode. Indoor units requesting cooling or in fan only mode display the mode conflict error.

5. **Cooling only mode:** The outdoor unit only operates in cooling mode. Indoor units requesting cooling operate in cooling mode; indoor units in fan only mode operate in fan only mode. Indoor units requesting heating display the mode conflict error.

Part 5

Electrical Components and Wiring Diagrams

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2	Outdoor Unit Main PCB.....	35
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1 Outdoor Unit Electric Control Box Layout

Figure 5-1.1: 7/8/9HP the view of electric control box

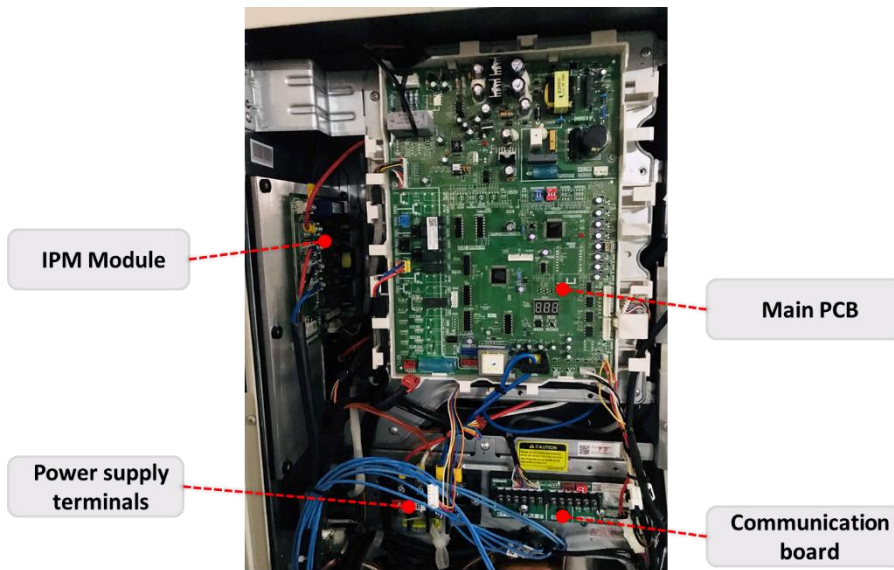


Figure 5-1.2: 14/16HP front view of electric control box

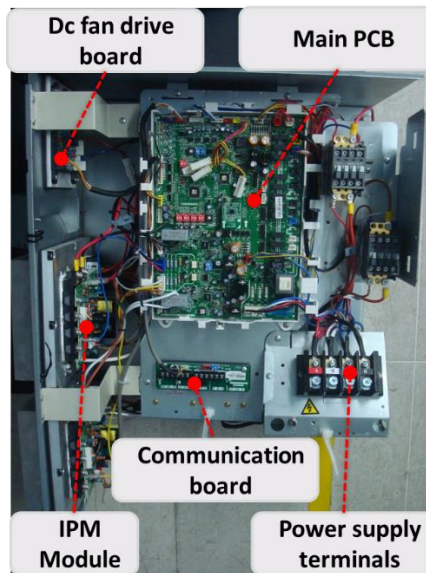


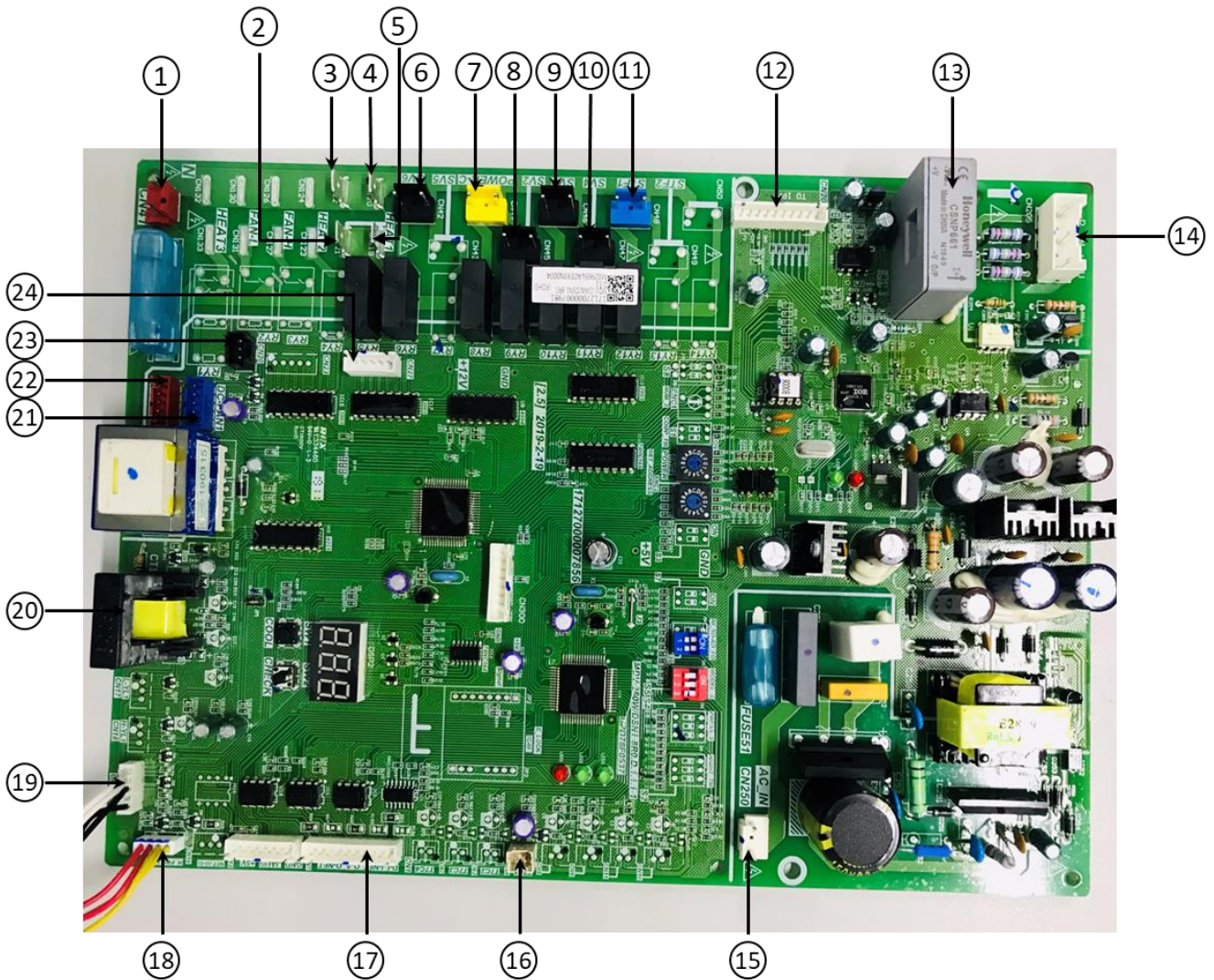
Figure 5-1.3: 14/16HP rear view of electric control box



2 Outdoor Unit Main PCB

2.1 Ports

Figure 5-2.1: 7/8/9HP outdoor unit main PCB ports



Notes:

1. Label descriptions are given in Table 5-2.1.

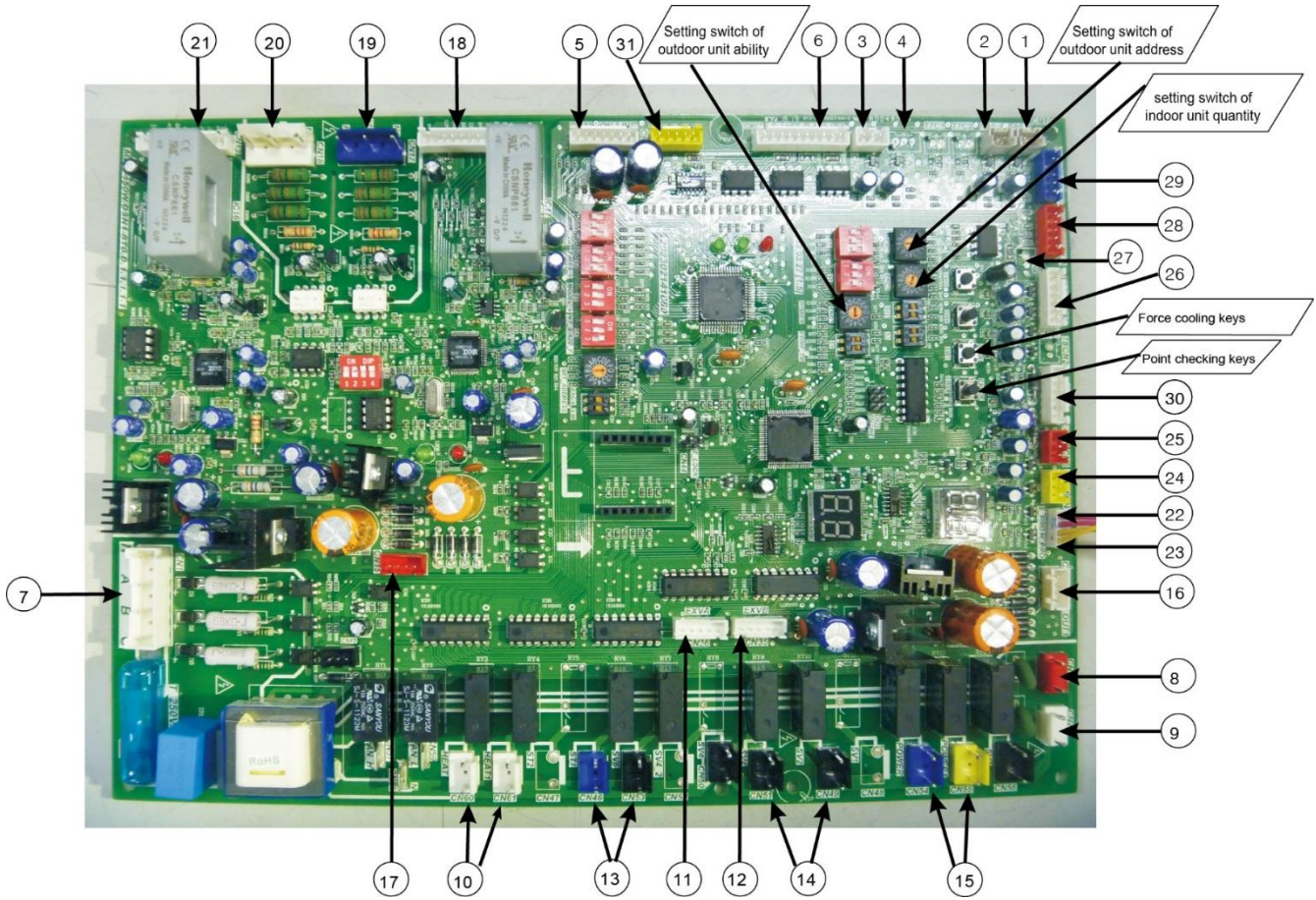
Mini TVR Individual 60Hz



Table 5-2.1: 7/8/9HP main PCB ports

Label in Figure 5-2.1	Port code	Content	Port voltage
1	CN41	Power input port of the main PCB	220V
2	CN121	Load output port (crankcase heater HAET 1&HEAT 2)	220V
3	CN122	Load output port	220V
4	CN120	Load output port	220V
5	CN119	Load output port	220V
6	CN42	Load output port (solenoid valve SV6 control)	220V
7	CN44	Load output port (contactor control POWER-C port)	220V
8	CN45	Load output port (solenoid valve SV2 control)	220V
9	CN46	Load output port (solenoid valve SV7 control)	220V
10	CN47	Load output port (solenoid valve SV4 control)	220V
11	CN48	Load output port (solenoid valve ST1 control)	220V
12	CN201	Inverter module drive port	The third pin on the left: DC3.3V Other pins: in dynamic change
13		Mutual inductor for DC main lead current inspection	In dynamic change
14	CN205	Voltage detection port of inverter module	DC540V, +15V, N
15	CN250	Power input port of the main PCB	220V
16	CN4	Discharge temperature detection port of inverter compressor	DC0~5V (in dynamic change)
17	CN7	Communication port	DC2.5~5V
18	CN24	Signal input port for high pressure and low pressure detection switch	DC0~5V (in dynamic change)
19	CN9	Outdoor ambient temperature detection port	DC0~5V (in dynamic change)
20		Current detection port	DC0~5V (in dynamic change)
21	CN13	Control port of DC fan 1	The right pin: +5V
22	CN14	Control port of DC fan 2	The right pin: +5V
23	CN20	Power output port of the main PCB	The first pin on the left: +12V
24	CN27	EEV drive port	The first pin on the left: DC12V The other four pins: in dynamic change

Figure 5-2.2: 14/16HP outdoor unit main PCB ports



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Table 5-2.2: 14/16HP main PCB ports

Label in Figure 5-2.2	Port code	Content	Port voltage
1	CN10	Discharge temp detection port of inverter compressor A	DC 0~5V (in dynamic change)
2	CN11	Discharge temp detection port of inverter compressor B	DC 0~5V (in dynamic change)
3	CN2	Temp detection port of inverter module radiator	DC 0~5V (in dynamic change)
4	CN3	Reserved	/
5	CN22	Reserved	/
6	CN16	Wiring port for communication between indoor and outdoor units, indoor unit network and network accounting	DC 2.5~2.7V
7	CN1	Phase-sequence detection port	380V
8	CN30	Power supply port of No. 1 transformer	220V
9	CN29	Power supply port of No. 2 transformer	220V
10	CN60/61	Load output port(crankcase heater HAET 1&HEAT 2)	220V
11	CN36	Drive port of EXVA	The first pin on left: DC 12V The other four pins: in dynamic change
12	CN35	Drive port of EXVB	
13	CN46/53	Load output port	220V
14	CN49/51	Load output port	220V
15	CN54/55	Load output port	220V
16	CN12	Power output port of No.1 transformer	AC 13.5V (between upper two pins) AC 9V (between under two pins)
17	CN15	Power output port of No.2 transformer	AC 14.5V (between upper two pins) AC 14.5V (between under two pins)
18	CN14	Drive port of inverter module B	The third pin on left: DC 3.3V
19	CN17	Voltage detection port of inverter module B	DC 540V (between P and N), +DC 15V (between +15V and N)
20	CN18	Voltage detection port of inverter module A	DC 540V (between P and N), +DC 15V (between +15V and N)
21	CN13	Drive port of inverter module A	The third pin on left: DC 3.3V
22	CN25	Signal input port for system low pressure detection switch	DC 0~5V (in dynamic change)
23		Signal input port for system high pressure detection switch	DC 0~5V (in dynamic change)
24	CN7	Reserved	/
25	CN6	Reserved	/
26	CN27	Temperature detection port of ambient temp and condenser temp	DC 0~5V (in dynamic change)
27	CN24	Reserved	/
28	CN20	Control port of DC fan 1	The right pin: +5V
29	CN21	Control port of DC fan 2	The right pin: +5V
30	CN43	Current detection port of inverter compressor A and B	AC 0~7.8V (in dynamic change)
31	CN19	PCB power supply port	+5V(between GND and 5V pins) +12V(between GND and 12V pins)

2.2 Components

2.2.1 Layout

Figure 5-2.3: 7/8/9HP outdoor unit main PCB components

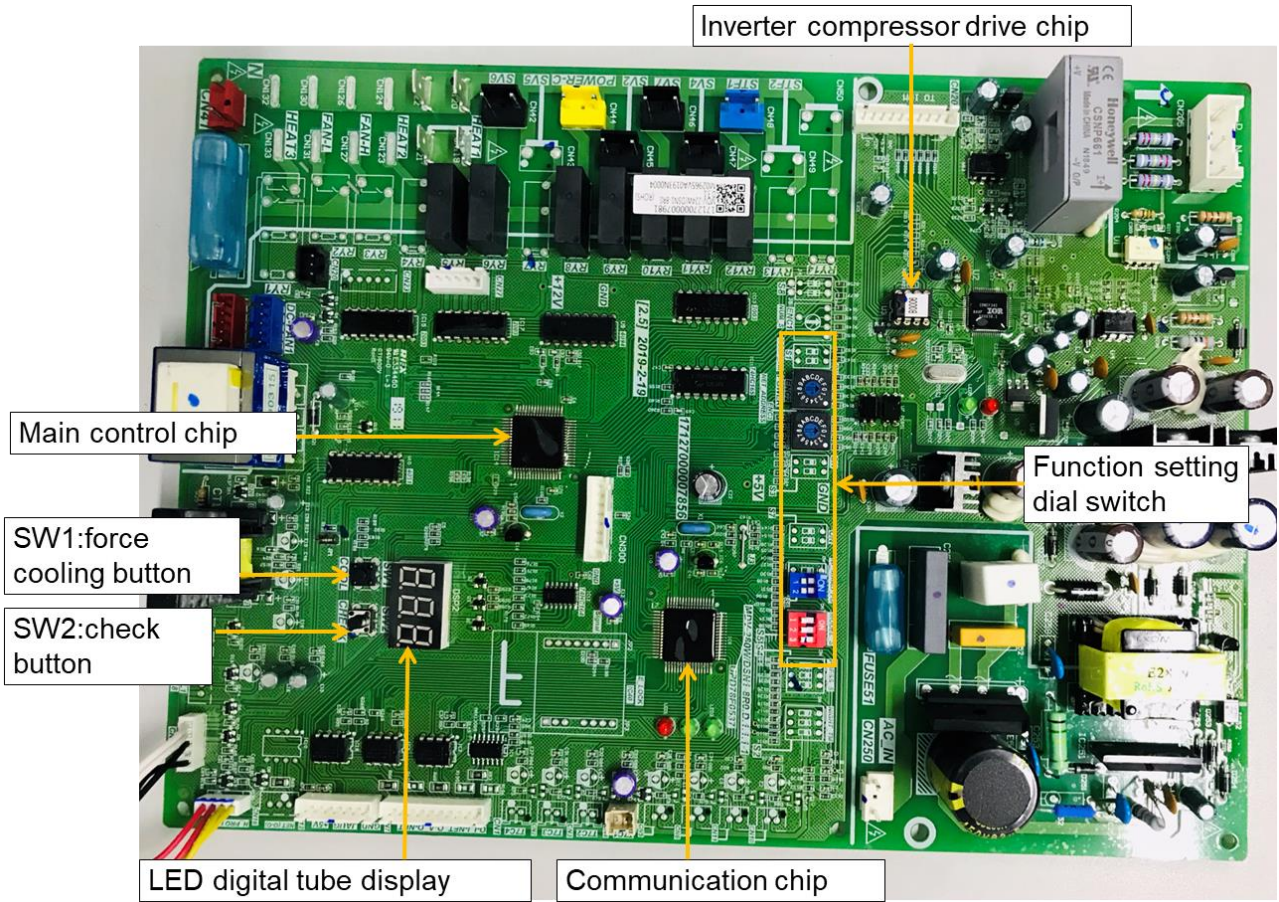
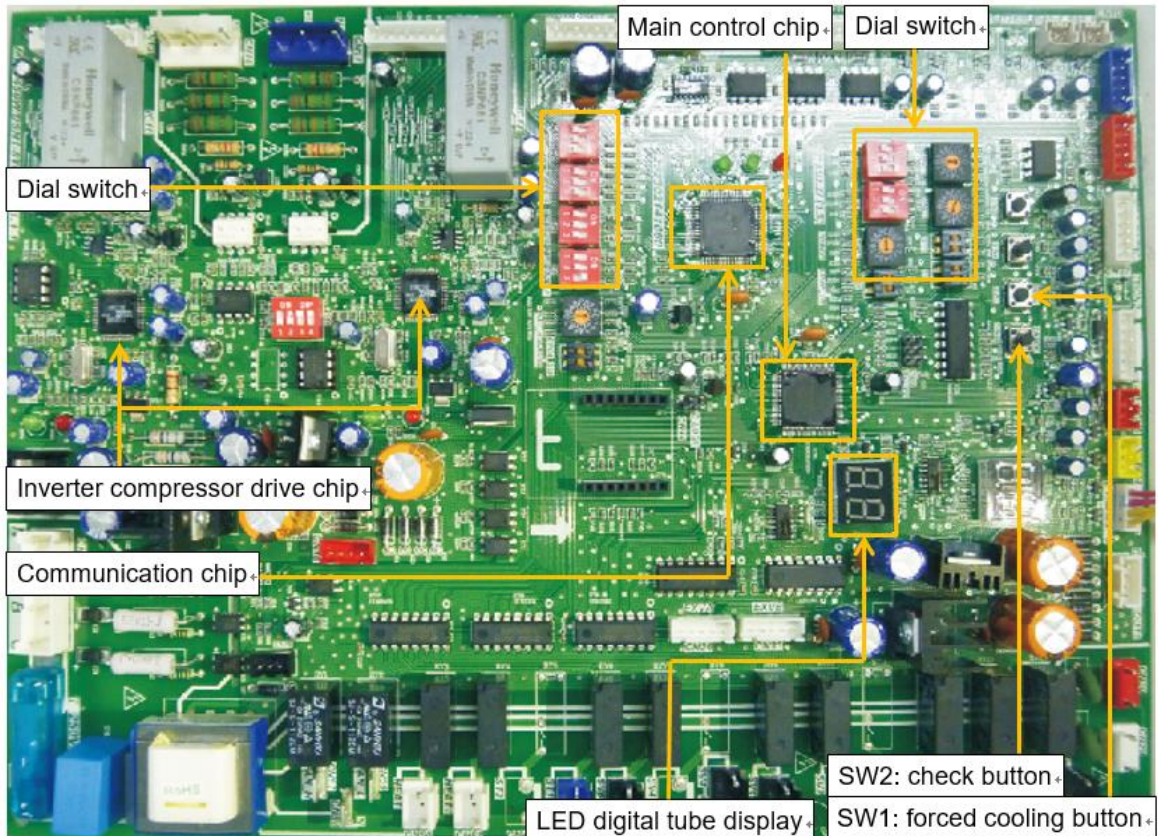



Figure 5-2.4: 14/16HP outdoor unit main PCB components



2.2.2 Function of buttons SW1 to SW2

Table 5-2.3: Function of buttons SW1 to SW2



Button	Function
SW1	Force cooling button
SW2	Check button



2.2.3 LED indicators LED1 to LED7

Table 5-2.4: LED indicators LED1 to LED7

Indicator	LED indicator function and status
LED 1	Error indicator. Flashing slowly ¹ if a communication error between indoor and master outdoor unit has occurred. Flashing rapidly ¹ for other errors. Off when there is no error.
LED 2	Running indicator. Continuously on if the system is operating normally and flashing if the system is in standby.
LED 3	Power supply indicator. Continuously on if the power supply is normal.
LED4/6	Inverter module operating indicator. Continuously on if the compressor is running normally and flashing if an inverter module error has occurred ² (in which case LED5/7 will be continuously on) or if the system is standby
LED5/7	Inverter module error indicator. Continuously on if an inverter module error has occurred ² (in which case LED4/6 will be flashing).

Notes:

1. Flashing slowly means flashing on for 1s then off for 1s in a cycle; flashing rapidly means flashing on for 0.5s then off for 0.5s in a cycle.
2. If an inverter module error occurs, refer to Part 6, 2.17 "H4 Trouble shooting". The error code is displayed on the digital display

2.2.4 System check button

On pressing check button, the parameters listed in Table 5-2.5 and Table 5-2.6 will be displayed in sequence.

Table 5-2.5: 7/8/9HP system check

DSP content	Parameters displayed on DSP	Remarks
	Normal display	Refer to note 1
0--	Capacity of this outdoor unit	7HP, 8HP, 10HP
1--	Total capacity requirements of indoor units	Actual value
2--	Revised total capacity requirements of outdoor unit	Actual value
3--	Operating mode	Refer to note 2
4--	Fan speed	Refer to note 3
5--	Average temperature of T2B/T2	Actual value
6--	T3 pipe temperature	Actual value
7--	T4 ambient temperature	Actual value
8--	Discharge temperature of inverter compressor	Actual value
9--	Discharge temperature of fixed compressor (reserved)	0
0--	Surface temperature of radiator (reserved)	0
1--	Open degree of EXV	Actual value=display×8
2--	Current of inverter compressor	Actual value
3--	Current of fixed compressor (reserved)	0
4--	Discharge pressure (reserved)	0

Table 5-2.5: 7/8/9HP system check (continued)

DSP content	Parameters displayed on DSP	Remarks
5--	Priority mode	Refer to note 4
6--	Total quantity of indoor units	Actual value
7--	Quantity of running units	Actual value
8--	The last error or protection code	Display 00 if it has no error or protection code
9--	--	Check over

- Notes:
1. Display compressor frequency when system is running and display the quantity of indoor unit which communicate with outdoor unit when system is standby.
 2. Operating mode: 0 – standby mode; 2 – cooling mode; 3 – heating mode; 4 – forced cooling.
 3. Fan speed: 0 – fan stop; 1~9 – speed increase sequentially; 9 – the maximum fan speed.
 4. Priority mode: 0 – heating priority; 1 – cooling priority; 2 – first running mode priority; 3 – only respond heating mode; 4 – only respond cooling mode.

Table 5-2.6: 14/16HP system check

DSP content	Parameters displayed on DSP	Remarks
0.- -	Outdoor unit address	0 (individual type)
1.- -	Outdoor unit capacity setting	Refer to note 1
2.- -	Outdoor unit quantity	Reserved
3.- -	Setting quantity of indoor units	Actual value=display value
4.- -	Total capacity of outdoor units	Capacity requirement
5.- -	Total capacity requirement of indoor units	Actual value=display value
6.- -	Revised total capacity requirements of outdoor unit	Actual value=display value
7.- -	Running mode	Refer to note 2
8.- -	Actual running capacity of this outdoor unit	Capacity requirement
9.- -	No.1 fan speed3	Refer to note 3
10.- -	No.2 fan speed3	Refer to note 3
11.- -	T2B/T2 average temperature	Actual value=display value
12.- -	T3 pipe temperature	Actual value=display value
13.- -	T4 ambient temperature	Actual value=display value
14.- -	Discharge temperature of No. 1 inverter compressor	Actual value=display value
15.- -	Discharge temperature of No. 2 inverter compressor	Actual value=display value
16.- -	Reserved	/
17.- -	Current of No. 1 inverter compressor	Actual value=display value
18.- -	Current of No. 2 inverter compressor	Actual value=display value
19.- -	EXVA opening degree	Pulsed value=display value×8
20.- -	EXVB opening degree	Pulsed value=display value×8
21.- -	High pressure	Reserved
22.- -	T3B	/
23.- -	Indoor units quantity	Actual value=display value
24.- -	Running indoor units quantity	Actual value=display value
25.- -	Mode priority4	Refer to note 4
26.- -	Silent mode5	Refer to note 5
27.- -	Static pressure mode6	Refer to note 6
28.- -	DC voltage A	Actual value=display value×10
29.- -	DC voltage B	Actual value=display value×10
30.- -	Reserved	/
- -	Reserved	/
- -	- -	Over

Notes:

1. Outdoor unit capacity setting: capacity code 4—40kW; capacity code 5—45kW.
2. Running mode: 0—closed; 2—cooling mode; 3—heating mode; 4—forced cooling mode.
3. Fan speed: 0—closed; 1~10—fan speed increase in sequence.
4. Mode priority: 0—heating priority; 1—cooling priority; 2—open the priority mode first; 3—only response to heating; 4—only response to cooling.
5. Silent mode: 0—nighttime silent mode; 1—silent mode; 2—reserved; 3—no silent mode.
6. Static pressure mode: 0—no static pressure; 1—low static pressure; 2—medium static pressure; 3—high static pressure.

2.2.5 Digital display output

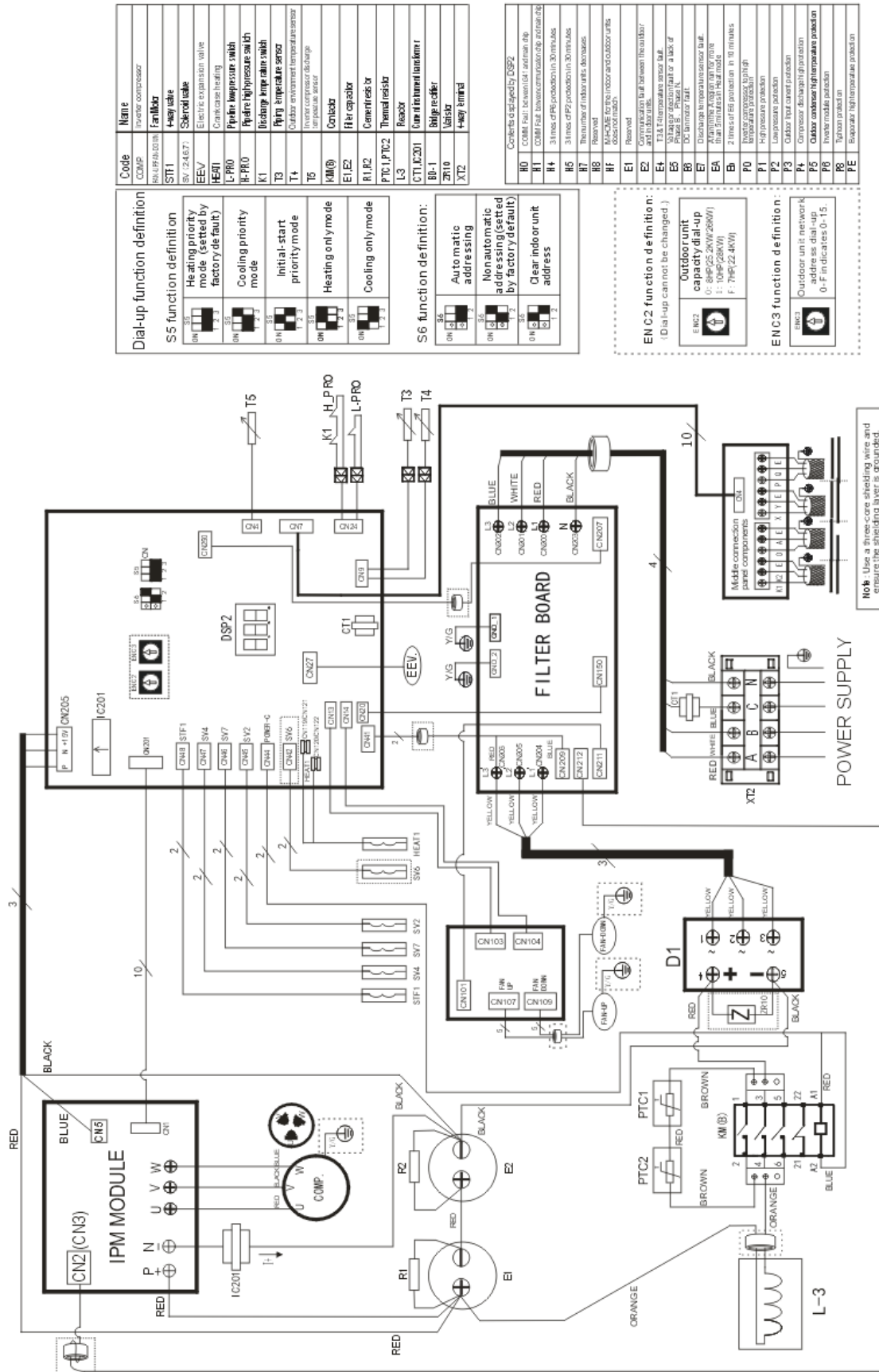
Table 5-2.7: Digital display output in different operating states

Outdoor unit state	Parameters displayed on DSP
Standby	The number of indoor units in communication with the outdoor unit
Normal operation	Compressor frequency
Error or protection	Error or protection code
System check	Refer to Table 5-2.5 and Table 5-2.6



3 Wiring Diagrams

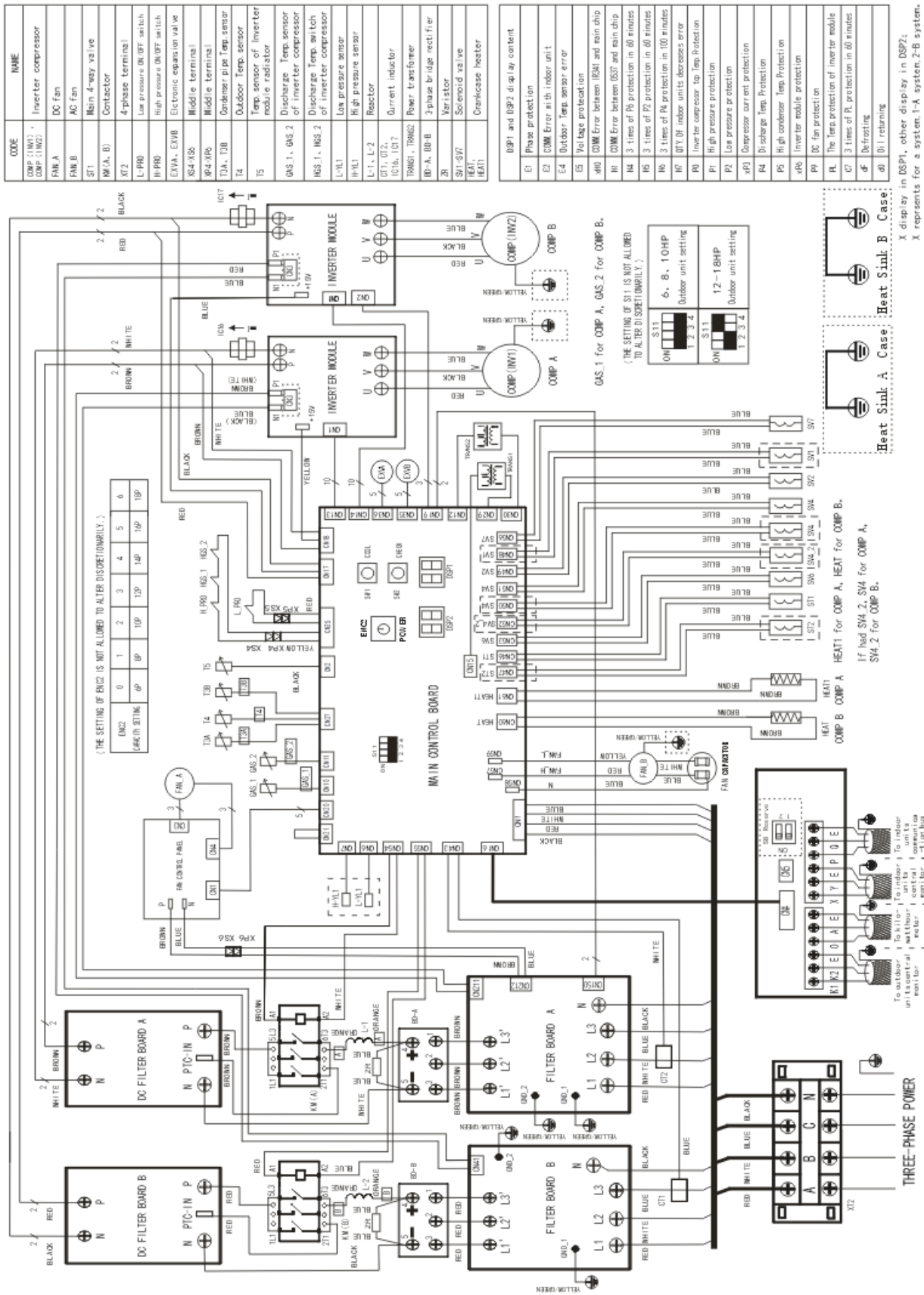
Figure 5-3.1: 7/8/9HP wiring diagram



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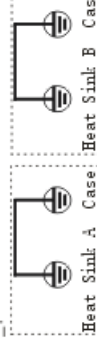
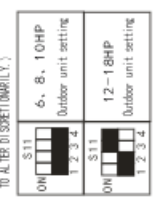
Figure 5-3.2: 14/16HP wiring diagram



CODE	NAME
COMP (IMV1)	Inverter compressor
COMP (IMV2)	Inverter compressor
FNK.A	DC fan
FNK.B	DC fan
ST1	Main 4-way valve
NK(A, B)	Contactors
XT2	4-phase terminal
L-PRO	Low pressure ON/OFF switch
H-PRO	High pressure ON/OFF switch
EVVA, EXVB	Electronic expansion valve
MSA-XSB	Middle terminal
MSA-XSB	Middle terminal
MSA-XSB	Middle terminal
TDA, TDB	Outdoor pipe temp sensor
T4	Outdoor Temp sensor
T5	Temp sensor of inverter module radiator
GAS.1 - GAS.2	Discharge Temp sensor of inverter compressor
INS.1 - INS.2	Discharge Temp switch of inverter compressor
L-PL1	Low pressure sensor
H-PL1	High pressure sensor
L-L1, L-2	Reactor
IC1b, IC17	Current inductor
TRMS1, TRMS2	Power transistor
BD-A, BD-B	3 phase bridge rectifier
TR	Thyristor
SV1-SV7	Solenoid valve
HEAT, HEAT1	Drainage heater

DISP1 and DISP2	di display content
E1	Phase protection
E2	COM Error at the indoor unit
E4	Outdoor Temp sensor error
E5	Voltage protection
HI0	COM Error between EMS and main chip
HI1	COM Error between GS07 and main chip
HI4	3 times of P1 protection in 60 minutes
HI5	3 times of P2 protection in 60 minutes
HI6	3 times of P4 protection in 100 minutes
HI7	OT indoor units decreases error
P0	Inverter compressor Temp Protection
P1	High pressure protection
P2	Low pressure protection
xP0	Compressor current protection
PA	Discharge Temp Protection
PS	High condenser Temp Protection
xPS	Inverter module protection
PI	DC fan protection
PL	The Temp protection of inverter module
PT	3 times of PL protection in 60 minutes
d	Defrosting
di	di returning

X display in DISP1, other display in DISP2;
X represents for a system, 1-A system, 2-B system.



(THE SETTING OF ENCL IS NOT ALLOWED TO ALTER DISCREETLY.)

ENCL SETTING	OP	1P	13P	14P	16P	18P
0	1	2	3	4	5	6

Part 6

Diagnosis and Troubleshooting

1	Error Code Table	46
2	Troubleshooting	48
3	Appendix to Part 6	93

1 Error Code Table

Table 6-1.1: 7/8/9HP error code table

Error code	Content
E1	Reserved
E2	communication fault between the outdoor and indoor units
E4	T3 & T4 temperature sensor fault
E5	Voltage protection fault or a lack of Phase B、Phase N
E6	DC fan motor error
E7	Discharge temp sensor error
EA	A fan in the A region run for more than 5 minutes in Heat mode
EB	2 times of E6 protection in 10 minutes
H0	Communication error between main control chip and module chip
H1	Communication error between main control chip and communication chip
H4	3 times of P6 protection in 30 minutes
H5	3 times of P2 protection in 30 minutes
H7	The number of indoor units decreases
H8	Reserved
HF	M-HOME for the indoor and outdoor units does not match
P0	Top temperature protection of inverter compressor
P1	High pressure protection
P2	Low pressure protection
P3	Outdoor input current protection
P4	Compressor discharge high protection
P5	Outdoor condenser high temperature protection
P6	Module protection
P8	Typhoon protection
PE	Evaporator high temperature protection

Table 6-1.2: 14/16HP error code table

Error code	Content
E0	Outdoor unit communication error
E1	Phase protection
E2	Indoor units and master unit communication error
E4	Pipe temp T3/ambient temp T4 sensor error
E5	Voltage error
E6	DC fan motor error
E7	Discharge temp sensor error
E8	Outdoor unit address error
xE9	Wrong drive model
EL	E-lock error
EA	5-min protection in A zone(heating fan)
EB	E6 protection appears twice in 10 minutes
H0	Communication error between main control chip and IR341
H1	Communication error between main control chip and 0573
xH4	3 times of P6 protection in 60 minutes
H5	3 times of P2 protection in 60 minutes
H6	3 times of P4 protection in 100 minutes
H7	Quantity of indoor units decrease
H9	P9 protection appears three times in 60 minutes
P1	High pressure protection
P2	Low pressure protection
xP3	Compressor current protection
P4	Discharge temperature protection
P5	Outdoor condenser high temperature protection
PE	Evaporator high temperature protection
PF	E-lock unlocking
xP6	Module protection
P7	Reserved
P8	Reserved
P9	Module protection of DC fan
PL	Temperature protection of inverter module
C7	3 times of PL protection in 90 minutes
xL0	DC compressor module error
xL1	Low voltage protection of DC generatrix
xL2	High voltage protection of DC generatrix
xL3	Reserved
xL4	MCE error/ synchronization/ closed loop
xL5	Zero speed protection
xL6	Reserved
xL7	Phase sequence error
xL8	Frequency difference in one second more than 15Hz protection
xL9	Frequency difference between the real and the setting frequency more than 15Hz protection

Notes:

- 'x' is a placeholder for the compressor system, with 1 representing compressor system A and 2 representing compressor system B.
- L0~L9 error codes can't display on digital tube automatically, these error codes will display on digital tube only through SW3 button (press SW3 ten times, every one second for a time)

2 Troubleshooting

2.1 Warning

Warning



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

2.2 E1: Phase sequence error

2.2.1 Digital display output



2.2.2 Description

- Phase sequence error.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

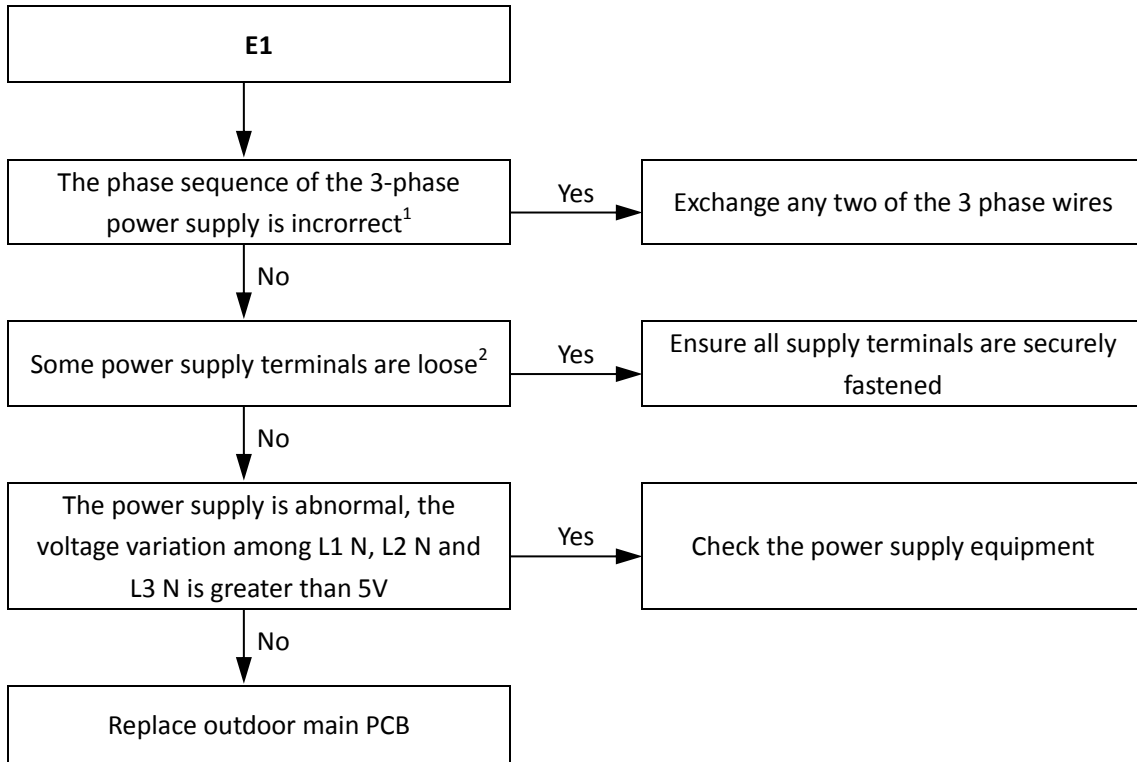
2.2.3 Trigger / recover condition

- Trigger condition: Wrong phase connection for 1.6s or phase missing for 48s.
- Recover condition: Correct phase connection.
- Reset method: Manually restart.

2.2.4 Possible causes

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

2.2.5 Procedure



Notes:

1. The L1, L2, L3 terminals of the 3-phase power supply should match compressor phase sequence requirements. If the phase sequence is inverted, the compressor will operate inversely.
2. Loose power supply terminals can cause the compressor to operate abnormally and compressor current to be very large.

2.3 E2: Communication error between indoor and outdoor unit

2.3.1 Digital display output



2.3.2 Description

- Communication error between indoor and outdoor unit.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

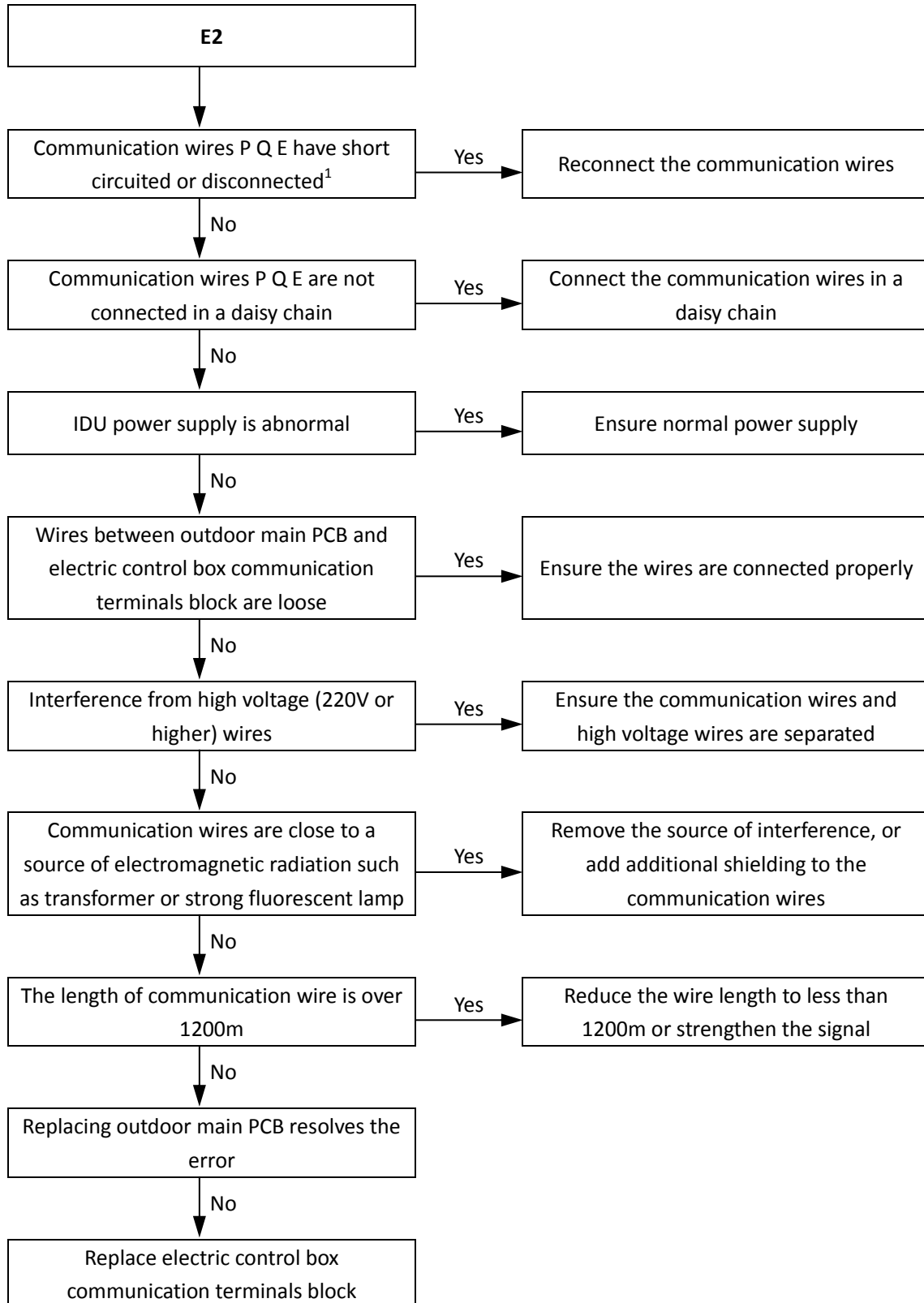
2.3.3 Trigger / recover condition

- Trigger condition: Indoor units and the outdoor unit cannot communicate for 2 minutes after the system is powered on for 20 minutes.
- Recover condition: Communication go back to normal.
- Reset method: Resume automatically.

2.3.4 Possible causes

- Communication wires between indoor and outdoor units not connected properly.
- Indoor unit power supply abnormal.
- Loosened wiring within electric control box.
- Interference from high voltage wires or other sources of electromagnetic radiation.
- Communication wire too long.
- Damaged main PCB or electric control box communication terminals block.

2.3.5 Procedure



Notes:

1. Measure the resistance among P, Q and E. The normal resistance between P and Q is 120Ω, between P and E is infinite, between Q and E is infinite.

2.4 E4: Temperature sensor (T3/T4) error

2.4.1 Digital display output



2.4.2 Description

- Outdoor heat exchanger temperature sensor (T3) error or outdoor ambient temperature sensor (T4) error.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

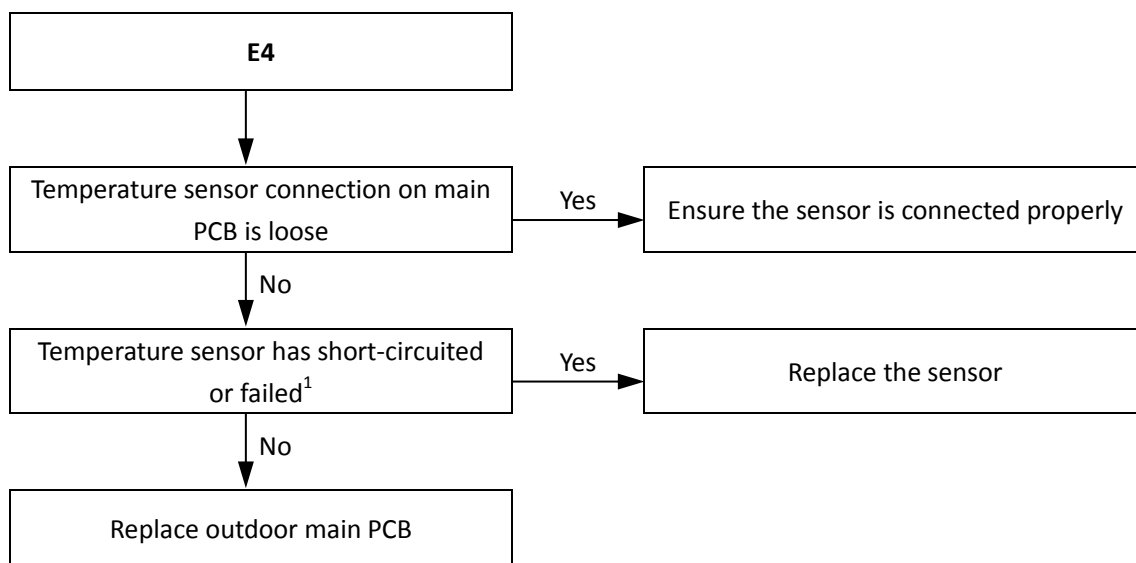
2.4.3 Trigger / recover condition

- Trigger condition: The main control board cannot receive the feedback signal of temperature sensor T3 or T4.
- Recover condition: The main control board can receive the feedback signal of temperature sensor T3 or T4.
- Reset method: Resume automatically.

2.4.4 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Damaged main PCB.

2.4.5 Procedure



Notes:

1. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 6-3.1 in Part 6, 3.1 "Temperature Sensor Resistance Characteristics".

2.5 E5: Abnormal power supply voltage

2.5.1 Digital display output



2.5.2 Description

- Abnormal power supply voltage.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

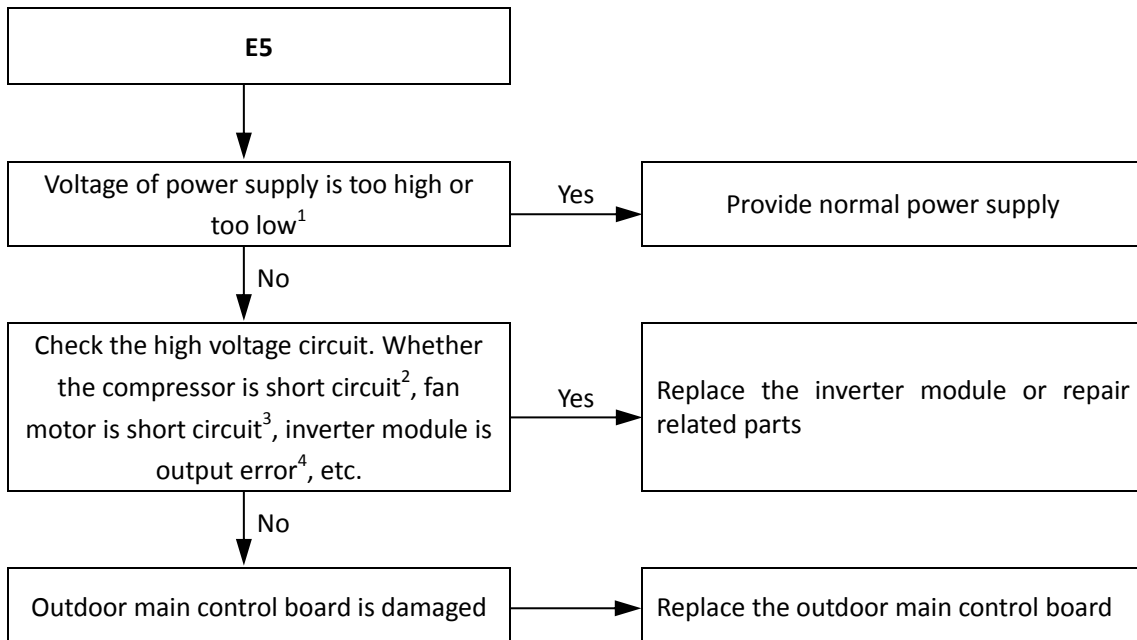
2.5.3 Trigger / recover condition

- Trigger condition: Outdoor unit power supply phase voltage < 163V or > 268V.
- Recover condition: Outdoor unit power supply phase voltage is within 163V ~ 268V.
- Reset method: Resume automatically.

2.5.4 Possible causes

- Outdoor unit power supply voltage is abnormal or a phase is missing.
- Loosened wiring within electric control box.
- High voltage circuit error.
- Main PCB damaged.

2.5.5 Procedure



Notes:

1. The normal voltage between A and N (B and N, C and N) should be 163V~268V.
2. The normal resistance value of inverter compressor among U V W is 0.7~1.5Ω, and infinity to earth. If the resistance value is out of the range, the compressor is abnormal.
3. The normal value of DC fan motor coil among U V W is less than 10Ω, and the value of AC fan motor coil is from a few ohm to hundreds of ohm for different fan motor model. If the measured value is 0Ω, the fan motor is short circuit.
4. Dial the multimeter to diode file, black pen on P and red pen respectively on U,V,W, if the multimeter displays 0.4~0.7 V, it is normal; Red pen on N, black pen respectively on U,V,W, if the multimeter displays 0.4~0.7 V, it is normal. Satisfying the above two conditions at the same time indicates that the inverter module has no problem.

2.6 E6: DC fan motor error, Eb: E6 protection appears twice in 10 minutes

2.6.1 Digital display output



2.6.2 Description

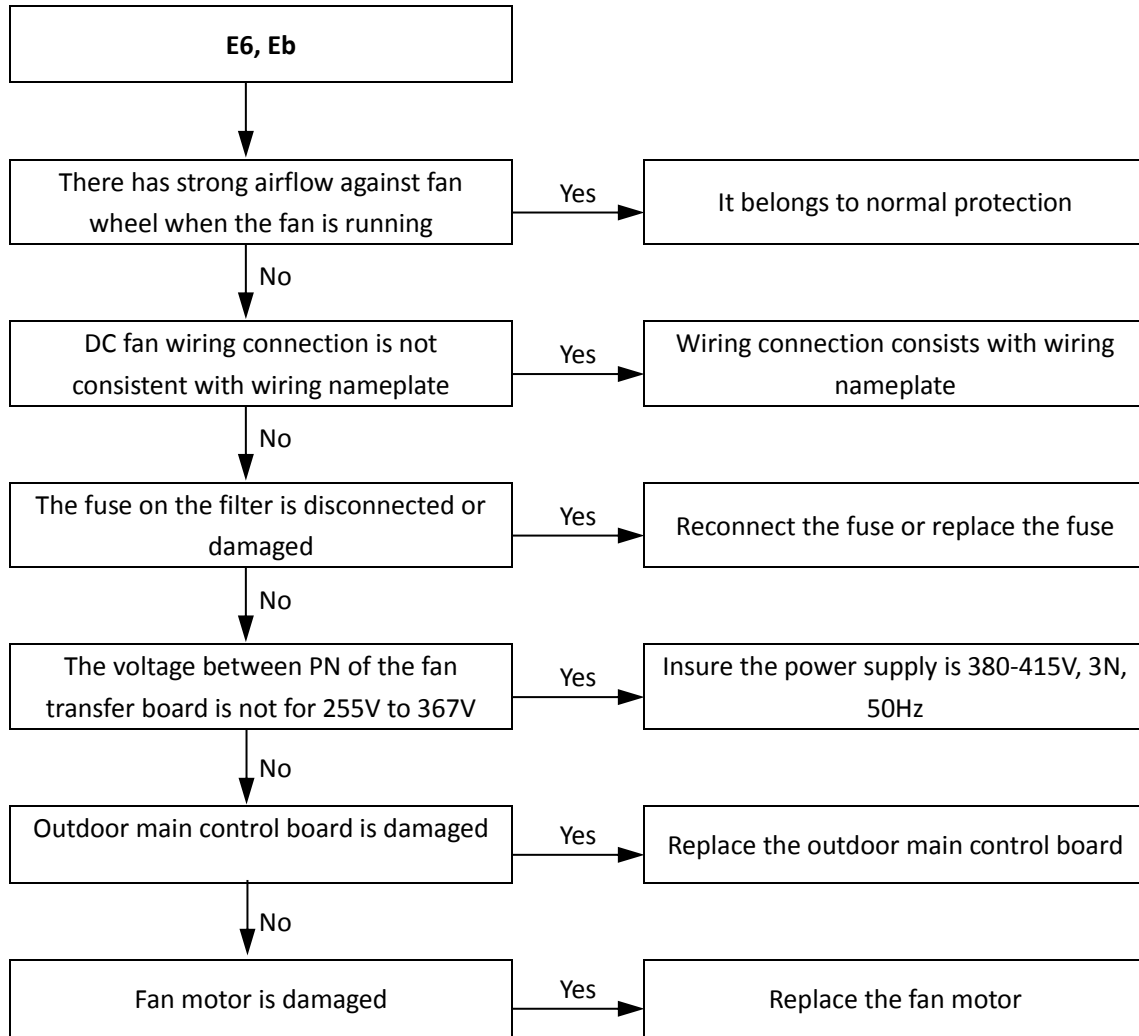
- DC fan motor error.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

2.6.3 Trigger / recover condition

- Trigger condition:
 - For E6 protection: Actual fan speed is < 120 rps more than 20S or the actual fan speed differs from target speed by more 200rps for more than 3 minutes.
 - For Eb protection: E6 protection appears twice in 10 minutes.
- Recover condition: Actual fan speed is > 120 rps and the actual fan speed differs from target speed less than 200rps.
- Reset method: Resume automatically.
 - For E6 protection: Resume automatically.
 - For Eb protection: Manually restart.

2.6.4 Possible causes

- Loosened wiring within electric control box.
- DC fan motor damaged.
- Filter board damaged.
- Main PCB damaged.

2.6.5 Procedure


2.7 E7: Temperature sensor (T5) error

2.7.1 Digital display output



2.7.2 Description

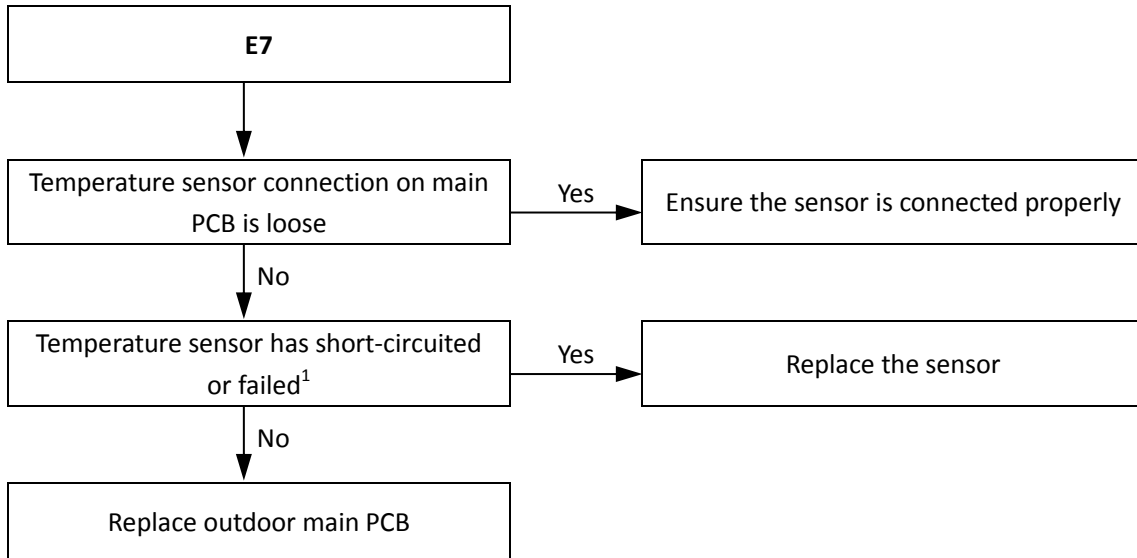
- A compressor discharge pipe temperature sensor (T5) error.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

2.7.3 Trigger / recover condition

- Trigger condition: Discharge temperature $< 10^{\circ}\text{C}$ for 5 minutes after compressor startup for 15 minutes.
- Recover condition: Discharge temperature go back to normal.
- Reset method: Manually restart.

2.7.4 Possible causes

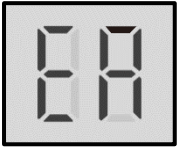
- Temperature sensor not connected properly or has malfunctioned.
- Damaged main PCB.

2.7.5 Procedure

Notes:

1. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 6-3.2 in Part 6, 3.1 "Temperature Sensor Resistance Characteristics".

2.8 EA: 5-min protection in A zone(heating mode)

2.8.1 Digital display output



2.8.2 Description

- When T3 pipe temperature exceeds 27°C lasting for 5 minutes in heating mode, the unit will display EA error.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

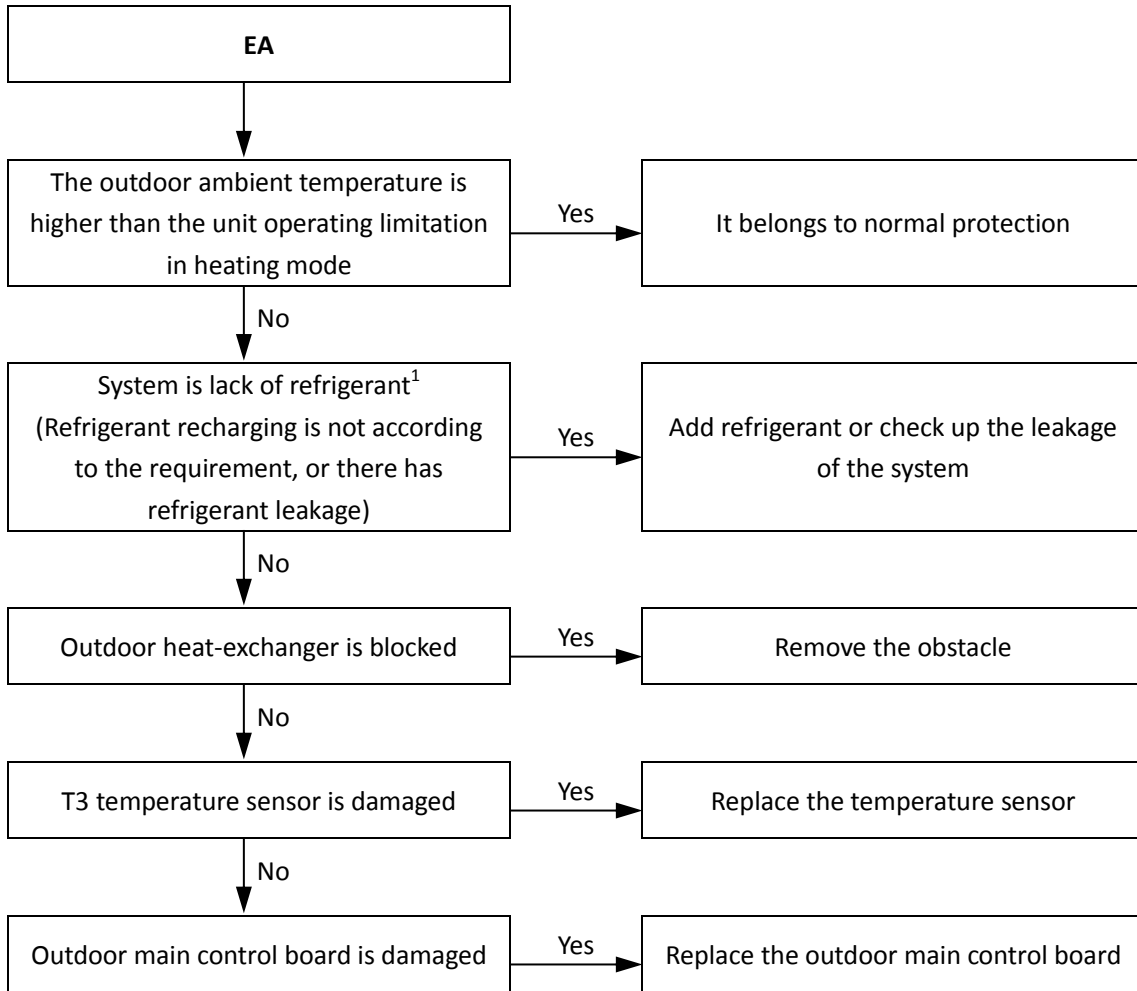
2.8.3 Trigger / recover condition

- Trigger condition: Pipe temperature (T3) > 27°C for 5 minutes in heating mode.
- Recover condition: Pipe temperature go back to normal.
- Reset method: Manually restart.

2.8.4 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Lack of refrigerant.
- Outdoor heat-exchanger is blocked
- Damaged main PCB.

2.8.5 Procedure

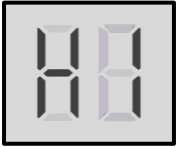


Notes:

1. An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. All the phenomenon will disappear after recharging refrigerant.

2.9 H0, H1: Communication error

2.9.1 Digital display output



2.9.2 Description

- H0 indicates a communication error between the main control chip and the compressor inverter driver chip.
- H1 indicates a communication error between the main control chip and communication chip.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

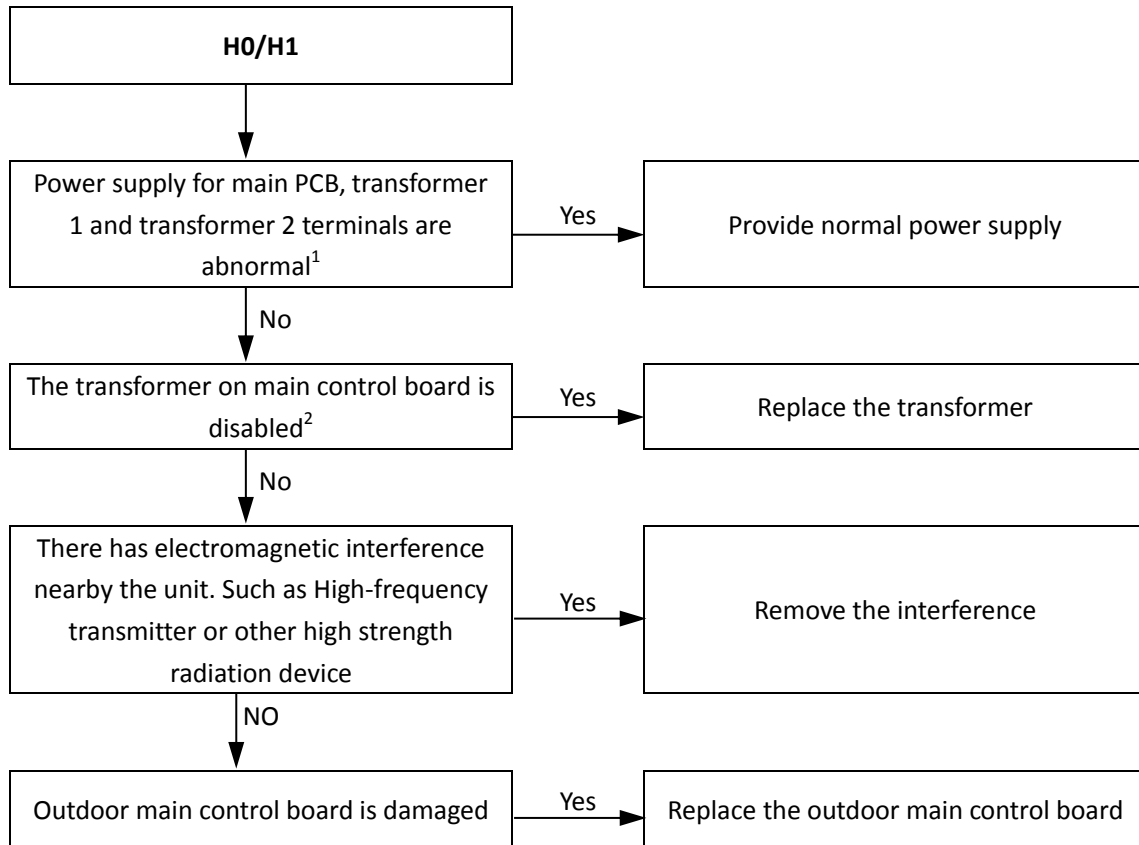
2.9.3 Trigger / recover condition

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

2.9.4 Possible causes

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

2.9.5 Procedure



Notes:

1. The voltage of power supply for transformer 1 and transformer 2 terminals are both 220V, the voltage between "GND" and "+5V" terminals of Power supply for main PCB ports is 5V, and between "GND" and "+12V" terminals of Power supply for main PCB ports is 12V.
2. The voltage of power supply for transformer 1 and transformer 2 terminals are both 220V, the voltage of transformer 1 output terminals is AC9V (between left two pins) and AC13.5V (between rights two pins); the voltage of transformer 2 output terminal is AC14.5V (between left two pins) and AC 14.5V (between rights two pins). If the voltage is out of the range, the transformer is disabled.

2.10 H7: Quantity of indoor units decrease error

2.10.1 Digital display output



2.10.2 Description

- Number of indoor units detected by the outdoor unit not same as number set on main PCB.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

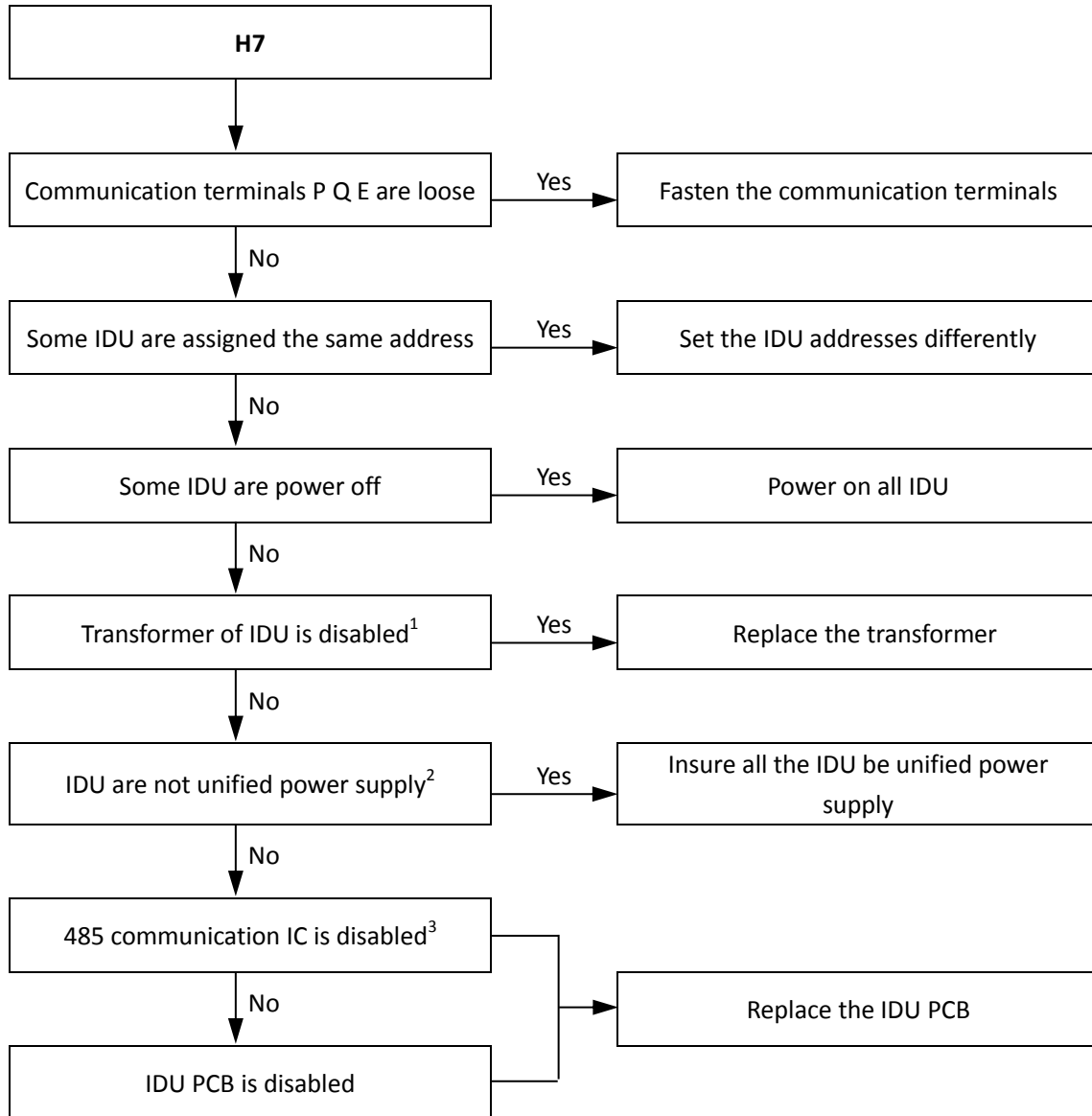
2.10.3 Trigger / recover condition

- Trigger condition: At least one indoor unit cannot be detected by the outdoor unit for more than 20 minutes for the first time powered on or at least one indoor unit cannot be detected by the outdoor unit for more than 3 minutes.
- Recover condition: Number of indoor units detected by the outdoor unit is same as number set on main PCB.
- Reset method: Resume automatically.

2.10.4 Possible causes

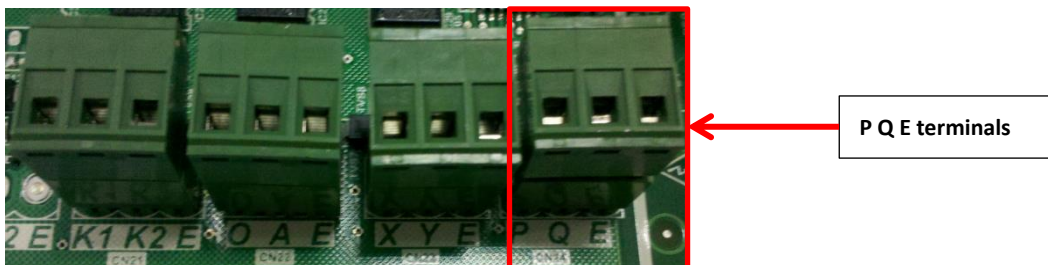
- Number of indoor units set on main PCB not same as actual number of indoor units.
- Some indoor units are powered off.
- Communication wires between indoor and outdoor units not connected properly.
- Indoor unit PCB damaged.
- Indoor unit without address or indoor unit address duplicated.
- Main PCB damaged.

2.10.5 Procedure



Notes:

1. The voltage input for IDU transformer is 220V, the voltage output of is AC9V (yellow-yellow) and AC13.5V (brown-brown)
2. Indoor units should be unified power supply, which can prevent compressor from liquid hammer caused by dropped indoor units with EXV unclosed.
3. The normal voltage between "P" and "GND" is DC2.5~2.7V, between "Q" and "GND" is DC2.5~2.7V. If the voltage is out of the normal range, the 485 communication IC is disabled.



2.11 H8: High pressure sensor error

2.11.1 Digital display output



2.11.2 Description

- High pressure sensor error.
- The system stops running.
- Error code is displayed on the unit with the error.

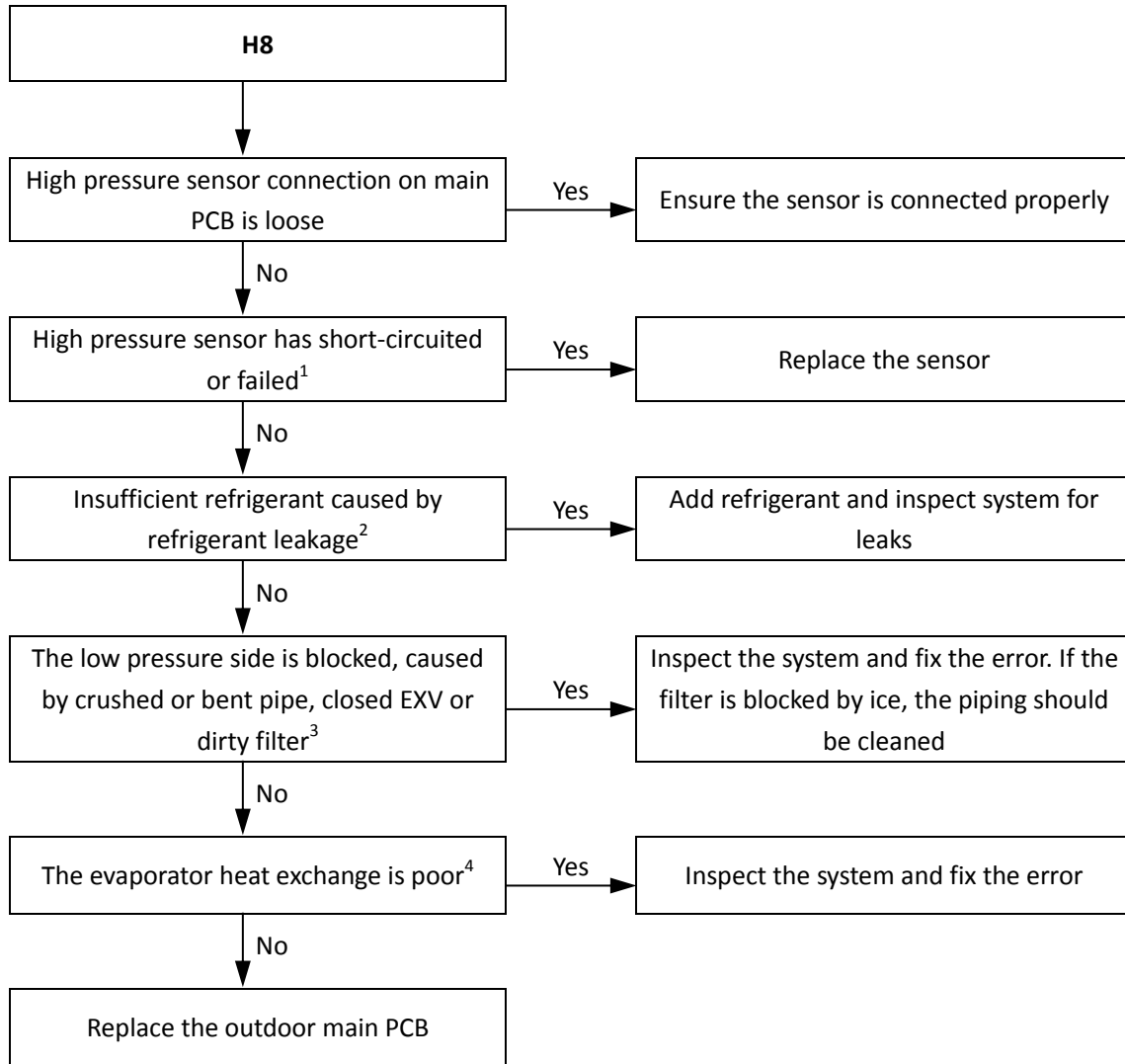
2.11.3 Trigger / recover condition

- Trigger condition: Discharge pressure ≤ 0.3 MPa.
- Recover condition: Discharge pressure > 0.3 MPa.
- Reset method: Resume automatically.

2.11.4 Possible causes

- Pressure sensor not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange.
- Main PCB damaged.

2.11.5 Procedure



Notes:

1. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
2. An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
3. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
4. In cooling mode check indoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check outdoor heat exchangers, fans and air outlets for dirt/blockages.

2.12 P1: Discharge pipe high pressure protection

2.12.1 Digital display output



2.12.2 Description

- Discharge pipe high pressure protection.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

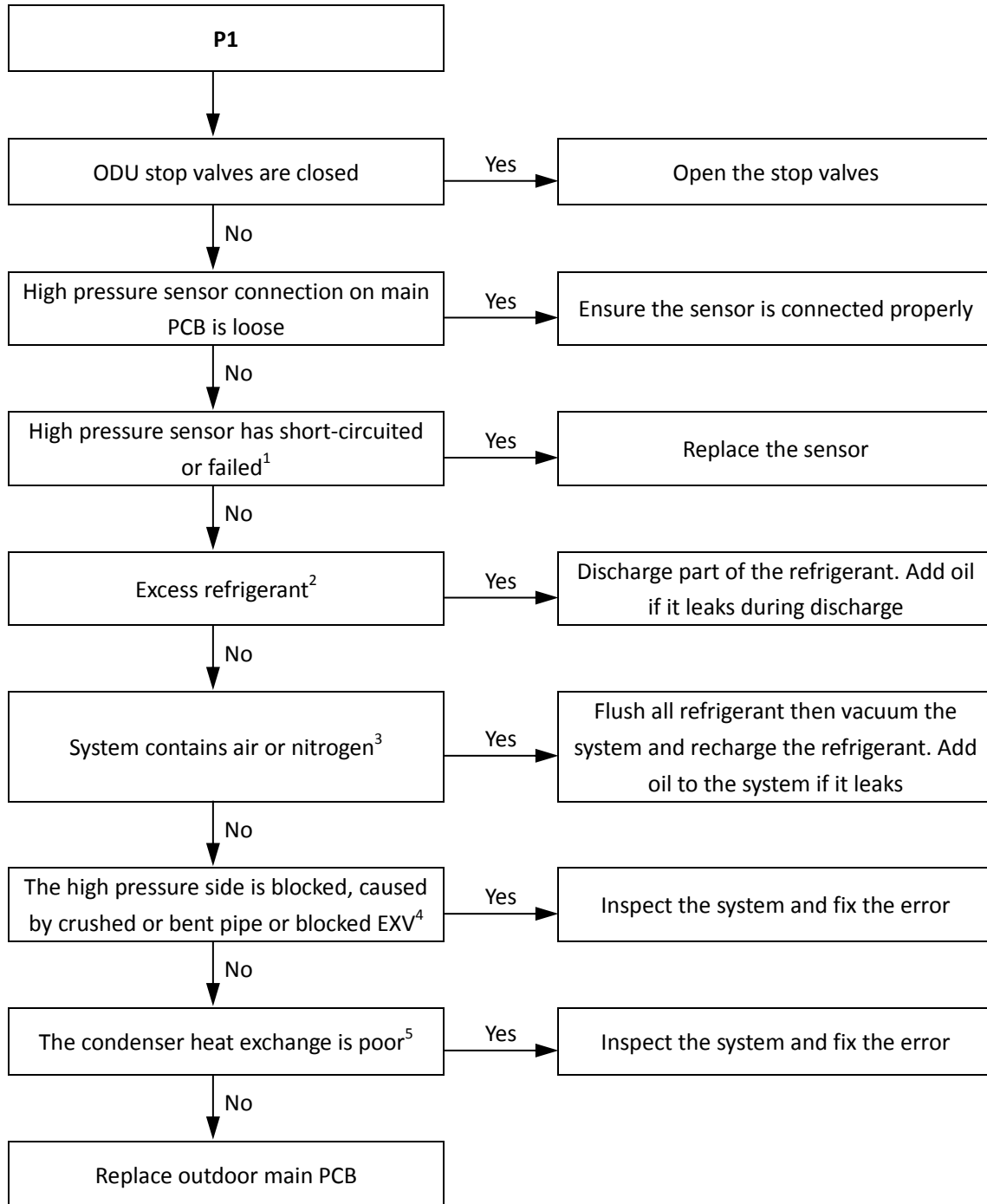
2.12.3 Trigger / recover condition

- Trigger condition: Discharge pressure ≥ 4.4 MPa.
- Recover condition: Discharge pressure ≤ 3.2 MPa.
- Reset method: Resume automatically.

2.12.4 Possible causes

- Outdoor unit stop valves are closed.
- Pressure sensor/switch not connected properly or has malfunctioned.
- Excess refrigerant.
- System contains air or nitrogen.
- High pressure side blockage.
- Poor condenser heat exchange.
- Main PCB damaged.

2.12.5 Procedure



Notes:

1. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed.
2. Excess refrigerant causes discharge temperature to be lower than normal, discharge pressure to be higher than normal and suction pressure to be higher than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
3. Air or nitrogen in the system causes discharge temperature to be higher than normal, discharge pressure to be higher than normal, compressor current to be higher than normal, abnormal compressor noise and an unsteady pressure meter reading. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
4. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
5. In cooling mode check outdoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check indoor heat exchangers, fans and air outlets for dirt/blockages.

Mini TVR Individual 60Hz

2.13 P2, H5: Suction pipe low pressure protection

2.13.1 Digital display output



2.13.2 Description

- Suction pipe low pressure protection.
- The system stops running.
- Error code is displayed on outdoor unit PCB.

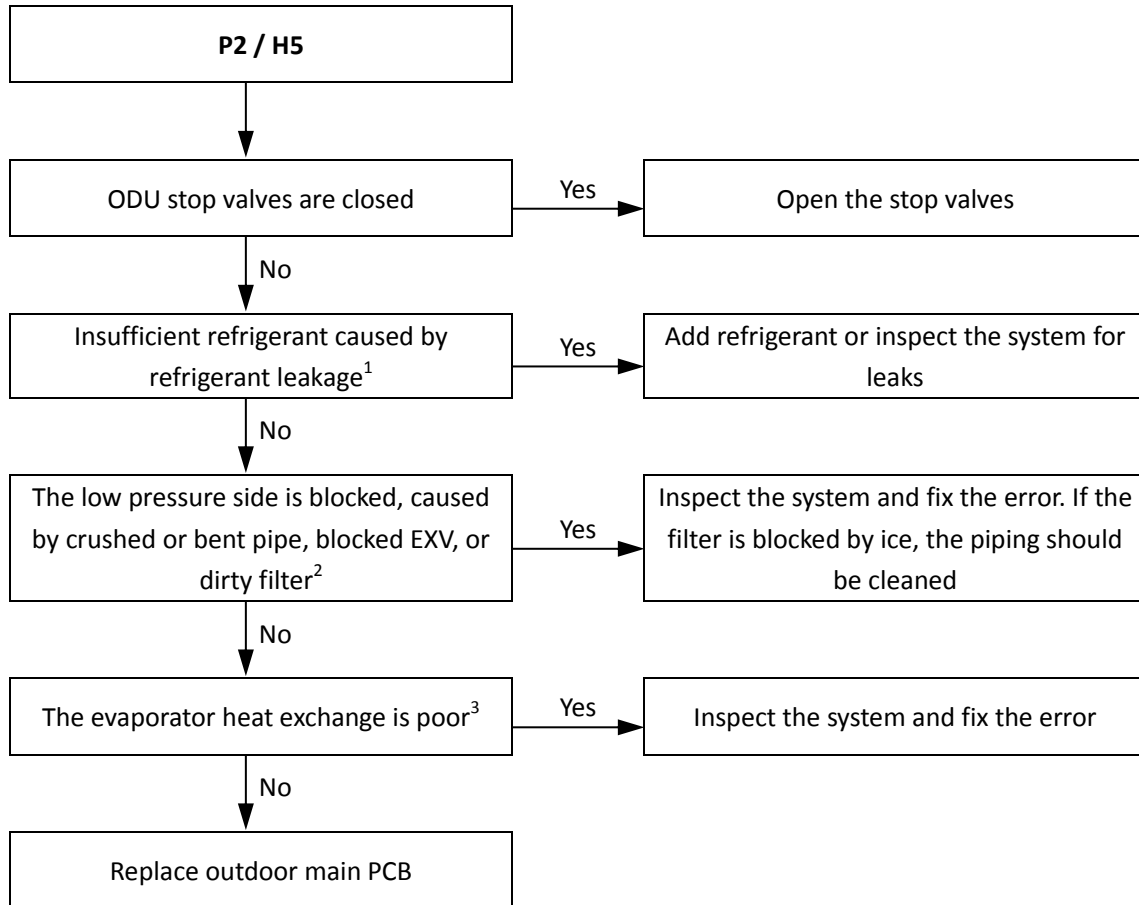
2.13.3 Trigger / recover condition

- Trigger condition:
 - For P2 protection: Suction pressure $\leq 0.05\text{MPa}$.
 - For H5 protection: P2 protection appears three times in 30 minutes.
- Recover condition: Suction pressure $\geq 0.15\text{MPa}$.
- Reset method:
 - For P2 protection: Resume automatically.
 - For H5 protection: Manually restart.

2.13.4 Possible causes

- Outdoor unit stop valves are closed.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange.
- Main PCB damaged.

2.13.5 Procedure



Notes:

1. An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
2. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
3. In cooling mode check indoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check outdoor heat exchangers, fans and air outlets for dirt/blockages.

2.14 P3: Compressor current protection

2.14.1 Digital display output



2.14.2 Description

- P3 indicates current protection on compressor.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

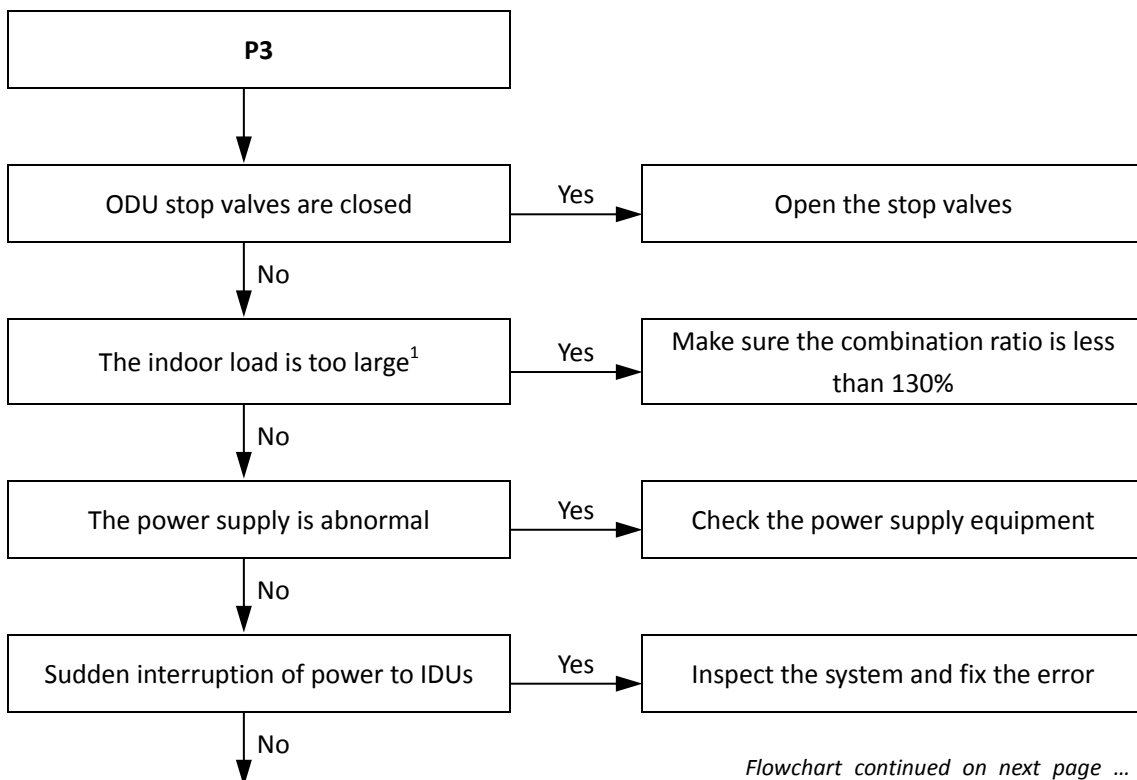
2.14.3 Trigger / recover condition

- Trigger condition: Current of compressor LNB42FSAMC $\geq 18A$, LNB53FCAMC $\geq 23A$
- Recover condition: Current of compressor LNB42FSAMC $< 18A$, LNB53FCAMC $< 23A$.
- Reset method: Resume automatically.

2.14.4 Possible causes

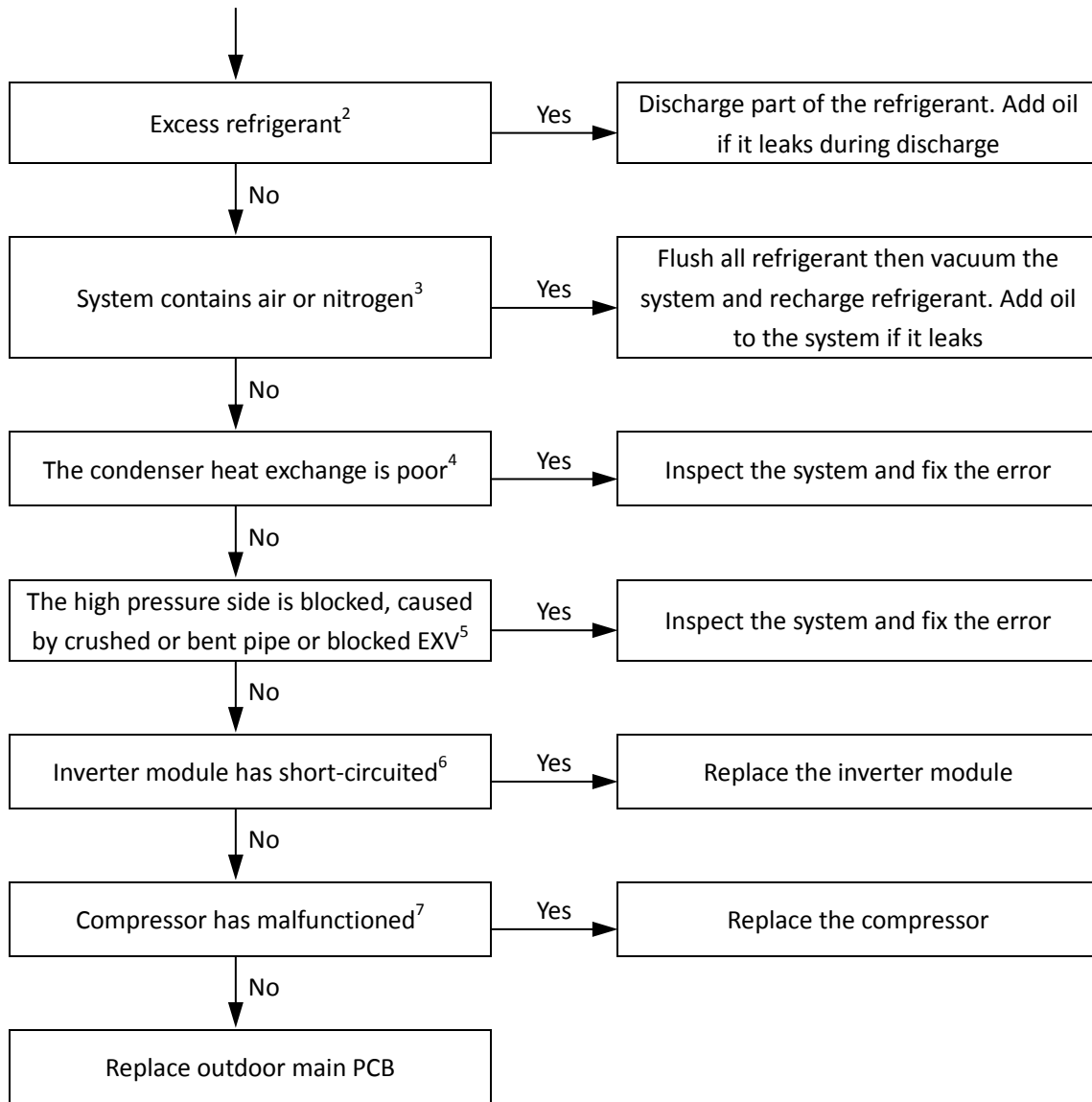
- Outdoor unit stop valves are closed.
- Indoor load too large.
- Power supply abnormal.
- Sudden interruption of power to IDUs.
- Excess refrigerant.
- System contains air or nitrogen.
- Poor condenser heat exchange.
- High pressure side blockage.
- Inverter module damaged.
- Compressor damaged.
- Main PCB damaged.

2.14.5 Procedure



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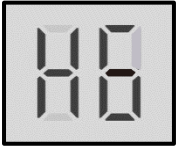


Notes:

1. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
2. Excess refrigerant causes discharge temperature to be lower than normal, discharge pressure to be higher than normal and suction pressure to be higher than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
3. Air or nitrogen in the system causes discharge temperature to be higher than normal, discharge pressure to be higher than normal, compressor current to be higher than normal, abnormal compressor noise and an unsteady pressure meter reading. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
4. In cooling mode check outdoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check indoor heat exchangers, fans and air outlets for dirt/blockages.
5. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
6. Set a multi-meter to buzzer mode and test any two terminals of P N U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited.
7. The normal resistances of the inverter compressor are 0.5-1.5Ω among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.

2.15 P4, H6: Discharge temperature protection

2.15.1 Digital display output



2.15.2 Description

- Discharge temperature protection.
- The system stops running.
- Error code is displayed on the unit with the error.

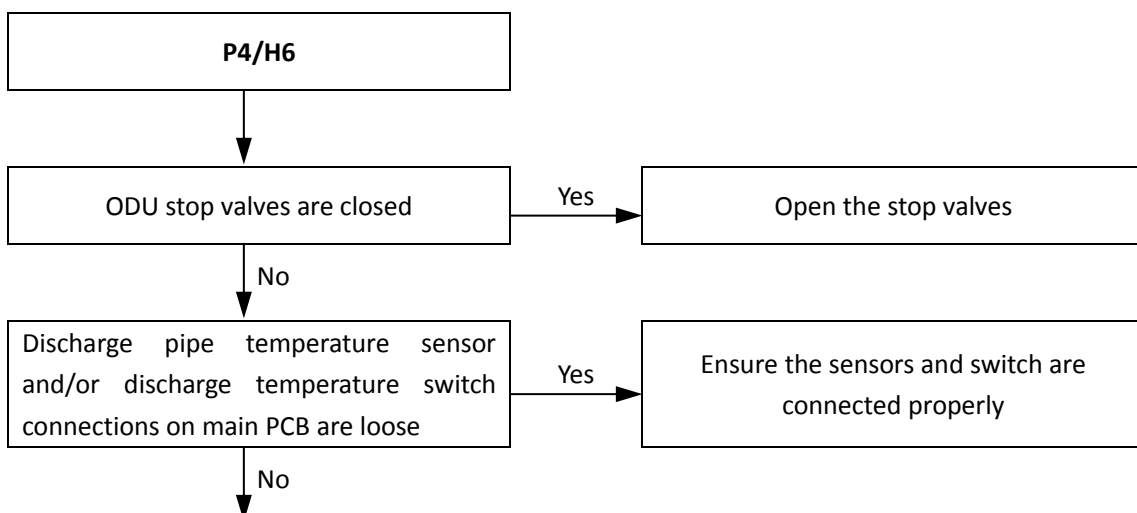
2.15.3 Trigger / recover condition

- Trigger condition:
For P4 protection: Discharge temperature (T5) > 110°C.
For H6 protection: P4 protection appears three times in 100 minutes.
- Recover condition: Discharge temperature (T5) < 85 °C.
- Reset method:
For P4 protection: Resume automatically.
For H6 protection: Manually restart.

2.15.4 Possible causes

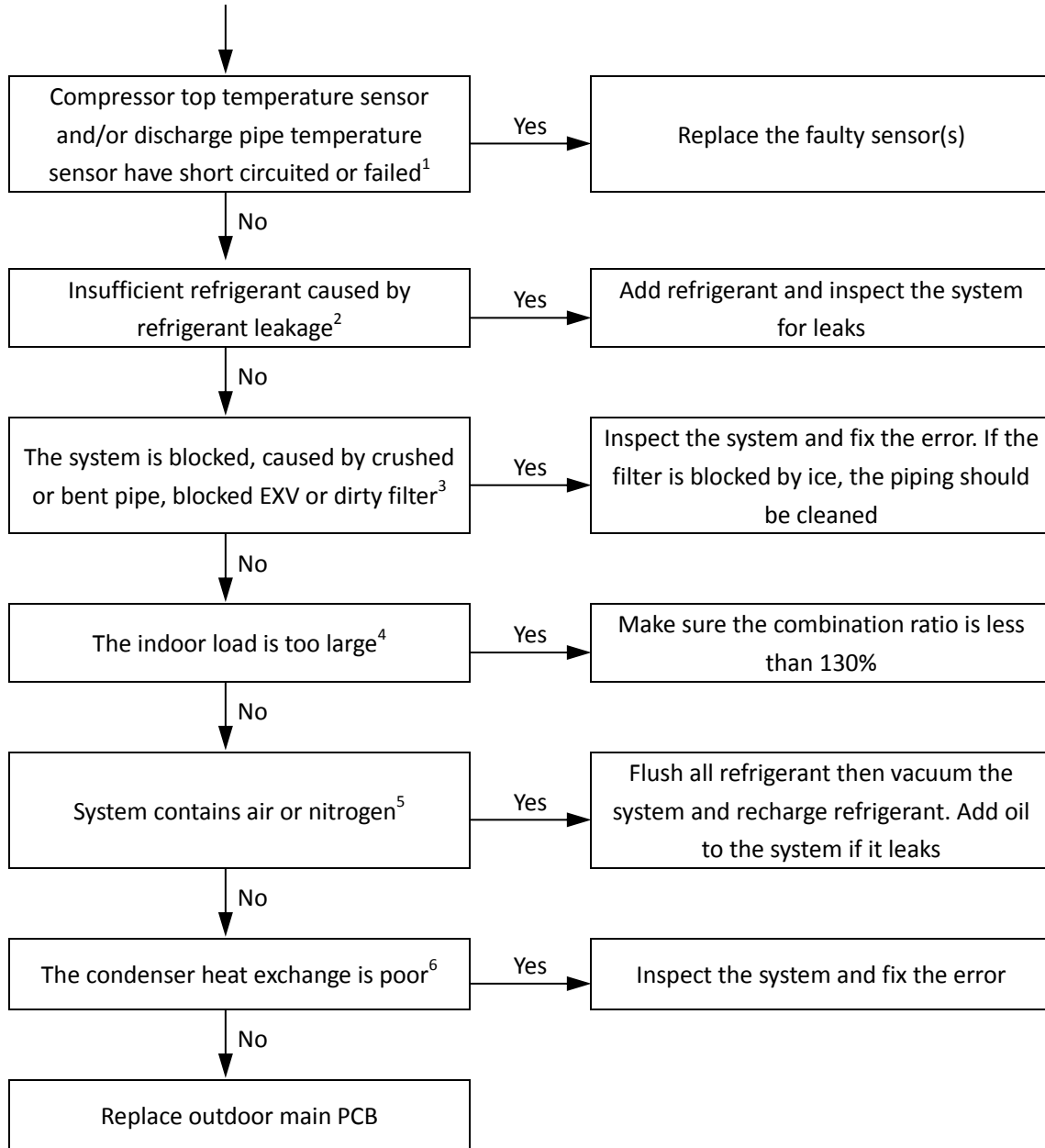
- Outdoor unit stop valves are closed.
- Temperature sensor/switch not connected properly or has malfunctioned.
- Insufficient refrigerant.
- System blockage.
- Indoor load too large.
- System contains air or nitrogen.
- Poor condenser heat exchange.
- Main PCB damaged.

2.15.5 Procedure



Flowchart continued on next page ...

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- Notes:
1. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 6-3.2 in Part 6, 3.1 "Temperature Sensor Resistance Characteristics".
 2. An insufficiency of refrigerant causes compressor discharge temperature to be higher than normal, discharge and suction pressures to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. These issues disappear once sufficient refrigerant has been charged into the system. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
 3. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
 4. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
 5. Air or nitrogen in the system causes discharge temperature to be higher than normal, discharge pressure to be higher than normal, compressor current to be higher than normal, abnormal compressor noise and an unsteady pressure meter reading. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
 6. In cooling mode check outdoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check indoor heat exchangers, fans and air outlets for dirt/blockages.

2.16 P5: Outdoor heat exchanger temperature protection

2.16.1 Digital display output



2.16.2 Description

- Outdoor heat exchanger temperature protection.
- The system stops running.
- Error code is displayed on the unit with the error.

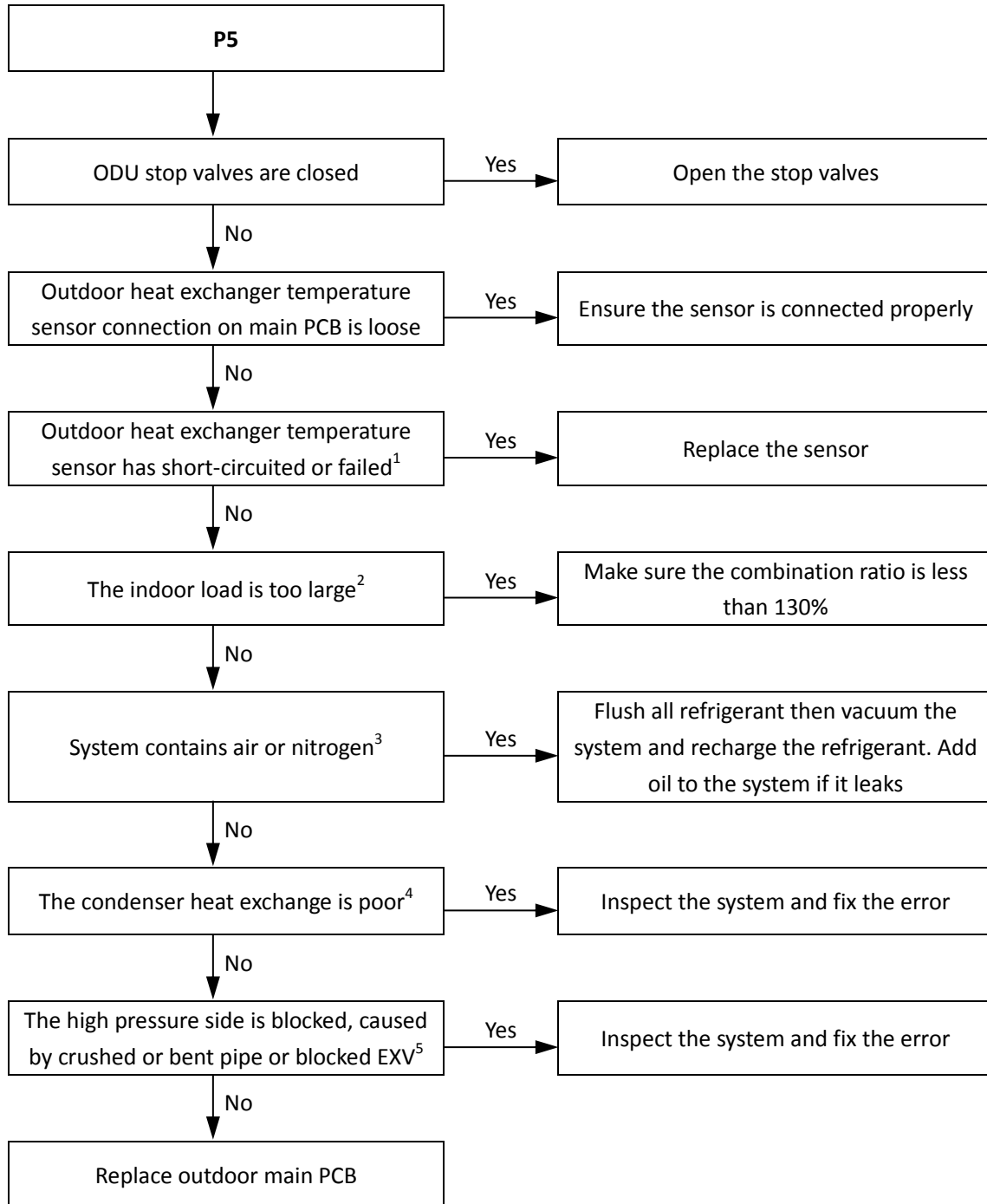
2.16.3 Trigger / recover condition

- Trigger condition: Outdoor heat exchanger temperature (T3) $\geq 65^{\circ}\text{C}$.
- Recover condition: Outdoor heat exchanger temperature (T3) $< 55^{\circ}\text{C}$.
- Reset method: Resume automatically.

2.16.4 Possible causes

- Outdoor unit stop valves are closed.
- Temperature sensor not connected properly or has malfunctioned.
- Indoor load too large.
- System contains air or nitrogen.
- Poor condenser heat exchange.
- High pressure side blockage.
- Main PCB damaged.

2.16.5 Procedure



Notes:

1. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 6-3.1 in Part 6, 3.1 "Temperature Sensor Resistance Characteristics"
2. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
3. Air or nitrogen in the system causes discharge temperature to be higher than normal, discharge pressure to be higher than normal, compressor current to be higher than normal, abnormal compressor noise and an unsteady pressure meter reading. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".
4. In cooling mode check outdoor heat exchangers, fans and air outlets for dirt/blockages. In heating mode check indoor heat exchangers, fans and air outlets for dirt/blockages.
5. High pressure side blockage causes discharge temperature to be higher than normal, discharge pressure to be higher than normal and suction pressure to be lower than normal. For normal system parameters refer to Table 6-3.4 and 6-3.5 in Part 6, 3.2 "Normal Operating Parameters of Refrigerant System".

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2.17 P6, H4: Inverter module protection

2.17.1 Digital display output



2.17.2 Description

- H4 indicates compressor inverter module protection.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

2.17.3 Trigger / recover condition

- Trigger condition: Compressor appears three inverter module protections.
- Recover condition: Inverter module goes back to normal.
- Reset method: Manually restart.

2.17.4 Possible causes

- Inverter module protection.
- DC bus low or high voltage protection.
- MCE error.
- Zero speed protection.
- Phase sequence error.
- Excessive compressor frequency variation.
- Actual compressor frequency differs from target frequency.

2.17.5 Specific error codes for H4 inverter module protection

If an H4 error code is displayed, Check the history error code to check the following specific error code: L0, L1, L2, L4, L5, L7, L8, L9.

Table 6-2.1: Specific error codes for error xH4

Specific error code ¹	Content
L0	Inverter module protection
L1	DC bus low voltage protection
L2	DC bus high voltage protection
L4	MCE error
L5	Zero speed protection
L7	Phase sequence error
L8	Compressor frequency variation greater than 15Hz within one second protection
L9	Actual compressor frequency differs from target frequency by more than 15Hz protection

The specific error codes xL0, xL1, xL2 and xL4 can be obtained from the inverter module LED indicators. If an inverter module error has occurred, LED5/7 is continuously on and LED4/6 flashes.

Table 2-6.2: Errors indicated on LED1

LED4/6 flashing pattern	Corresponding error
Flashes 8 times and stops for 1 second, then repeats	L0 - Inverter module protection
Flashes 9 times and stops for 1 second, then repeats	L1 - DC bus low voltage protection
Flashes 10 times and stops for 1 second, then repeats	L2 - DC bus high voltage protection
Flashes 12 times and stops for 1 second, then repeats	L4 - MCE error

2.17.6 L0: Inverter module protection

Step 1: Compressor check

Measure the resistance between each two of U, V, W terminals of the compressor, all the resistance should be the same and equal to $0.9 \sim 5 \Omega$. (Fig. A and Fig. B)

Measure the resistance between each of U, V, W terminals of the compressor to ground (Fig. C), all the resistance should trend to infinity (Fig. D), otherwise the compressor has been malfunction, needs to be replaced.

Fig. A



Fig.B



Fig.C

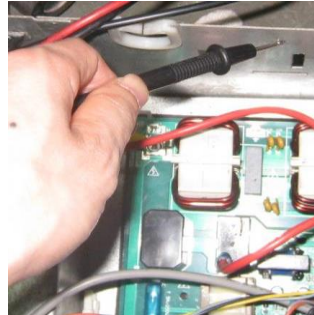
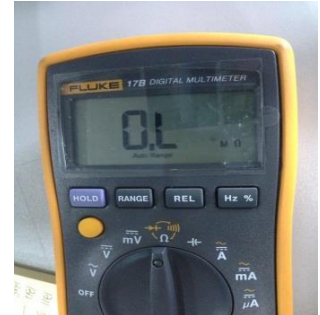


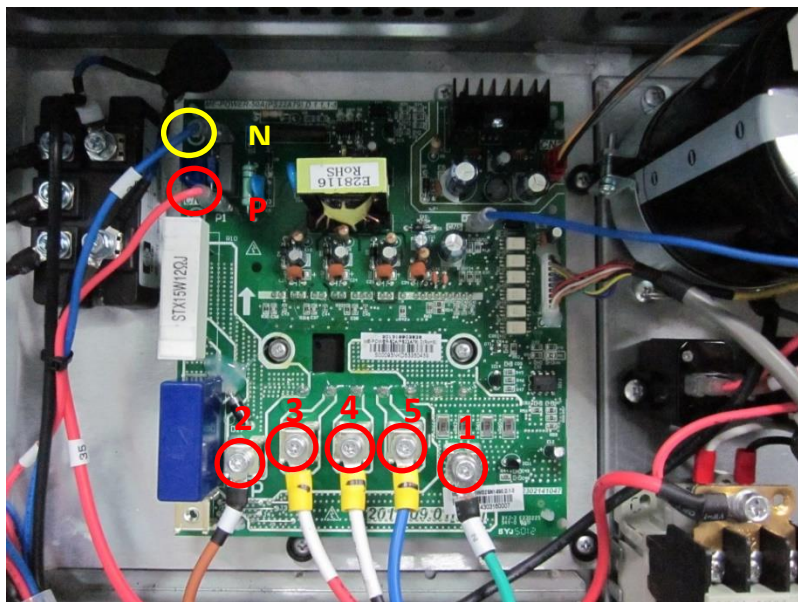
Fig.D



If the resistance value are normal, then go to step 2.

Step 2: Module check

Figure 6-2.1: P and N terminals on Inverter module



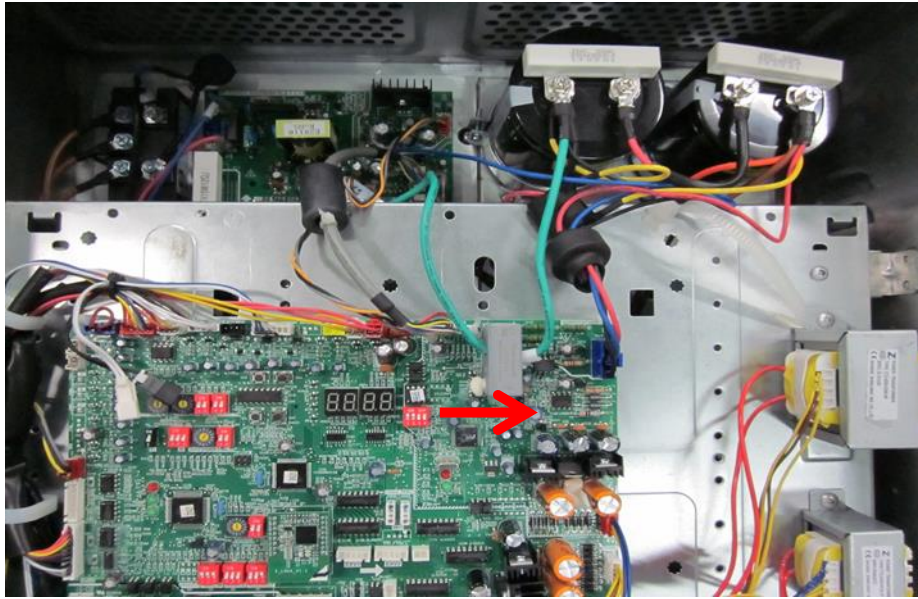
- 1) DC voltage between terminal P and terminal N should be 1.41 times of the local power supply voltage.
- 2) DC voltage between terminal 1 and 2 should be $510V \sim 580V$.
- 3) Disconnect the terminal 3, 4, and 5 from inverter compressor. Measure the resistance between any two terminals among terminal 1, 2, 3, 4, 5. All the values should be infinity. If any of the value approximates to 0, the inverter module is damaged and should be replaced.

After replaced the inverter module, if the system is still abnormal, then go to step 3.

Step 3: DC generatrix check

Direction of the current in DC supply wire which is running through the inductor should be the same as the direction of arrow marked on the inductor.

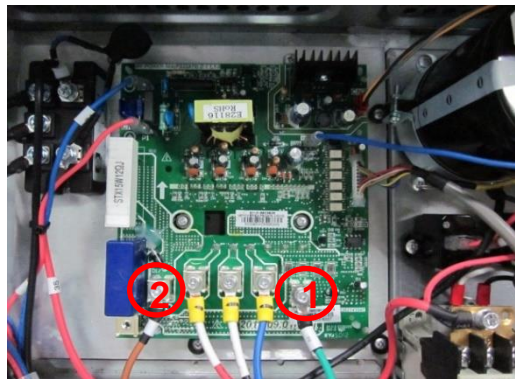
Figure 6-2.2: Direction of the current in DC supply wire



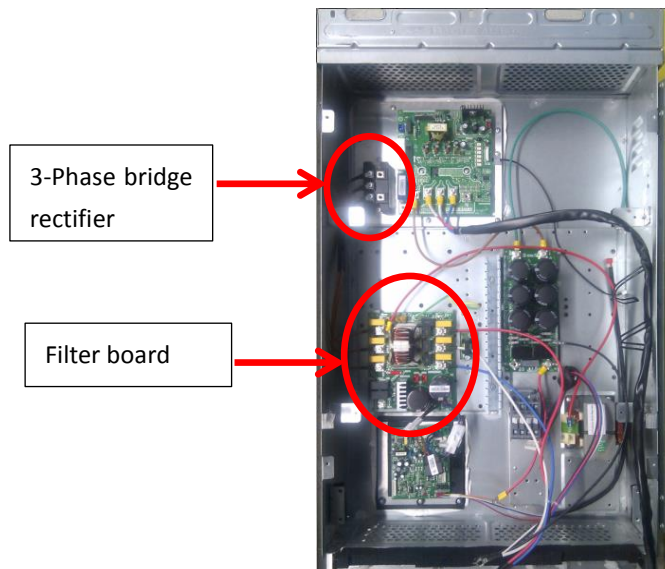
2.17.7 L1: DC bus low voltage protection

Step 1: Check the DC voltage between 1 and 2 terminal, the normal value should be 510V~580V, if the voltage is lower than 510V, go to step 2.

Figure 6-2.3: Terminals on Inverter module



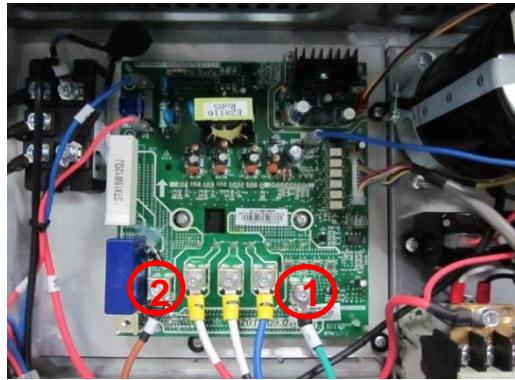
Step 2: Check whether the wires of rectifier circuit are loose or not. If wires are loosen, fasten the wires. If wires are OK, replace the main PCB.



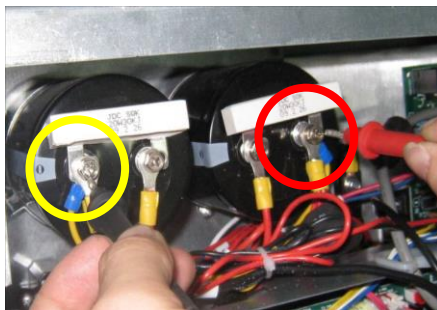
2.17.8 L2: DC bus high voltage protection

Step 1: Check the DC voltage between 1 and 2 terminal, the normal value should be 510V~580V, if the voltage is higher than 580V, go to step 2.

Figure 6-2.3: Terminals on Inverter module



Step 2: Check the voltage between the two electrolytic capacitors, the normal value should be 510V~580V.



Turn the measure range of the meter to 1kV, measure the voltage between two electrolytic capacitors



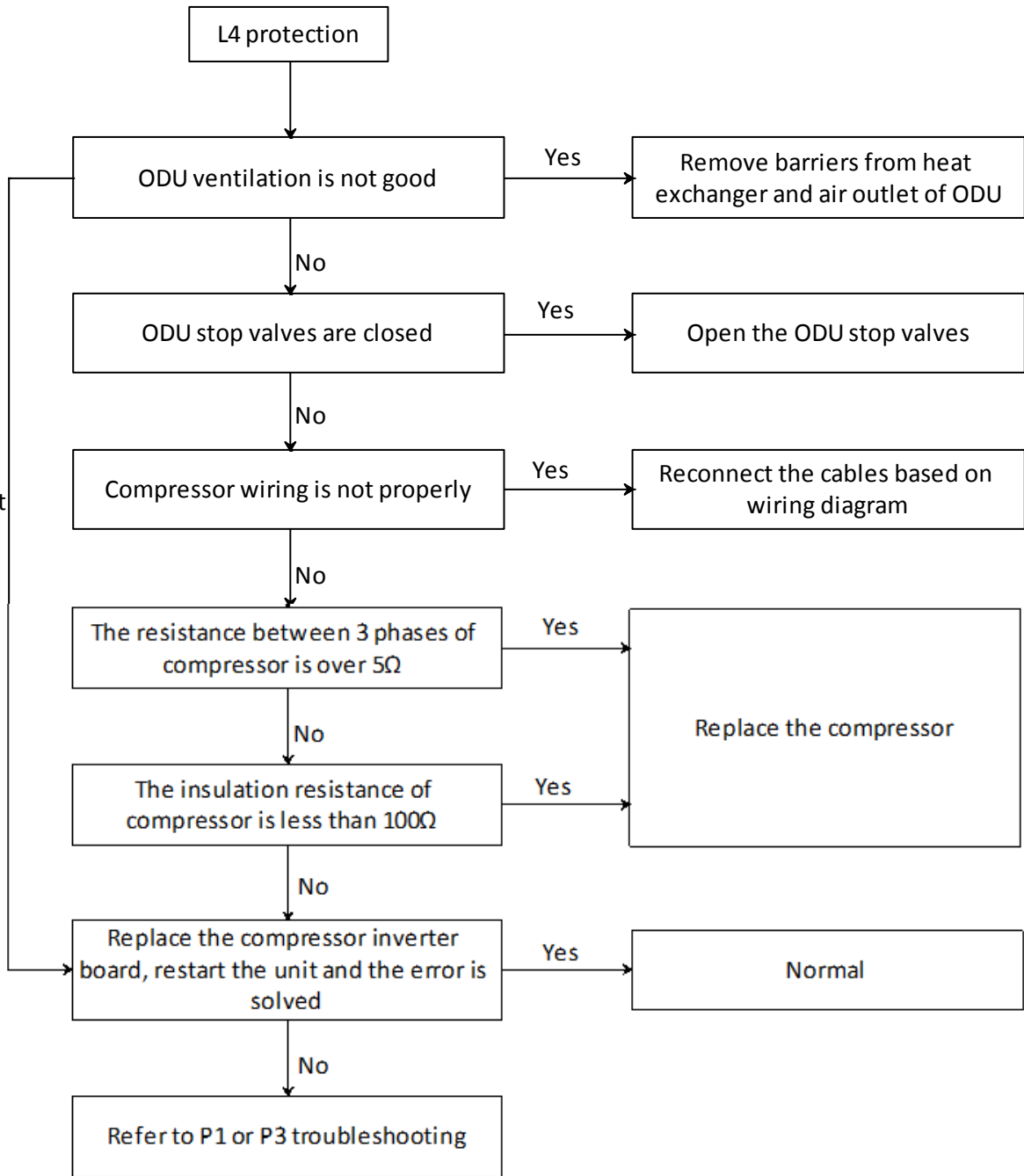
If the value is not in the range, that means the power supply for electrolytic capacitors has problem, you should check the power supply, whether the voltage is too high and whether the voltage is stable.

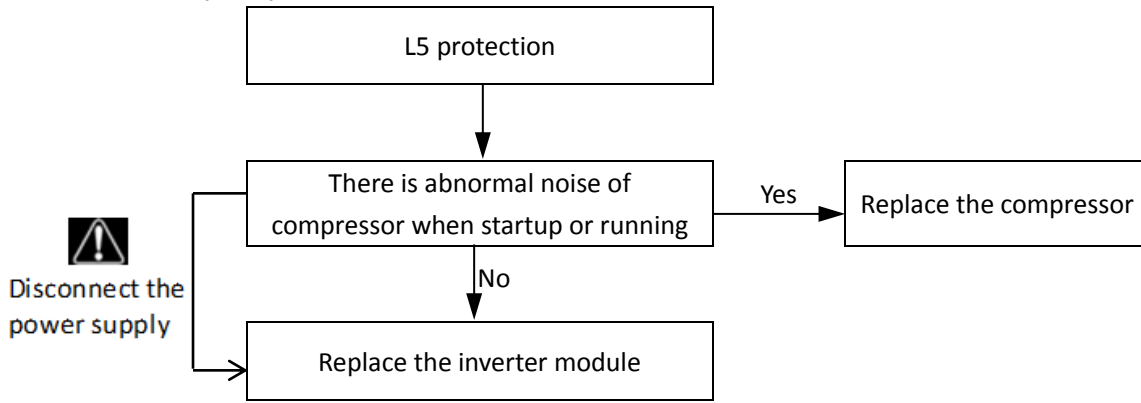
If the voltage value is normal, then the main PCB has malfunction, it needs to be replaced.

2.17.9 L4: MCE error

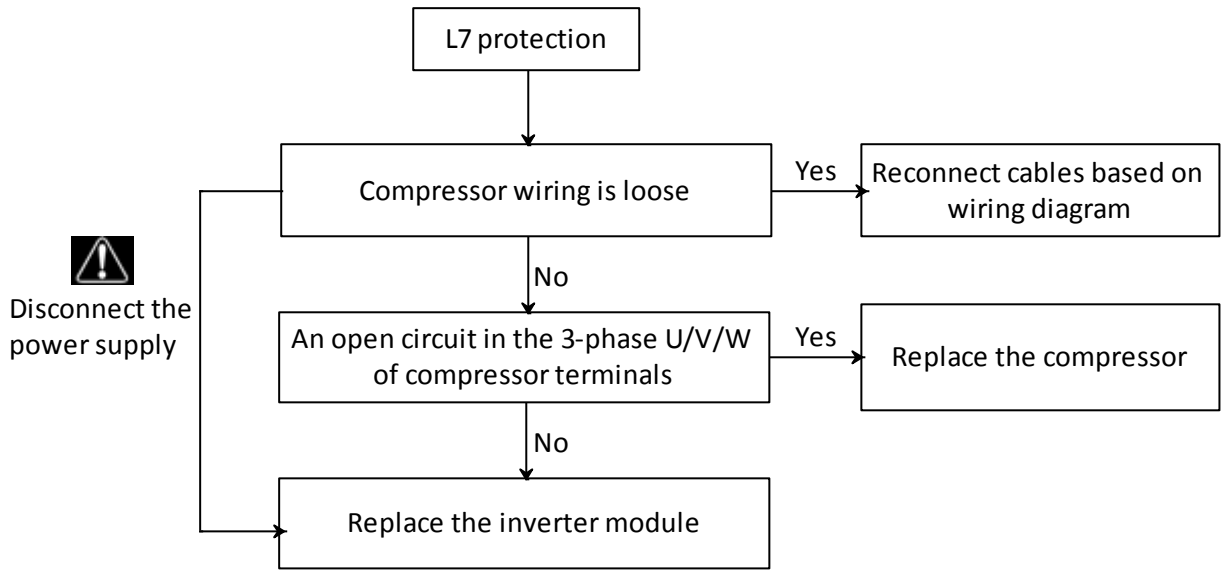


Disconnect the power supply



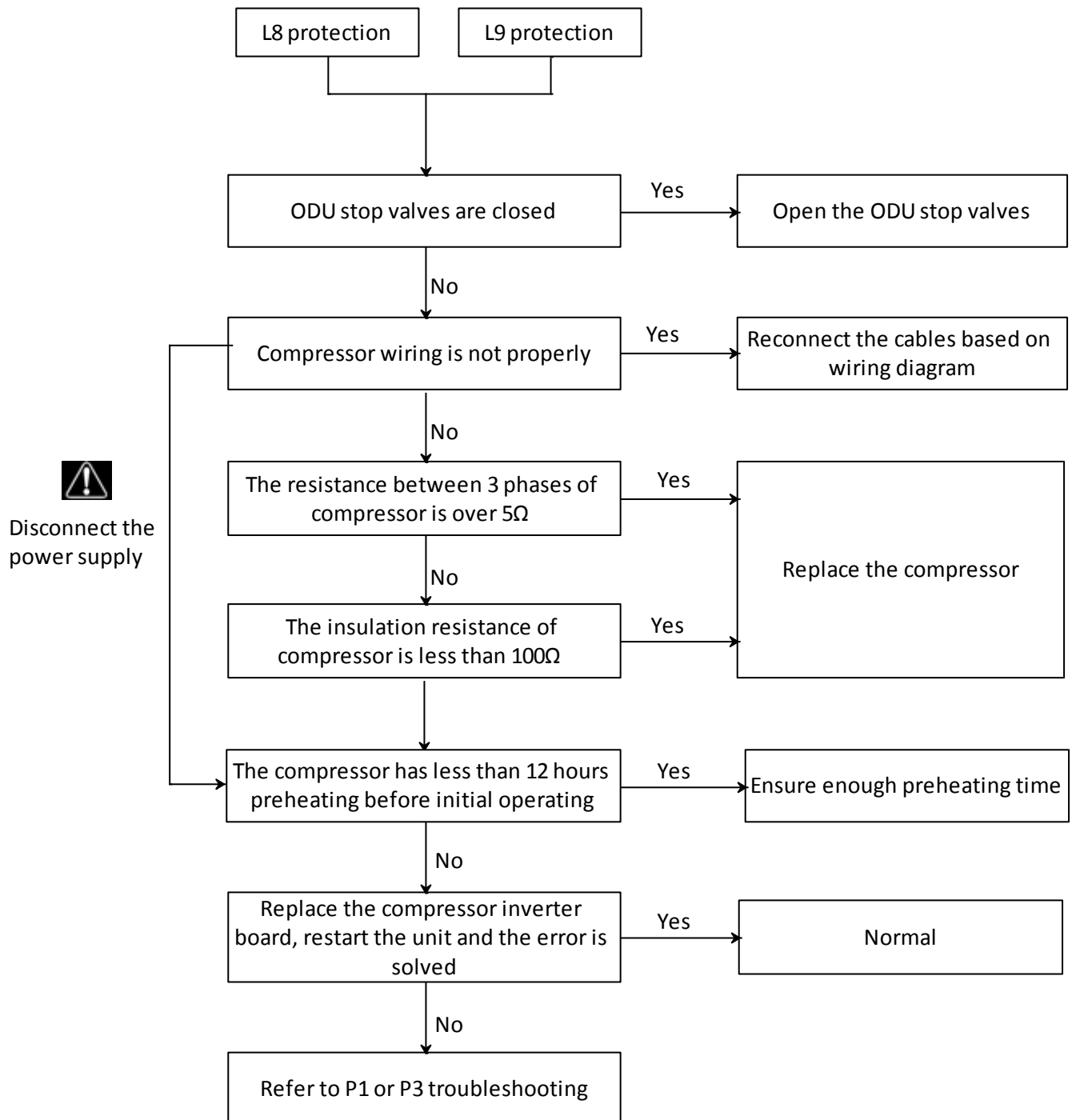
2.17.10 L5: Zero speed protection

2.17.11 L7: Phase sequence error



2.17.12 L8: Compressor frequency variation greater than 15Hz within one second protection

L9: Actual compressor frequency differs from target frequency by more than 15Hz protection



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2.17.13 Compressor replacement procedure

Step 1: Remove faulty compressor and remove oil

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

Figure 6-2.4: Draining oil from a compressor



Step 2: Inspect oil from faulty compressor

- The oil should be clear and transparent. Slightly yellow oil is not an indication of any problems. However, if the oil is dark, black or contains impurities, the system has problems and the oil needs to be changed. Refer to Figure 6-2.6 for further details regarding inspecting compressor oil. (If the compressor oil has been spoiled, the compressor will not be being lubricated effectively. The scroll plate, crankshaft and bearings will wear. Abrasion will lead to a larger load and higher current. More electric energy will get dissipated as heat and the temperature of the motor will become increasingly high. Finally, compressor damage or burnout will result.)

Step 3: Check oil in other compressors in the system

- If the oil drained from the faulty compressor is clean, go to Step 6.
- If the oil drained from the faulty compressor is spoiled (lightly or heavily), go to Step 4.

Step 4: Replace oil separator and accumulator

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

Step 5: Check filters(s)

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

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

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

Figure 6-2.5: Compressor piping



Step 7: Add compressor oil

- Add oil to each of the compressors from which oil was drained in Step 3.
- Only use FV50S oil. Different compressors require different types of oil. Using the wrong type of oil leads to various problems.
- Add oil to the accumulator from which oil was drained in Step 4.

Step 8: Vacuum drying and refrigerant charging

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

Figure 6-2.6: Inspecting compressor oil

This oil is black - it has been carbonized

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

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

Cloudy or gray oil indicates abnormal system operation

This oil contains particles of copper

2.18 P8: Typhoon protection

2.18.1 Digital display output



2.18.2 Description

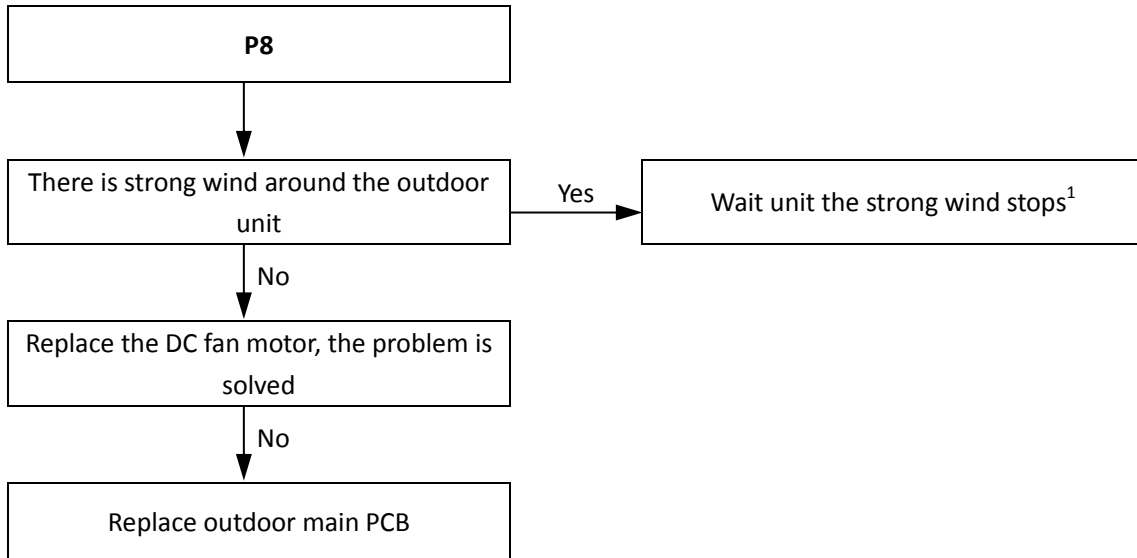
- P8 indicates strong wind protection.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

2.18.3 Trigger / recover condition

- Trigger condition:
Fan speed ≥ 400 rps when the outdoor unit is not start up.
- Recover condition:
Both the upper and lower fan speed < 400 rps for more than 120S.
- Reset method:
Resume automatically.

2.18.4 Possible causes

- There is strong wind around the outdoor unit.
- DC fan motor is damaged.
- Main PCB damaged.

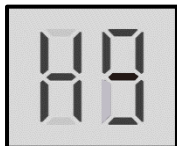
2.18.5 Procedure

Notes:

1. P8 protection recovers in 2 minutes when the strong wind stops.

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2.19 P9, H9: DC fan module protection

2.19.1 Digital display output



2.19.2 Description

- P9 indicates DC fan module protection.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

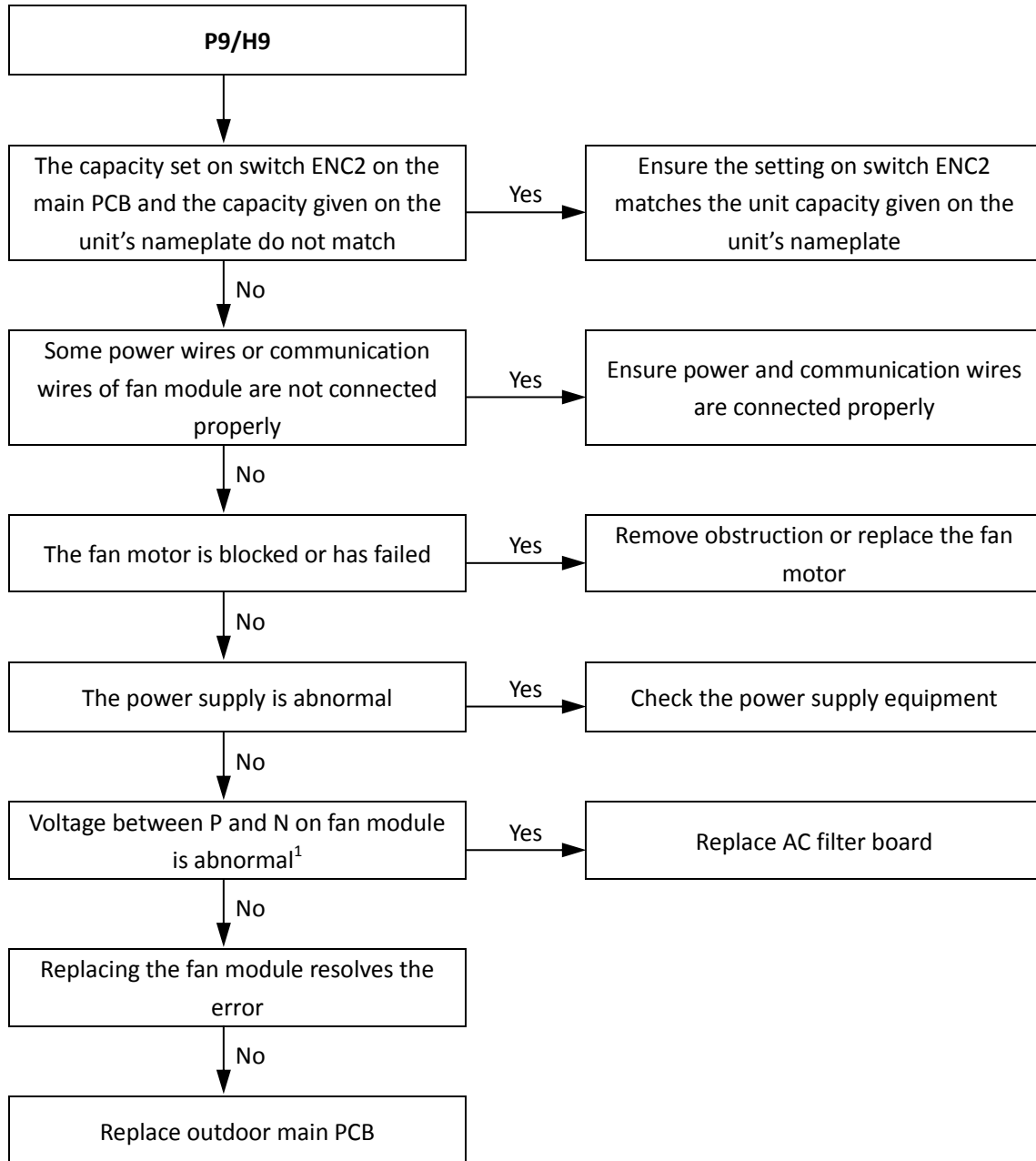
2.19.3 Trigger / recover condition

- Trigger condition:
 - For P9 protection: Fan speed is too low.
 - For H9 protection: P9 protection appears three times in 60 minutes.
- Recover condition: Fan speed goes back to normal.
- Reset method:
 - For P9 protection: Resume automatically.
 - For H9 protection: Manually restart.

2.19.4 Possible causes

- Switch ENC2 incorrectly set.
- Power or communication wires not connected properly.
- Fan motor blocked or has failed.
- Power supply abnormal.
- AC filter board damaged.
- Fan module damaged.
- Main PCB damaged.

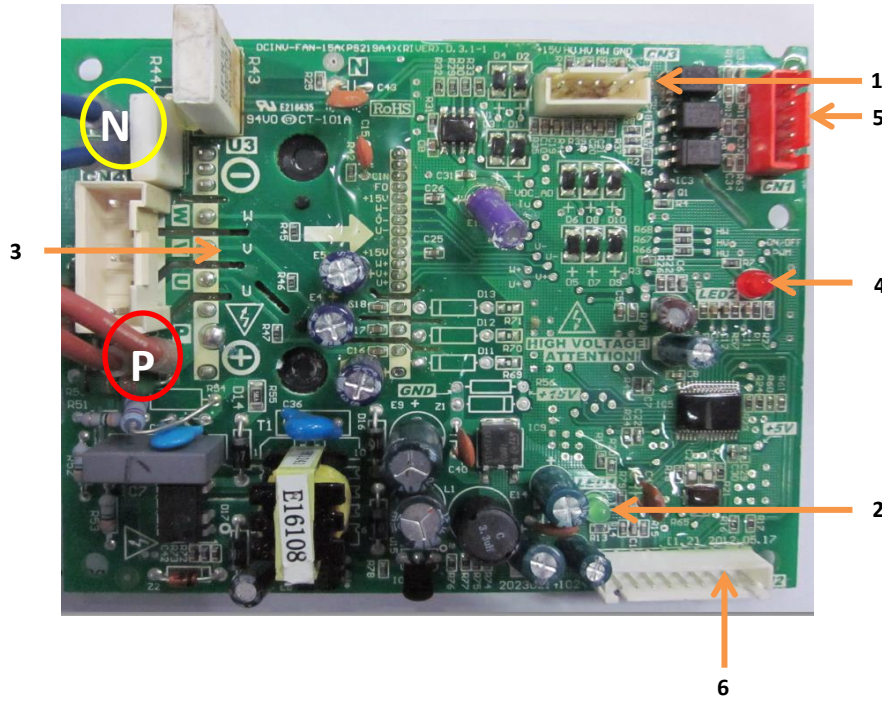
2.19.5 Procedure



Notes:

1. The normal voltage between P and N on the fan module is 310V DC.

Figure 6-2.7: Compressor piping



Notes:

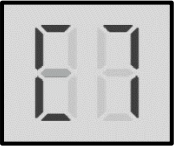
1. Program input port
2. Power supply indicator lamp
3. Fan motor U, V, W output port
4. Fault indicator lamp
5. PCB control signal input port
6. Signal feedback port

Table 6-2.3: P9 protection analysis

Conditions	Fault indicator lamp of fan module	Power supply indicator lamp of fan module	Digital tube display	Malfunction analysis
Power on	Off	Off	Quantity of IDU or "0"	Check the power supply circuit for fan module; Check whether there has power supply for lightning protection plate, whether the protective tube is broken, whether the voltage after rectification is normal, whether the bridge rectifier is broken.
Power on	Off	Flicker	Quantity of IDU or "0"	Power supply of fan module has problem, needs to replace the fan module.
When fan motor start	At first the lamp is on then the lamp is off	On	P9/H9	Check whether the drive port and signal feedback port is loose, whether the fan module and fan motor is installed firmly. If above conditions are all OK, it needs to replace the fan module.
When fan motor start	At first the lamp is on then the lamp flicker	On	P9/H9	Check whether the transformer in lightning protection plate is open circuit, whether the relay is broken. If occurs above problem, it needs to replace the lightning protection plate.
Fan motor running several minutes	On	On	P9/H9	Check whether the capacity setting from dial switch is accordance with actual ODU capacity, whether the capacity from spot check is accordance with actual ODU capacity. If occurs above problem, it needs to adjust the capacity setting. If above conditions are both OK, it needs to replace the main control board.

2.20 PL, C7: Inverter module temperature protection

2.20.1 Digital display output



2.20.2 Description

- PL indicates inverter module temperature protection.
- The system stops running.
- Error code is displayed on the outdoor unit PCB.

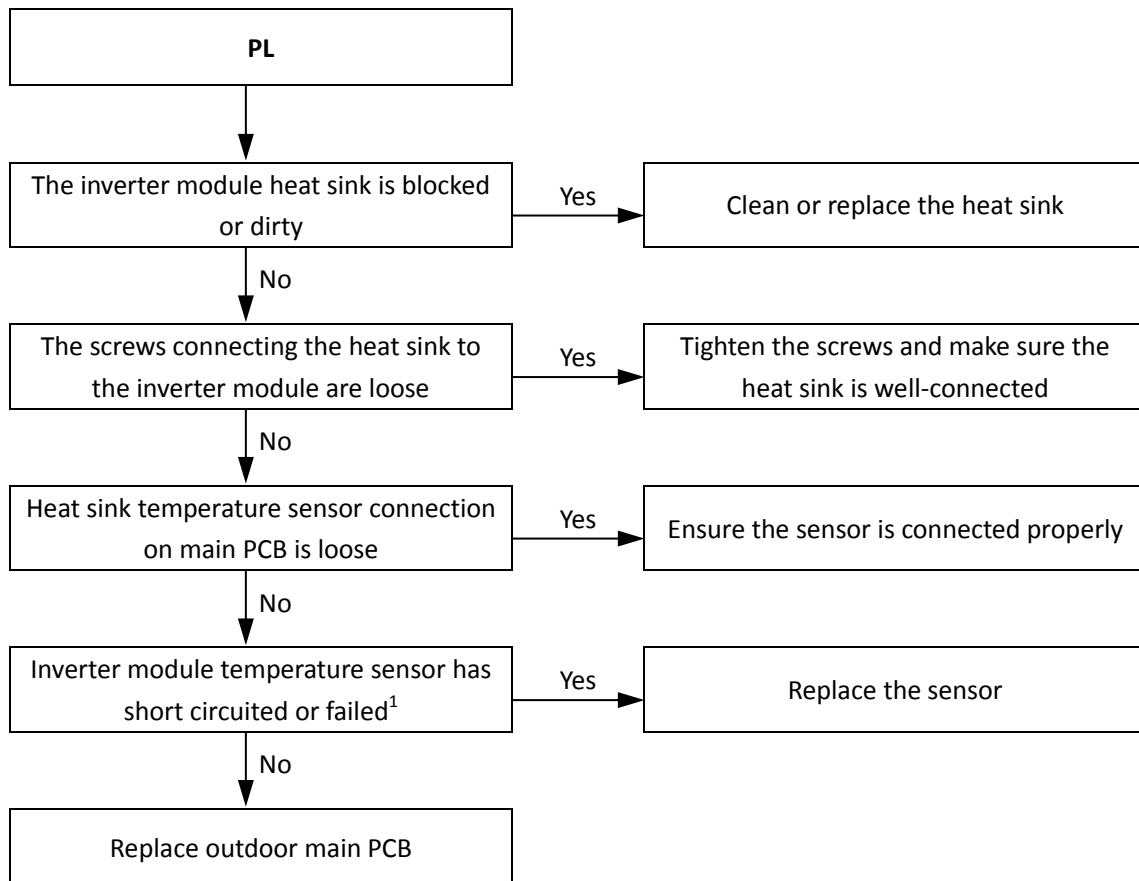
2.20.3 Trigger / recover condition

- Trigger condition:
 - For PL protection: Inverter module heat sink temperature (T_f) $\geq 80^\circ\text{C}$.
 - For C7 protection: PL protection appears three times in 90 minutes.
- Recover condition:
 - Inverter module heat sink temperature (T_f) $< 66^\circ\text{C}$
- Reset method:
 - For PL protection: Resume automatically.
 - For C7 protection: Manually restart.

2.20.4 Possible causes

- Blocked, dirty or loose heat sink.
- Temperature sensor not connected properly or has malfunctioned.
- Main PCB damaged.

2.20.5 Procedure



Notes:

1. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Table 6-3.3 in Part 6, 3.1 "Temperature Sensor Resistance Characteristics".

3 Appendix to Part 6

3.1 Temperature Sensor Resistance Characteristics

Table 6-3.1: Outdoor ambient temperature sensor, outdoor heat exchanger temperature sensor and refrigerant cooling pipe temperature sensor resistance characteristics

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-20	115.3	20	12.64	60	2.358	100	0.6297
-19	108.1	21	12.06	61	2.272	101	0.6115
-18	101.5	22	11.50	62	2.191	102	0.5939
-17	96.34	23	10.97	63	2.112	103	0.5768
-16	89.59	24	10.47	64	2.037	104	0.5604
-15	84.22	25	10.00	65	1.965	105	0.5445
-14	79.31	26	9.551	66	1.896	106	0.5291
-13	74.54	27	9.124	67	1.830	107	0.5143
-12	70.17	28	8.720	68	1.766	108	0.4999
-11	66.09	29	8.336	69	1.705	109	0.4860
-10	62.28	30	7.971	70	1.647	110	0.4726
-9	58.71	31	7.624	71	1.591	111	0.4596
-8	56.37	32	7.295	72	1.537	112	0.4470
-7	52.24	33	6.981	73	1.485	113	0.4348
-6	49.32	34	6.684	74	1.435	114	0.4230
-5	46.57	35	6.400	75	1.387	115	0.4116
-4	44.00	36	6.131	76	1.341	116	0.4006
-3	41.59	37	5.874	77	1.291	117	0.3899
-2	39.82	38	5.630	78	1.254	118	0.3796
-1	37.20	39	5.397	79	1.2133	119	0.3695
0	35.20	40	5.175	80	1.174	120	0.3598
1	33.33	41	4.964	81	1.136	121	0.3504
2	31.56	42	4.763	82	1.100	122	0.3413
3	29.91	43	4.571	83	1.064	123	0.3325
4	28.35	44	4.387	84	1.031	124	0.3239
5	26.88	45	4.213	85	0.9982	125	0.3156
6	25.50	46	4.046	86	0.9668	126	0.3075
7	24.19	47	3.887	87	0.9366	127	0.2997
8	22.57	48	3.735	88	0.9075	128	0.2922
9	21.81	49	3.590	89	0.8795	129	0.2848
10	20.72	50	3.451	90	0.8525	130	0.2777
11	19.69	51	3.318	91	0.8264	131	0.2708
12	18.72	52	3.192	92	0.8013	132	0.2641
13	17.80	53	3.071	93	0.7771	133	0.2576
14	16.93	54	2.959	94	0.7537	134	0.2513
15	16.12	55	2.844	95	0.7312	135	0.2451
16	15.34	56	2.738	96	0.7094	136	0.2392
17	14.62	57	2.637	97	0.6884	137	0.2334
18	13.92	58	2.540	98	0.6682	138	0.2278
19	13.26	59	2.447	99	0.6486	139	0.2223

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Table 6-3.2: Compressor discharge pipe temperature sensor resistance characteristics

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-20	542.7	20	68.66	60	13.59	100	3.702
-19	511.9	21	65.62	61	13.11	101	3.595
-18	483.0	22	62.73	62	12.65	102	3.492
-17	455.9	23	59.98	63	12.21	103	3.392
-16	430.5	24	57.37	64	11.79	104	3.296
-15	406.7	25	54.89	65	11.38	105	3.203
-14	384.3	26	52.53	66	10.99	106	3.113
-13	363.3	27	50.28	67	10.61	107	3.025
-12	343.6	28	48.14	68	10.25	108	2.941
-11	325.1	29	46.11	69	9.902	109	2.860
-10	307.7	30	44.17	70	9.569	110	2.781
-9	291.3	31	42.33	71	9.248	111	2.704
-8	275.9	32	40.57	72	8.940	112	2.630
-7	261.4	33	38.89	73	8.643	113	2.559
-6	247.8	34	37.30	74	8.358	114	2.489
-5	234.9	35	35.78	75	8.084	115	2.422
-4	222.8	36	34.32	76	7.820	116	2.357
-3	211.4	37	32.94	77	7.566	117	2.294
-2	200.7	38	31.62	78	7.321	118	2.233
-1	190.5	39	30.36	79	7.086	119	2.174
0	180.9	40	29.15	80	6.859	120	2.117
1	171.9	41	28.00	81	6.641	121	2.061
2	163.3	42	26.90	82	6.430	122	2.007
3	155.2	43	25.86	83	6.228	123	1.955
4	147.6	44	24.85	84	6.033	124	1.905
5	140.4	45	23.89	85	5.844	125	1.856
6	133.5	46	22.89	86	5.663	126	1.808
7	127.1	47	22.10	87	5.488	127	1.762
8	121.0	48	21.26	88	5.320	128	1.717
9	115.2	49	20.46	89	5.157	129	1.674
10	109.8	50	19.69	90	5.000	130	1.632
11	104.6	51	18.96	91	4.849		
12	99.69	52	18.26	92	4.703		
13	95.05	53	17.58	93	4.562		
14	90.66	54	16.94	94	4.426		
15	86.49	55	16.32	95	4.294		
16	82.54	56	15.73	96	4.167		
17	78.79	57	15.16	97	4.045		
18	75.24	58	14.62	98	3.927		
19	71.86	59	14.09	99	3.812		

Table 6-3.3: Heat sink temperature sensor resistance characteristics

Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-30	971.4	10	109.0	50	19.70	90	5.000
-29	912.8	11	103.9	51	18.97	91	4.855
-28	858.2	12	99.02	52	18.26	92	4.705
-27	807.3	13	94.44	53	17.59	93	4.566
-26	759.7	14	90.11	54	16.94	94	4.431
-25	715.3	15	86.00	55	16.32	95	4.301
-24	673.6	16	82.09	56	15.73	96	4.176
-23	634.7	17	78.38	57	15.16	97	4.055
-22	598.2	18	74.87	58	14.62	98	3.938
-21	564.1	19	71.53	59	14.10	99	3.825
-20	532.2	20	68.36	60	13.60	100	3.716
-19	502.2	21	65.34	61	13.12	101	3.613
-18	474.1	22	62.47	62	12.65	102	3.514
-17	447.7	23	59.75	63	12.22	103	3.418
-16	423.0	24	57.17	64	11.79	104	3.326
-15	399.8	25	54.71	65	11.39	105	3.235
-14	378.0	26	52.36	66	10.99	106	3.148
-13	357.5	27	50.13	67	10.62	107	3.063
-12	338.2	28	48.01	68	10.25	108	2.982
-11	320.1	29	45.99	69	9.909	109	2.902
-10	303.1	30	44.07	70	9.576	110	2.826
-9	287.1	31	42.23	71	9.253	111	2.747
-8	272.0	32	40.48	72	8.947	112	2.672
-7	257.8	33	38.81	73	8.646	113	2.599
-6	244.4	34	37.23	74	8.362	114	2.528
-5	231.9	35	35.71	75	8.089	115	2.460
-4	220.0	36	34.27	76	7.821	116	2.390
-3	208.7	37	32.89	77	7.569	117	2.322
-2	198.2	38	31.58	78	7.323	118	2.256
-1	188.2	39	30.33	79	7.088	119	2.193
0	178.8	40	29.13	80	6.858	120	2.132
1	169.9	41	27.98	81	6.640	121	2.073
2	161.5	42	26.89	82	6.432	122	2.017
3	153.6	43	25.85	83	6.230	123	1.962
4	146.1	44	24.85	84	6.033	124	1.910
5	139.1	45	23.90	85	5.847	125	1.859
6	132.3	46	22.98	86	5.667		
7	126.0	47	22.10	87	5.492		
8	120.0	48	21.26	88	5.322		
9	114.3	49	20.47	89	5.159		

Mini TVR Individual 60Hz



3.2 Normal Operating Parameters of Refrigerant System

Under the following conditions, the operating parameters given in Tables 6-3.4 and 6-3.5 should be observed:

- The outdoor unit can detect all the indoor units.
- The number of indoor units displayed on DSP is steady and is equal to the actual number of indoor units installed.
- All stop valves are open and all indoor unit EXVs are connected to their unit's PCB.
- All the indoor units are currently running.
- If the outdoor ambient temperature is high, the system is being run in cooling mode with the following settings: temperature 17°C; fan speed high.
- If the outdoor ambient temperature is low, the system is being run in heating mode with the following settings: temperature 30°C; fan speed high.
- The system has been running normally for more than 30 minutes.

Table 6-3.4: Outdoor unit cooling mode operating parameters

Ambient temperature (T4)	°C	20-27	27-33	33-38	38-45
Discharge pressure (spot check)	MPa	2.1-2.3	2.8-3.1	3.3-3.5	3.7-3.9
Pressure of high pressure valve	MPa	1.8-2.0	2.4-2.7	2.8-3.0	3.2-3.5
Pressure of low pressure valve	MPa	0.7-0.9	0.8-1.0	1.0-1.2	1.2-1.4
DC Inverter compressor current (spot check)	A	4-5	6-7	7-8	9-11
Fixed compressor current (spot check)	A	6-7	8-9	9-11	11-12
Discharge temperature (spot check)	°C	50-65	70-85	70-90	80-90
Average temperature of evaporator outlet T2B	°C	8-9	12-15	16-17	20

Table 6-3.5: Outdoor unit heating mode operating parameters

Ambient temperature (T4)	°C	-15--5	-5-5	5-12	12-18
Discharge pressure (spot check)	MPa	2.0-2.2	2.2-2.7	3.0-3.1	2.6-2.7
Pressure of high pressure valve	MPa	1.7-1.8	1.8-2.4	2.6-2.8	2.1-2.4
Pressure of low pressure valve	MPa	2.0-2.2	2.2-2.6	3.0-3.1	2.5-2.7
DC Inverter compressor current (spot check)	A	5	5-6	6-8	5-6
Fixed compressor current (spot check)	A	6	6-7	9-10	8-9
Discharge temperature (spot check)	°C	50-70	60-70	60-85	60-70
Average temperature of condenser outlet T2	°C	33	33-40	46-50	39-41