

TECHNICAL SERVICE MANUAL

InverSmart / InverStar



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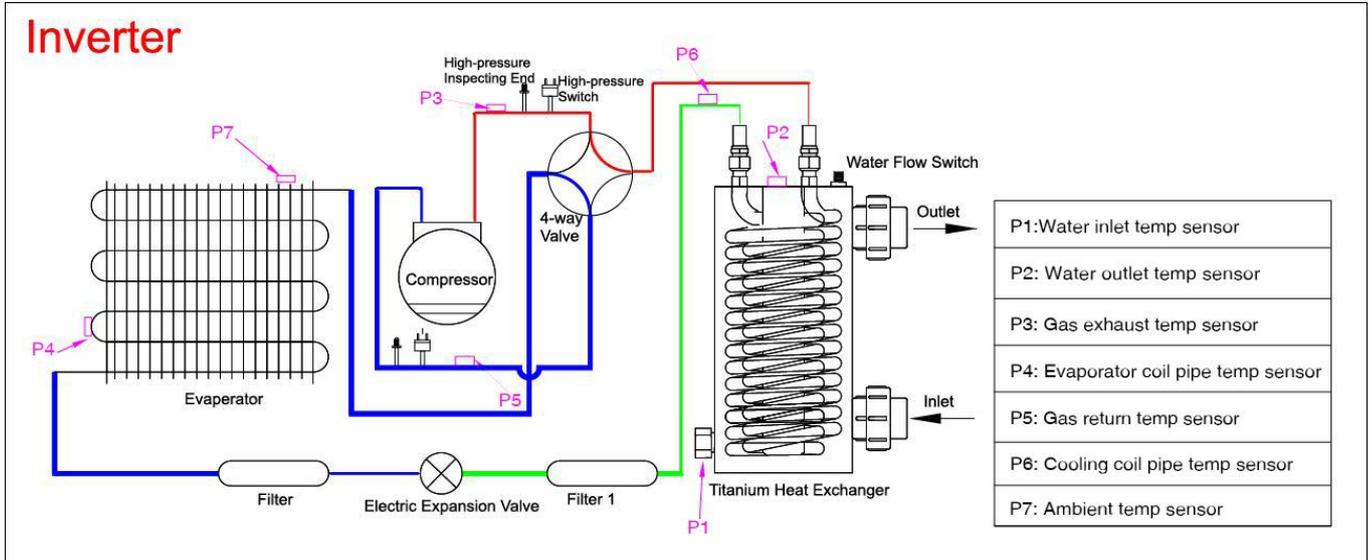
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Chapter I : Generalization

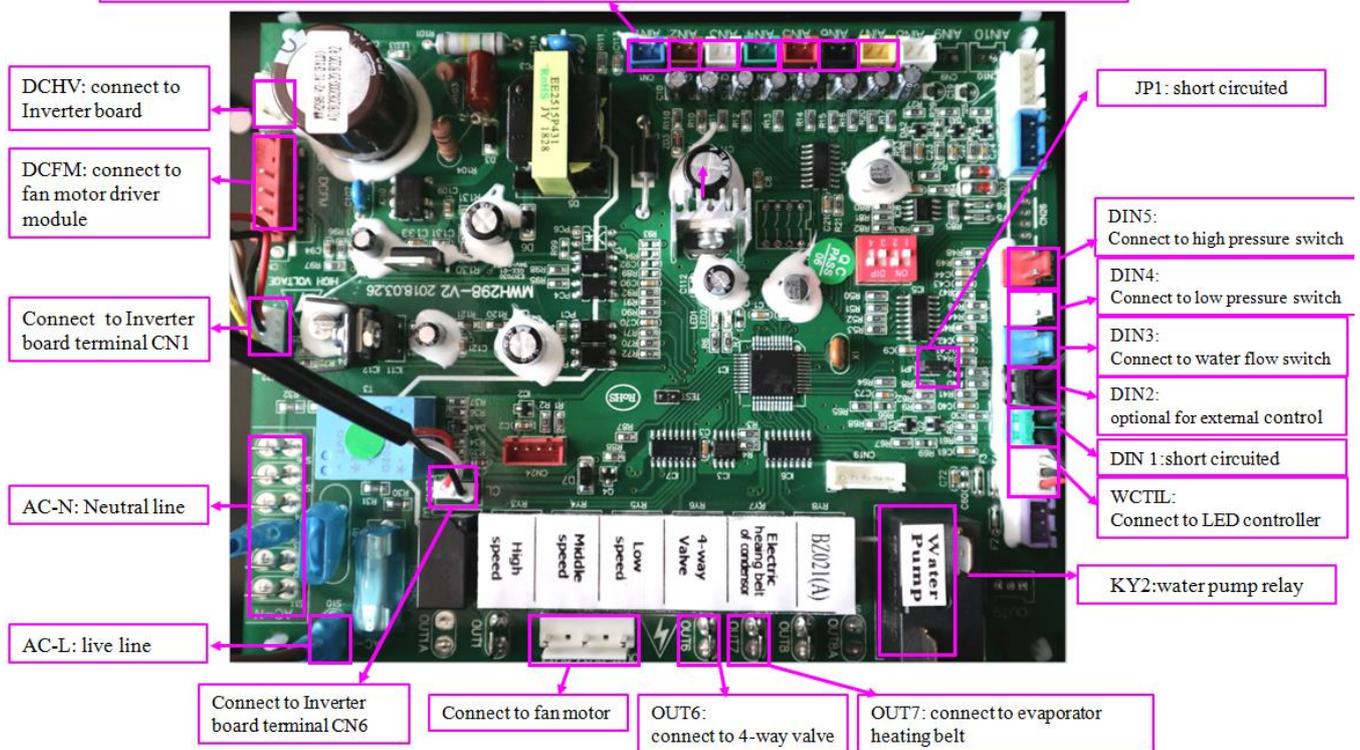
1. Product diagram

The air source heat pump for swimming pool is mainly consisted of compressor, evaporator, throttling element, filter and titanium heat exchanger.

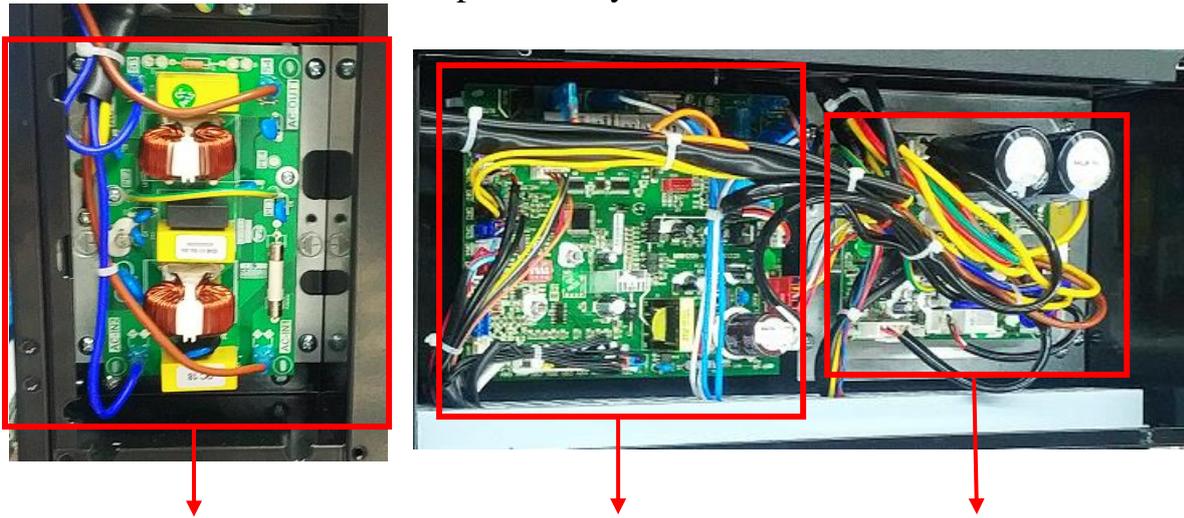


2. 2021 season PC board terminal introduction

AIN1: water inlet temp sensor (blue) AIN5: Gas exhaust temp sensor (red)
 AIN2: water outlet temp sensor (brown) AIN6: Gas return temp sensor (black)
 AIN3: Heating coil pipe (evaporator) temp sensor (white) AIN7: Ambient temp sensor failure (yellow)
 AIN4: Cooling coil pipe (heat exchanger) temp sensor (green)
 PS: the color of temp sensor plug is in accordance with the color of terminals on PCB



3. 2021 season electric box components layout



Power Filter Board

PC Board

Inverter Board

4. Safety Precautions

We have provided important safety messages in this manual and on your heater. Please always read and obey all safety messages.

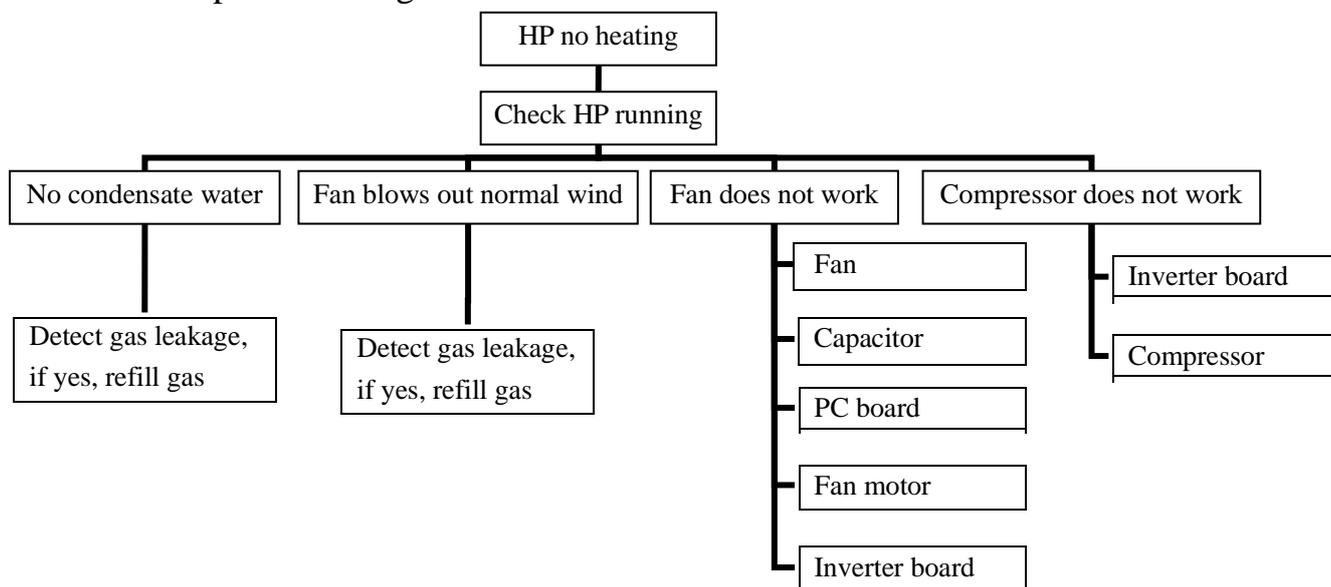
- A. Environment friendly R32 Refrigerant is used for this heat pump. All operations must be done by professional staff only in accordance with this manual. All repair practice by non-professional is prohibited.
- B. Installation and any repairing should be conducted in the area with good ventilation. The ignition source is prohibited during the operation.
- C. Safety inspection must be carried before the maintenance or repair for heat pumps with R32 gas in order to minimize the risk.

	<p>a. Keep the heat pump away from fire source.</p>
	<p>b. It must be placed in well ventilated area; indoor or closed area is not allowed.</p>
	<p>c. Repair and disposal must be carried out by trained service personnel</p>
	<p>d. Vacuumize completely before welding. Welding can only be carried out by professional personnel in service center.</p>

Chapter II : Common Fault

Error code	Description	Solution	Page
N/A	No heating	Checking HP running status	3~5
N/A	Defrosting Problems	1). Check installation environment 2). Compulsory defrosting 3). Detect leakage and refill gas	6

1. Heat Pump No Heating



After HP reach the set temp, it will stop, if the pool temp decrease more than 1°C, the HP will restart and heat. To check if there is any error code, if there is, please check according to after-service manual; if there is no error code, please check according to following steps:

1.1 Check if there is condensate water, as normally the running HP is with condensate water. If no condensate water, please detect gas leakage and refill gas.

Only qualified R32 gas technician is able to detect and refill the gas !



1.2 Check the wind blows out from HP: under heating mode, the wind is cold, under cooling mode, the wind is warm. If fan blows out normal temp wind, please check gas leakage and recharge

Only qualified R32 gas technician is able to detect and refill the gas !



1.3 Check if fan is working. If not, please check and clear out the fault step by step. If the problem still exists after one step, then please proceed to next step.

- A. Check the fan is running properly, if not, please replace the fan
- B. Check capacitor wire connection
- C. Please replace PC board
- D. Check if the fan motor is failure, if failure, please replace fan motor.

E. Replace the inverter board

1.4 Check if compressor is running normally. Please check and clear out the fault step by step. If the problem still exists after one step, then please proceed to next step.

A. Replace the inverter board

B. Compressor detection: Please detect the compressor in below 2 ways. If either occur, please replace compressor.

a) Check if the circuit of compressor is failure:

Warning: When conducting below operation, heat pump must be powered off!

The resistance is the same between any two terminals. If one of them is different, that means compressor fail in circuit, please replace compressor.



1st, Please adjust resistance grade to 200 Ω before use.



2nd, Three terminals of compressor
U(R) -Terminal of running winding
W(C) -Public terminals of two windings.
V(S)-Terminal of startup winding



3rd, As photos, if the resistance between any two terminals of compressor, that means the compressor is ok. But if one of them is zero or infinite, that means failure, please replace compressor.

b) Check if the compressor gets stuck by clamp meter:

1st, If the compressor has any special sound

2nd, If no special sound, please detect the running current by clamp meter, if it is several times more than rate current, please replace compressor.



Detection of running current:

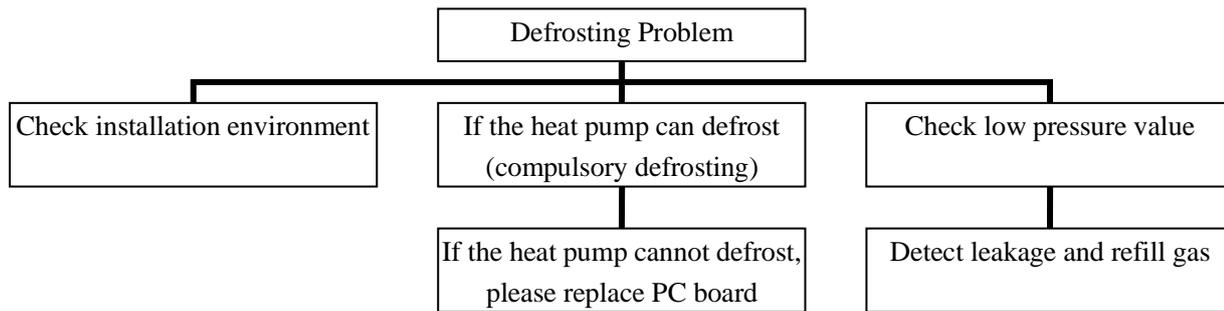
- 1, When power off, adjust clamp meter to applicable grade, and clamp the power cord of terminal L.
- 2, When power on, the detected current is several times more than rated current, and no cold wind blow out from fan, that means compressor get stuck. Please turn off the unit and replace compressor quickly to avoid potential safety hazard

• Rated current of different models for reference

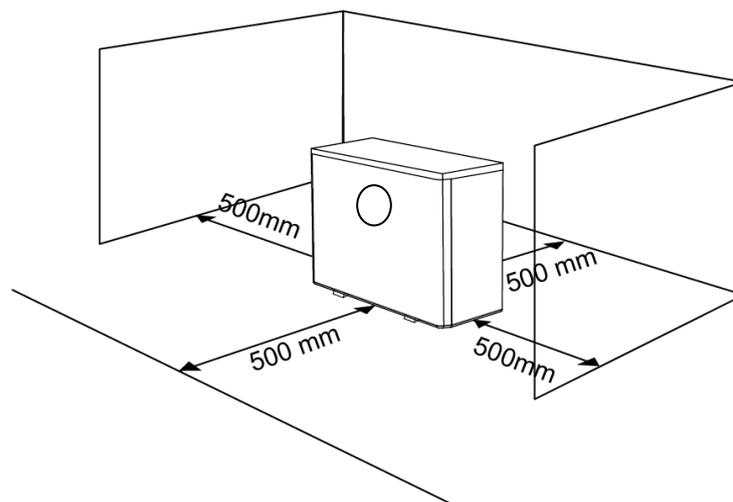
Model	IST07	IST09	IST13	IST16	IST20	IST24
Rated input current (A)	0.79~5.1	1.05~6.4	1.4~9.0	1.7~10.7	2.18~13.3	2.45~16.1

1.5 If not belong to above situation (there is condense water, fan blows out cold/heating wind, fan does work, and compressor work), please power off the HP at least 5 minutes, and then restart it and set pool temp to 35 °C

2. Defrosting Problem



2.1 Installation environment



A. Check if the heat pump is installed according to above requested distance.

B. Check if evaporator fins of heat pump are blocked.

2.2 Manual defrosting:

A. Controller manual defrosting instruction

When heat pump is in heating mode and the compressor is working continuously for 10 minutes,

press “”, and “” for 5 seconds to start manual defrosting. The “” indicator will keep flashing until the defrosting process finishes.

(Remarks: To start another Manual Defrosting, please wait at least 30 minutes after finishing the previous one.)

B. Please replace PC board if manual defrosting cannot start up

2.3 Detect leakage and refill gas

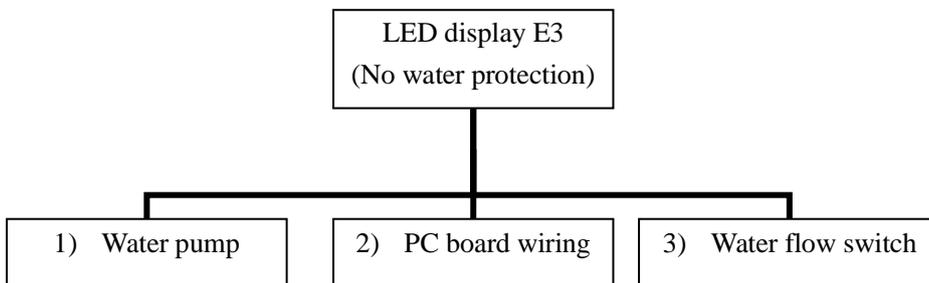
Only qualified R32 gas technician is able to detect and refill the gas !



Chapter III :Protection Code

Error code	Description	Solution	Page
E3	No water protection	1). Water pump 2). PC board wiring 3). Water flow switch	7~8
E5	Power supply excesses operation range (not failure)	1). Recover when back to the normal power 2). Replace PC board	9
E6	Excessive temp difference between inlet and outlet water (insufficient water flow protection)	Check water pump	9
Eb	Ambient temperature too high or too low protection (not failure)	Out of application range	9
Ed	Anti-freezing reminder (not failure)	Wait for automatic recovery	10

1. E3 solution



 **Warning: When conducting below operation, heat pump must be powered off!**

1.1 Check water pump

- A. If water pump is running well
- B. If water flow is sufficient
- C. If water pump is blocked
- D. If by-pass is fully opened

1.2 Check PC board wiring

- A. Check if DIN3 of water flow switch on PC board is well connected. (DIN3, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)
- B. Please replace water flow switch if above checking is ok

1.3 Water flow switch installation

A. Check if there is O-ring seal in the new water flow switch



B. Insert water flow switch as photo, pay attention to the arrow direction.



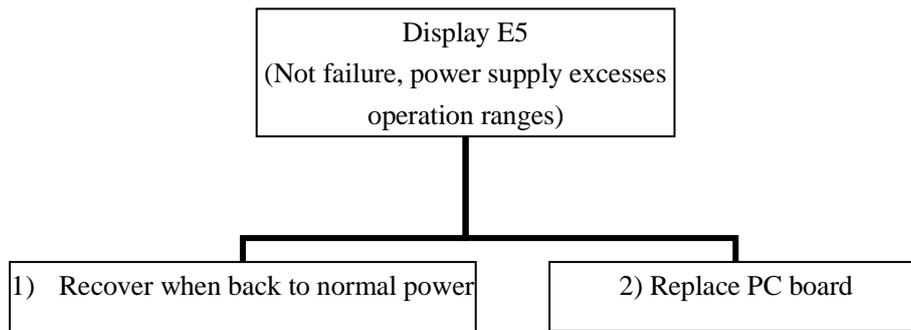
C. Hold steady up-side, screw tight water flow switch with pliers



D. After installation



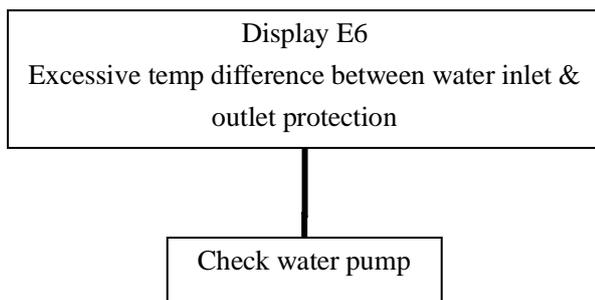
2. E5 Solution



2.1 Display E5 when Power $\leq 170V$ or $\geq 270V$, 180V~255V will recover

2.2 If still display E5 after power supply is normal, replace PC board

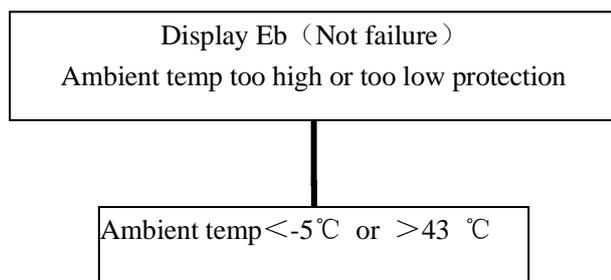
3. E6 Solution



When water temp difference between inlet & outlet excess $10^{\circ}C$, check water pump

- A. If water pump is running well
- B. If water flow is sufficient
- C. If water pump is blocked
- D. If by-pass is fully opened

4. Eb Solution



Solution: Wait until air temp is $-5\sim 43^{\circ}C$.

5. Ed Solution

Display Ed (not failure)
Anti-freezing reminder

Anti-freezing reminder
Display Ed: When water inlet temp ≤ 2 °C and air temp ≤ 0 °C.
Status: Heat pump automatically start running at heating mode.

Recover: When water inlet temp ≥ 15 °C or air temp ≥ 1 °C.
Status: Heat pump recover to be turned off or standby.

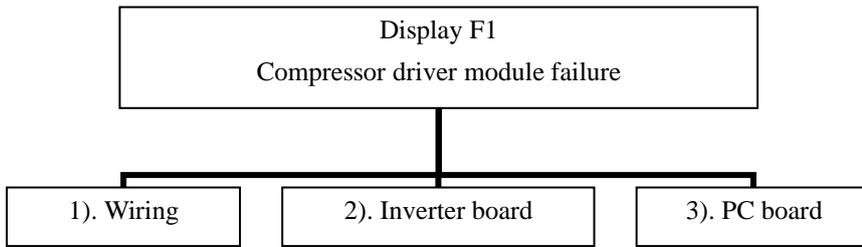
Note:

- Only when heat pump is powered on and water pump is running, heat pump can enter anti-freezing status, if there is no water goes through heat pump, then E3 will display, heat pump will stop.
- Ed displays only if heat pump is standby or turned off but with power on.

Chapter IV : Electrical system failure

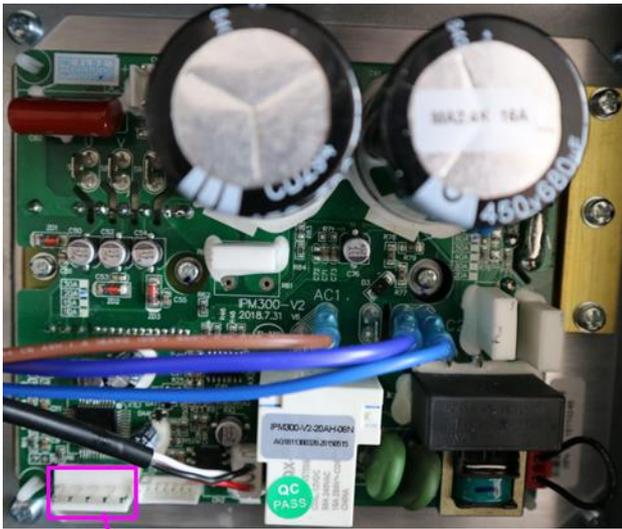
Error code	Description	Solution	Page
F1	Compressor drive module failure	1). Wiring 2). Inverter board 3). PC board	12
F2	PFC module failure	1). Inverter board 2). PC board	12
F3	Compressor start failure	1). Compressor wiring 2). Inverter board 3). Compressor	13
F4	Compressor running failure	1). Compressor wiring 2). Inverter board 3). Compressor	13
F5	Inverter board over current protection	1). Wiring 2). Inverter board 3). PC board	13~14
F6	Inverter board overheat protection	1). Wiring 2). Inverter board 3). PC board	13~14
F7	Current protection	1). Power off and restart 2). Inverter board 3). Compressor	14
F8	Cooling plate overheat protection	1). Power off and restart 2). Check fan motor 3). Check cooling plate	14
F9	Fan motor failure	1). Wiring 2). PC board 3). Fan motor	15
Fb	Power filter plate No-power protection	1). Replace Inverter board	15
FA	PFC module over current protection	1). Power off and restart 2). Replace Inverter board	15
P0	Controller communication failure	1). Wiring 2). Replace LCD controller 3). Replace PC board	16
PA	Restart memory failure	Replace PC board	16

1. F1 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

1.1 Please Check if wiring of terminal CN1 or other terminals on inverter board is well connected.

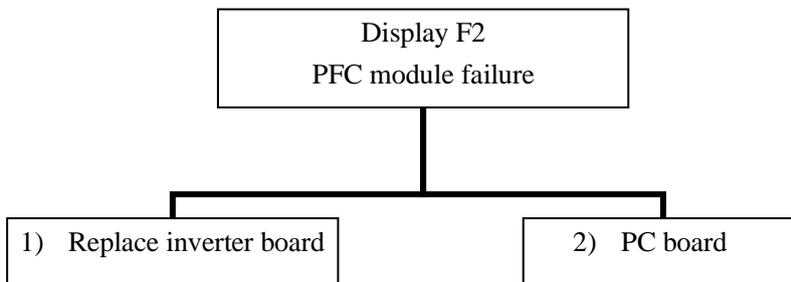


Terminal CN1

1.2 If above checking is no problem, please replace inverter board.

1.3 If still display error code after replacing inverter board, please replace PC board.

2. F2 Solution

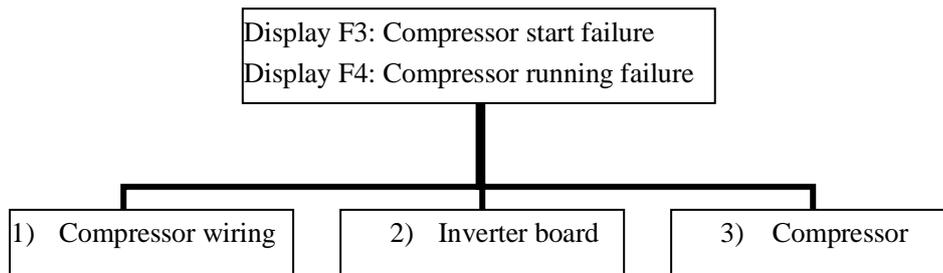


⚠ Warning: When conducting below operation, heat pump must be powered off!

2.1 Replace the inverter board first

2.2 If the error code still exists, please replace PC board

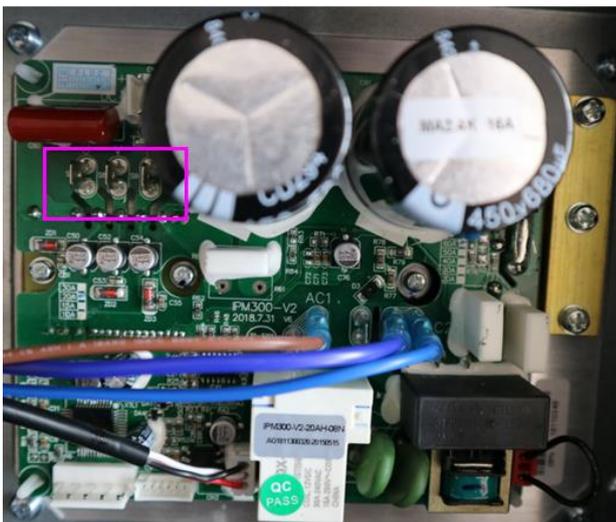
3. F3/F4 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

3.1 Check if wiring between compressor and Inverter board is well connected

Terminals: U、V、W



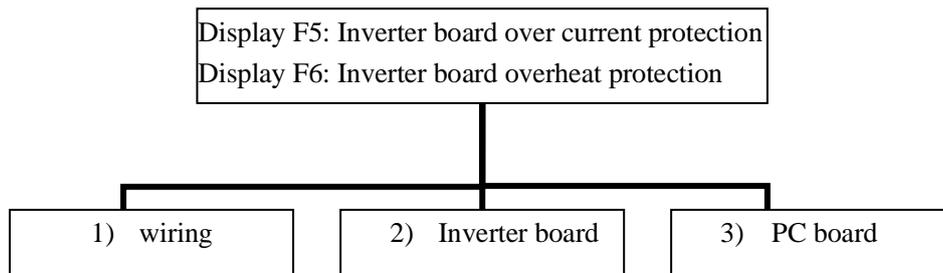
Inverter Board(Single Phase)

3.2 If wiring is no problem, please replace Inverter board

3.3 If the error code still exists, please check compressor: values between any two terminals should be the same. If the values are not the same, that means the compressor is with problem, please replace a new compressor.

Checking methods, pls refers to page7. (*Chapter II Common Failure, Part 1.4-Check if compressor is working*)

4. F5/F6 Solution



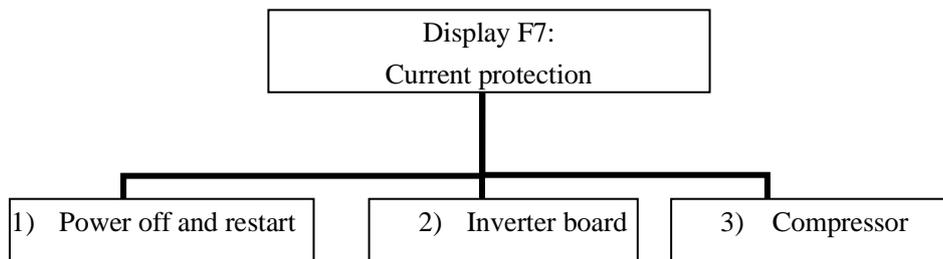
 **Warning: When conducting below operation, heat pump must be powered off!**

4.1 Check if wiring of terminal CN1 is well connected (CIN1, refers to page 15, *Chapter IV Electrical system failure, Part 1.1 –wiring*)

4.2 If it well connected, please replace Inverter board

4.3 If the error code still exists, please replace PC board

5. F7 Solution



 **Warning: When conducting below operation, heat pump must be powered off!**

If current is over max setting value, F7 will display. Normally when current reach max setting value, the HP will run by lower frequency. Restart at least 5 minutes after disconnection

5.1 Power off and restart

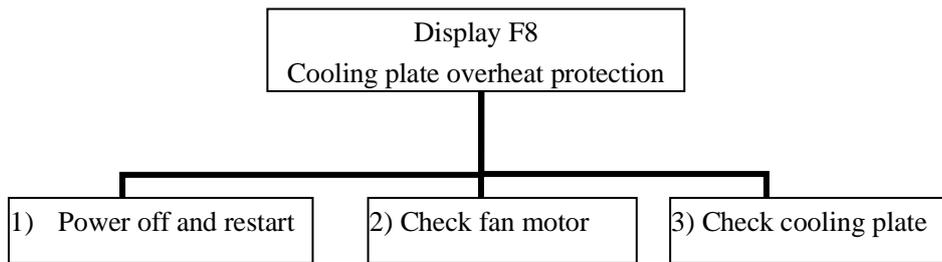
5.2 Replace inverter board

5.3 Check compressor

A. When compressor runs, listen and check if any sound “Kaka”.

B. HP power off, check resistance of 3 terminals of compressor: check between any 2 terminals of compressor, if the three values are the same, the compressor is ok; otherwise compressor fail.

6. F8 Solution



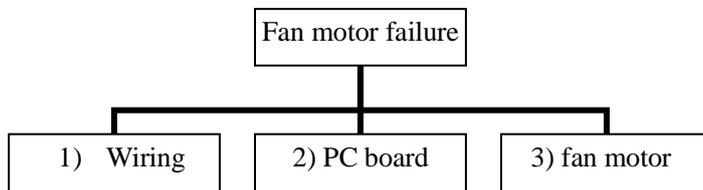
Alarm: Temp of cooling plate: Cooling $\geq 85^{\circ}\text{C}$, heating $\geq 75^{\circ}\text{C}$

6.1 Switch off at least 5 minutes and the temp of cooling plate $\leq 50^{\circ}\text{C}$

6.2 Check the fan motor is running well or not

6.3 Check if there is much accumulated dust on cooling plate, if yes, please clean it.

7. F9 Solution



 **Warning: When conducting below operation, heat pump must be powered off!**

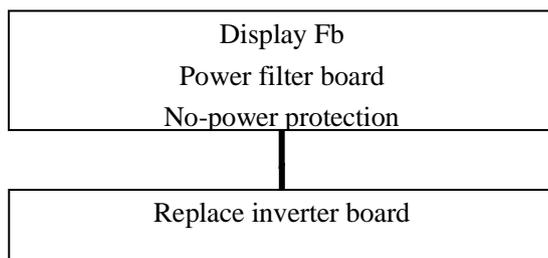
7.1 Wiring

Check if DCFM & JP1 terminals are well connected (DCFM & JP1, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

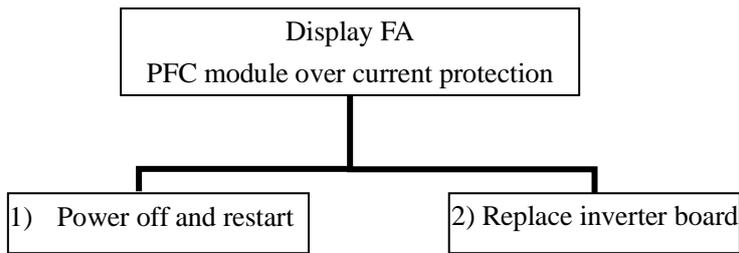
7.3 If the error code still exists, please replace PC board

7.4 If the error code still exists, please replace fan motor

8. Fb Solution



9. FA Solution

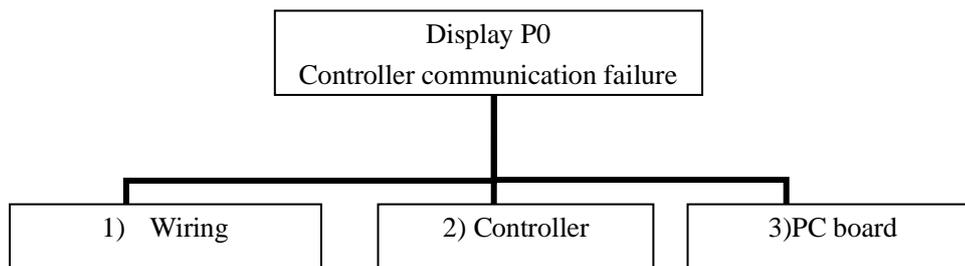


 **Warning: When conducting below operation, heat pump must be powered off!**

9.1 Restart the HP at least 5 minutes after turning off

9.2 Replace inverter board

10. P0 Solution



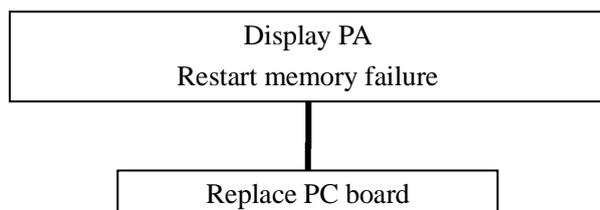
 **Warning: When conducting below operation, heat pump must be powered off!**

10.1 Check if WCTIL wiring on PC board is well connected (WCTIL, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

10.2 If the error code still exists, replace controller

10.3 If the error code still exists, please replace PC board

11. PA Solution

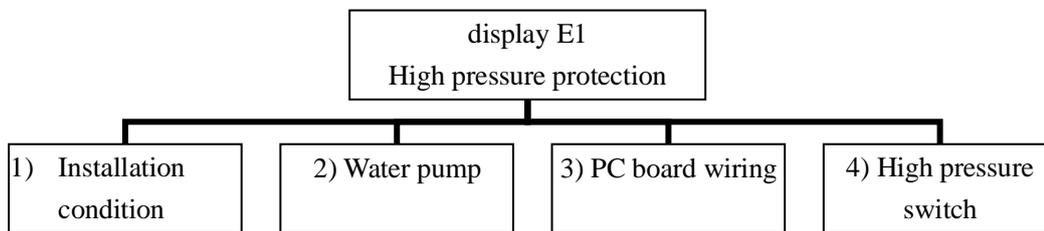


 **Warning: When conducting below operation, heat pump must be powered off!**

Chapter V : Piping system failure

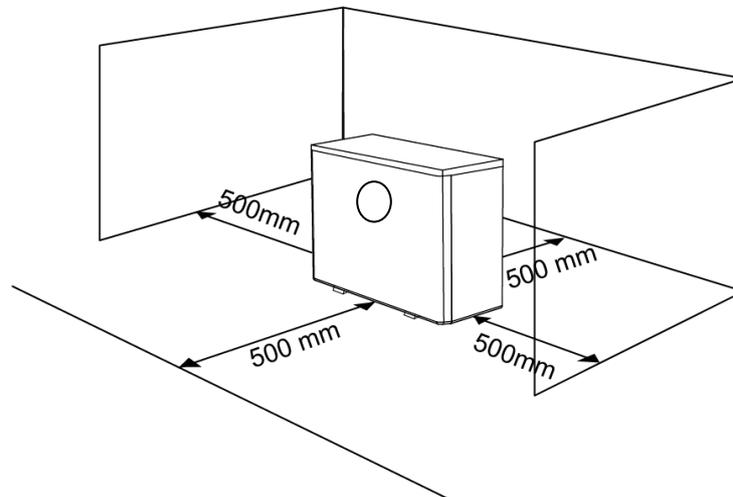
Error code	Description	Solution	Page
E1	High pressure protection	1). Installation condition 2). Water pump 3). Wiring 4). High pressure switch	17~18
E2	Low pressure protection	1). Wiring 2). Detect gas leakage 3). Low pressure switch	18
E8	High exhaust temp protection	1). Installation condition 2). Water pump 3). Detect gas leakage 4). Gas exhaust temp sensor	19
EA	Heat exchanger overheat protection / Evaporator overheat protection (only at cooling mode)	1). Installation condition 2). Fan 3). Fan motor	20

1. E1 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

1.1 Installation condition



A. Check if heat pump is installed according to above distance

B. Check if heat pump evaporator fins are blocked

1.2 Check water pump

A. If water pump is running well

B. If water flow is sufficient

C. If water pump is blocked

D. Check if water pump valve is fully opened

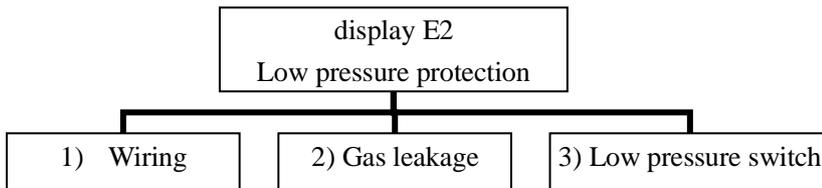
1.3 Check if DIN5 wiring on PC board is well connected. (DIN5, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

1.4 Check high pressure switch

If wiring on PC board is ok, please replace high pressure switch (photo). If problem still unsolved, maybe heat pump gas circulation system blocked, please replace a new HP.



2. E2 Solution



 **Warning: When conducting below operation, heat pump must be powered off!**

2.1 Check if DIN4 wiring on PC board is well connected (DIN4, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

2.2 Gas leakage detecting & refilling

Only qualified R32 gas technician is able to detect and refill the gas !

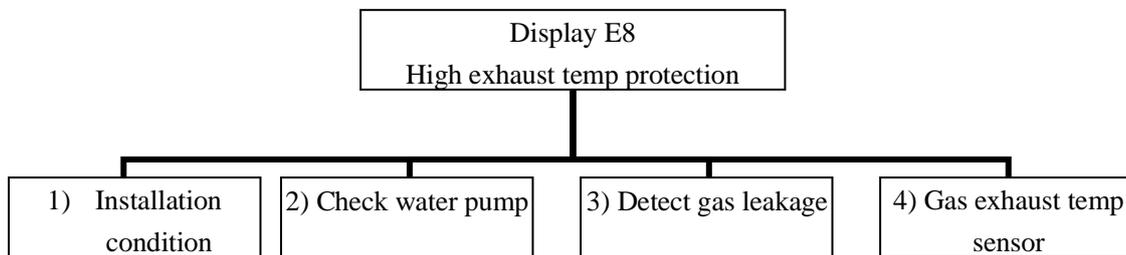


2.3 Check low pressure switch

If the error code still exists, please replace low pressure switch (photo)



3. E8 solution



 **Warning: When conducting below operation, heat pump must be powered off!**

3.1 Check installation condition

Checking methods, refers to page 22. (*Chapter V Piping system failure, Part 1.1-Installation condition*)

3.2 Check water pump

- A. If water pump is running well
- B. If water flow is sufficient
- C. If water pump is blocked
- D. Check if water pump valve is fully opened. If it is blocked, it will lead to water inlet and outlet temp too high, and gas exhaust temp overheat, then E8 display.

3.3 Gas leakage detecting

Only qualified R32 gas technician is able to detect and refill the gas !



3.4 Gas exhaust temp sensor

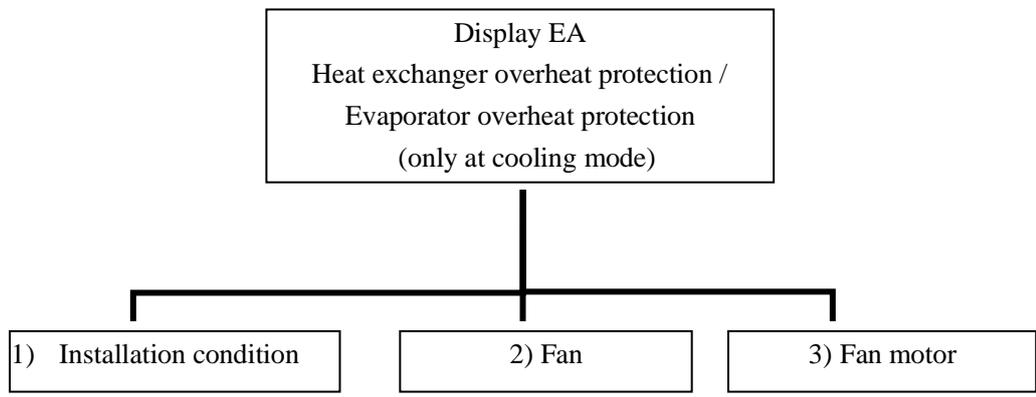
- A. Check if wiring of AIN5 is well connected. (AIN5, refers to page1, *Chapter I, PC board terminal introduction*)
- B. Check if gas exhaust temp sensor is well connected.



Gas exhaust temp sensor position:
On gas exhaust copper pipe

C. If the error code still exists, please replace gas exhaust temp sensor.

4. EA Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

4.1 Check installation condition (checking methods, refers to page22, *Chapter V Piping system failure, 1.1-Installation condition*)

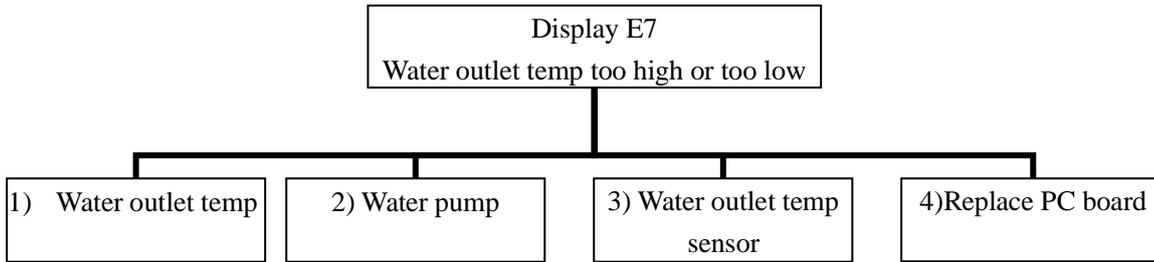
4.2 If the error code still exists, check if fan is broken.

4.3 If the error code still exists, replace fan motor.

Chapter VI : Water system failure

Error code	Description	Solution	Page
E7	Water outlet temp too high or too low protection	1). Water outlet temp 2). Water pump 3). Water outlet temp sensor 4). Replace PC board	21

1. E7 solution



 **Warning: When conducting below operation, heat pump must be powered off!**

1.1 Water outlet temp checking

Check water outlet temp: Cooling: water outlet temp $\leq 2^{\circ}\text{C}$, Heating: water outlet temp $\geq 55^{\circ}\text{C}$

1.2 Check water pump

- A. If water pump is running well
- B. If water flow is sufficient
- C. If water pump is blocked
- D. Check if water pump valve is fully opened

1.3 Check water outlet temp sensor

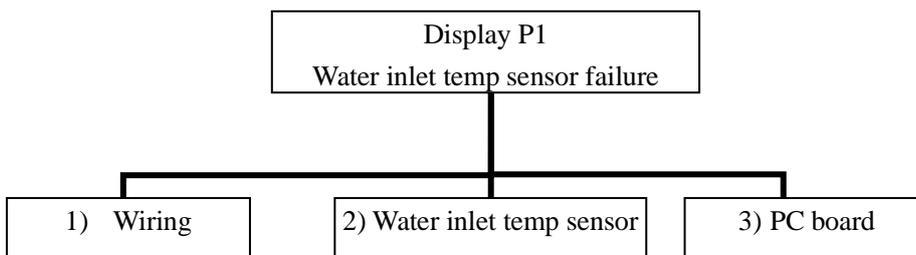
- A. Check if water outlet temp sensor terminal AIN2 is well connected. (AIN2, refers to page1, *Chapter I, PC board terminal introduction*)
- B. If the error code still exists, please replace water outlet temp sensor

1.4 If the error code still exists, please replace PC board

Chapter VII : Temperature sensor failure

Error code	Description	Solution	Page
P1	Water inlet temp sensor failure	1). Wiring 2). Water inlet temp sensor 3). Replace PC board	22~23
P2	Water outlet temp sensor failure	1). Wiring 2). Water outlet temp sensor 3). Replace PC board	23
P3	Gas exhaust temp sensor failure	1). Wiring 2). Gas exhaust temp sensor failure 3). Replace PC board	24
P4	Evaporator coil pipe temp sensor failure	1). Wiring 2). Evaporator coil pipe temp sensor 3). Replace PC board	24~25
P5	Gas return temp sensor failure	1). Wiring 2). Gas return temp sensor 3). Replace PC board	25
P6	Cooling coil pipe temp sensor failure	1). Wiring 2). Cooling coil pipe temp sensor 3). Replace PC board	26
P7	Ambient temp sensor failure	1). Wiring 2). Ambient temp sensor 3). Replace PC board	26~27
P8	Cooling plate temp sensor failure	Replace inverter board	27
P9	Current sensor failure	1). Replace inverter board for single phase model 2). Replace power filter plate for 3 phases model	27

1. P1 solution



• **Warning: When conducting below operation, heat pump must be powered off!**

1.1 Check if water inlet temp sensor wiring AIN1 is well connected. (AIN1, refers to page 1, *Chapter I Generation, Section 2, PC board terminal introduction*)

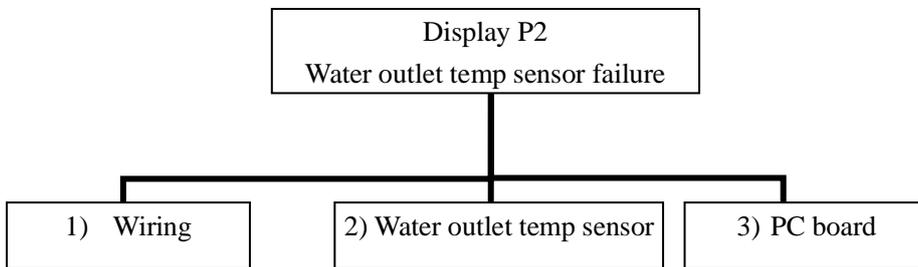
1.2 If the error code still exists, please replace water inlet temp sensor



Water inlet temp sensor position:
Down side of heat exchanger

1.3 If still display P1 after replacing water inlet temp sensor, please replace PC board.

2. P2 solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

2.1 Check if water outlet temp sensor wiring AIN2 is well connected. (AIN2, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

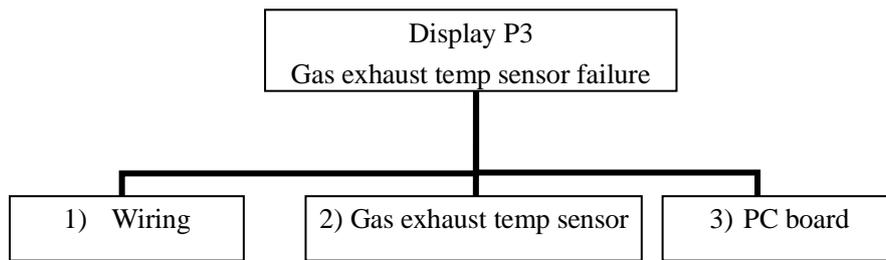
2.2 If the error code still exists, please replace water outlet temp sensor



Water outlet temp sensor position:
Above heat exchanger

2.3 If still P2 after replacing water inlet temp sensor, please replace PC board.

3. P3 solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

3.1 Check if gas exhaust temp sensor wiring AIN5 is well connected. (AIN5, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

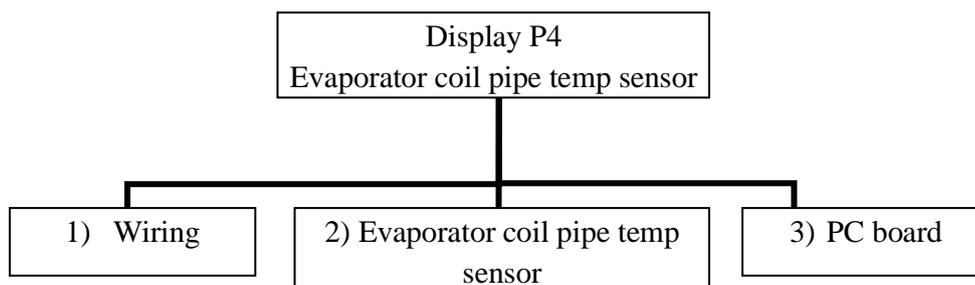
3.2 If the error code still exists, please replace gas exhaust temp sensor.



Gas exhaust temp sensor position:
On gas exhaust copper pipe

3.3 If still P3 after replacing water inlet temp sensor, please replace PC board.

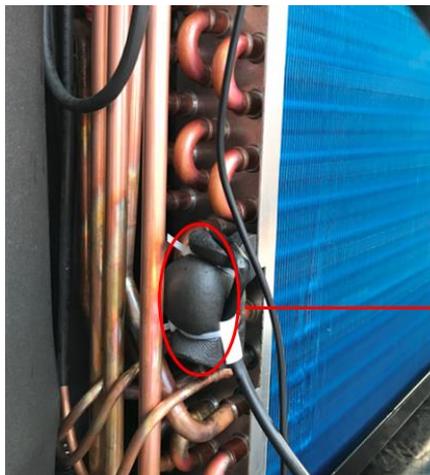
4. P4 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

4.1 Please check if heating coil pipe temp sensor AIN3 wiring is well connected. (AIN3, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

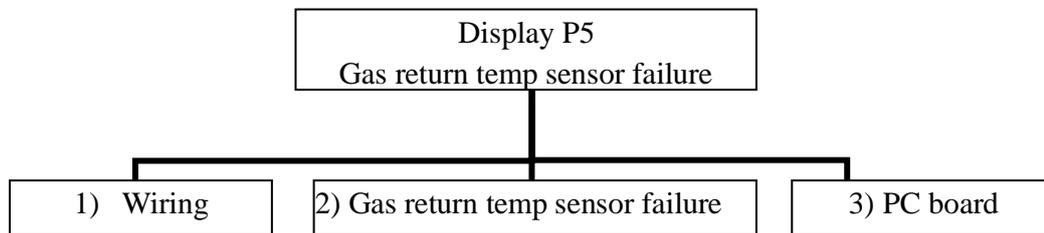
4.2 If the error code still exists, please replace heating coil pipe temp sensor.



Evaporator coil pipe position: the bottom of evaporator coil pipe

4.3 If still P4 after replacing water inlet temp sensor, please replace PC board.

5. P5 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

5.1 Please check if gas return temp sensor AIN6 wiring is well connected. (AIN6, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

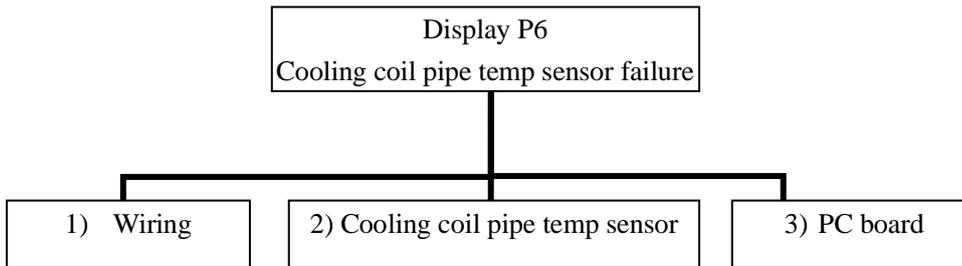
5.2 If the error code still exists, please replace gas return temp sensor



Gas return temp sensor position: near low pressure switch

5.3 If still P5 after replacing gas return temp sensor, please replace PC board.

6. P6 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

6.1 Please check if cooling coil pipe temp sensor AIN4 wiring is well connected. (AIN4, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

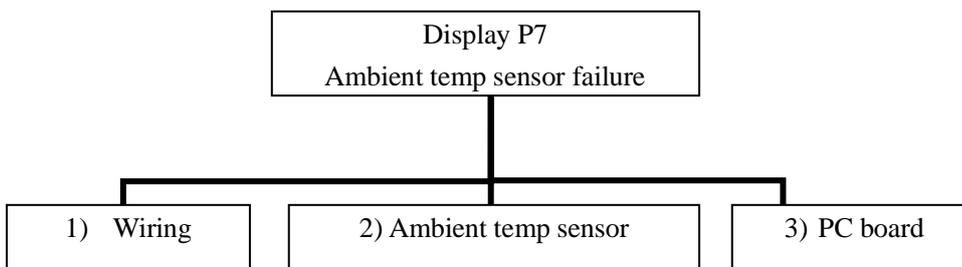
6.2 If the error code still exists, please replace cooling coil pipe temp sensor.



Cooling coil pipe temp sensor position:
on the top of heat exchanger

6.3 If still P6 after replacing gas return temp sensor, please replace PC board.

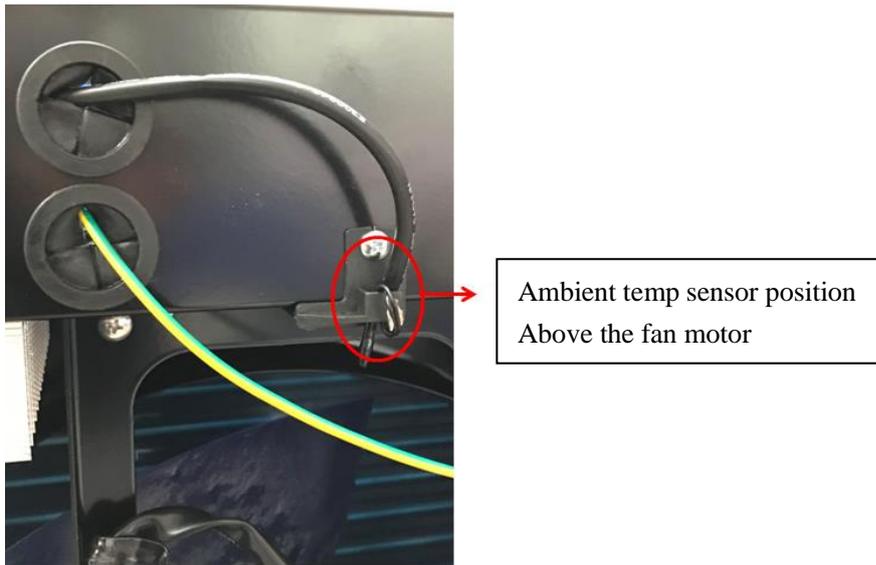
7. P7 Solution



⚠ Warning: When conducting below operation, heat pump must be powered off!

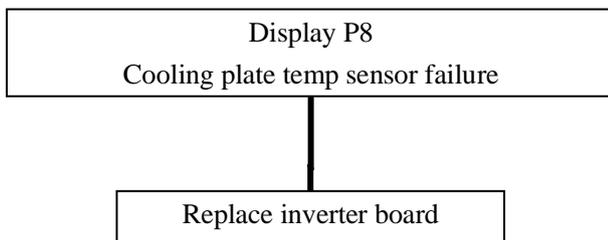
7.1 Please check if ambient temp sensor AIN7 wiring is well connected. (AIN7, refers to page1, *Chapter I Generation, Section 2, PC board terminal introduction*)

7.2 If the error code still exists, please replace ambient temp sensor.



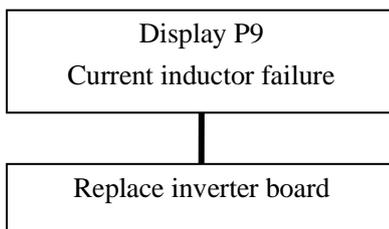
7.3 If still P7 after replacing gas return temp sensor, please replace PC board.

8. P8 Solution



 **Warning: When conducting below operation, heat pump must be powered off!**

9. P9 Solution



 **Warning: When conducting below operation, heat pump must be powered off!**