

38VMH-1P (036-060)
Outdoor Units for
Variable Refrigerant Flow (VRF) Heat Pump System

Service Manual



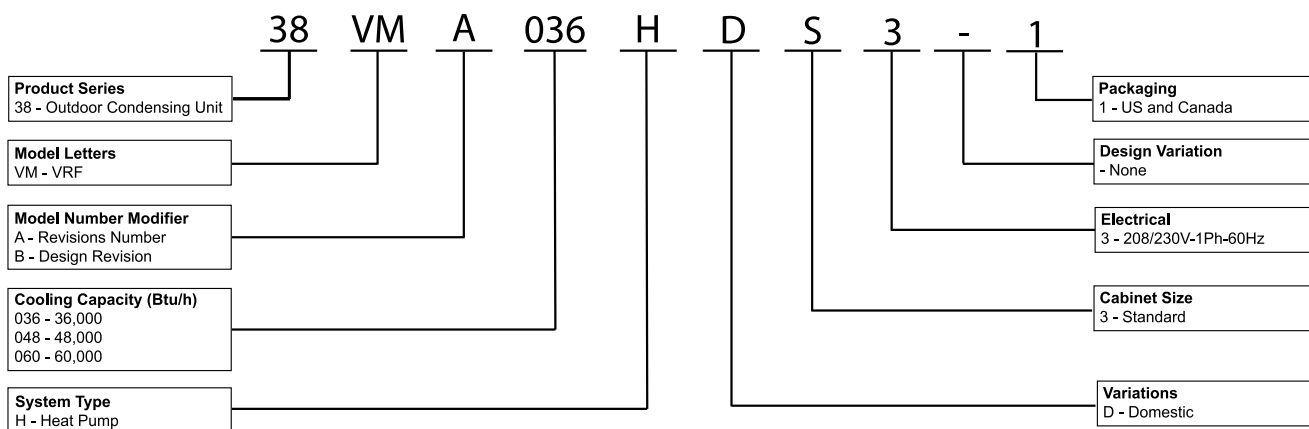
A210217

TABLE OF CONTENTS

GENERAL INFORMATION.....	3
Model Number of Outdoor Unit / Indoor Unit.....	3
Connected Capacity Ratio Restrictions.....	4
External Appearance.....	5
Piping Design.....	6
Refrigerant Charge Calculation.....	12
REFRIGERANT CIRCUIT.....	13
Refrigerant Circuit.....	14
Refrigerant flow for Each Operation Mode.....	15
FIELD WIRING.....	18
Typical Power Supply Wiring	19
Typical Control Wiring	20
FUNCTION AND CONTROL.....	23
Basic Control.....	24
Special Control.....	28
Oil Return Operation.....	29
Defrost Control.....	30
Protection Control.....	31
TROUBLESHOOTING.....	32
Service Diagnosis.....	32
Electrical Components and Wiring Diagrams.....	33
Troubleshooting from Outdoor Unit.....	36
APPENDIX.....	59
BILL OF MATERIAL (BOM).....	62

GENERAL INFORMATION

Model Number of Outdoor / Indoor Units



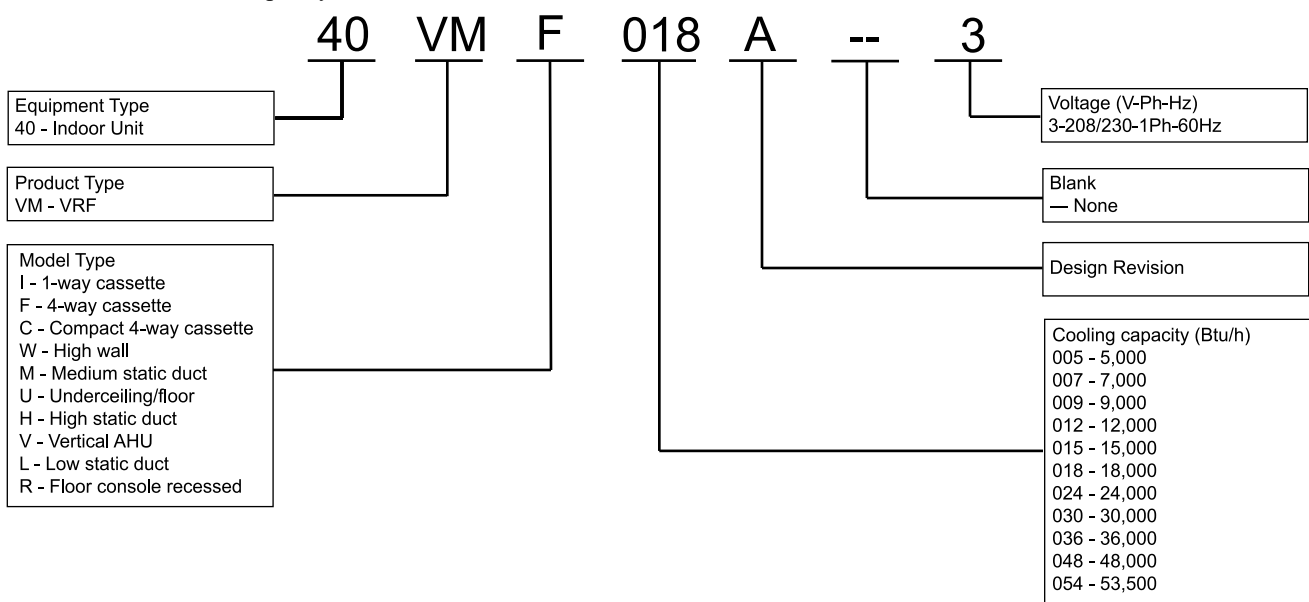
A210214

Fig. 1 —Outdoor Units

Table 1 —Outdoor Unit Nomenclature

Capacity		3 Ton	4 Ton	5 Ton
Model Number		38VMB036HDS3-1	38VMB048HDS3-1	38VMB060HDS3-1
Nominal Capacity		36	48	60
Indoor Unit Connectable	Connected Capacity	50% - 130%	50% - 130%	50% - 130%
	Max. Unit Number	5	7	9

NOTE: Refer to connected capacity restrictions



A210215

Fig. 2 —Indoor Units

Table 2 —Indoor Unit Capacity Chart

CONNECTABLE INDOOR UNIT CAPACITY INDEX*		5	7	9	12	15	18	24	30	36	48	54
1-Way Cassette	40VMI	•	•	•	•	•	•	•				
4-Way Cassette	40VMF			•	•	•	•	•	•	•	•	
Compact 4-way Cassette	40VMC	•	•	•	•	•						
High Wall	40VMW	•	•	•	•	•	•	•	•			
Low Static Duct	40VML		•	•	•	•	•	•				
Medium Static Duct	40VMM		•	•	•	•	•	•	•	•	•	
High Static Duct	40VMH							•	•	•	•	•
Vertical AHU	40VMV				•		•	•	•	•	•	•
Underceiling/Floor	40VMU				•	•	•	•	•	•	•	
Floor Console Recessed	40VMR		•	•	•	•	•	•				

* For example: The capacity index of 40VMF009A--3 and 40VMV024---3 is 9 and 24 separately.

Connected Capacity Ratio Restrictions

$$\text{Connected Capacity Ratio} = \frac{\text{Total capacity index of the indoor units}}{\text{Capacity index of the outdoor units}}$$

Keep a proper connected capacity ratio for the entire system.

Table 3 —Connected Capacity Ratio

Minimum Connected Capacity Ratio	Maximum Connected Capacity		
	40VMH*1 only 40VMV only	Including 40VMH*1 or 40VMV at least one unit	Other indoor unit models
50%	100%	115%*2	130%

NOTES:

*1 When 40VMH048, 054---3 is installed

*2 When the total capacity of 40VMH048, 054---3 or 40VMV exceeds 30%, the connected capacity must not exceed 100%

External Appearance

OUTDOOR UNIT



A210217

Fig. 3 —38VMH-Heat Pump

INDOOR UNITS LINEUP



A210219

**Figure 4 - 1-Way Cassette
(40VMI)**



A210220

**Figure 5 - 4-Way Cassette
(40VMF)**



A210221

**Figure 6 - Compact 4-Way Cassette
(40VMC)**



A210222

**Figure 7 - High Static Duct
(40VMH)**



A210223

**Figure 8 - High Wall
(40VMW)**



A210224

**Figure 9 - Low Static Duct
(40VML)**



A210225

**Figure 10 - Medium Static Duct
(40VMM)**



A210226

**Figure 11 - Underceiling / Floor
(40VMU)**



A210227

**Figure 12 - Floor Console Recessed
(40VMR)**

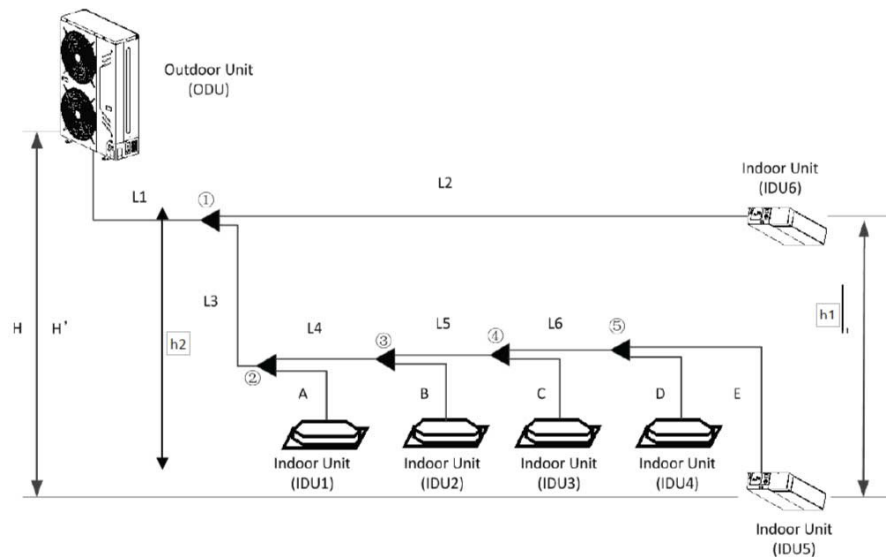


A210228

**Figure 13 - Vertical AHU
(40VMV)**

Piping Design

Case 1



A210229

Fig. 15 —Piping Design - Case 1

- Bends in piping cause pressure loss during transportation of the refrigerant, so fewer bends increase performance.
- The equivalent length of each bend is 1.64 feet.
- The equivalent length of each Y-Joint is 1.64 feet.
- Total “downstream indoor capacity” is the total capacity of all the indoor units connected downstream.

For example, Y-joint ⑤ is connected with IDU4 and IDU5 (40VMF009A--3 + 40VMM007A--3), which has a downstream indoor capacity of 16k (Capacity index 9 + 7 = 16).

- The pipe length difference from the first branch to each indoor unit must not exceed 65 feet.

For example, the distance from IDU1 to the first branch is $L3 + A$, the distance from IDU6 to the first branch is $L2$, while the distance from IDU5 to the first branch is $L3 + L4 + L5 + L6 + E$, so make sure that $|L2 - (L3 + A)|$, $|L2 - (L3 + L4 + L5 + L6 + E)|$ and $|(L3 + L4 + L5 + L6 + E) - (L3 + A)|$ are all less than 65 feet.

Table 4 —Piping Length

ITEM	PIPING in the FIGURES	MAXIMUM LENGTH	EQUIVALENT
Total piping length	$L1 + L2 + L3 + L4 + L5 + L6 + A + B + C + D + E$	492*1	-
Maximum distance from ODU to farthest IDU	$L1 + L3 + L4 + L5 + L6 + E$	296	328
First branch to farthest IDU	$L3 + L4 + L5 + L6 + E$	131	-
Height between ODU and IDU (ODU above IDU)	H	164	-
Height between ODU and IDU (ODU below IDU)	H'	131	-
Height between IDU and IDU	h1	49	-
Height between first branch to IDU	h2	49	-

*1 If only one IDU connects to the ODU, the total piping length must not exceed 328 feet.

Table 5 —Selection of “L1”

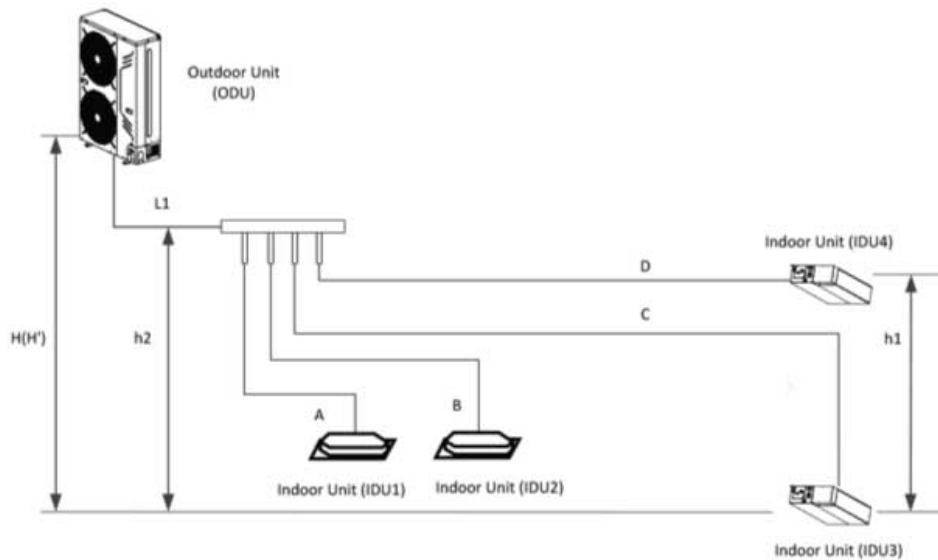
Model	Gas Pipe	Liquid Pipe
38VMB036HDS3-1	5/8 *	3/8
38VMB048HDS3-1		
38VMB060HDS3-1	3/4 *	

*When the length of $L1 > 230$ feet, the gas pipe should be increased from 5/8” to 3/4”, or from 3/4” to 7/8”. The pipe adapter must be located as close as possible to the outdoor unit.

Table 6 —Selection of L2~L6, A, B, C, D, E

Downstream Indoor Capacity (Kbtu/h)	Gas Pipe	Liquid Pipe
Capacity $\leq 15K$	1/2	1/4
$15K < \text{Capacity} \leq 78K$	5/8	3/8

Case 2



A210230

Fig. 16 —Piping Design (Case 2)

- Bends in piping cause pressure loss during transportation of refrigerant, so fewer bends increase performance.
- The equivalent length of each bend is 1.64 feet.
- The equivalent length header is 1.64 feet.
- The pipe length difference between each IDU must not exceed 49 feet.

Table 7 —Piping Length

Item	Piping in the Figure	Maximum Length	Equivalent Length
Total piping length	$L1 + A + B + C + D$	492	-
Maximum distance from ODU to farthest IDU	$L1 + A, L1 + B, L1 + C, L1 + D$	296	328
First branch (Header) to farthest IDU	A, B, C, D	131	-
Height between ODU and IDU (ODU above IDU)	H	164	-
Height between ODU and IDU (ODU below IDU)	H'	131	-
Height between IDU and IDU	h1	49	-
Height between first branch (header) and IDU	h2	49	-

Table 8 —Selection of “L1”

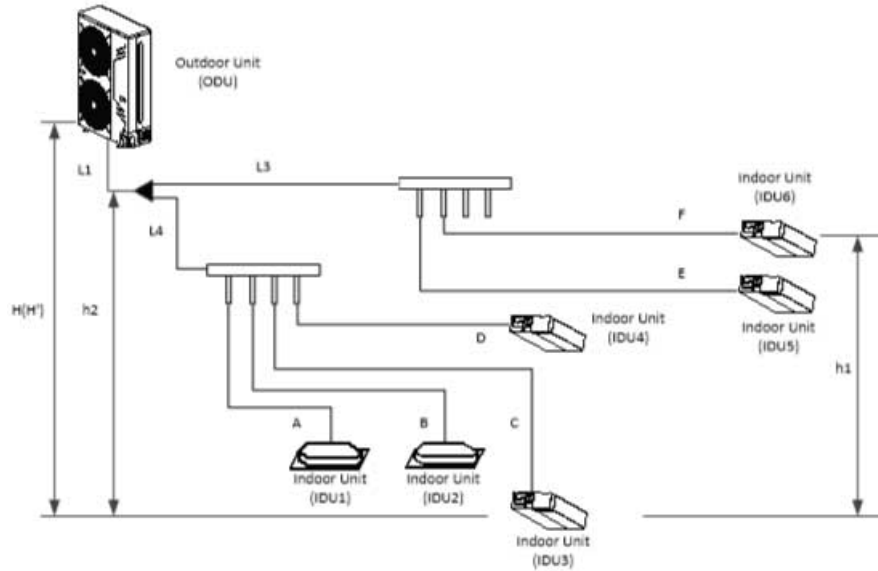
Model	Gas Pipe	Liquid Pipe
38VMB036HDS3-1	5/8 *	3/8
38VMB048HDS3-1		
38VMB060HDS3-1		

*When the length of L1 > 230 feet, the gas pipe should be increased from 5/8” to 3/4” or from 3/4” to 7/8”. The pipe adapter must be located as close as possible to the ODU.

Table 9 —Selection of A~D

Downstream Indoor Capacity (KBtu/h)	Gas Pipe	Liquid Pipe
Capacity ≤ 15K	1/2	1/4
15K < Capacity ≤ 78K	5/8	3/8

Case 3



A210231

- Bends in piping cause pressure loss during transportation of refrigerant, so fewer bends increase performance.
- The equivalent length of each bend is 1.64 feet.
- The equivalent length of each Y-Joint or header is 1.64 feet.
- Total “downstream indoor capacity” is the total capacity of all the indoor units connected downstream.
- The pipe length difference from the first branch to each indoor unit must not exceed 49 feet.

Table 10 —Piping Length

Item	Piping in the Figure	Maximum Length	Equivalent Length
Total piping length	$L1 + L3 + L4 + A + B + C + D + E + F$	492	-
Maximum distance from ODU to farthest IDU	$L1 + L4 + A$, $L1 + L4 + B$, $L1 + L4 + C$, $L1 + L4 + D$, $L1 + L3 + E$, $L1 + L3 + F$	296	328
First branch to farthest IDU	$L4 + A$, $L4 + B$, $L4 + C$, $L4 + D$, $L3 + E$, $L3 + F$	131	-
Height between ODU and IDU (ODU above IDU)	H	164	-
Height between ODU and IDU (ODU below IDU)	H'	131	-
Height between IDU and IDU	h1	49	-
Height between first branch and IDU	h2	49	-

Table 11 —Selection of “L1”

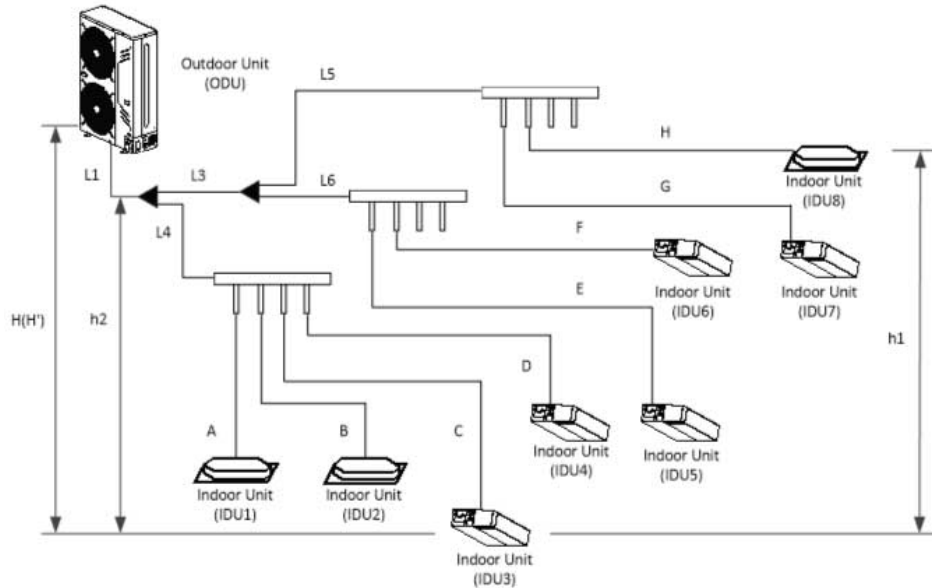
MODEL	GAS PIPE	LIQUID PIPE
38VMB036HDS3-1	5/8 *	3/8
38VMB048HDS3-1		
38VMB060HDS3-1		

* When the length of “L1” > 230 feet, the gas pipe should be increased from 5/8” to 3/4” or from 3/4” to 7/8”. The pipe adapter must be located as close as possible to the outdoor unit.

Table 12 —Selection of L3~4, A~F

Downstream Indoor Capacity (KBtu/h)	Gas Pipe	Liquid Pipe
Capacity ≤ 15K	1/2	1/4
15K < Capacity ≤ 78K	5/8	3/8

Case 4



A210232

Fig. 17 —Piping Design (Case 4)

- Bends in piping cause pressure loss during transportation of refrigerant, so fewer bends increases performance.
- The equivalent length of each bend is 1.64 feet.
- The equivalent length of each Y-Joint or header is 1.64 feet.
- Total “downstream indoor capacity” is the total capacity of all the indoor units connected downstream.
- The pipe length difference from the first branch to each indoor unit must not exceed 49 feet.

Table 13 —Piping Length

Item	Piping in the Figure	Maximum Length	Equivalent Length
Total piping length	$L1 + L3 + L4 + L5 + L6 + A + B + C + D + E + F + G + H$	492	-
Maximum distance from ODU to farthest IDU	$L1 + L4 + A, L1 + L4 + B, L1 + L4 + C, L1 + L4 + D, L1 + L3 + L6 + E, L1 + L3 + L6 + F, L1 + L3 + L5 + G, L1 + L3 + L5 + H$	296	328
First branch to farthest IDU	$L4 + A, L4 + B, L4 + C, L4 + D, L3 + L6 + E, L3 + L6 + F, L3 + L5 + G, L3 + L5 + H$	131	-
Height between ODU and IDU (ODU above IDU)	H	164	-
Height between ODU and IDU (ODU below IDU)	H'	131	-
Height between IDU and IDU	h1	49	-
Height between first branch and IDU	h2	49	-

Table 14 —Selection of “L1”

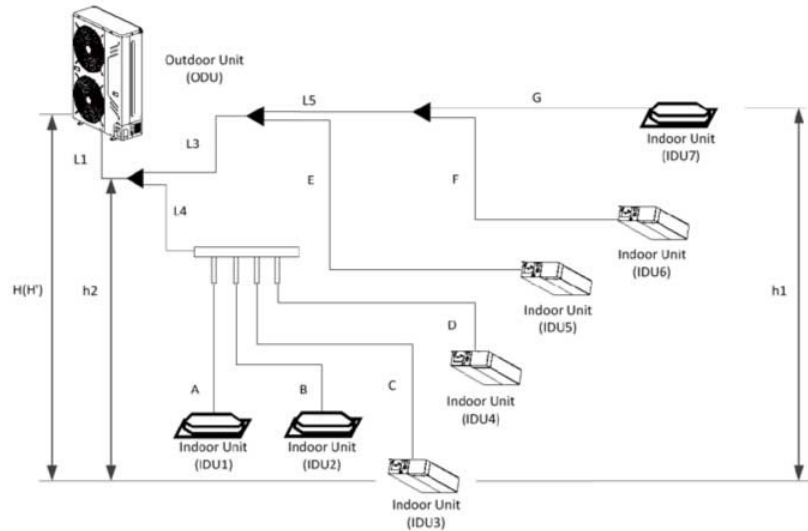
Model	Gas Pipe	Liquid Pipe
38VMB036HDS3-1	5/8 *	3/8
38VMB048HDS3-1		
38VMB060HDS3-1	3/4 *	

* When the length of “L1” > 230 feet, the gas pipe should be increased from 5/8” to 3/4” or from 3/4” to 7/8”. The pipe adapter must be located as close as possible to the outdoor unit.

Table 15 —Selection of L3~5, A~F

Downstream Indoor Capacity (KBtu/h)	Gas Pipe	Liquid Pipe
Capacity ≤ 15K	1/2	1/4
15K < Capacity ≤ 78K	5/8	3/8

Case 5



A210233

- Bends in piping cause pressure loss during transportation of refrigerant, so fewer bends increase performance.
- The equivalent length of each bend is 1.64 feet.
- The equivalent length of each Y-Joint or header is 1.64 feet.
- Total “downstream indoor capacity” is the total capacity of all the indoor units connected downstream.
- The pipe length difference from first branch to each indoor unit must not exceed 49 feet.

Table 16 —Piping Length

Item	Piping in the Figure	Maximum Length	Equivalent length
Total piping length	$L1 + L3 + L4 + L5 + A + B + C + D + E + F + G$	492	-
Maximum distance from ODU to farthest IDU	$L1 + L4 + A, L1 + L4 + B, L1 + L4 + C, L1 + L4 + D, L1 + L3 + E, L1 + L3 + L5 + F, L1 + L3 + L5 + G$	296	328
First branch to farthest IDU	$L4 + A, L4 + B, L4 + C, L4 + D, L3 + E, L3 + L5 + F, L3 + L5 + G$	131	-
Height between ODU and IDU (ODU above IDU)	H	164	-
Height between ODU and IDU (ODU below IDU)	H'	131	-
Height between IDU and IDU	h1	49	-
Height between first branch and IDU	h2	49	-

Table 17 —Selection of “L1”

Model	Gas Pipe	Liquid Pipe
38VMB036HDS3-1	5/8 *	3/8
38VMB048HDS3-1		
38VMB060HDS3-1	3/4 *	

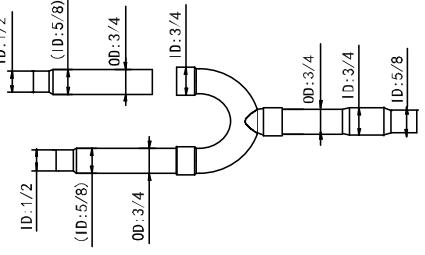
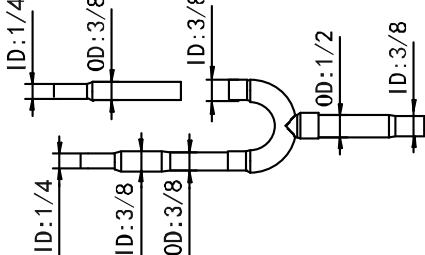
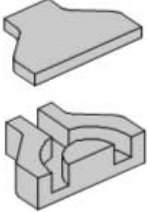
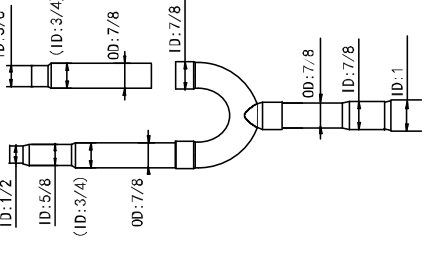
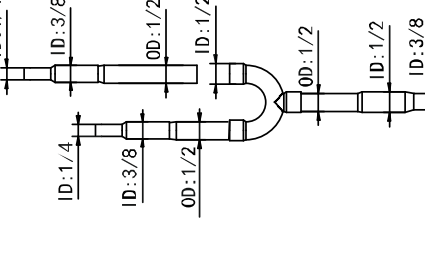
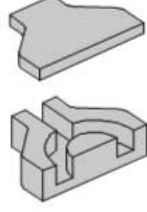
* When the length of “L1” > 230 feet, the gas pipe should be increased from 5/8” to 3/4” or from 3/4” to 7/8”. The pipe adapter must be located as close as possible to the outdoor unit.

Table 18 —Selection of L3~5, A~F

DOWNSTREAM INDOOR CAPACITY (KBtu/h)	GAS PIPE	LIQUID PIPE
Capacity ≤ 15K	1/2	1/4
15K < Capacity ≤ 78K	5/8	3/8

Select adapter pipes based on downstream indoor capacity. Use the proper tool to cut off unnecessary parts when connecting field pipes.

Table 19 —Adapter Pipe Selection

Model Name	Gas Side	Liquid Side	Heat Insulation Material
40VM900031	 A210234	 A210235	 (2 sets) A210236
40VM900032	 A210237	 A210238	 (2 sets) A210236

The branch joint must be installed parallel to the ground. The angle of the joint should be $\leq 10^\circ$.

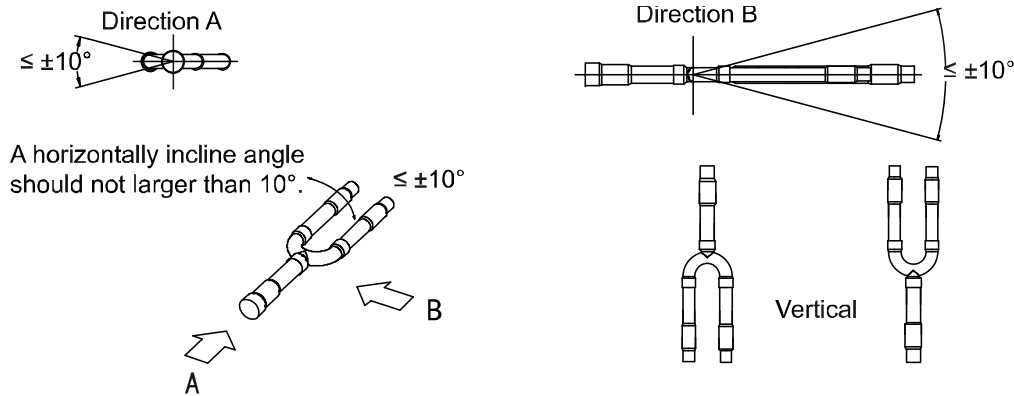


Fig. 18 —Branch Joint Installation

A210239

:

Refrigerant Charge Calculation

Based on the field installed refrigerant pipe and system layout, additional refrigerant charge may be required. Add additional refrigerant based on the calculation below.

R*=

Total length of liquid pipe size
at 7/8 in.
(ft)×0.255 (lbs/ft)

+

Total length of liquid pipe size
at 3/4 in.
(ft)×0.181 (lbs/ft)

+

Total length of liquid pipe size
at 5/8 in.
(ft)×0.120 (lbs/ft)

+

Total length of liquid pipe size
at 1/2 in.
(ft)×0.080 (lbs/ft)

+

Total length of liquid pipe size
at 3/8 in.
(ft)×0.040 (lbs/ft)

+

Total length of liquid pipe size
at 1/4 in.
(ft)×0.015 (lbs/ft)

+

Number of Y-joints or
headers in liquid side
X0.22 (lbs/item)

A210240

Fig. 19 —Calculating Refrigerant Charge

R*: Amount of additional refrigerant to be charged

Regardless of the total amount calculated by the formula above, the maximum additional refrigerant charge must not exceed 22.0 lbs for the system.

REFRIGERANT CIRCUIT

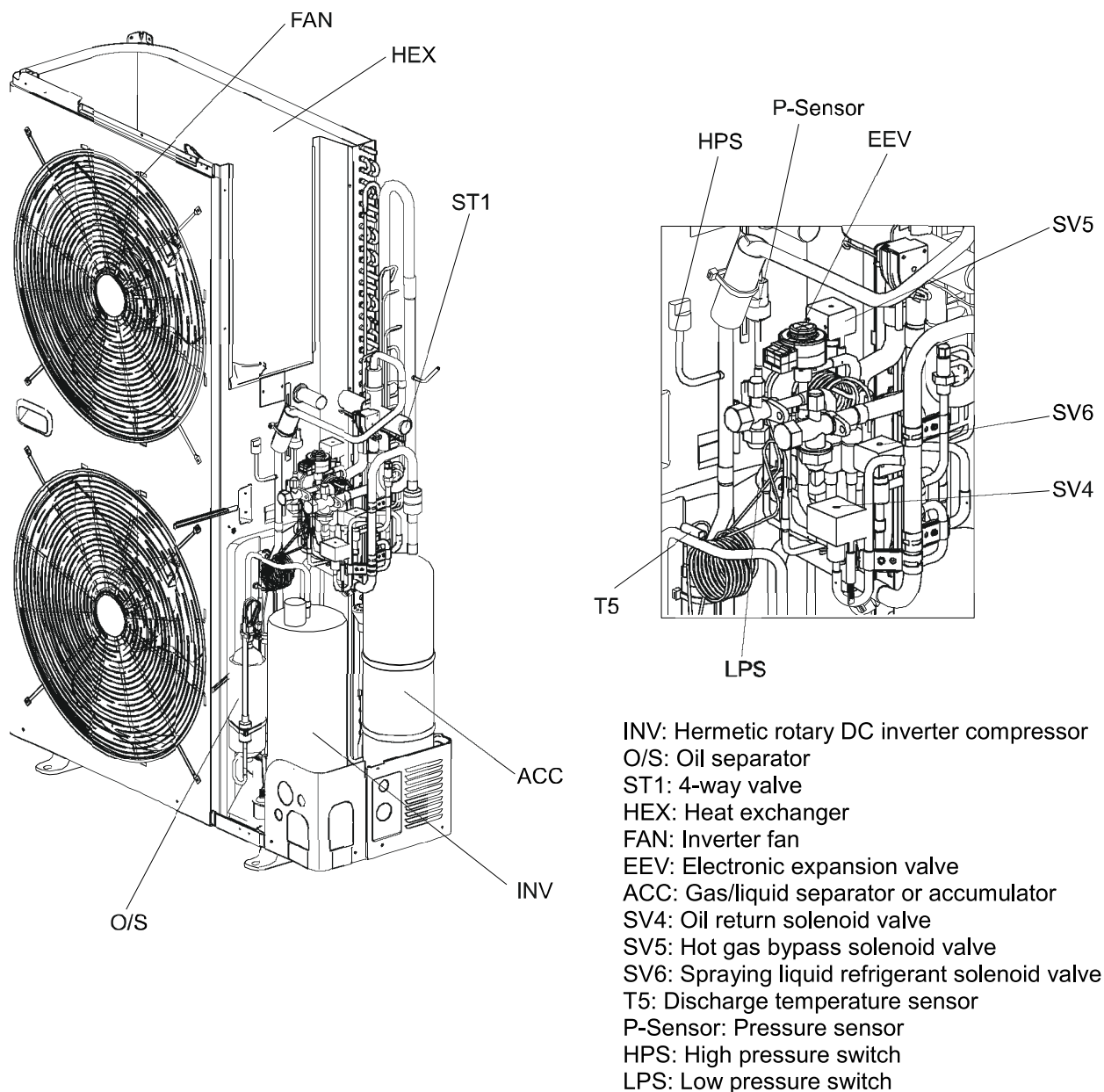


Fig. 20 —Functional Parts Layout

A210241

Refrigerant Circuit

Table 20 —Refrigerant Circuit Description

Name	Symbol	Major Function
Inverter compressor	INV	Used to vary the refrigerant flow rate by adjusting the frequency based on capacity requirement
Oil separator	O/S	Used to separate oil from high pressure gas refrigerant, which is pumped out from the compressor
4-way valve	ST1	Switches the operation mode between heating and cooling
Heat exchanger	HEX	Transfers heat with outside surroundings
Inverter fan	FAN	Regulates the heat exchanger capacity by adjusting rotating speeds
Electronic expansion valve	EEV	Used to adjust refrigerant flow rate
Gas/liquid separator	ACC	Used to separate gas refrigerant to prevent liquid slugging
Solenoid valve	SV4	Used to control the amount of oil from the oil separator back to the inverter compressor
	SV5	Bypasses hot gas from compressor discharge in heating mode
	SV6	Used to cool down compressor by spraying liquid refrigerant when discharge temperature > 199°F
Thermistor	T3	Used to detect pipe temperature on heat exchanger
	T4	Used to detect ambient temperature
	T5	Used to detect discharge pipe temperature
Fusible plug	FP	This plug is going to melt at a temperature of 158°F to 167°F when fire occurs
High pressure sensor	P-Sensor	Used to detect high pressure
High pressure switch	HPS	Prevents abnormal increase of high pressure, which will activate at 638 psi and shut down compressor
Low pressure switch	LPS	Prevents abnormal decrease of low pressure, which will activate at 20.3 psi and shut down compressor

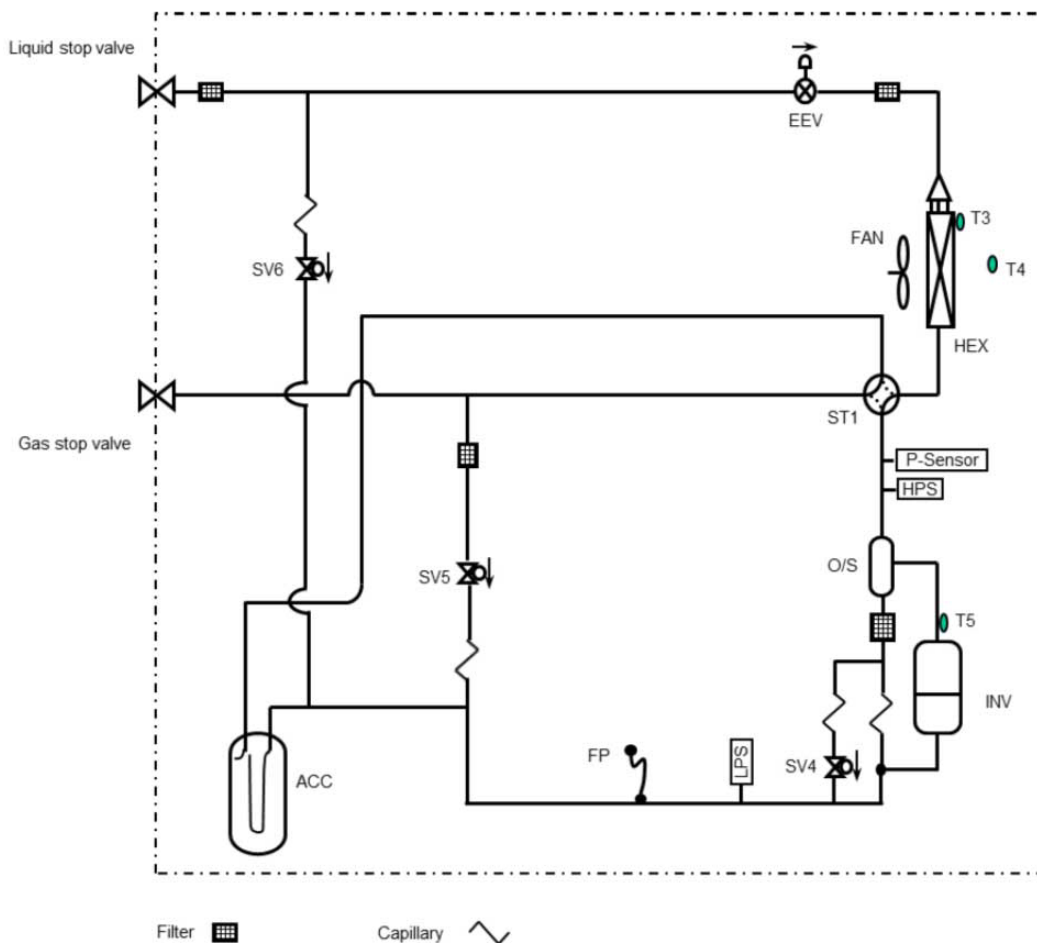
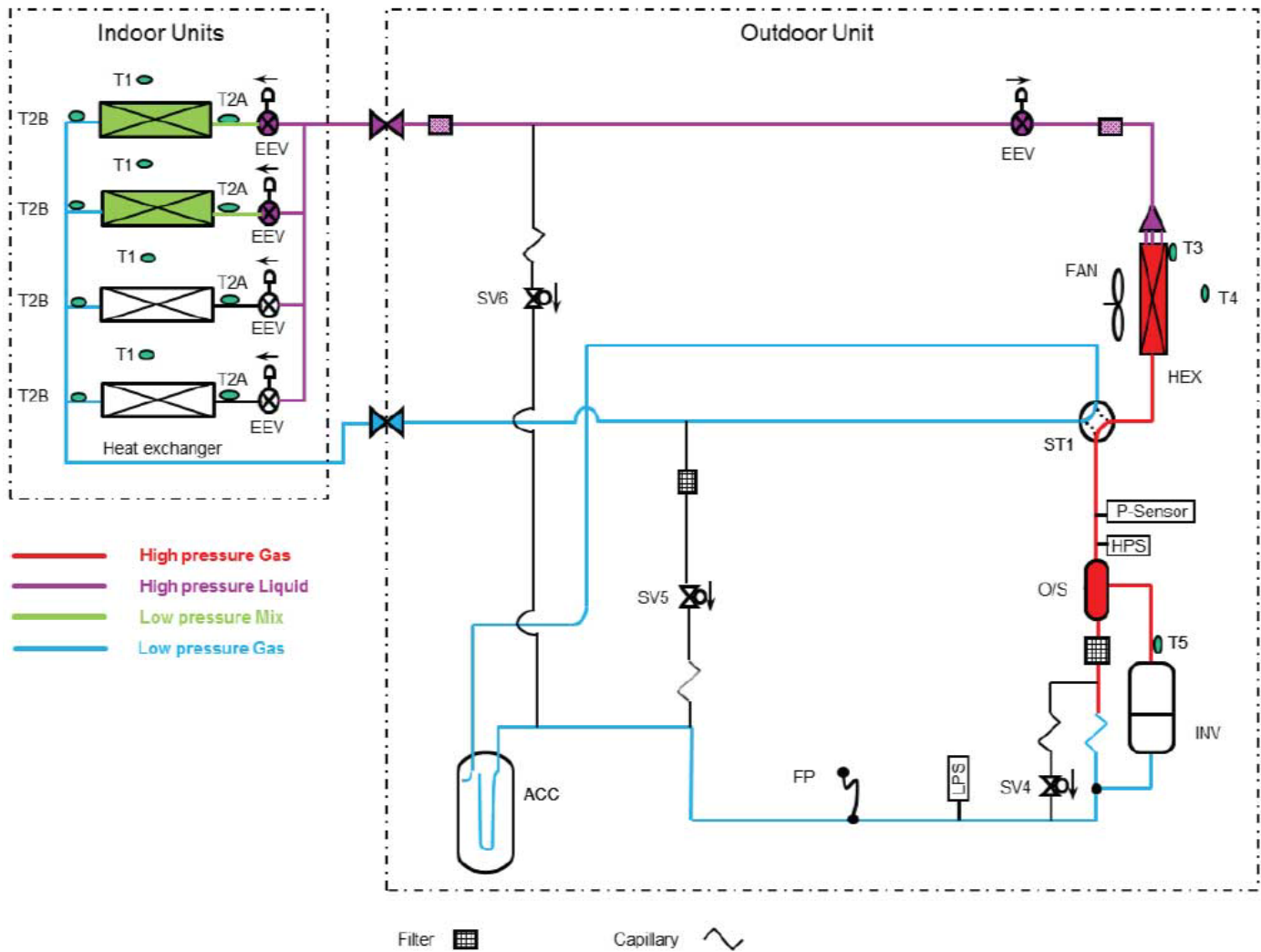


Fig. 21 —Refrigerant Circuit Diagram

A210242

Refrigerant Flow for Each Operation Mode



A210243

Fig. 22 —Cooling Operation

Heating Operation

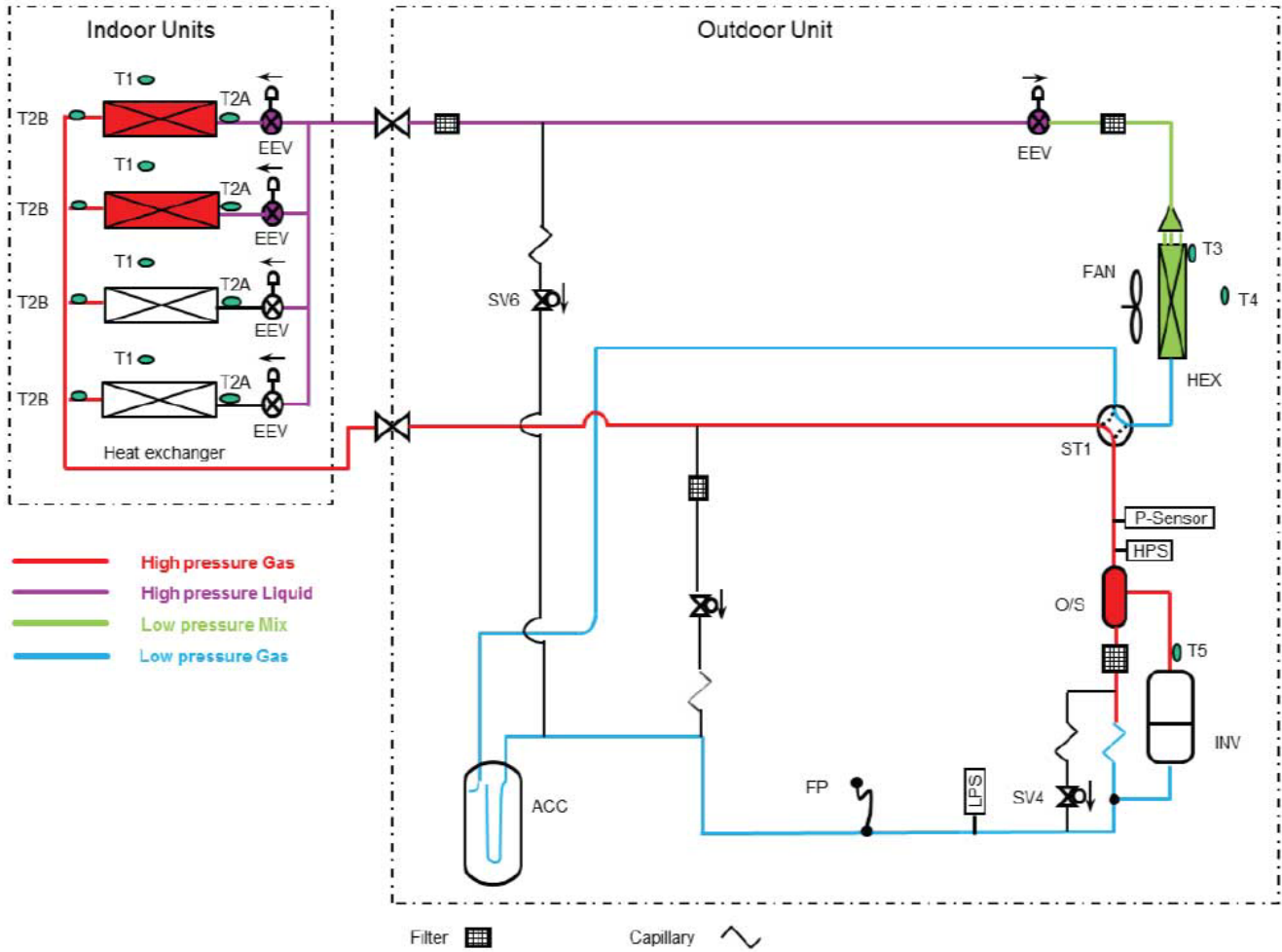
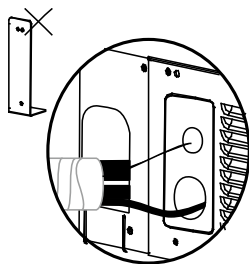


Fig. 23 —Heating Operation

A210244

FIELD WIRING

Remove the L-shape metal plate for power supply and control wiring.



A210246

Table 21 —Thickness of Wire for Main Power Supply

Outdoor Unit Model	Recommended Setting				
	Minimum Wire Thickness AWG		MCA	Breaker for Wiring(A)	Breaker for Current Leakage
	Main Wire	Ground			
38VMB036HDS3-1	8	8	36	40	40A 100mA 0.1second. or less
38VMB048HDS3-1	8	8	38	40	40A 100mA 0.1second or less
38VMB060HDS3-1	8	8	40	45	45A 100mA 0.1second or less



WARNING

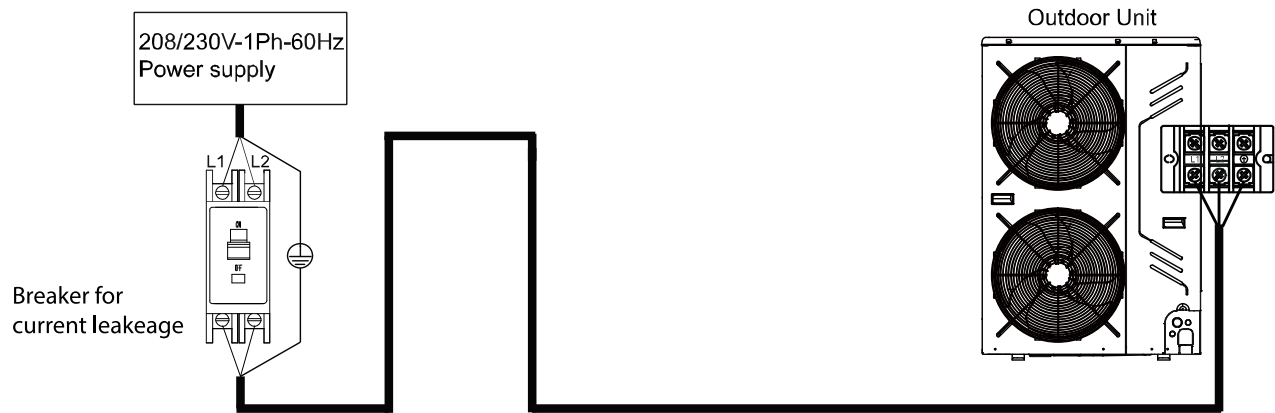
Be sure to use specified wires for connections and ensure no external force is impacting the terminal connections. If connections are not fixed firmly, heating or fire may occur. Be sure to use the correct overcurrent protection switch.



CAUTION

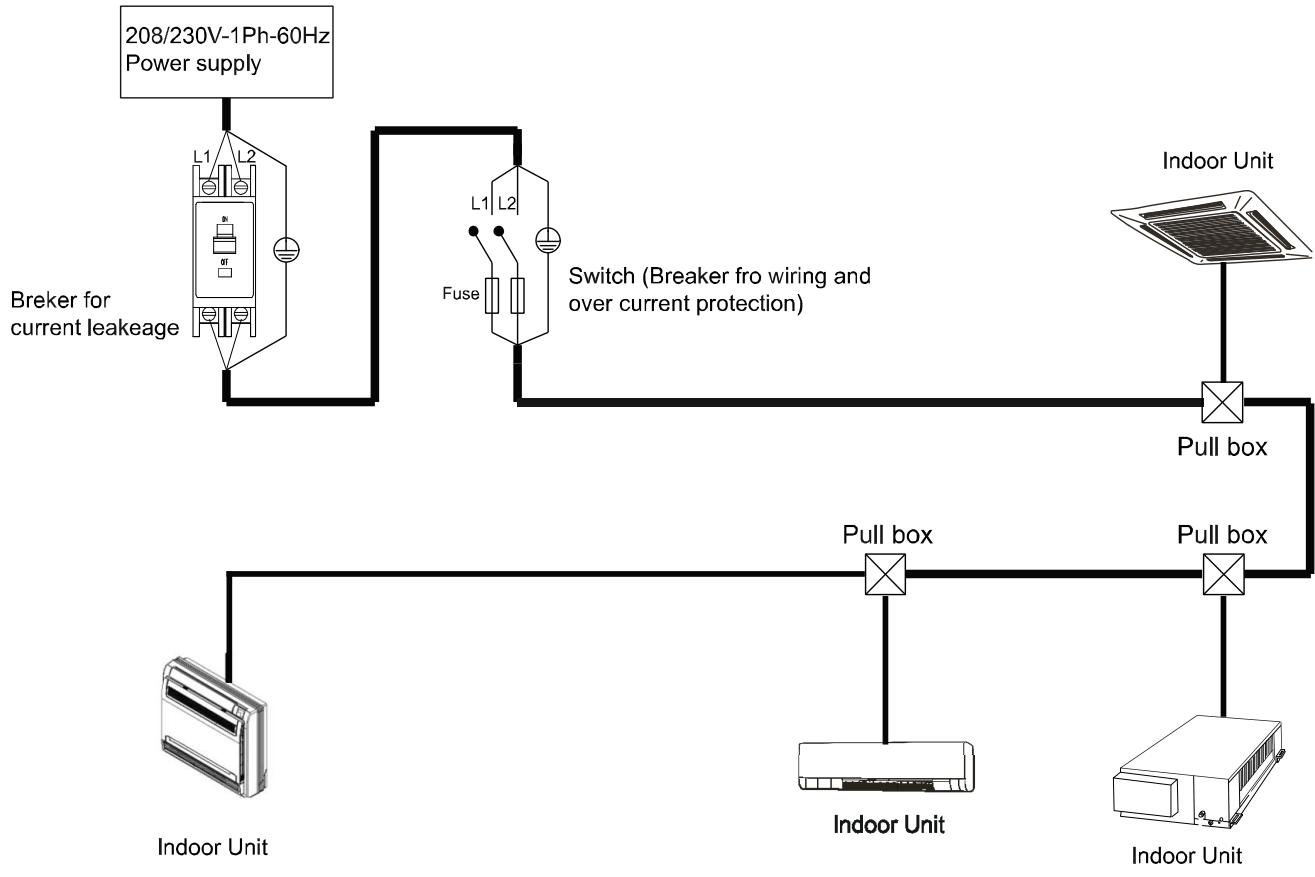
A breaker for current leakage must be attached to the power supply. If no earth leakage breaker is installed, it may cause an electric shock. Do not use anything other than a breaker and fuse with the correct capacity. Using a fuse or wire that is too large may cause malfunction or fire. Be sure to use the correct overcurrent protection switch.

Typical Power Supply Wiring



A210247

Fig. 25 —Outdoor Unit Power Supply Wiring



A210248

Fig. 26 —Indoor Unit Power Supply Wiring

Typical Control Wiring

Use 2-core stranded shielded wires for communication bus.

Maximum Length to Outdoor Unit	L1 + L3, L5	≤ 3937 feet	AWG 18
Maximum Length from Controller to Indoor Units	L6 + L7 + L8 + L9, L10 + L11	≤ 820 feet	AWG 18

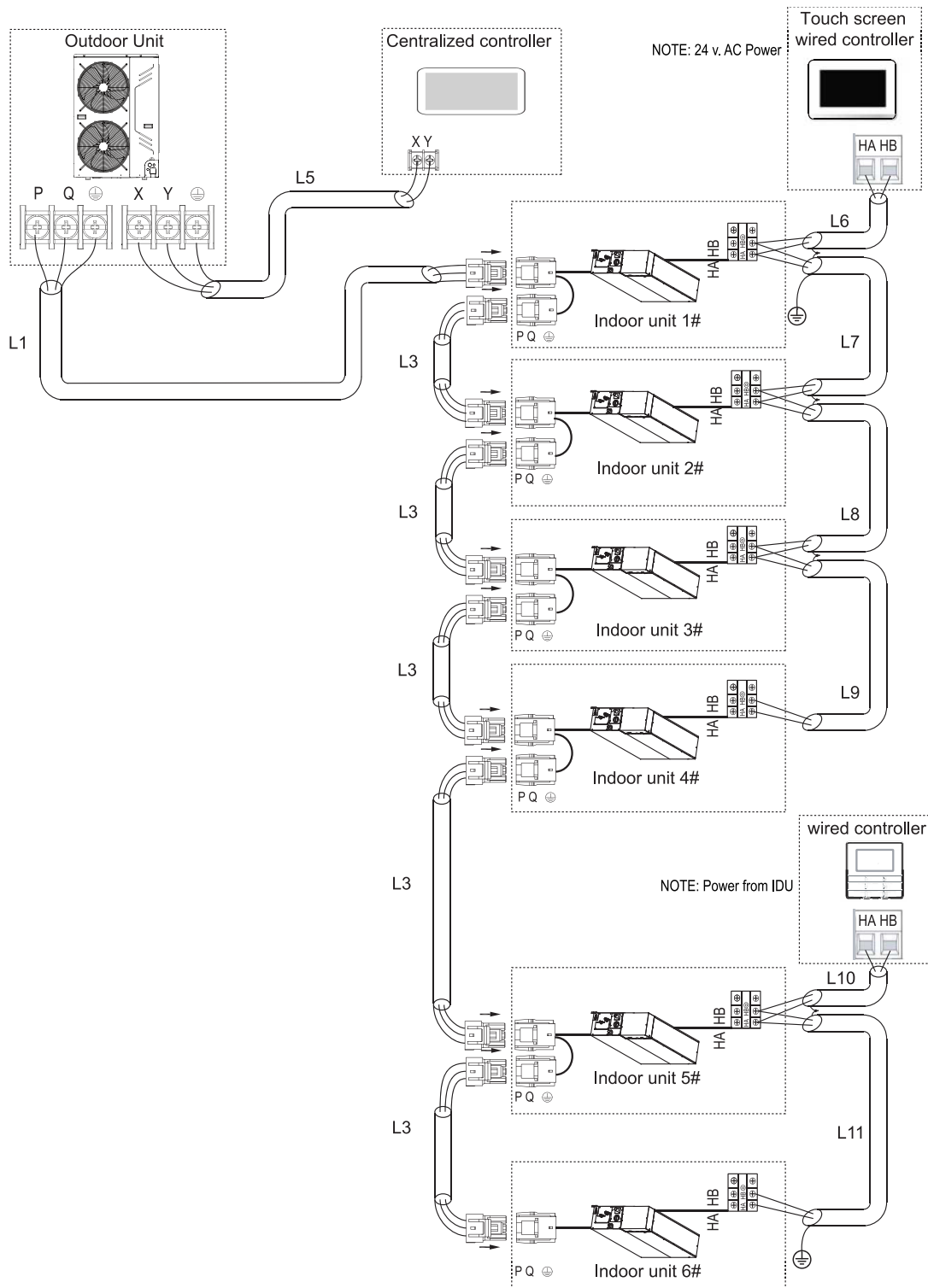


Fig. 27 —Control Wiring

A210249

SW1 button on PCB is for force cooling mode. Press once to enter the force cooling mode, and press twice to exit the operation.

SW2 button is the query button. The LED will display the parameter values by the number of pushes per SW2 query instructions.

Table 22 —Spot Check Query Instructions

No.	Description	Note
0	Normal display ^{*1}	0
1	Operating mode ^{*2}	0, 2, 3, 4
2	Operating fan speed	
3	The total capacity demands of indoor units	
4	The capacity requirement of the revised external unit	
5	T3 (Condenser temperature)	Actual value
6	T4 (Outdoor temperature)	Actual value
7	T5 (Compressor discharge temperature)	Actual value (if the temperature over 100, DIS1 will only display the first two values)
8	The surface temperature of the heat exchanger	Actual value
9	Opening of EEV	Actual value = Display value x 8
10	Unit current	
11	1/10 of DC bus voltage	Actual value / 10
12	T2A average temperature (indoor unit)	
13	Total number of indoor units	
14	Number of the operating indoor units	
15	Outdoor unit capacity ^{*3}	12, 14, 16
16	Discharge pressure	Actual value = Display value x 0.1 MPa
17	Saturation temperature of the discharge pressure	
18	Priority mode ^{*4}	0, 1, 2, 4, 5, 6
19	Version of the program	
20	Last error of protection code	None with “nn”
21	Display “--”	

NOTES:

1. Normal display: If standby, the LED displays the quantities of indoor units communicated. Otherwise, it displays the rotation frequency of compressor. It may display 0 Hz at startup stage. When defrosting, it displays dF.
2. Mode:
 - 0 = OFF
 - 2 = Cooling
 - 3 = Heating
 - 4 = Forced cooling mode
3. 3 Ton-12 (KW), 4 Ton-14 (KW), 5 Ton-16 (KW)
4. 0-Heating priority mode:
 - 1 = Cooling priority mode
 - 2 = VIP
 - 4 = Cooling only
 - 5 = Debugging mode No.1
 - 6 = Debugging mode No.2

Table 23 —Dip Switch Setting <<start here>>

Dip Switch		Function Definition
SW3	A210250	Heating priority mode (factory setting)
	A210251	Cooling priority mode
	A210252	Indoor unit priority mode (IDU #63) or majority mode
	A210253	Heating mode only
	A210254	Cooling mode only
SW4	A210255	Automatic addressing
	A210256	Manual addressing (factory setting)
	A210257	Clear indoor unit address
	A210258	Fahrenheit temperature (factory setting)
	A210259	Celsius temperature
ENC1	A210260	Reserved (factory use only)
ENC2	A210261	Outdoor unit network address (0 to 7 only)

FUNCTION AND CONTROL

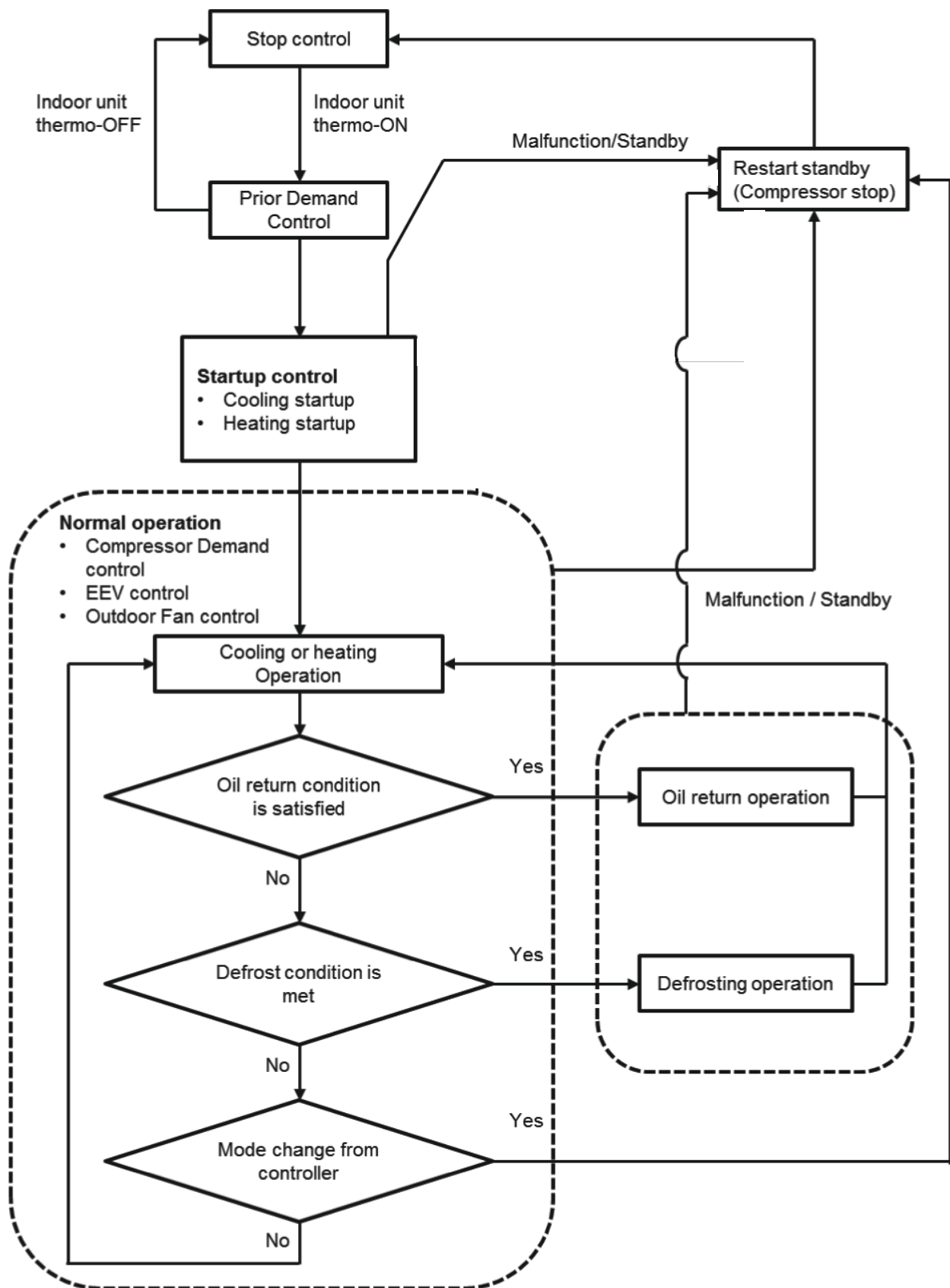


Fig. 28 —Operation Mode

A210262

Basic Control

NORMAL OPERATION

Table 24 —Cooling Operation

COMPONENT	NORMAL OPERATION	REMARK
Compressor (INV)	Capacity demand control	To build pressure difference
Outdoor Unit fan (FAN)	Cooling fan control	-
4-Way Valve	OFF	-
Electronic Expansion Valve (EEV)	Discharge temperature control	Adjust refrigerant flow rate to protect compressor
Fast Oil Return Valve (SV4)	17 minutes OFF then 3 minutes ON	-
Hot Gas Bypass Valve (SV5)	OFF	-
Spraying Liquid Valve (SV6)	Discharge temperature protection control	-

Table 25 —Heating Operation

COMPONENT	NORMAL OPERATION	REMARK
Compressor (INV)	Capacity demand control	To build pressure difference
Outdoor Unit fan (FAN)	Heating fan control	-
4-Way Valve	ON	-
Electronic Expansion Valve (EEV)	Discharge temperature control	Adjust refrigerant flow rate to protect compressor
Fast Oil Return Valve (SV4)	17 minutes OFF then 3 minutes ON	-
Hot Gas Bypass Valve (SV5)	OFF	Open based on conditions at startup stage (after defrosting and oil return operation)
Spraying Liquid Valve (SV6)	Discharge temperature protection control	-

NOTE: Heating operation is not functional at an outdoor air temperature of 77°F or more.

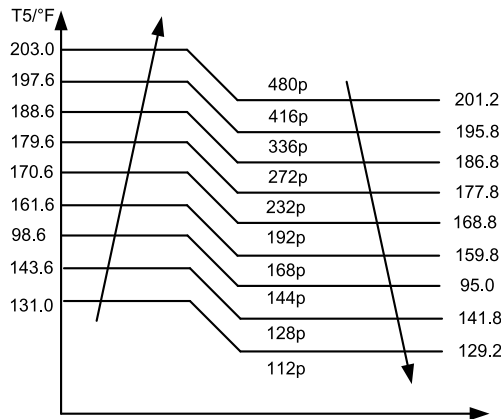
LEGEND:

INV – Inverter

SV – Solenoid Valve

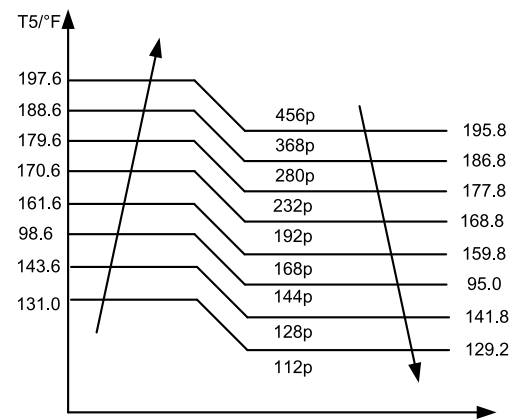
ELECTRONIC EXPANSION VALVE (EEV)

The opening of the EEV is based on compressor discharge temperature (T5). If T5 increases, EEV operates the opening to target value directly. Otherwise, it regulates itself to step-by-step operation.



A210263

Fig. 29 —Cooling Operation

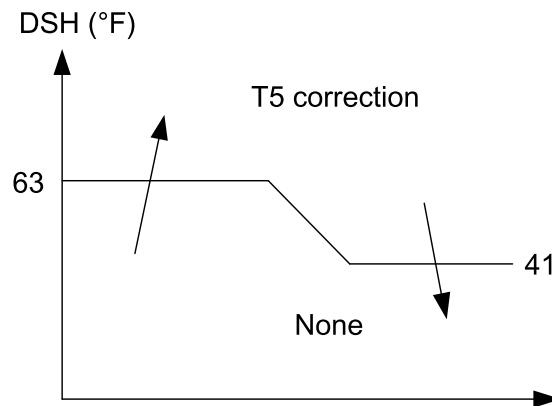


A210264

Fig. 30 —Heating Operation

If the superheat is too high, the software revises T5 so that EEV can quickly adjust to a larger opening. Discharge Superheat Correction adjusts every two minutes.

$$T5 \text{ (new)} = T5 \text{ (old)} + 18^{\circ}\text{F}$$



A210265

Fig. 31 —Discharge Superheat Correction

OUTDOOR FAN CONTROL

There are eight step levels (W1 to W8); however, OFF = 0 rpm is not displayed as a step level.

Table 26 —Eight Steps of Outdoor Fan Control

FAN		OFF	W1	W2	W3	W4	W5	W6	W7
RPM	Up	0	300	330	400	460	520	630	780
	Down	0	0	300	380	440	500	610	760

Fan Control in Cooling Mode

Table 27 —Fan Control by Outdoor Temperature (T4) and Compressor Frequency

38VMB036~060HDS3-1	Frequency < 34		34 ≤ Frequency < 48		Frequency ≥ 50	
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum
T4 ≥ 84.2°F	W2	W7	W4	W7	W6	W7
62.6°F ≤ T4 < 84.2°F	W1	W4	W2	W6	W4	W6
41°F ≤ T4 < 62.6°F	OFF	W2	W1	W4	W3	W6
32°F ≤ T4 < 41°F	OFF	W1	W1	W2	W1	W4
23°F ≤ T4 < 32°F	OFF	W1	W1	W2	W1	W2
T4 < 23°F	OFF	OFF	OFF	OFF	OFF	OFF

SEQUENCE:

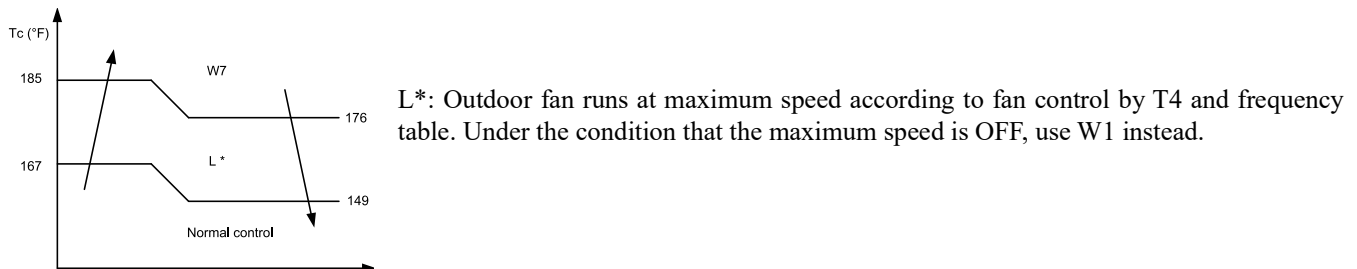
1. Outdoor fan will come on (W7) for 20 seconds before compressor starts.
2. Outdoor fan continues to run (W7) for another 20 seconds after compressor starts.
3. Based on outdoor temperature (T4), outdoor fan will follow step level for another 40 seconds as shown in table above.
4. 60 seconds after the compressor starts, outdoor fan step level is determined based on T4, T5, and Tc.



A210260A210266

Fig. 32 —Fan Control by Condensing Temperature (Tc)

Method B shows the T4 < 23°F operation as mentioned in the above table.



L*: Outdoor fan runs at maximum speed according to fan control by T4 and frequency table. Under the condition that the maximum speed is OFF, use W1 instead.

A210267

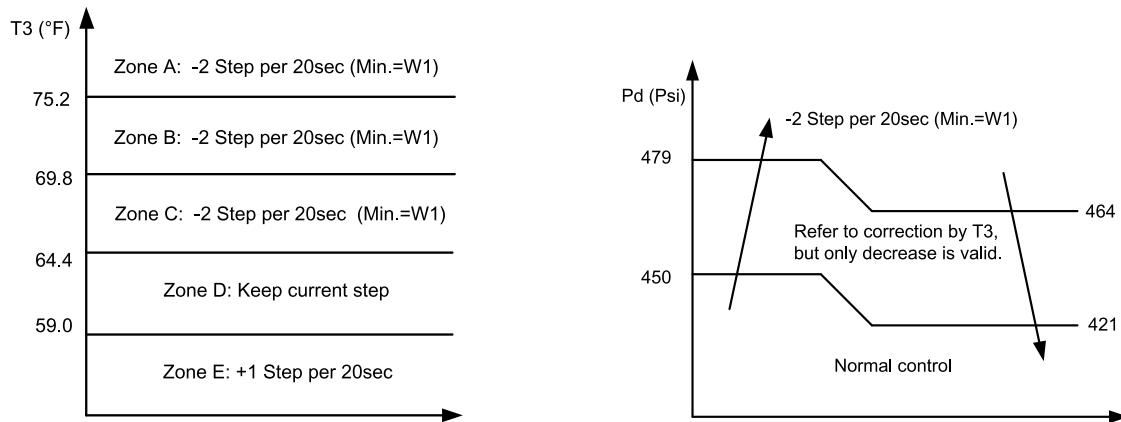
Fig. 33 —Fan Control Correction by Compressor Discharge Temperature (T5)

Table 28 —Fan Control by Outdoor Temperature (T4) and Compressor Frequency

38VMB036, 048HDS3-1		Frequency < 34	34 ≤ Frequency < 50	Frequency ≥ 50
Max. speed	T4 ≥ 50°F	W3	W5	W6
	41°F ≤ T4 < 50°F	W4	W6	W7
	33.8°F ≤ T4 < 41°F	W6	W7	W7
	T4 < 33.8°F	W7	W7	W7
38VMB060HDS3-1		Frequency < 34	34 ≤ Frequency < 50	Frequency ≥ 50
Max. speed	T4 ≥ 50°F	W4	W6	W6
	41°F ≤ T4 < 50°F	W6	W7	W7
	33.8°F ≤ T4 < 41°F	W7	W7	W7
	T4 < 33.8°F	W7	W7	W7

SEQUENCE:

1. Outdoor fan will come on (W7) for 29 seconds before compressor starts.
2. Once compressor starts, based on outdoor temperature (T4), outdoor fan runs at max. speed for the next 180 seconds.
3. After 180 seconds of compressor start, outdoor fan step level is determined based on frequency, T3 and T4.



A210268

Fig. 34 —Fan Control Correction by T3 and High Pressure (Pd)

The compressor will stop and display 'EA' error code suggesting outdoor fan has stayed in Zone A for more than five minutes. The system will restart approximately three minutes after pressure equalization. Outdoor fan will adjust the step level every 20 seconds if Pd is greater than 479 psi.

Special Control

Table 29 —Startup Control

Component	Cooling Operation	Heating Operation	Remark
Compressor	Capacity demand control	Capacity demand control	Sequence ^{*1} A to C
Outdoor unit fan	W7 for twenty seconds, then control based on frequency, T4, T5, and Tc	Maximum speed referred to T4 and frequency	
4-Way Valve (ST1)	OFF	ON	
EEV	300 pls for three minutes after compressor starts, then normal control	300 pls for three minutes when $T4 \geq 32^{\circ}\text{F}$ 300 pls for 6minutes when $T4 < 32^{\circ}\text{F}$ Then normal control	
Fast oil return (SV4)	ON	ON	Continuous time based on T4
Hot gas bypass valve (SV5)	OFF	Bypass control ^{*2}	
Spraying liquid valve (SV6)	OFF	OFF	
Ending conditions	According to target frequency and startup stage		

SEQUENCE:

Sequence A: $T5 \geq 59^{\circ}\text{F}$ and $T4 \geq 23^{\circ}\text{F}$, or $T4 \geq 37.4^{\circ}\text{F}$.

Sequence B: $23^{\circ}\text{F} \leq T4 < 37.4^{\circ}\text{F}$.

Sequence C: $5^{\circ}\text{F} \leq T4 < 23^{\circ}\text{F}$.

Take sequence A as an example, and assume that the target frequency is 50 Hz.

The compressor runs 33 Hz and 42 Hz for 60 seconds respectively, and goes to 50 Hz afterward.

If the target frequency is higher than 66 Hz, the ODU needs to operate at 33, 42, 56, 66 Hz respectively for one minute, or it directly goes to the target frequency like the example above.

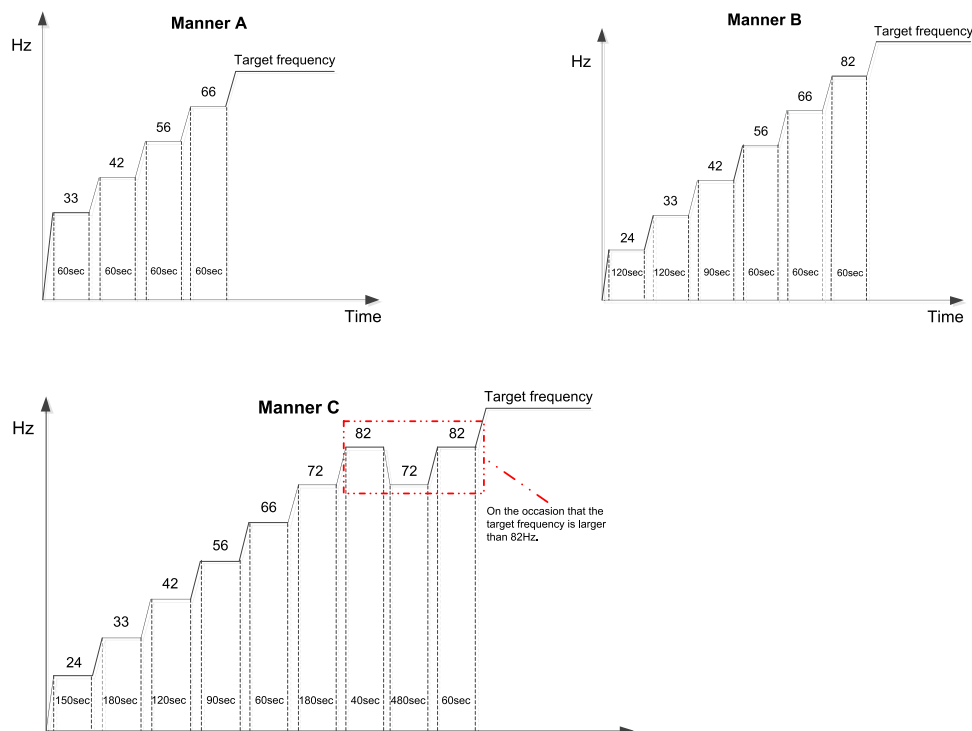


Fig. 35 —Sequence for Startup Control

SV5 will open if heating frequency ≥ 50 Hz with startup manner A or B.

A210269

Oil Return Operation

When cumulative compressor operating time exceeds eight hours, the outdoor unit starts oil return operation.

Table 30 —Oil Return in Cooling Mode

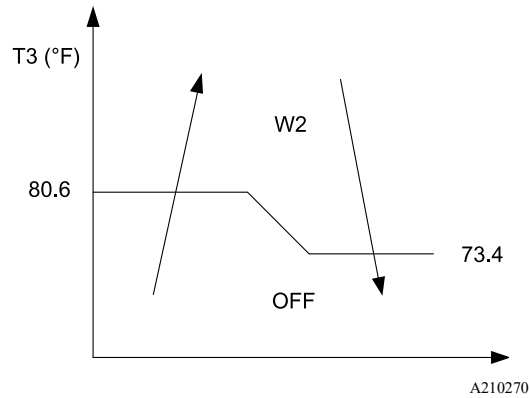
Component	Before Oil Return Operation	Oil Return	After Oil Return Operation
Compressor	Normal control	Target frequency for oil return (58Hz for 38VMB036HDS3-1, 66Hz for 38VMB048, 060HDS3-1)	Normal control
Outdoor unit fan	Normal control		
Four way valve (ST1)	OFF		
EEV	Normal control	300 Pls	Normal control
Fast oil return (SV4)	Normal control		
Hot gas bypass valve (SV5)	OFF		
Spraying liquid valve (SV6)	Discharge temperature protection control		
Ending conditions	-	five minutes	-

Table 31 —Oil Return in Heating Mode

Component	Before Oil Return Operation	Oil Return	After Oil Return Operation
Compressor	Current value →30 Hz for two seconds	30Hz for 30sec→ Target frequency for oil return (58Hz for 38VMB036HDS3-1, 66Hz for 38VMB048, 060HDS3-1)	→30 Hz for 55 seconds, then normal control
Outdoor unit fan	Normal control	Low pressure control *1	Normal control
Four way valve (ST1)	ON	OFF	OFF for 45 seconds, then switch to ON
EEV	Current opening→300P	300 Pls	300 Pls
Fast oil return (SV4)	Normal control		
Hot gas bypass valve (SV5)	OFF	OFF	Bypass control
Spraying liquid valve (SV6)	Discharge temperature protection control		
Ending conditions	-	five minutes	six minutes

*1 Fan control for oil return in heating mode.

If $T_4 \geq 59^\circ\text{F}$, outdoor fan step is W2. Otherwise, follow the logic below.



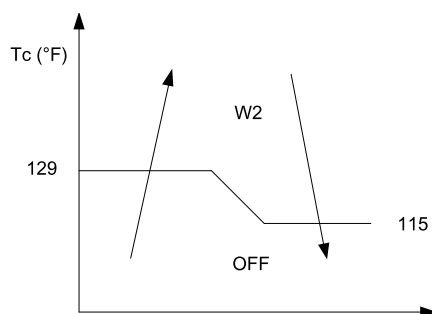
Defrost Control

The outdoor unit activates defrosting operation by T3 and accumulative heating time after the latest defrosting.

Table 32 —Defrosting Operation

Component	Before Defrosting Operation	Defrosting Operation	After Defrosting Operation
Compressor	Current value →30 Hz for 10 seconds	30 Hz for 30 seconds → Target frequency for defrosting operation (58 Hz for 38VMB036HDS3-1, 66 Hz for 38VMB048, 060HDS3-1)	→30 Hz for 55 seconds, then adjusts to normal control
Outdoor unit fan	Normal control	ON for ten seconds, then OFF *1	OFF for 45 seconds, then normal control
Four way valve (ST1)	ON	ON for ten seconds, switch to OFF	OFF for 45 seconds, then switch to ON
EEV	Current opening → 480 Pls	480 Pls	300 Pls for four minutes, then normal control
Fast oil return (SV4)	Normal control		
Hot gas bypass valve (SV5)	OFF	OFF	Bypass control
Spraying liquid valve (SV6)	Discharge temperature protection control		
Ending conditions	-	Defrosting time reaches ten minutes or T3 ≥ 54°F for one minute, or T3 ≥ 68°F	six minutes

*1 Outdoor fan will run at step level W2 to prevent abnormal increase in high pressure value. This protection is shown as below.



A210271

Table 33 —Stop Control

Component	Cooling Operation	Heating Operation
Compressor	OFF	
Outdoor unit fan	W7 step level for 30 seconds, then OFF	
Four way valve (ST1)	OFF	Thermo-off standby: ON Stop: ON for 15 seconds, then OFF
EEV	300 Pls	
Fast oil return (SV4)	ON for two minutes, then OFF	
Hot gas bypass valve (SV5)	OFF	
Spraying liquid valve (SV6)	OFF	
Crankcase heater	ON if T4 ≤ 37°F with compressor stopped for more than three hours, or powered on for the first time, else OFF	

Protection Control

PRESSURE PROTECTION CONTROL

These controls are used to protect the unit due to abnormal increase of high pressure or decrease of low pressure.

HPS opens at 638 psi, and closes when high pressure is lower than 464 psi.

LPS opens at 20 psi, and closes when detected low pressure is larger than 43 psi.

DISCHARGE TEMPERATURE PROTECTION CONTROL (SV6 CONTROL)

SV6 will open when the temperature T5 is over 199°F, and closes when it is under 190°F.

If the discharge temperature exceeds 212°F even though SV6 has sprayed liquid refrigerant to cool down the compressor, the frequency will be limited to 48 Hz. Once the discharge temperature (T5) is lower than 199°F, the unit runs normal control.

When the discharge temperature arises to 230°F, the compressor stops immediately to run. It is prohibited to restart unless T5 is less than 212°F.

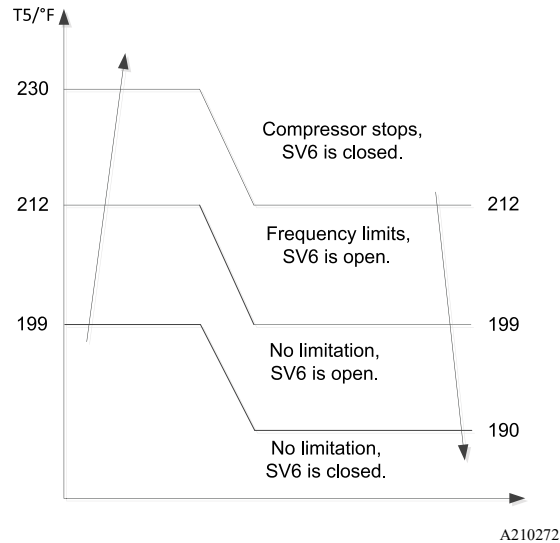


Fig. 36 —SV6 Control

CONDENSER TEMPERATURE PROTECTION CONTROL

This control is to suspend the abnormal condensing temperature for the outdoor heat exchanger.

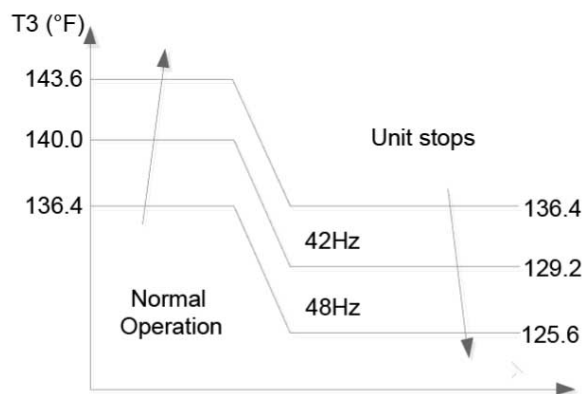


Fig. 37 —38VMA036HDS3-1

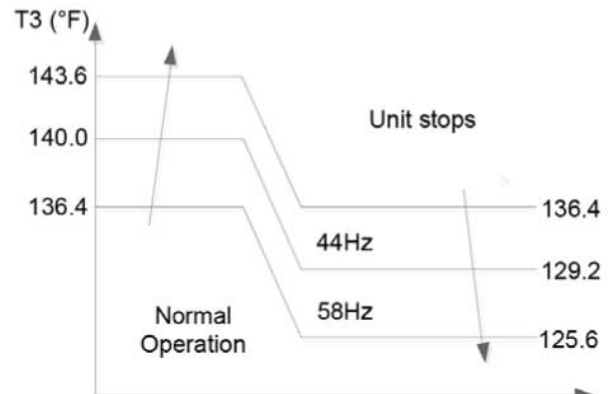


Fig. 38 —38VMA048, 060HDS3-1

A210273

TROUBLESHOOTING

Service Diagnosis

If one of the following errors have occurred, contact local distributor for assistance.

- The error lamp of the outdoor unit flashing rapidly even though shut down and restart of the system is carried out.
- The remote controller displays error codes or the buttons on the controller do not work.
- The safety fuse blows frequently or the circuit breaker trips frequently.
- Obstacles and water enter the unit.
- Water leaks from indoor unit.

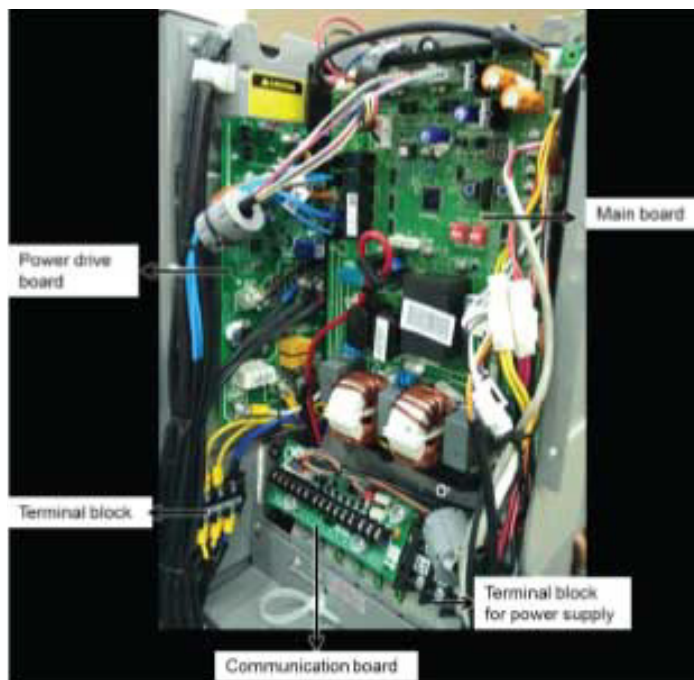
If system does not operate properly besides cases or malfunctions mentioned above, use the following procedure to check system.

Table 34 —Troubleshooting Procedures

Symptoms	Causes	Solution
Unit will not start	• Power supply failure • Power switch is off • Fuse burned out	• Recover the power supply • Switch on the power • Replace the fuse
Fan operates, no cooling or heating	• Temperature is not set correctly • Time delay in compressor operation	• Set the temperature correctly • Wait for at least three minutes for compressor to come back on
Unit starts or stops frequently	• Incorrect refrigerant charge • Air or other gas in the refrigerant circuit • Improper voltage	• Check for leaks and refrigerant charge • Vacuum and recharge refrigerant • Voltage measured between L1 and L2 should be 187 to 253 volts
No cooling effect	• Heat exchanger of ODU or IDU is dirty or blocked • Air filter of indoor unit is dirty • Outdoor temperature is too high • Lack of refrigerant	• Clean the heat exchanger and eliminate any obstacles • Clean or replace the air filter • Normal control • Check for leaks and refrigerant charge
No heating effect	• Lack of refrigerant	• Check for leaks and refrigerant charge

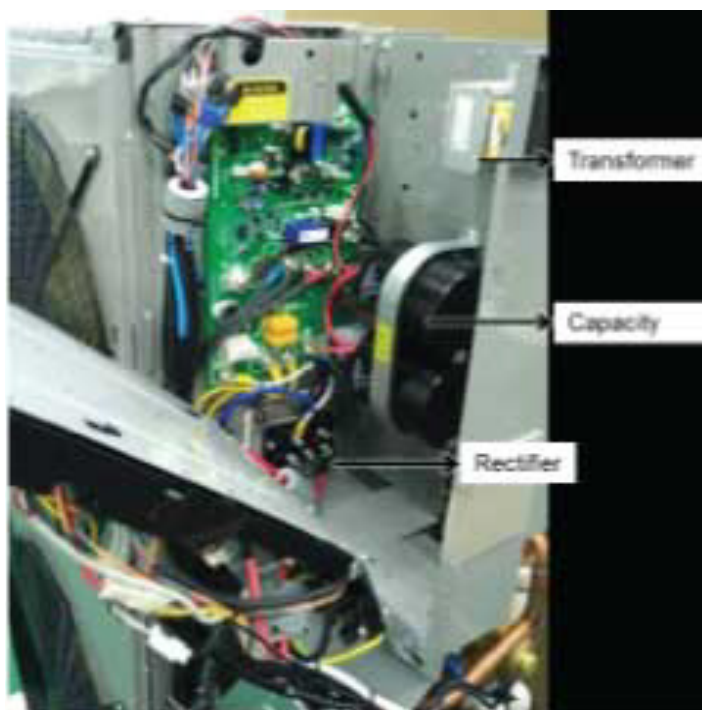
Electrical Components and Wiring Diagrams

OUTDOOR UNIT CIRCUIT BOARD ARRANGEMENT



A210274

Fig. 39 —Integral Arrangement



A210275

Fig. 40 —Inner Arrangement

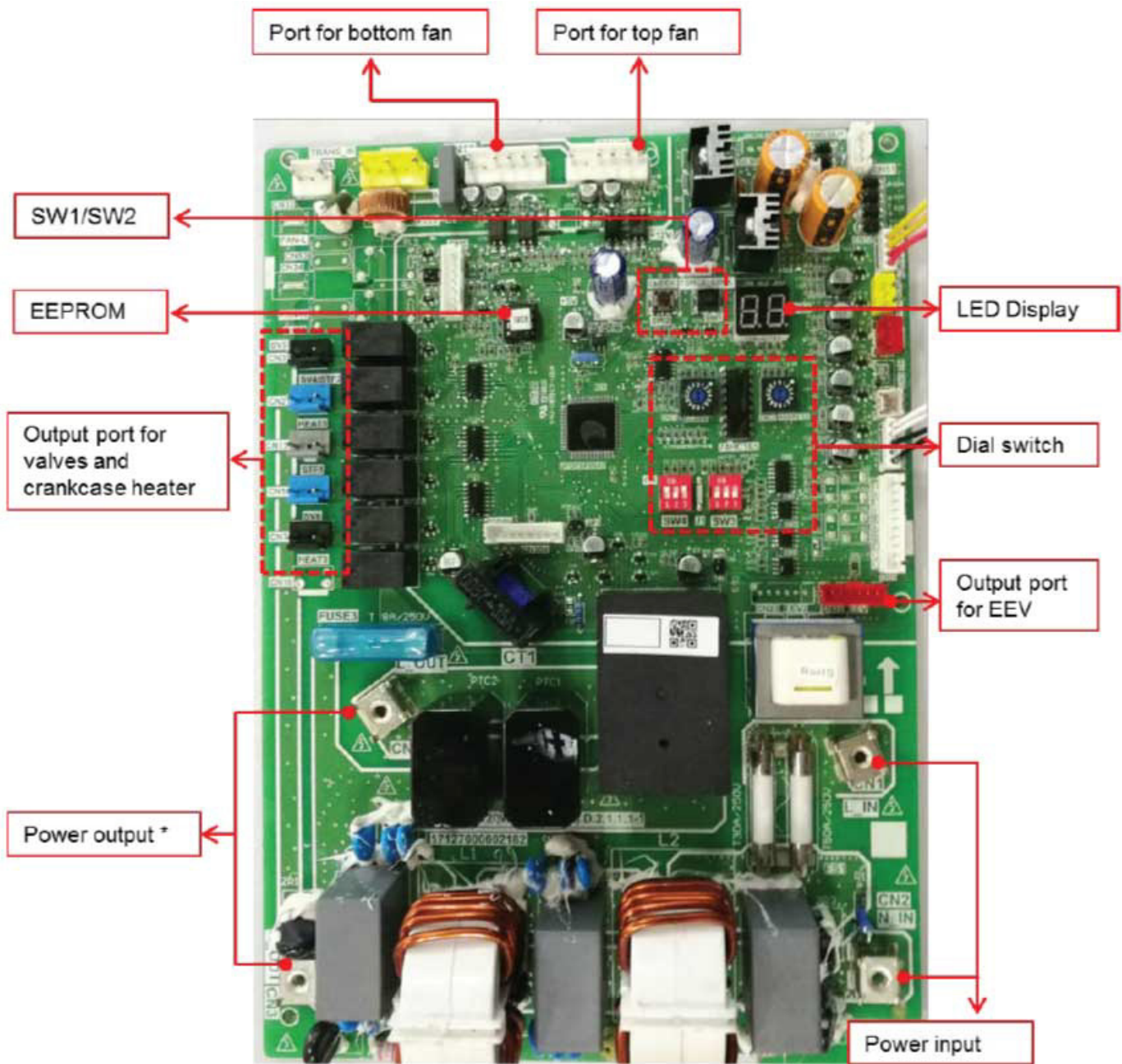


Fig. 41 —Main Board

* Power output in this board is to provide power supply for power drive board.

A210276

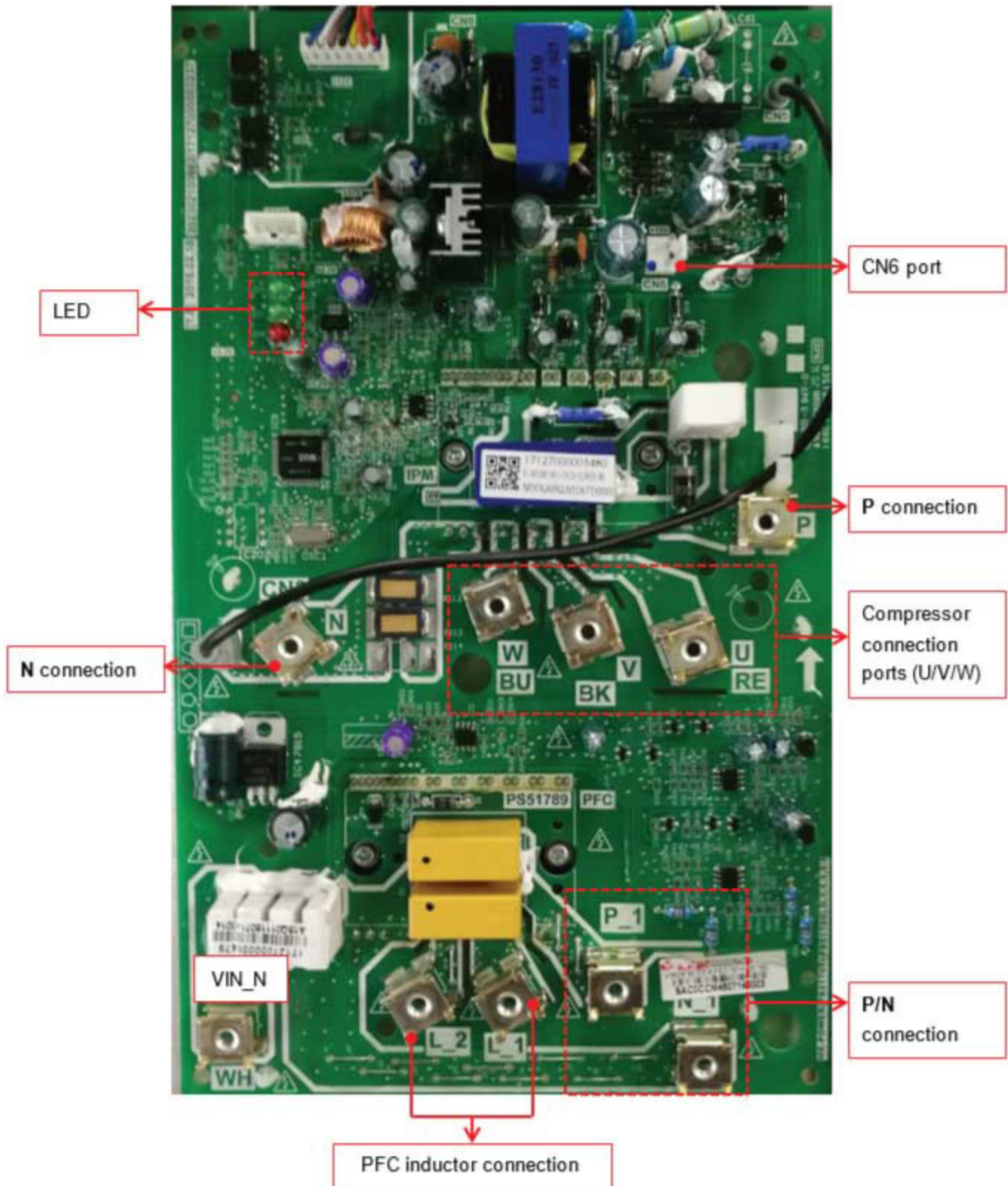


Fig. 42 —Power Drive Board

A210277

Troubleshooting from Outdoor Unit



CAUTION

Be sure to turn off power switch before connecting or disconnecting the connector. Failure to do so could damage the board.

Table 35 —Error Code of Outdoor Unit

Error Code	Definition
E2	Communication error between indoor units and outdoor unit
E4	Temperature sensor (T3 or T4) error
E5	Power voltage protection
E6	DC fan error
E7	Discharge temperature sensor (T5) error
E9	EEPROM error
E.9.	Mismatched main chip with EEPROM
EA	DC fans stay at zone A for more than five minutes (i.e. the low pressure is too high) in heating mode
Eb	E6 error more than two times in ten minutes
P1	High pressure protection
P2	Low pressure protection
P3	Input current overload protection
P4	Discharge temperature (T5) protection
P5	Condenser temperature (T3) protection
P8	Fan speed exceeds setpoint for five seconds or more
PE	High indoor coil temperature (T2A) protection
PP	Liquid slugging protection; indoor evaporator super heat too low
F1	DC bus voltage is too low (< 200V DC) for five seconds
H0	Communication error between power driver and main control board
H4	L0 or L1 error more than three times in 60 minutes
L0	Error in compressor module
L1	DC bus under-voltage protection
L2	DC bus over-voltage protection
L4	Compressor MCE error
L8	Compressor speed difference is more than 15 rps in one second
L9	Compressor speed difference between setting speed and running speed is more than 15 rps

E2: COMMUNICATION ERROR BETWEEN INDOOR UNITS AND OUTDOOR UNIT

DEFINITION

Outdoor unit cannot communicate with indoor units.

POSSIBLE CAUSES

- Communication wires between ODU and IDUs are installed incorrectly.
- Communication wires between communication and main control board are installed incorrectly.
- Incorrect power supply for all IDUs.
- Damaged main control or communication board.
- Communication wiring over 3937 feet.
- External interference (e.g. electromagnetic).

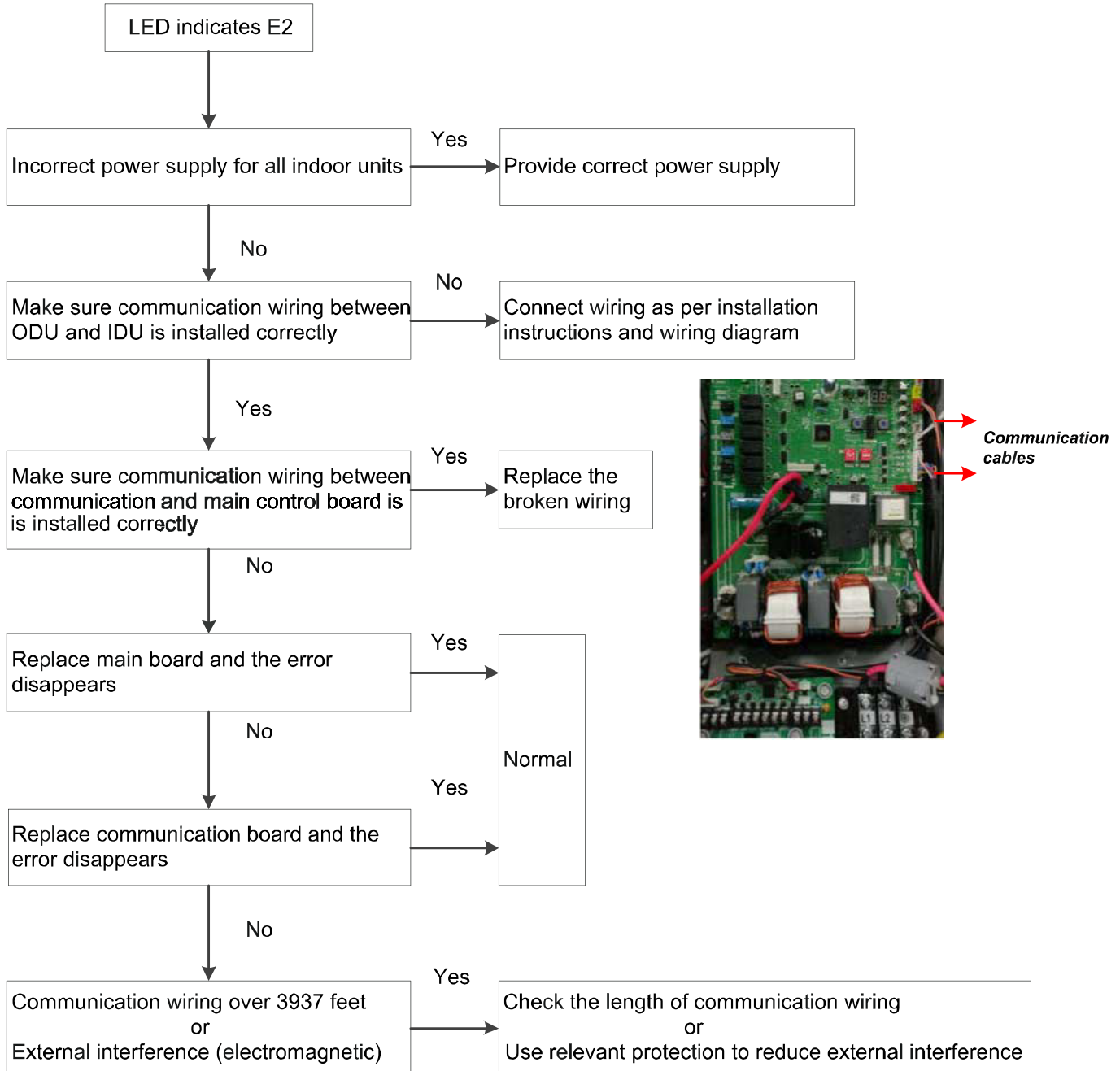


Fig. 43 —E2 Troubleshooting Chart

NOTE: Make sure that the matched resistance has been connected in the last indoor unit.

A210278

E4: TEMPERATURE SENSOR (T3 OR T4) ERROR

DEFINITION

The temperature sensor (T3 or T4) on main board is short or damaged.
(i.e. The test voltage > 4.95V or < 0.05V)

POSSIBLE CAUSES

- The temperature sensor is located at wrong place
- Loose connection at port on main control board
- Damaged sensor (resistance drift)
- Interference of other heat sources
- Damaged main board

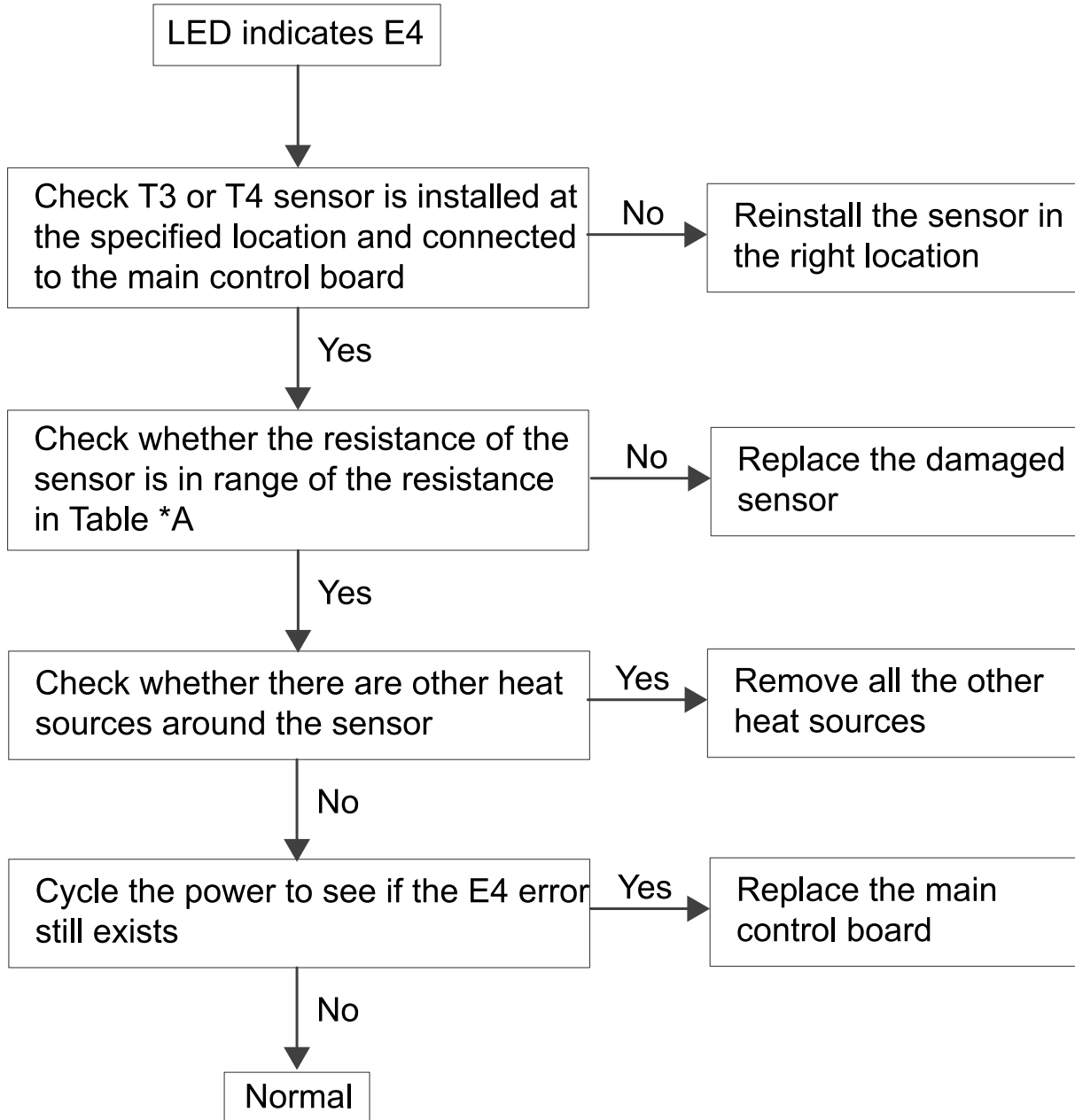


Fig. 44 —E4 Troubleshooting Chart

* A Refer to resistance temperature sensor in Appendix A.

A210279

E5: POWER VOLTAGE PROTECTION

DEFINITION

The voltage of ODU is not within the acceptable range.

POSSIBLE CAUSES

- Improper voltage
- Loose wiring between power terminals and main control board
- Damaged main board of ODU

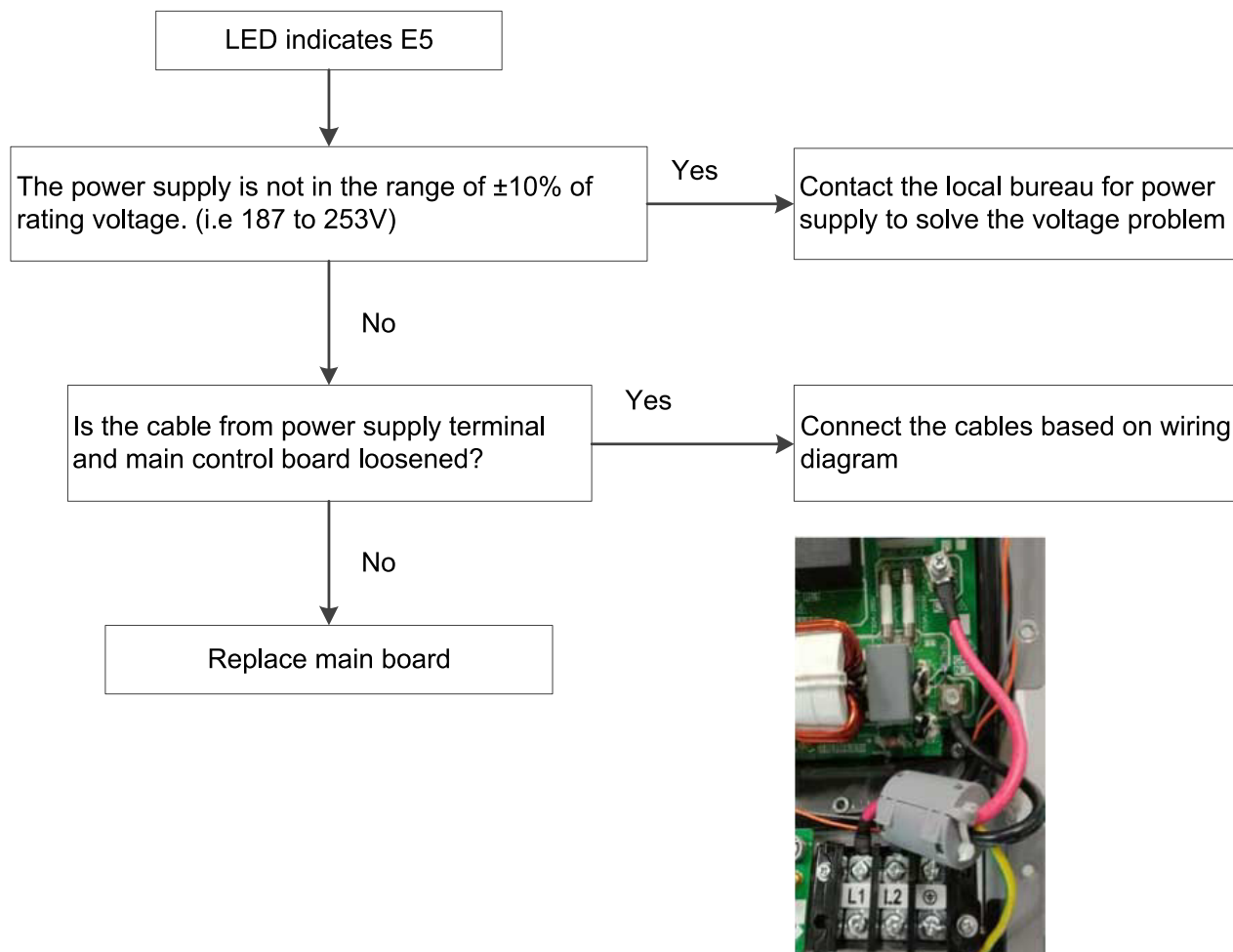


Fig. 45 —E5 Troubleshooting Chart

A210280

E6 OR EB: DC FAN ERROR

DEFINITION

- Fan rotation is less than 240 RPM for 20 seconds during operation.
- Fan rotation difference between the transient RPM and target one is larger than set value for three minutes.
- Eb will be reported on DIS1 if E6 occurs two times within ten minutes.

POSSIBLE CAUSES

- Burned out motor
- Incorrect wiring within electric control box
- Damaged power drive board
- Damaged main board of ODU

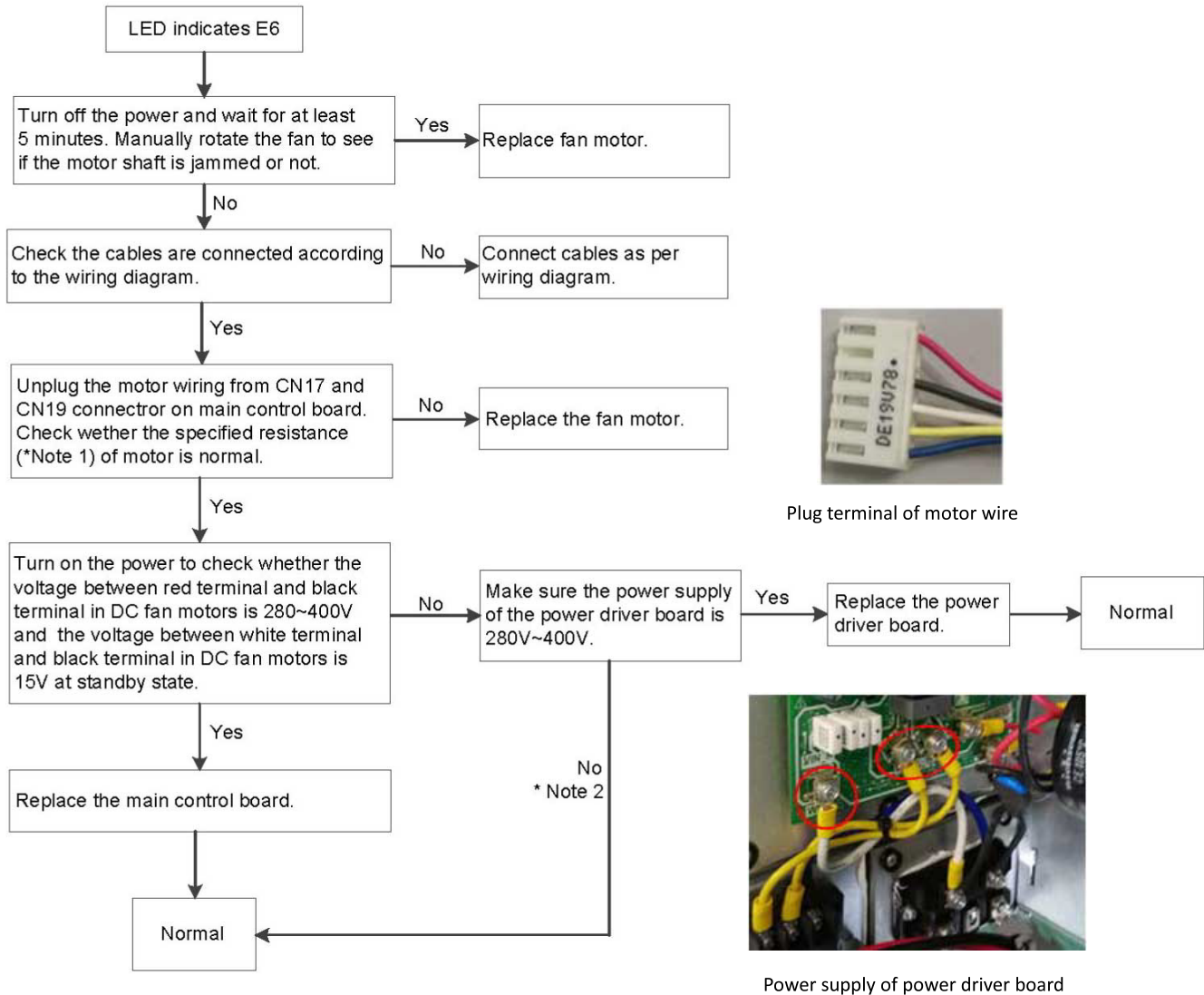


Fig. 46 —E6 or Eb Troubleshooting Chart

*** NOTE 1:** If resistance difference between the tested value and the one shown below is larger than 30%, the motor is burned out.

Between two terminals	Red and Black	White and Black	Yellow and Black	Blue and Black
Resistance (KΩ)	≥ 1000	1.2	200	≥ 1000

*** NOTE 2:** Check the power output from main board and connection wires before replacing it.

E7: DISCHARGE TEMPERATURE SENSOR (T5) ERROR

DEFINITION

- The temperature sensor (T5) is short or damaged.
- Test voltage > 4.95V or < 0.05V.

POSSIBLE CAUSES

- The temperature sensor is installed in the wrong place
- Loose connection at post on main control board
- Damaged sensor (resistance drift)
- Interference of other heat sources
- Damaged main control board

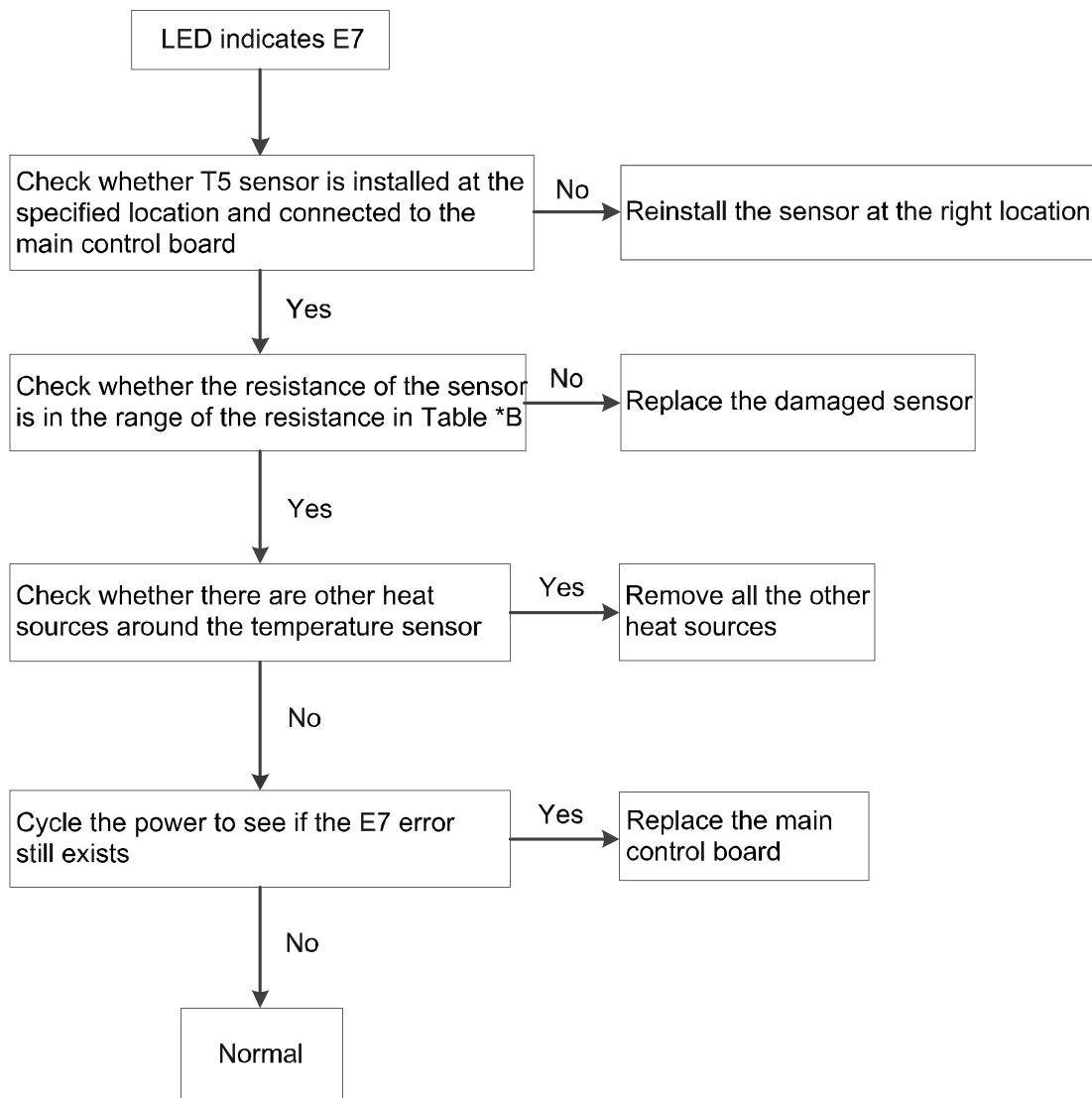


Fig. 47 —E7 Troubleshooting Chart

*B Refers to resistance of temperature sensor in Appendix.

A210282

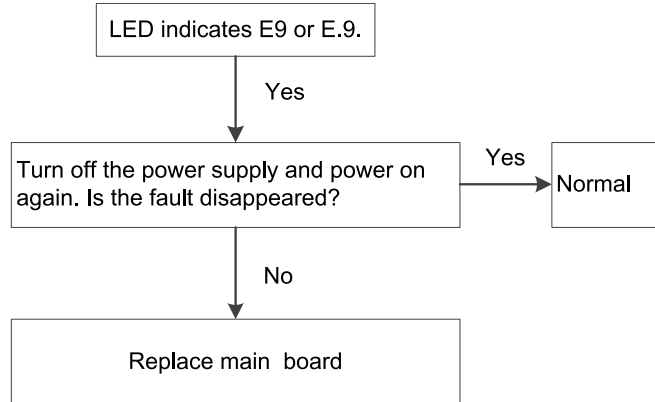
E9 OR E.9.: EEPROM ERROR

DEFINITION

- E9: EEPROM damage
- E.9.: Unmatched data for EEPROM

POSSIBLE CAUSES

- Chip or main board damaged
- Wrong software in EEPROM
- Wrong EEPROM mode



A210283

Fig. 48 —E9 or E.9 Troubleshooting Chart

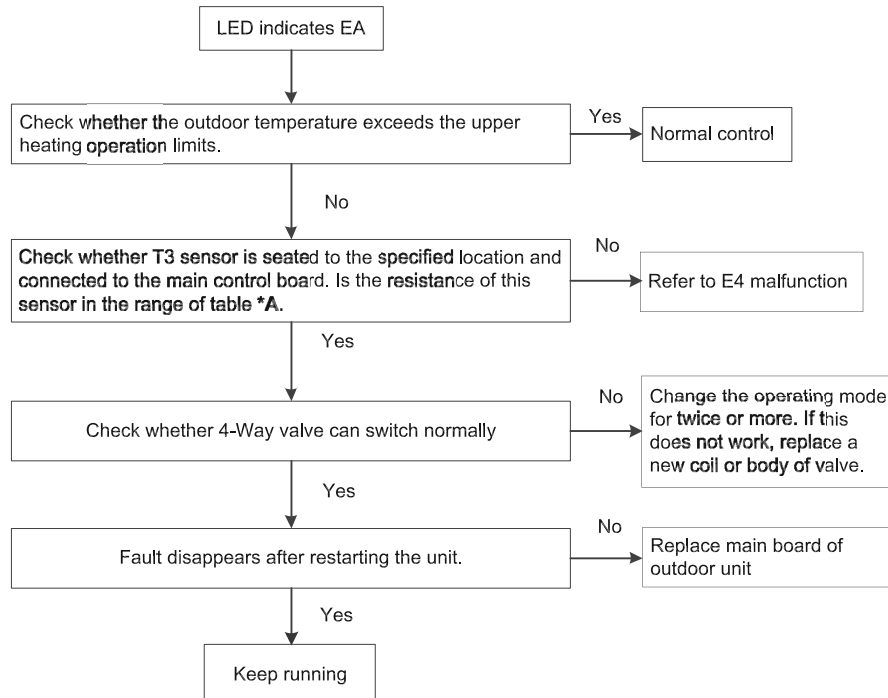
EA: DC FANS STAY AT ZONE A FOR MORE THAN FIVE MINUTES IN HEATING MODE

DEFINITION

Low pressure is too high even though the fan step minimum is $T3 > 75^{\circ}\text{F}$.

POSSIBLE CAUSES

- Operation temperature is too high
- Temperature sensor (T3) error
- 4-Way valve cannot switch successfully
- Damaged main board



A210284

Fig. 49 —EA Troubleshooting Chart

*A Refer to resistance table of ambient temperature sensor in Appendix.

P1: HIGH PRESSURE PROTECTION

DEFINITION

High pressure switch is activated for pressure > 638 psi.

POSSIBLE CAUSES

- Stop valve is closed
- The heat exchanger is dirty or blocked
- Excess refrigerant in the system
- Damaged main board
- Damaged high pressure sensor
- Refrigerant is blocked in high pressure zone

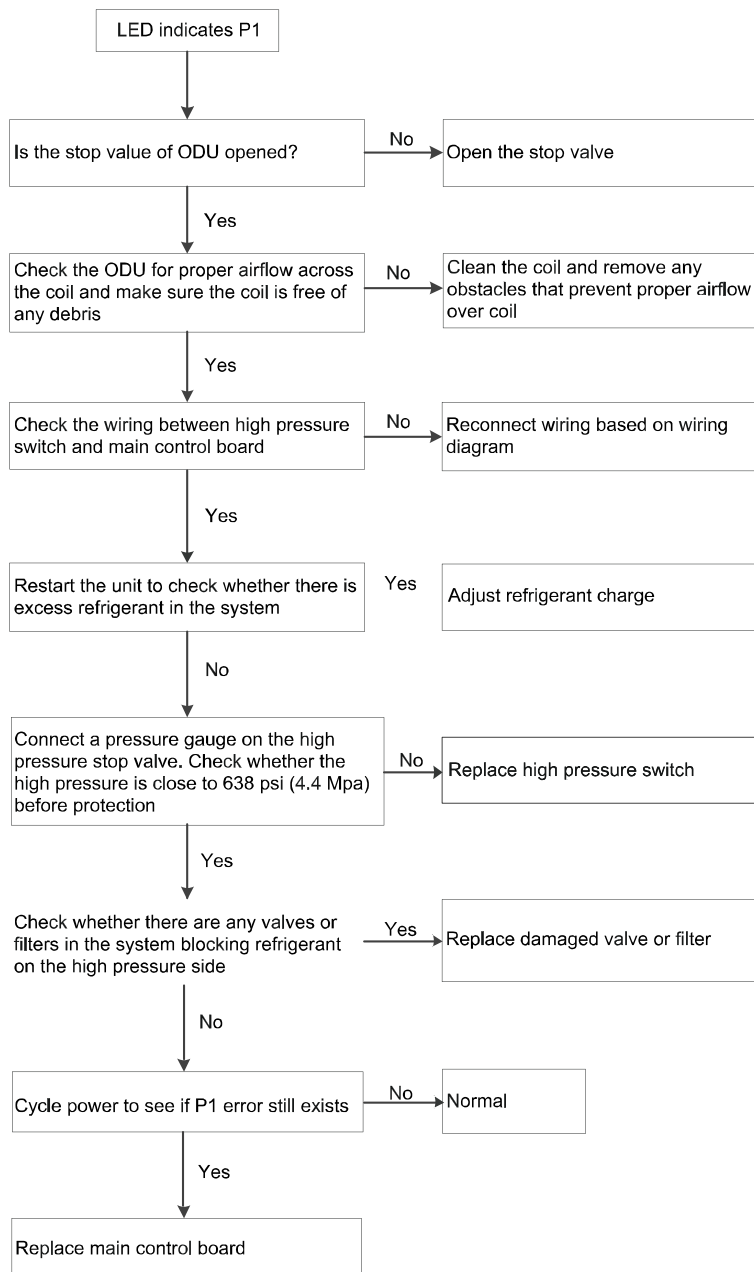


Fig. 50 —P1 Troubleshooting Chart

A210285

P2: LOW PRESSURE PROTECTION

DEFINITION

Low pressure switch is activated for pressure ≤ 20 psi

POSSIBLE CAUSES

- Stop valve is closed
- The heat exchanger is dirty or blocked
- Insufficient refrigerant in the system
- Damaged main board
- Low pressure resulted by refrigerant blocked on high pressure zone due to the damaged valve of IDU or ODU

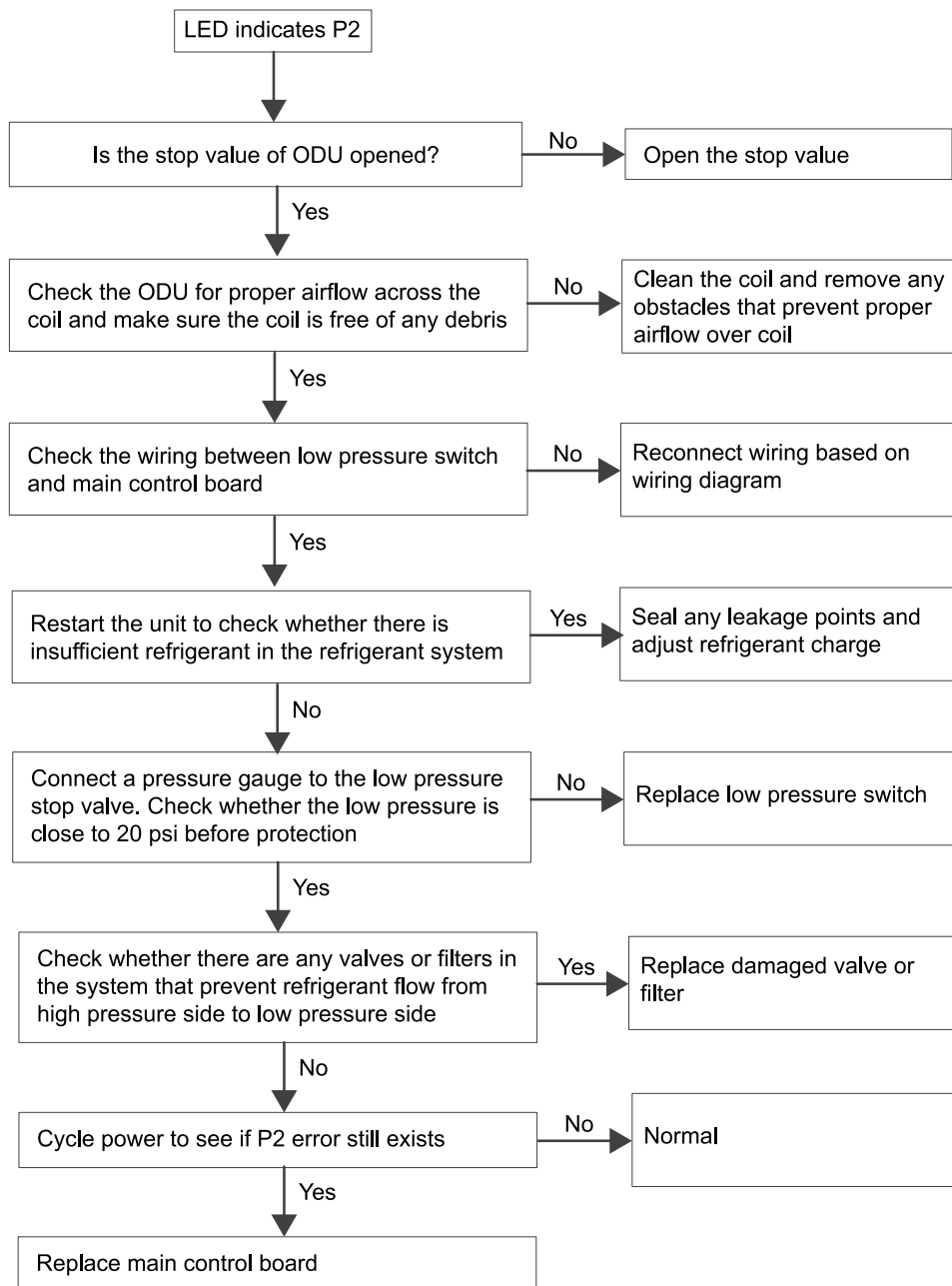


Fig. 51 —P2 Troubleshooting Chart

A210286

P3: INPUT CURRENT OVERLOAD PROTECTION

DEFINITION

Input current overload protection is activated when current is drawn above the allowable limit.

POSSIBLE CAUSES

- Stop valve is closed
- Improper power supply
- Excess refrigerant in the system
- Damaged valve or filter resulting in large pressure ratio
- Damaged main board

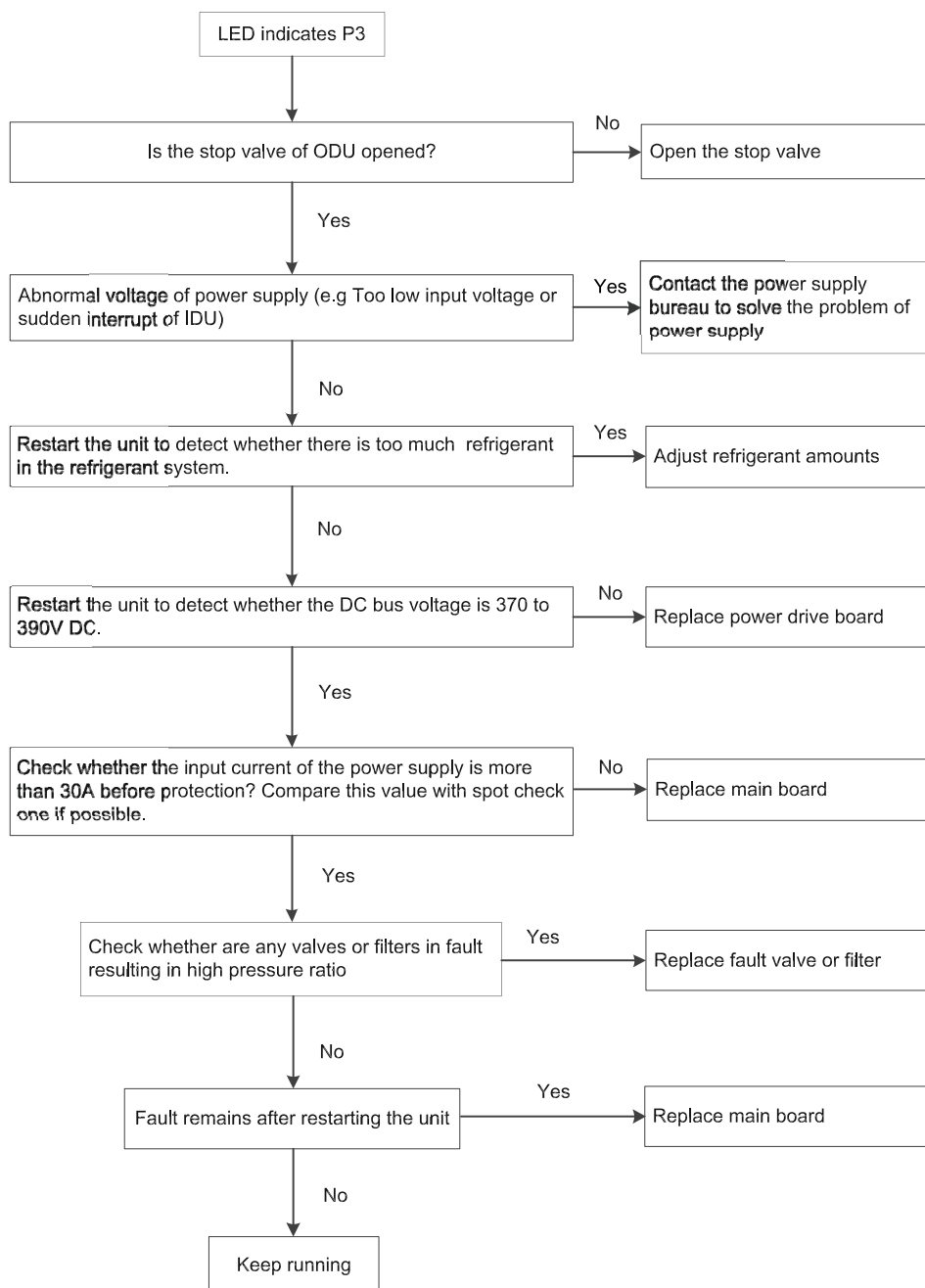


Fig. 52 —P3 Troubleshooting Chart

A210287

P4: DISCHARGE TEMPERATURE PROTECTION

DEFINITION

- Discharge temperature protection is activated when discharge temperature is higher than 230°F.
- System will restart once the discharge temperature (T5) is below 190°F.

POSSIBLE CAUSES

- Stop valve is closed
- Improper power supply
- Insufficient refrigerant in the system
- Damaged valve or filter resulting in large pressure ratio
- Damaged main board

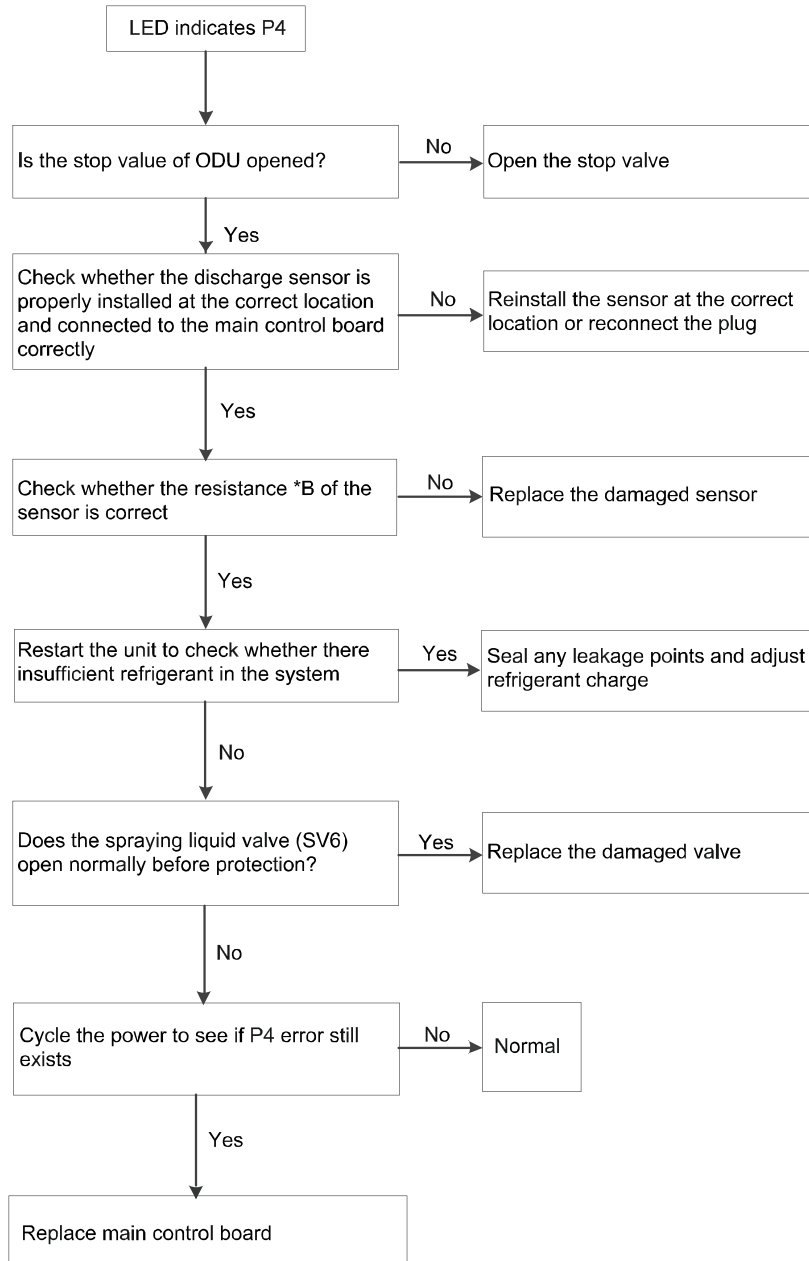


Fig. 53 —P4 Troubleshooting Chart

*B Refer to resistance temperature sensor in Appendix.

A210288

P5: CONDENSER TEMPERATURE PROTECTION

DEFINITION

- Condenser temperature protection is activated when condenser temperature is higher than 144°F.
- System will restart once the condensing temperature (T3) is below 126°F.

POSSIBLE CAUSES

- Stop valve is closed
- Improper airflow
- Temperature sensor error
- Other heat resources around T3
- Damaged main board

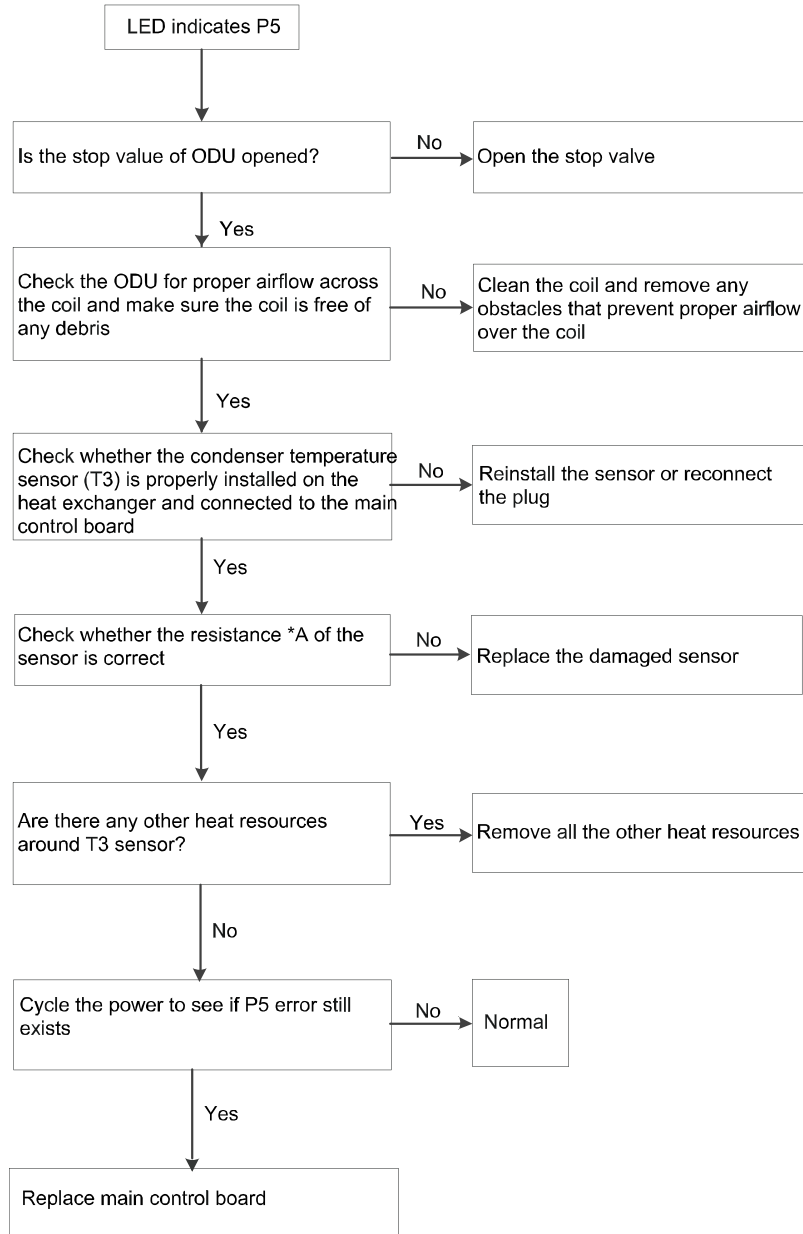


Fig. 54 —P5 Troubleshooting Chart

*A Refer to resistance of temperature sensor in Appendix.

A210289

P8: FAN SPEED EXCEEDS TARGET FAN MOTOR ROTATION FOR FIVE SECONDS OR MORE

DEFINITION

- When fan speed exceeds minimum target fan motor rotation (500 RPM) for five seconds or more, protection is activated.
- System will restart once the fan speed is < 400 RPM.

POSSIBLE CAUSES

Fan speed exceeds the target fan motor rotation due to excessive wind.

PE: HIGH INDOOR COIL TEMPERATURE (T2A) PROTECTION

DEFINITION

- High indoor coil temperature (T2A) protection is activated when coil temperature is higher than 144°F.
- The unit will restart once the coil temperature (T2A) is below 109.4°F.

POSSIBLE CAUSES

- Air filter or indoor coil are dirty
- Temperature sensor (T2A) error
- Other heat resources around T2A
- Damaged main board of indoor unit

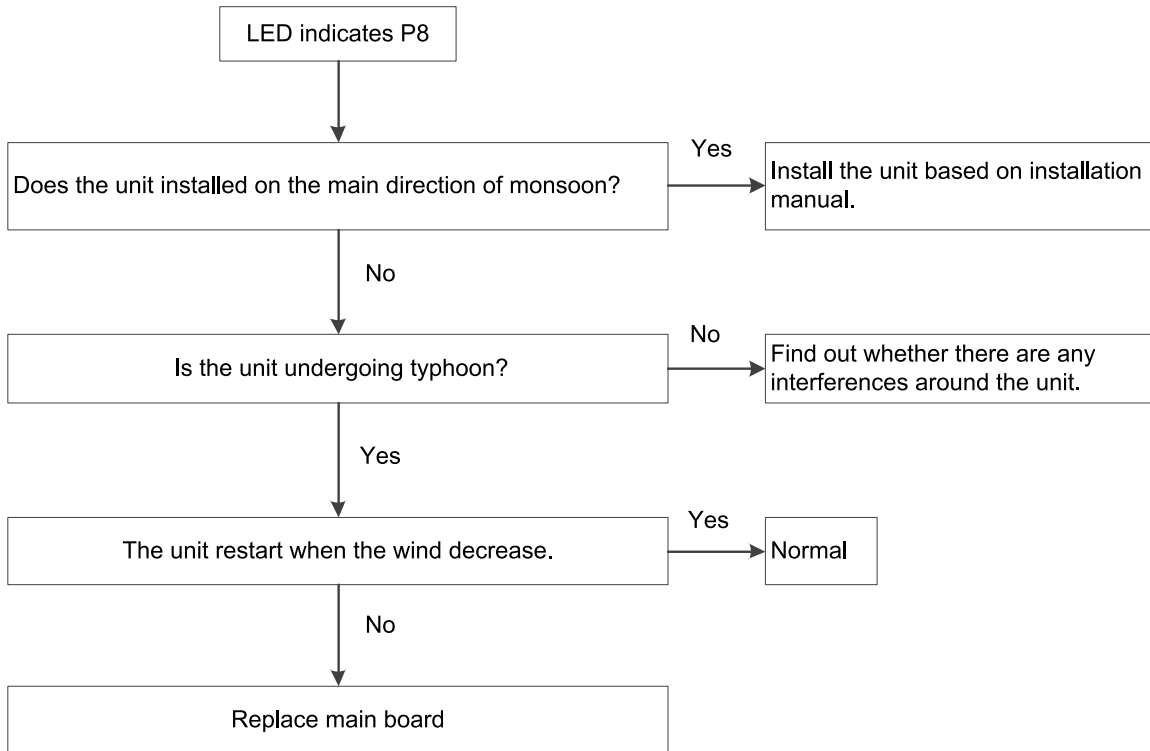


Fig. 55 —P8 Troubleshooting Chart

*A Refer to resistance of temperature sensor in Appendix.

A210290

PP: LIQUID SLUGGING PROTECTION

DEFINITION

The discharge superheat of compressor is less than 5.4°F for 50 minutes.

POSSIBLE CAUSES

- Defective discharge temperature sensor
- Damaged main board
- Excess refrigerant charge
- Improper valve function of IDU or ODU
- Defective indoor unit fan

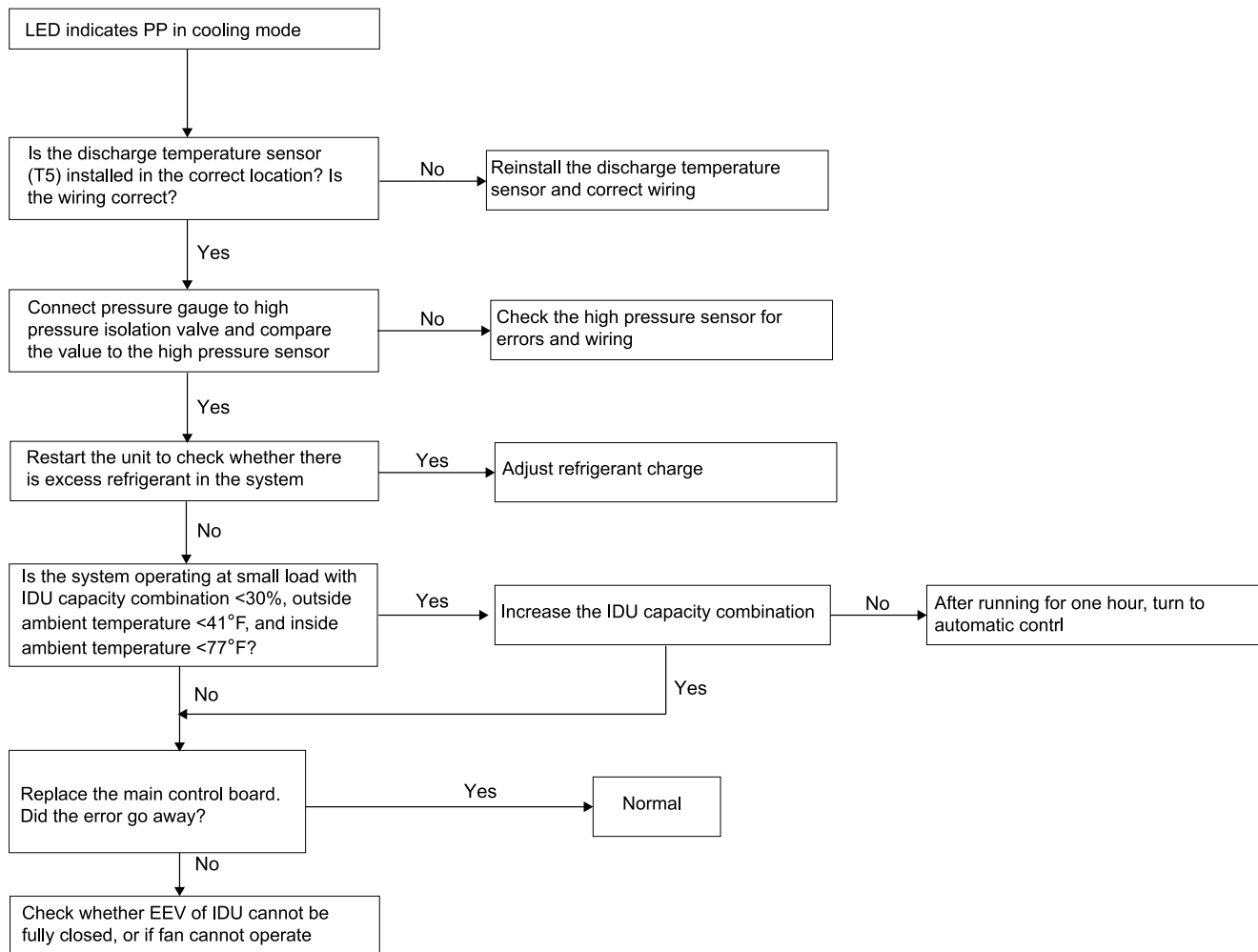


Fig. 56 —PP Troubleshooting Chart

A210291

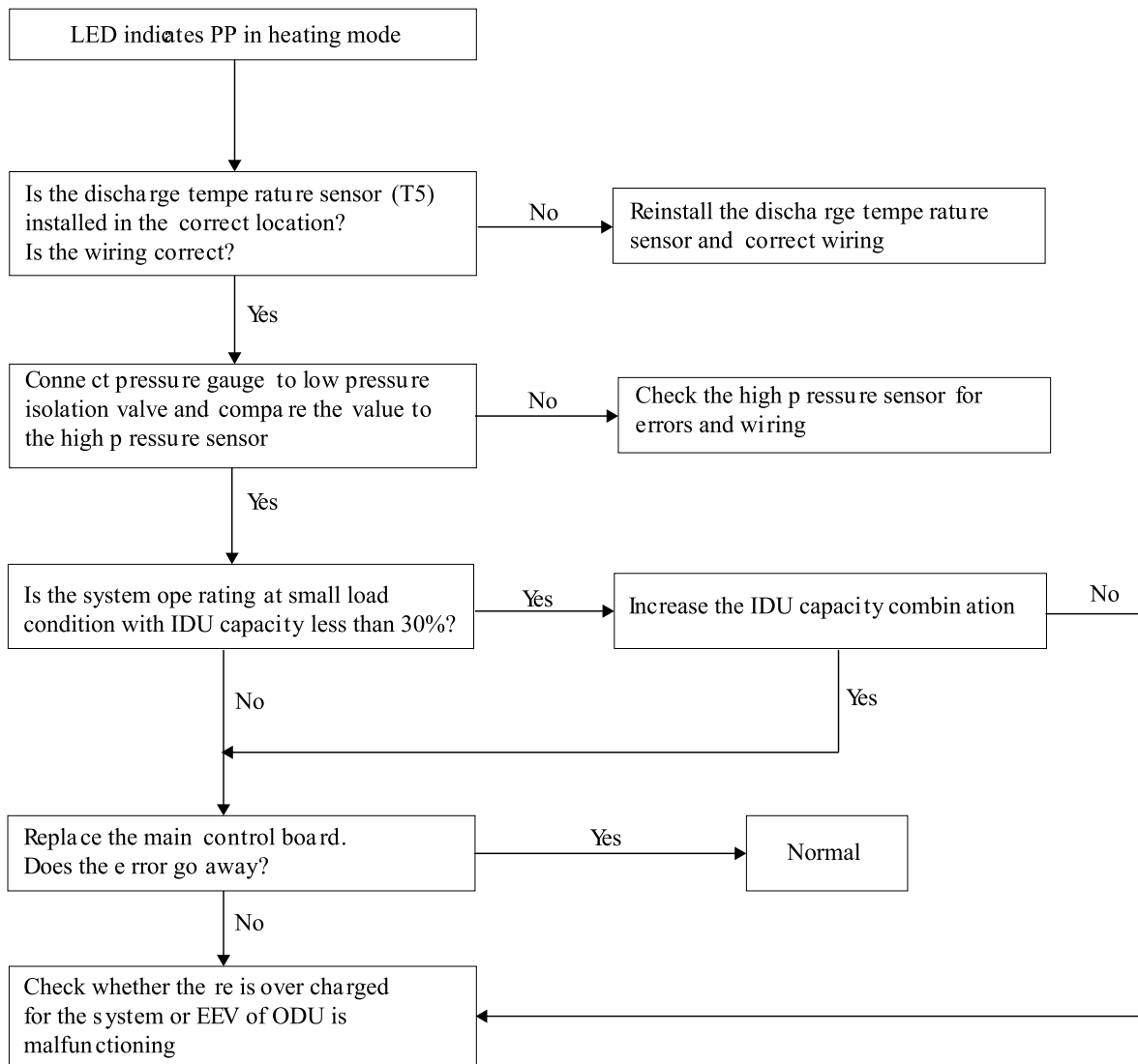


Fig. 57 —PP Troubleshooting Chart

A210292

F1: DC BUS VOLTAGE TOO LOW

DEFINITION

If DC bus voltage of compressor module P and N is less than 200 VDC for five seconds, relay on the main board is inoperable.

POSSIBLE CAUSES

- Abnormal power supply to power drive board
- Damaged rectifier
- Damaged DC fan motor
- Damaged power drive board or main board
- The communication wire between power drive board and main board is loose

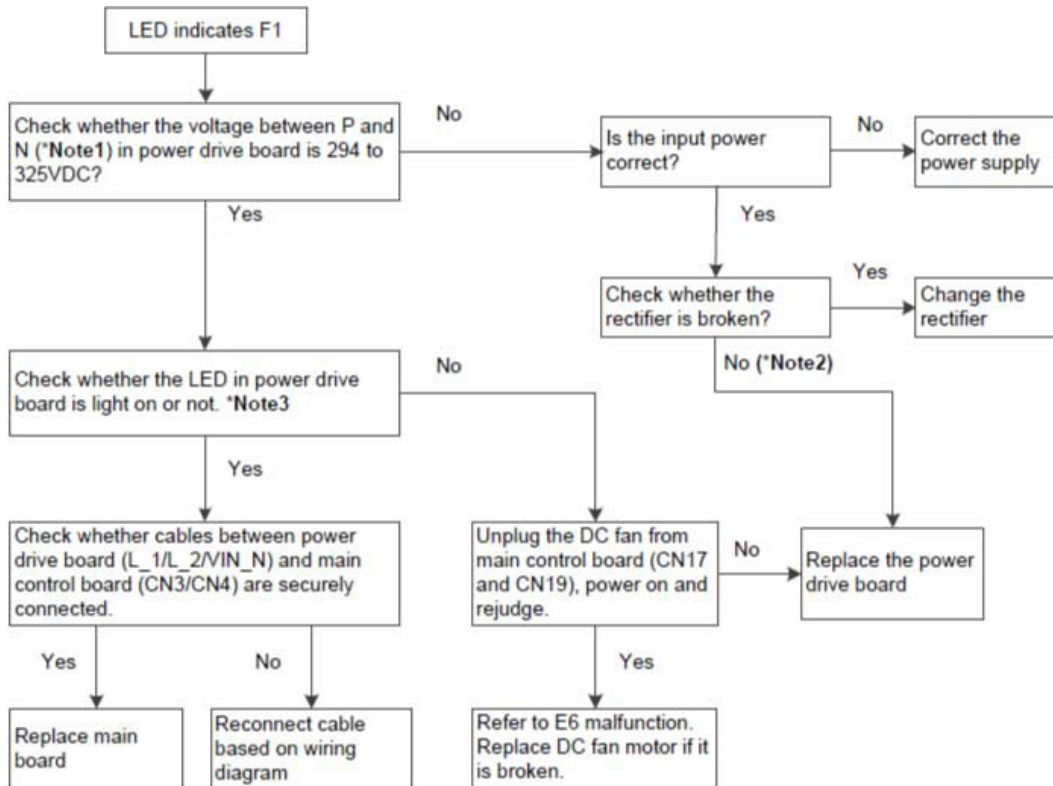


Fig. 58 —F1 Troubleshooting Chart

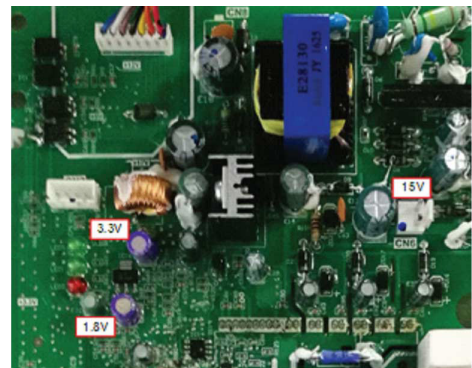
Note: Check the voltage between red and black terminals.

Note: Check whether these three voltage are normal or not.

Note: Check whether the PFC and IPM in power drive are shorted.



A210294



A210295

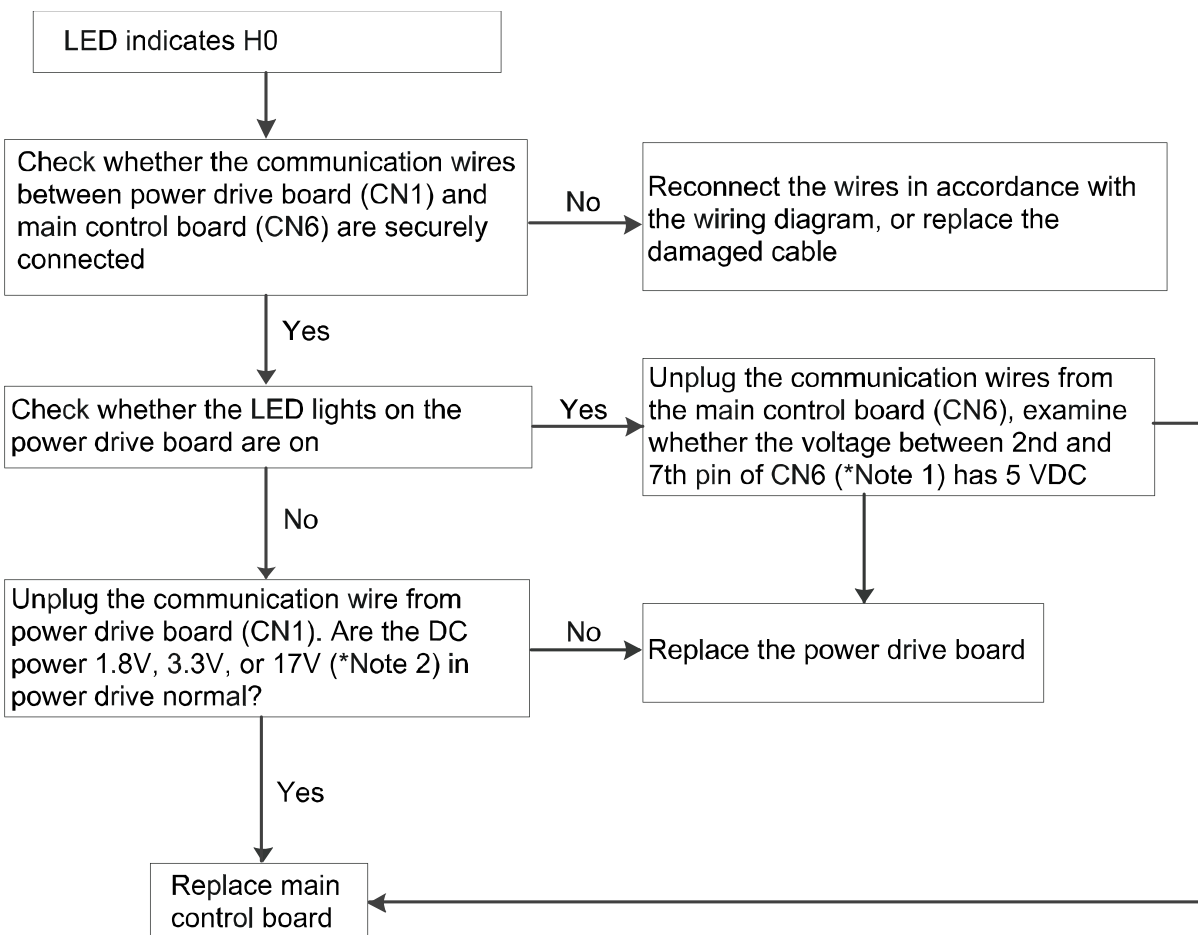
H0: COMMUNICATION ERROR BETWEEN POWER DRIVE AND MAIN CONTROL BOARD

DEFINITION

Communication error between power drive and main control board.

POSSIBLE CAUSES

- Communication wire between power drive board and main board is loose
- Damaged power drive board
- Damaged main board

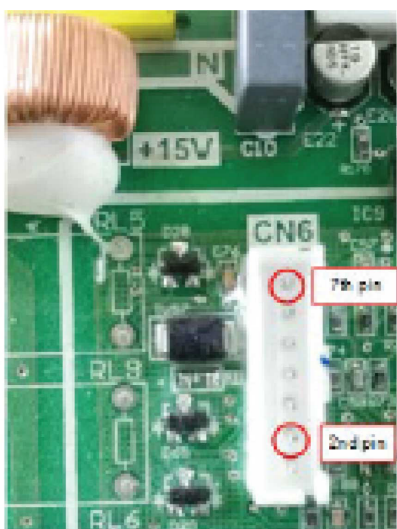


A210296

Fig. 59 —H0 Troubleshooting Chart

***NOTE 1:**

*** NOTE 2:** Refer to the picture in F1 malfunction.



A210297

L0~L9 OR H4: COMPRESSOR MODULE PROTECTION

DEFINITION

Error	Detailed Definition	Number of Flashing Times for Green LED	Red LED
Compressor module protection	L0: Error in compressor module	8	Light on constantly
	L1: DC bus under-voltage protection	9	
	L2: DC bus over-voltage protection	10	
	L4: Compressor MCE error	12	
	L8: Compressor speed difference between set and run is more than 15 rps	16	
	L9: Compressor speed difference is more than 15 rps in one second	17	

H4: L0 or L1 errors happen for three times in 60 seconds. The unit will stop and requires recycling power to restart.



A210298

Fig. 60 —L0~L9 Troubleshooting Chart

POSSIBLE CAUSES

- ODU system in poor heat dissipation
- IPM in poor heat dissipation
- Improper power supply
- Damaged compressor module in power drive board
- Burnt compressor
- Improper refrigerant in the system

L0: ERROR IN COMPRESSOR MODULE

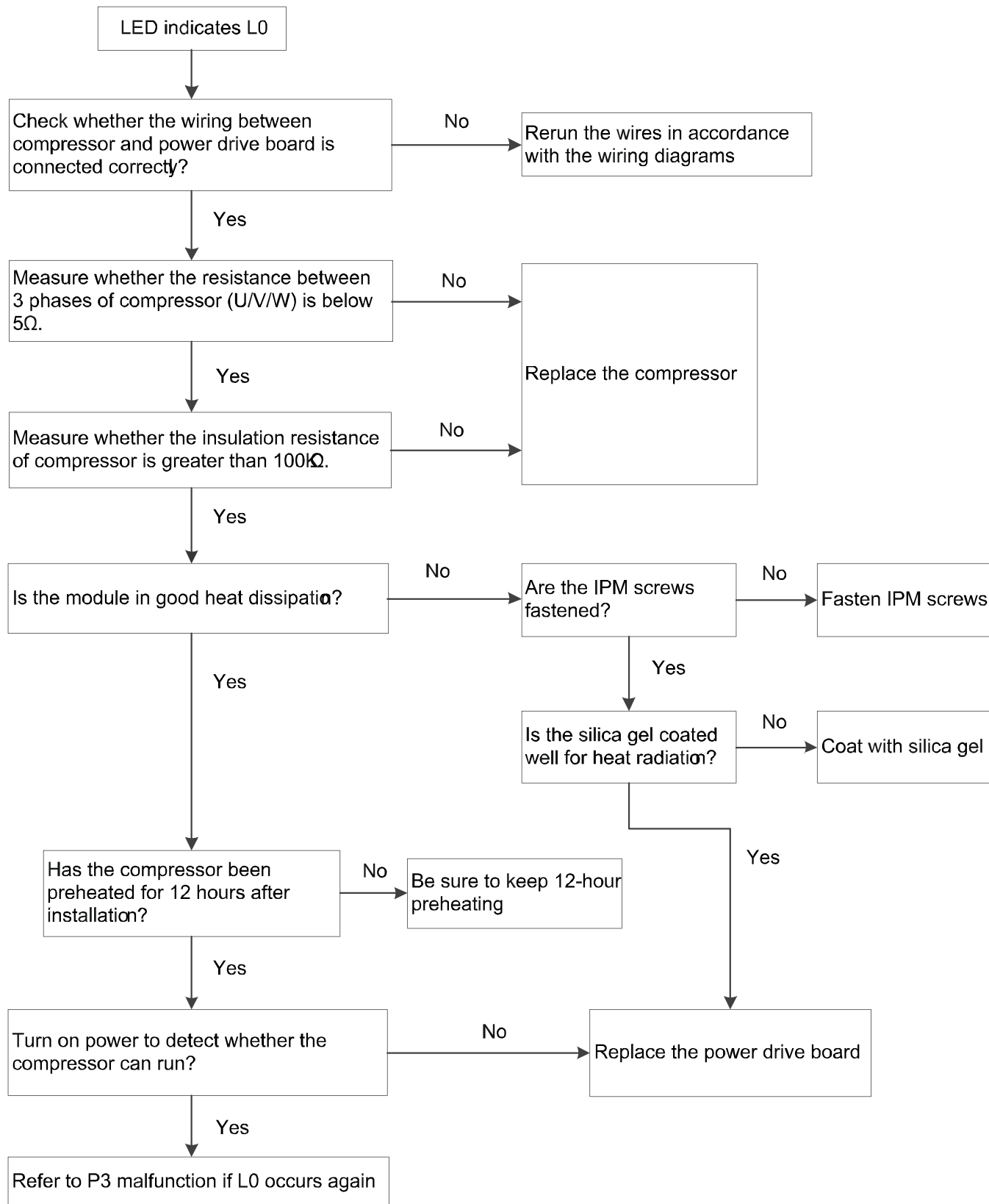


Fig. 61 —L0 Troubleshooting Chart

A210299

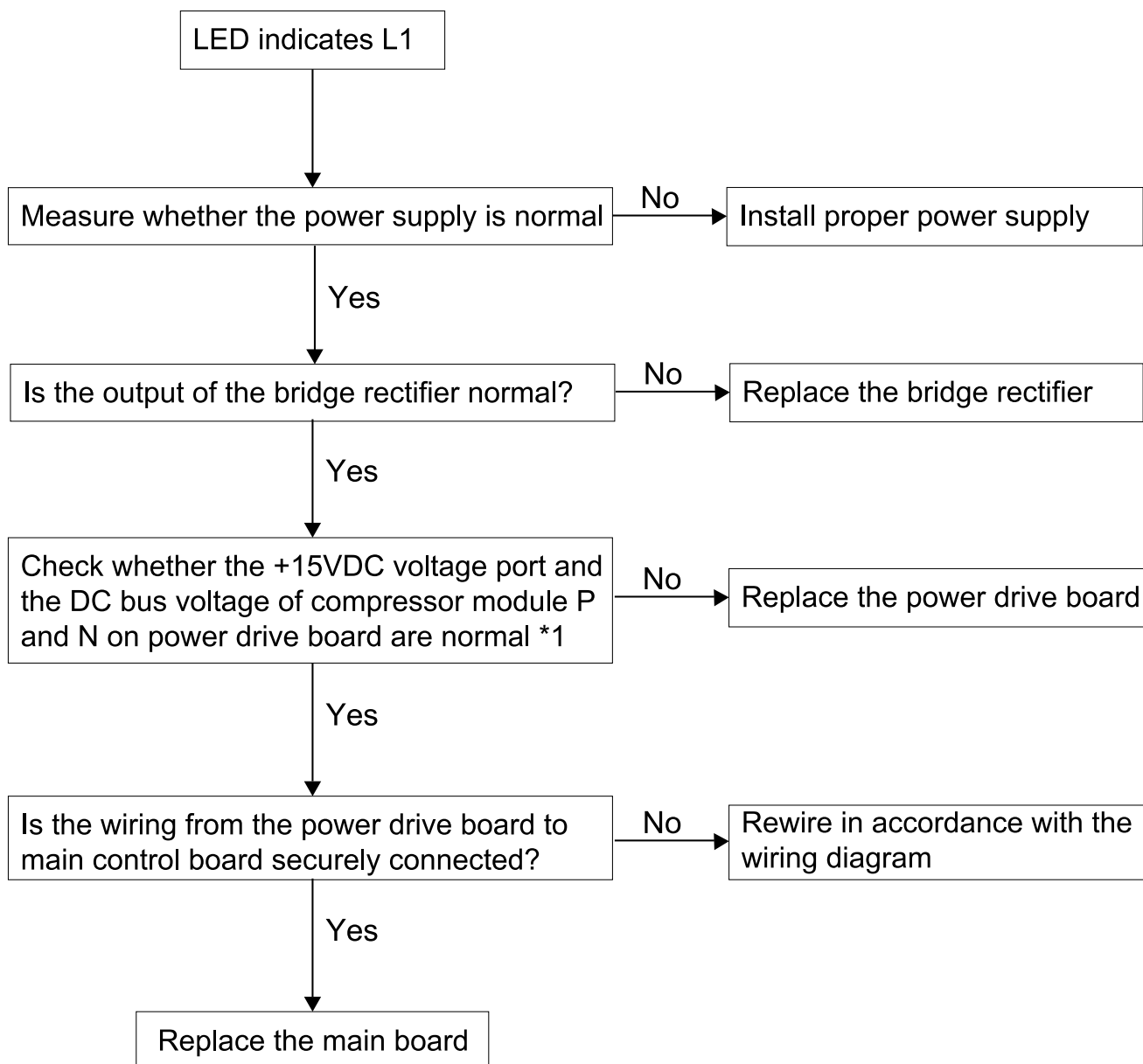


Fig. 62 —L1 Troubleshooting Chart

*1 L1 error will be reported when it is lower than 220 VDC.

A210300

L2: DC BUS OVER-VOLTAGE PROTECTION

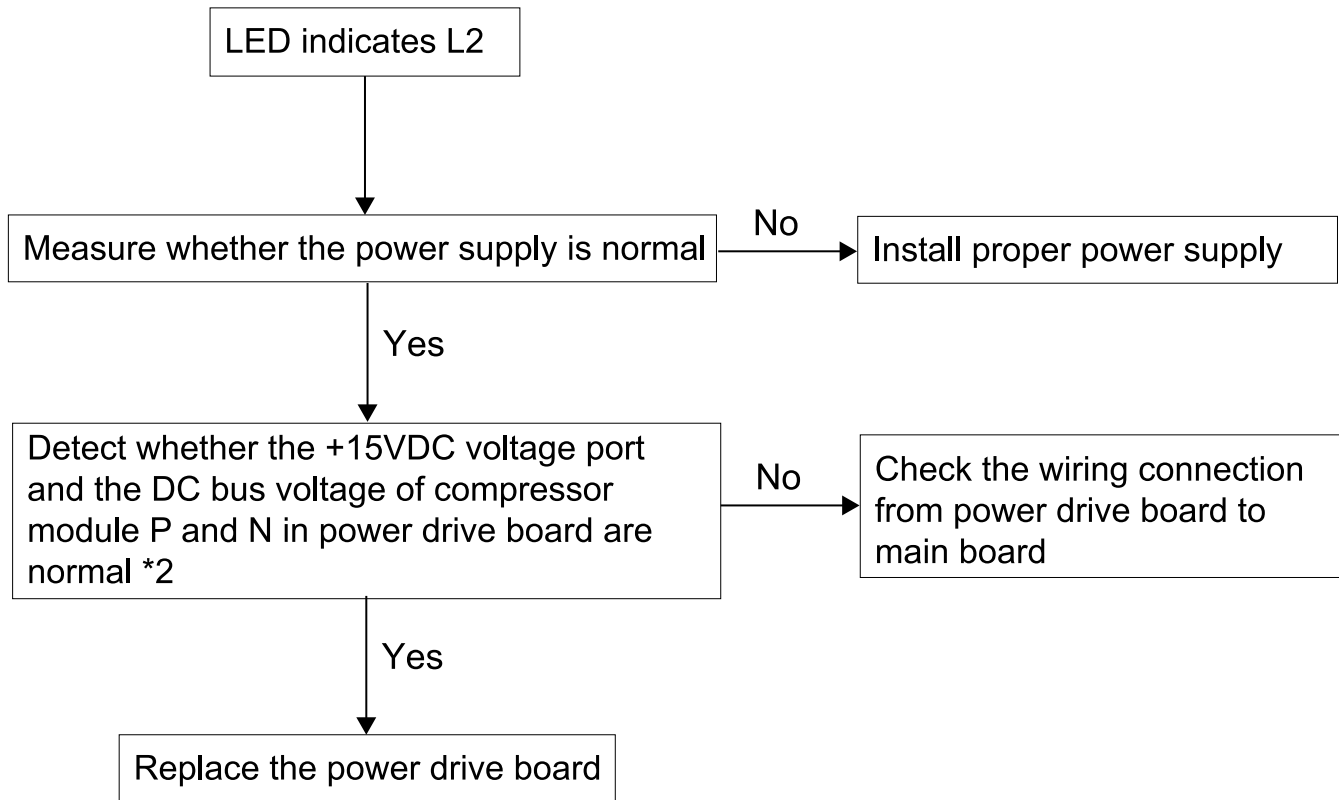


Fig. 63 —L2 Troubleshooting Chart

*2 L2 fault will be reported when it is higher than 500 VDC.

A210301

L4: COMPRESSOR MCE ERROR

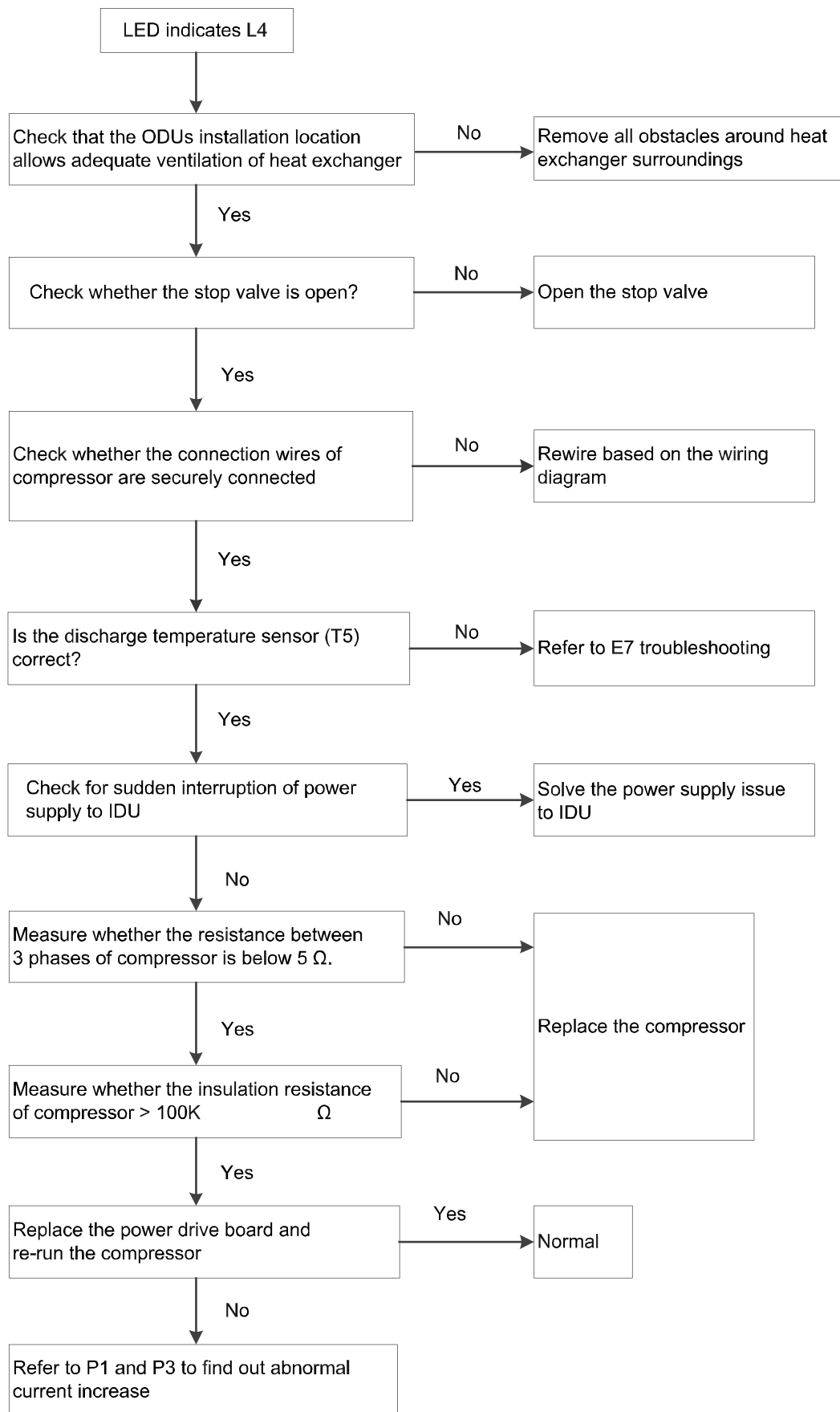


Fig. 64 —L4 Troubleshooting Chart

A210302

L8: COMPRESSOR SPEED DIFFERENCE BETWEEN SET AND RUN IS MORE THAN 15 RPS

L9: COMPRESSOR SPEED DIFFERENCE IS MORE THAN 15 RPS IN ONE SECOND

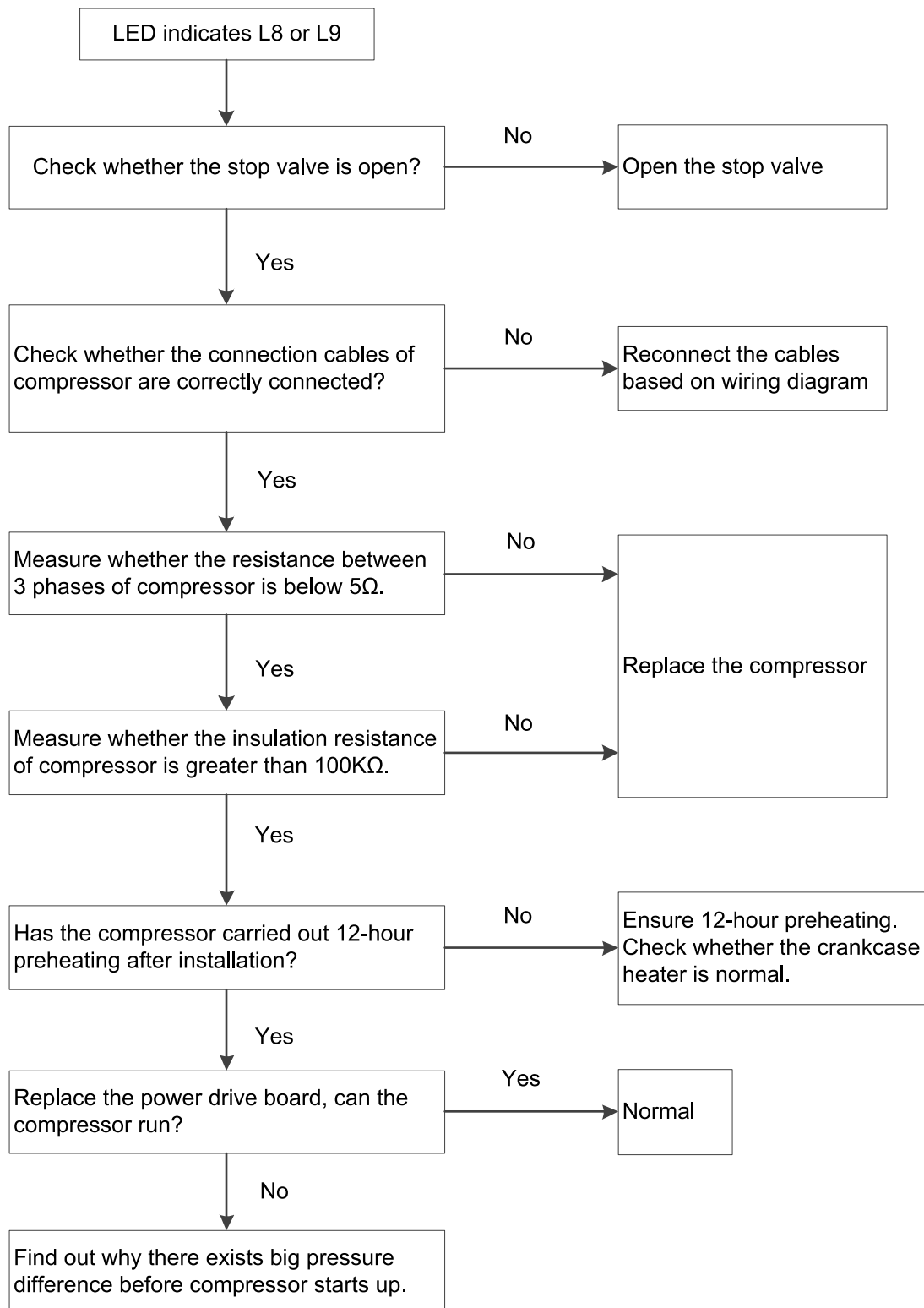


Fig. 65 —L8 and L9 Troubleshooting Chart

A210303

APPENDIX

Resistance of Temperature Sensor (A)*

Table 36 —Temperature Sensor Resistance

Temp. (°F)	Resistance (KΩ)	Voltage (V)	Temp. (°F)	Resistance (KΩ)	Voltage (V)	Temp. (°F)	Resistance (KΩ)	Voltage (V)
-38.2	387.13	0.10	51.8	19.62	1.46	141.8	2.27	3.90
-36.4	360.98	0.11	53.6	18.66	1.51	143.6	2.19	3.93
-34.6	336.73	0.12	55.4	17.75	1.56	145.4	2.11	3.96
-32.8	314.24	0.12	57.2	16.89	1.61	147.2	2.04	3.99
-31.0	293.38	0.13	59.0	16.08	1.67	149.0	1.97	4.02
-29.2	274.01	0.14	60.8	15.31	1.72	150.8	1.90	4.05
-27.4	256.05	0.15	62.6	14.59	1.78	152.6	1.83	4.07
-25.6	239.36	0.16	64.4	13.90	1.83	154.4	1.77	4.10
-23.8	223.87	0.17	66.2	13.25	1.89	156.2	1.71	4.13
-22.0	209.48	0.18	68.0	12.63	1.95	158.0	1.65	4.15
-20.2	196.11	0.20	69.8	12.05	2.00	159.8	1.59	4.17
-18.4	183.68	0.21	71.6	11.49	2.06	161.6	1.54	4.20
-16.6	172.12	0.22	73.4	10.97	2.12	163.4	1.49	4.22
-14.8	161.36	0.24	75.2	10.47	2.17	165.2	1.44	4.24
-13.0	151.34	0.25	77.0	10.00	2.23	167.0	1.39	4.26
-11.2	142.02	0.27	78.8	9.55	2.28	168.8	1.34	4.28
-9.4	133.32	0.28	80.6	9.13	2.34	170.6	1.30	4.30
-7.6	125.22	0.30	82.4	8.72	2.40	172.4	1.26	4.32
-5.8	117.66	0.32	84.2	8.34	2.46	174.2	1.22	4.34
-4.0	110.60	0.34	86.0	7.97	2.51	176.0	1.18	4.36
-2.2	104.02	0.36	87.8	7.63	2.57	177.8	1.14	4.38
-0.4	97.86	0.38	89.6	7.30	2.62	179.6	1.10	4.40
1.4	92.11	0.40	91.4	6.98	2.68	181.4	1.07	4.41
3.2	86.73	0.42	93.2	6.69	2.73	183.2	1.03	4.43
5.0	81.69	0.45	95.0	6.40	2.79	185.0	1.00	4.45
6.8	76.98	0.47	96.8	6.13	2.84	186.8	0.97	4.46
8.6	72.57	0.50	98.6	5.88	2.89	188.6	0.94	4.48
10.4	68.44	0.53	100.4	5.63	2.94	190.4	0.91	4.49
12.2	64.57	0.55	102.2	5.40	2.99	192.2	0.88	4.51
14.0	60.93	0.58	104.0	5.18	3.04	194.0	0.86	4.52
15.8	57.53	0.61	105.8	4.97	3.09	195.8	0.83	4.53
17.6	54.33	0.64	107.6	4.76	3.14	197.6	0.80	4.54
19.4	51.33	0.68	109.4	4.57	3.19	199.4	0.78	4.56
21.2	48.51	0.71	111.2	4.39	3.24	201.2	0.76	4.57
23.0	45.87	0.75	113.0	4.21	3.28	203.0	0.73	4.58
24.8	43.38	0.78	114.8	4.05	3.33	204.8	0.71	4.59
26.6	41.05	0.82	116.6	3.89	3.37	206.6	0.69	4.60
28.4	38.85	0.86	118.4	3.73	3.42	208.4	0.67	4.61
30.2	36.78	0.90	120.2	3.59	3.46	210.2	0.65	4.62
32.0	34.84	0.94	122.0	3.45	3.50	212.0	0.63	4.63
33.8	33.01	0.98	123.8	3.32	3.54	213.8	0.61	4.64
35.6	31.29	1.02	125.6	3.19	3.58	215.6	0.60	4.65
37.4	29.67	1.07	127.4	3.07	3.62	217.4	0.58	4.66
39.2	28.14	1.11	129.2	2.95	3.66	219.2	0.56	4.67
41.0	26.70	1.16	131.0	2.84	3.69	221.0	0.55	4.68
42.8	25.34	1.21	132.8	2.74	3.73			
44.6	24.06	1.25	134.6	2.64	3.77			
46.4	22.85	1.30	136.4	2.54	3.80			
48.2	21.71	1.35	138.2	2.45	3.83			
50.0	20.63	1.40	140.0	2.30	3.87			

* Outdoor unit: T3, T4

Indoor unit: T1, T2A, T2B

The Resistance of 77°F is 10 KΩ ± 1%. The relation between voltage and resistance is:

Resistance of Temperature Sensor (B)**

Table 37 —Temperature Sensor Resistance

Temp. (°F)	Resistance (KΩ)	Voltage (V)
-4.0	542.70	0.0732
-2.2	511.90	0.0775
-0.4	483.00	0.0821
1.4	455.90	0.0869
3.2	430.50	0.0919
5.0	406.70	0.0972
6.8	384.30	0.1027
8.6	363.30	0.1085
10.4	343.60	0.1146
12.2	325.10	0.1210
14.0	307.70	0.1276
15.8	291.30	0.1346
17.6	275.90	0.1419
19.4	261.40	0.1496
21.2	247.80	0.1575
23.0	234.90	0.1659
24.8	222.80	0.1746
26.6	211.40	0.1836
28.4	200.70	0.1930
30.2	190.50	0.2030
32.0	180.90	0.2133
33.8	171.90	0.2239
35.6	163.30	0.2352
37.4	155.20	0.2468
39.2	147.60	0.2589
41.0	140.40	0.2715
42.8	133.50	0.2847
44.6	127.10	0.2982
46.4	121.00	0.3123
48.2	115.20	0.3270
50.0	109.80	0.3419
51.8	104.60	0.3577
53.6	99.69	0.3740
55.4	95.05	0.3908
57.2	90.66	0.4082
59.0	86.49	0.4262
60.8	82.54	0.4448
62.6	78.79	0.4640
64.4	75.2	0.48
66.2	71.9	0.50
68.0	68.7	0.52
69.8	65.6	0.55
71.6	62.7	0.57
73.4	60.0	0.59
75.2	57.4	0.61
77.0	54.9	0.64
78.8	52.5	0.66
80.6	50.3	0.69
82.4	48.1	0.72
84.2	46.1	0.74
86.0	44.2	0.77
87.8	42.3	0.80

Temp. (°F)	Resistance (KΩ)	Voltage (V)
89.6	40.57	0.83
91.4	38.89	0.86
93.2	37.30	0.89
95.0	35.78	0.92
96.8	34.32	0.95
98.6	32.94	0.98
100.4	31.62	1.01
102.2	30.36	1.05
104.0	29.15	1.08
105.8	28.00	1.12
107.6	26.90	1.15
109.4	25.86	1.19
111.2	24.85	1.22
113.0	23.89	1.26
114.8	22.89	1.30
116.6	22.10	1.34
118.4	21.26	1.37
120.2	20.46	1.41
122.0	19.69	1.45
123.8	18.96	1.49
125.6	18.26	1.53
127.4	17.58	1.57
129.2	16.94	1.61
131.0	16.32	1.65
132.8	15.73	1.69
134.6	15.16	1.73
136.4	14.62	1.78
138.2	14.09	1.82
140.0	13.59	1.86
141.8	13.11	1.90
143.6	12.65	1.94
145.4	12.21	1.99
147.2	11.79	2.03
149.0	11.38	2.07
150.8	10.99	2.11
152.6	10.61	2.16
154.4	10.25	2.20
156.2	9.90	2.24
158.0	9.57	2.2860
159.8	9.25	2.3284
161.6	8.94	2.3706
163.4	8.64	2.4127
165.2	8.36	2.4546
167.0	8.08	2.4963
168.8	7.82	2.5378
170.6	7.57	2.5790
172.4	7.32	2.6201
174.2	7.09	2.6608
176.0	6.80	2.7013
177.8	6.64	2.7413
179.6	6.43	2.7812
181.4	6.23	2.8205

Temp. (°F)	Resistance (KΩ)	Voltage (V)
183.2	6.03	2.86
185.0	5.84	2.90
186.8	5.66	2.94
188.6	5.49	2.97
190.4	5.32	3.01
192.2	5.16	3.05
194.0	5.00	3.08
195.8	4.85	3.12
197.6	4.70	3.16
199.4	4.56	3.19
201.2	4.43	3.23
203.0	4.29	3.26
204.8	4.17	3.30
206.6	4.04	3.33
208.4	3.93	3.36
210.2	3.81	3.39
212.0	3.70	3.43
213.8	3.59	3.46
215.6	3.49	3.49
217.4	3.39	3.52
219.2	3.30	3.55
221.0	3.20	3.58
222.8	3.11	3.61
224.6	3.02	3.63
226.4	2.94	3.66
228.2	2.86	3.69
230.0	2.78	3.72
231.8	2.70	3.74
233.6	2.63	3.77
235.4	2.56	3.79
237.2	2.49	3.82
239.0	2.42	3.84
240.8	2.36	3.87
242.6	2.29	3.89
244.4	2.23	3.91
246.2	2.17	3.94
248.0	2.12	3.96
249.8	2.06	3.98
251.6	2.01	4.00
253.4	1.95	4.02
255.2	1.90	4.04
257.0	1.86	4.06
258.8	1.81	4.08
260.6	1.76	4.10
262.4	1.72	4.12
264.2	1.67	4.14
266.0	1.63	4.16

** Discharge temperature sensor (T5) of outdoor unit

The Resistance of 194°F is 5 KΩ ± 3%. The relation between voltage and resistance is:

Electrical Wiring Diagrams

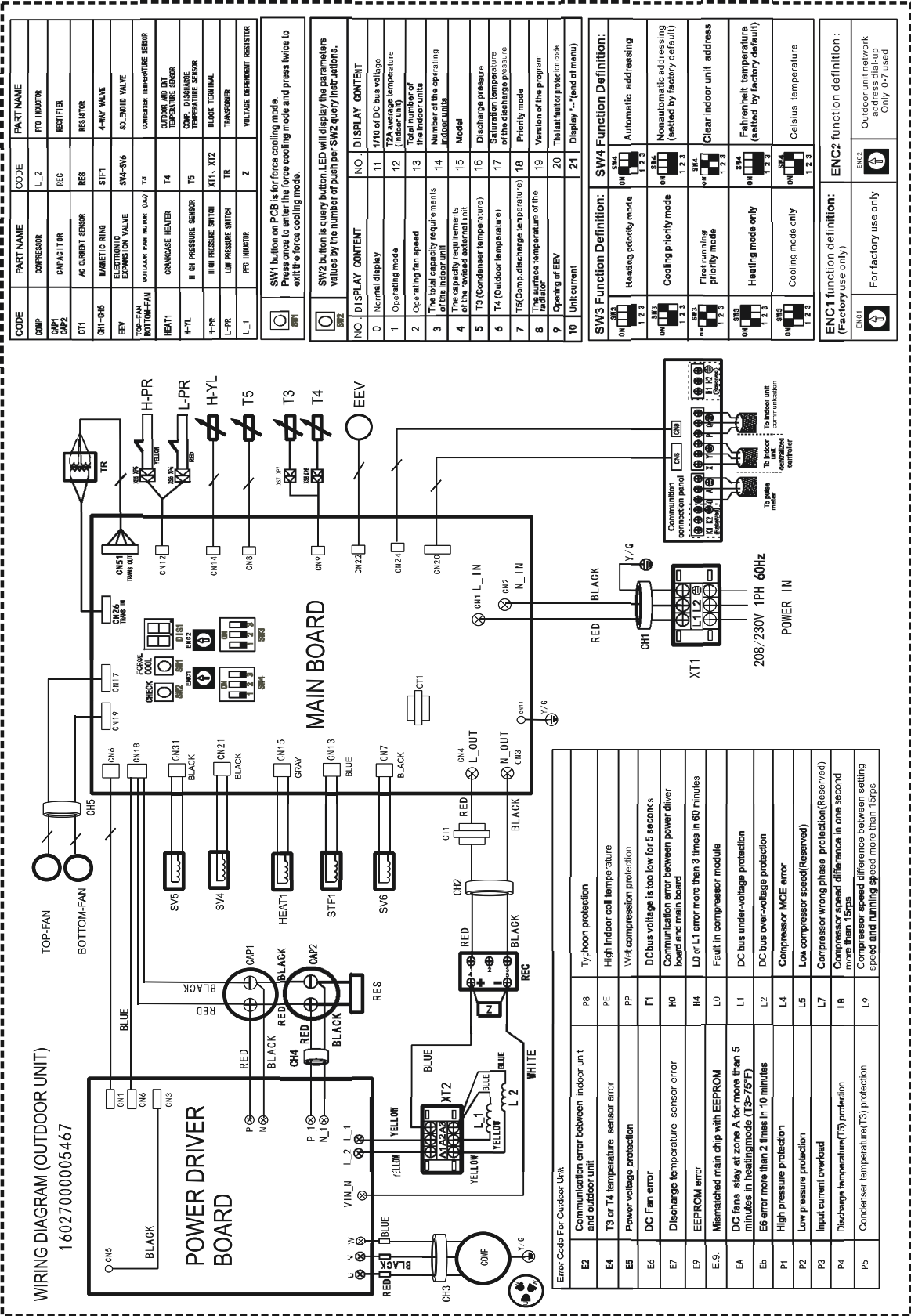


Fig. 66 —Wiring Diagram

A210304

BILL OF MATERIAL (BOM)

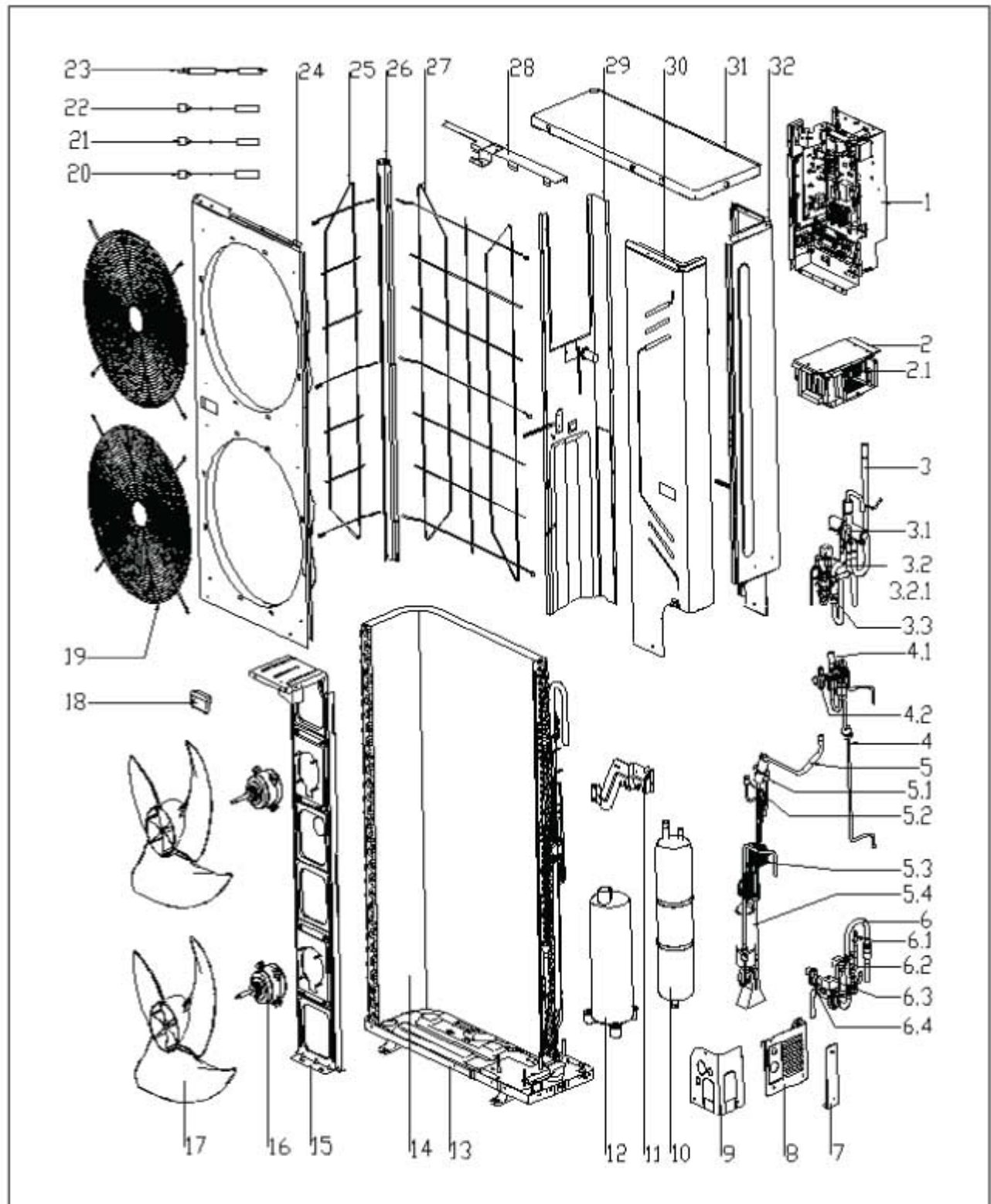
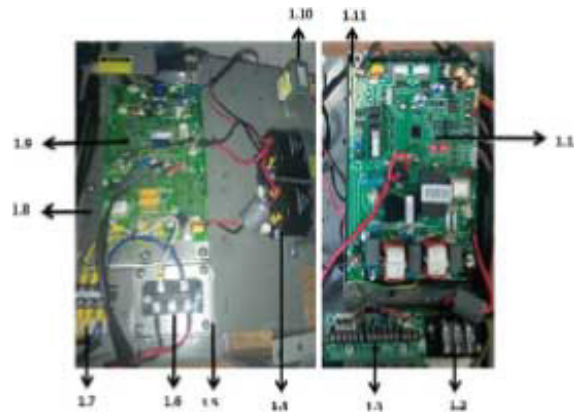


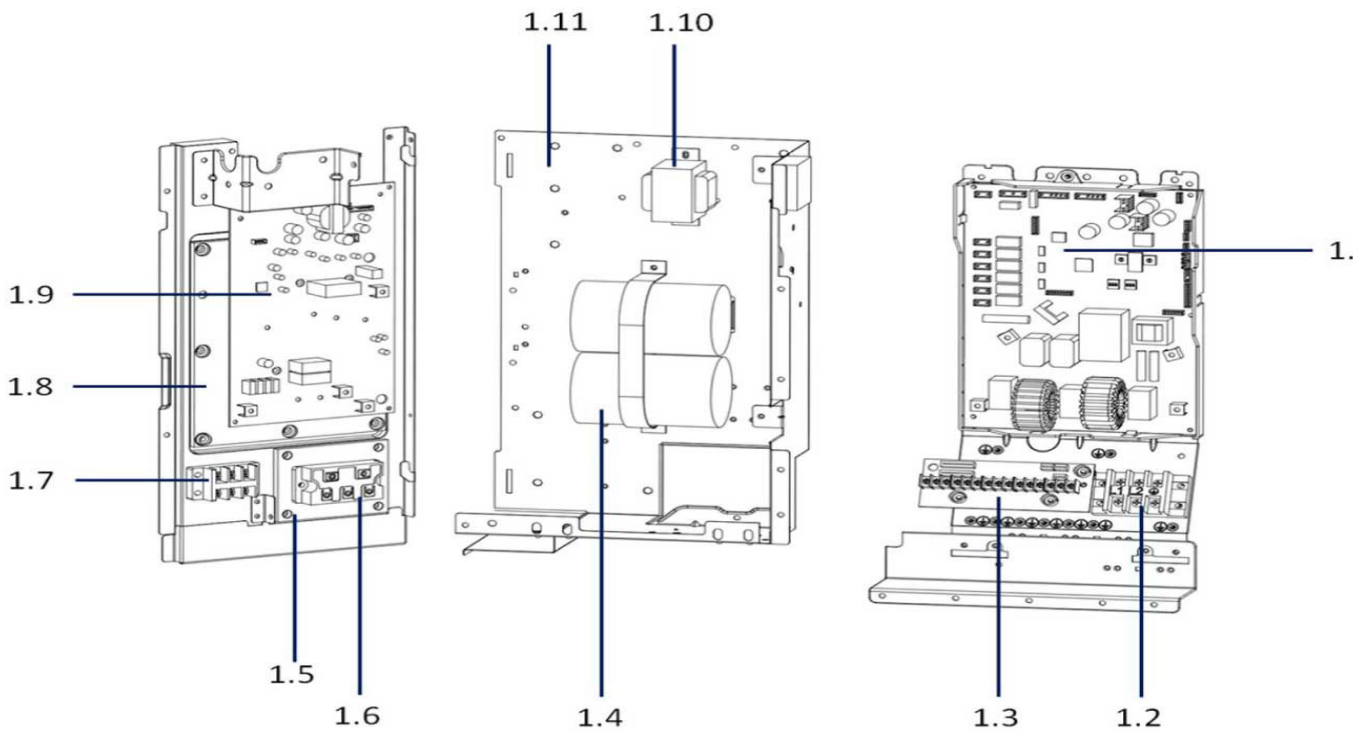
Fig. 67 —VRF Outdoor Unit Internal Components

A210305



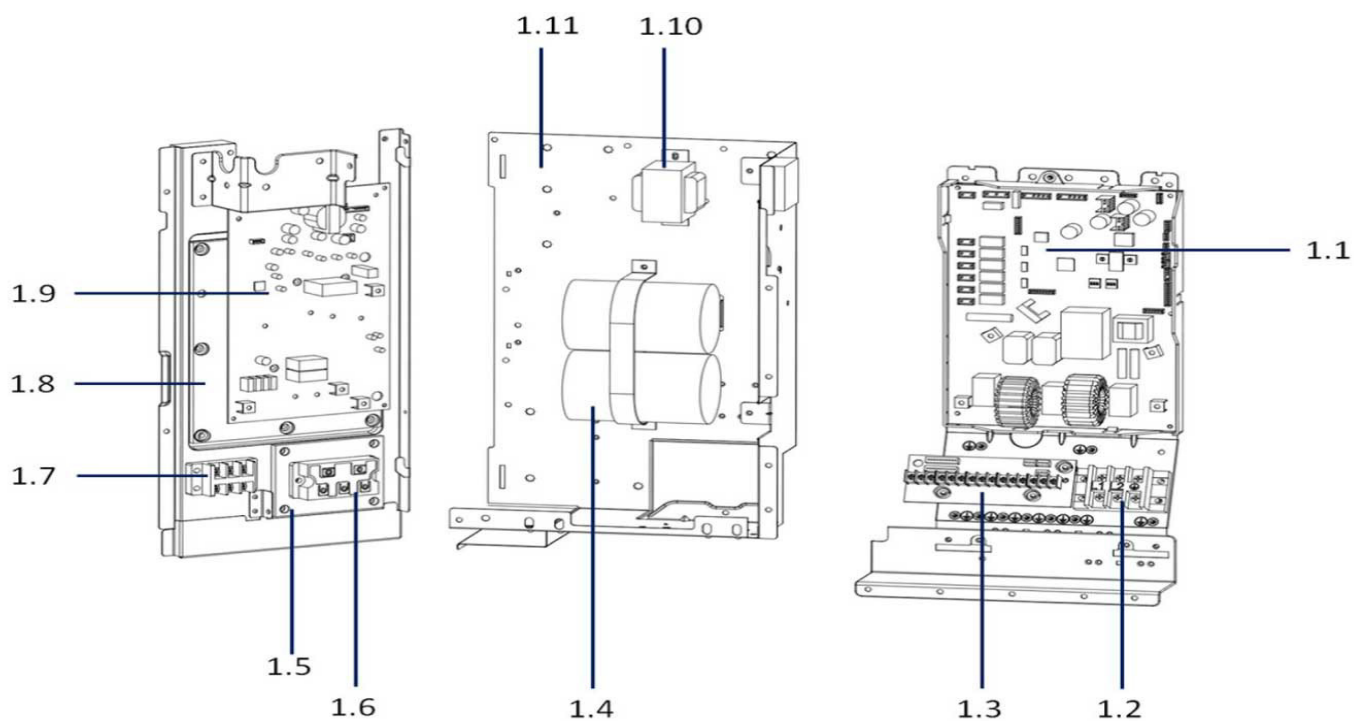
A210306

Fig. 68 —VRF Outdoor Unit Internal Components



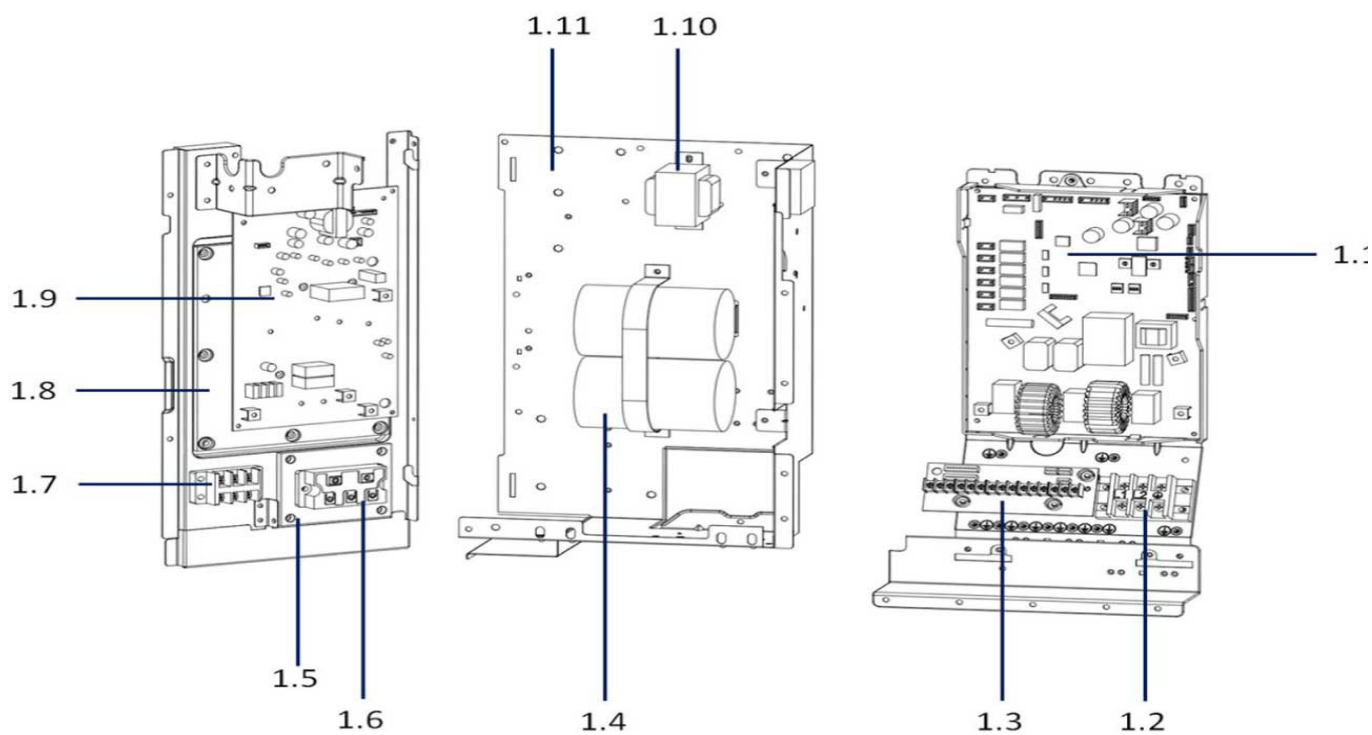
A210307

Fig. 69 —3-Ton Exploded View



A210308

Fig. 70 —4-Ton Exploded View



A210309

Fig. 71 —5-Ton Exploded View

Table 38 —VRF Outdoor Unit Parts Breakdown

NO.	CARRIER NAME	PART NAME	QUANTITY	BOM CODE
1	CONTROL BOX ASSEMBLY	E-part box assembly	1.0	17227000001779
1.1	BOARD, MAIN CONTROL	Outdoor main control board assembly	1.0	17127000005516
1.1	TRANSFORMER	Transformer	1.0	11203103000225
1.11	BOX, CONTROL	Supporter of electric parts	1.0	12126000000338
1.2	BLOCK, 3P TERMINAL, XT1	Wire joint, 3p	1.0	17400401000242
1.3	BOARD, COMMUNICATION	Outdoor main control board assembly	1.0	17127000005136
1.4	CAPACITOR	Electrolytic capacitor	2.0	11201205000306
1.5	HEATSINK, INVERTER BOARD	Radiator	1.0	11203803000039
1.6	BRIDGE, RECTIFIER	Rectifier bridge	1.0	11201418000002
1.7	BLOCK, 3P TERMINAL, XT2	Wire joint	1.0	17400401000186
1.8	HEATSINK, RECTIFIER	Radiator	1.0	11203803000179
1.9	MODULE, COMPRESSOR	Power drive mounting plate assembly	1.0	17127000005478
2	BOX, INDUCTOR	Electrical inductance box assembly	1.0	17227000001778
2.1	PFC INDUCTOR	Power Factor Correction Inductance	2.0	11201101000006
3	REVERSING VALVE ASSEMBLY	Four-way valve assembly	1.0	15427000002362
3.1	VALVE, REVERSING	four-way valve assembly	1.0	15500216001041
3.2	VALVE, ASSEMBLY, SOLENOID, SV5	Solenoid valve assembly	1.0	15427000002363
3.3	VALVE, SUCTION SERVICE	Suction valve	1.0	15500204000117
4	VALVE ASSEMBLY, HIGH PRESSURE	High pressure valve ass.	1.0	15427000002361
4.1	VALVE, ELECTRONIC EXPANSION	Electronic expansion valve suite	1.0	15500213001346
4.2	VALVE, SERVICE	Gas valve	1.0	15500204000008
5	DISCHARGE PIPE ASSEMBLY	Discharge pipe assembly B	1.0	15427000002364
5.1	SENSOR, PRESSURE	Pressure sensor	1.0	11201008000033
5.2	SWITCH, PRESSURE(DISCHARGE)	Pressure switch	1.0	17400516000032
5.3	CAPILLARY, DISCHARGE	Capillary assembly	1.0	15427000002366
5.4	SEPARATOR, OIL	Oil separator	1.0	15500501000011
6	ONE WAY VALVE ASSEMBLY	D unit suction pipe assembly	1.0	15427000002359
6.1	PLUG, FUSIBLE	Fusible plug assembly	1.0	15427000001439
6.2	VALVE, ONE-WAY SOLENOID, SV5	One-way solenoid valve assembly	1.0	15500205000010
6.3	VALVE, ONE WAY SOLENOID, SV6	One-way solenoid valve	1.0	15500205000026
6.4	SWITCH, PRESSURE(SUCTION)	Pressure switch	1.0	17400516000089
7	BAFFLE	Baffle	1.0	122270000011354
8	PANEL, PIPE	Rear Tube Side Plate	1.0	122270000011362
9	PANEL, SERVICE VALVE	Front Tube Side Plate	1.0	122270000011360
10	ACCUMULATOR	Gas-liquid separator	1.0	15500501000744
11	PLATE, VALVE MOUNTING	Valve plate	1.0	12227000000247
12	COMPRESSOR	DC Inverter rotary compressor	1.0	11103020000029
13	BASE PAN	Chassis part	1.0	122270000012207
14	COIL, CONDENSER	Condenser components	1.0	15827000000866
15	MOUNT, MOTOR	Supporter subassembly of fan motor	1.0	12227000000149
16	MOTOR, FAN, DC, BRUSHLESS	Brushless DC Motor	2.0	11002015000277
17	FAN	Cross fan	2.0	12100105000422
17.1	VALVE, ONE WAY SOLENOID, SV4	One-way solenoid valve assembly	1.0	15500205000010
18	HANDLE, SMALL	Small handle	3.0	12100701000317
19	GUARD, FAN	Air-out mesh enclosure	2.0	12927000001032
20	SENSOR, AMBIENT TEMP., T4	Room Temp. sensor ass'y	1.0	11201007000077
21	SENSOR, PIPE TEMPERATURE, T3	Pipe Temperature Sensor	1.0	11201007001785
22	SENSOR, DISCHARGE TEMP., T5	Discharge Temperature Sensor	1.0	11201007002463
23	HEATER, CRANKCASE	Compressor electric heater	1.0	17402001000053
24	PANEL, FRONT	Upper front panel	1.0	122270000012111
25	COIL GUARD - SIDE	Back mesh	1.0	12927000001393
26	REAR LEFT SUPPORT BEAM	Support	1.0	122270000011358
27	COIL GUARD - BACK	Back mesh	1.0	12927000001392
28	ASSEMBLY, FRONT PANEL, CLAMP	Bracket assembly, net	1.0	12227000001944
29	PARTITION	Partition board assembly	1.0	122270000012110
30	PANEL, RIGHT FRONT	Right Front Side Panel Assembly	1.0	122270000011356
31	COVER, TOP	Top cover assembly	1.0	122270000011355
32	PANEL, RIGHT REAR	Right Rear Side Panel Assembly	1.0	122270000012206

