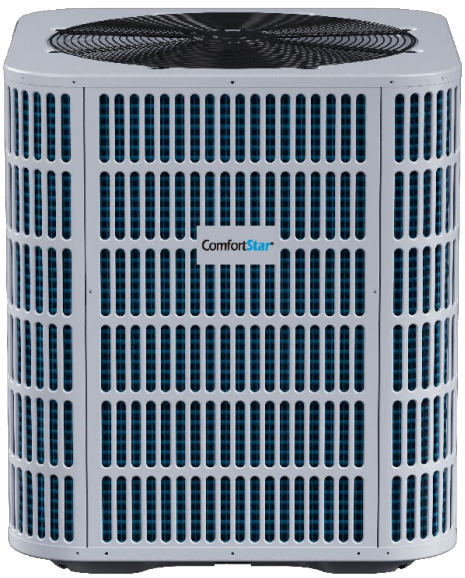
ComfortStar®

Service manual

BAR7/BAH7/MAH7 Series

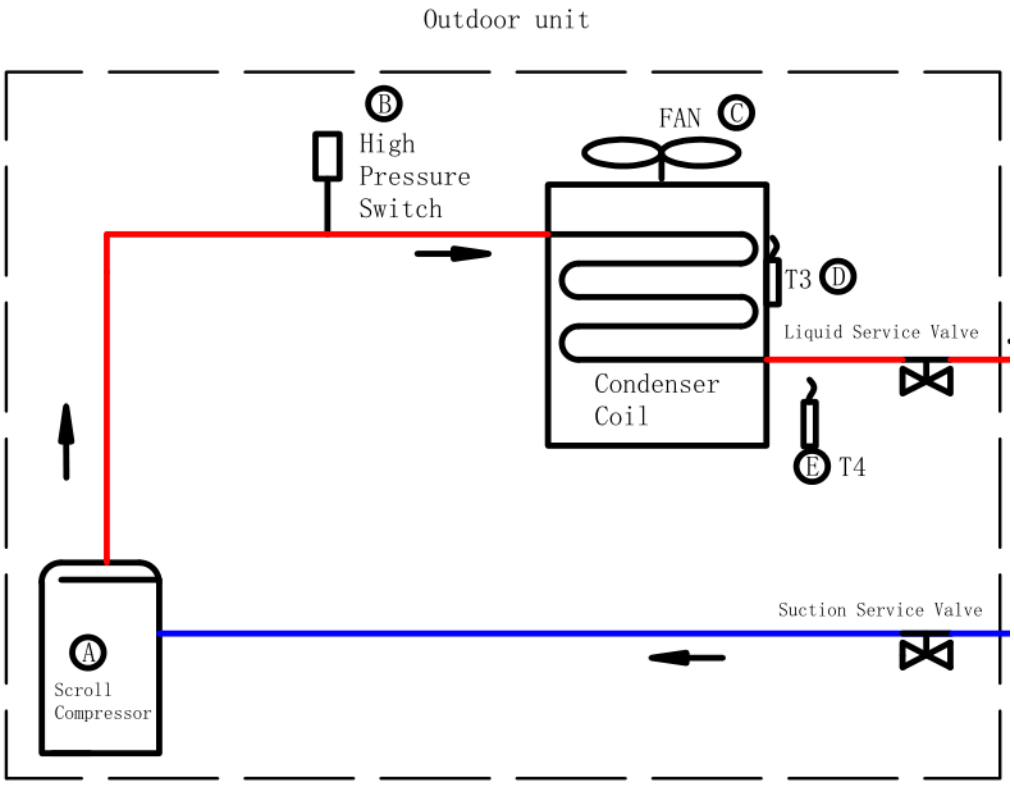


•Content

- System Operation
- Typical Issue Troubleshooting

System Operation

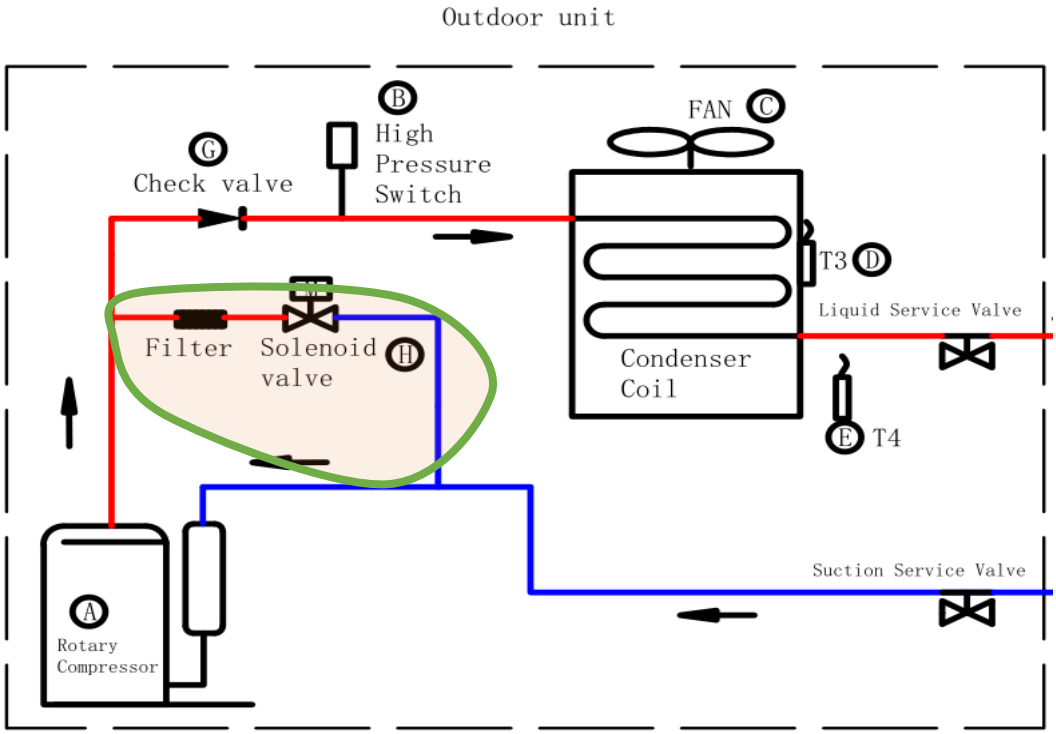
Refrigerant Circuit – **Air Conditioner Scroll Compressor**



No. in diagram	Symbol	Part Name	Major function
A	Scroll Comp.	Scroll Compressor	To compress the refrigerant
B	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.
C	Fan	Fan of outdoor	Used to help heat exchange by 10-speeds ECM motor.
D	T3	Condenser coil temperature sensor	Used to discharge temperature protection and Fan control in cooling mode, and defrost control.
E	T4	Ambient temperature sensor	Used to ambient protection and Fan control in cooling mode, and defrost control.

System Operation

Refrigerant Circuit – **Air Conditioner Rotary Compressor**

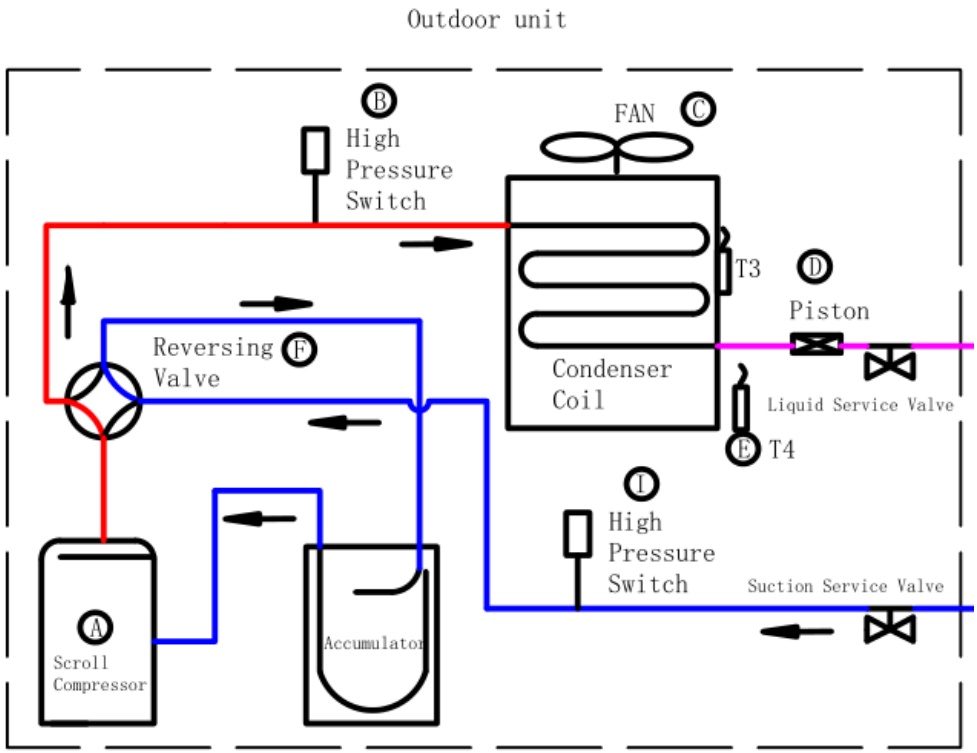


No. in diagram	Symbol	Part Name	Major function
A	Rotary Comp.	Rotary Compressor	To compress the refrigerant
B	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.
C	Fan	Fan of outdoor	Used to help heat exchange by 10-speeds ECM motor.
D	T3	Condenser coil temperature sensor	Used to discharge temperature protection and Fan control in cooling mode, and defrost control.
E	T4	Ambient temperature sensor	Used to ambient protection and Fan control in cooling mode, and defrost control.
G	CV	Check Valve	Open during cooling and shutoff during heating by itself.
H	PEV	Pressure Equalizer Valve	To ensure pressure balance before compressor starts

System Operation

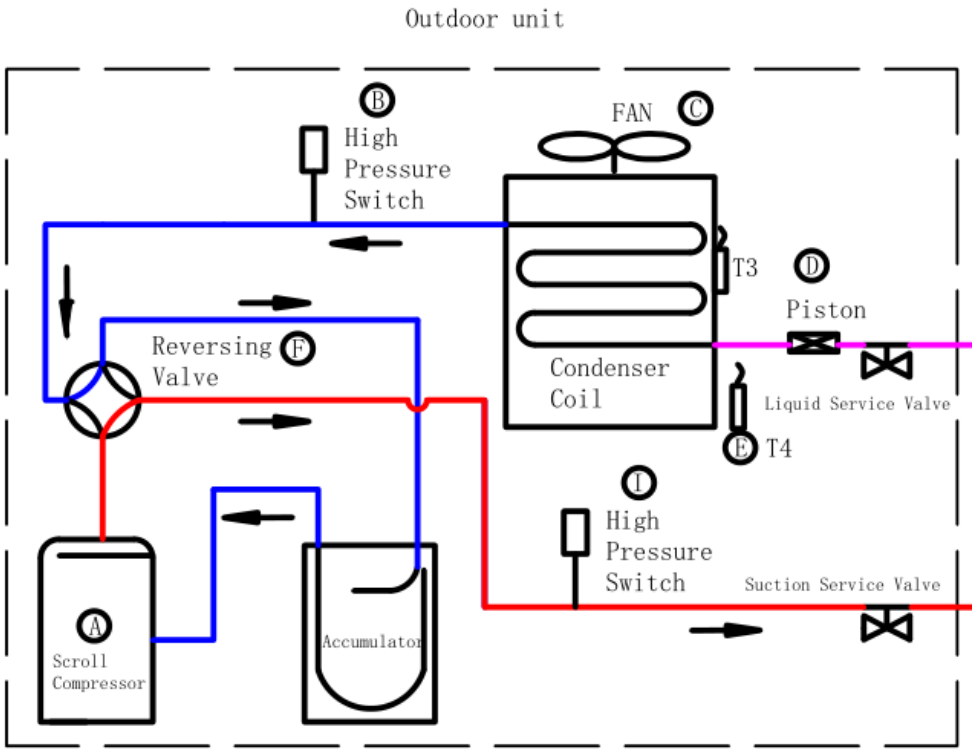
Refrigerant Circuit – **Heat Pump Scroll Compressor**

No. in diagram	Symbol	Part Name	Major function
A	Scroll Comp.	Scroll Compressor	To compress the refrigerant
B	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.
C	Fan	Fan of outdoor	Used to help heat exchange by 10-speeds ECM motor.
D	T3	Condenser coil temperature sensor	Used to discharge temperature protection and Fan control in cooling mode, and defrost control.
E	T4	Ambient temperature sensor	Used to ambient protection and Fan control in cooling mode, and defrost control.
F	RV	The Reversing Valve	Used to switch mode between cooing and heating.
I	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.



System Operation

Refrigerant Circuit – **Heat Pump Scroll Compressor**



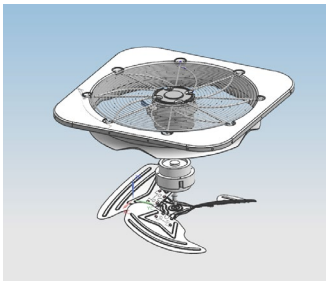
No. in diagram	Symbol	Part Name	Major function
A	Scroll Comp.	Scroll Compressor	To compress the refrigerant
B	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.
C	Fan	Fan of outdoor	Used to help heat exchange by 10-speeds ECM motor.
D	T3	Condenser coil temperature sensor	Used to discharge temperature protection and Fan control in cooling mode, and defrost control.
E	T4	Ambient temperature sensor	Used to ambient protection and Fan control in cooling mode, and defrost control.
F	RV	The Reversing Valve	Used to switch mode between cooing and heating.
I	HPS	High pressure switch	Used to high pressure protection when up to 580 PSIG and recovery when below to 435PSIG.

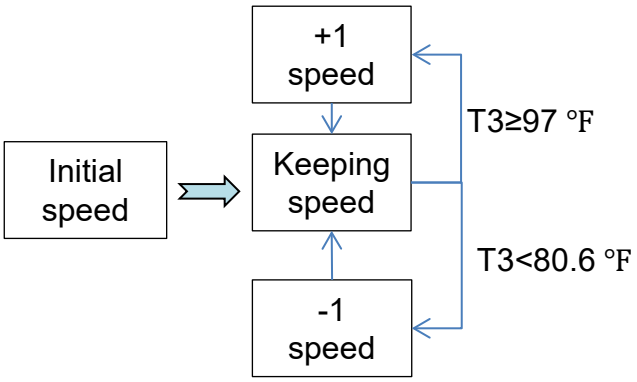
System Operation

Parts Control

Fan control

[Cooling]





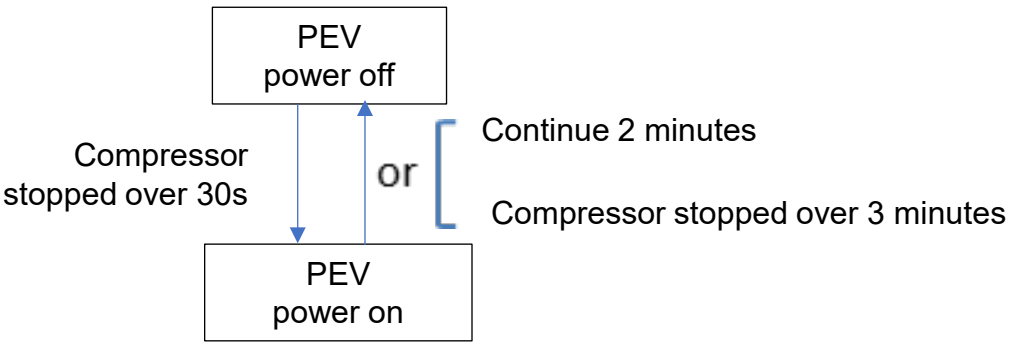
Note: ±1 speed/25 seconds,10 speeds ECM motor.

[Heating]

Fan when heating maintains 10 speed（Highest Speed）

PEV control

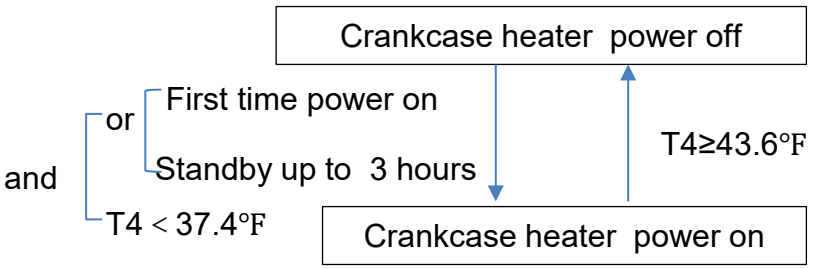
The PEV's function is to help equalize the refrigerant pressures on the high and low sides prior to compressor operation . You will hear a "hissing" sound every time after the compressor stops, this is the PEV equalizing the pressure.



System Operation

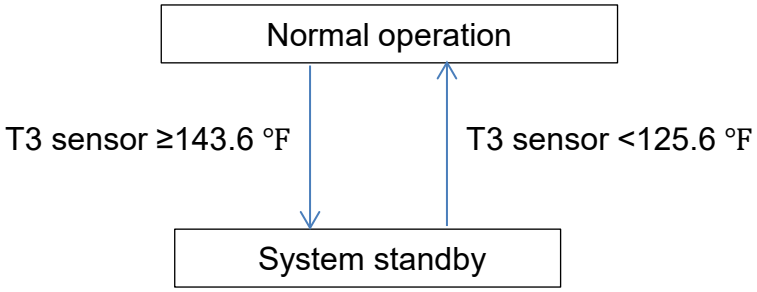
Parts Control

Crankcase Heat



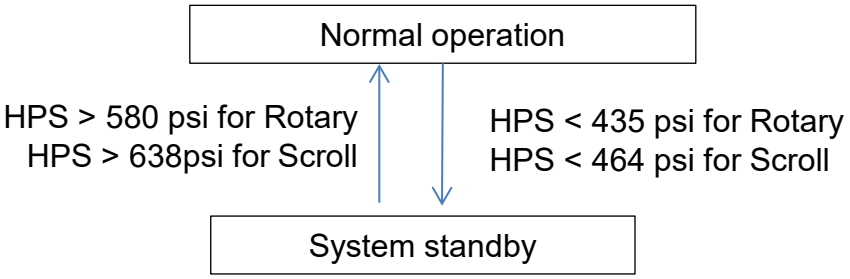
T4 is the Ambient temperature .

T3 Protection in cooling



LED 2 flashes
”2S ON/2S OFF”

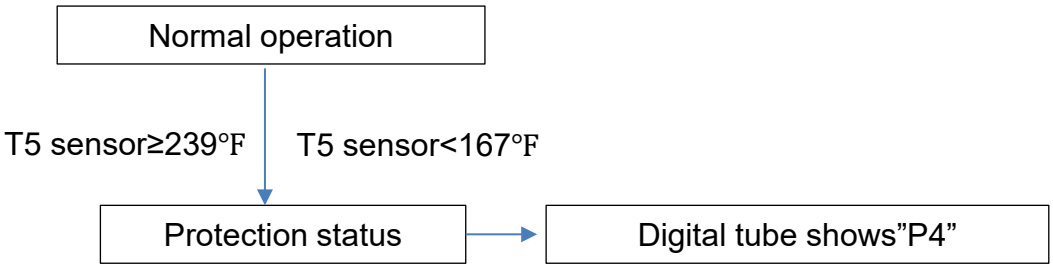
High Pressure Switch Protection



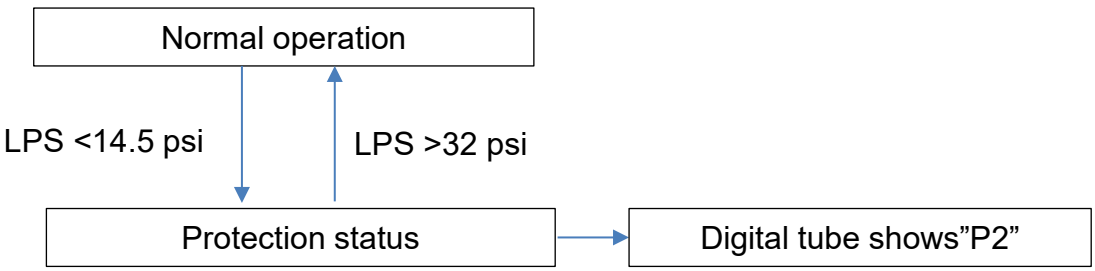
System Operation

Parts Control

T5(Discharge Temp.) Protection



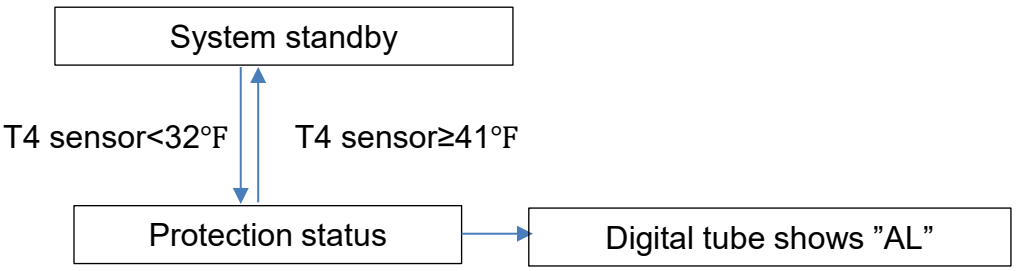
Low Pressure Switch Protection



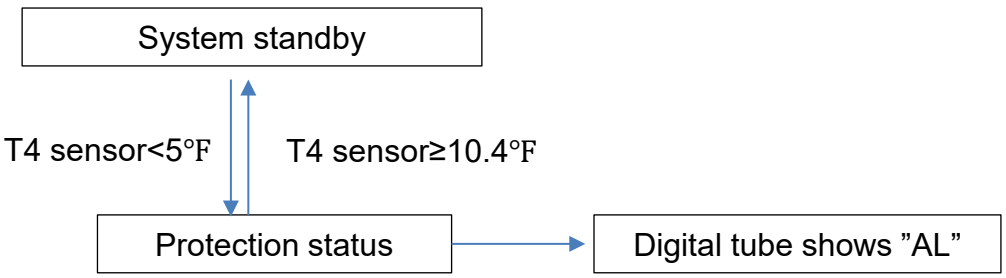
System Operation

Parts Control

Ambient temperature limitation in cooling



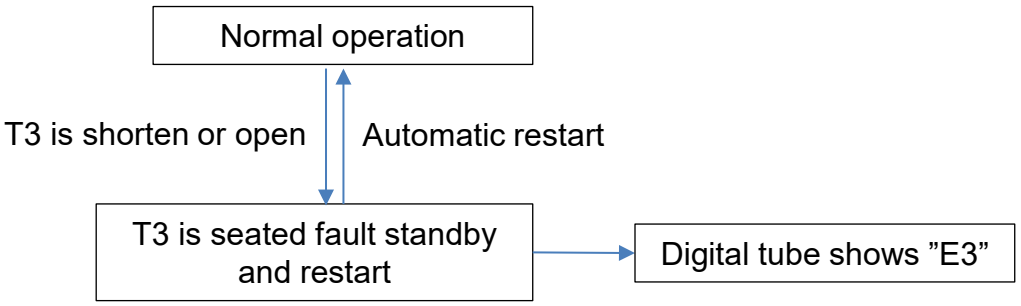
Ambient temperature limitation in heating



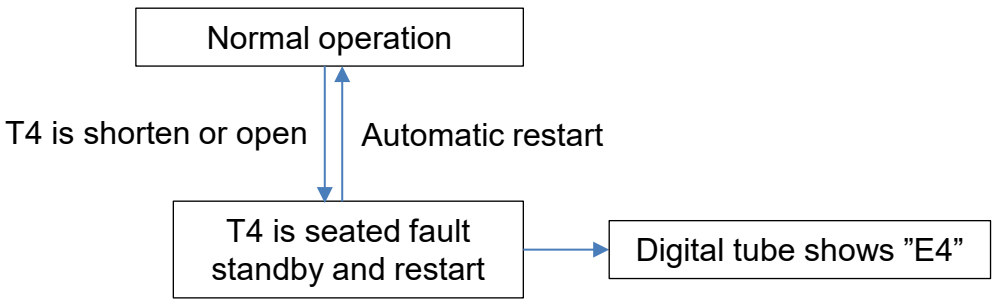
System Operation

Parts Control

T3 Sensor not reading correctly



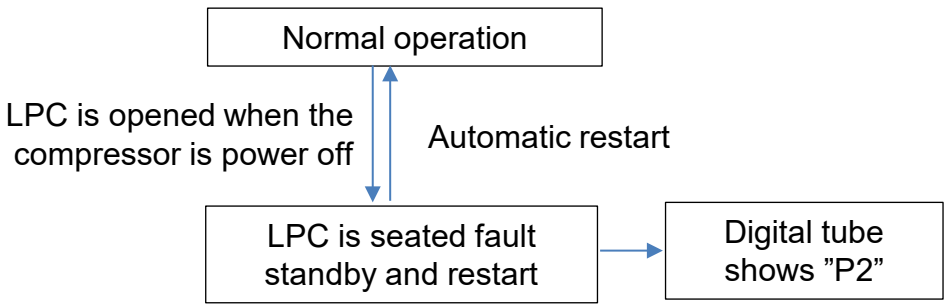
T4 Sensor not reading correctly



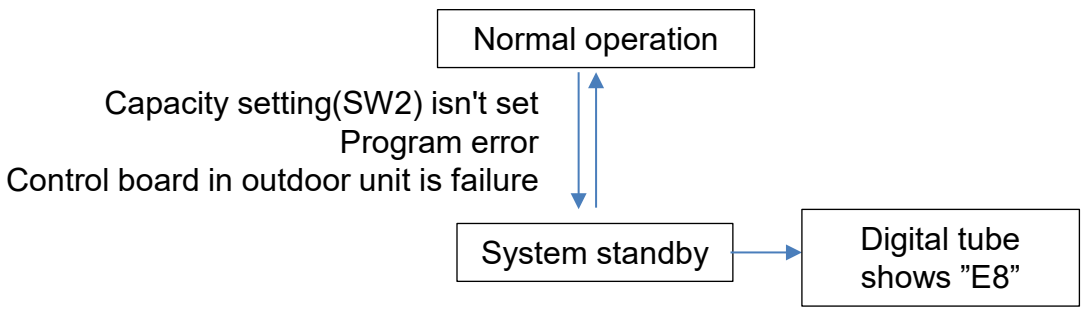
System Operation

Parts Control

LPC open



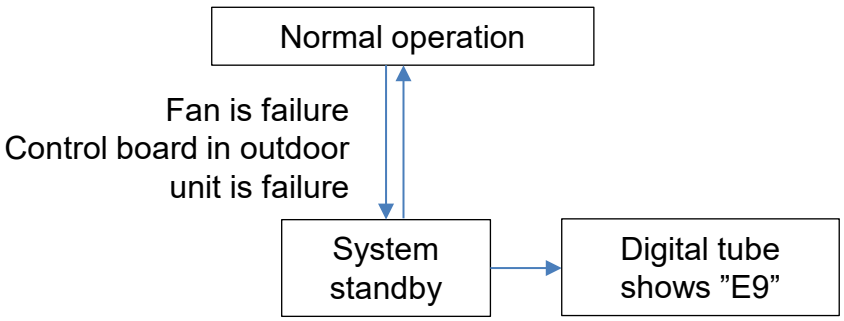
Capacity setting no set



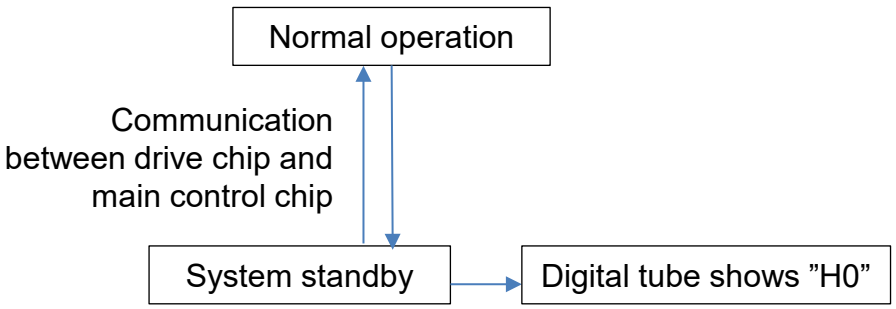
System Operation

Parts Control

Main board or drive chip software fault



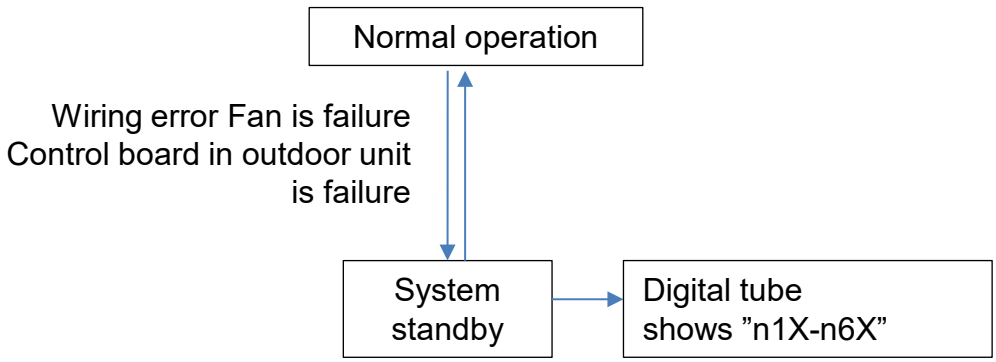
Communication fault between drive chip and main control chip



System Operation

Parts Control

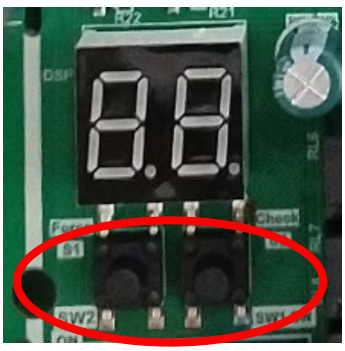
Fan drive fault



Function – Manual Defrost

Force button
Long press “Force” at least 6 seconds and enter Defrost mode

Short press “Force ” and enter Force Cooling mode



Troubleshooting

No.	Protection code	Protection control description	Possible Reason
1	E3	T3 sensor fault	T3 sensor is short circuit or open circuit
2	E4	T4 sensor fault	T4 sensor is short circuit or open circuit
3	E8	Capacity setting no set	Capacity setting(SW2) isn't set/Program error/Control board in outdoor unit is failure
4	E9	R110 resistor or drive chip software fault	Fan is failure/Control board in outdoor unit is failure
5	P2	LPC protection	Speed message isn’t wrote in main board
6	P4	Discharge temperature protection	High temperature and overload/Throttle blockage/Charging leakage (low refrigerant)/DTS fault
7	P5	T3 high-temperature protection	High temperature and overload/Poor heat exchange on condensing side/T3 fault
8	AL	Ambient temperature limitation	Ambient temperature is out of the range/There are other cooling sources around T4
9	H0	Communication fault between drive chip and main control chip	Program error/Control board in outdoor unit is failure
10	n1X-n6X	Fan drive fault	Wiring error/Fan is failure/Control board in outdoor unit is failure

Diagnosis system introduction

There are two types of auxiliary diagnosis code in system: Main board code and Motor driver module code

1. Fault of Main board

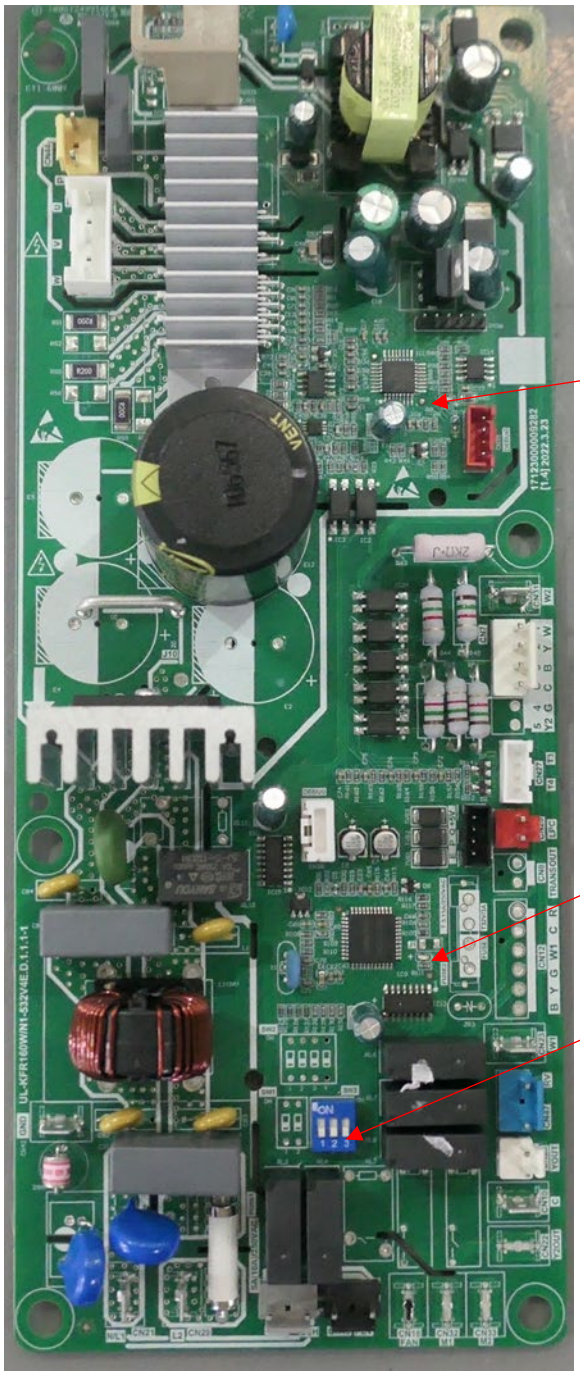
No.	Operation LED	Protection code	Protection control description	Supposed cause
1	LED2	1 Flash/cycle	T3 sensor not reading correctly in cooling	T3 sensor is not properly placed/High pressure switch fault
2	LED2	2 Flash/cycle	T4 sensor not reading correctly	T4 sensor is not properly placed/High pressure switch fault/ Discharge temp. switch open
3	LED2	3 Flash/cycle	Low pressure switch not reading correctly	Low pressure switch is not properly connected.
4	LED2	5 Flash/cycle	DC fan motor fault	Motor fault/severe weather (fan rpm too low due to wind)
5	LED2	6 Flash/cycle	No machine type	Speed message isn't wrote in main board

2. Fault of Motor driver module

No.	Operation LED	Protection code	Protection control description	Supposed cause
1	LED1	0.2S ON/0.2S OFF	Inter integrated circuit communication error	Main board is broken
2	LED1	1 Flash/cycle	Motor current error	Motor shaft is stuck or Motor is broken
3	LED1	2 Flash/cycle	Inverter module temperature error	Motor is broken
4	LED1	3 Flash/cycle	Dc bus voltage error	Check out the power supply
5	LED1	4 Flash/cycle	Motor parameter error	Main board is broken or motor type is wrong
6	LED1	5 Flash/cycle	Motor startup failure	Check out the Motor
7	LED1	6 Flash/cycle	Phase sequence error	Check out the Motor supply wring

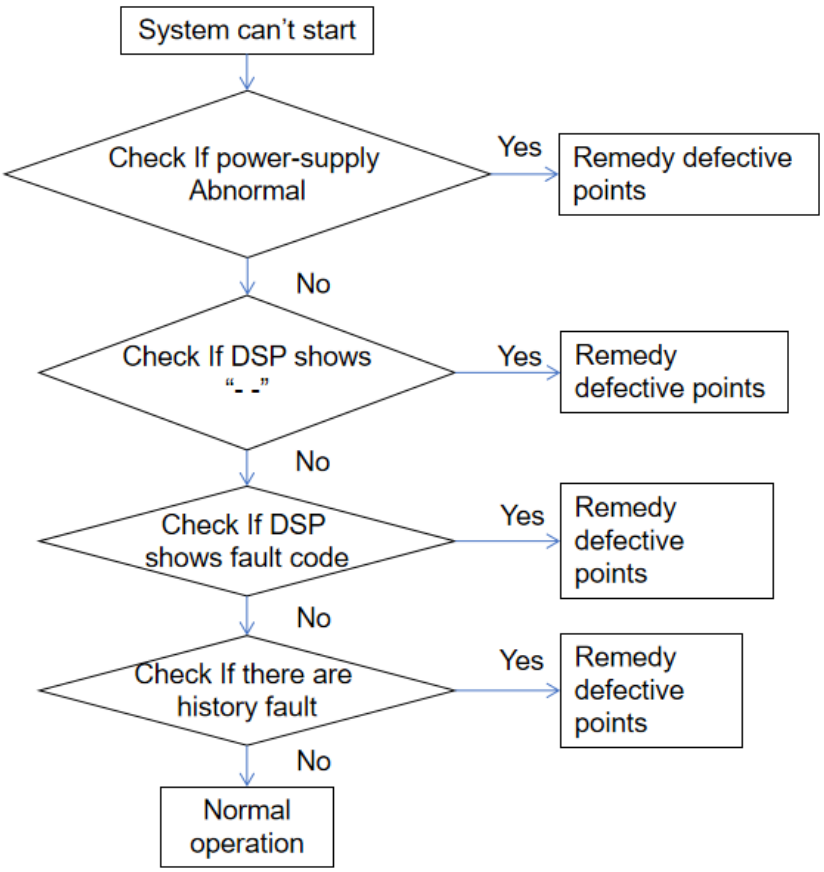
Note:
These fault codes will be displayed on the digital tube until the issue is resolved.

DIP switch position indication ---2/3TON



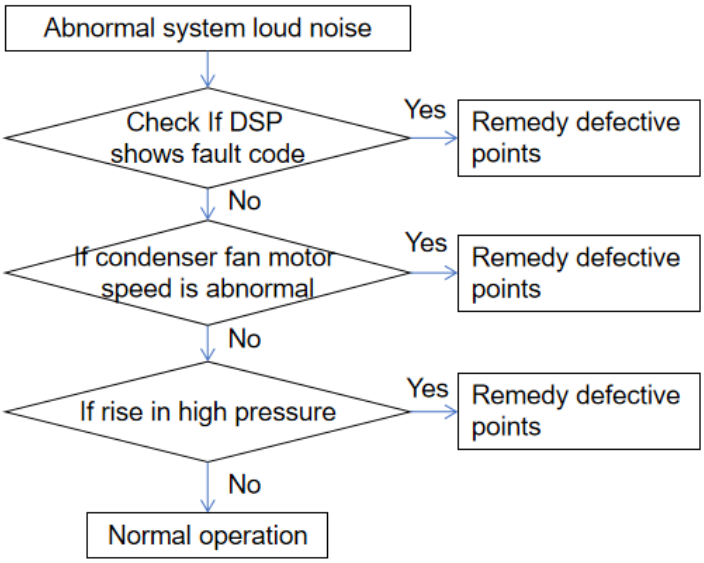
Intelligent Troubleshooting

System can’t start

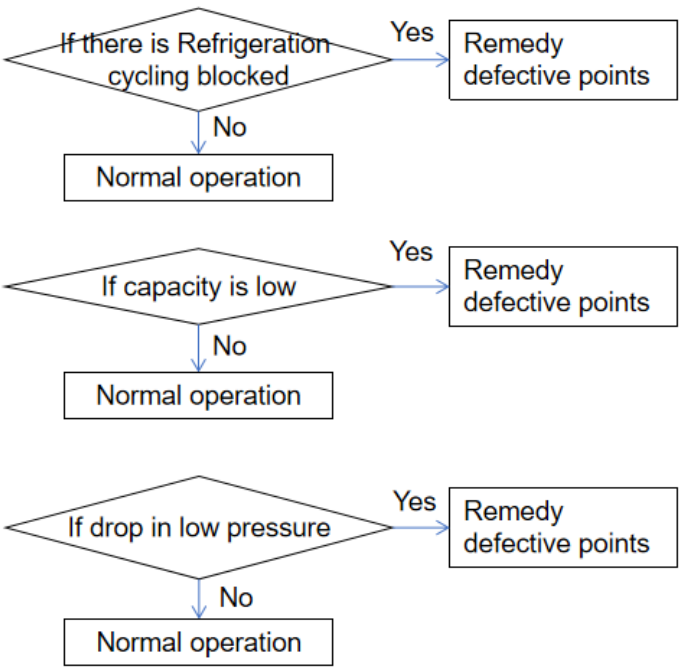


Intelligent Troubleshooting

Abnormal system loud noise



Other common issues

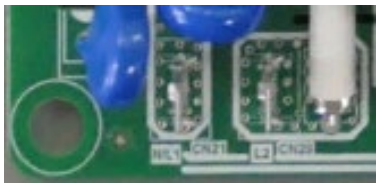


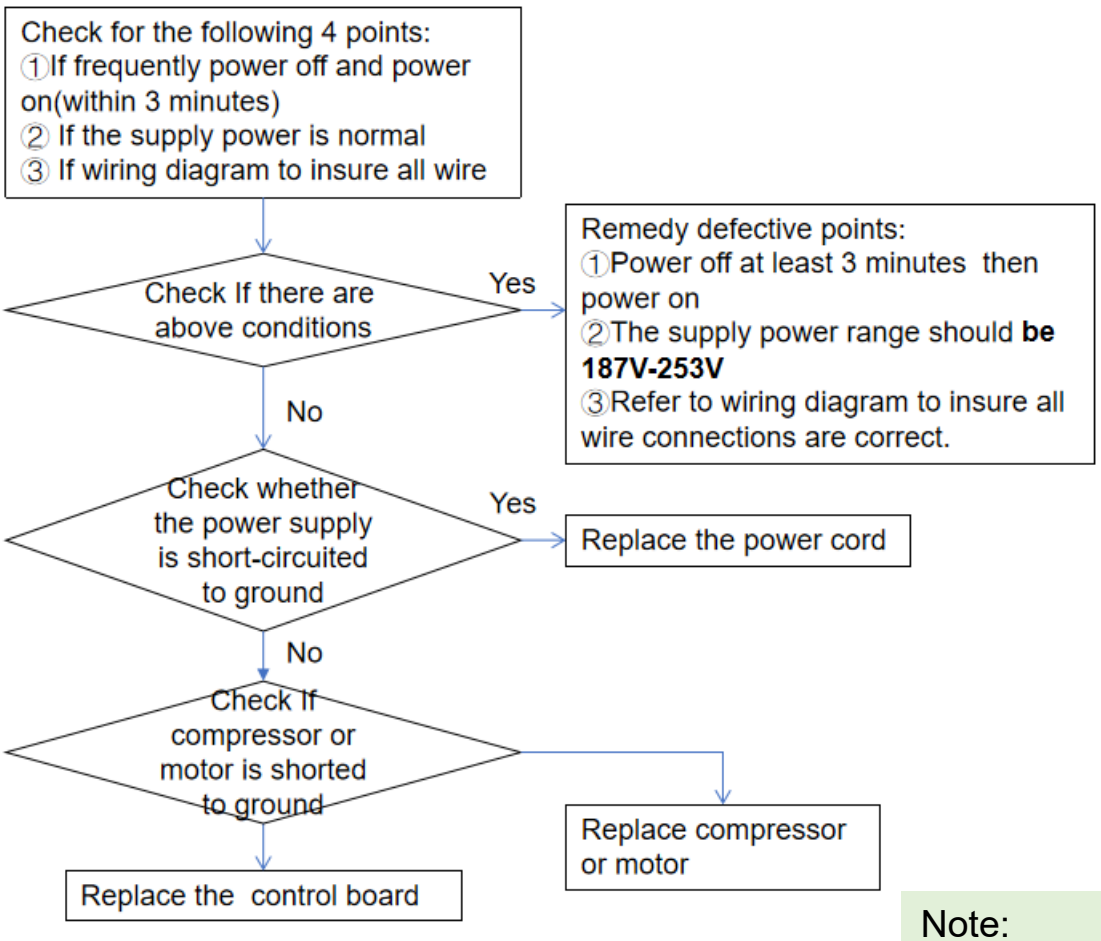
Intelligent Troubleshooting

DSP/LED1 OFF

Issue	DSP OFF/LED1 OFF
Model	All
Fault name	/
Classify	Power/electric issue
Possible cause	· Frequently power off and power on （within 3 minutes） · Abnormal power input · Abnormal wire connections
Notes:	

Troubleshooting





Note:
① to ①
② to ②

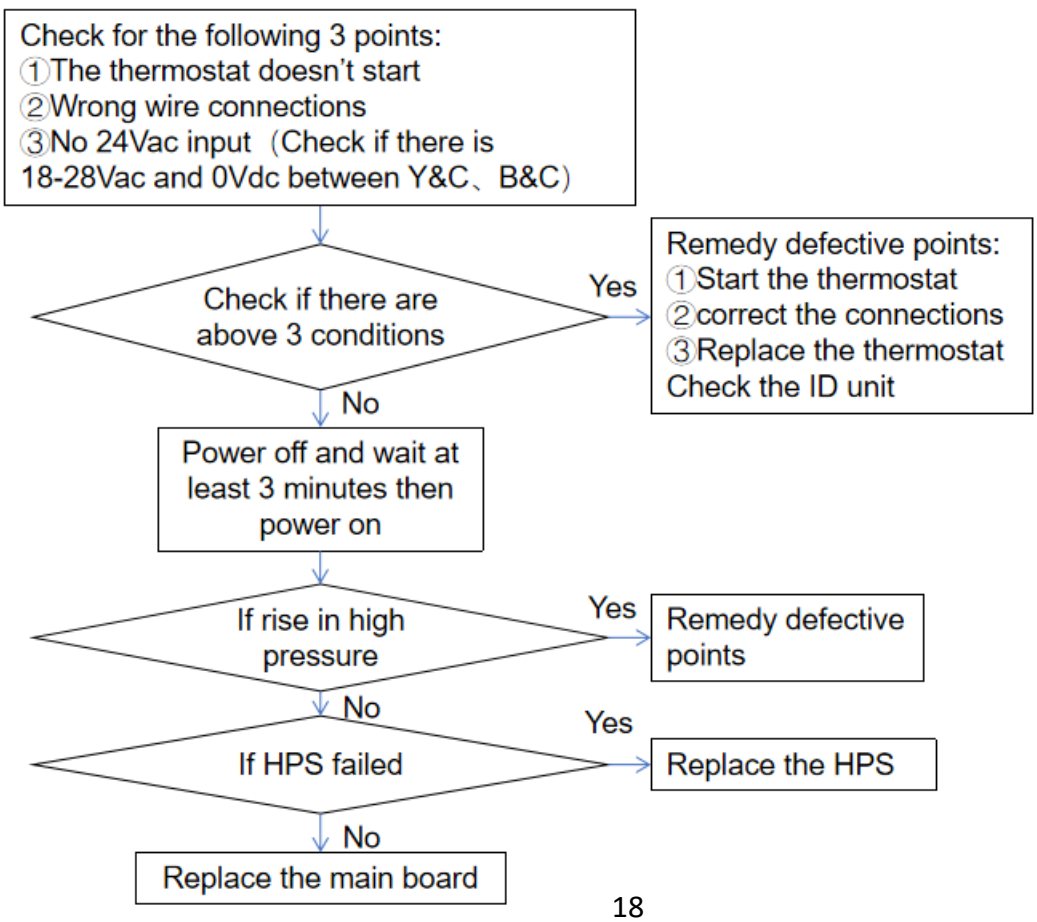
The same below

Intelligent Troubleshooting

System does not start operation(DSP shows “--”)

Issue	System does not start operation(DSP shows “--”)
Model	All
Fault name	/
Classify	Thermostat fault
Possible cause	· The thermostat doesn’t start · Wrong wire connections between thermostat and unit · Damaged thermostat · Disconnect the compressor wire （could be caused after service）
Notes:	

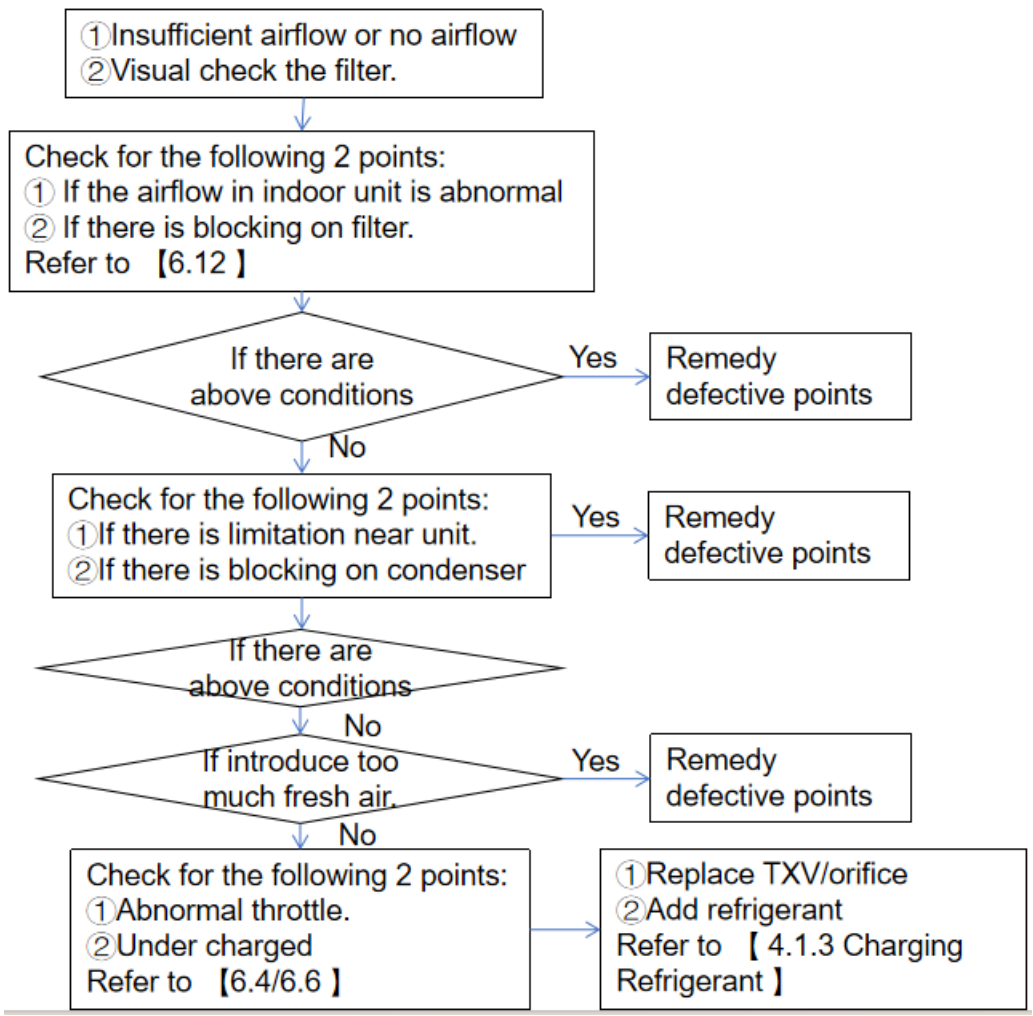
Troubleshooting



Intelligent Troubleshooting

Capacity is low

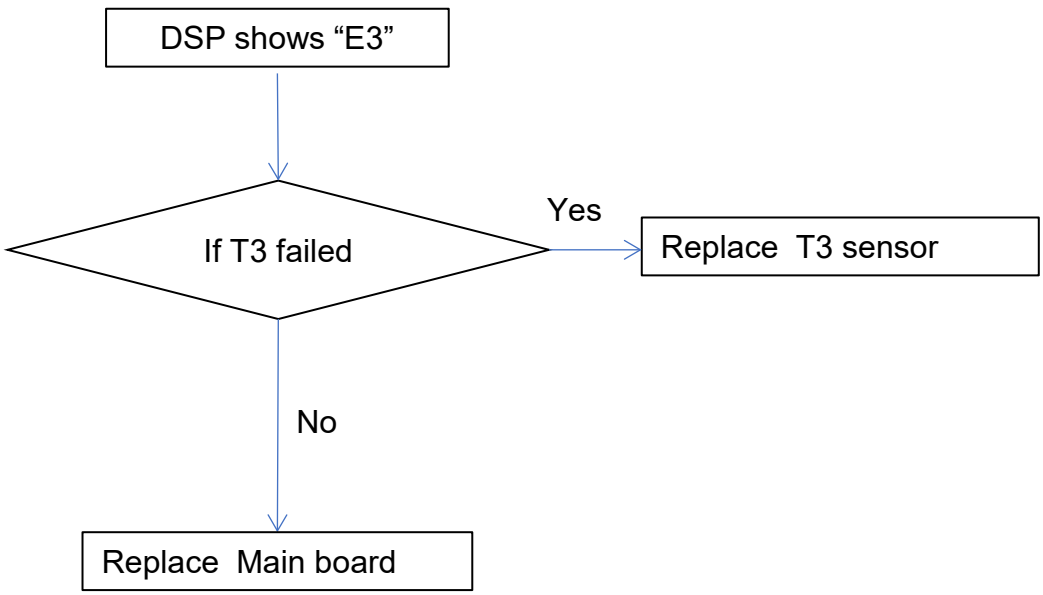
Issue	Capacity is low
Model	All
Name	/
Classify	System fault
Possible cause	· Poor heat dissipation in indoor unit · Poor heat dissipation in outdoor unit · Under charged · First start



Intelligent Troubleshooting

“E3” code

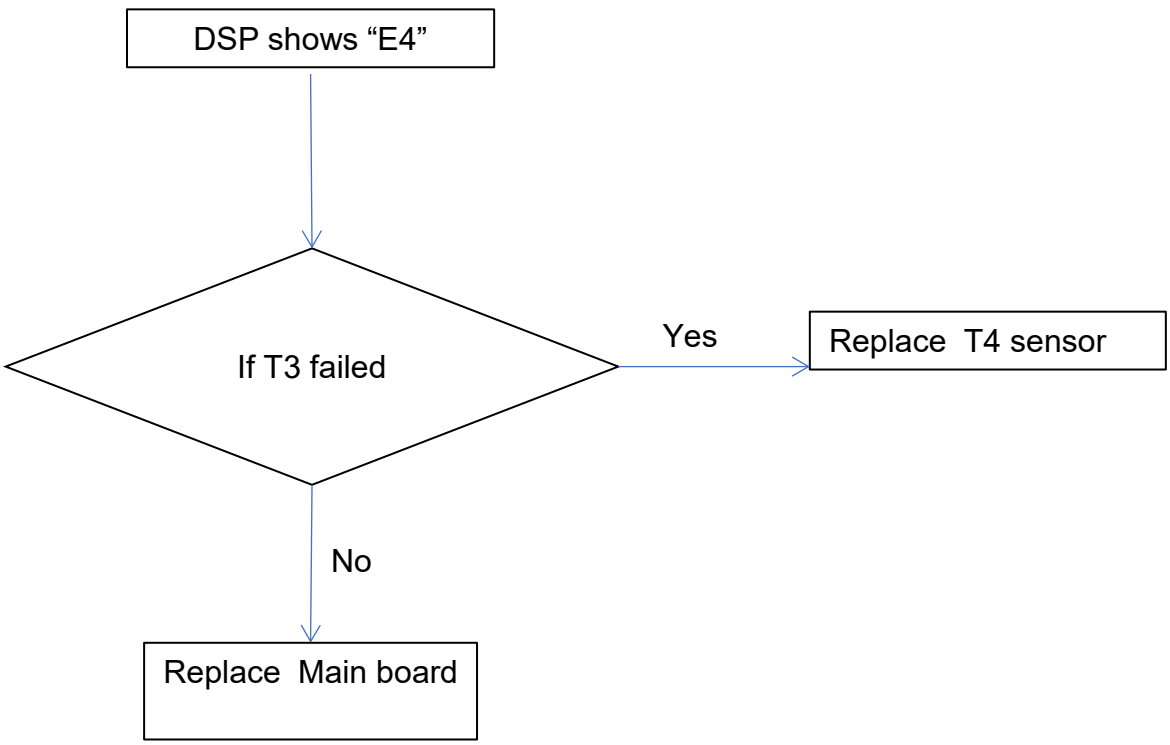
Faulty code	DSP shows “E3”
Model	All
Name	T3 sensor not reading correctly in cooling
Classify	System fault
Possible cause	· Faulty T3 sensor



Intelligent Troubleshooting

“E4” code

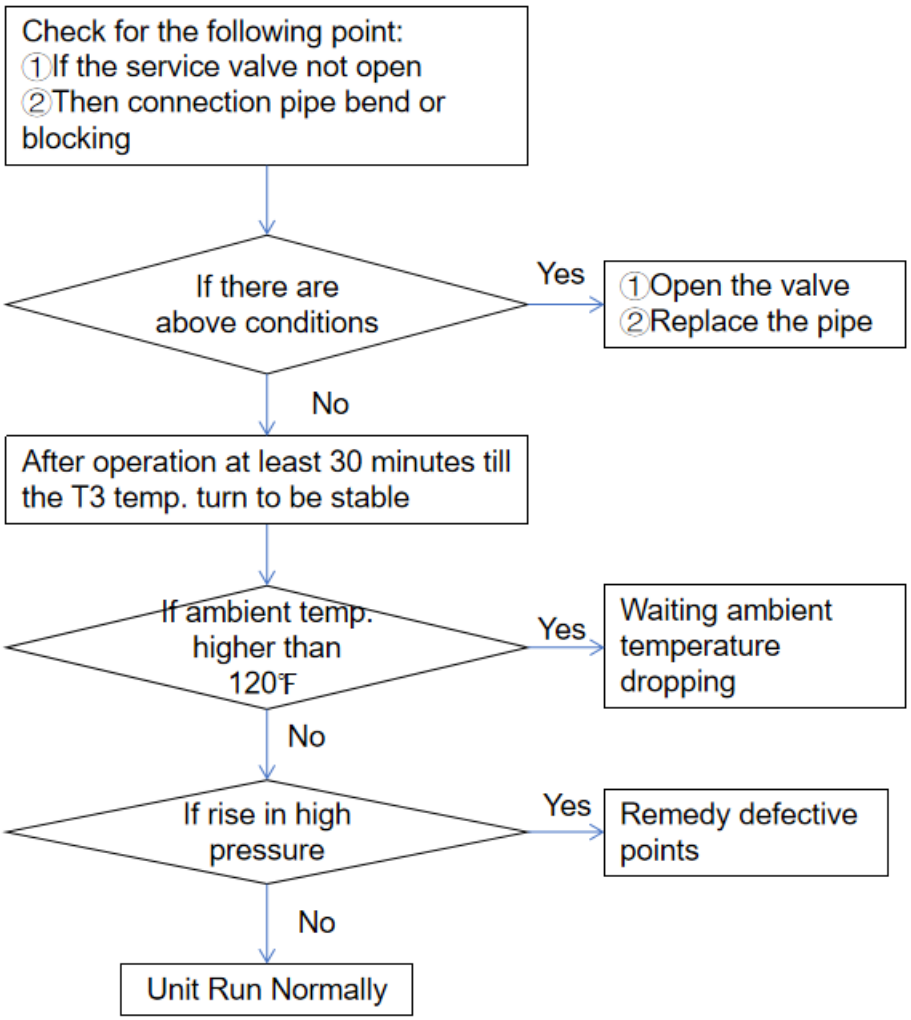
Faulty code	DSP shows “E4”
Model	All
Name	T4 sensor not reading correctly in cooling
Classify	System fault
Possible cause	· Faulty T3 sensor



Intelligent Troubleshooting

“P5” code

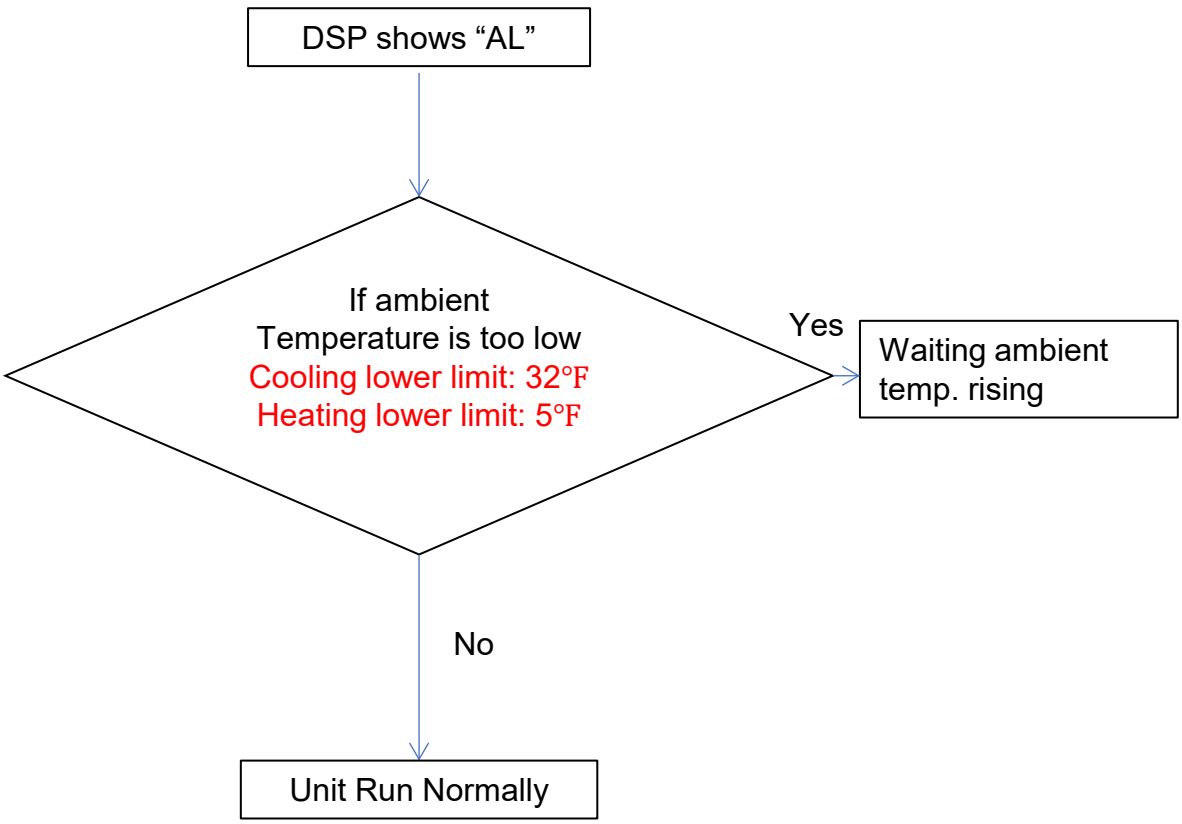
Faulty code	DSP shows “P5”
Model	All
Name	T3 sensor temperature is too high
Classify	System fault
Possible cause	· Wrong location of T3 sensor · Service valves not open ; pipe bend or blocking · Multi-refrigerant · High ambition temp.



Intelligent Troubleshooting

“AL” code

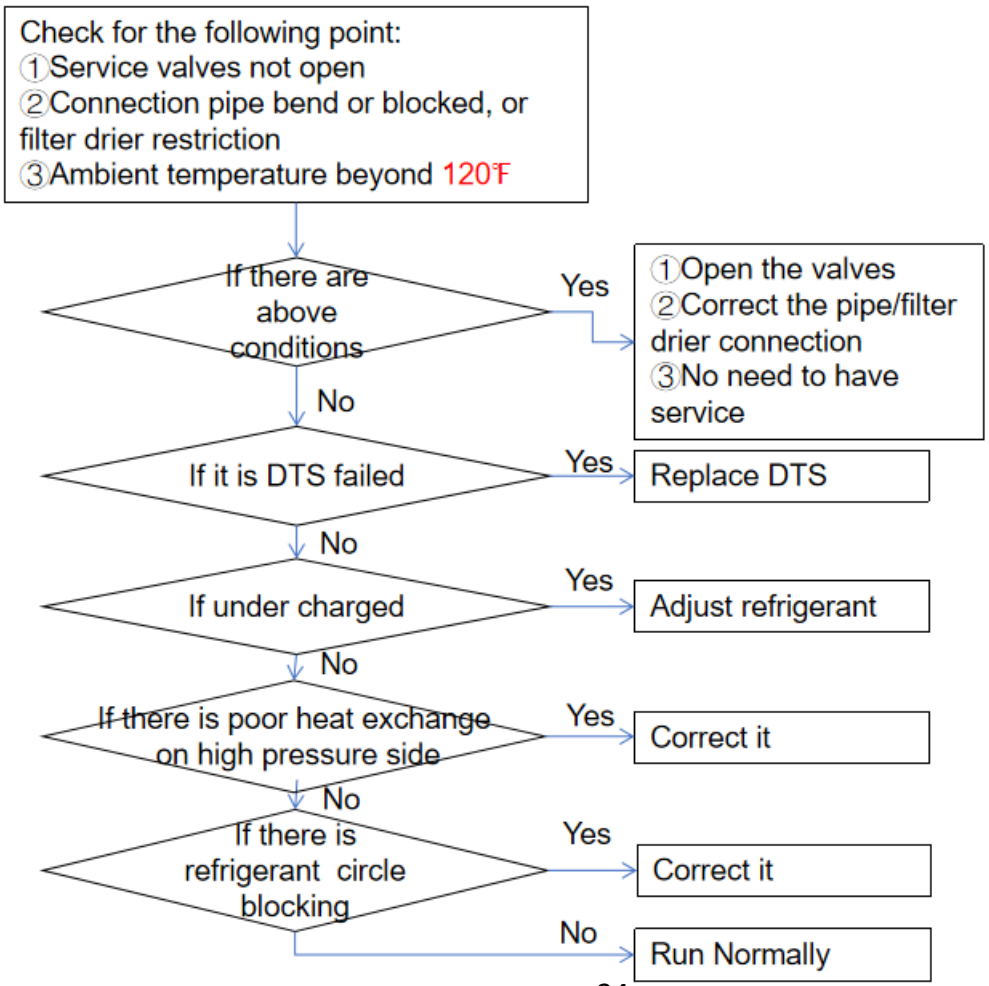
Faulty code	DSP shows “AL”
Model	All
Name	ambition temperature is beyond of the scope
Classify	System fault
Possible cause	· ambition temperature is beyond of the scope · Wrong location of T4 sensor



Intelligent Troubleshooting

“P4” code

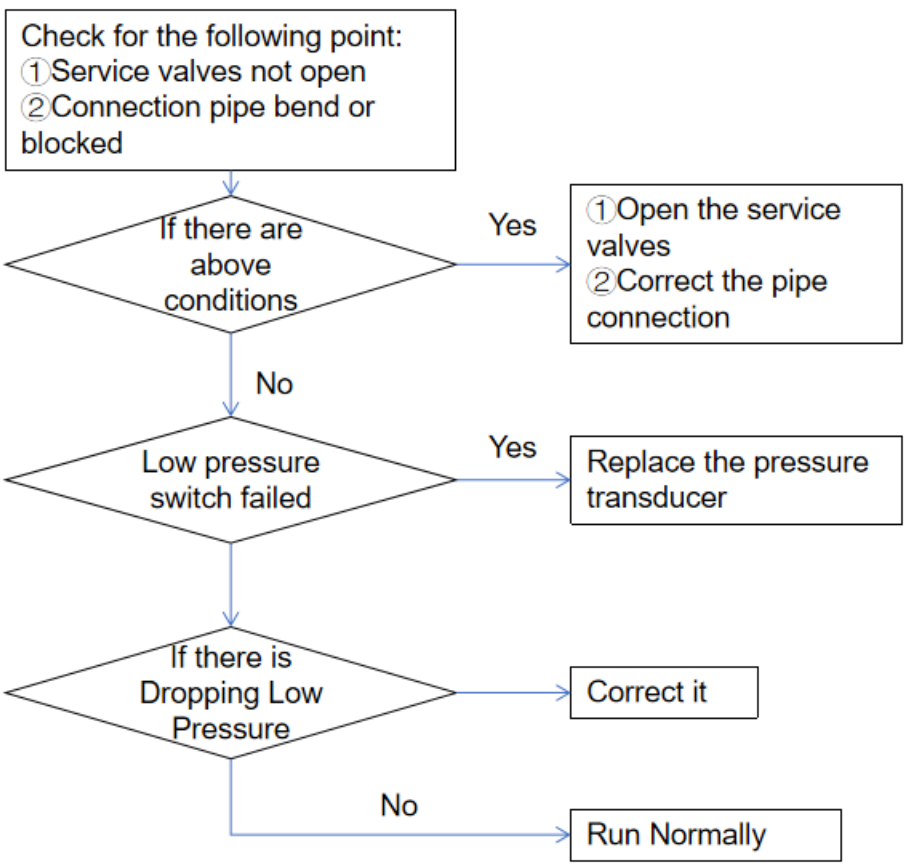
Faulty code	DSP shows “P4”
Model	All
Name	Compressor discharge temperature switch protection
Possible cause	· **TXV/filter drier blocked** · **Under charged** · Service valves not open/filter drier restriction · Indoor unit motor stopped abnormally / poor heat exchange (**heating mode**) · **Poor heat exchange on outdoor unit (cooling mode)**



Intelligent Troubleshooting

“P2”code

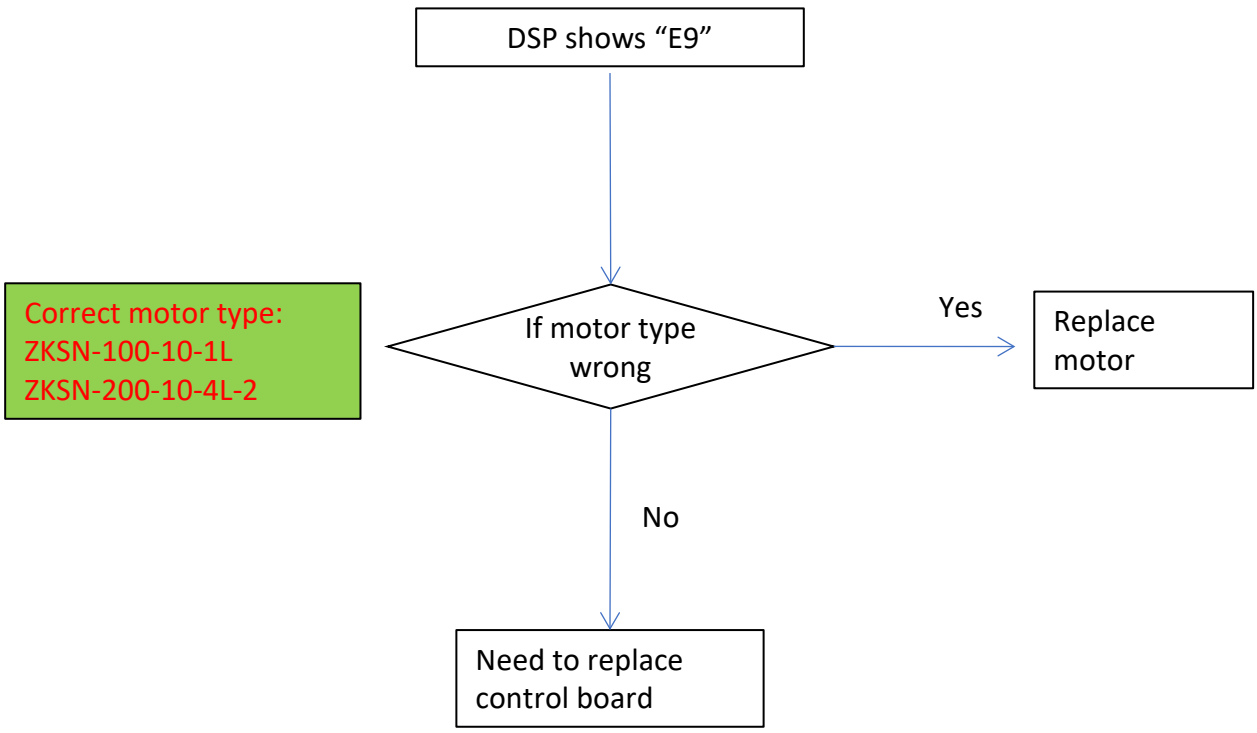
Faulty code	DSP shows “P2”
Mode	All
Name	Low pressure protection
Classify	System fault
Possible cause	· Indoor unit motor stopped abnormally / poor heat exchange · **TXV/filter drier/indoor coil blocked** · Service valves not open · Under charged



Intelligent Troubleshooting

“E9” code

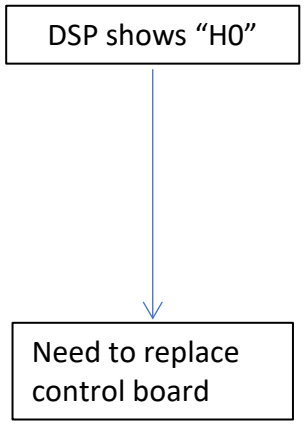
Faulty code	DSP shows “E9”
Model	All
Name	DC fan motor fault or Motor control failed
Classify	Electric issue
Possible cause	· Motor control failed · Motor failed



Intelligent Troubleshooting

“H0” code

Faulty code	DSP shows “H0”
Model	All
Name	Communication fault between drive chip and main control chip
Classify	Electric issue
Possible cause	·Program error ·Control board in outdoor unit is failure

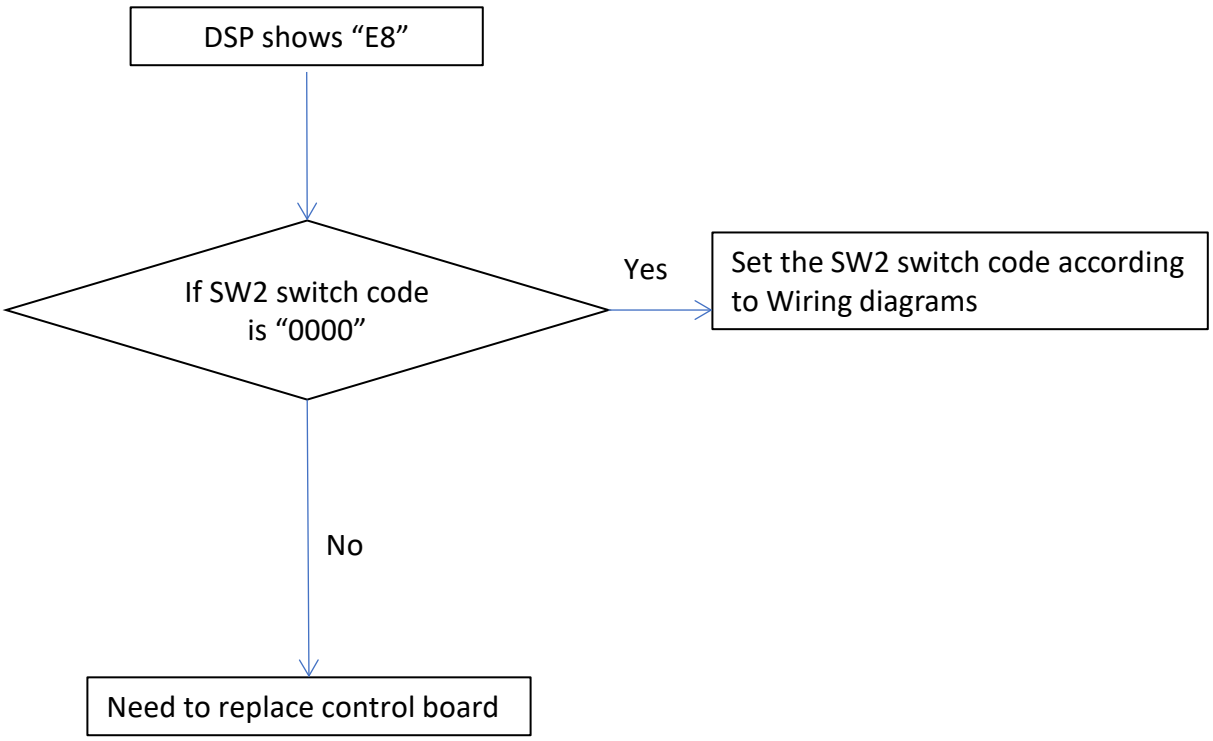


43

Intelligent Troubleshooting

“E8” code

Faulty code	DSP shows “E8”
Model	All
Name	No machine type
Classify	Electric issue
Possible cause	· Speed message isn’t wrote in main board · Control board broken

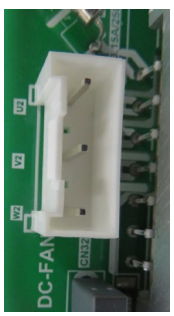


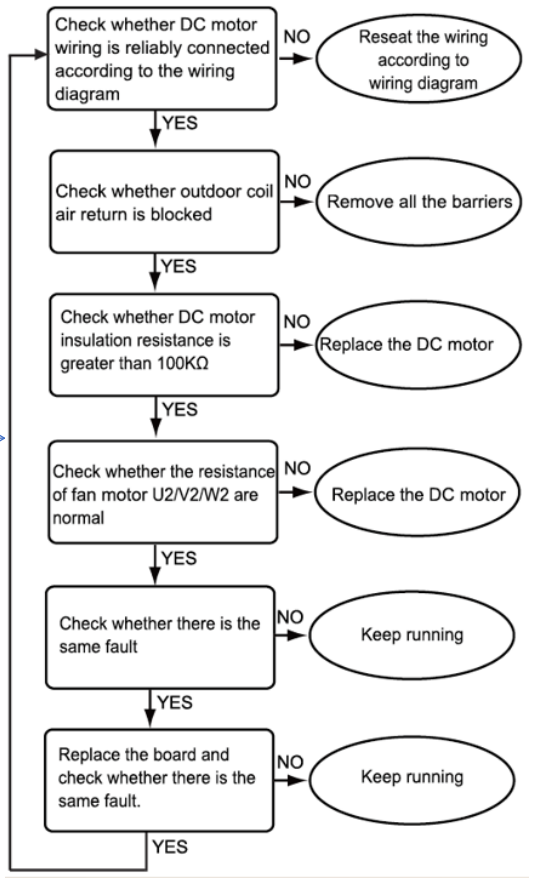
Intelligent Troubleshooting

“n1X~n6X” code

Faulty code	DSP shows “n1X~n6X”
Model	All
Name	DC fan motor fault or Motor control failed
Classify	Electric issue
Possible cause	· Start electromagnetic interference · Motor failed · Motor control failed · Electric issue

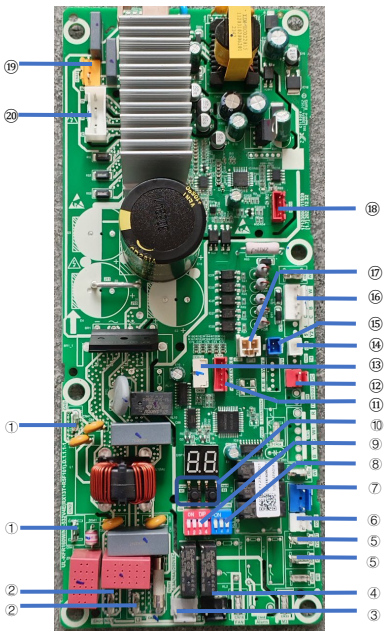
Troubleshooting





Intelligent Troubleshooting

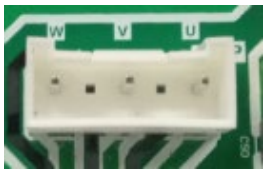
Control board



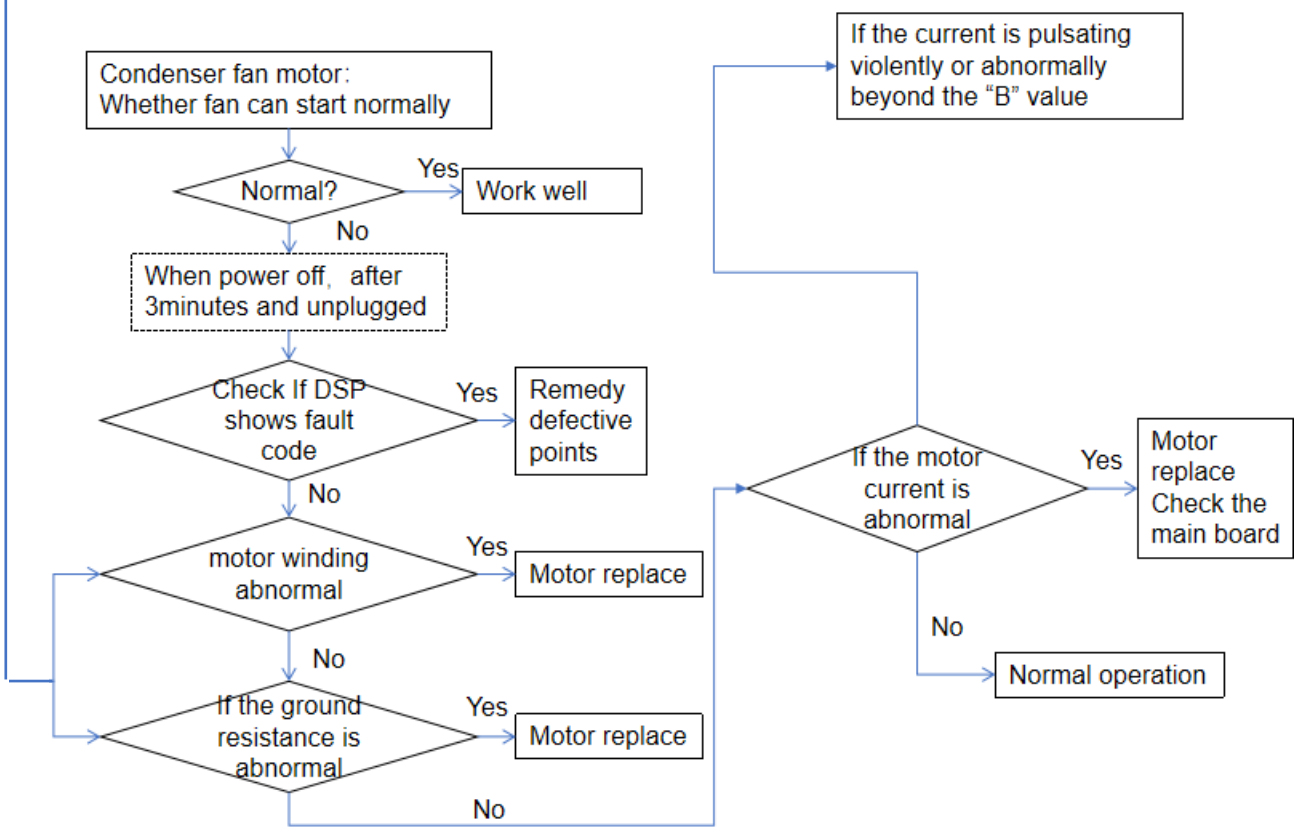
① Earth port
② Power port
③ Compressor crankcase heater port (heat pump only)
④ Pressure Equalizer Valve port
⑤ Two-stage compressor control port
⑥ Compressor contactor control port
⑦ Reversing Valve port (heat pump only)
⑧ SW1-3 dip switch : defrost logic setting
⑨ Capacity setting
⑩ Force and check
⑪ Message port
⑫ Low Pressure switch port (heat pump only)
⑬ Main control board debug port
⑭ T3 sensor port
⑮ T4 sensor port
⑯ Conventional 24VAC non-communicating thermostat control wires port
⑰ Discharge temperature switch port
⑱ Motor drive debug port
⑲ Reserve
⑳ DC motor port

Intelligent Troubleshooting

Condenser fan motor

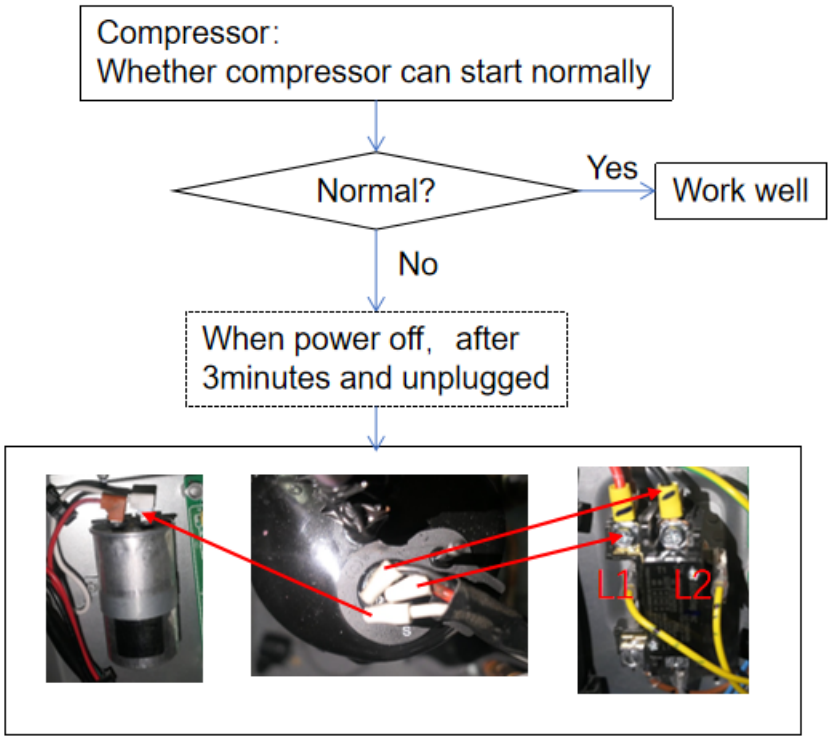


Resistance （Ω）	100W/200W
Between U and V	<36
Between V and W	<36
Between W and U	<36
Between U/V/W and ground	>10M



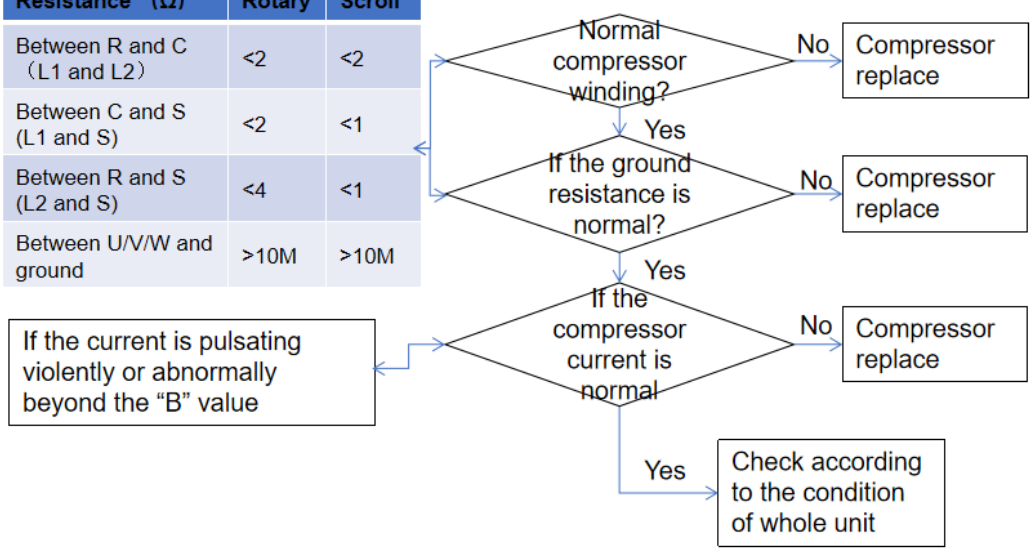
Intelligent Troubleshooting

Compressor



For Scroll compressor, supply wring is unitary, which can be identified with colors (Red for L1, Black for L2, White for S).

Resistance （Ω）	Rotary	Scroll
Between R and C （L1 and L2）	<2	<2
Between C and S (L1 and S)	<2	<1
Between R and S (L2 and S)	<4	<1
Between U/V/W and ground	>10M	>10M



Model	1.5Ton	2Ton	2.5Ton	3Ton	3.5Ton	4Ton	5Ton
B(A)	10	12	13	17	20	23	30

Troubleshooting

Multi-meter

Voltage AC (V)

Resistance (Ω)

Capacitor (μF)

Current AC (A)

Intelligent Troubleshooting

Control board replacement procedure

WARNING:

- Improper servicing could result in dangerous operation, injury or property damage. The operations described below must be performed by qualified personnel.

NOTICE:

- Do not directly touch the components on the control board to avoid static electricity damage.

Board Replacement Procedure

1. Turn off power to both the indoor and outdoor unit and wait AT LEAST 3 minutes before removing the outdoor unit's control board access panel.

WARNING: ELECTRICAL HAZARD 325 VOLTS DC

- Wait 3 minutes after disconnecting power, then verify DC voltage is less than 42.4 VDC at port CN44 (P-N). Components may store a dangerous electrical potential of 325 Volts DC. Failure to follow these instructions could result in personal injury or death.

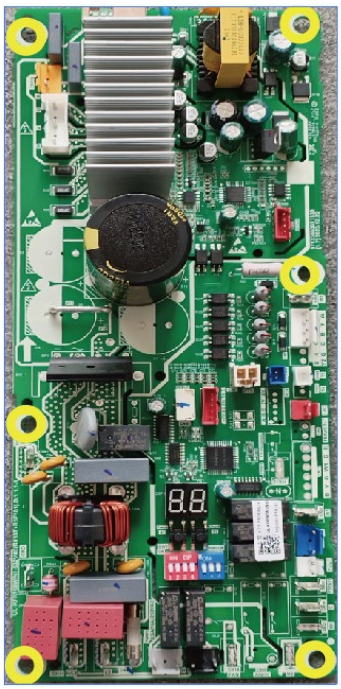
NOTICE:

- Take a photo before removing any screws or wiring to use as reference when installing the new board.
- Use a screwdriver instead of an electric screwdriver/drill, otherwise the control board may be damaged.
- There is no need to disconnect the field supplied thermostat wires; directly remove the thermostat wire plug on the control board.

2. Remove all wires and plugs from the control board.
3. Remove the 6 screws on the control board and separate the board from the unit (Refer to Figure 1: items circled in yellow.)

NOTICE:

- Hold the control board before removing the last screw, otherwise the control board may be damaged because of falling.

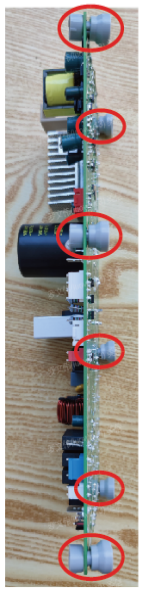


THE OUTDOOR CONTROL BOARD

*The photo shown is for reference only, the actual product may vary.

Figure 1

4. Install the 6 pairs separation pillars removed from the old control board on the new control board (Refer to Figure 2: items circled in red.)



SEPARATION PILLAR

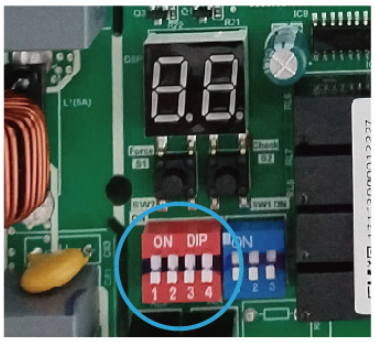
*The photo shown is for reference only, the actual product may vary.

Figure 2

Intelligent Troubleshooting

Control board replacement procedure

5. Install the new board on the unit and fasten all screws removed from the old board (Refer to Figure 1 for screw location.)
6. Reconnect the wires according to the wiring diagram (Or refer to the photo before disassembly.) (Note: CN34,CN35,CN38,CN44 do not have any wire connections.)
7. Set and check SW2 switch code. Refer to Table 1 or the wiring diagram for information (Refer to Figure 3: SW2 circled in blue.)



SW2 SWITCH

Figure 3

CAPACITY SETTING	MODEL	18K 1.5TON	24K 2TON	30K 2.5TON	36K 3TON	42K 3.5TON	48K 4TON	60K 5TON	61K 5TON
SW2	15.2AC FIN	010,0	001,0	001,0	010,1	011,1	100,1	100,1	100,1
	15.2AC MC	010,0	001,0	010,1	010,1	011,1	100,1	100,1	/
	15.2HP	011,0	001,0	001,0	010,1	011,1	100,1	100,1	100,1

0/1 Definition of dial code switch		SW2 - 4 definition	
	means 0=OFF		100W Fan motor
	means 1=ON		200W Fan motor

MODEL	DESCRIPTION
15.2AC FIN	15.2 SEER Fin type heat exchanger cooling only system
15.2AC MC	15.2 SEER Micro-channel heat exchanger cooling only system
15.2HP	15.2 SEER heat exchanger heat pump system

SW2 SWITCH CODE

Table 1

8. SW1 switch is set for the defrost control mode.

∗ The factory default

SW1	SW1-1	ON	Reserved
		OFF	Reserved ∗
	SW1-2	ON	Reserved
		OFF	Reserved ∗
	SW1-3	ON	Defrosting cycle:30min
		OFF	Defrosting cycle:60min ∗

9. Double check all wire connections and screw positions before powering on.

NOTICE:

- The AC unit comes with a shorted wire group in port CN28. See red circle in below picture . This wire should be removed from the original control board then use it in the new control board. Refer to Figure 4.

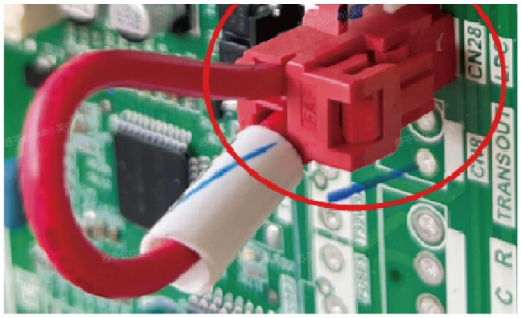


Figure 4