

VMEX Series

Modular VRF Outdoor Unit

Service Manual

220~240V/3/50-60Hz



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Part 1

General Information

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1 Indoor and Outdoor Unit Capacities

1.1 Indoor Units

1.1.1 Standard indoor units

Table 1-1.1: Standard indoor unit abbreviation codes

Abbreviation code	Type
VECW	One-way Cassette
VECT	Two-way Cassette
VECM	Compact Four-way Cassette
VECR	Four-way Cassette
VEMP	Medium Static Pressure Duct

Abbreviation code	Type
VEHP	High Static Pressure Duct
VEWM	Wall-mounted
VEFC	Ceiling & Floor
VEFB	Floor Standing

Table 1-1.2: Standard indoor unit capacity range

Capacity		Capacity index	VECW	VECT	VECM	VECR	VEMP	VEHP	VEWM	VEFC	VEFB
kW	HP										
1.8	0.6	18	18	—	—	—	—	—	—	—	—
2.2	0.8	22	22	22	22	—	22	—	22	—	22
2.8	1	28	28	28	28	28	28	—	28	—	28
3.6	1.25	36	36	36	36	36	36	—	36	36	36
4.5	1.6	45	45	45	45	45	45	—	45	45	45
5.6	2	56	56	56	—	56	56	—	56	56	56
7.1	2.5	71	71	71	—	71	71	71	71	71	71
8.0	3	80	—	—	—	80	80	80	80	80	80
9.0	3.2	90	—	—	—	90	90	90	90	90	—
10.0	3.6	100	—	—	—	100	—	—	—	—	—
11.2	4	112	—	—	—	112	112	112	—	112	—
14.0	5	140	—	—	—	140	140	140	—	140	—
16.0	6	160	—	—	—	—	—	160	—	160	—
20.0	7	200	—	—	—	—	—	200	—	—	—
25.0	9	250	—	—	—	—	—	250	—	—	—
28.0	10	280	—	—	—	—	—	280	—	—	—
40.0	14	400	—	—	—	—	—	400	—	—	—
45.0	16	450	—	—	—	—	—	450	—	—	—
56.0	20	560	—	—	—	—	—	560	—	—	—

1.1.2 Fresh air processing unit

Table 1-1.3: Fresh air processing unit capacity range

Capacity	12.5kW	14kW	20kW	25kW	28kW	45kW	56kW
Capacity index	125	140	200	250	280	450	560

1.2 Heat recovery ventilator

Table 1-1.4: Heat recovery ventilator capacity range

Capacity (m ³ /h)	400	500	800	1000	1500	2000
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1.3 Outdoor Units

Table 1-1.5: Outdoor unit capacity range

Model	VMEX008Q4A	VMEX009Q4A	VMEX010Q4A	VMEX012Q4A	VMEX014Q4A	VMEX016Q4A	VMEX018Q4A	VMEX020Q4A
Capacity	X252W	X280W	X335W	X400W	X450W	X500W	X560W	X615W

Model	VMEX022Q4A	VMEX024Q4A	VMEX026Q4A	VMEX028Q4A	VMEX029Q4A	VMEX030Q4A	VMEX032Q4A	VMEX034Q4A
Capacity	X670W	X730W	X780W	X840W	X895W	X950W	X1000W	X1065W
Outdoor unit 1	12HP	10HP	10HP	10HP	10HP	12HP	18HP	16HP
Outdoor unit 2	12HP	16HP	18HP	20HP	22HP	22HP	18HP	22HP

Model	VMEX036Q4A	VMEX038Q4A	VMEX040Q4A	VMEX042Q4A	VMEX044Q4A	VMEX046Q4A	VMEX048Q4A	VMEX050Q4A
Capacity	X1115W	X1175W	X1230W	X1285W	X1345W	X1395W	X1455W	X1510W
Outdoor unit 1	18HP	20HP	22HP	12HP	10HP	10HP	10HP	10HP
Outdoor unit 2	22HP	22HP	22HP	12HP	16HP	18HP	20HP	22HP
Outdoor unit 3	—	—	—	22HP	22HP	22HP	22HP	22HP

Model	VMEX052Q4A	VMEX054Q4A	VMEX056Q4A	VMEX058Q4A	VMEX060Q4A	VMEX062Q4A	VMEX064Q4A	VMEX066Q4A
Capacity	X1565W	X1615W	X1680W	X1730W	X1790W	X1845W	X1900W	X1960W
Outdoor unit 1	12HP	18HP	16HP	18HP	20HP	22HP	12HP	10HP
Outdoor unit 2	22HP	18HP	22HP	22HP	22HP	22HP	12HP	16HP
Outdoor unit 3	22HP	22HP	22HP	22HP	22HP	22HP	22HP	22HP
Outdoor unit 4	—	—	—	—	—	—	22HP	22HP

Model	VMEX068Q4A	VMEX070Q4A	VMEX072Q4A	VMEX074Q4A	VMEX076Q4A	VMEX078Q4A	VMEX080Q4A	VMEX082Q4A
Capacity	X2010W	X2070W	X2125W	X2180W	X2230W	X2295W	X2345W	X2405W
Outdoor unit 1	10HP	10HP	10HP	12HP	18HP	16HP	18HP	20HP
Outdoor unit 2	18HP	20HP	22HP	22HP	18HP	22HP	22HP	22HP
Outdoor unit 3	22HP	22HP	22HP	22HP	22HP	22HP	22HP	22HP
Outdoor unit 4	22HP	22HP	22HP	22HP	22HP	22HP	22HP	22HP

Model	VMEX084Q4A
Capacity	X2460W
Outdoor unit 1	22HP
Outdoor unit 2	22HP
Outdoor unit 3	22HP
Outdoor unit 4	22HP

Notes:



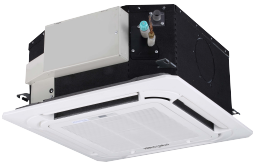

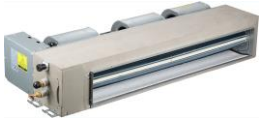
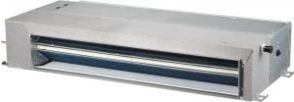



1. The full model names can be obtained by substituting the asterisk in the model name format given in the left-hand column of the table above with the shortened model names given in the table.
2. The combinations of units shown in the table are factory-recommended. Other combinations of units are also possible.

2 External Appearance

2.1 Indoor Units

2.1.1 Standard indoor unit

Table 1-2.1: Standard indoor unit appearance

<p>One-way Cassette</p> <p>VECW</p> 	<p>Two-way Cassette</p> <p>VECT</p> 
<p>Compact Four-way Cassette</p> <p>VECM</p> 	<p>Four-way Cassette</p> <p>VECR</p> 
<p>Low Static Pressure Duct</p> <p>VELP</p> 	<p>Medium Static Pressure Duct</p> <p>VEMP</p> 
<p>High Static Pressure Duct</p> <p>VEHP</p> 	<p>Wall-mounted</p> <p>VEWM</p> 
<p>Floor Ceiling</p> <p>VEFC</p> 	<p>Floor Standing</p> <p>VEFB</p> 


2.1.2 Fresh air processing unit

Table 1-2.2: Fresh air processing unit appearance

<p>Fresh Air Processing Unit</p> <p>VEFA</p> 
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2.2 Heat Recovery Ventilator



Table 1-2.3: Heat recovery ventilator appearance

<p>Heat Recovery Ventilator</p> 

2.3 Outdoor Units

2.3.1 Single units

Table 1-2.4: Single outdoor unit appearance

VMEX008,009,010	VMEX012,014,016,018,020
 A tall, rectangular outdoor air conditioning unit with a white front panel and a blue vented side panel. The unit is mounted on a base. The front panel has the 'VMEX' logo at the top and 'VRFP' near the bottom.	 A taller, rectangular outdoor air conditioning unit with a white front panel and a blue vented side panel. The unit is mounted on a base. The front panel has the 'VMEX' logo at the top and 'VRFP' near the bottom.

3 Outdoor Unit Combinations

Table 1-3.1: Outdoor unit combinations

System capacity		Number of units	Modules ¹									Outdoor branch joint kit ²
kW	HP		8	10	12	14	16	18	20	22		
25.2	8	1	•								—	
28.0	10	1		•								
33.5	12	1			•							
40.0	14	1				•						
45.0	16	1					•					
50.0	18	1						•				
56.0	20	1							•			
61.5	22	1								•		
67.0	24	2			••							VAMC002-DDF
73.0	26	2		•			•					
78.0	28	2		•				•				
84.0	30	2		•					•			
89.5	32	2		•						•		
95.0	34	2			•					•		
100.0	36	2						••				
106.5	38	2					•			•		
111.5	40	2						•		•		
117.5	42	2							•	•		
123.0	44	2								••	VAMC003-DDF	
128.5	46	3			••					•		
134.5	48	3		•			•			•		
139.5	50	3		•				•		•		
145.5	52	3		•					•	•		
151.0	54	3		•						••		
156.5	56	3			•					••		
161.5	58	3						••		•		
168.0	60	3					•			••		
173.0	62	3						•		••		
179.0	64	3							•	••		
184.5	66	3								•••	VAMC004-DDF	
190.0	68	4			••					••		
196.0	70	4		•			•			••		
201.0	72	4		•				•		••		
207.0	74	4		•					•	••		
212.5	76	4		•						•••		
218.0	78	4			•					•••		
223.0	80	4						••		••		
229.5	82	4					•			•••		
234.5	84	4						•		•••		
240.5	86	4							•	•••		
246.0	88	4								••••		

Notes:

1. The combinations of units shown in the table are factory-recommended. Other combinations of units are also possible.
2. For systems with two or more outdoor units, outdoor branch joints (sold separately) are required.

4 Combination Ratio

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

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

Type	Minimum combination ratio	Maximum combination ratio		
		Standard indoor units only	Fresh air processing units only	Fresh air processing units and standard indoor units together
V5 X Series outdoor units	50%	130%	100%	100% ¹

- Notes:
- When fresh air processing units are installed together with standard indoor units, the total capacity of the fresh air processing units must not exceed 30% of the total capacity of the outdoor units and the combination ratio must not exceed 100%.

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			
25.2	8	252	126 to 327.6	126 to 252	13
28.0	10	280	140 to 364	140 to 280	16
33.5	12	335	167.5 to 435.5	167.5 to 335	20
40.0	14	400	200 to 520	200 to 400	23
45.0	16	450	225 to 585	225 to 450	26
50.0	18	500	250 to 650	250 to 500	29
56.0	20	560	280 to 728	280 to 560	33
61.5	22	615	307.5 to 799.5	307.5 to 615	36
67.0	24	670	335 to 871	335 to 670	39
73.0	26	730	365 to 949	365 to 730	43
78.0	28	780	390 to 1014	390 to 780	46
84.0	30	840	420 to 1092	420 to 840	50
89.5	32	895	447.5 to 1163.5	447.5 to 895	53
95.0	34	950	475 to 1235	475 to 950	56
100.0	36	1000	500 to 1300	500 to 1000	59
106.5	38	1065	532.5 to 1384.5	532.5 to 1065	63
111.5	40	1115	557.5 to 1449.5	557.5 to 1115	64
117.5	42	1175	587.5 to 1527.5	587.5 to 1175	
123.0	44	1230	615 to 1599	615 to 1230	
128.5	46	1285	642.5 to 1670.5	642.5 to 1285	
134.5	48	1345	672.5 to 1748.5	672.5 to 1345	
139.5	50	1395	697.5 to 1813.5	697.5 to 1395	
145.5	52	1455	727.5 to 1891.5	727.5 to 1455	
151.0	54	1510	755 to 1963	755 to 1510	
156.5	56	1565	782.5 to 2034.5	782.5 to 1565	
161.5	58	1615	807.5 to 2099.5	807.5 to 1615	
168.0	60	1680	840 to 2184	840 to 1680	
173.0	62	1730	865 to 2249	865 to 1730	
179.0	64	1790	895 to 2327	895 to 1790	
184.5	66	1845	922.5 to 2398.5	922.5 to 1845	
190.0	68	1900	950 to 2470	950 to 1900	
196.0	70	1960	980 to 2548	980 to 1960	
201.0	72	2010	1005 to 2613	1005 to 2010	
207.0	74	2070	1035 to 2691	1035 to 2070	
212.5	76	2125	1062.5 to 2762.5	1062.5 to 2125	
218.0	78	2180	1090 to 2834	1090 to 2180	
223.0	80	2230	1115 to 2899	1115 to 2230	
229.5	82	2295	1147.5 to 2983.5	1147.5 to 2295	
234.5	84	2345	1172.5 to 3048.5	1172.5 to 2345	
240.5	86	2405	1202.5 to 3126.5	1202.5 to 2405	
246.0	88	2460	1230 to 3198	1230 to 2460	

Part 2

Component Layout and Refrigerant Circuits

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VMEX VRF 50/60Hz

1 Layout of Functional Components

VMEX008Q4A-D13V224 / VMEX009Q4A-D16V280 / VMEX010Q4A-D20V335

Figure 2-2.1: VMEX008(009,010)Q4A top view

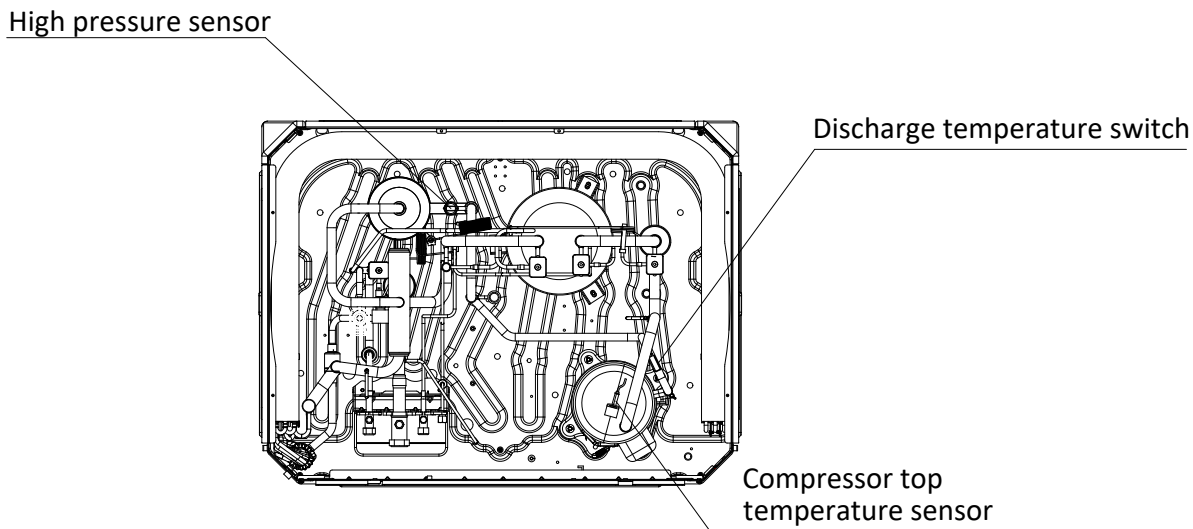
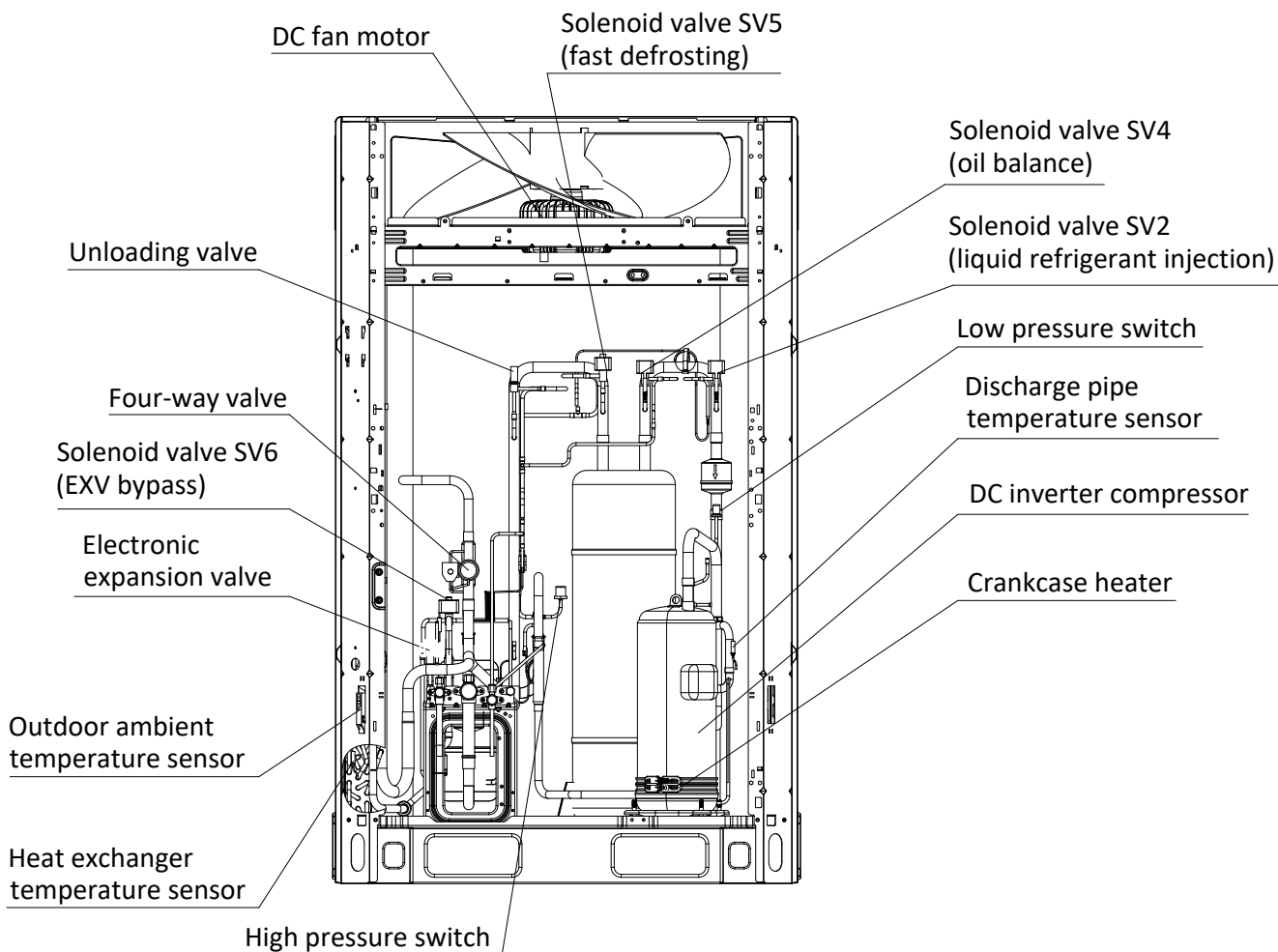


Figure 2-2.2: VMEX008(009,010)Q7A front view



VMEX VRF 50/60Hz

VMEX012Q4A-D23V400/VMEX014Q4A-D26V450/VMEX016Q4A-D29V500/VMEX018Q4A-D33V560/
VMEX020Q4A-D36V615

Figure 2-2.3: VMEX012(014,016,018, 020)Q4A top view

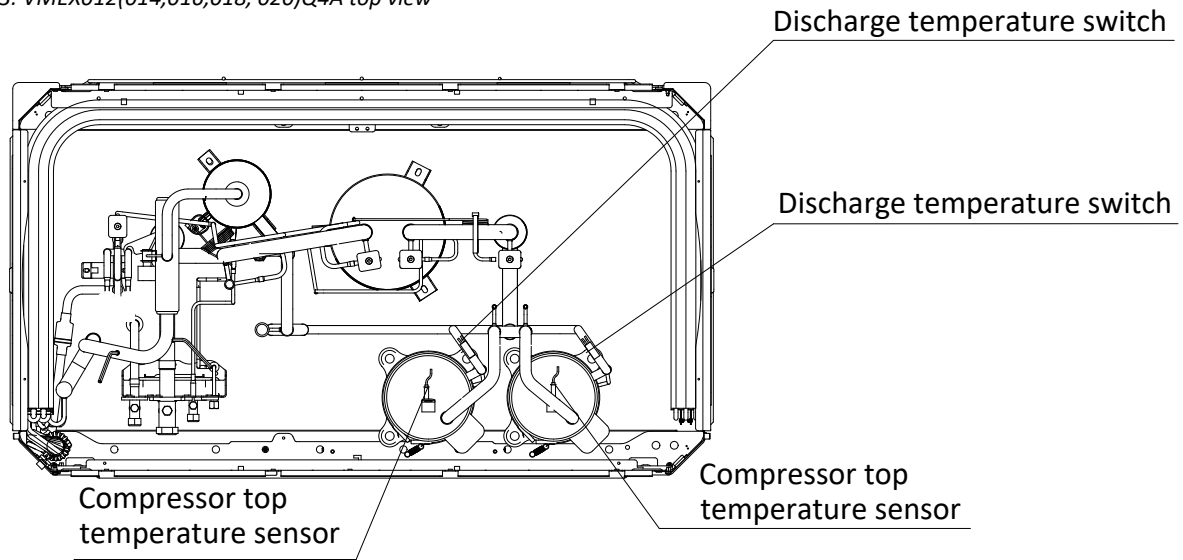
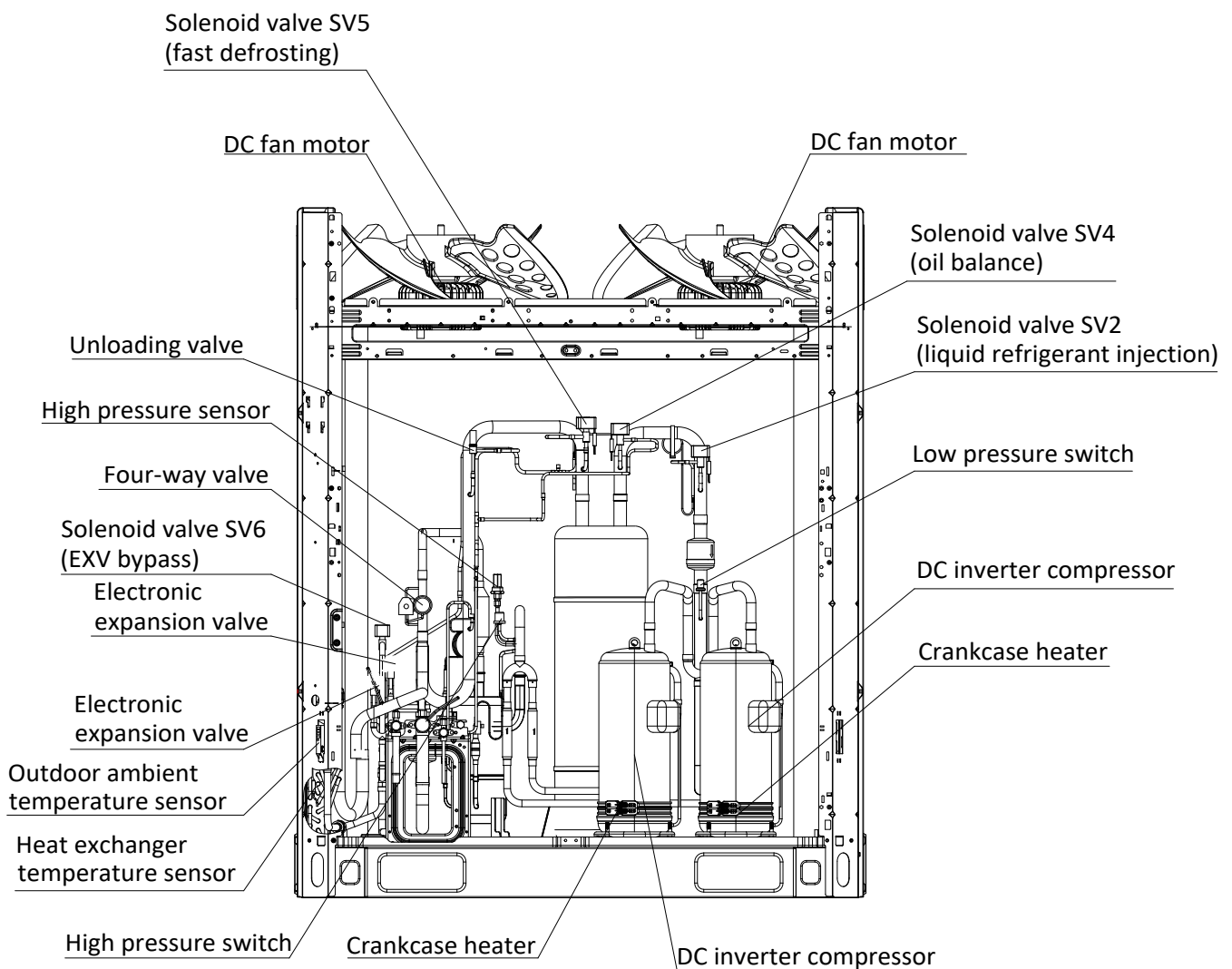


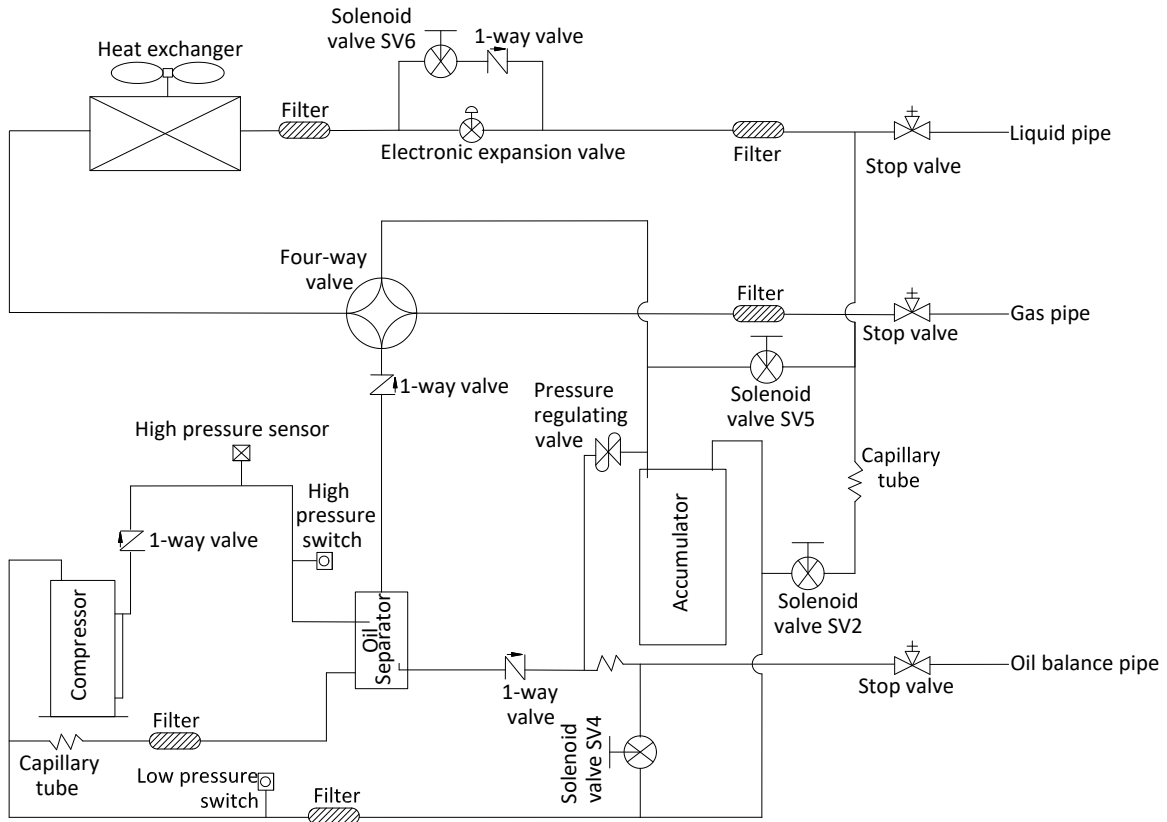
Figure 2-2.4: VMEX012(014,016,018, 020)Q4A front view



2 Piping Diagrams

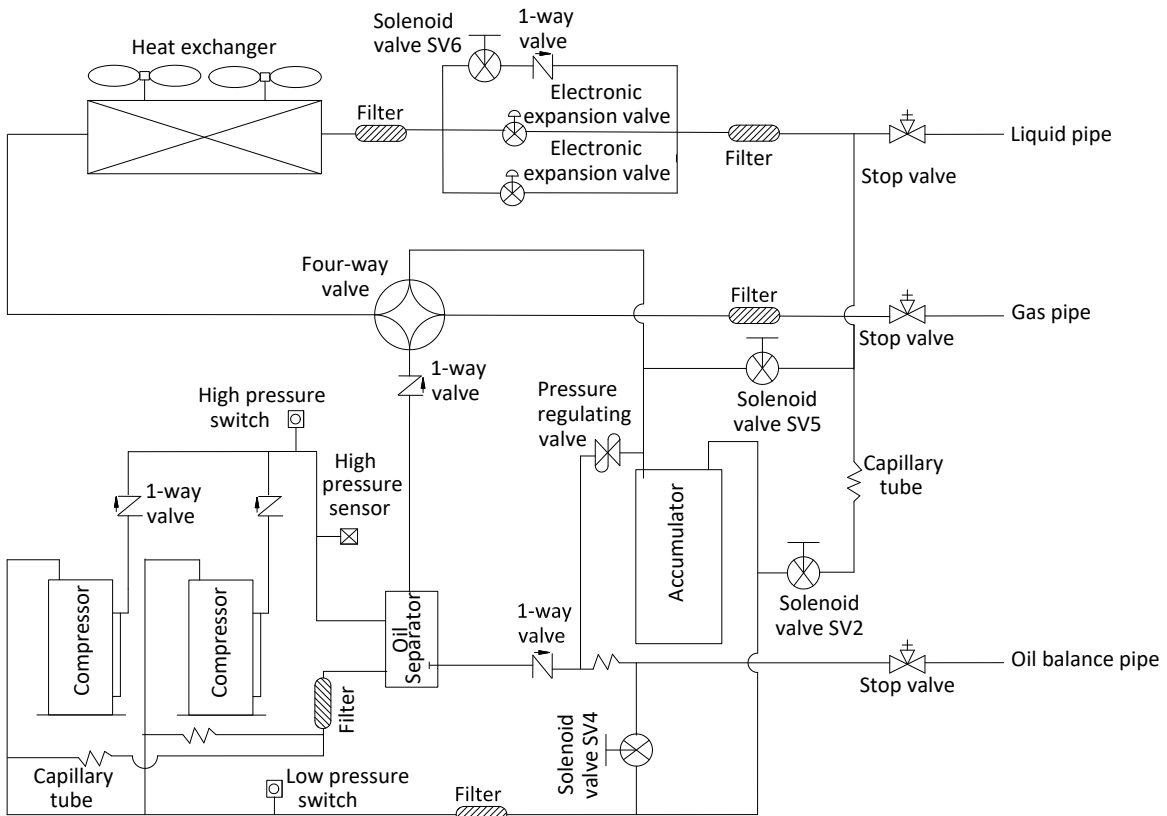
VMEX008Q4A-D13V252 / VMEX009Q4A-D16V280 / VMEX010Q4A-D20V335

Figure 2-1.1: VMEX008(009, 010)Q4A piping diagram



VMEX012Q4A-D23V400 / VMEX014Q4A-D26V450 / VMEX016Q4A-D29V500/ VMEX018Q4A-D33V560 / VMEX020Q4A-D36V615

Figure 2-1.2: VMEX012(014,016,018, 020)Q4A piping diagram



Key components:

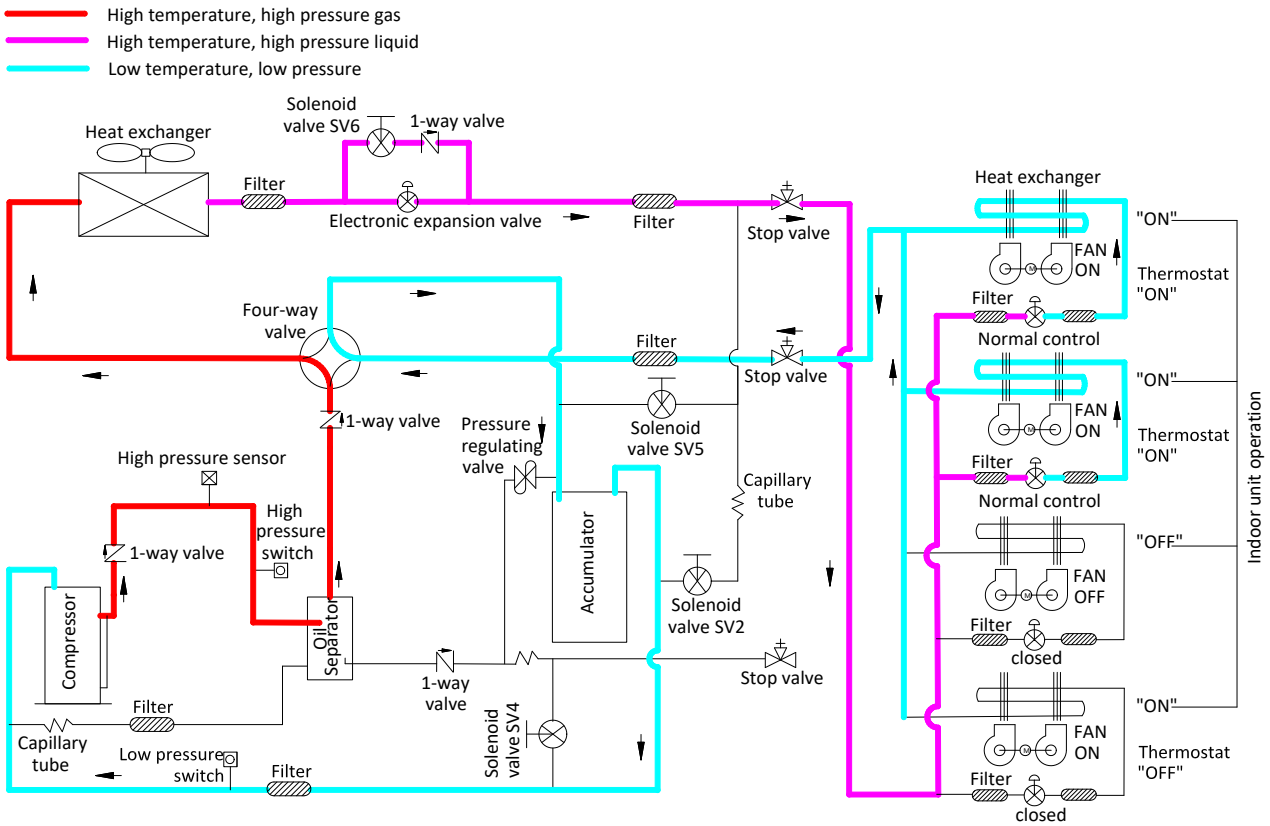
1. **Oil separator:**
Separates oil from gas refrigerant pumped out of the compressor and quickly returns it to the compressor. Separation efficiency is up to 99%.
2. **Accumulator:**
Stores liquid refrigerant and oil to protect compressor from liquid hammering.
3. **Electronic Expansion Valve (EXV):**
Controls refrigerant flow and reduces refrigerant pressure.
4. **Four-way valve:**
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 100°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 90°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 SV5:**
Enables fast defrosting. During defrosting operation, opens to shorten the refrigerant flow cycle and quicken the defrosting process. Closed in cooling mode.
8. **Solenoid valve SV6:**
Allows refrigerant to bypass the expansion valves. Open in cooling mode when discharge temperature exceeds the limit. Closed in heating mode or standby.
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 10 minutes, the compressor restarts.

3 Refrigerant Flow Diagrams

VMEX008Q4A-D13V252 / VMEX009Q4A-D16V280 / VMEX010Q4A-D20V335

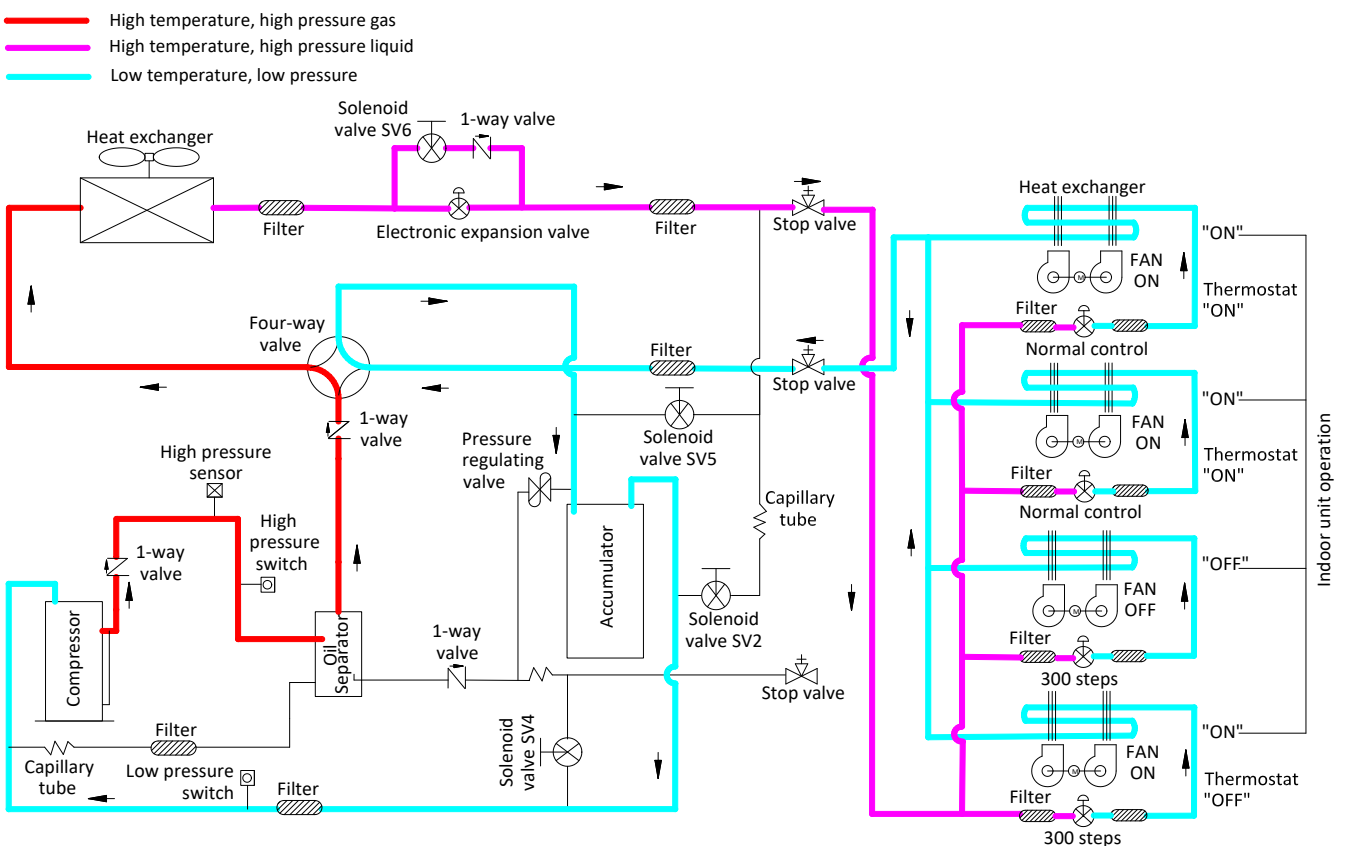
Cooling operation

Figure 2-3.1: VMEX008(009, 010)Q4A refrigerant flow during cooling operation



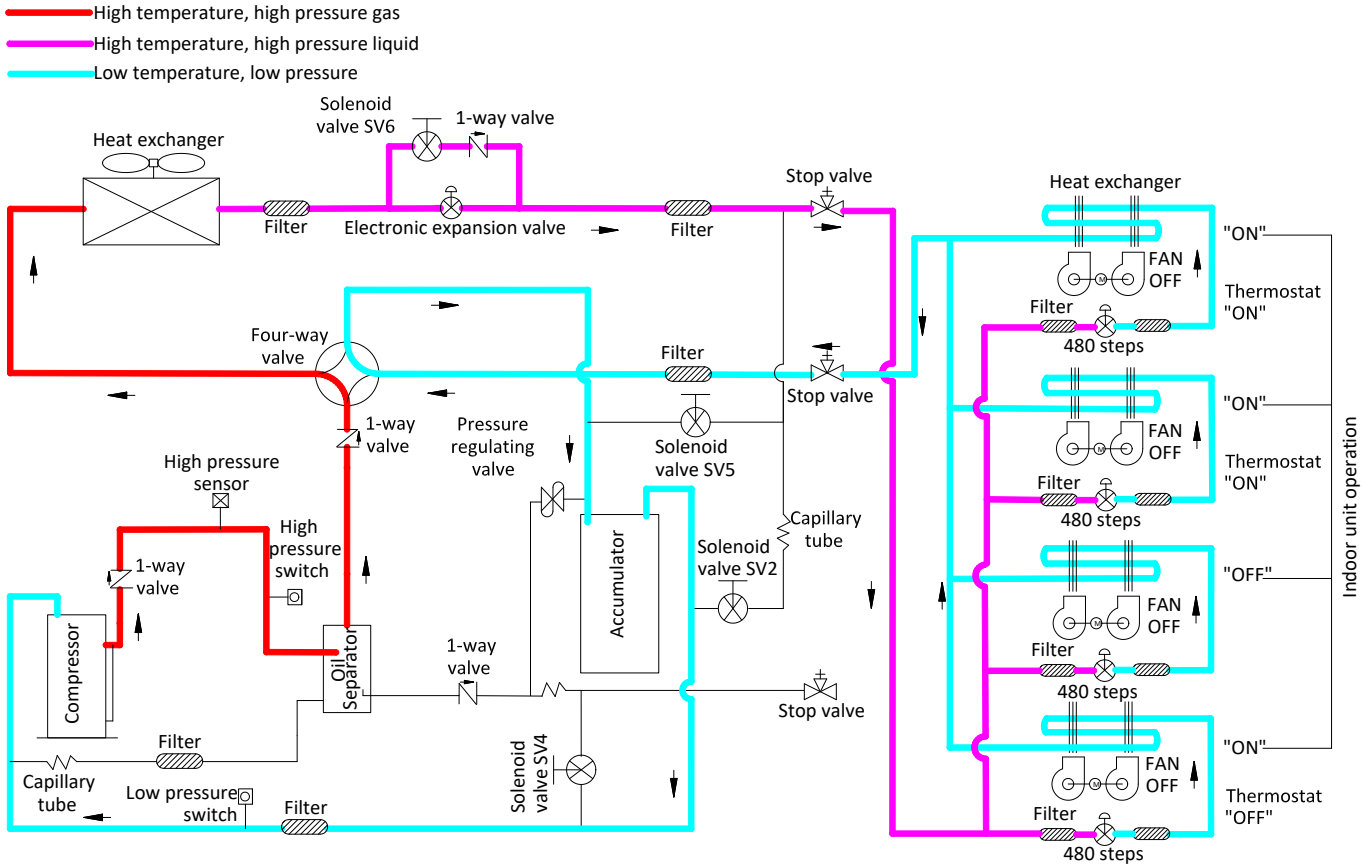
Oil return operation in cooling mode

Figure 2-3.2: VMEX008(009, 010)Q4A refrigerant flow during oil return operation in cooling mode



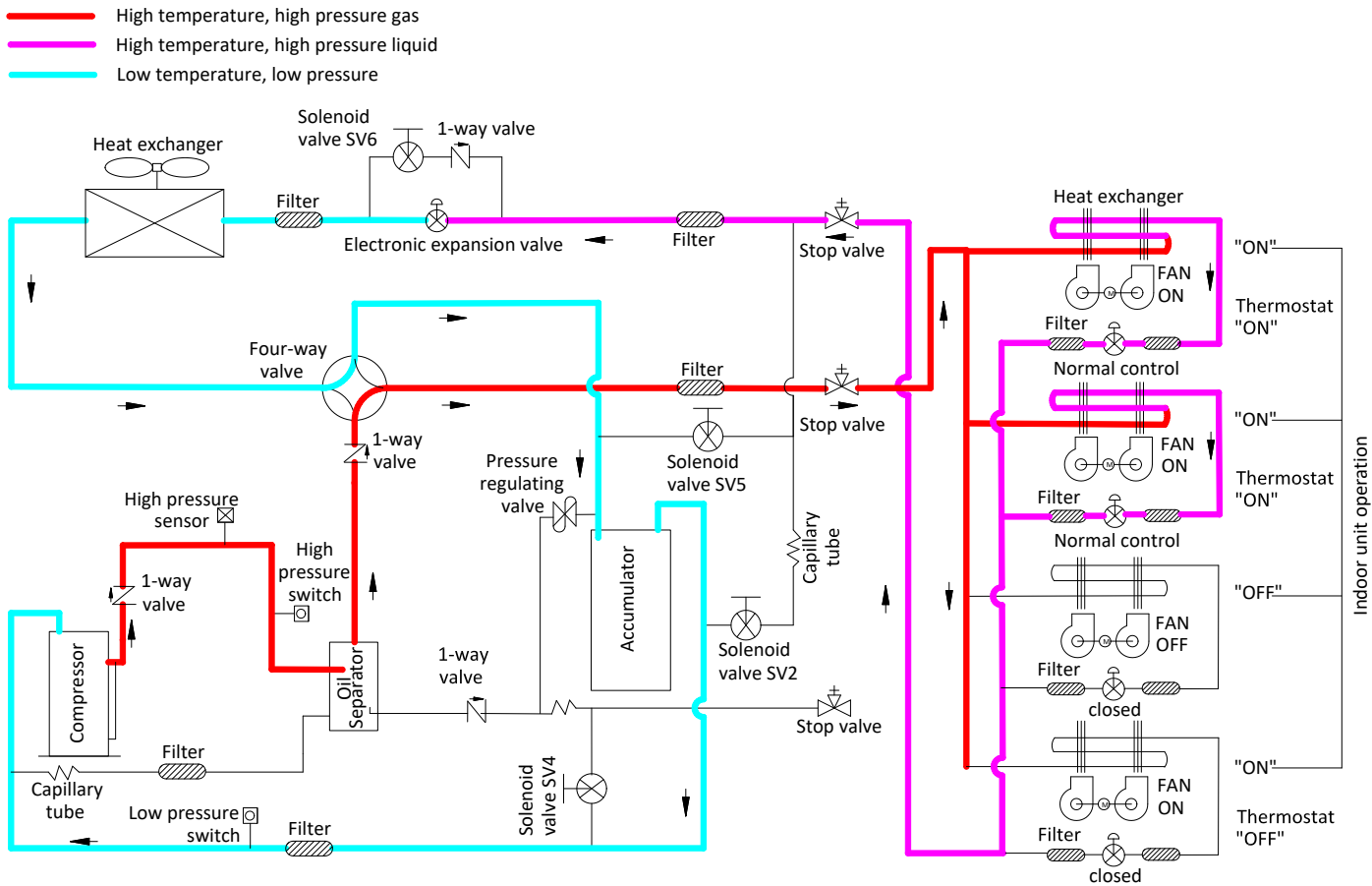
Oil return operation in heating mode and defrosting operation

Figure 2-3.3: VMEX008(009, 010)Q4A refrigerant flow during oil return operation in heating mode and during defrosting operation



Heating operation

Figure 2-3.4: VMEX008(009, 010)Q4A refrigerant flow during heating operation

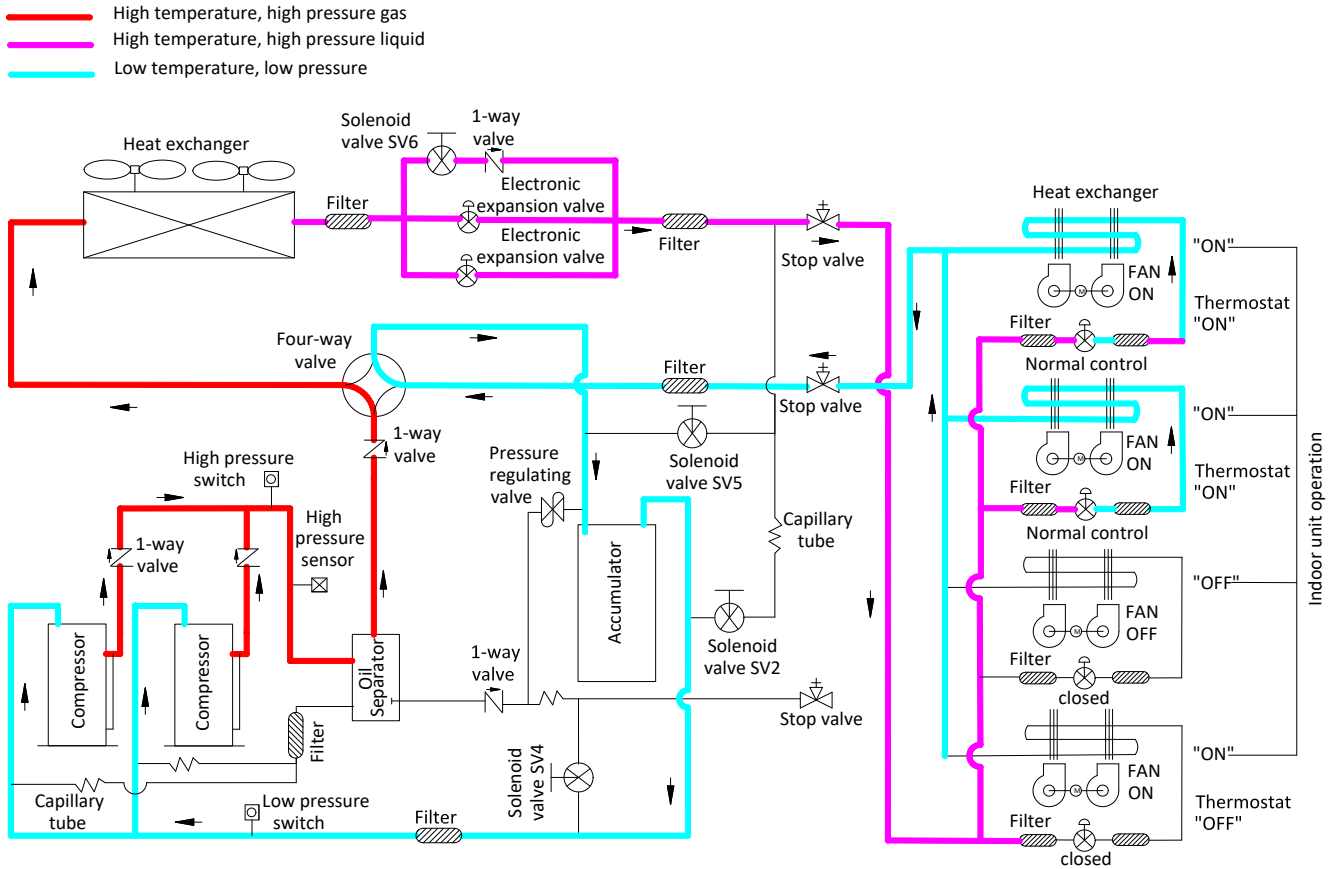


VMEX VRF 50/60Hz

VMEX012Q4A-D23V400 / VMEX014Q4A-D26V450 / VMEX016Q4A-D29V500/ VMEX018Q4A-D33V560 / VMEX020Q4A-D36V615

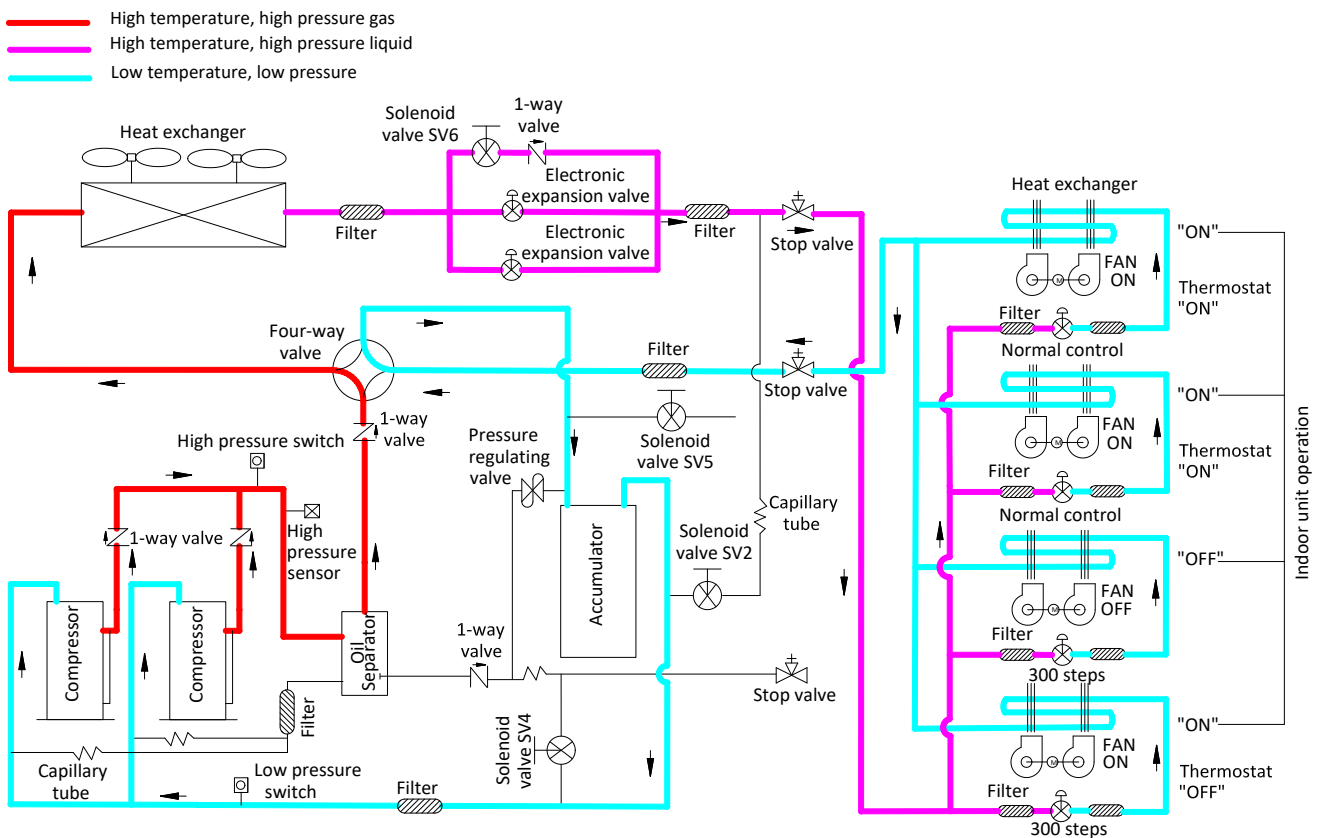
Cooling operation

Figure 2-3.5: VMEX012(014,016,018, 020)Q4A refrigerant flow during cooling operation



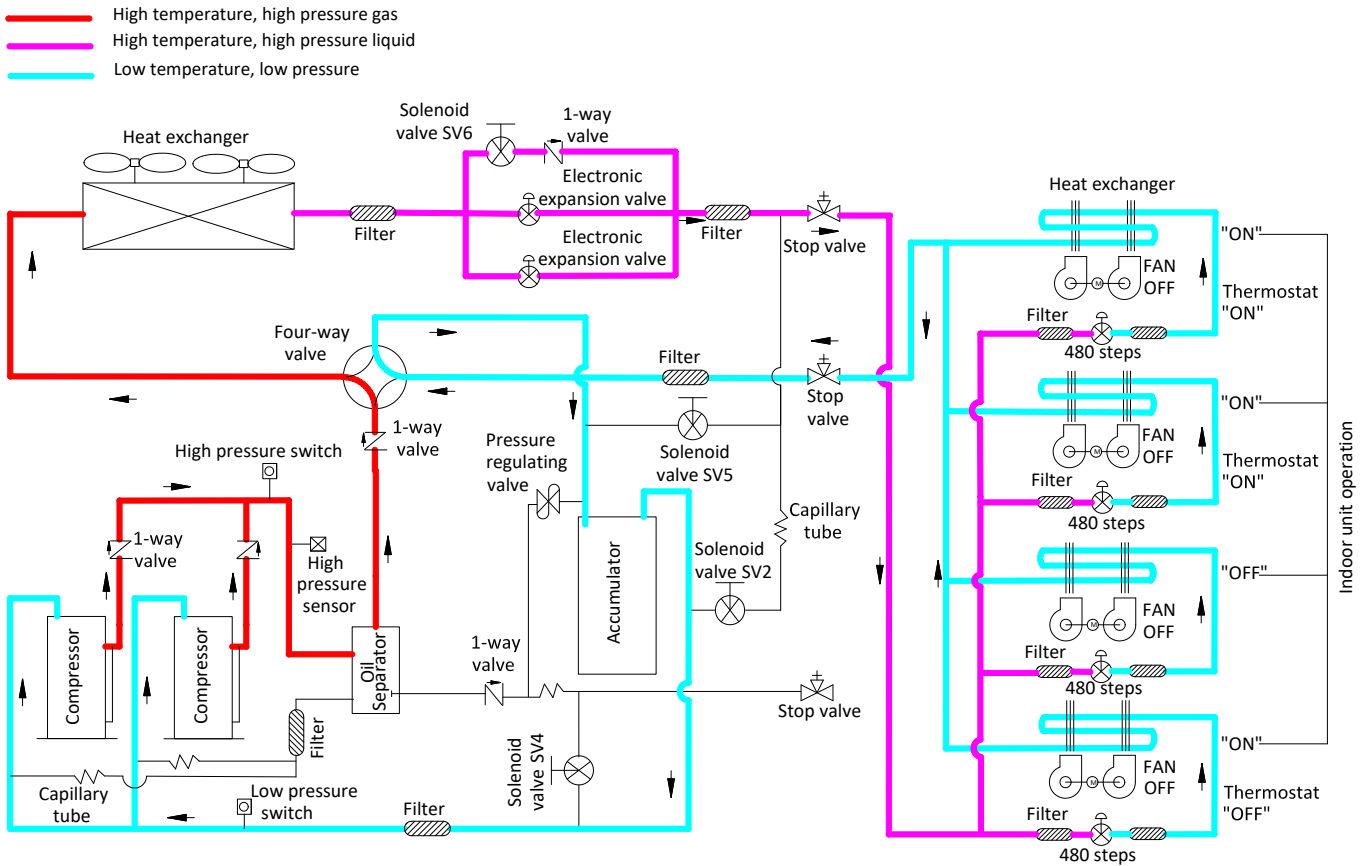
Oil return operation in cooling mode

Figure 2-3.6: VMEX012(014,016,018, 020)Q4A refrigerant flow during oil return operation in cooling mode



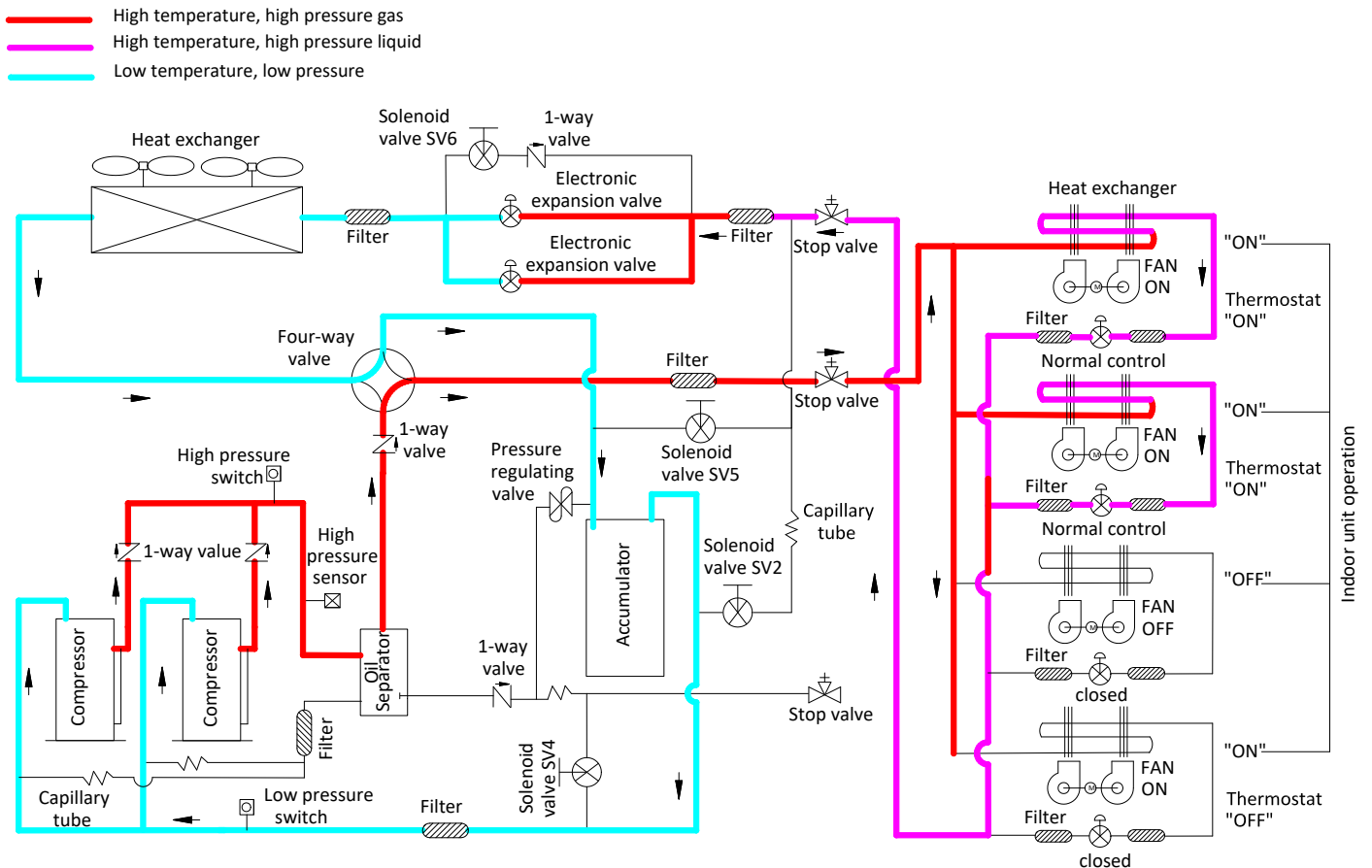
Oil return operation in heating mode and defrosting operation

Figure 2-3.7: VMEX012(014,016,018, 020)Q4A refrigerant flow during oil return operation in heating mode and during defrosting operation



Heating operation

Figure 2-3.8: VMEX012(014,016,018, 020)Q4A refrigerant flow during heating operation



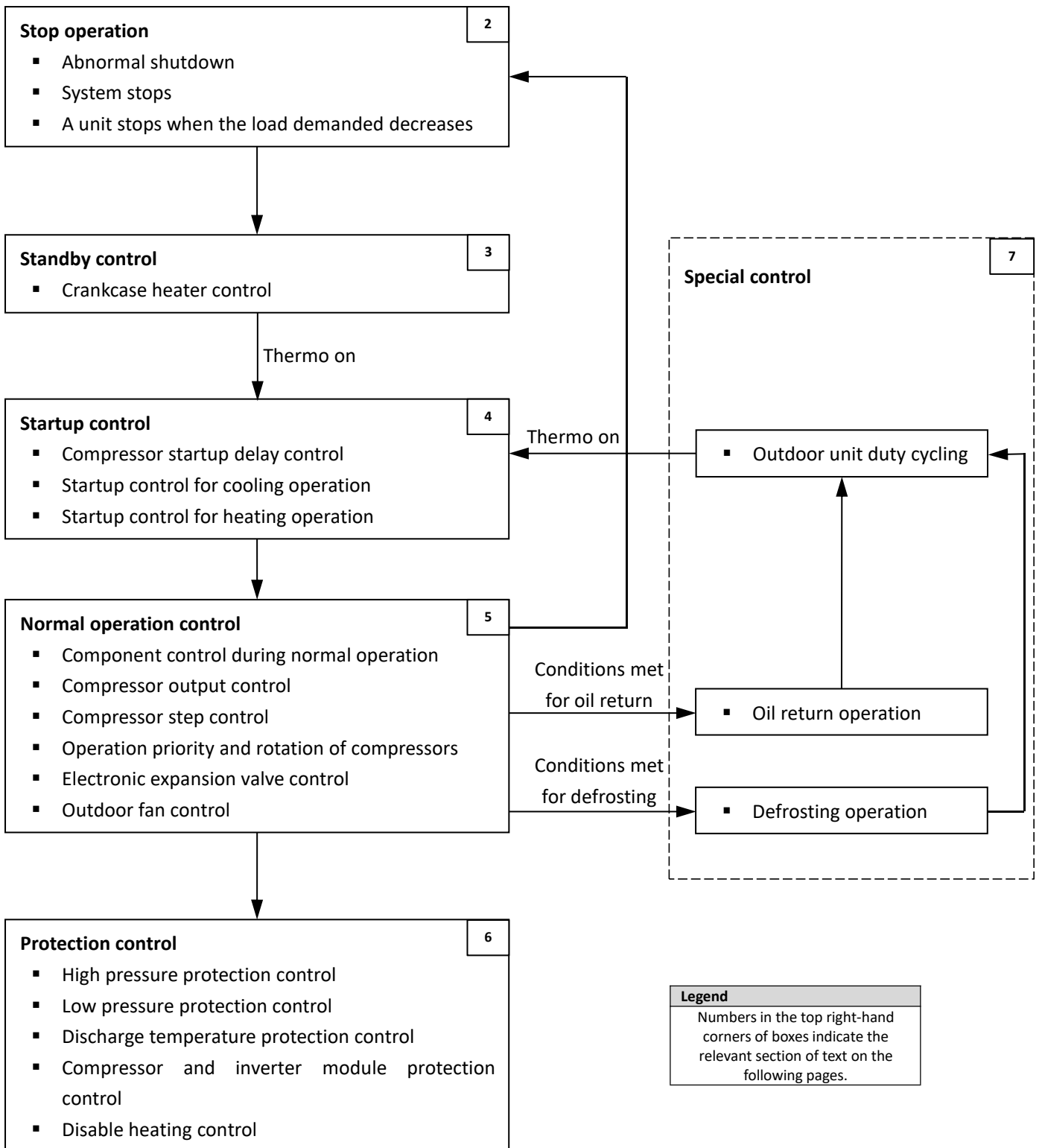
Part 3

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 three 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. A unit stops when the load demanded by the indoor units decreases and can be handled by fewer outdoor units.

When a unit stops because the load demanded by the indoor units has decreased and can be handled by fewer outdoor units, the unit's four-way valve remains on until the load demanded by the indoor units increases and the unit is required to operate. When the whole system stops, all the units' four-way valves turn off.

3 Standby Control

3.1 Crankcase Heater Control

The crankcase heater is used to prevent refrigerant from mixing with compressor oil when the compressors are stopped. The crankcase heater is controlled according to outdoor ambient temperature and discharge temperature. When the outdoor ambient temperature is above 40°C, the crankcase heater is off; when the outdoor ambient temperature is below 35°C, the crankcase heater is controlled according to discharge temperature. Refer to Figures 3-3.1 and 3-3.2.

Figure 3-3.1: Crankcase heater controlled according to outdoor ambient temperature

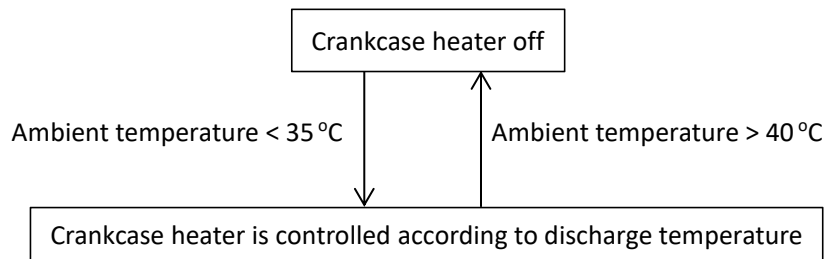
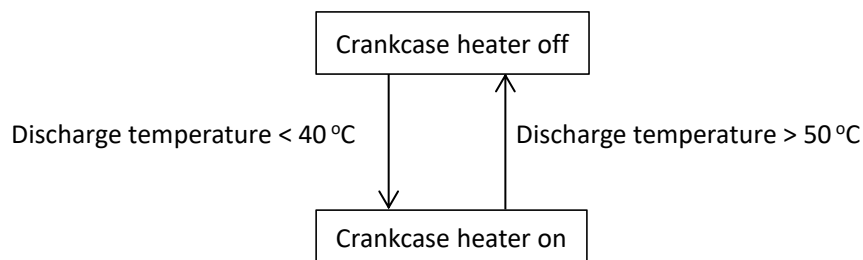


Figure 3-3.2: Crankcase heater controlled according to discharge temperature



4 Startup Control

4.1 Compressor Startup Delay Control

In initial startup control, compressor startup is delayed for 12 minutes in order to let the master unit search for the indoor units' addresses. In restart control (except in oil return operation and defrosting operation), compressor startup is delayed such that a minimum of 7 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	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	●	●	Controlled according to load requirement, operating frequency increased by 1 step / sec
Inverter compressor B	COMP(INV1)		●	
DC fan motor A	FANA	●	●	Fan speed ¹ controlled according to discharge pressure (P_c): <ul style="list-style-type: none"> ▪ At initial speed for 90 seconds. ▪ Subsequently, P_c checked every 10 seconds: <ul style="list-style-type: none"> • $P_c \geq 2.7\text{MPa} \Rightarrow$ 1 step increase. • $P_c \leq 2.1\text{MPa} \Rightarrow$ 1 step decrease.
DC fan motor B	FANB		●	
Electronic expansion valve A	EXVA	●	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature
Electronic expansion valve B	EXVB		●	
Four-way valve	ST1	●	●	Off
Solenoid valve (liquid refrigerant injection)	SV2	●	●	Off
Solenoid valve (oil balance)	SV4	●	●	Closed for 200 secs, open for 600 secs, then closed
Solenoid valve (fast defrosting)	SV5	●	●	Off
Solenoid valve (EXV bypass)	SV6	●	●	Open for 20 mins, then closed
Solenoid valve (indoor units bypass)	SV7	●	●	Off

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.6 "Outdoor Fan Control" for more information on fan speed steps.

4.3 Startup Control for Heating Operation

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

Component	Wiring diagram label	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	●	●	Controlled according to load requirement, operating frequency increased by 1 step / sec
Inverter compressor B	COMP(INV1)		●	
DC fan motor A	FANA	●	●	Open once the four-way valve has opened, controlled according to outdoor ambient temperature and load requirement
DC fan motor B	FANB		●	
Electronic expansion valve A	EXVA	●	●	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge superheat
Electronic expansion valve B	EXVB		●	
Four-way valve	ST1	●	●	On
Solenoid valve (liquid refrigerant injection)	SV2	●	●	Off
Solenoid valve (oil balance)	SV4	●	●	Closed for 200 secs, open for 600 secs, then closed
Solenoid valve (fast defrosting)	SV5	●	●	Off
Solenoid valve (EXV bypass)	SV6	●	●	Off
Solenoid valve (indoor units bypass)	SV7	●	●	Off

Notes:

1. Refer to Table 3-5.3 in Part 3, 5.6 "Outdoor Fan Control" for more information on fan speed steps.

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	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	•	•	Controlled according to load requirement
Inverter compressor B	COMP(INV1)		•	
DC fan motor A	FANA	•	•	Controlled according to discharge pressure
DC fan motor B	FANB		•	
Electronic expansion valve A	EXVA	•	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge temperature
Electronic expansion valve B	EXVB		•	
Four-way valve	ST1	•	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	•	Only open if discharge temperature > 100°C
Solenoid valve (oil balance)	SV4	•	•	Open regularly
Solenoid valve (fast defrosting)	SV5	•	•	Off
Solenoid valve (EXV bypass)	SV6	•	•	Only open if pressure > 3.6MPa
Solenoid valve (indoor units bypass)	SV7	•	•	Controlled according to load requirement

Table 3-5.2: Component control during heating operation

Component	Wiring diagram label	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	•	•	Controlled according to load requirement
Inverter compressor B	COMP(INV1)		•	
DC fan motor A	FANA	•	•	Controlled according to outdoor heat exchanger pipe temperature
DC fan motor B	FANB		•	
Electronic expansion valve A	EXVA	•	•	Position (steps) from 0 (fully closed) to 480 (fully open), controlled according to discharge superheat
Electronic expansion valve B	EXVB		•	
Four-way valve	ST1	•	•	On
Solenoid valve (liquid refrigerant injection)	SV2	•	•	Only open if discharge temperature > 100°C
Solenoid valve (oil balance)	SV4	•	•	Open regularly
Solenoid valve (fast defrosting)	SV5	•	•	Open during defrosting operation
Solenoid valve (EXV bypass)	SV6	•	•	Off
Solenoid valve (indoor units bypass)	SV7	•	•	Controlled according to load requirement

5.2 Compressor Output Control

The compressor rotation speed is controlled according to the load requirement. Before compressor startup, the outdoor units first estimate 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.

During operation the compressors are controlled according to the nominal capacity of indoor units currently running and the indoor unit heat exchanger temperatures. If the actual load requirement can be provided by one unit alone, then only one unit starts up. If the actual load requirement requires all outdoor unit modules to operate, the weighted average actual load requirement is sent to each module and each module operates according to this distributed load requirement.

5.3 Compressor Step Control

The running speed of the compressors in rotations per second (rps) is half 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 Operating Priority and Rotation of Compressors

Figures 3-5.1 to 3-5.4 show the compressor operating priority and rotation in systems with one, two, three and four outdoor units. In units with two compressors, inverter compressor A (BP1) operates in priority to inverter compressor B (BP2). In multi-unit systems, units operate in rotation. In Figures 3-5.2 to 3-5.4 the master unit and slave units 1, 2 and 3 are shown from left to right in that order, and the circled numbers (①, ②, ③, ④) indicate the rotation sequence.

Figure 3-5.1: Compressor priority and rotation – one outdoor unit



Figure 3-5.2: Compressor priority and rotation – two outdoor units

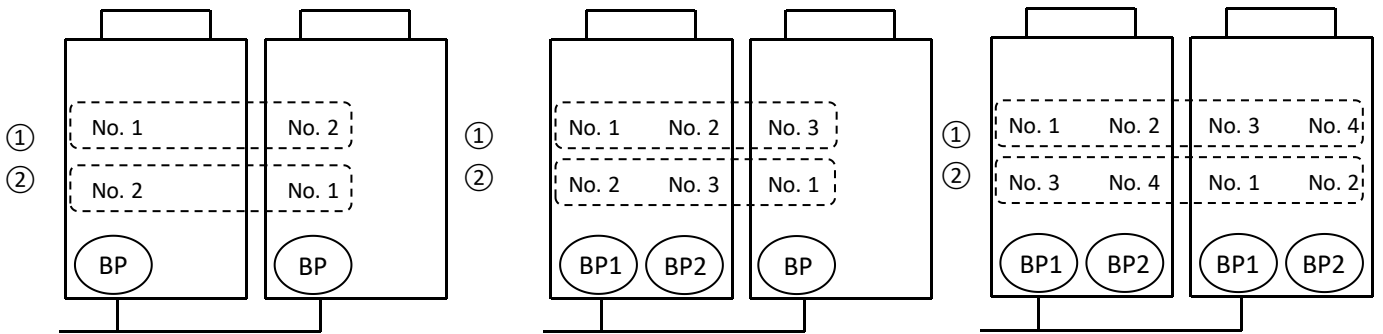


Figure 3-5.3: Compressor priority and rotation – three outdoor units

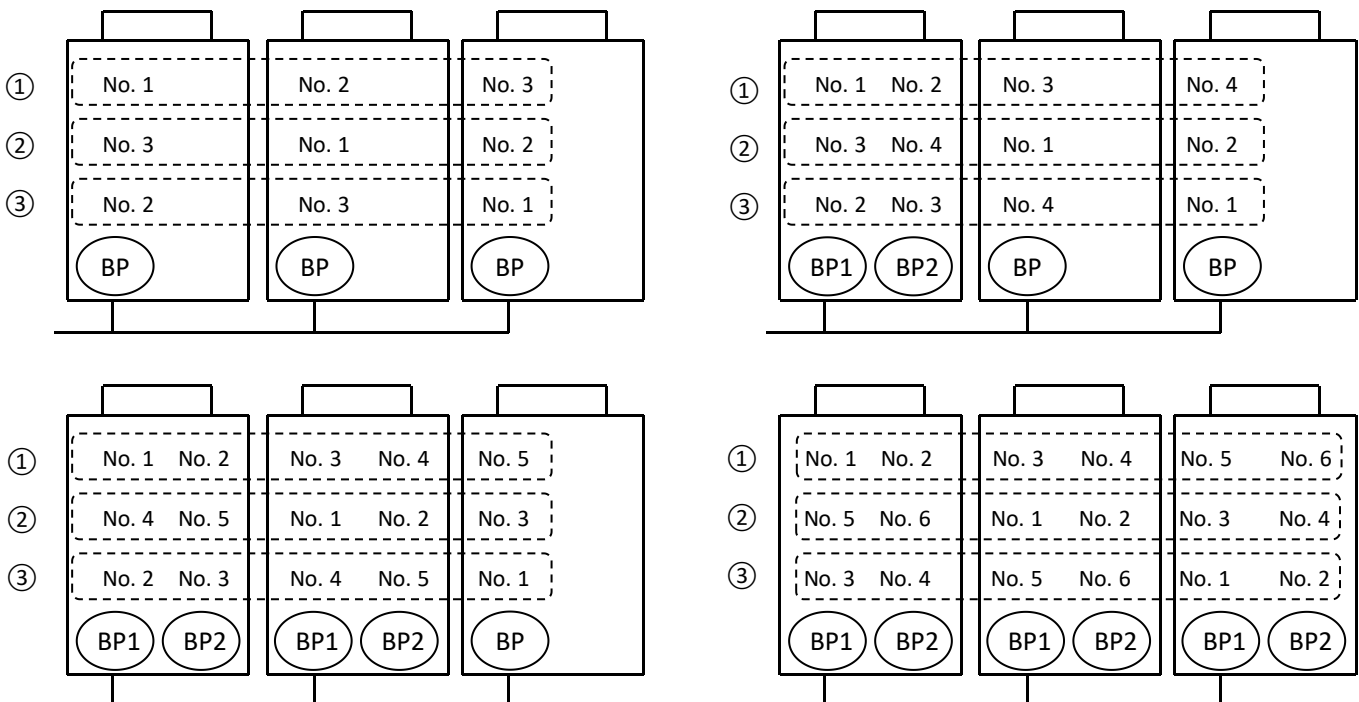
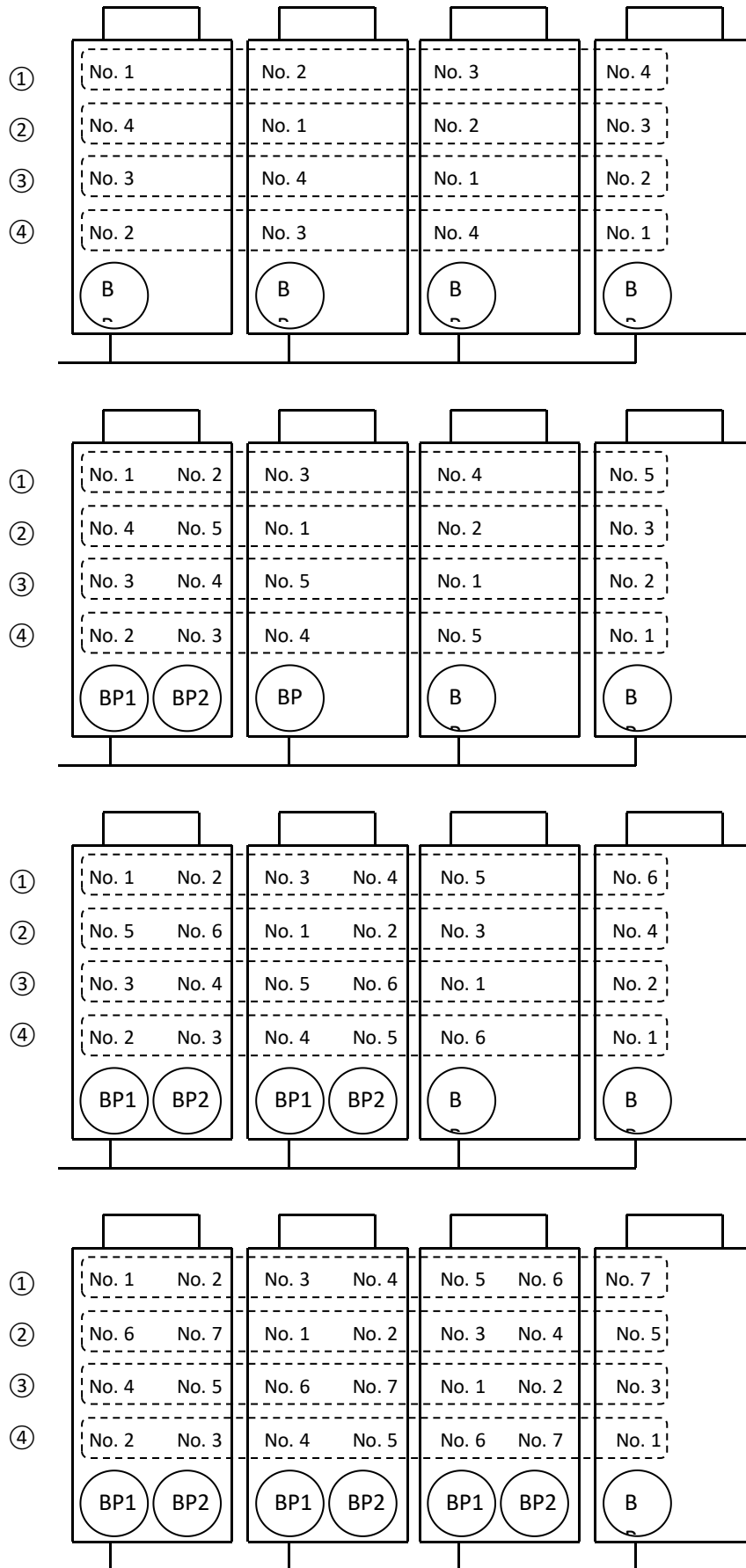


Figure 3-5.4: Compressor priority and rotation – four outdoor units



5.6 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	Fan speed (rpm)								
	8HP	10HP	12HP	14/16HP		18HP		20/22HP	
				FANA	FANB	FANA	FANB	FANA	FANB
0	0	0	0	0	0	0	0	0	0
1	330	330	330	250	0	250	0	250	0
2	360	360	360	330	0	360	0	360	0
3	410	410	410	250	250	290	290	290	290
4	460	460	460	330	330	360	360	360	360
5	530	530	530	410	410	460	460	460	460
6	580	580	580	460	460	530	530	530	530
7	630	630	630	530	530	580	580	580	580
8 (super silent mode)	660	660	660	580	580	660	660	660	660
9	710	710	710	660	660	710	710	710	710
10 (silent mode)	760	760	760	710	710	850	760	850	760
11	800	800	800	800	800	890	800	890	800
12	850	850	850	980	890	1010	930	1010	930
13 (standard ESP mode)	870	870	870	980	890	1050	980	1050	980
14 (medium ESP mode)	930	930	930	980	890	1050	1010	1050	1010
15 (high ESP mode)	930	930	930	1010	930	1050	1050	1050	1050

Abbreviations:

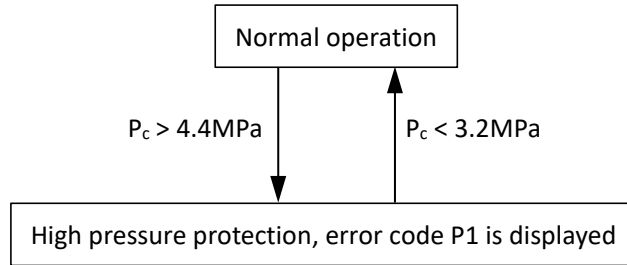
ESP: External static pressure

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



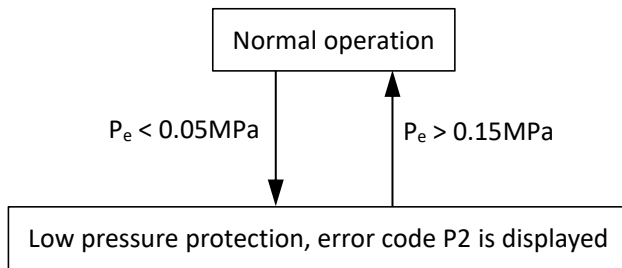
Notes:

1. P_c : Discharge pressure

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:

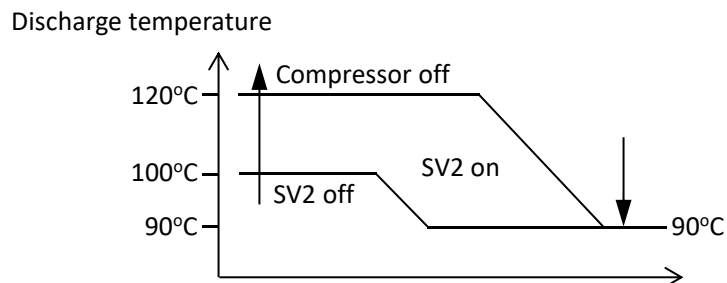
1. P_e : Suction pressure

When P2 protection occurs 3 times in 60 minutes, 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: Discharge temperature protection control



When the discharge temperature rises above 120°C the system displays P4 protection and all units stop running. When P4 protection occurs 3 times in 100 minutes, the H6 error is displayed. 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. It is performed for each compressor and inverter module.

Figure 3-6.4: Compressor current protection control

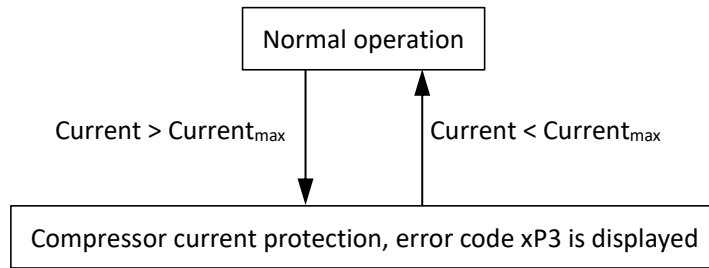
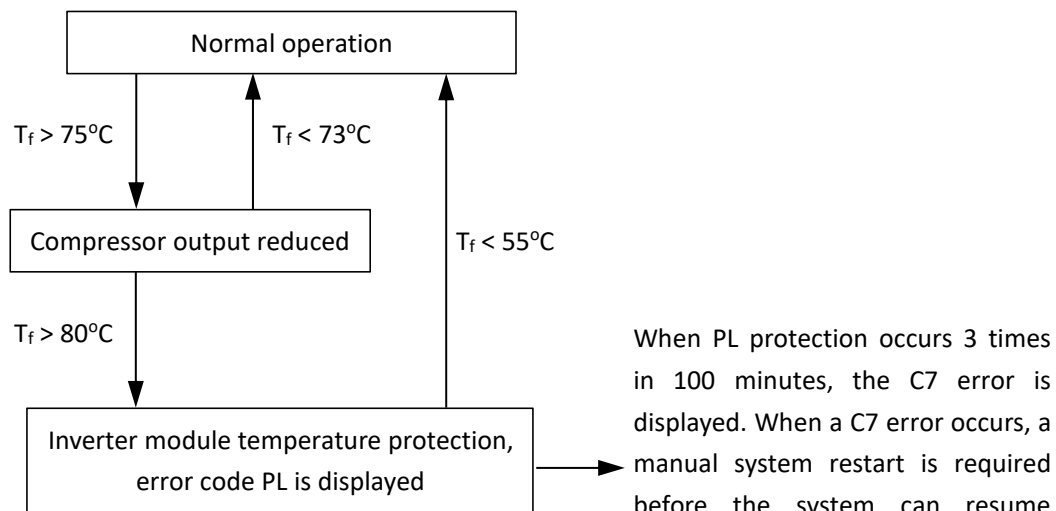


Table 3-6.1: Current limitation for compressors

Compressor model	E705DHD-72	E655DHD-65	E405DHD-36	E405DHD-42
Current _{max}	23A	21A	12A	15A

Figure 3-6.5: Inverter module temperature protection control



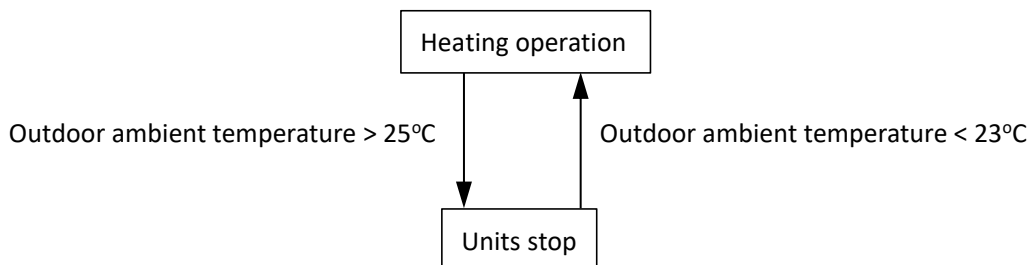
When PL protection occurs 3 times in 100 minutes, the C7 error is displayed. When a C7 error occurs, a manual system restart is required before the system can resume operation.

- Notes:
 1. T_f : Heat sink temperature

6.5 Disable Heating Control

When the outdoor ambient temperature rises above 25°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.

Figure 3-6.6: Disable heating control



7 Special Control

7.1 Outdoor Unit Duty Cycling

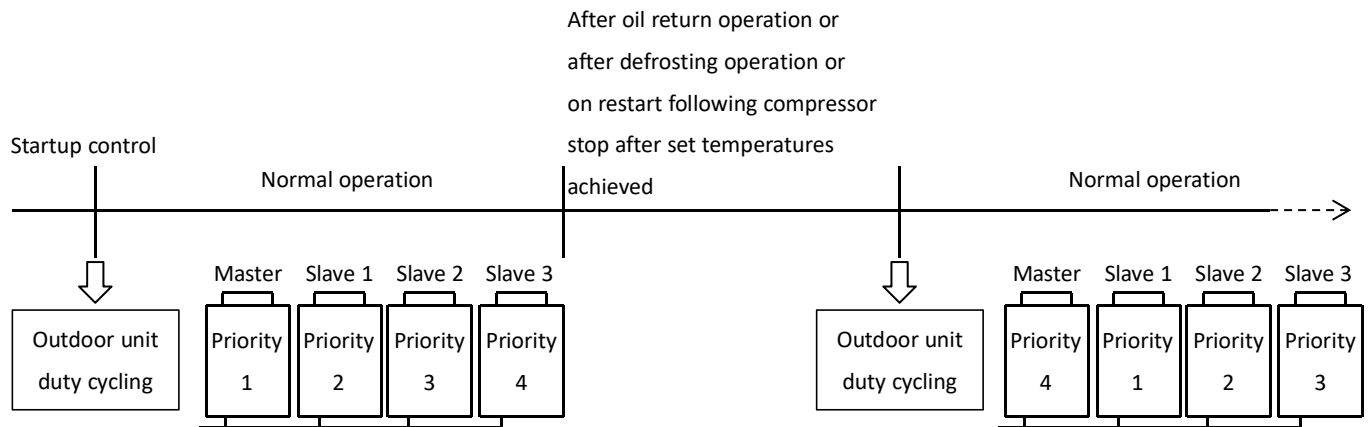
In systems with multiple outdoor units, outdoor unit duty cycling is used to prevent compressor burn out due to unbalanced oil levels between outdoor units.

Timing of outdoor unit duty cycling:

- After oil return operation.
- After defrosting operation.
- On restart following compressor stop after set temperatures achieved.

Figure 3-7.1 shows an example of duty cycling in a system with 4 outdoor units.

Figure 3-7.1: Duty cycling in a system with 4 outdoor units¹



Notes:

1. The address settings on the outdoor unit main PCBs for “master unit”, “slave unit 1”, “slave unit 2” and “slave unit 3” do not change.

7.2 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	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	•	•	Controlled according to load requirement
Inverter compressor B	COMP(INV1)		•	
DC fan motor A	FANA	•	•	Controlled according to discharge pressure
DC fan motor B	FAN2		•	
Electronic expansion valve A	EXVA	•	•	Fully open
Electronic expansion valve B	EXVB		•	
Four-way valve	ST1	•	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	•	Normal control
Solenoid valve (oil balance)	SV4	•	•	Normal control
Solenoid valve (fast defrosting)	SV5	•	•	Off
Solenoid valve (EXV bypass)	SV6	•	•	On
Solenoid valve (indoor units bypass)	SV7	•	•	Normal control

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	Remote controller setting
Electronic expansion valve	Thermo on	Normal control
	Standby	300 (steps)
	Thermo off	300 (steps)

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	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	•	•	Controlled according to load requirement
Inverter compressor B	COMP(INV1)		•	
DC fan motor A	FANA	•	•	Controlled according to discharge pressure
DC fan motor B	FANB		•	
Electronic expansion valve A	EXVA	•	•	Fully open
Electronic expansion valve B	EXVB		•	
Four-way valve	ST1	•	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	•	Normal control
Solenoid valve (oil balance)	SV4	•	•	Normal control
Solenoid valve (fast defrosting)	SV5	•	•	Off
Solenoid valve (EXV bypass)	SV6	•	•	On
Solenoid valve (indoor units bypass)	SV7	•	•	Normal control

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	480 (steps)
	Standby	480 (steps)
	Thermo off	480 (steps)

7.3 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 units running time.

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

Component	Wiring diagram label	8-12HP	14-22HP	Control functions and states
Inverter compressor A	COMP(INV)	•	•	Controlled according to load requirement
Inverter compressor B	COMP(INV1)		•	
DC fan motor A	FANA	•	•	Off
DC fan motor B	FANB		•	
Electronic expansion valve A	EXVA	•	•	Fully open
Electronic expansion valve B	EXVB		•	
Four way valve	ST1	•	•	Off
Solenoid valve (liquid refrigerant injection)	SV2	•	•	Normal control
Solenoid valve (oil balance)	SV4	•	•	Normal control
Solenoid valve (fast defrosting)	SV5	•	•	On
Solenoid valve (EXV bypass)	SV6	•	•	On
Solenoid valve (indoor units bypass)	SV7	•	•	Normal control

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..... 36

1 Outdoor Unit Field Settings

1.1 PCB Switches and Switch Settings

Figure 4-1.1: Outdoor unit main PCB switches

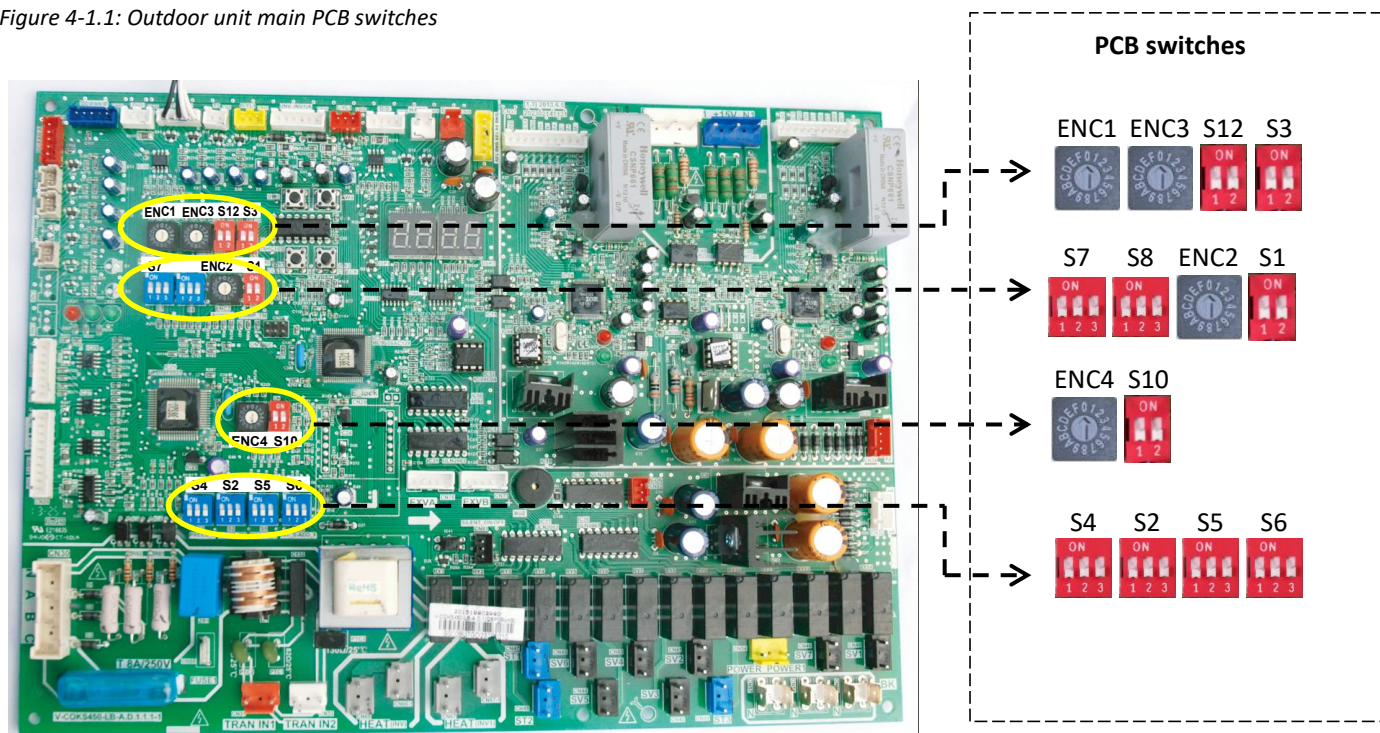


Table 4-1.1: Outdoor unit main PCB switch settings

























Switch	Setting	Switch positions ¹	Description
S1	Start-up time		Start-up time is 12 minutes (default)
			Start-up time is 10 minutes
S2	Night silent time ²		Night silent time is 6h/10h (default)
			Night silent time is 6h/12h
			Night silent time is 8h/10h
			Night silent time is 8h/12h
S3	Silent mode		Night silent mode (default)
			Silent mode
			Super silent mode
			No silent mode
S4	Static pressure		Standard static pressure (default)
			Low static pressure mode (reserved, can be customized)
			Medium static pressure mode (reserved, can be customized)
			High static pressure mode (reserved, can be customized)

Notes:

1. Black denotes the switch position.
2. Refer to Part 4, 1.2.1 "Night silent time setting".

Table continued on next page ...

Table 4-1.1: Outdoor unit main PCB switch settings (continued)

Switch	Setting	Switch positions ¹	Description
	Priority mode ³		Heating priority (default)
			Cooling priority
			VIP priority or voting priority
			Heating only
			Cooling only
	Addressing mode ⁴		Auto addressing
			Manual addressing (default)
			Clear indoor unit addresses
	Number of indoor units manually set		The number of indoor units is not manually set (default)
			The number of indoor units is manually set on switches ENC3 and S12
S8/S10	Reserved		
	Number of indoor units		The number of indoor units is in the range 0-15 0-9 on ENC3 indicate 0-9 indoor units; A-F on ENC3 indicate 10-15 indoor units
			The number of indoor units is in the range 16-31 0-9 on ENC3 indicate 16-25 indoor units; A-F on ENC3 indicate 26-31 indoor units
			The number of indoor units is in the range 32-47 0-9 on ENC3 indicate 32-41 indoor units; A-F on ENC3 indicate 42-47 indoor units
			The number of indoor units is in the range 48-63 0-9 on ENC3 indicate 48-57 indoor units; A-F on ENC3 indicate 58-63 indoor units
	Outdoor unit address		Only 0, 1, 2, 3 should be selected 0 is for master unit; 1, 2, 3 are for slave units
	Outdoor unit capacity ⁵		Only 0, 1, 2, 3, 4, 5, 6, 7 should be selected 0: 8HP; 1: 10HP; 2: 12HP; 3: 14HP; 4: 16HP; 5: 18HP; 6: 20HP; 7: 22HP
	Network address		Only 0, 1, 2, 3, 4, 5, 6, 7 should be selected

Notes:

1. Black denotes the switch position.
3. Refer to Part 4, 1.2.2 "Priority mode setting".
4. Refer to Part 4, 1.2.3 "Addressing mode setting".
5. Switch ENC2 is factory-set and its setting should not be changed.

VMEX VRF 50/60Hz

1.2 Modes Set on Main PCB

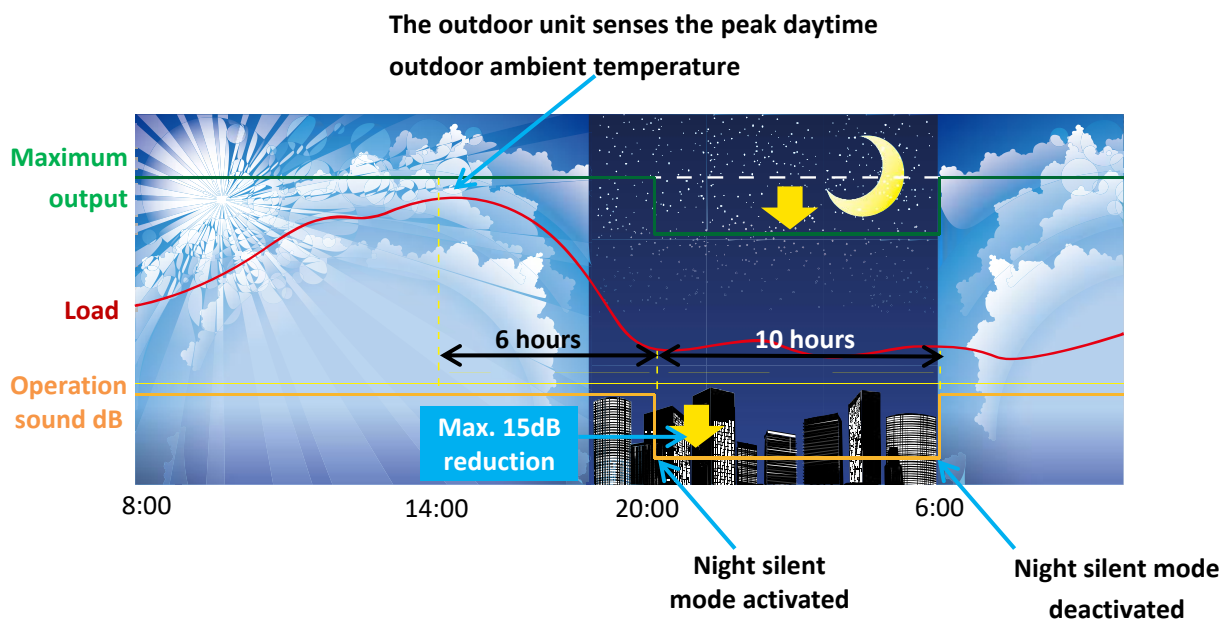
1.2.1 Night silent time setting

Night silent mode is activated X hours after the peak daytime temperature, and is deactivated after Y hours, where X and Y are as specified in Table 4-1.2.

Table 4-1.2: Night silent time setting

Switch	Switch positions	Description	X	Y
S2		Night silent time is 6h/10h (default)	6	10
		Night silent time is 6h/12h	6	12
		Night silent time is 8h/10h	8	10
		Night silent time is 8h/12h	8	12

Figure 4-1.2: Night silent mode example (default setting,



6h/10h)

1.2.2 Priority mode setting

Priority mode can only be set on the master unit. When an indoor unit is in mode conflict with the outdoor units the unit displays the mode conflict error. If the indoor unit has a digital display, it will display error code E0; if the indoor unit display board has LED indicators, the “DEF./FAN” LED will flash rapidly.

Figure 4-1.3: Indoor unit digital displays and LED indicators



There are five priority mode options:

1. Heating priority mode (default):

- a) **During cooling operation:** If an indoor unit requests heating, the outdoor units stop and then restart 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 units ignore the request and continue 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 units restart 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 units stop and then restart 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 units restart in heating mode after 5 minutes and any indoor units requesting heating then start in heating mode.

3. VIP priority mode or voting priority mode: 63 is the VIP address. If the VIP indoor unit is operating, the outdoor units operate in the mode of the VIP indoor unit. Indoor units that are in a mode different to that of the VIP unit display the mode conflict error. If there is no unit with address 63 or the unit at address 63 is in standby, the outdoor units operate in voting priority mode. In voting priority mode, the outdoor units operate in whichever of heating and cooling modes is being requested by the larger number of indoor units.

4. Heating only mode: The outdoor units only operate 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 units only operate 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.

VMEX VRF 50/60Hz

1.2.3 Addressing mode setting

The V5 X supports two addressing modes, auto addressing and manual addressing:

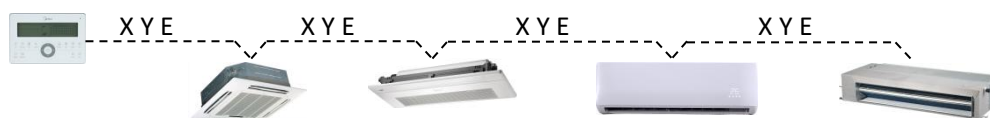
- If an indoor centralized controller (CCM03, CCM09 or CCM30) is connected directly to the master outdoor unit's X Y E terminals, the master unit must be set to auto addressing mode. If the installation situation requires that the indoor unit addresses are set manually, first set the master unit to manual addressing mode then use a remote or wired controller to set the indoor units' addresses one by one, and then change the master unit to auto addressing mode. (Changing to auto addressing mode will not affect indoor unit addresses that have already been set manually).

Figure 4-1.4: Indoor centralized controller connected to master outdoor unit



- If an indoor centralized controller (CCM03, CCM09 or CCM30) is connected to the indoor units through X Y E terminals, the master unit can be set to auto addressing mode or manual addressing mode.

Figure 4-1.5: Indoor centralized controller connected to indoor units



Part 5

Diagnosis and Troubleshooting

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1 Outdoor Unit Electric Control Box Layout

VMEX008Q4A-D13V224/ VMEX009Q4A-D16V280/ VMEX010Q4A-D20V335

Figure 5-1.1: Bottom layer of electric control box

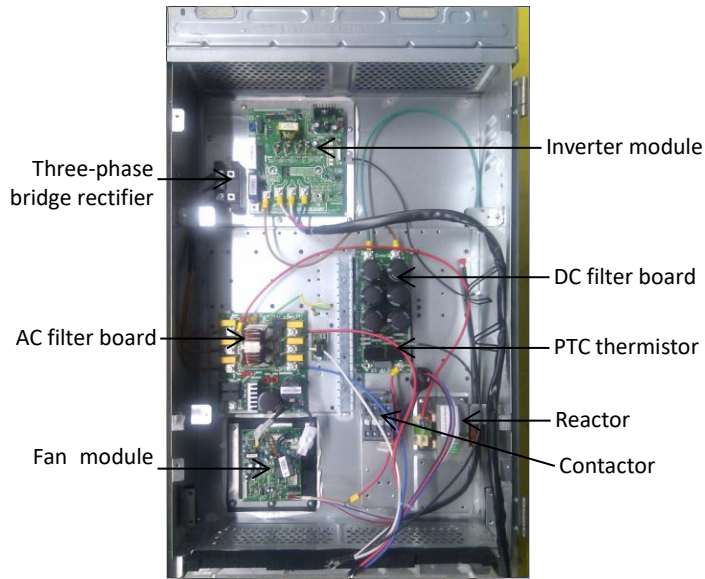
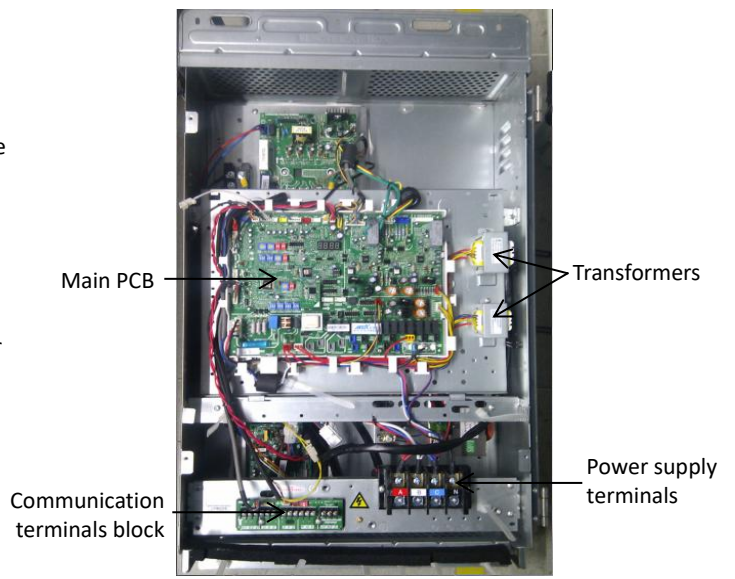


Figure 5-1.2: Top layer of electric control box



VMEX012Q4A-D23V400/ VMEX014Q4A-D26V450/ VMEX016Q4A-D29V500/ VMEX018Q4A-D33V560/ MEX020Q4A-D36V615

Figure 5-1.3: Bottom layer of electric control box

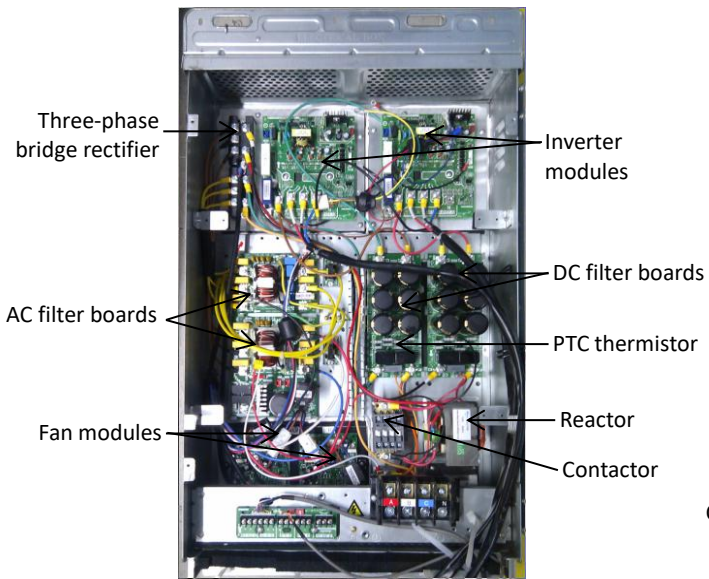
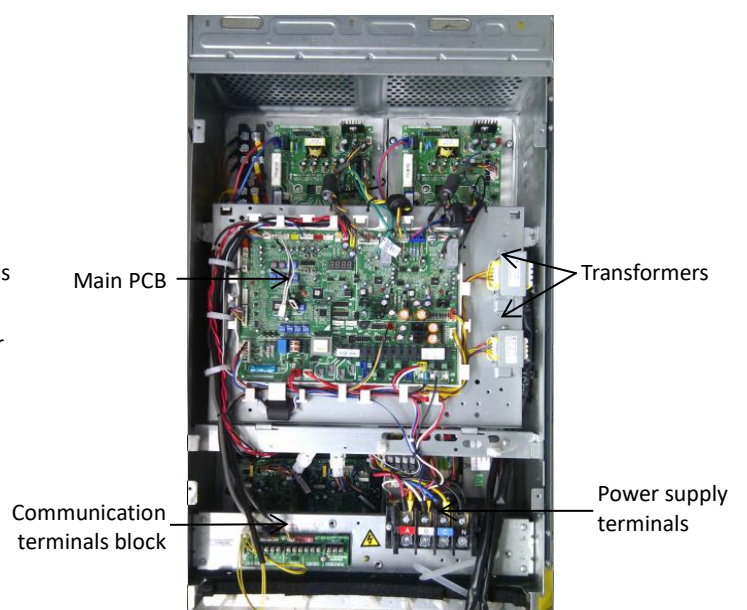


Figure 5-1.4: Top layer of electric control box



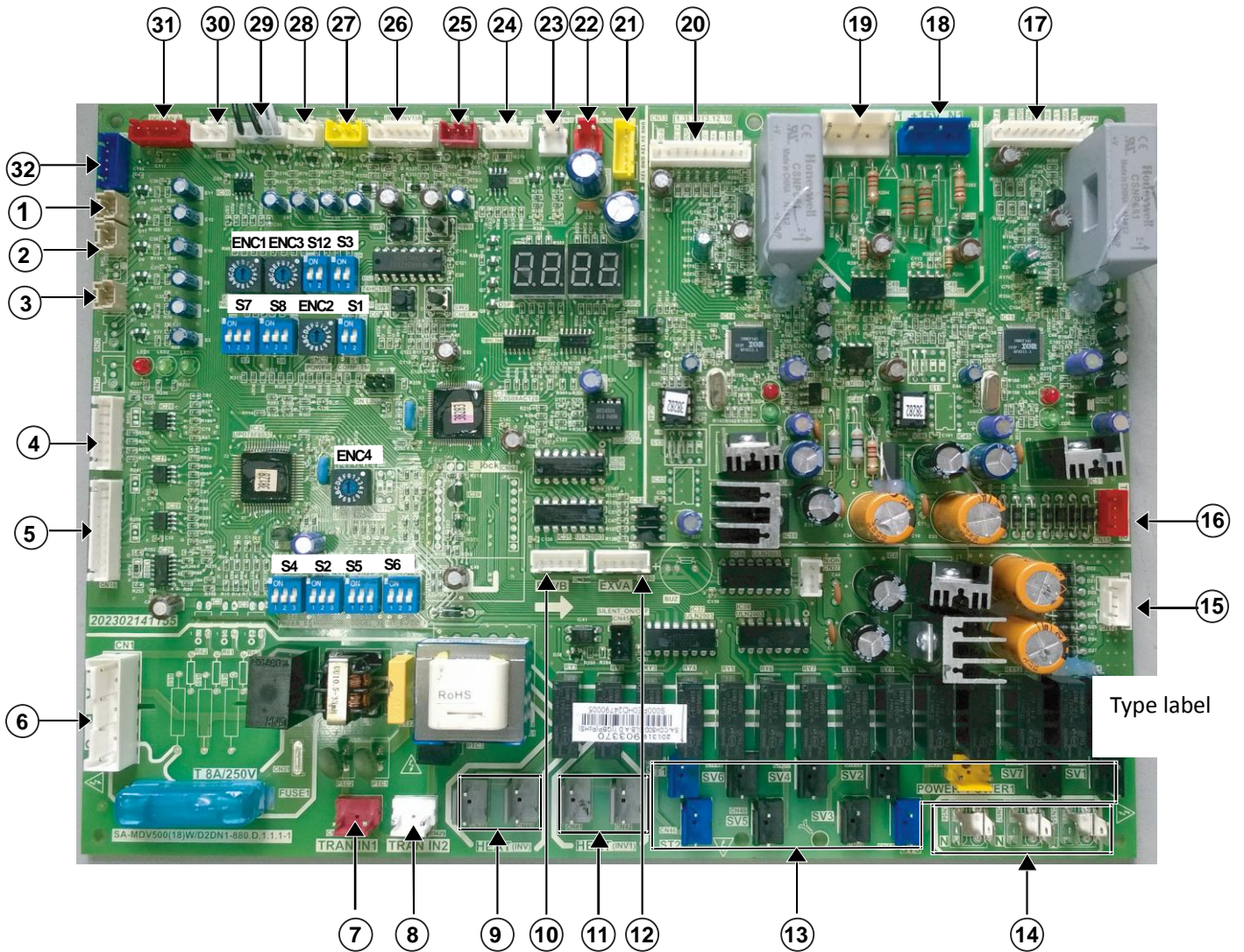
2 Outdoor Unit Main PCB

2.1 Types

There are four main PCB types for V5 X outdoor units. 8/10/12HP units share a main PCB type, 14/16HP share a main PCB type, 18HP has a unique main PCB type, and 20/22HP share a main PCB type. The type label is affixed to the main PCB. When changing a main PCB, be sure to use the right type of main PCB. Refer to Table 5-2.1.

2.2 Ports

Figure 5-2.1: Outdoor unit main PCB ports¹



Notes:

1. Label descriptions are given in Table 5-2.2.

VMEX VRF 50/60Hz

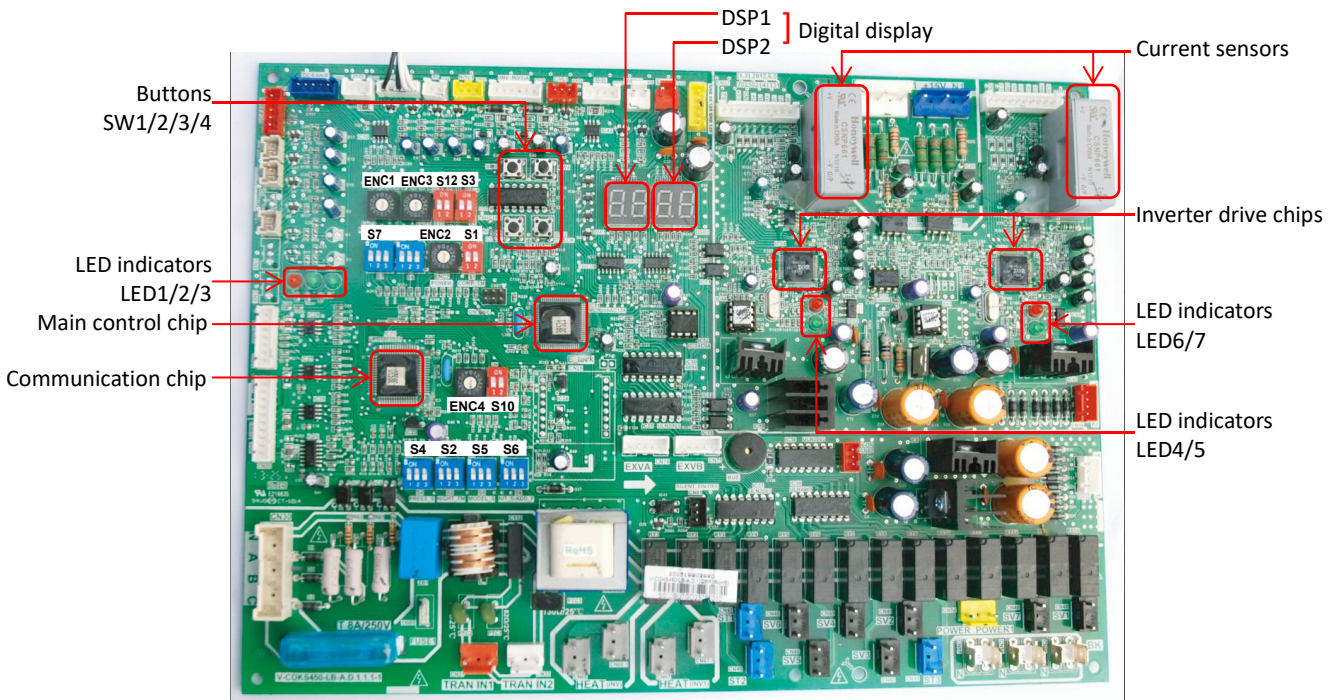
Table 5-2.2: Main PCB ports

Label in Figure 5-2.1	Port code	Content	Port voltage
1	CN10	Compressor top temperature sensor (single compressor units) or compressor A compressor top temperature sensor (dual compressor units) connection	0-5V DC (varying)
2	CN11	Discharge pipe temperature sensor (single compressor units) or compressor B compressor top temperature sensor (dual compressor units) connection	0-5V DC (varying)
3	CN8	Inverter module temperature sensor connection	0-5V DC (varying)
4	CN22	Reserved	/
5	CN16	Communication port	2.5-2.7V DC
6	CN1	Power input	220V
7	CN30	No.1 transformer power input	220V
8	CN29	No.2 transformer power input	220V
9	CN38/40	Power supply to compressor A crankcase heater	220V
10	CN35	EVXB drive port	First pin on the left: 12V DC; other four pins: varying
11	CN41/42	Power supply to compressor B crankcase heater	220V
12	CN36	EVXA drive port	First pin on the left: 12V DC; other four pins: varying
13	CN46-55	Solenoid valve drive ports	220V
14	CN56-58	Neutral terminals	/
15	CN12	No.1 transformer power output	Voltage between upper two pins: 13.5V AC; voltage between lower two pins: 9V AC
16	CN15	No.2 transformer power output	Voltage between upper two pins: 14.5V AC; voltage between lower two pins: 14.5V AC
17	CN14	Inverter module B control port	Third pin on the left: 3.3V DC
18	CN17	Inverter module B voltage monitor port	310V DC, +15V DC, N
19	CN18	Inverter module A voltage monitor port	310V DC, +15V DC, N
20	CN13	Inverter module A control port	Third pin on the left: 3.3V DC
21	CN19	5V DC, 12V DC power input	GND, +5V, +12V, GND, 12V
22	CN25	Low pressure switch connection	0 or 5V
23	CN26	High pressure switch connection	0 or 5V
24	CN7	Reserved	/
25	CN6	Reserved	/
26	CN43	Inverter compressor A and B current sensor connections	0-7.8V AC (varying)
27	CN32	High pressure sensor connection	0-5V DC (varying)
28	CN28	Reserved	
29	CN27	Outdoor ambient temperature sensor and outdoor heat exchanger temperature sensor connections	0-5V DC (varying)
30	CN24	Outdoor units communication port	2.5-2.7V DC
31	CN20	Fan A control port	First pin on the left: 5V DC; other four pins:
32	CN21	Fan B control port	varying

2.3 Components

2.3.1 Layout

Figure 5-2.2: Outdoor unit main PCB components



2.3.2 Function of buttons SW1 to SW4

Table 5-2.3: Function of buttons SW1 to SW4

Button	Function
SW1	Force cooling
SW2	System check
SW3	Check for specific errors
SW4	Reserved

2.3.3 SW2 system check button

Before pressing SW2, allow the system to operate steadily for more than an hour. On pressing SW2, the parameters listed in Table 5-2.4 will be displayed in sequence.

Table 5-2.4: SW2 system check

DSP1 content	Parameters displayed on DSP2	Remarks
- 0	Outdoor unit address	Master unit: 0; slave units: 1, 2, 3
- 1	Outdoor unit capacity	Refer to Note 1
- 2	Number of outdoor units	Displayed on master unit PCB only
- 3	Number of indoor units as set on PCB	Displayed on master unit PCB only
- 4	Outdoor unit output metric (total of all units)	Displayed on master unit PCB only
- 5	Indoor unit demand metric (total of all units)	
- 6	Outdoor unit output metric (master unit)	
- 7	Operating mode	Refer to Note 2
- 8	Outdoor unit output metric (this unit)	
- 9	Fan A speed index	Refer to Note 3

Table continued on next page ...

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Table 5-2.4: SW2 system check (continued)

DSP1 content	Parameters displayed on DSP2	Remarks
10	Fan B speed index	Refer to Note 3
11	Indoor heat exchanger pipe temperature (°C)	Actual value = value displayed
12	Outdoor heat exchanger pipe temperature (°C)	Actual value = value displayed
13	Outdoor ambient temperature (°C)	Actual value = value displayed
14	Inverter compressor A discharge temperature (°C)	Actual value = value displayed
15	Inverter compressor B discharge temperature (°C)	Actual value = value displayed
16	Main inverter module temperature (°C)	Actual value = value displayed
17	Saturation temperature (°C) corresponding to the discharge pressure	Actual value = value displayed - 30
18	Inverter compressor A current (A)	Actual value = value displayed
19	Inverter compressor B current (A)	Actual value = value displayed
20	EXVA position	Steps = value displayed × 8
21	EXVB position	Steps = value displayed × 8
22	Compressor discharge pressure (MPa)	Actual value = value displayed × 0.1
23	Reserved	
24	Number of indoor units currently in communication with master unit	Actual value = value displayed
25	Number of indoor units currently operating	Actual value = value displayed
26	Priority mode	Refer to Note 4
27	Silent mode	Refer to Note 5
28	Static pressure mode	Refer to Note 6
29	DC voltage A	Actual value = value displayed × 10
30	DC voltage B	Actual value = value displayed × 10
31	Reserved	
32	Most recent error or protection code	000 is displayed if no error or protection events have occurred since start-up
33	Error clearance metric	Actual value = value displayed
34	----	End

Notes:

1. Outdoor unit capacity setting:
 - 0: 8HP; 1: 10HP; 2: 12HP; 3: 14HP; 4: 16HP; 5: 18HP; 6: 20HP; 7: 22HP.
2. Operating mode:
 - 0: off; 2: cooling; 3: heating; 4: forced cooling.
3. The fan speed index is related to the fan speed in rpm as described in Table 3-5.3 in Part 3, 5.6 "Outdoor Fan Control".
4. Priority mode:
 - 0: heating priority; 1: cooling priority; 2: VIP priority or voting priority; 3: heating only; 4: cooling only.
5. Silent mode:
 - 0: night silent mode; 1: silent mode; 2: super silent mode; 3: no silent mode.
6. Static pressure mode:
 - 0: standard static pressure; 1: low static pressure; 2: medium static pressure; 3: high static pressure.

2.3.4 Digital display output

Table 5-2.5: Digital display output in different operating states

Outdoor unit state		Parameters displayed on DSP1	Parameters displayed on DSP2
Standby		Unit's address	The number of indoor units in communication with the outdoor units
Normal operation	For single compressor units	--	Running speed of the compressor in rotations per second
	For dual compressor units	Running speed of compressor B in rotations per second	Running speed of compressor A in rotations per second
Error or protection		-- or placeholder	Error or protection code
System check		Refer to Table 5-2.4	Refer to Table 5-2.4

2.3.5 LED indicators LED1 to LED7

Table 5-2.6: LED indicators LED1 to LED7

Indicator	LED indicator function and status
LED1	Power supply indicator. Continuously on if the power supply is normal.
LED2	Running indicator. Continuously on if the system is operating normally and flashing if the system is in standby.
LED3	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.
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 5, 4.11 "xH4 Troubleshooting". The error code is displayed on the digital display.

3 Error Code Table

Table 5-3.1: Error code table

Error code ¹	Content	Remarks
E0	Communication error between outdoor units	Only displayed on the slave unit with the error
E1	Phase sequence error	Displayed on the unit with the error
E2	Communication error between indoor and master unit	Only displayed on the master unit
E4	Outdoor ambient temperature sensor error	Displayed on the unit with the error
E5	Abnormal power supply voltage	Displayed on the unit with the error
E7	Compressor top or discharge pipe temperature sensor error	Displayed on the unit with the error
E8	Outdoor unit address error	Displayed on the unit with the error
xE9	EEPROM mismatch	Displayed on the unit with the error
xH0	Communication error between main control chip and inverter driver chip	Displayed on the unit with the error
H1	Communication error between main control chip and communication chip	Displayed on the unit with the error
H2	Number of slave units detected by master unit has decreased	Only displayed on the master unit
H3	Number of slave units detected by master unit has increased	Only displayed on the master unit
xH4	Inverter module protection	Displayed on the unit with the error

Table continued on next page ...

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Table 5-3.1: Error code table (continued)

Error code ¹	Content	Remarks
H7	Number of indoor units detected by master unit not same as number set on main PCB	Only displayed on the master unit
H8	Discharge pipe low pressure protection.	Displayed on the unit with the error
yHd	Slave unit malfunction	Only displayed on the master unit
P0	Compressor temperature protection	Displayed on the unit with the error
P1	Discharge pipe high pressure protection	Displayed on the unit with the error
P2, H5	Suction pipe low pressure protection	Displayed on the unit with the error
xP3	Compressor current protection	Displayed on the unit with the error
P4, H6	Discharge temperature protection	Displayed on the unit with the error
P5	Outdoor heat exchanger temperature protection	Displayed on the unit with the error
P9, H9	Fan module protection	Displayed on the unit with the error
PL, C7	Inverter module temperature protection	Displayed on the unit with the error
PP, F0	Compressor discharge insufficient superheat protection	Displayed on the unit with the error
xF1	DC bus voltage error	Displayed on the unit with the error
dF	Defrosting operation	
d0	Oil return operation	
xL0	Inverter module protection	
xL1	DC bus low voltage protection	
xL2	DC bus high voltage protection	
xL4	MCE error	
xL5	Zero speed protection	
xL7	Phase sequence error	
xL8	Compressor frequency variation greater than 15Hz within one second protection	
xL9	Actual compressor frequency differs from target frequency by more than 15Hz protection	
r1	Refrigerant quantity slightly insufficient protection	
r2	Refrigerant quantity significantly insufficient protection	
r3	Refrigerant quantity critically insufficient protection	
R1	Refrigerant quantity slightly excessive protection	
R2	Refrigerant quantity critically excessive protection	

Notes:

- 'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B. 'y' is a placeholder for the address (1, 2 or 3) of the slave unit with the error.

4 Troubleshooting

4.1 Warning

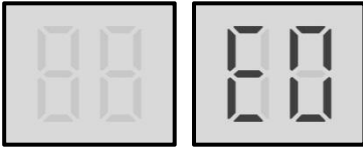
Warning



- 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.

4.2 E0 Troubleshooting

4.2.1 Digital display output



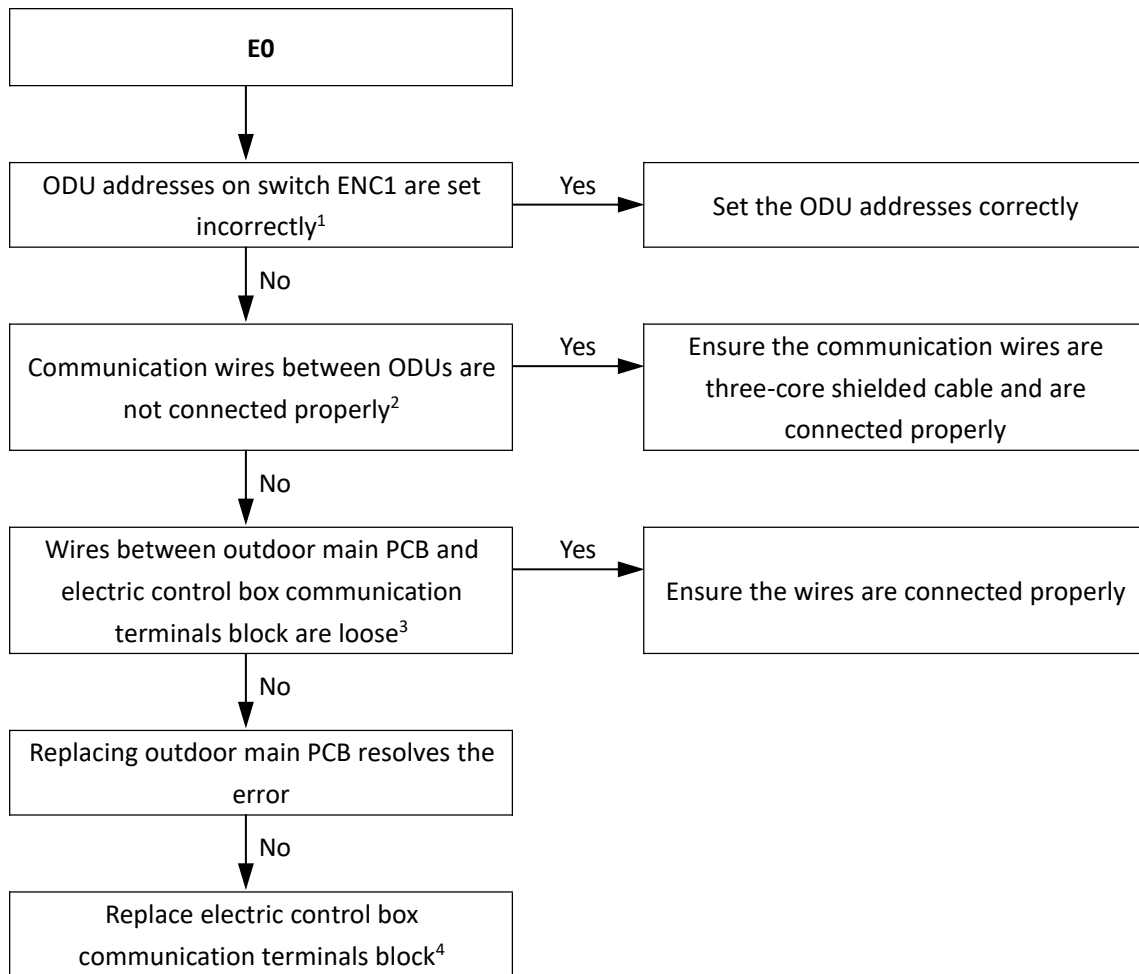
4.2.2 Description

- Communication error between outdoor units.
- All units stop running.
- Error code is only displayed on the slave unit with the error.

4.2.3 Possible causes

- Incorrect outdoor unit address setting.
- Communication wires between outdoor units not connected properly.
- Loosened wiring within electric control box.
- Damaged main PCB or electric control box communication terminals block.

4.2.4 Procedure

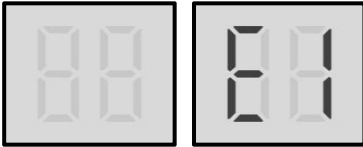


Notes:

1. The master unit address should be set as 0, slave units addresses should be set from 1 to 3, and the addresses should not be repeated within one system. Refer to Part 4, 1.1 "PCB Switches and Switch Settings".
2. All the wires for H1, H2, E connections should be three-core shielded cable, the wiring should be connected according to polarity (H1 to H1, etc), the wiring should not be open or short circuited. Refer to the V5 X Engineering Data Book, Part 2, 5 "Wiring Diagrams" and Part 3, 9.3 "Communication Wiring".
3. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to the V5 X Engineering Data Book, Part 2, 5 "Wiring Diagrams".
4. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".

4.3 E1 Troubleshooting

4.3.1 Digital display output



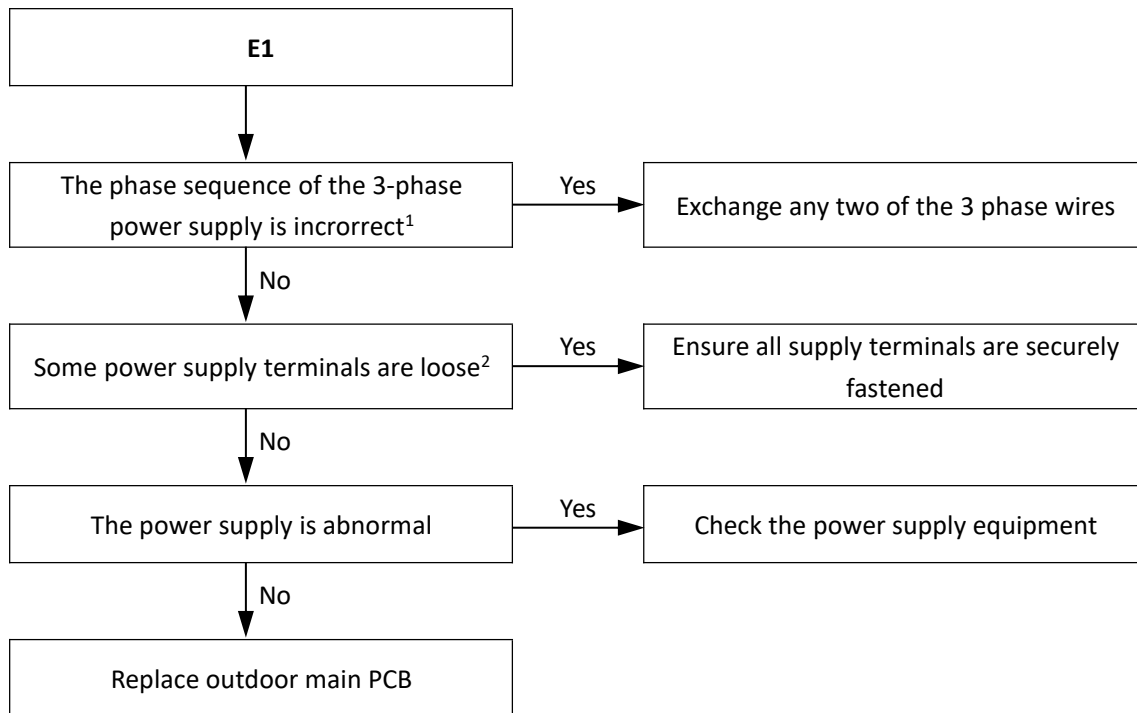
4.3.2 Description

- Phase sequence error.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.3.3 Possible causes

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

4.3.4 Procedure

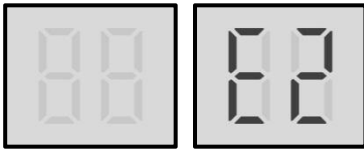


Notes:

1. The A, B, C terminals of the 3-phase power supply should match compressor phase sequence requirements. If the phase sequence is inverted, the compressor will operate inversely. If the wiring connection of each outdoor unit is in A, B, C phase sequence, and multiple units are connected, the current difference between C phase and A, B phases will be very large as the power supply load of each outdoor unit will be on C phase. This can easily lead to tripped circuits and terminal wiring burnout. Therefore if multiple units are to be used, the phase sequence should be staggered, so that the current is distributed among the three phases equally. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".
2. Loose power supply terminals can cause the compressors to operate abnormally and compressor current to be very large. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".

4.4 E2 Troubleshooting

4.4.1 Digital display output



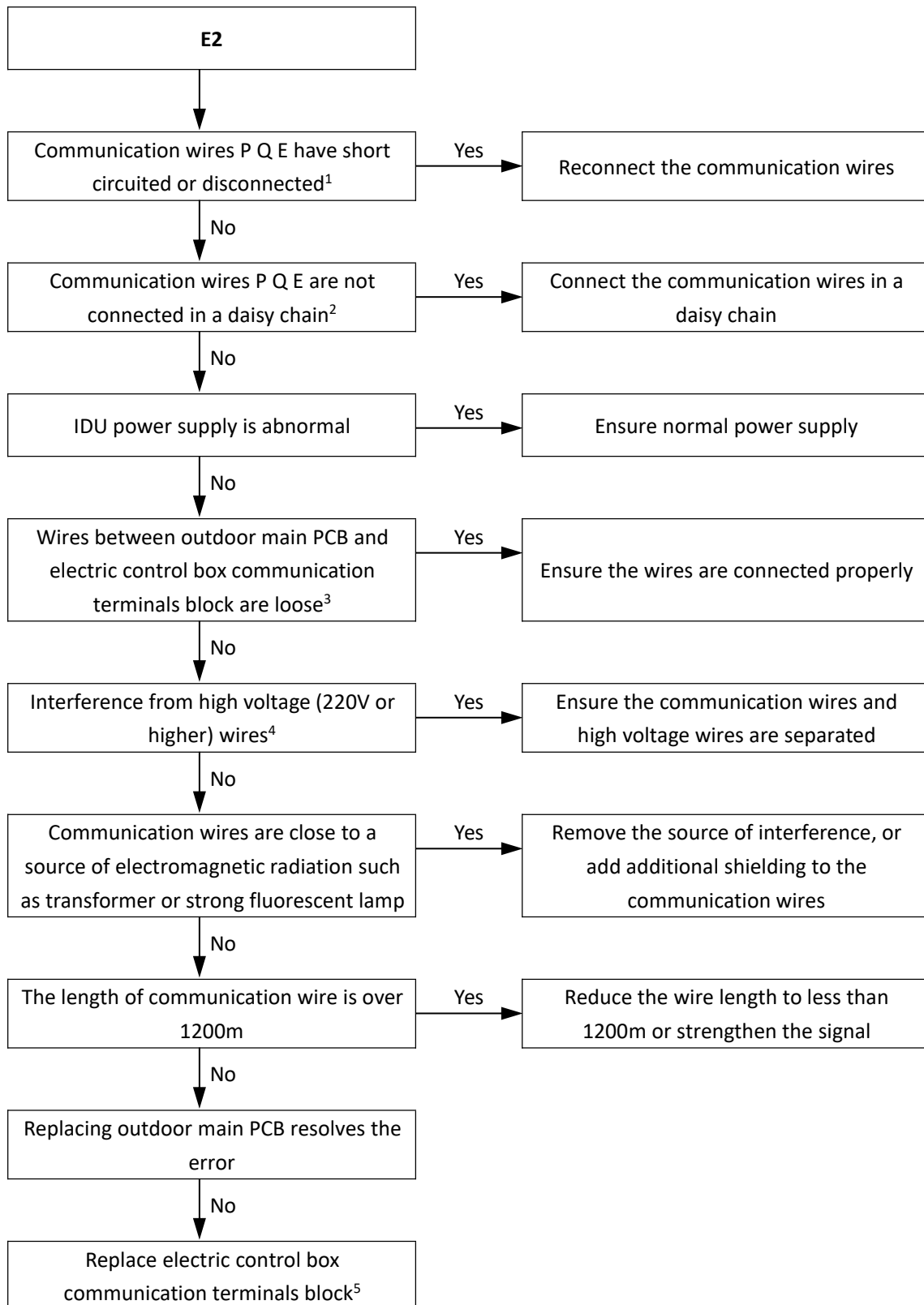
4.4.2 Description

- Communication error between indoor and master unit.
- All units stop running.
- Error code is only displayed on the master unit.

4.4.3 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.

4.4.4 Procedure



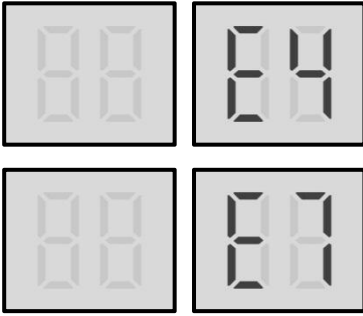
Notes:

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. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to the V5 X Engineering Data Book, Part 3, 9.3 "Communication Wiring".
2. Refer to the V5 X Engineering Data Book, Part 3, 9.3 "Communication Wiring".
3. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to the V5 X Engineering Data Book, Part 2, 5 "Wiring Diagrams".
4. Refer to the V5 X Engineering Data Book, Part 3, 9.1 "General" for required separation distances between communication wiring and power wiring.
5. Refer to Figures 5-1.2 and 5-1.4 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".

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4.5 E4, E7 Troubleshooting

4.5.1 Digital display output



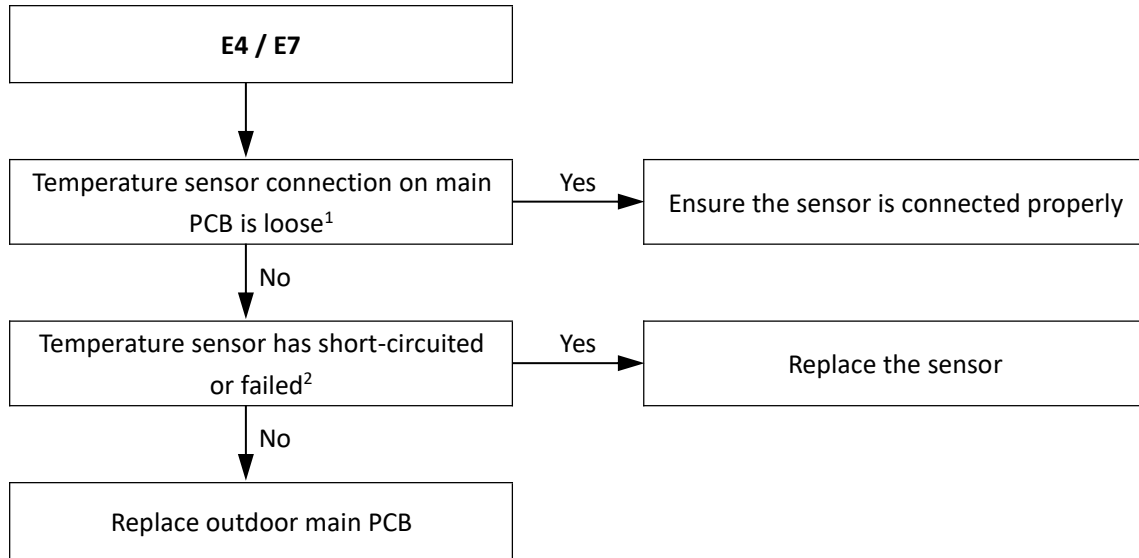
4.5.2 Description

- E4 indicates an outdoor ambient temperature sensor error.
- E7 indicates a compressor top temperature sensor or discharge pipe temperature sensor error.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.5.3 Possible causes

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

4.5.4 Procedure



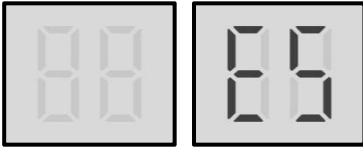
Notes:

1. Outdoor ambient temperature sensor connection is port CN1 on the main PCB (labeled 32 in Figure 5-2.1 in Part 5, 2.2 “Ports”). Compressor top temperature sensor and discharge pipe temperature sensor connections are ports CN10 and CN11 on the main PCB (labeled 1 and 2, respectively, in Figure 5-2.1 in Part 5, 2.2 “Ports”).
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor’s resistance characteristics table, the sensor has failed. Refer to Part 2, 1 “Layout of Functional Components” and to Table 5-5.1 or 5-5.2 in Part 5, 5.1 “Temperature Sensor Resistance Characteristics”.

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4.6 E5 Troubleshooting

4.6.1 Digital display output



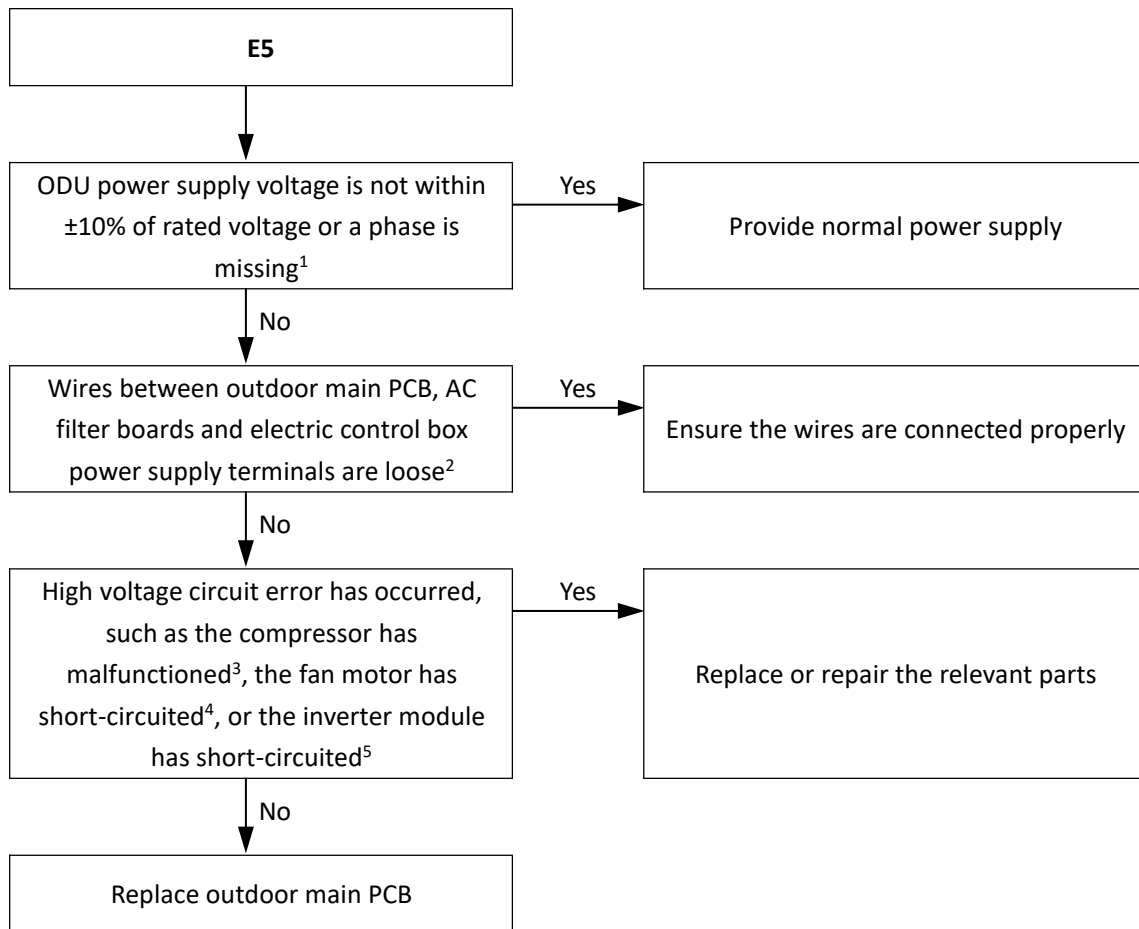
4.6.2 Description

- Abnormal power supply voltage.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.6.3 Possible causes

- Outdoor unit power supply voltage not within $\pm 10\%$ of rated voltage or a phase is missing.
- Loosened wiring within electric control box.
- High voltage circuit error.
- Main PCB damaged.

4.6.4 Procedure



Notes:

1. The normal voltage between A and N, B and N, and C and N is 198-242V.
2. Refer to Figures 5-1.1 to 5-1.4 in Part 5, 1 “Outdoor Unit Electric Control Box Layout” and to the V5 X Engineering Data Book, Part 2, 5 “Wiring Diagrams”.
3. The normal resistances of the inverter compressor are 0.7-1.5Ω 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. Refer to Figures 5-4.6 and 5-4.7 in Part 5, 4.11.6 “xLO troubleshooting”.
4. The normal resistances of the fan motor coil among U V W are less than 10Ω. If a measured resistance is 0Ω, the fan motor has short-circuited. Refer to Part 2, 1 “Layout of Functional Components”.
5. Set a multi-meter to buzzer mode and test any two terminals of P N and U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 “Outdoor Unit Electric Control Box Layout” and to Figure 5-4.1.

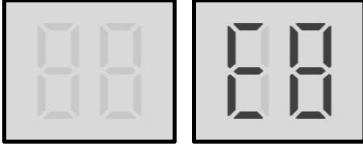
Figure 5-4.1: Inverter module terminals



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4.7 E8 Troubleshooting

4.7.1 Digital display output



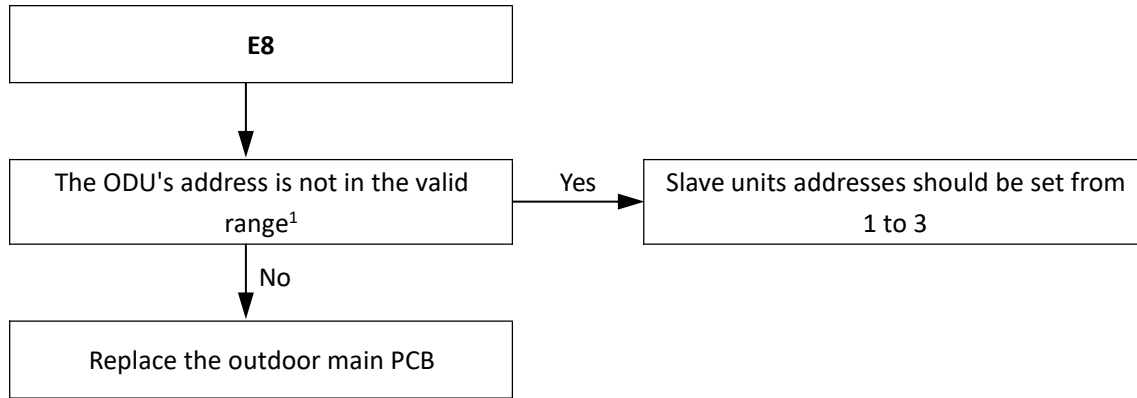
4.7.2 Description

- Outdoor unit address error.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.7.3 Possible causes

- Invalid outdoor unit address.
- Main PCB damaged.

4.7.4 Procedure

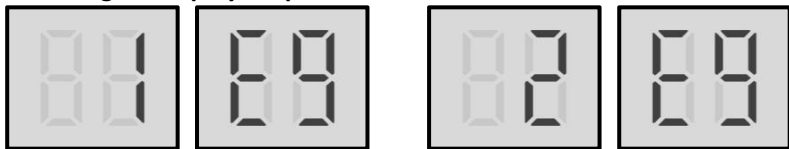


Notes:

1. The master unit address should be set as 0, slave units addresses should be set from 1 to 3, and the addresses should not be repeated within one system. Refer to Part 4, 1.1 "PCB Switches and Switch Settings".

4.8 xE9 Troubleshooting

4.8.1 Digital display output



In the error code, 'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B.

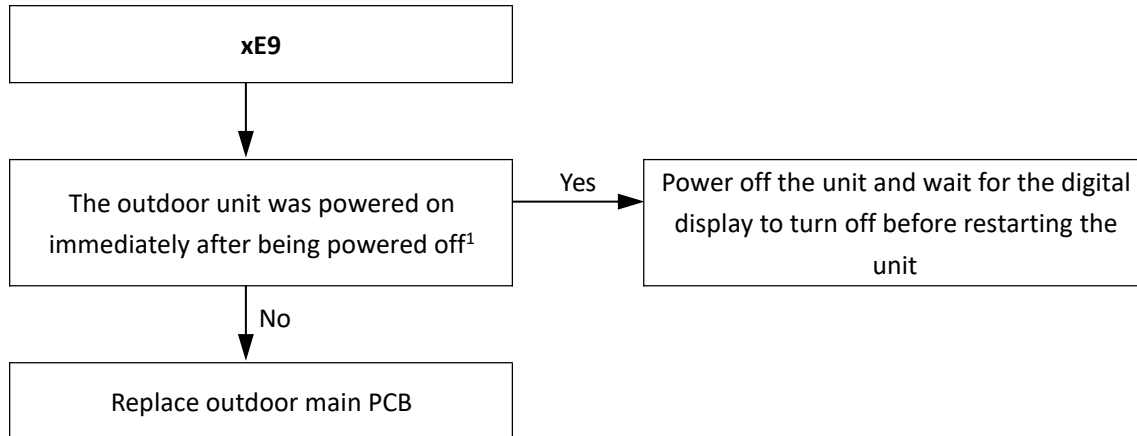
4.8.2 Description

- 1E9 indicates a compressor A EEPROM mismatch.
- 2E9 indicates a compressor B EEPROM mismatch.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.8.3 Possible causes

- Outdoor unit was powered on immediately after being powered off.
- Main PCB damaged.

4.8.4 Procedure

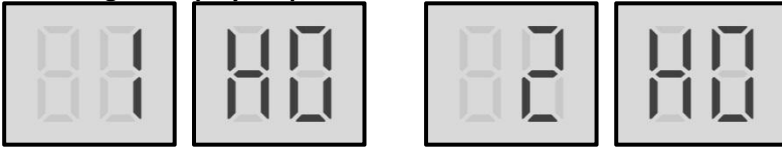


Notes:

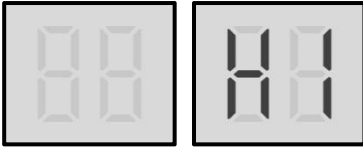
1. When performing a manual restart of an outdoor unit, once the unit has been powered off it should not be powered on again until the digital display has turned off.

4.9 xH0, H1 Troubleshooting

4.9.1 Digital display output



In the error code, 'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B.



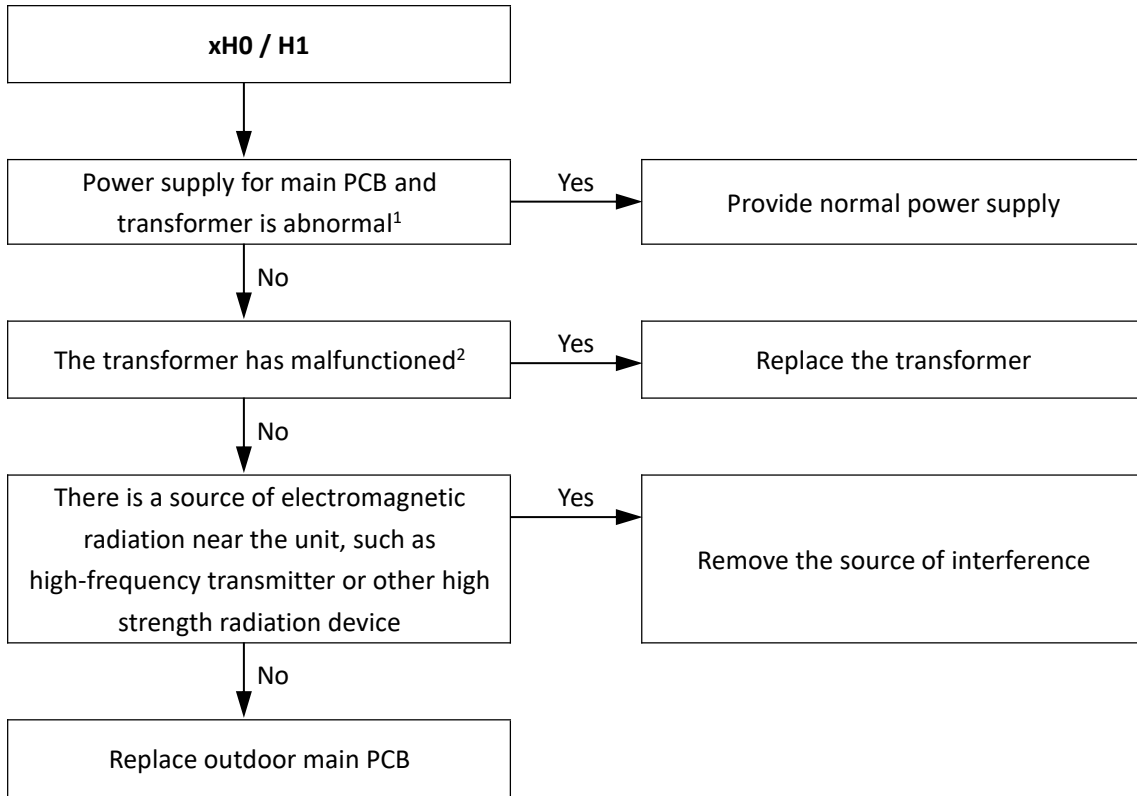
4.9.2 Description

- 1H0 indicates a communication error between the main control chip and the compressor A inverter driver chip.
- 2H0 indicates a communication error between the main control chip and the compressor B inverter driver chip.
- H1 indicates a communication error between the main control chip and the communication chip.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.9.3 Possible causes

- Power supply abnormal.
- Transformer malfunction.
- Interference from a source of electromagnetic radiation.
- Main PCB damaged.

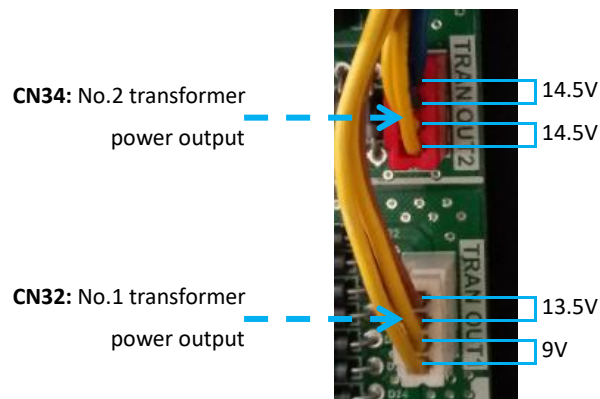
4.9.4 Procedure



Notes:

1. Measure the voltages of ports CN31, CN33 and CN35 on the main PCB (labeled 8, 9 and 24, respectively, in Figure 5-2.1 in Part 5, 2.2 "Ports"). The normal voltage between CN31 and CN33 terminals is 220V, between GND and the 5V pins of CN35 is 5V, between GND and 12V pins of CN35 is 12V. If one or more of the voltages are not normal, the power supply for main PCB and transformer is abnormal.
2. Measure the voltages of ports CN32 and CN34 on the main PCB (labeled 18 and 19, respectively, in Figure 5-2.1 in Part 5, 2.2 "Ports"). The normal voltage across the upper two pins of CN32 is 13.5V (AC), across the lower two pins is 9V (AC). The normal voltage across the upper two pins of CN34 is 14.5V (AC), across the lower two pins is 14.5V (AC). If one or more of the voltages are not normal, the transformer has malfunctioned. Refer to Figure 5-4.2.

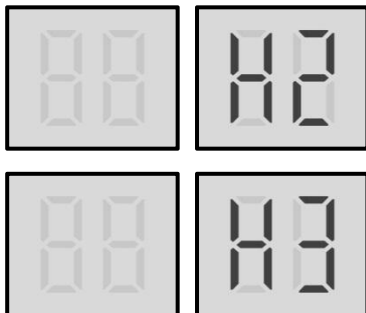
Figure 5-4.2: Transformer power output terminals



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4.10 H2, H3 Troubleshooting

4.10.1 Digital display output



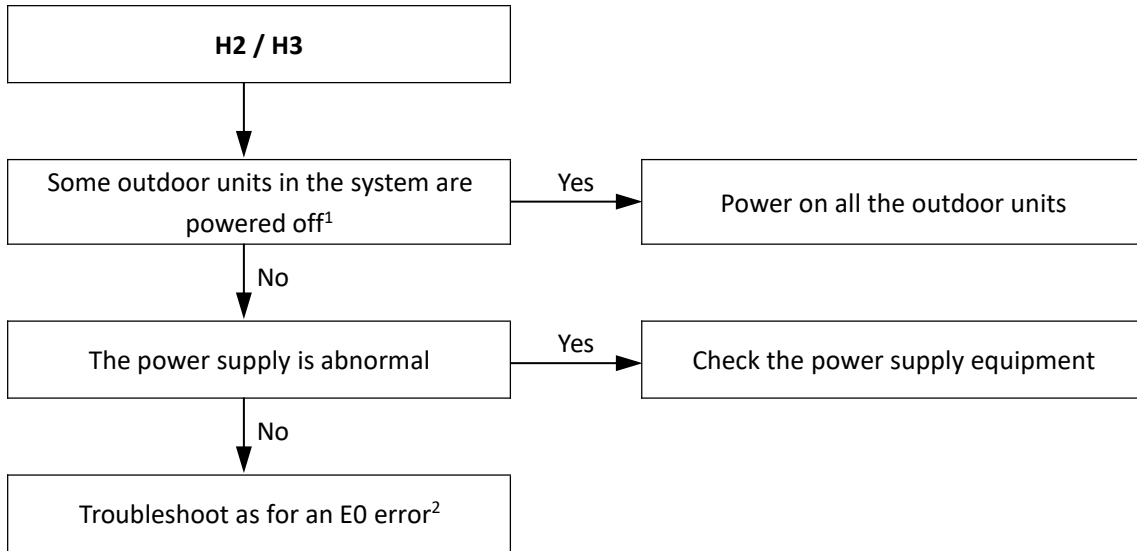
4.10.2 Description

- H2 indicates that the number of slave units detected by master unit has decreased.
- H3 indicates that the number of slave units detected by master unit has increased.
- All units stop running.
- Error code is only displayed on the master unit.

4.10.3 Possible causes

- Some outdoor units are powered off.
- Power supply abnormal.
- Incorrect outdoor unit address setting.
- Communication wires between outdoor units not connected properly.
- Loosened wiring within electric control box.
- Damaged main PCB or electric control box communication terminals block.

4.10.4 Procedure



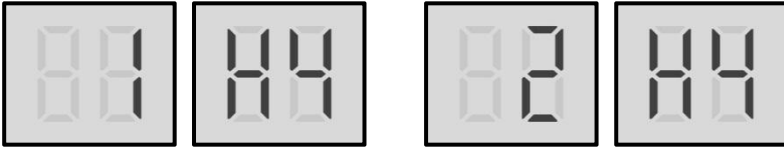
Notes:

1. Check LED1 on the main PCB. If LED1 is on, the main PCB is powered on, if LED1 is off, the main PCB is powered off. Refer to Figure 5-2.2 in Part 5, 2.3.1 "Layout".
2. See Part 5, 4.2 "E0 Troubleshooting".

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4.11 xH4 Troubleshooting

4.11.1 Digital display output



In the error code, 'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B.

4.11.2 Description

- 1H4 indicates compressor A inverter module protection.
- 2H4 indicates compressor B inverter module protection.
- When an xH4 error occurs, a manual system restart is required before the system can resume operation. The cause of an xH4 error should be addressed promptly in order to avoid system damage.
- All units stop running.
- Error code is only displayed on the unit with the error.

4.11.3 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.

4.11.4 Specific error codes for xH4 inverter module protection

If an xH4 error code is displayed, press button SW3 every two seconds until one of the following specific error codes is displayed on the digital display: xL0, xL1, xL2, xL4, xL5, xL7, xL8, xL9. Refer to Figure 5-4.3 and Table 5-4.1.

Figure 5-4.3: Button SW3 on main PCB

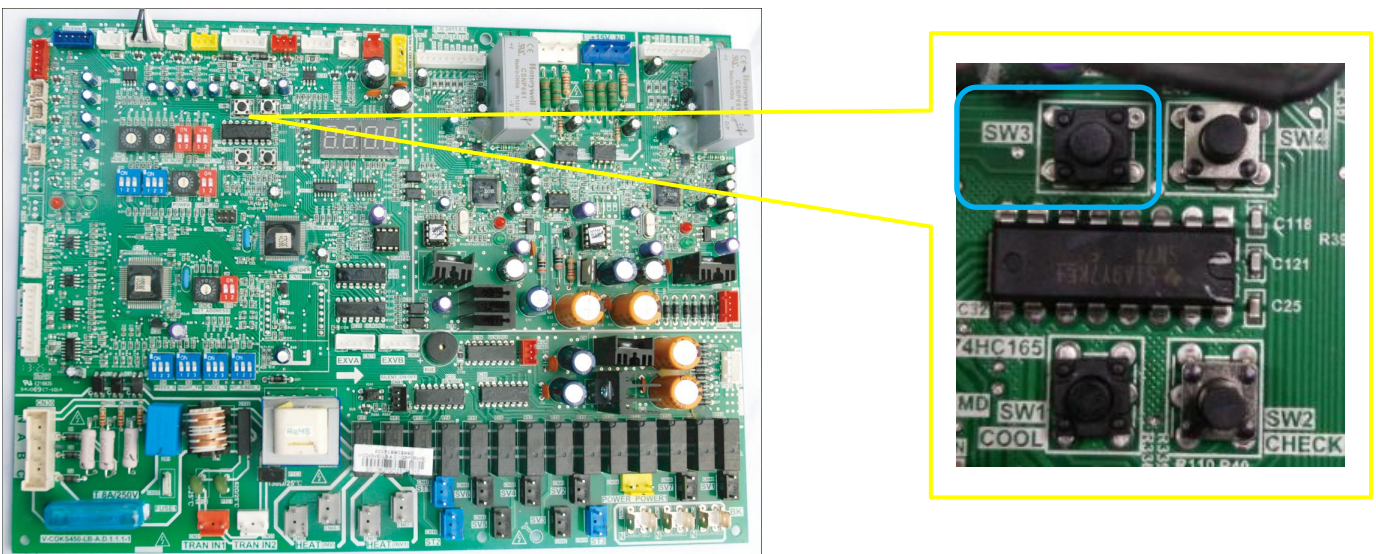


Table 5-4.1: Specific error codes for error xH4

Specific error code ¹	Content
xL0	Inverter module protection
xL1	DC bus low voltage protection
xL2	DC bus high voltage protection
xL4	MCE error
xL5	Zero speed protection
xL7	Phase sequence error
xL8	Compressor frequency variation greater than 15Hz within one second protection
xL9	Actual compressor frequency differs from target frequency by more than 15Hz protection

Notes:

- 'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B.

The specific error codes xL0, xL1, xL2 and xL4 can also be obtained from the inverter module LED indicators. If an inverter module error has occurred, LED5/7 is continuously on and LED4/6 flashes. Refer to Figure 5-4.4 and Table 5-4.2.

Figure 5-4.4: LED indicators LED4 to LED7 on main PCB

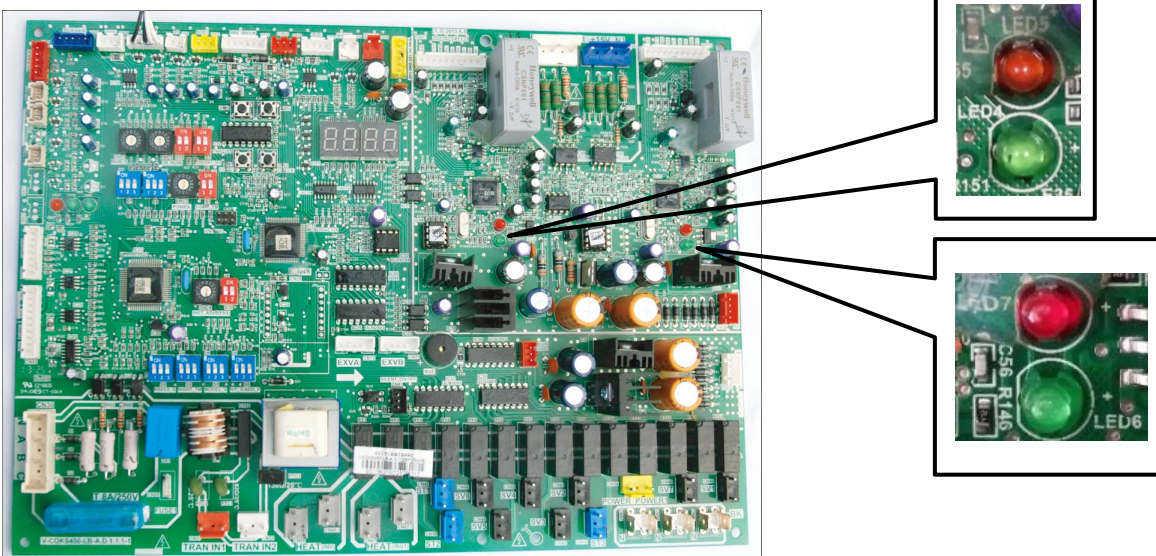


Table 5-4.2: Errors indicated on LED4/6

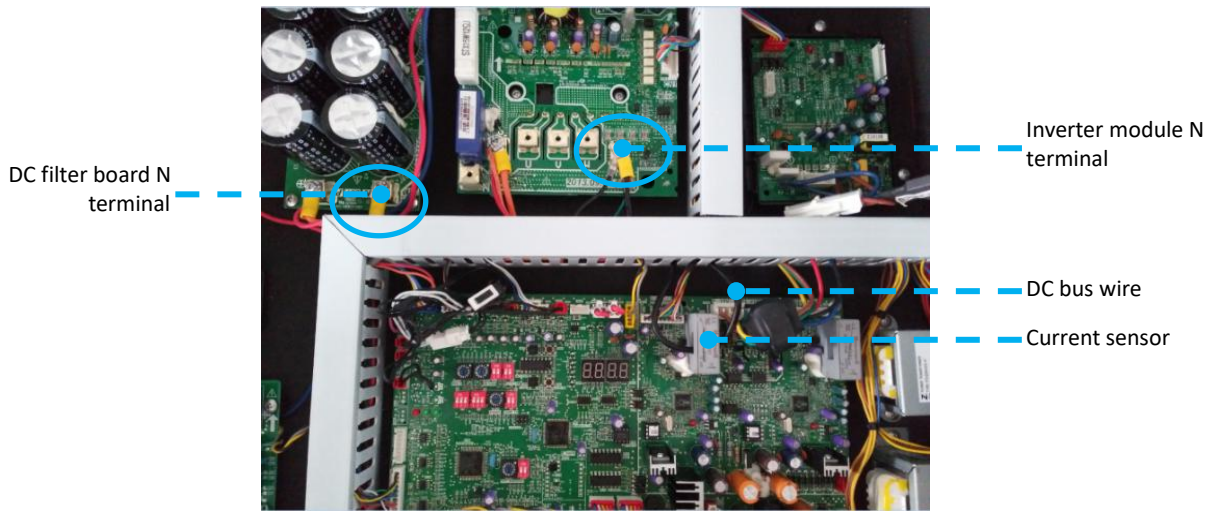
LED4/6 flashing pattern	Corresponding error
Flashes 8 times and stops for 1 second, then repeats	xL0 - Inverter module protection
Flashes 9 times and stops for 1 second, then repeats	xL1 - DC bus low voltage protection
Flashes 10 times and stops for 1 second, then repeats	xL2 - DC bus high voltage protection
Flashes 12 times and stops for 1 second, then repeats	xL4 - MCE error

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4.11.5 First troubleshooting step

To troubleshoot xH4 errors, first ensure that the DC bus wire is connected correctly. The DC bus wire should run from the N terminal on the inverter module, through the current sensor (in the direction indicated by the arrow on the current sensor), and end at the N terminal on the DC filter board.

Figure 5-4.5: DC detection wire connection method



4.11.6 xL0 troubleshooting

Step 1: Check compressor

- Check that compressor wiring is all connected properly.
- The normal resistances of the inverter compressor are 0.7-1.5Ω 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.

Figure 5-4.6: Measuring resistances among compressor terminals

Figure 5-4.7: Measuring resistances between compressor terminals and ground



- If the resistances are normal, go to Step 2.

Step 2: Check inverter module

- The DC voltage between terminals P1 and N1 should be 1.41 times the local power supply voltage. The DC voltage between terminals P and N should be 510-580V. If either voltage is not in the normal range, troubleshoot as for xL1 or xL2 errors. Refer to Part 5, 4.11.7 “xL1/xL4 troubleshooting” or Part 5, 4.11.8 “xL2 troubleshooting”.
- Disconnect the terminals U, N, W from the inverter compressor. Measure the resistance among terminals P, N, U, V, W. All the resistances should be infinite. If any of them are not infinite, the inverter module is damaged and should be replaced.

Figure 5-4.8: Inverter module terminals



4.11.7 xL1/xL4 troubleshooting

Step 1: Check inverter module

- Check the DC voltage between terminals P and N. The normal value is 510-580V. If the voltage is lower than 510V, go to Step 2.

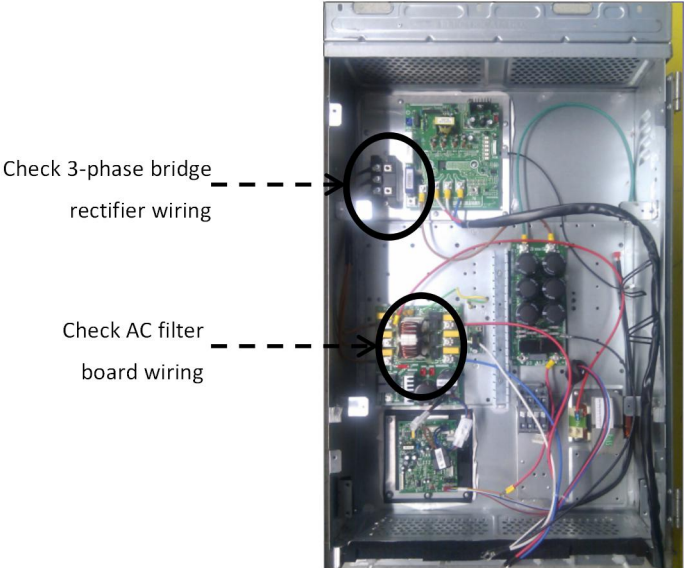
Figure 5-4.9: Inverter module terminals



Step 2: Check rectifier wiring circuit

- If the wires are loose, fasten the wires. If the wires are OK, replace the main PCB.

Figure 5-4.10: Rectifier and AC filter board in electric control box



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4.11.8 xL2 troubleshooting

Step 1: Check inverter module

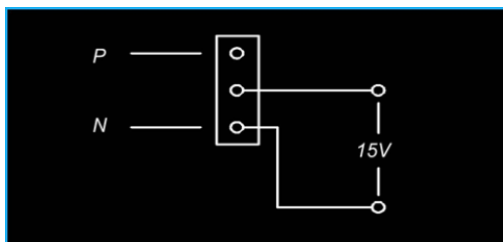
- Check the DC voltage between terminals P and N. The normal value is 510-580V, if the voltage is higher than 580V, go to Step 2.

Figure 5-4.11: Inverter module terminals



Step 2: Check the voltage detection port of inverter module, the normal value between P and N should be 1.4 times the rated voltage, the normal value between +15V and N should be 15V. If the values are normal, that means PCB has been malfunction, needs to be replaced, or else reinstall the wire connection.

Figure 5-4.12: P +15V N terminals on inverter module



4.11.9 xL8/xL9 troubleshooting

Step 1: Check compressor

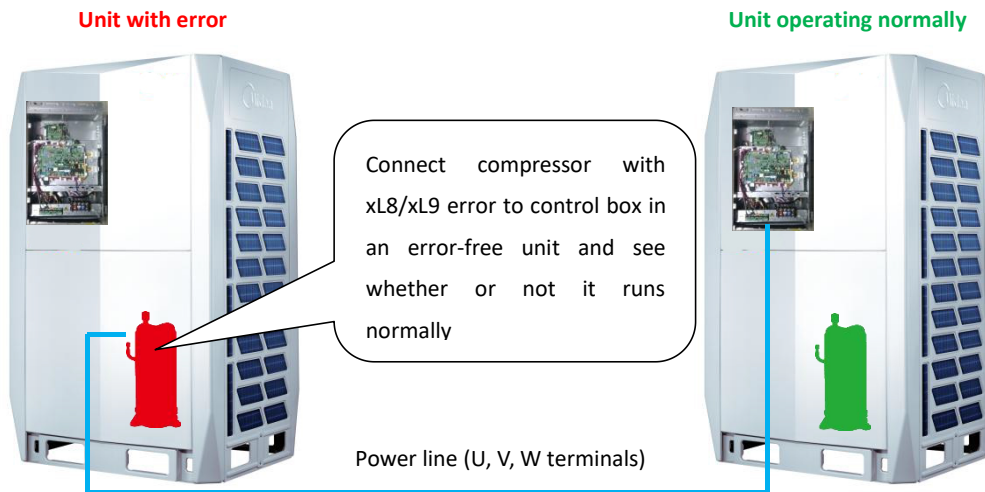
- The normal resistances of the inverter compressor are 0.7-1.5Ω among U V W and infinite between each of U V W and ground. If any of the resistances differ from these specifications, the compressor has malfunctioned.
- Refer to Figures 5-4.6 and 5-4.7 in Part 5, 4.11.6 “xL0 troubleshooting”. If the resistance values are normal, go to Step 2.

Step 2: Check compressor and main PCB

- If there is another unit nearby (either in the same system or another system) that is operating normally, its electric control box can be used to determine whether the xL8/xL9 error is being caused by a compressor fault or a main PCB fault:
 - If using another unit in the same system as the unit with the error to perform the test, set it as the master unit (address 0); if using a unit in another system, use the master unit.
 - Disconnect the power wires of the compressor referenced in the xL8/xL9 error code.
 - In the unit that is operating normally, disconnect the power wires that connect a compressor to the electric control box and use them to connect the compressor with the xL8/xL9 error to the electric control box of the unit that is operating normally. Ensure that the U, V, W terminals are connected in the right order, and then start the system that is operating normally.
 - If the compressor with the xL8/xL9 error runs normally, replace the main PCB of the unit with the xL8/xL9 error

and ensure the wiring is correct; if the compressor with the xL8/xL9 error still does not run normally, it needs to be replaced. Refer to Part 5, 4.11.10 “Compressor replacement procedure”.

Figure 5-4.13: Connecting compressor to an error-free unit



- If there is no error-free unit nearby:
 - Replace the main PCB of the unit with the xL8/xL9 error and ensure the wiring is correct. If the compressor with the xL8/xL9 error runs normally, a fault with the main PCB was causing the xL8/xL9 error; if the compressor with the xL8/xL9 error still does not run normally, it needs to be replaced. Refer to Part 5, 4.11.10 “Compressor replacement procedure”.

4.11.10 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. Refer to Figure 5-4.14.

Figure 5-4.14: 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 5-4.16 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. Refer to Figure 5-4.17.)

Step 3: Check oil in other compressors in the system

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

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

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

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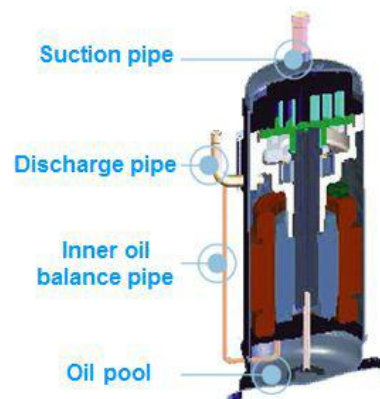
Step 5: Check filters(s)

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

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

- Replace the faulty compressor.
- If the oil had been spoiled and was drained from the non-faulty compressors in Step 3, use clean oil to clean them before re-fitting them into the units. To clean, add oil into the compressor through the discharge pipe using a funnel, shake the compressor, and then drain the oil. Repeat several times and then re-fit the compressors into the units. (The discharge pipe is connected to the oil pool of the compressor by the inner oil balance pipe. Refer to Figure 5-4.15.)

Figure 5-4.15: Compressor piping



Step 7: Add compressor oil

- Add 1.2L of oil to the new compressor through the discharge pipe, using a funnel.
- Add 1.2L of oil to each of the compressors from which oil was drained in Step 3.
- Only use FV68H oil. Different compressors require different types of oil. Using the wrong type of oil leads to various problems.
- Add additional oil to the accumulators such that the total amount of oil is 5L in 8-12HP units and 7L in 14-22HP units.

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. Refer to the V5 X Engineering Data Book, Part 3.

Figure 5-4.16: 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

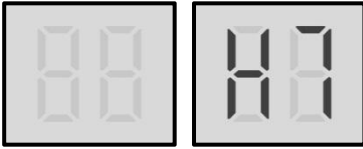
Figure 5-4.17: Effects of spoiled compressor oil



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4.12 H7 Troubleshooting

4.12.1 Digital display output



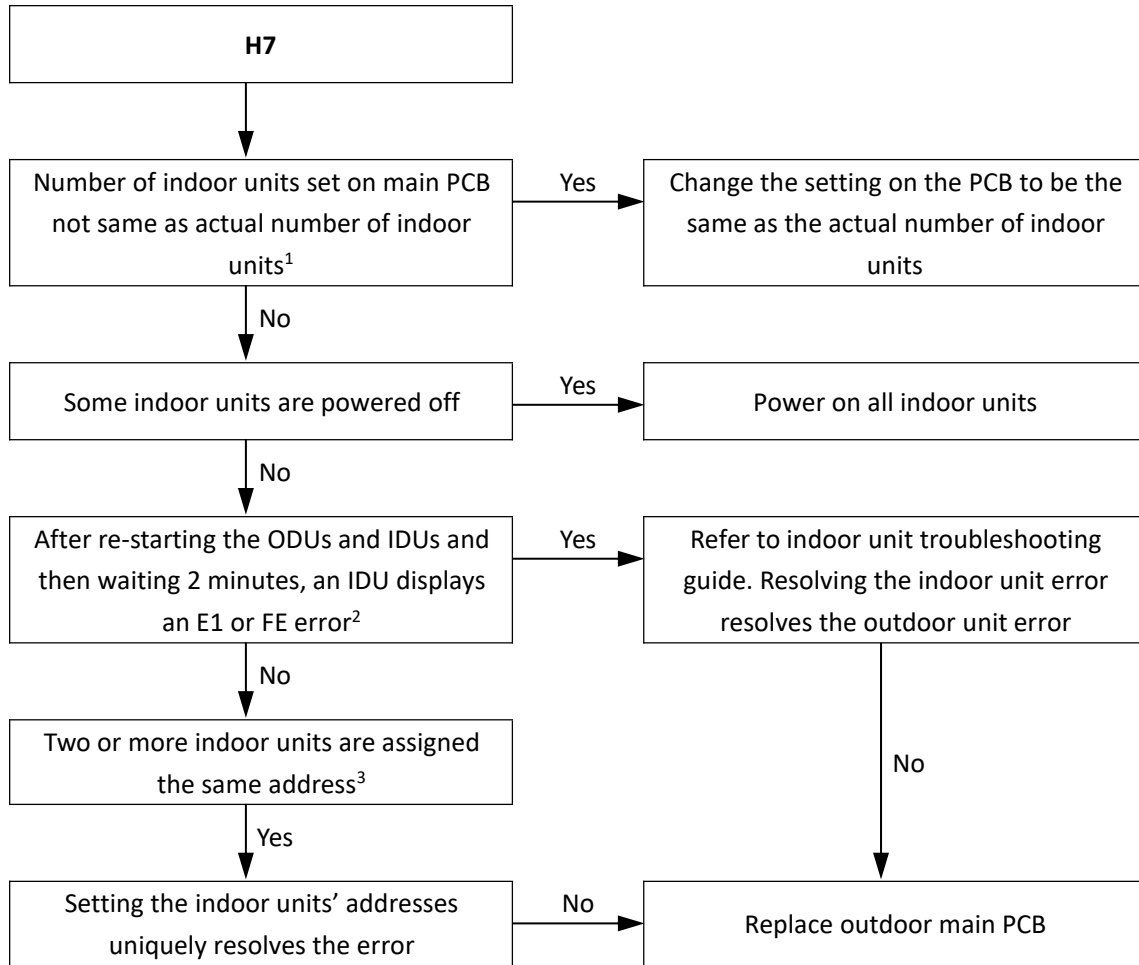
4.12.2 Description

- Number of indoor units detected by master unit not same as number set on main PCB.
- All units stop running.
- Error code is only displayed on the master unit.

4.12.3 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.

4.12.4 Procedure



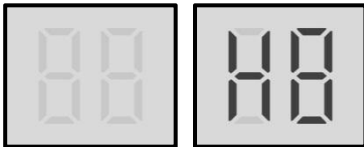
Notes:

1. The number of indoor units can be set on switches EN3 and S12 on the main PCB. Refer to Part 4, 1.1 “PCB Switches and Switch Settings”.
2. Indoor unit error code E1 indicates a communication error between indoor and master unit. Indoor unit error code FE indicates that an indoor unit has not been assigned an address.
3. Indoor unit addresses can be checked and manually assigned using indoor unit remote/wired controllers. Alternatively, indoor unit addresses can be automatically assigned by the master outdoor unit. Auto-addressing mode is selected by setting switch S6 on the main PCB. Refer to Part 4, 1.1 “PCB Switches and Switch Settings”.

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4.13 H8 Troubleshooting

4.13.1 Digital display output



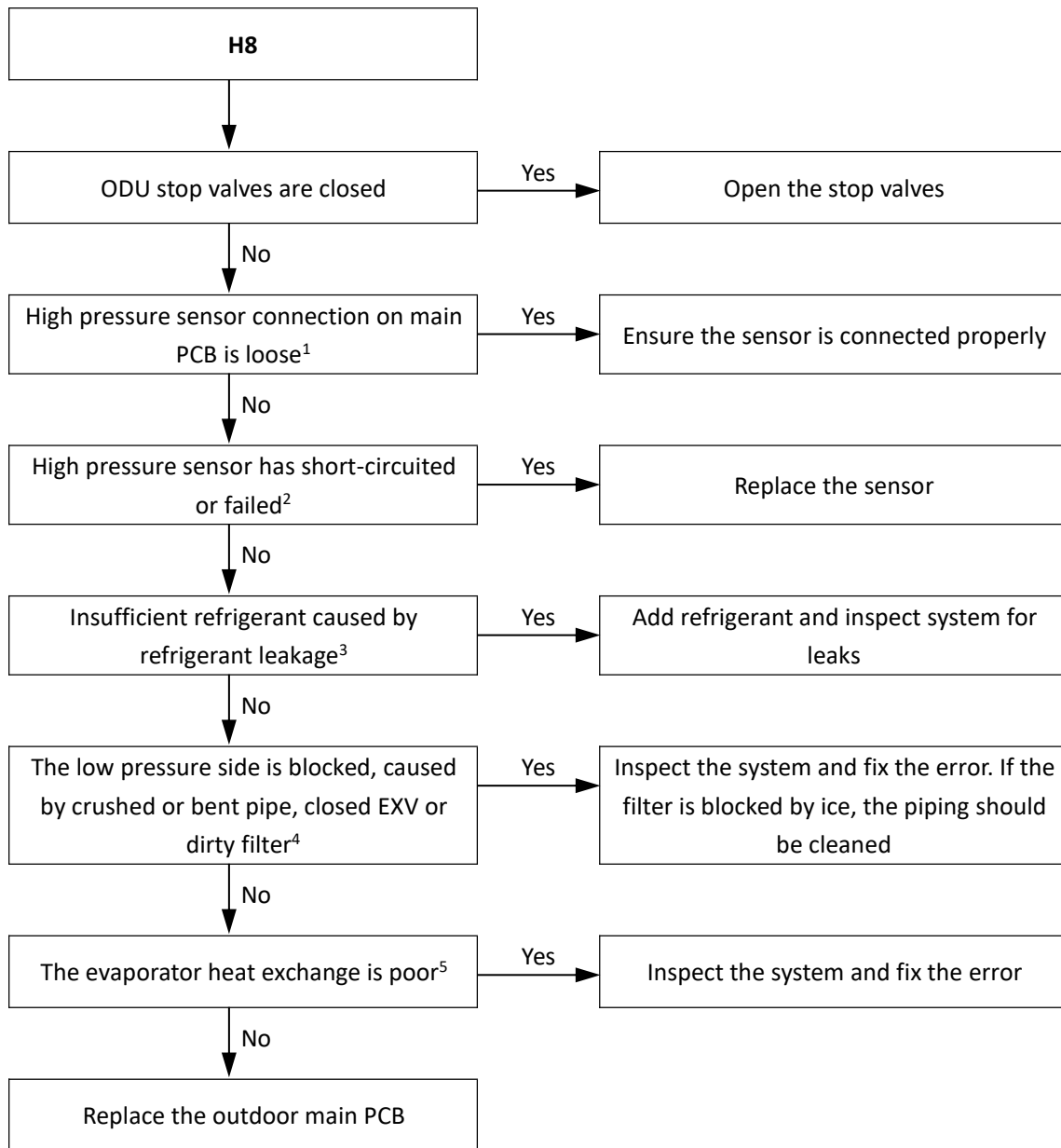
4.13.2 Description

- Discharge pipe low pressure protection. When the discharge pressure falls below 0.3MPa, the system displays H8 protection and all units stop running. When the discharge pressure returns to normal, H8 is removed and normal operation resumes.
- Error code is only displayed on the unit with the error.

4.13.3 Possible causes

- Outdoor unit stop valves are closed.
- Pressure sensor not connected properly or has malfunctioned.
- Insufficient refrigerant.
- Low pressure side blockage.
- Poor evaporator heat exchange.
- Main PCB damaged.

4.13.4 Procedure



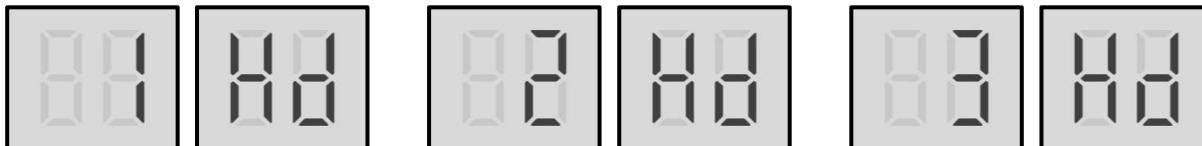
Notes:

1. High pressure sensor connection is port CN17 on the main PCB (labeled 30 in Figure 5-2.1 in Part 5, 2.2 "Ports").
2. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed. Refer to Part 2, 1 "Layout of Functional Components".
3. To check for insufficient refrigerant:
 - Re-start the outdoor units. If an r1, r2 or r3 error is displayed upon start-up, there is insufficient refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
4. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters refer to Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
5. 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.

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4.14 yHd Troubleshooting

4.14.1 Digital display output



In the error code, 'y' is a placeholder for the address (1, 2 or 3) of the slave unit with the error.

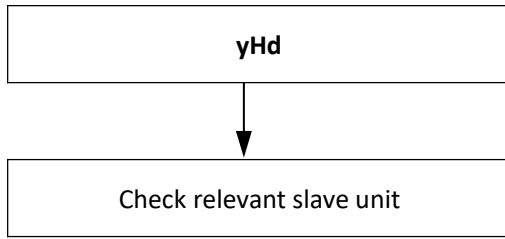
4.14.2 Description

- 1Hd indicates an error on the slave unit with address 1.
- 2Hd indicates an error on the slave unit with address 2.
- 3Hd indicates an error on the slave unit with address 3.
- All units stop running.
- Error code is only displayed on the master unit.

4.14.3 Possible causes

- Slave unit malfunction.

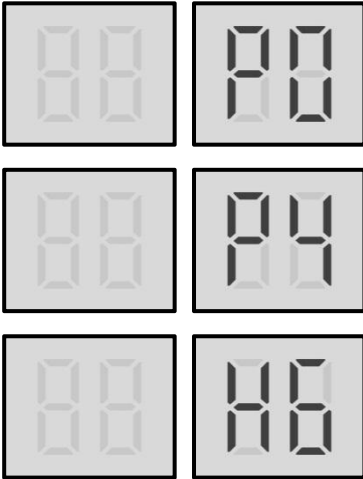
4.14.4 Procedure



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4.15 P0, P4, H6 Troubleshooting

4.15.1 Digital display output



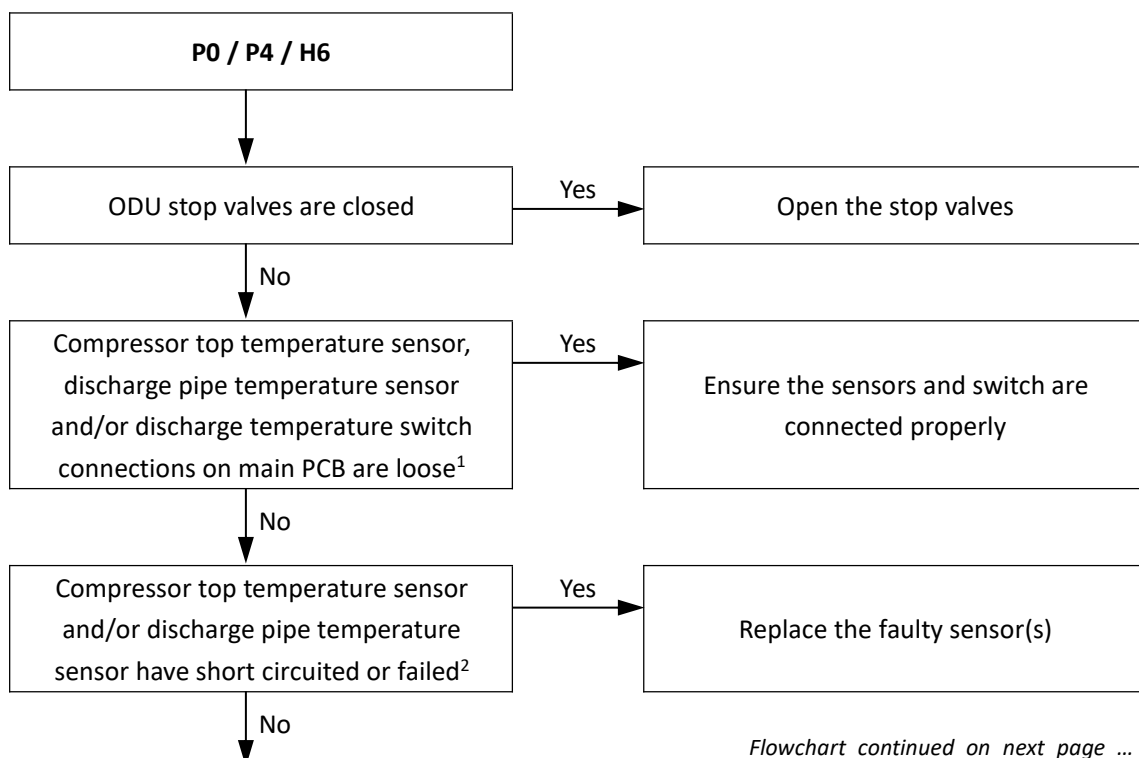
4.15.2 Description

- P0 indicates compressor temperature protection.
- P4 indicates discharge temperature protection. When the discharge temperature rises above 120°C the system displays P4 protection and all units stop running.
- H6 indicates P4 protection has occurred 3 times in 100 minutes. When an H6 error occurs, a manual system restart is required before the system can resume operation.
- Error code is only displayed on the unit with the error.

4.15.3 Possible causes

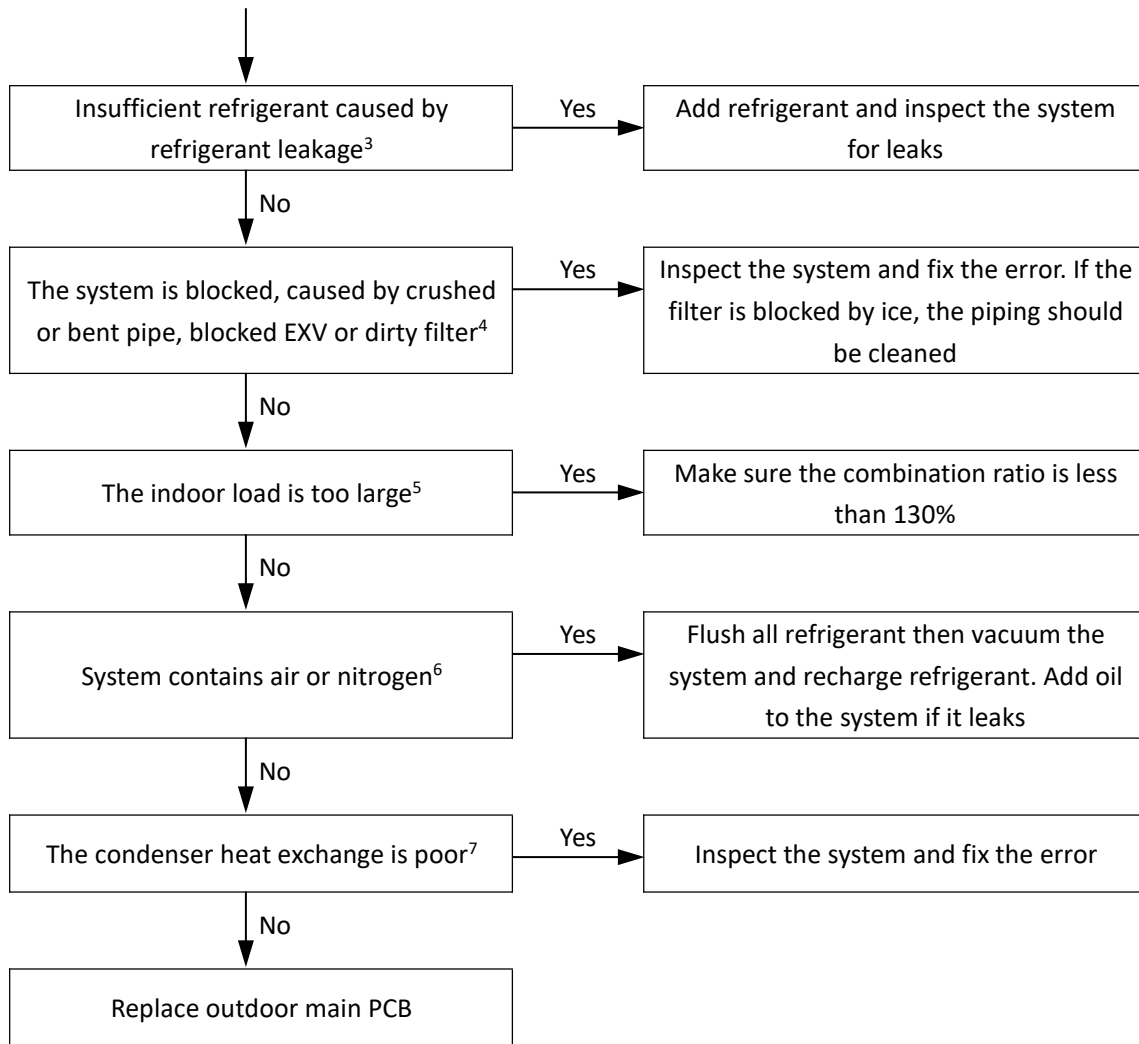
- Outdoor unit stop valves are closed.
- Temperature sensor/switch not connected properly or has malfunctioned.
- Insufficient refrigerant.
- System blockage.
- Indoor load too large.
- System contains air or nitrogen.
- Poor condenser heat exchange.
- Main PCB damaged.

4.15.4 Procedure



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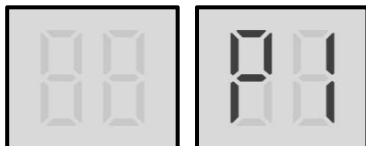
Notes:

1. Compressor top temperature sensor and discharge pipe temperature sensor connections are ports CN10 and CN11 on the main PCB (labeled 1 and 2, respectively, in Figure 5-2.1 in Part 5, 2.2 "Ports"). The discharge temperature switch connection is port CN18 on the main PCB (labeled 26 in Figure 5-2.1 in Part 5, 2.2 "Ports").
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 2, 1 "Layout of Functional Components" and to Table 5-5.2 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".
3. To check for insufficient refrigerant:
 - Re-start the outdoor units. If an r1, r2 or r3 error is displayed upon start-up, there is insufficient refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
4. A low pressure side blockage causes compressor discharge temperature to be higher than normal, suction pressure to be lower than normal and compressor current to be lower than normal, and may cause frosting to occur on the suction pipe. For normal system parameters refer to Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
5. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
6. 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
7. 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.

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4.16 P1 Troubleshooting

4.16.1 Digital display output



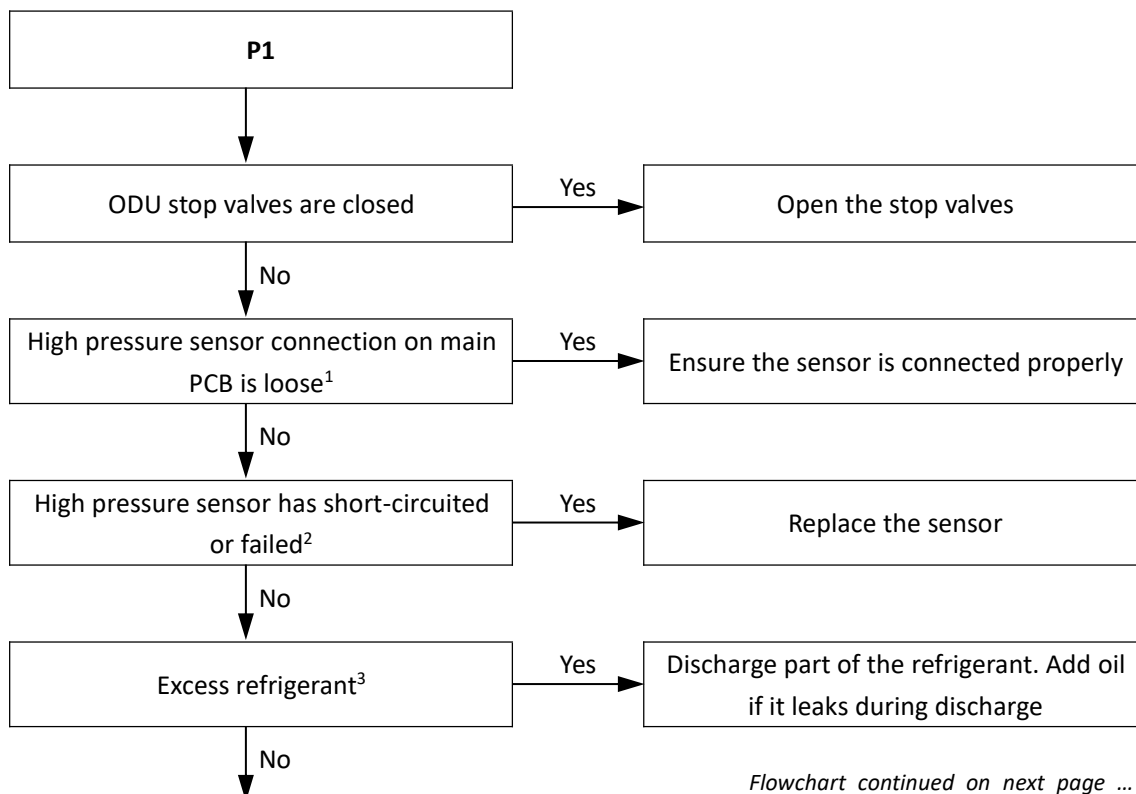
4.16.2 Description

- Discharge pipe high pressure protection. When the discharge pressure rises above 4.4MPa, the system displays P1 protection and all units stop running. When the discharge pressure falls below 3.2MPa, P1 is removed and normal operation resumes.
- If the system has a 3-phase protector and the 3-phase protector is connected with the high pressure switch, the system will display P1 protection when initially powered on, and P1 protection will disappear once the system reaches a steady state.
- Error code is only displayed on the unit with the error.

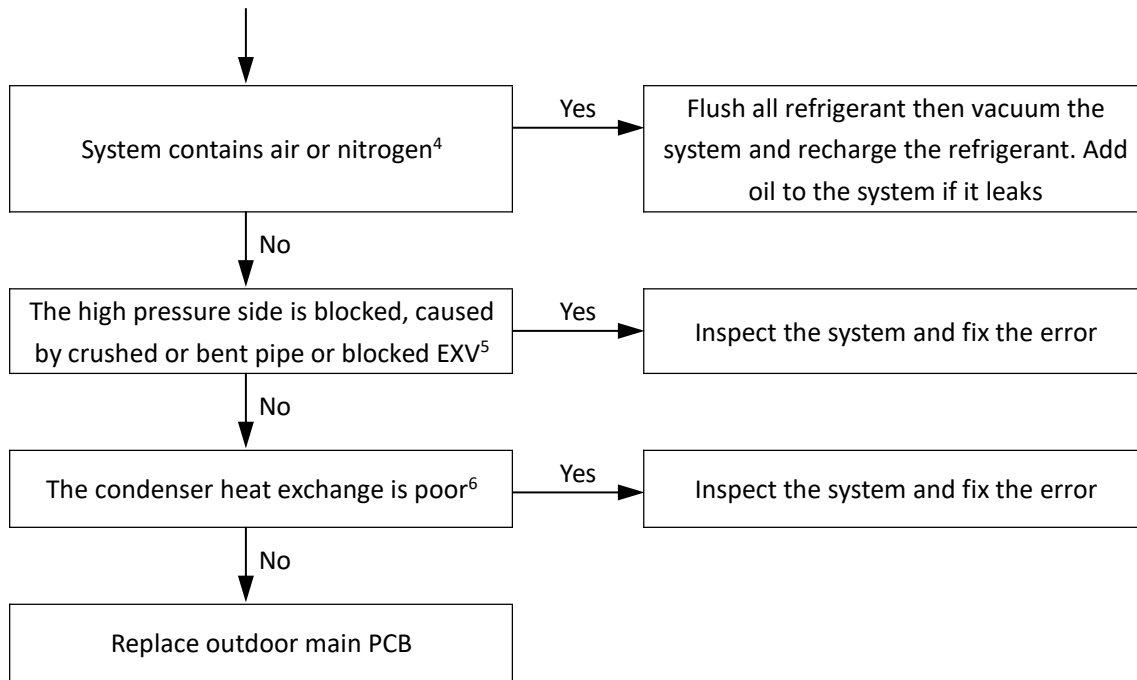
4.16.3 Possible causes

- 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.

4.16.4 Procedure



... flowchart continued from previous page



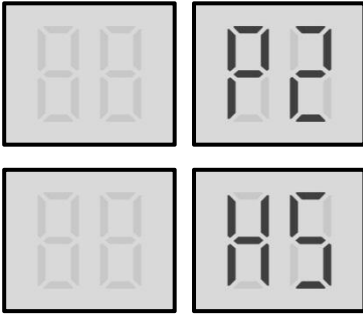
Notes:

1. The high pressure sensor connection is port CN17 on the main PCB (labeled 30 in Figure 5-2.1 in Part 5, 2.2 "Ports").
2. Measure the resistance among the three terminals of the pressure sensor. If the resistance is of the order of mega Ohms or infinite, the pressure sensor has failed. Refer to Part 2, 1 "Layout of Functional Components".
3. To check for excess refrigerant:
 - Re-start the outdoor units. If an R1 or R2 error is displayed upon start-up, there is excess refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
4. 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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.

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4.17 P2, H5 Troubleshooting

4.17.1 Digital display output



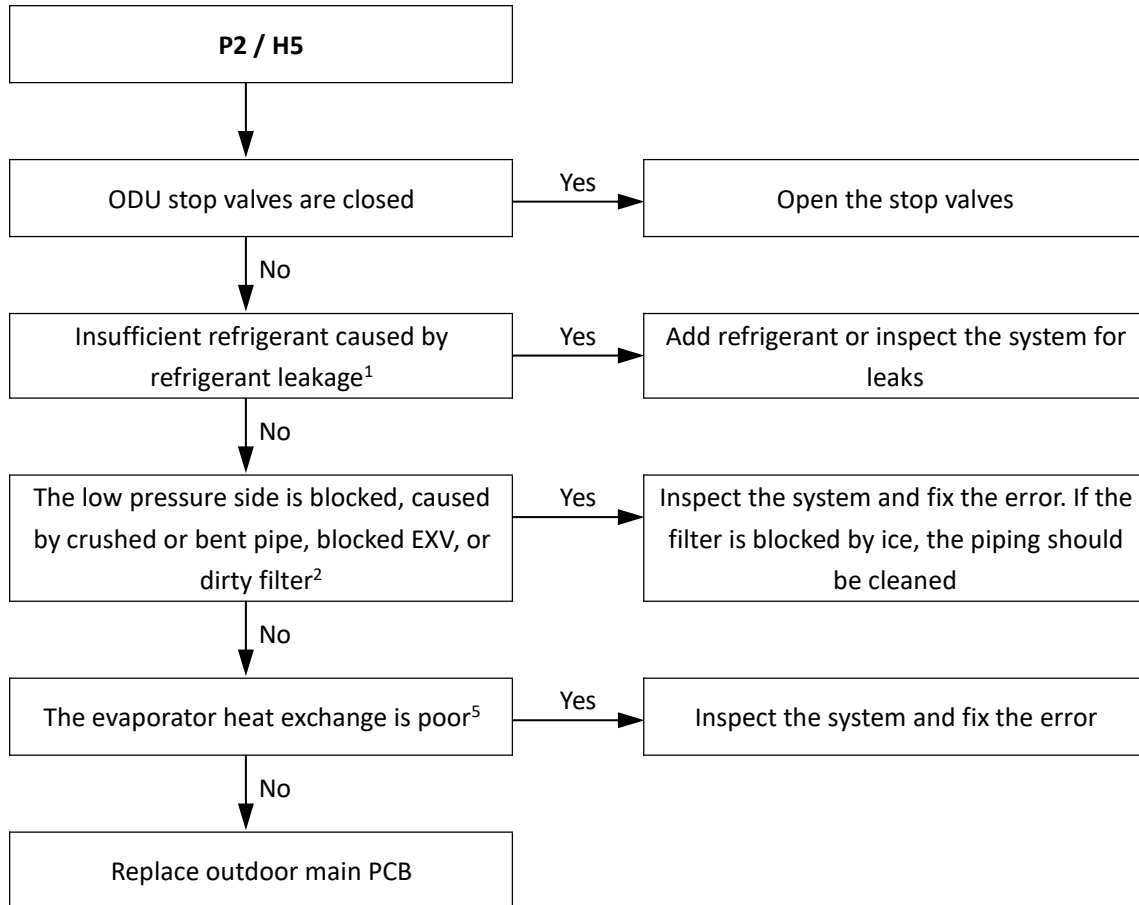
4.17.2 Description

- P2 indicates suction pipe low pressure protection. When the suction pressure falls below 0.05MPa, the system displays P2 protection and all units stop running. When the pressure rises above 0.15MPa, P2 is removed and normal operation resumes.
- H5 indicates P2 protection has occurred 3 times in 60 minutes. When an H5 error occurs, a manual system restart is required before the system can resume operation.
- If the system has a 3-phase protector and the 3-phase protector is connected to the low pressure switch, the system will display P2 protection when initially powered on, and P2 protection will disappear once the system reaches a steady state.
- Error code is only displayed on the unit with the error.

4.17.3 Possible causes

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

4.17.4 Procedure



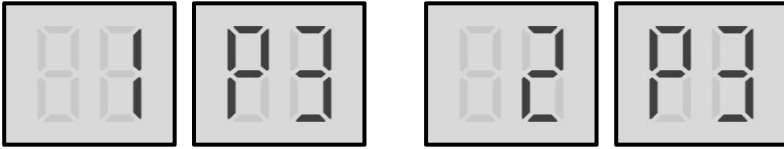
Notes:

1. To check for insufficient refrigerant:
 - Re-start the outdoor units. If an r1, r2 or r3 error is displayed upon start-up, there is insufficient refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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.

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4.18 xP3 Troubleshooting

4.18.1 Digital display output



'x' is a placeholder for the compressor system (compressor and related electrical components), with 1 representing compressor system A and 2 representing compressor system B.

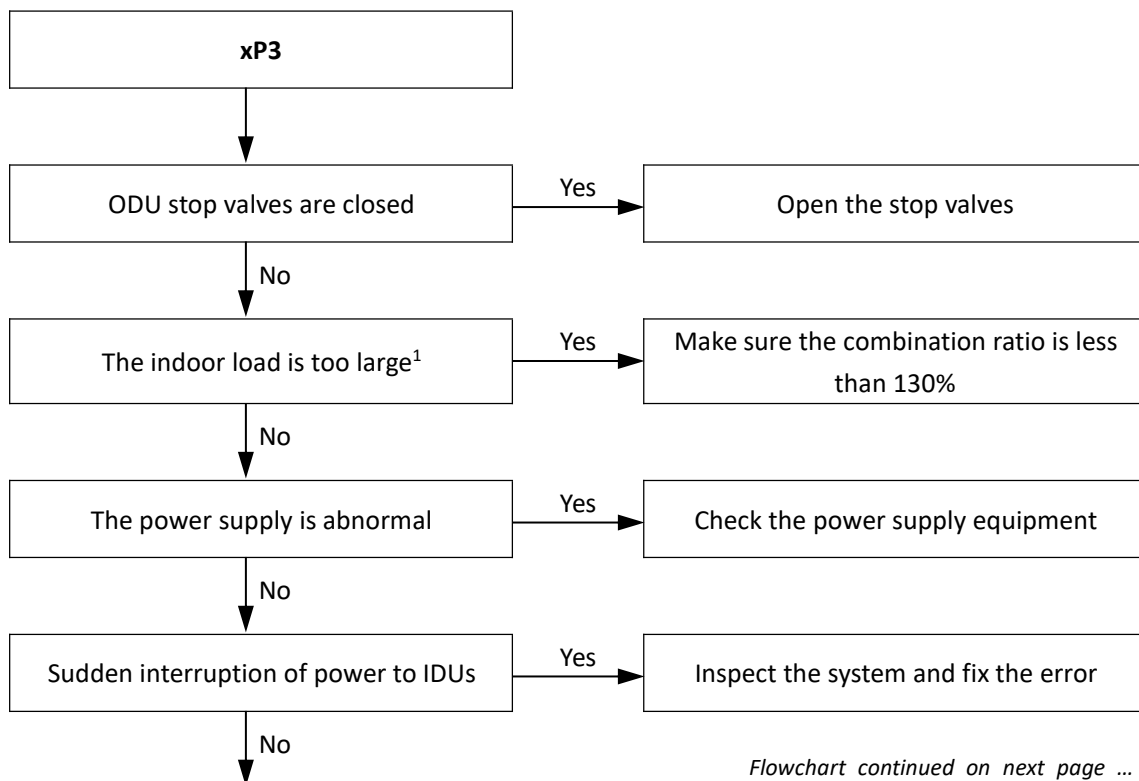
4.18.2 Description

- 1P3 indicates current protection on compressor A.
- 2P3 indicates current protection on compressor B.
- When the compressor current rises above the protection value (E705DHD-72: 23A; E655DHD-65: 21A; E405DHD-36: 12A; E405DHD-42: 15A), the system displays P3 protection and all units stop running. When the current returns to the normal range, P3 is removed and normal operation resumes.
- Error code is only displayed on the unit with the error.

4.18.3 Possible causes

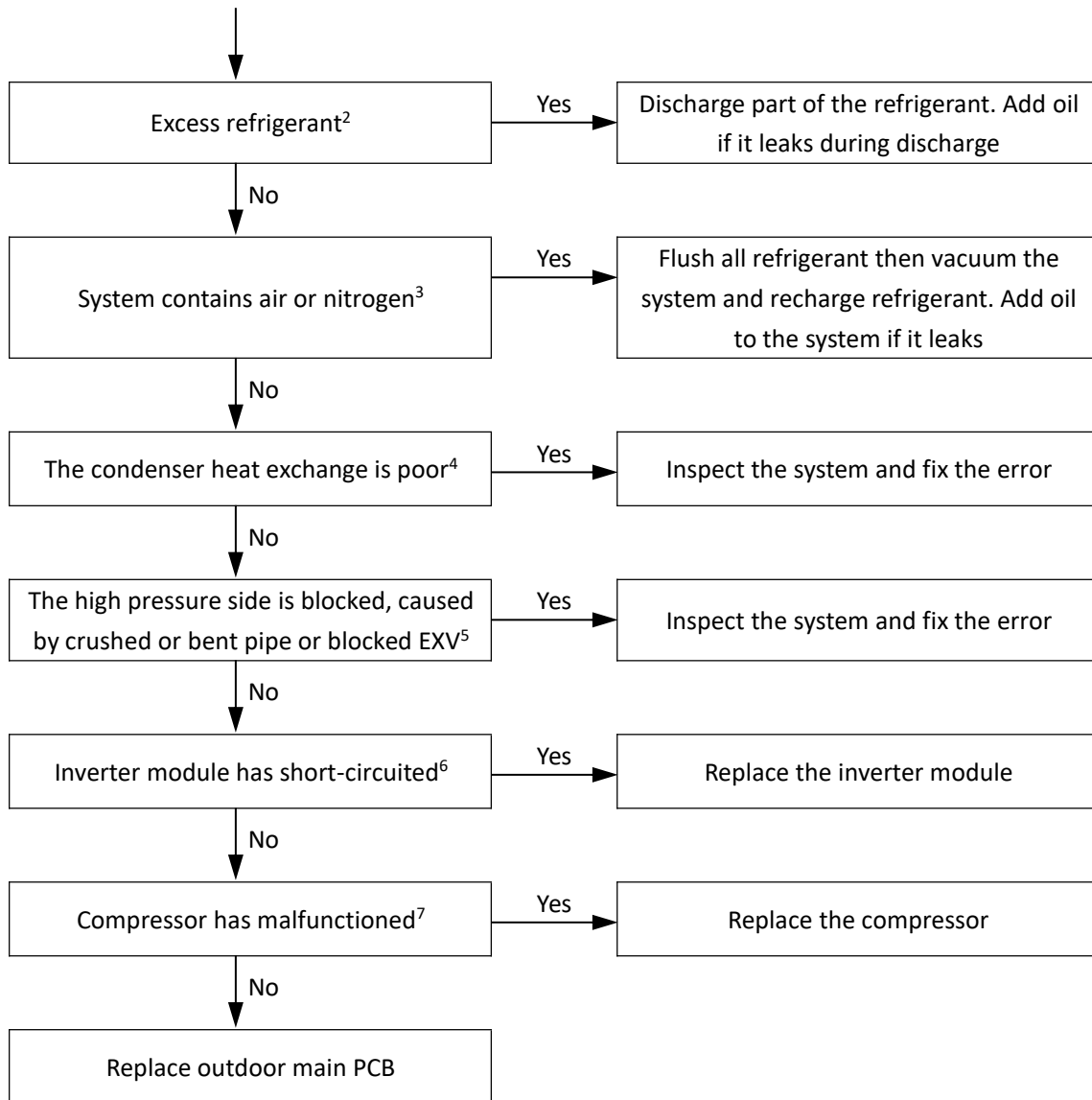
- Outdoor unit stop valves are closed.
- Indoor load too large.
- Power supply abnormal.
- Sudden interruption of power to IDUs.
- Excess refrigerant.
- System contains air or nitrogen.
- Poor condenser heat exchange.
- High pressure side blockage.
- Inverter module damaged.
- Compressor damaged.
- Main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

4.18.4 Procedure



Flowchart continued on next page ...

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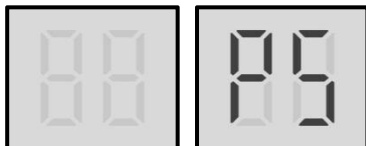
Notes:

1. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
2. To check for excess refrigerant:
 - Re-start the outdoor units. If an R1 or R2 error is displayed upon start-up, there is excess refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
6. Set a multi-meter to buzzer mode and test any two terminals of P N and U V W of the inverter module. If the buzzer sounds, the inverter module has short-circuited. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to Figure 5-4.1 in Part 5, 4.6 "E5 Troubleshooting".
7. The normal resistances of the inverter compressor are 0.7-1.5Ω 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. Refer to Figures 5-4.6 and 5-4.7 in Part 5, 4.11.6 "xL0 troubleshooting".

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4.19 P5 Troubleshooting

4.19.1 Digital display output



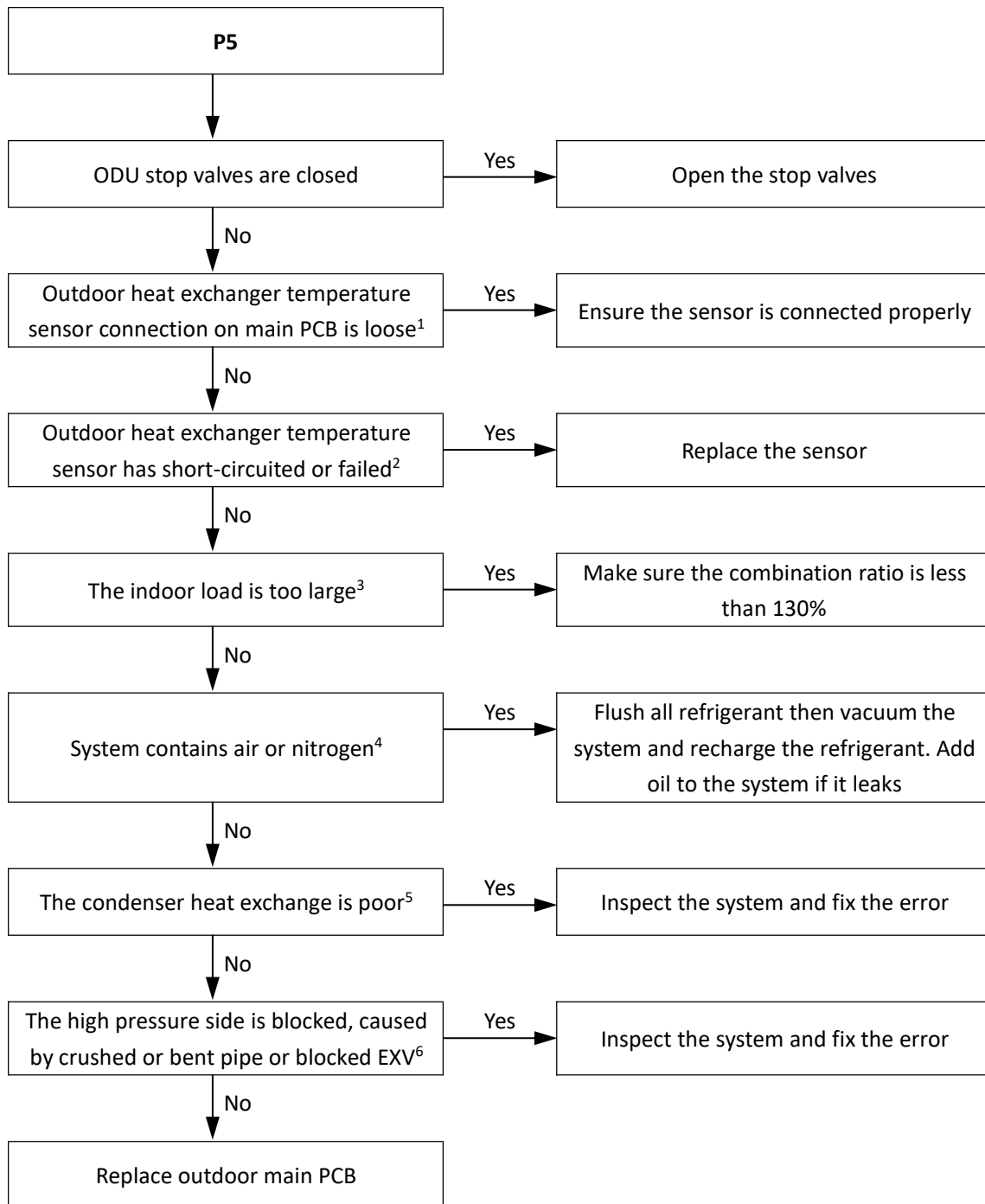
4.19.2 Description

- Outdoor heat exchanger temperature protection. When the outdoor heat exchanger temperature rises above 65°C, the system displays P5 protection and all units stop running. When the temperature returns to the normal range, P5 is removed and normal operation resumes.
- Error code is only displayed on the unit with the error.

4.19.3 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.

4.19.4 Procedure



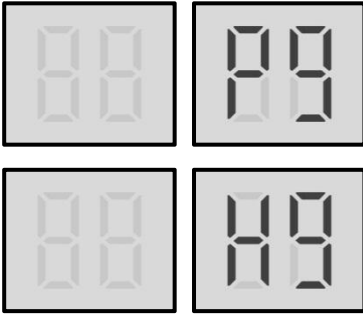
Notes:

1. Outdoor heat exchanger temperature sensor connection is port CN1 on the main PCB (labeled 32 in Figure 5-2.1 in Part 5, 2.2 "Ports").
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 2, 1 "Layout of Functional Components" and to Table 5-5.1 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".
3. An indoor load that is too large causes suction and discharge temperatures to be higher than normal. For normal system parameters refer to Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
4. 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "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.
6. 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".

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4.20 P9, H9 Troubleshooting

4.20.1 Digital display output



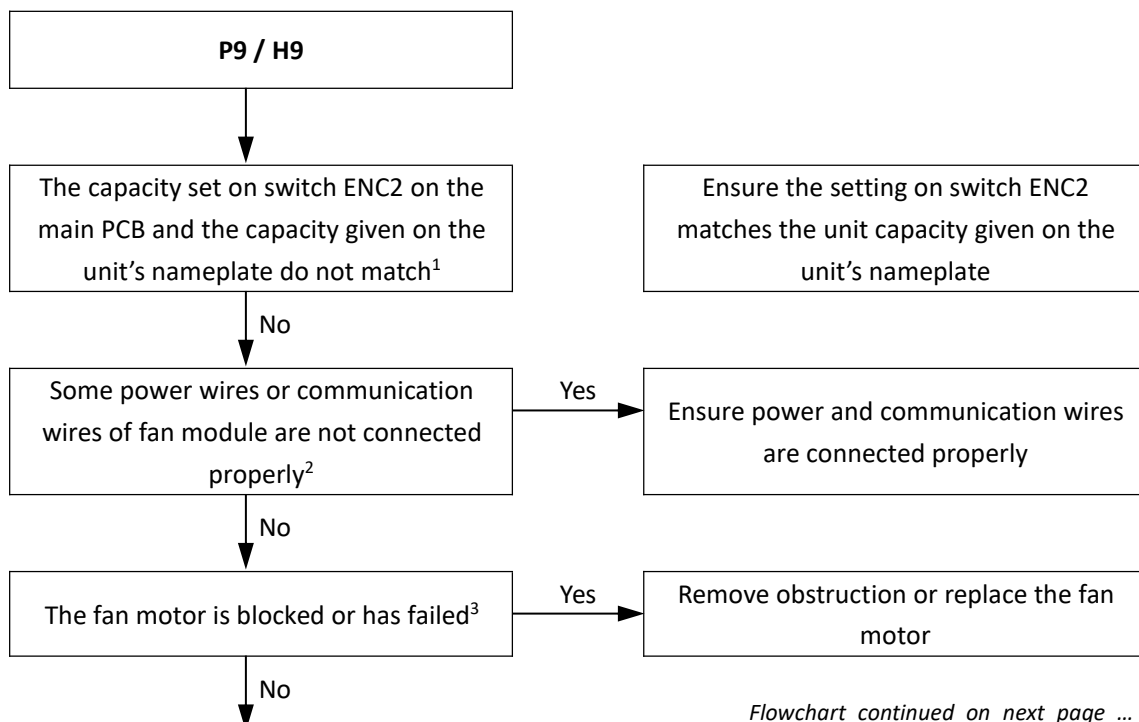
4.20.2 Description

- P9 indicates fan module protection. All units stop running.
- H9 indicates that P9 protection has occurred 3 times in 60 minutes. When an H9 error occurs, a manual system restart is required before the system can resume operation. The cause of an H9 error should be addressed promptly in order to avoid system damage.
- Error code is only displayed on the unit with the error.

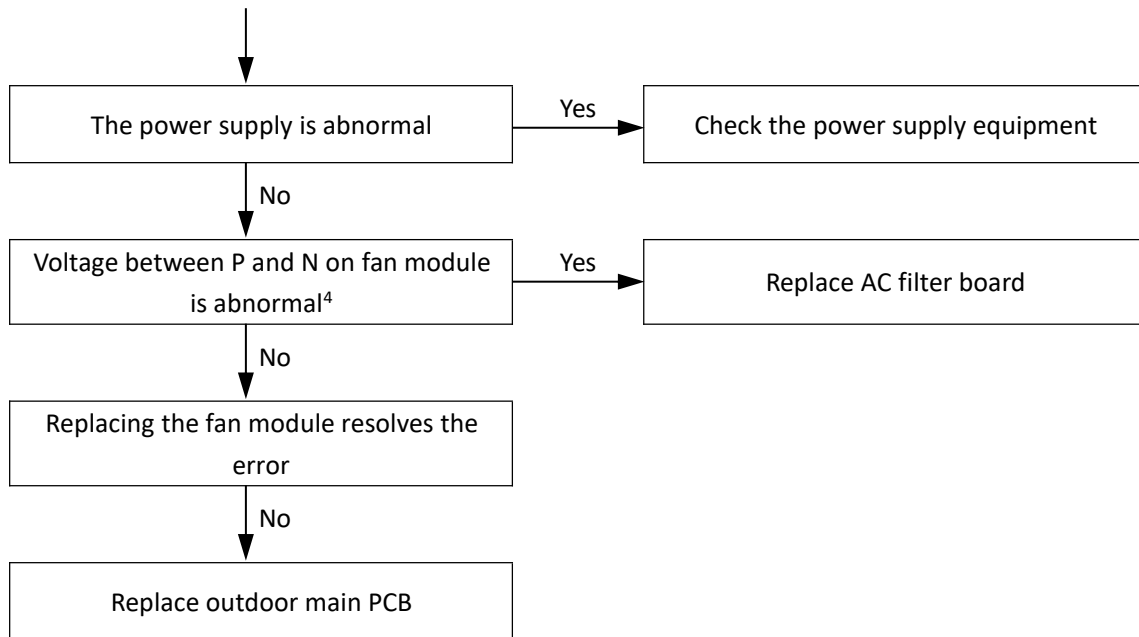
4.20.3 Possible causes

- 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.

4.20.4 Procedure



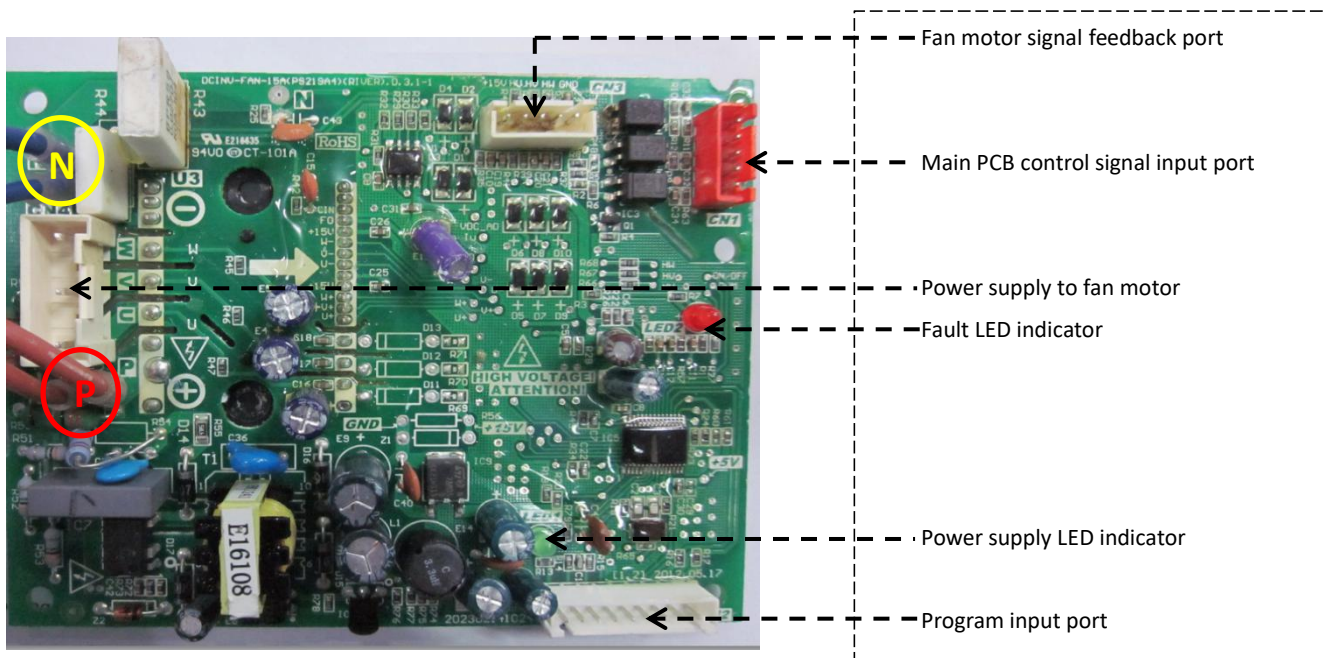
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Notes:

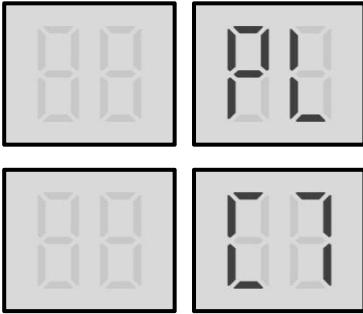
1. Refer to Part 4, 1.1 "PCB Switches and Switch Settings".
2. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to the V5 X Engineering Data Book, Part 2, 5 "Wiring Diagrams".
3. Refer to Part 2, 1 "Layout of Functional Components".
4. The normal voltage between P and N on the fan module is 310V DC. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to Figure 5-4.18.

Figure 5-4.18: Fan module layout



4.21 PL, C7 Troubleshooting

4.21.1 Digital display output



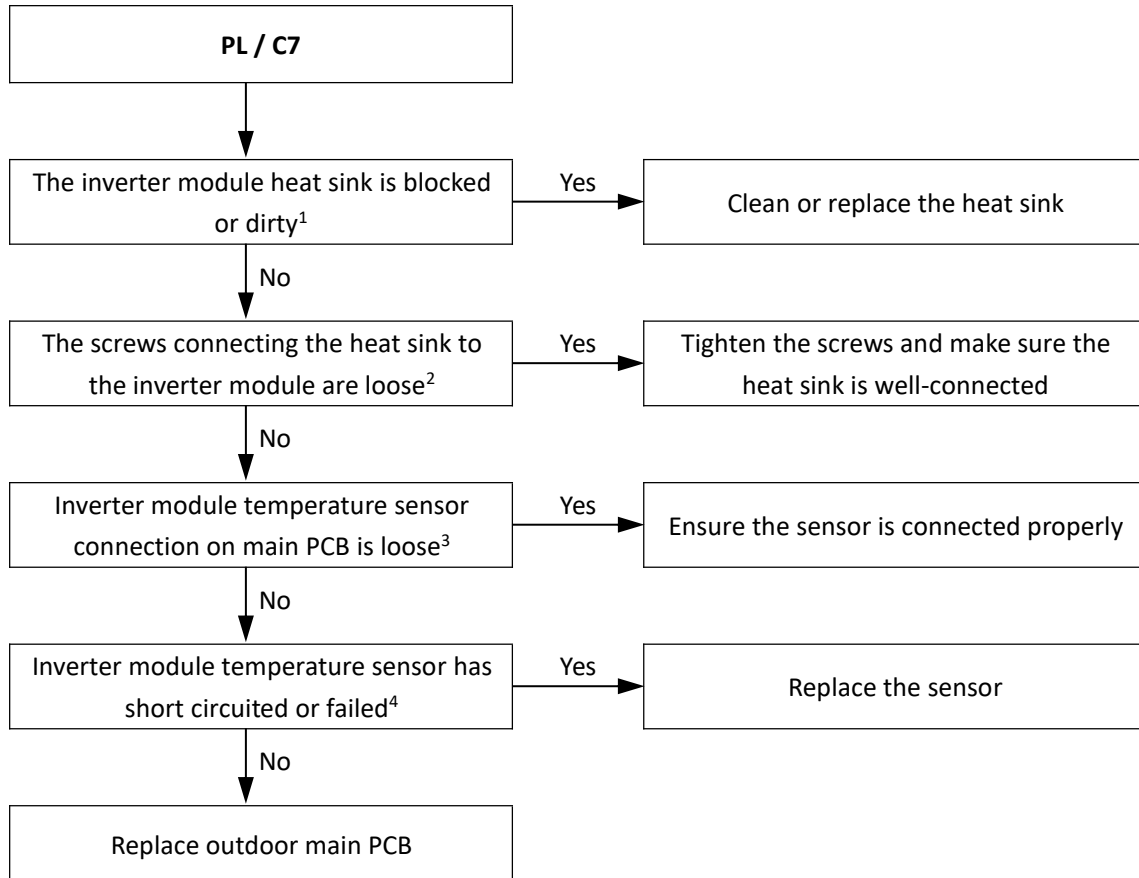
4.21.2 Description

- PL indicates inverter module temperature protection. When the main inverter module temperature rises above 80°C, the system displays PL protection and all units stop running.
- C7 indicates PL protection has occurred 3 times in 100 minutes. When a C7 error occurs, a manual system restart is required before the system can resume operation.
- Error code is only displayed on the unit with the error.

4.21.3 Possible causes

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

4.21.4 Procedure

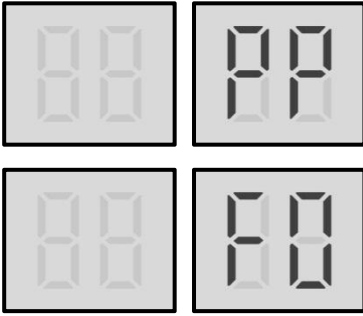


Notes:

1. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".
2. Refer to Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout".
3. Inverter module temperature sensor connection is port CN4 on the main PCB (labeled 3 in Figure 5-2.1 in Part 5, 2.2 "Ports").
4. 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 Figures 5-1.1 and 5-1.3 in Part 5, 1 "Outdoor Unit Electric Control Box Layout" and to Table 5-5.3 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".

4.22 PP, F0 Troubleshooting

4.22.1 Digital display output



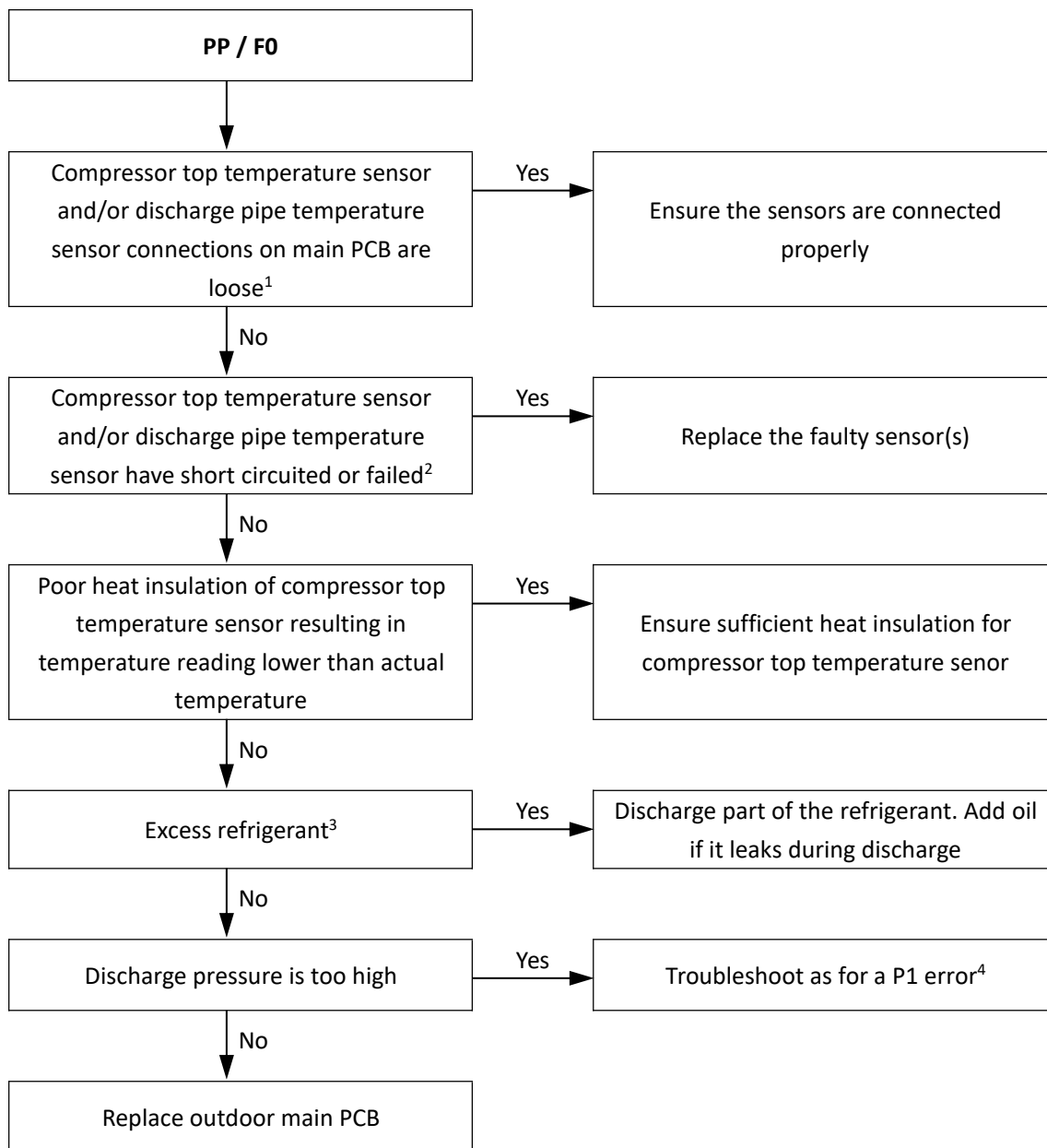
4.22.2 Description

- PP indicates compressor discharge insufficient superheat protection. When the discharge gas superheat is $\leq 0^{\circ}\text{C}$ for 20 minutes or $\leq 5^{\circ}\text{C}$ for 60 minutes, the system displays PP protection and all units stop running.
- F0 indicates PP protection has occurred 3 times in 150 minutes. When an F0 error occurs, a manual system restart is required before the system can resume operation.
- Error code is only displayed on the unit with the error.

4.22.3 Possible causes

- Temperature sensor not connected properly or has malfunctioned.
- Poor temperature sensor heat insulation.
- Excess refrigerant.
- Discharge pressure too high.
- Main PCB damaged.

4.22.4 Procedure



Notes:

1. Compressor top temperature sensor and discharge pipe temperature sensor connections are ports CN10 and CN11 on the main PCB (labeled 1 and 2, respectively, in Figure 5-2.1 in Part 5, 2.2 "Ports").
2. Measure sensor resistance. If the resistance is too low, the sensor has short-circuited. If the resistance is not consistent with the sensor's resistance characteristics table, the sensor has failed. Refer to Part 2, 1 "Layout of Functional Components" and to Table 5-5.2 in Part 5, 5.1 "Temperature Sensor Resistance Characteristics".
3. To check for excess refrigerant:
 - Re-start the outdoor units. If an R1 or R2 error is displayed upon start-up, there is excess refrigerant in the system.
 - 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 Tables 5-5.4 and 5-5.5 in Part 5, 5.2 "Normal Operating Parameters of Refrigerant System".
4. See Part 5, 4.16 "P1 Troubleshooting".

5 Appendix to Part 5

5.1 Temperature Sensor Resistance Characteristics

Table 5-5.1: Outdoor ambient temperature sensor and outdoor heat exchanger 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

Table 5-5.2: Compressor top temperature sensor and 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		

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Table 5-5.3: Inverter module 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		

5.2 Normal Operating Parameters of Refrigerant System

Under the following conditions, the operating parameters given in Tables 5-5.4 and 5-5.5 should be observed:

- The master outdoor unit can detect all the indoor units.
- The number of indoor units displayed on DSP2 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.
- If the combination ratio is 100% or less, all the indoor units are currently running and if the combination ratio is more than 100%, indoor units with total capacity equal to the total capacity of the outdoor 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 5-5.4: Outdoor unit cooling mode operating parameters

Outdoor ambient temperature	°C	< 10	10 to 26	26 to 31	31 to 41	> 41
Discharge temperature	°C	60-76	62-78	65-82	67-92	69-92
Discharge superheat	°C	17-30	17-33	17-34	17-36	10-32
Discharge pressure	MPa	2.3-2.8	2.3-2.8	2.4-3.6	2.6-3.8	3.1-4.2
Suction pressure	MPa	0.6-0.7	0.7-0.9	0.8-1.0	1.0-1.2	1.2-1.4
DC inverter compressor current	A	5-12	5-13	5-17	6-17	8-13

Table 5-5.5: Outdoor unit heating mode operating parameters

Outdoor ambient temperature	°C	< -10	-10 to 0	0 to 5	5 to 10	10 to 17	> 17
Discharge temperature	°C	56-74	57-76	58-78	61-82	63-82	63-82
Discharge superheat	°C	17-35	17-35	17-35	17-33	14-33	14-33
Discharge pressure	MPa	1.7-2.4	1.8-2.5	1.9-3.0	2.2-3.2	2.3-3.2	2.3-3.2
Suction pressure	MPa	1.4-1.6	1.5-1.7	1.6-2.2	1.8-2.6	1.8-2.6	2.0-2.4
DC inverter compressor current	A	10-15	10-16	5-17	5-17	6-16	6-12



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