

# Service Manual

High ESP Duct 196Pa

**SAD48HD1-A, SAD60HD1-A**

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## Chapter I Model Selection

### 1. General description

#### 1.1 Product introduction

Duct type air conditioner (Cooling-only or Heat pump), named for the duct can be installed to connect with air outlet and inlet. According to different ESP, it divides into Low ESP Duct type (12~30Pa), Medium ESP Duct type (50~80Pa) and High ESP Duct type (higher than 80Pa). The series of products static pressure for 196Pa High ESP Duct type.

**Application occasions:**

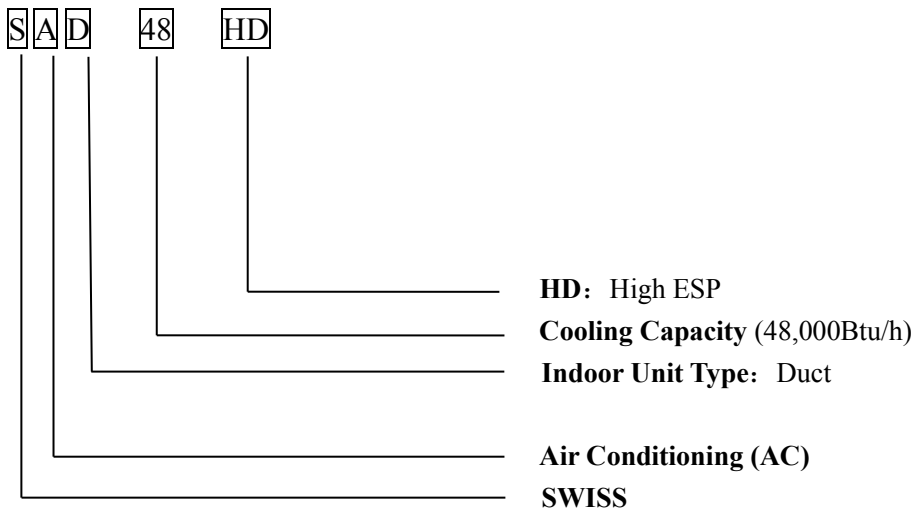
Small super market, hotel, restaurant, office, meeting room and so on.

**Features:**

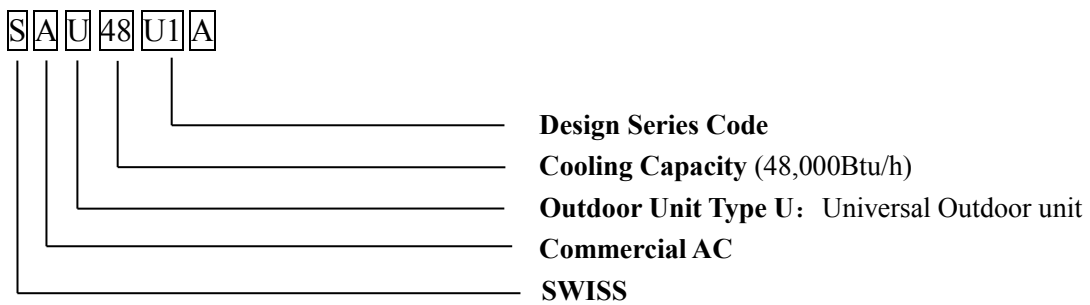
- ◇ESP range ie optional ,applicant place varies, ESP can reach 196Pa,It suits 6.5m super high ceiling air supply;
- ◇According to place designing different air-outlet, The type of air supply and air return was set flexibly and appropriate. The No matter where you are, it will provide confortable for you.
- ◇Conceal design, the unit is installed inside of ceiling, doesn't take room space.
- ◇With Setting or Auto two operation modes, multi speed wind, makes you feel more comfortable;
- ◇Auto restart;
- ◇Standard wired controller and optional remote controller;
- ◇Special insulation design, achieces high heat insulation efficiency and no condensation on shell;
- ◇units with low ambient temperature cooling function, which makes the unit can run normally on the condition that the ambient temperature falls down to -15℃;
- ◇Failure automatic detection, if there is a failure, the indicator will flash and the failure code will display on the wired controller, the failure cause is easier to be found..

## 1.2 Nomenclature

### 1.2.1 indoor unit



### 1.2.2 Universal Outdoor unit



### 1.3 Function introduction





Function Type	Function Item	48	60
Protection	High pressure protection	○	○
	Low pressure protection	○	○
	Compressor overloading protection	○	○
	High exh. temperate protection	○	○
	Phase protection (Phase-loss, phase- reverse)	○	○
	Over-heating protection	○	○
	Anti-freezing protection	○	○
	Sensor failure alarm	○	○
	Failure code display	○	○
Comfort	Cooling	○	○
	Heating	○	○
	3-Speed	○	○
	Adjustable ESP	—	—
	Auto-restart	○	○
	Anti-cold wind	○	○
	Afterheat wind blowing	○	○
	Timing ON/OFF	○	○
Operating	Time display	○	○
	Operation mode display	○	○
	Fan speed display	○	○
	Defrost display	○	○
	Timing ON/OFF display	○	○
	Wind angle display	—	—
	Sleeping mode display	○	○
Running	Auto start	○	○
	Dehumidifying	○	○
	Auto defrost	○	○
	Ventilation function	○	○
	Low ambient temperature cooling	○	○
Health	Washable air filter	○	○
	Fresh air interface	—	—
Installation	Left/right drainage	—	—
	Left/right pipe connection	—	—
	Down/back air suction	—	—
	Installation indicating board	—	—
	Two kinds of static pressure adjustable	—	—

Note : ○ means have this function

— means don't have this function

## 2 Unit Performance

### 2.1 Appearance

Series	Cooling capacity (kBtu/h)	
	48	60
Indoor unit High ESP Duct (196Pa) SAD** HD-A1		
Outdoor unit High ESP Duct (196Pa) SAU** U1-A		
Remote controller, wired controller		
	<b>Optional</b>	<b>Standard</b>

## 2.2 Specification

### 2.2.1 Universal outdoor unit

Model			SAU48U1-A	SAU60U1-A
Power Supply		V~,Hz,Ph	380~415,50,3	380~415,50,3
Capacity	Cooling	Btu/h	48000	60000
		kW	14,00	17,60
	Heating	Btu/h	52800	63122
		kW	15,50	18,50
Max. Input Consumption		W	6100	7800
Max. Current		A	18,00	23,00
Compressor	Model		ATE498SC3Q9RK1	ATE590SC3Q9JK
	Type		Twin Rotary	Twin Rotary
	Brand		HIGHLY	HIGHLY
	Capacity	W	12650	14850
	Input	W	4130	4950
	Rated Current(RLA)	A	7,2	8,7
	Locked Rotor Amp(LRA)	A	69	65
	Thermal Protection temp.	°C	160	180
	Capacitor	uF	/	/
	Refrigerant Oil	ml	1600	1850
Outdoor fan motor	Model		YDK60-6H	YDK60-6H
	Brand		Sinjun/Welling	Sinjun/Welling
	Output Power x Fan quantity	W	60×2	60×2
	Capacitor	μF	3.5×2	3.5×2
	Speed	r/min	750	750
Coil	a.Number Of Row		1,5	1,5
	b.Tube Pitch(a)x Row Pitch(b)	mm	22×19.05	22×19.05
	c.Fin Pitch	mm	1,4	1,4
	d.Fin Material		Hydrophilic aluminum wide fin	Hydrophilic aluminum wide fin
	e.Tube Outside Dia.And Material	mm	φ7 , Inner grooved	φ7 , Inner grooved
	f.Coil Length x Height x Width	mm	973×1320×38.1	973×1320×38.1
	g.Heat Exchanging Area	m <sup>2</sup>	47,62	47,62
Air Flow Volume		CFM	3765	3765
		m <sup>3</sup> /h	6400	6400
Noise Level		dB(A)	60	60
Dimension(W×D×H)	Net	mm	940×368×1366	940×368×1366
	Packing	mm	1080×460×1500	1080×460×1500
Weight	Net	kg	101	102
	Gross	kg	112	113
Refrigerant type/Quantity	Type		R410A	R410A
	Charged Volume	g	2750	2900
Design Pressure		MPa	4,4	4,4



## Light commercial(High ESP Duct 196Pa) Service Manual

Refrigerant Pipe	Liquid Side	mm	9,52	9,52
	Gas Side	mm	19,05	19,05
	Max. Length	m	50	50
	Max. Height	m	30	30
Operation Temperature Range		°C	16~32	16~32
Ambient Temp (Cooling/Heating)		°C	-15~49/-15~24	-15~49/-15~24
Connection Wiring	Power Wiring ( Indoor )	mm <sup>2</sup>	3×1mm <sup>2</sup>	3×1mm <sup>2</sup>
	Power Wiring ( Outdoor )	mm <sup>2</sup>	5×4mm <sup>2</sup>	5×4mm <sup>2</sup>
	Signal Wiring	mm <sup>2</sup>	2×1mm <sup>2</sup>	2×1mm <sup>2</sup>
Stuffing Quantity	20/40/40H	Unit	27/55/55	27/55/55

## 2.2.2 High ESP Duct (196Pa)

Model			<b>SAD48HD1-A</b>
Power Supply		V~,Hz,Ph	380~415,50,3
Capacity	Cooling	Btu/h	48000
		kW	14.0
	Heating	Btu/h	53000
		kW	15.5
Electric Data	Cooling Power Input	kW	4.87
	Heating Power Input	kW	5.13
	Cooling Current	A	9.50
	Heating Current	A	10.00
Performance	EER		2.87
	COP		3.02
Indoor fan motor	Model		YDK200-4
	Brand		KANGBAO
	Output Power	W	200
	Capacitor	uF	10
	Speed (Hi/Mi/Lo)	r/min	1230/1000/750
Indoor Coil	a.Number Of Row		3
	b.Tube Pitch(a)x Row Pitch(b)	mm	22.0/19.05
	c.Fin Spacing	mm	1.6
	d.Fin Material		Hydrophilic
	e.Tube Outside Dia.And Material	mm	φ7.94 , Inner grooved
	f.Coil Length x Height x Width	mm	900*176*57.2
	g.Number Of U-TubeU		24
	h. Number Of Circuits		8
	i.Heat Exchanging Area	m <sup>2</sup>	20.7
Indoor Unit	Indoor Air Flow (Hi/Mi/Lo)	m <sup>3</sup> /h	2000/1600/1400
	Noise Level(Hi/Mi/Lo)	dB(A)	60/57/50
	Rated Input Power(Cooling/Heating)	W	400
	Rated Current (Cooling/Heating)	A	1.90
	Moisture Removal	(L/h)	/
	External Static Pressure	Pa	196
	Unit Dimension (W*H*D)	mm	1200×719×380
	Packing (W*H*D)	mm	1235×760×415
	Net Weight	Kg	55
	Gross Weight	Kg	58
Refrigerant Pipe	Liquid Side	mm	9.52

	Gas Side		mm	19.05
	Max. Refrigerant Pipe Length		m	50
	Max. Difference In Level		m	20
Operation Temperature Range			°C	16~32
Ambient Temperature Range(Cooling/Heating)			°C	-5~49/-15~24
Connection Wiring	Power Wiring	Indoor	mm <sup>2</sup>	3×2.5mm <sup>2</sup>
		Outdoor	mm <sup>2</sup>	/
	Signal Wiring		mm <sup>2</sup>	3×2.5mm <sup>2</sup> +2×1 mm <sup>2</sup>
Wireless Remote Controller				G-XK-HCE3
Qty'per 20' & 40' & 40HQ(Only For Reference)			Set	25/54/54

Model			<b>SAD60HD1-A</b>	
Power Supply			V~,Hz,Ph	380~415,50,3
Capacity	Cooling		Btu/h	60000
			kW	17.6
	Heating		Btu/h	63500
			kW	18.5
Electric Data	Cooling Power Input		kW	5.71
	Heating Power Input		kW	6.00
	Cooling Current		A	10.93
	Heating Current		A	11.48
Performance	EER			2.80
	COP			3.00
Indoor fan motor	Model			YDK200-4
	Brand			KANGBAO
	Output Power		W	200
	Capacitor		uF	10
	Speed (Hi/Mi/Lo)		r/min	1230/1000/800
Indoor Coil	a.Number Of Row			3
	b.Tube Pitch(a)x Row Pitch(b)		mm	22.0/19.05
	c.Fin Spacing		mm	1.6
	d.Fin Material			Hydrophilic
	e.Tube Outside Dia.And Material		mm	φ7.94 , Inner grooved
	f.Coil Length x Height x Width		mm	900*176*57.2
	g.Number Of U-TubeU			24
	h. Number Of Circuits			8
	i.Heat Exchanging Area		m <sup>2</sup>	20.70
Indoor Unit	Indoor Air Flow (Hi/Mi/Lo)		m <sup>3</sup> /h	2000/1600/1400
	Noise Level(Hi/Mi/Lo)		dB(A)	60/57/50

	Rated Input Power(Cooling/Heating)		W	400
	Rated Current (Cooling/Heating)		A	1.9
	Moisture Removal		(L/h)	/
	External Static Pressure		Pa	196
	Unit Dimension (W*H*D)		mm	1200×719×380
	Packing (W*H*D)		mm	1235×760×415
	Net Weight		Kg	55
	Gross Weight		Kg	58
Refrigerant Pipe	Liquid Side		mm	9.52
	Gas Side		mm	19.05
	Max. Refrigerant Pipe Length		m	50
	Max. Difference In Level		m	20
Operation Temperature Range			°C	16~32
Ambient Temperature Range(Cooling/Heating)			°C	-5~49/-15~24
Connection Wiring	Power Wiring	Indoor	mm <sup>2</sup>	3×1mm <sup>2</sup>
		Outdoor	mm <sup>2</sup>	5×2.5mm <sup>2</sup>
	Signal Wiring		mm <sup>2</sup>	3×1mm <sup>2</sup> +3×1mm <sup>2</sup>
Wireless Remote Controller				G-XK-HCE3
Qty'per 20' & 40' & 40HQ(Only For Reference)			Set	25/54/54

Note: ◇ Working condition of the cooling capacity measured: Inside the room DB temperature 27°C, WB temperature 19°C; Outside of the room DB temperature 35°C, WB temperature 24°C; Working condition of the heating capacity measured: Inside the room DB temperature 20°C, Outside of the room DB temperature 7°C, WB temperature 6°C。

◇ Parameters above are all measured when the connecting pipe is 5 meters.

◇ Parameters above may be modified as product improvement. We keep the right to change the product specifications without prior notice, please take the parameters listed on the nameplate as criterion.

## 2.3 Capacity amendment

### 2.3.1 Running range

Cooling capacity (Btu/h)		48000	60000
Power supply		380-415V 3N~/50Hz	
Voltage		320~420V	
Outdoor ambient temperature	Cooling	-5~49℃	
	Heating	-15~24℃	

### 2.3.2 Amendment coefficient of cooling capacity under different indoor/outdoor DB and WB temperature

Indoor air inlet temperature℃		Outdoor air inlet DB temperature℃				
DB	DB	25	30	35	40	43
23	16	0.98	0.94	0.89	0.85	0.82
25	18	1.05	1	0.95	0.90	0.87
27	19	1.1	1.05	1	0.95	0.91
28	20	1.12	1.07	1.02	0.96	0.93
30	22	1.19	1.13	1.08	1.02	0.99
32	24	1.26	1.20	1.15	1.08	1.05

#### Actual cooling capacity calculation:

Actual cooling capacity=amendment coefficient of cooling capacity × nominal cooling capacity

——nominal cooling capacity could be found from the performance parameters list

——amendment coefficient of cooling capacity could be found from table above.

### 2.3.3 Amendment coefficient of heating capacity under different indoor/outdoor DB and WB temperature

Indoor air inlet DB temperature℃	Outdoor air inlet WB temperature℃				
	-5	0	6	10	15
16	0.65	0.80	1.02	1.13	-
18	0.61	0.76	1.02	1.12	-
20	0.6	0.75	1	1.11	1.25
21	0.59	0.72	0.99	1.1	1.24
22	0.58	0.71	0.97	1.09	1.23
24	0.56	0.7	0.96	1.08	1.22

#### Actual heating capacity calculation:

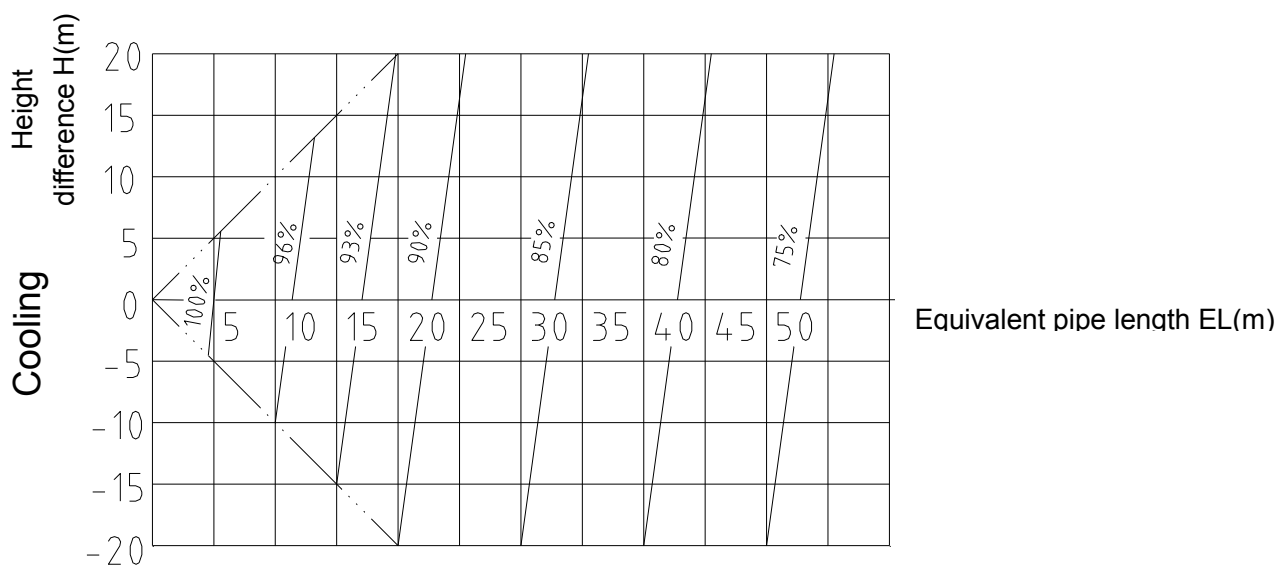
Actual heating capacity=amendment coefficient of heating capacity × nominal heating capacity

——nominal heating capacity could be found from the performance parameters list

——amendment coefficient of heating capacity could be found from table above.

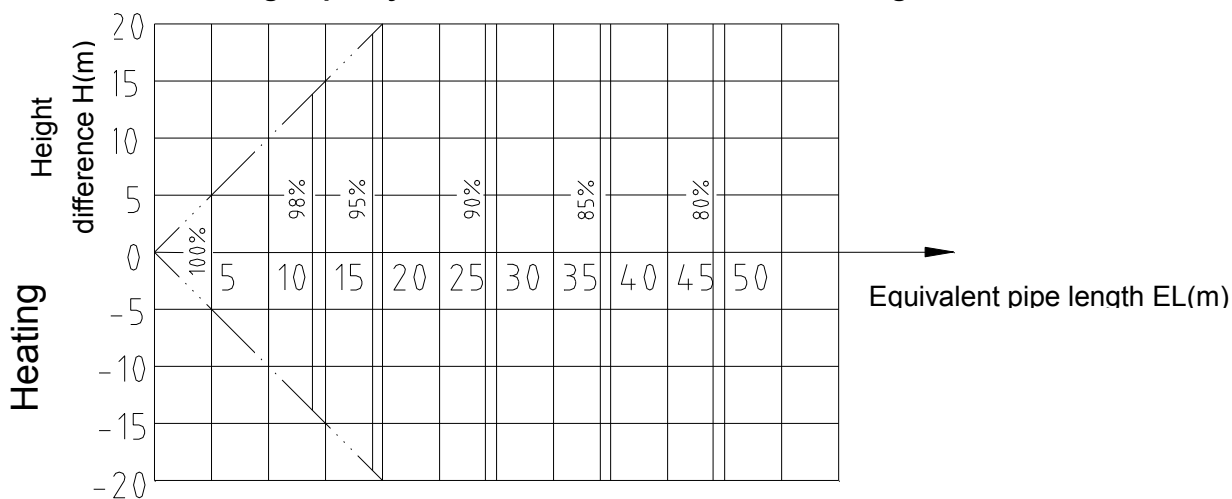
**2.3.4 Amendment coefficients of heating and cooling capacity under different height drop.**

**Different Cooling Capacity modified coefficients at different height:**



Note: H = Height of Outdoor Unit — Height of Indoor Unit

**Different Heating Capacity modified coefficients at different height:**



Note: H = Height of Outdoor Unit — Height of Indoor Unit

**2.3.5 Equivalent Pipe length conversion**

Equivalent pipe length means converting pipe elbow to straight pipe length after considerate the pressure loss.

Bend and Oil Loop Conversion tablet

Type Pipe Dia.(mm)	Bend	Oil Loop
6. 35	0. 10	0. 7
9. 52	0. 18	1. 3
12. 70	0. 20	1. 5
15. 88	0. 25	2. 0
19. 05	0. 35	2. 4
22. 02	0. 40	3. 0

**Equivalent Pipe length  $L = \text{Actual Pipe length } L + \text{Bend Qty} \times \text{Equivalent pipe bend length} + \text{Oil Loop Qty} \times \text{Equivalent Oil Loop length}$**

Sample:

SAC48C1-A Actual Pipe length is 30 meters, Gas pipe diameter is 19.05mm. If there's 5 bends and 2 oil loops during the installation, then the equivalent pipe length should be:

$$L = 30 + 0.35 \times 5 + 2.4 \times 2 = 36.55(\text{m})$$

◇ **Specification of Connection Pipe for Indoor Unit and Outdoor Unit**

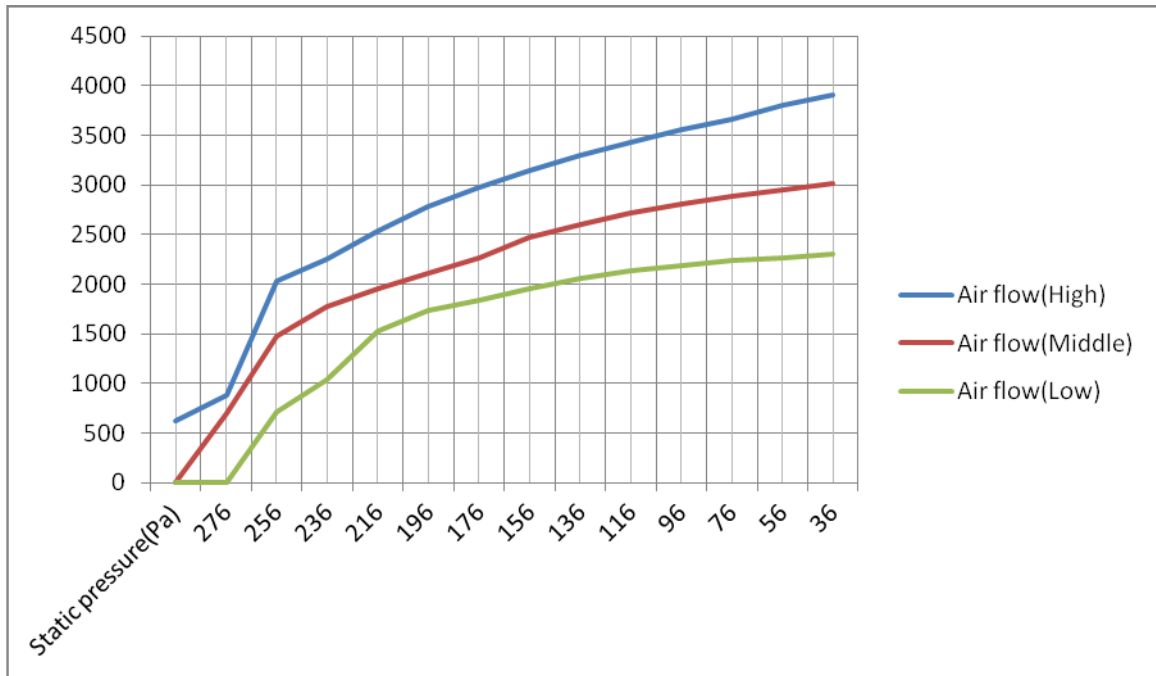
Cooling Capacity(Btu/h)		48000/60000
Connection Pipe (mm)	Liquid Pipe	Φ9.52
	Gas Pipe	Φ19.05
Max. Length(m)	Liquid Pipe Dia.	Φ9.52
	Gas Pipe Dia.	Φ19.05
	Max. Length	50
Max. Height (m)		30
Max. Bend Qty		10
Extra R410a per meter when the pipe length is more than 5 meter (kg)		0.07

**Caution:**

1. The standard Pipe length is 5m, if the pipe length is less than this then no additional charging is necessary. If the pipe length is more than this then you should charge more refrigerant into the system according to the above Charging Data
2. The thickness of the pipe is 0.5-1.0, bearing pressure is 3.040MPa;
3. If the connection pipe is too long, the cooling capacity and stability would be decreased. And the more bend quantity, the resistance in the piping system would be bigger, then the cooling and heating capacity would be decreased even lead to compressor broken. We suggest you to use the shortest connection pipe according to the pipe length parameter in this manual. In order to consider a return oil, each height difference 4 ~ 6 meters, the trachea and a return oil bent

### 2.3.6 Different static pressure of air volume change

SAD48HD1-A, SAD60HD1-A

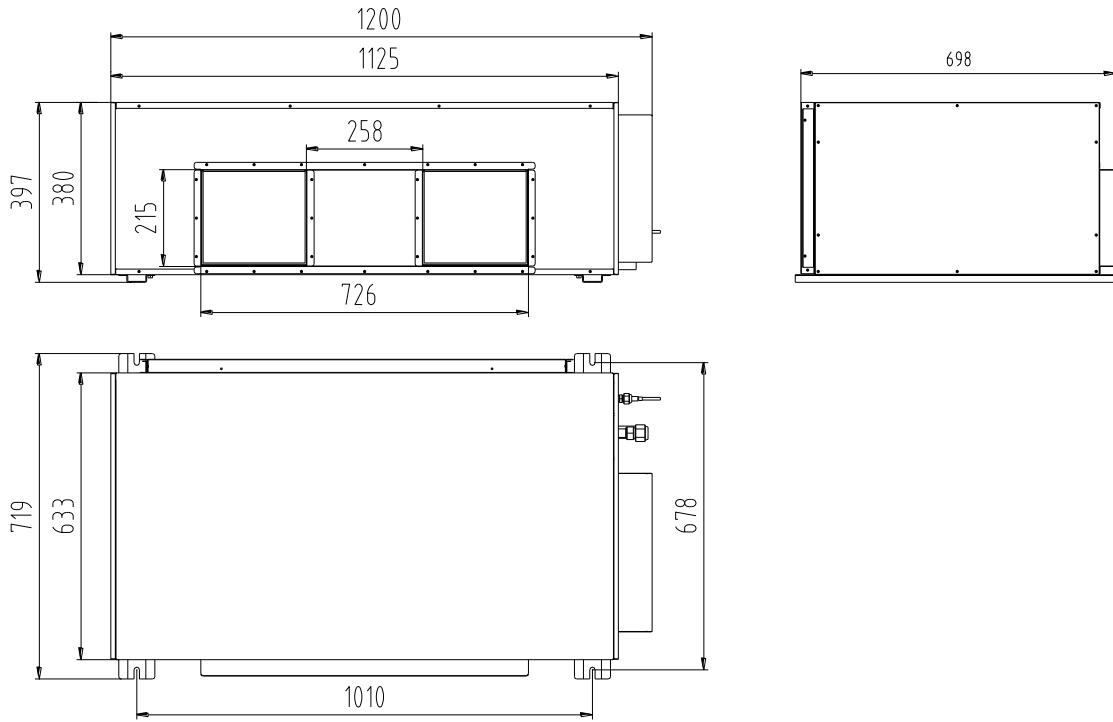




### 3. Unit outside dimension

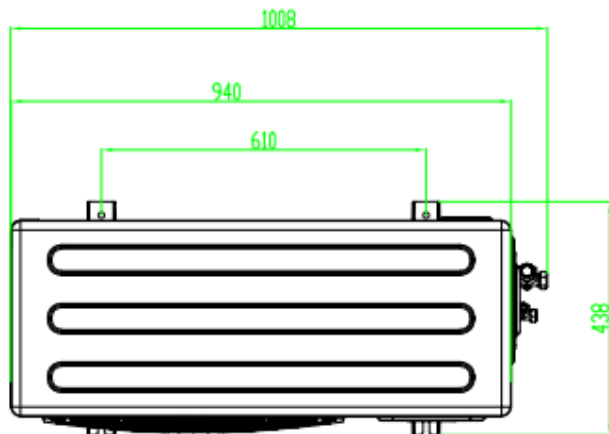
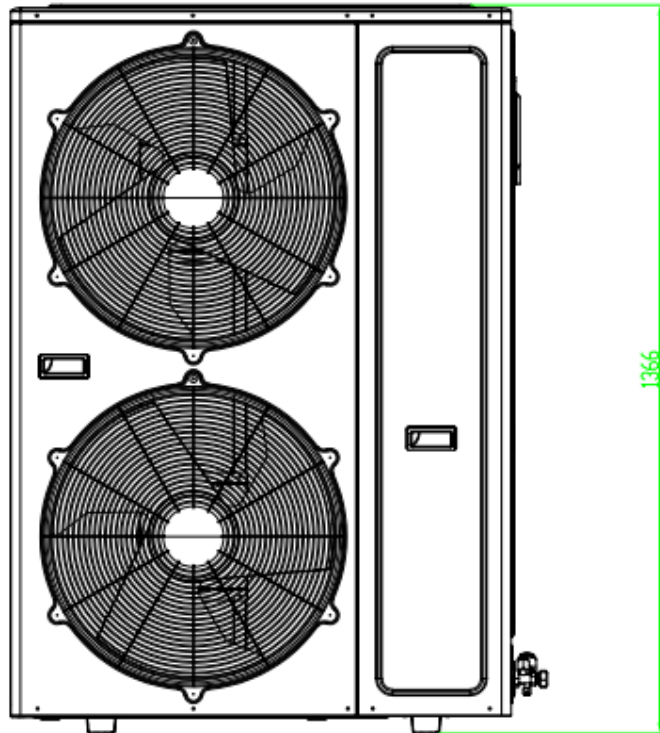
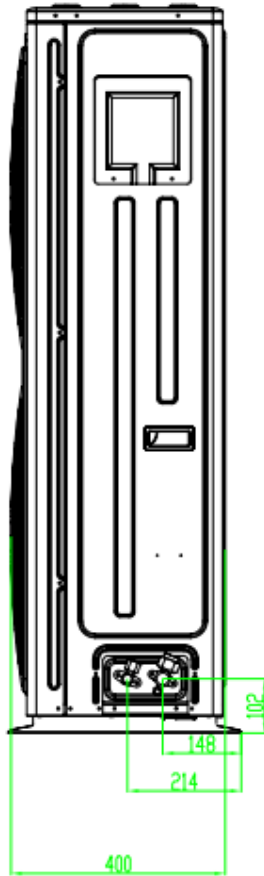
#### 3.1 Indoor Unit

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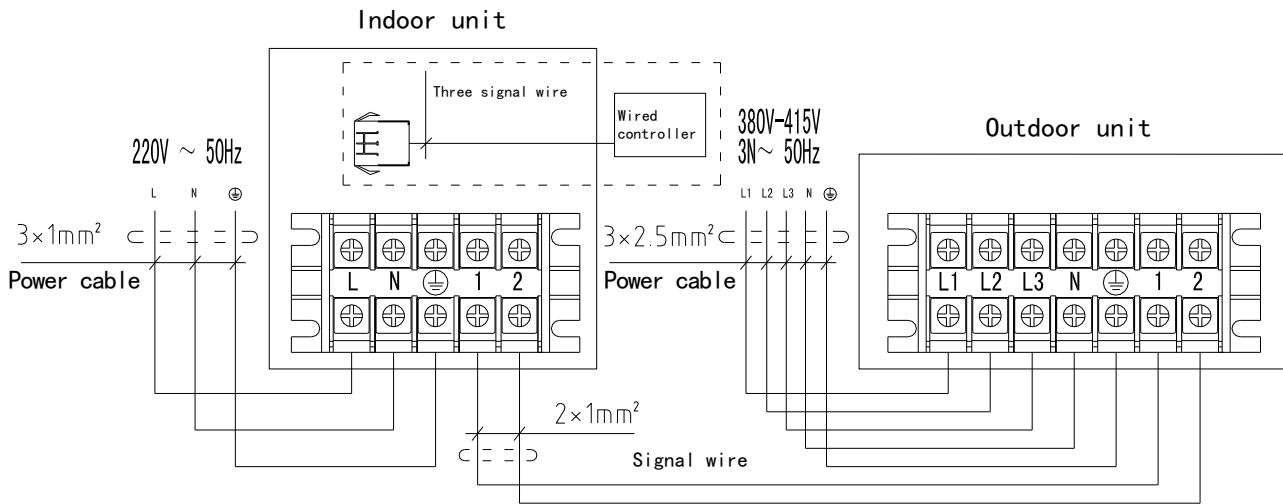
### 3.2 Outdoor Unit

SAU48U1-A, SAU60U1-A



## 4. Electrical connection diagram between indoor and outdoor unit

SAD48HD1-A, SAD60HD1-A



Note: Indoor machine power can also be introduced from the bonnet, which will indoor the L received the outdoor L1, L2, L3 either one,

The zero line of indoor will connected to the corresponding zero line of outdoor, then the group line will connected to the corresponding group line of outdoor,

## Part II Installation and Commissioning

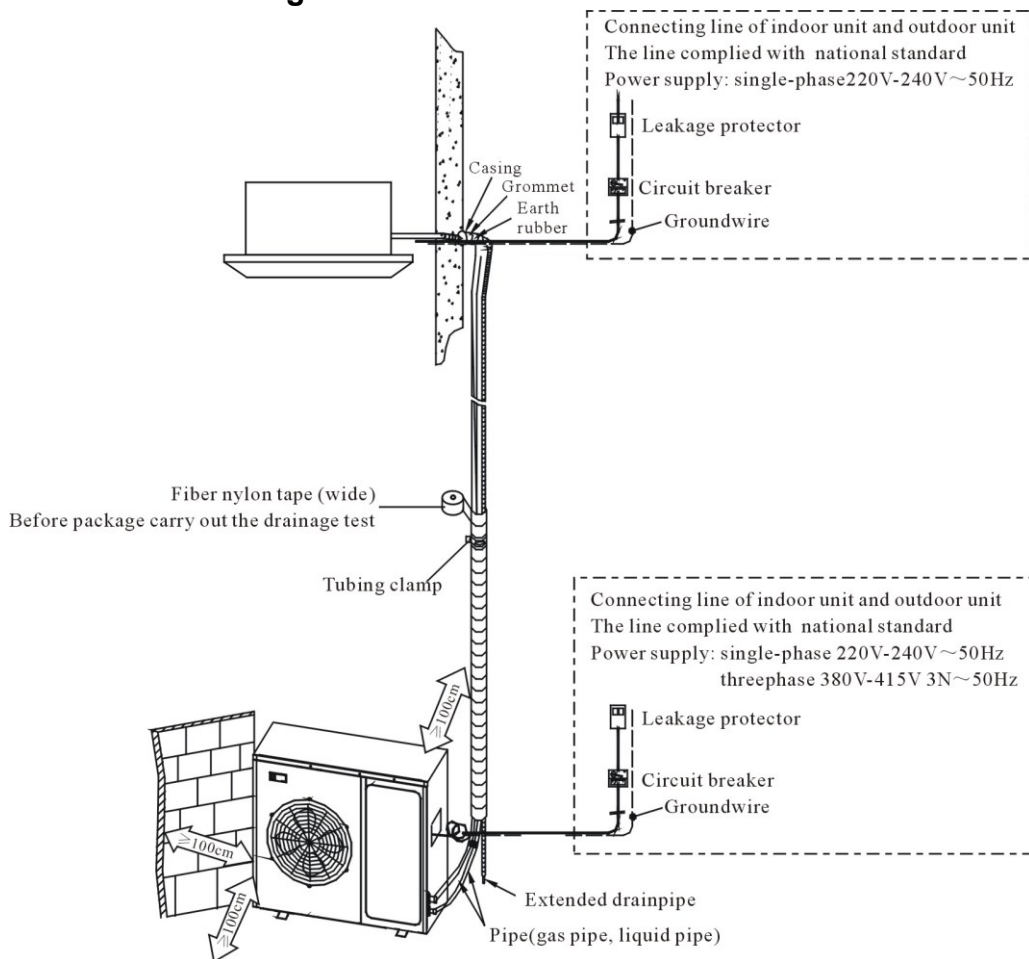
### 1. General introduction

#### 1.1 Preparation and equipments before installation

<b>Please buy following spare parts from your local market before installation</b>	<b>Besides general implements, other implements are needed when connecting the pipe</b>
<b>Hung bolts M12, 4 pcs</b>	<b>Acetylene cylinders, oxygen cylinders (when longer pipe used it should be welded)</b>
<b>Drainage pipe PVC</b>	<b>One set pipe cut machine. (cut copper pipe)</b>
<b>Copper connecting pipe</b>	<b>Refrigerant cans, electronic balance (when longer pipe used additional gas should be charged)</b>
<b>Adhesive belt (big size) 5 pcs, (small size) 5 pcs</b>	<b>Pressure gauges, pipe clamp, welding torch, 2B silver electrode</b>
<b>Heat insulation material used to connect copper pipe (PE foam material, its thickness is more than 8mm)</b>	<b>Wrench 2 pcs, one of them is with adjustable torque wrench(42N.m, 65N.m, 100N.mm)</b>
<b>Power cable, electrical wire between indoor and outdoor unit (Must be in accordance with the wire diameter in the wiring diagram)</b>	<b>Nitrogen cylinder (in order to prevent oxidation when welding, using Nitrogen to replace the air)</b>

## 1.2 Unit outside dimension (Please refer to Chapter I, part 3)

### 1.3 Installation diagram



## 2. Indoor unit installation

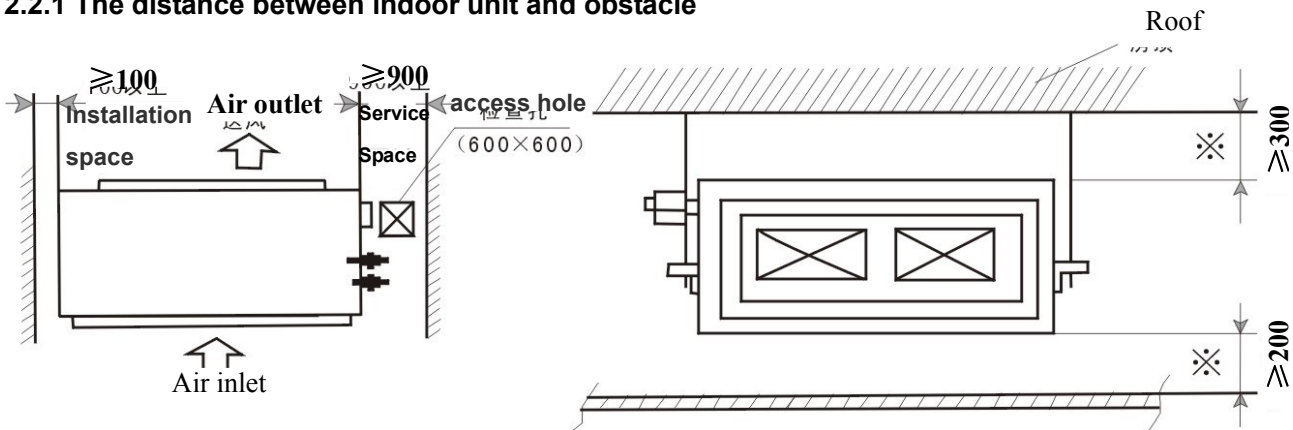
### 2.1 Installation precaution

- ◇ Hanging location should be able to support the unit's weight, there should be no increase in noise and vibration. If the hanging location needs reinforcement, it should be reinforced before installation;
- ◇ Choose the space above the ceiling that can put the indoor unit inside;
- ◇ The location should be easy for drainage;
- ◇ The unit should not be installed in the heat source, steam source, oil mist places (such as machine room, kitchen, laundry room, mechanical workshop, etc.) in order to avoid performance degradation, electric shock, plastic parts corrosion which lead to unit broken;
- ◇ Choose the location at least 1 meter away from TV and radio, in order to avoid interference to them
- ◇ There is no obstacles getting in the way of air circulation, cold air can evenly spread to all corners of the room;
- ◇ In order to facilitate maintenance and repair, there should be certain distance between indoor unit and obstacles;
- ◇ Refrigerant R22 is used for this unit, which is non-flammable and non-toxic gas. As the proportion of refrigerant is bigger than air, so if it leaks the gas will be filled on the ground. Therefore, if the units mounted on a closed room there must be good ventilation to prevent suffocation. In case of leakage of refrigerant, units should immediately stop running, and contact with maintenance personnel in time.

There must be no fire at the site, because the refrigerant will turn to harmful gas when get to the fire.

## 2.2 Indoor unit installation

### 2.2.1 The distance between indoor unit and obstacle



### 2.2.2 Indoor unit suspension

- ◇ Select the suspension foundation

The suspension foundation is a structure of either wooden frame or reinforced concrete. It must be firm and reliable to bear at least 4 times weight of itself and capable of bearing vibration for long periods;

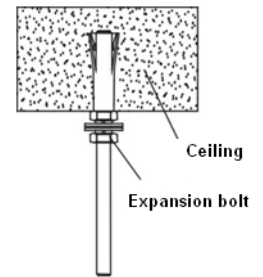
- ◇ Fixing of suspension foundation

Fix the suspension bolts either as shown in the picture or by a steel or wooden bracket;

- ◇ Adjust the relative positions of the suspension hooks to ensure the indoor unit is level in all directions. Use a spirit level to ensure this, otherwise water leakage, air leakage etc. will be resulted;

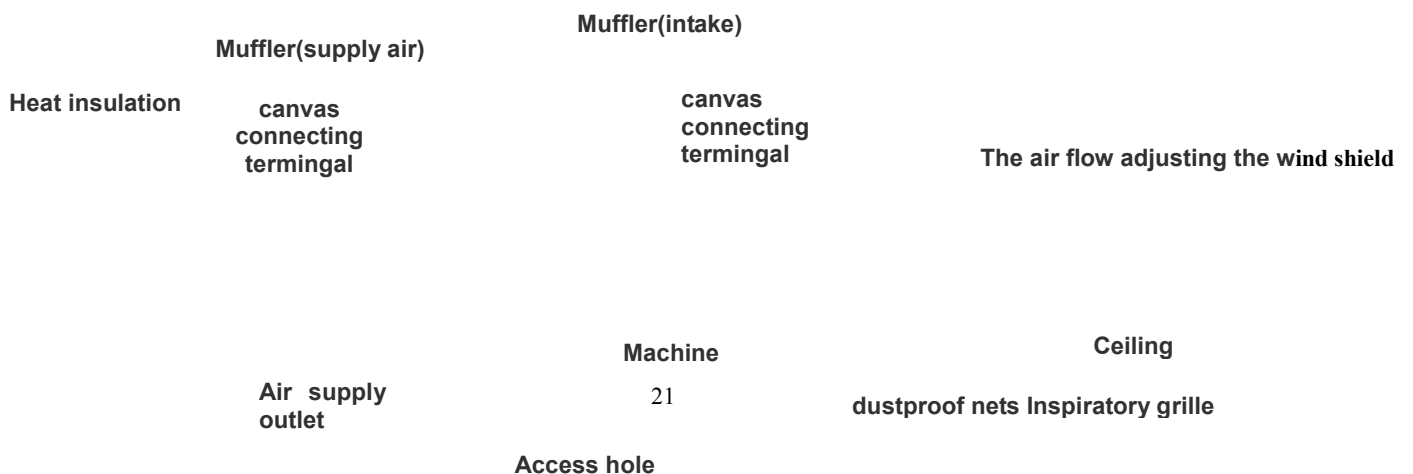
- ◇ Tighten the nuts and ensure that the hooks are tightly connected to the nuts and shims, and there is no phenomenon of virtual hanging;

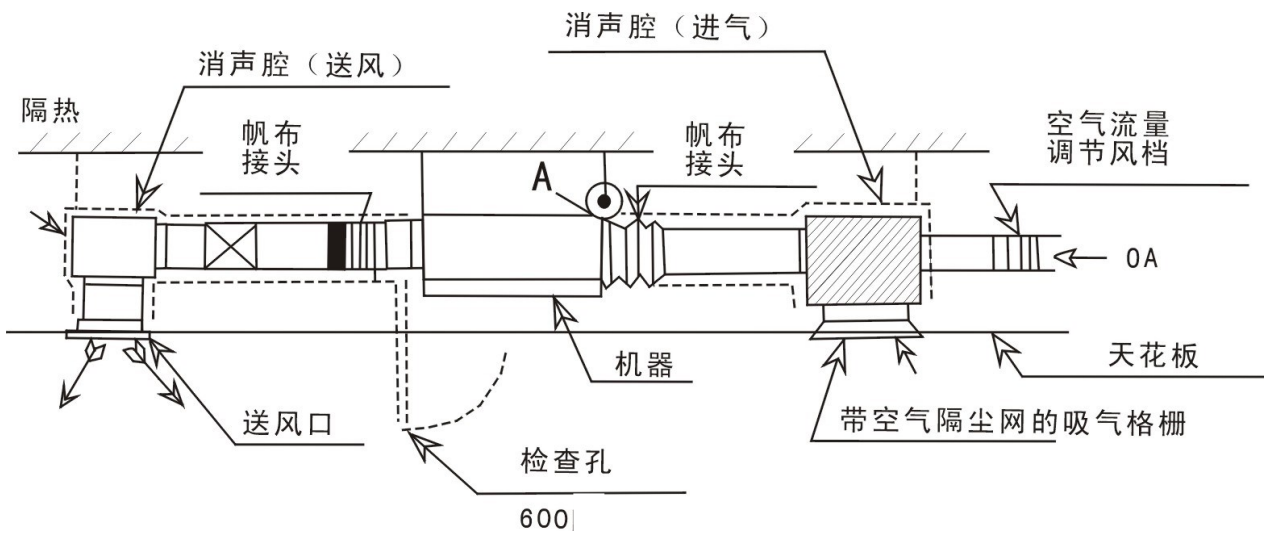
- ◇ After the unit is installed ensure it is secure and does not shake or sway.



### 2.2.3 Duct pipeline installation

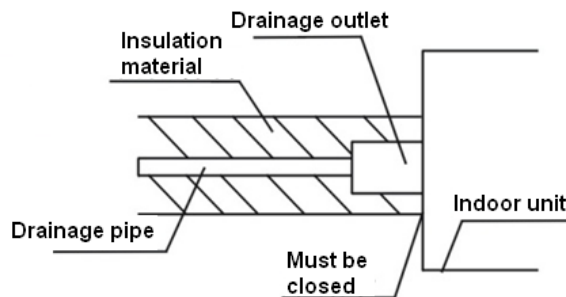
- ◇ Using canvas to connect between indoor unit and duct pipeline, in order to save unnecessary vibration, as to the detail connection method please refer to the following picture





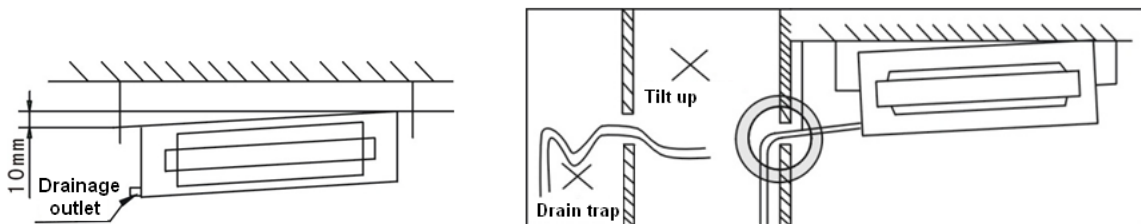
### 2.2.4 Drainage pipe installation

◇ Drainage pipes must be wrapped with heat insulation materials, otherwise it will cause frost or droplets, see picture as follows:



**Heat insulation material: rubber insulation pipe with the thickness of more than 8mm**

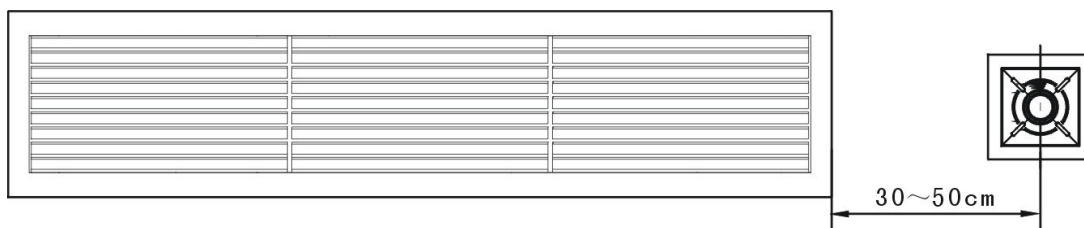
◇ Drainage pipe must have a downward gradient (1/50--1/100). If the drain pipe is installed ups and downs, it will cause water backflow or leakage etc.



◇ When finish installation please carry out the drainage test to ensure that the water flow through the pipeline fluently, and carefully observe the junction to ensure that there is no water leakage at the junction. If the unit is installed in the newly built house, strongly recommend that this test taken before the ceiling installation. Even it is the heating only unit, this test is unavoidable.

### 2.2.5 Remote controller receiver installation.

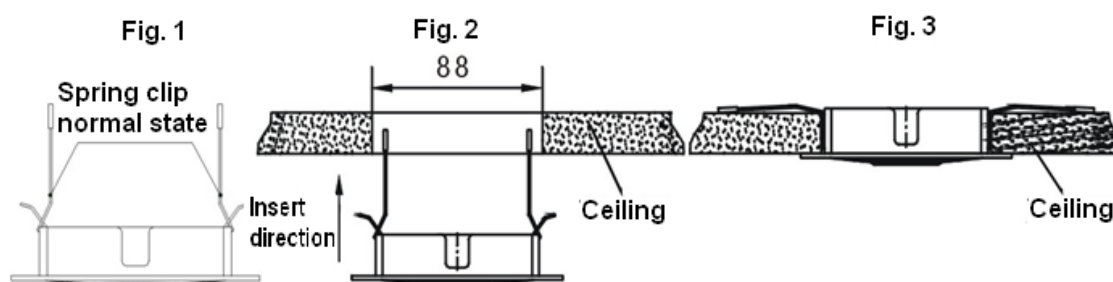
◇ Installation site: recommend that the receiver is mounted with the distance of 30~50 cm to the indoor unit air outlet(on your choice as well), while must ensure that the receiver can get the signal that the remote controller sends, please refer to the following installation picture:



NOTES: The remote control signal effectively work for straight line from 8 meters, when the battery after the power consumption, effective work will shorten the distance

- ◇ Mounting hole set up: please use certain instrument to dig a square hole with 88x88mm on the ceiling
- ◇ Remote controller receiver installation.

Hold the two sides (with clip sides) of the receiver, set the spring clip in the vertical way then put it into the mounting hole, if the two sides of the receiver is in the same level with the ceiling the installation is finished.



- ◇ Signal line connection: connect the wire of remote controller receiver to the CN-DISP terminal board on PCB of indoor unit wire box then fix it.

### 3. Outdoor unit installation

#### 3.1 Select installation position of outdoor unit

##### 3.1.1 Installation site and base

- ◇ The site shall be strong enough to bear its weight, prevent noise and vibration.
- ◇ The site shall be ensured to avoid direct sunshine, if necessary set a Havelock above the outdoor unit.
- ◇ The site shall be easy to drainage the rain water and the frost water.
- ◇ The site shall be ensured that the outdoor unit will not be covered by snow during the winter season.
- ◇ The site shall be ensured that the outlet is not facing the strong wind.
- ◇ The site shall be ensured that outlet air and operation noise will not affect the neighbors' daily life.
- ◇ The site shall be ensured that the outdoor unit will not be affected by the garbage and oil mist.

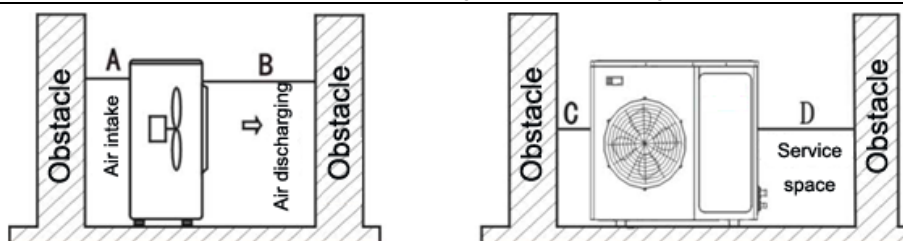
##### Warning :

**If outdoor unit working under such environment which contains oil (including machine oil) salt(marine areas), sulfide gas (hot springs and oil refinery areas), those substance may lead to the failure work of the outdoor unit.**

##### 3.1.2 Maintenance and ventilation space

- ◇ The site shall be easy for ventilation then the outdoor unit can inhale and discharge air easily. What's more please reserve enough space for maintenance.





**Note: Require A>300mm; B>1500mm; C>300mm; D>500mm;**

### 3.2 Outdoor unit installation

- ◇ Use size M10 bolt and nut to fasten the outdoor unit tightly on the bracket, keep it in the horizontal level. The suitable length for bolt shall 20mm over the base level, in order to minimize vibration please do set a rubber shock absorber.
- ◇ If the outdoor unit is mounted on the wall or on the rooftop, in order to prevent earthquake and strong wind please fasten it as tightly as possible.
- ◇ Set a drainage channel to ensure the condensing water can drain out smoothly.
- ◇ To avoid that only four angles metal sheet to support the outdoor unit.

## 4. Connection piping installation

### 4.1 Piping installation precaution

**Please choose the phosphorus deoxidation seamless copper pipe as the piping.**

- ◇ If use the lengthen piping needs welding:  
Please welding before fasten the nut, when welding using nitrogen gas to replace the air in the pipe in order to prevent oxidation.
- ◇ If there are many points to be welded when installing the lengthen piping, please set a filter in the pipe(buy from local market)
- ◇ Please use nitrogen gas or air to remove the dust and water in the pipe,
- ◇ Please lay out the piping according to the tend towards of the piping, but it is not allowed more than 3 times curved at the same point of the pipe(if do like this the pipe will become rigid)
- ◇ Pipe bending machine is used during the process of bending the pipe, the curvature shall not be too small or it will affect the refrigerant flow.

### 4.2 Connection piping installation

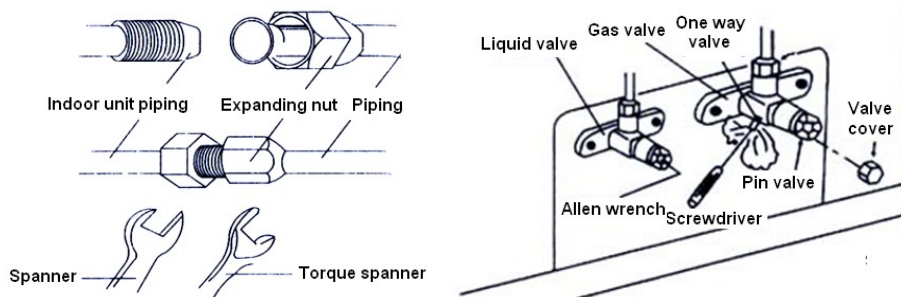
**4.2.1 Piping specification selection (As to the detail selection please take reference to the cooling capacity adjust index figure during different installation situations.)**

#### 4.2.2 Piping connections

- ◇ Using expanding machine to expand accessories, the size of horn shown in the following figure:
- ◇ Paint a thin layer of frozen oil at both inside and outside part of the expanding.
- ◇ Make the expanding right to the screw thread shape connection of the indoor unit, using hands to tighten the nut then using a wrench to tighten the nut again, the tighten torque as follows figure.
- ◇ Take out the cover of the indoor unit gas valve and liquid valve, make the expanding right to the stop valve of outdoor unit, using hands to tighten the nut then using a wrench to tighten the nut again, the tighten torque as follows figure.

Piping diameter	Tighten torque	Expanding size (A)	Expanding shape	Paint the frozen oil
-----------------	----------------	--------------------	-----------------	----------------------

1/4in(φ6.35mm)	15-19(N·m)	8.3-8.7mm	
3/8in(φ9.52mm)	35-40(N·m)	12.0-12.4mm	
1/2in(φ12.7mm)	50-60(N·m)	15.4-15.8mm	
5/8in(φ15.88mm)	62-76(N·m)	18.6-19.0mm	
3/4in(φ19.05mm)	70-75(N·m)	22.9-23.3mm	



### 4.2.3 Emptying or vacuum

Before charging the refrigerant to the system, to ensure that there is no impurities, water or non-condensable gas. So, emptying and vacuum operation should be carried out.

◇ Vacuum: when process this operation please be sure that the connection pipe is tightened up.

- ① Screw off the cover of maintenance valve connection, connect the pressure gauge to the connection of maintenance valve
- ② Connect the vacuum pump to the pressure gauge, turn on the vacuum pump and pressure gauge to process the vacuum operation toward the indoor unit and piping, while to ensure that the absolute pressure is less than 30Pa after this operation.
- ③ Turn off the pressure gauge and vacuum pump to keep the pressure in the same level in 20 minutes.
- ④ Pack to return the closing of the valve bonnet outdoor, open the two globe valve bonnet, will connect to the refrigerant in the refrigeration system

**(note: stop valve must all turned).**

◇ Emptying: when process this operation, please disconnect the high pressure valve with liquid valve.

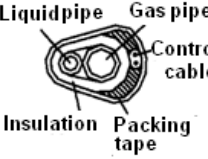
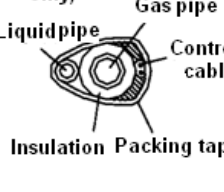
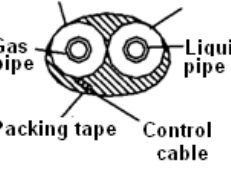

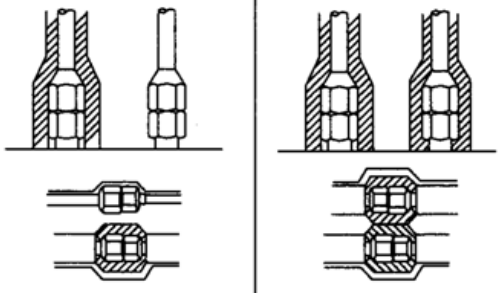
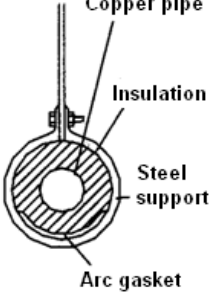
- ① In piping installation is completed, the machine to ensure the globe valves within the machine, single connector has been and piping on tight
- ② Open the refrigerant tank valve, using the refrigerant inside the tank with high speed to empty the air in the indoor unit and the connection piping. When the outlet air becomes mist (it feels cold by touching it), then the air is emptied.
- ③ Loosen the screwdriver, pack to return the closing of the valve bonnet outdoor, open the two globe valve bonnet, will connect to the refrigerant in the refrigeration system

**(note: stop valve must all turned).**

### 4.2.4 Heat insulation package of piping

**Notes: drainage pipe and connection piping should be wrapped by heat insulation material respectively or there will be dew or leakage.**

◇ Use heat insulation material with good insulation which can resist heat more than 120 °C performance to wrap the pipe.

Incorrect	Correct			
<ul style="list-style-type: none"> <li>Gas pipe and liquid pipe can't be insulated together</li> </ul> 	<ul style="list-style-type: none"> <li>Only gas pipe insulation(Cooling-only)</li> </ul> 	<ul style="list-style-type: none"> <li>Gas and liquid pipe insulation</li> </ul> 	<ul style="list-style-type: none"> <li>Insulation support</li> </ul>	
<ul style="list-style-type: none"> <li>Piping joints should be insulated</li> </ul> 				

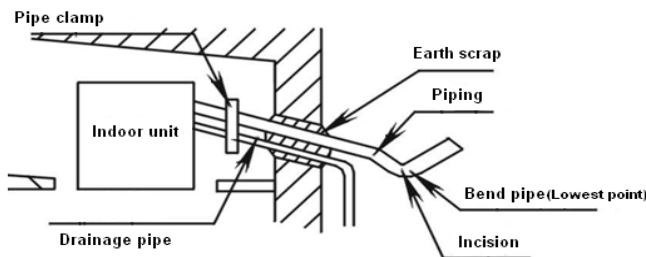
◇ Notes during the high temperature working environment

Our air conditioner is proved my dew conditioner experiment. But if it keeps on working during the high humidity (the dew temperature is more than 23℃ ) environment which may lead to water leakage, in such condition please use following additional insulation material:

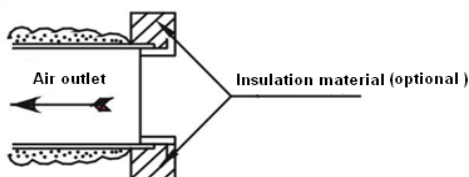
- ◇ Glass fiber insulation material with the thickness between 10~20mm can be used.
- ◇ The part of indoor unit which get in touch with the back side of ceiling should pasted with insulation material.
- ◇ Besides the previously more than 8mm thick insulation material, connection piping (both gas pipe and liquid pipe), drainage pipe should be wrapped by additional 10~30 mm thick insulation material.

**4.2.5 To seal the hole on the wall.**

- ◇ To prevent rainwater or other foreign bodies from entering the room and air-conditioner after installing the tubing and drain pipe, the gap between wall hole and tubing, drain pipe and electric wire should be sealed with mastic, sealant rubber or putty, or poor performance or leakage will result
- ◇ If the outdoor unit is higher than indoor unit, tubing should be bent to ensure that the lowest point of the tubing is lower than the wall hole to prevent rainwater entering the room or air-conditioner along the piping system.



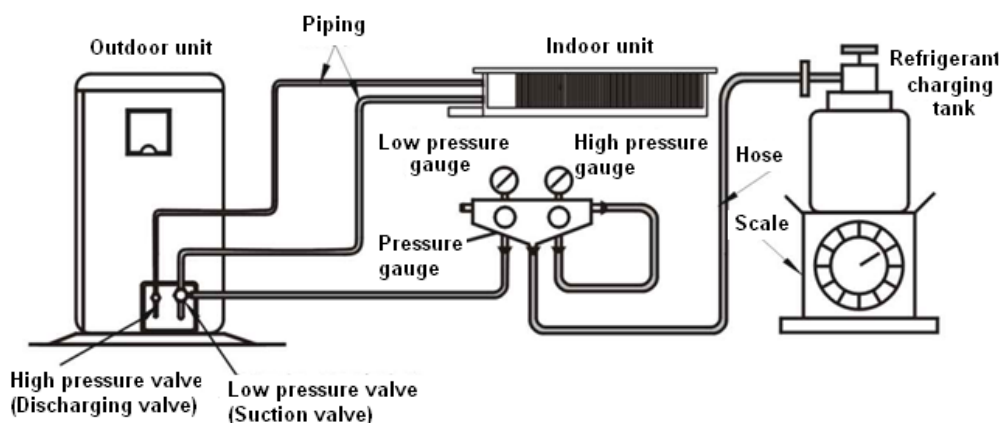
\* The incision is used to drain water



**4.2.6 Additional refrigerant charge**

When pipe length exceeds 5m, please add refrigerant according to the table below:

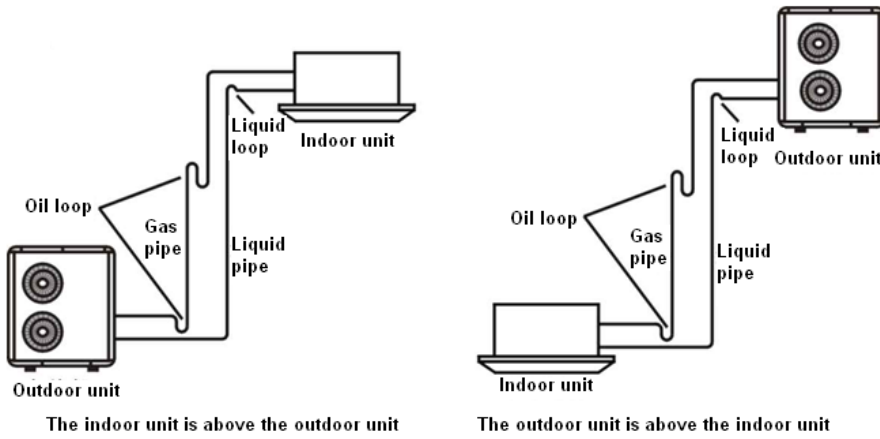
Connection piping	Piping size)		Additional refrigerant charge amount (kg/m)
	Gas pipe	Liquid pipe	
Piping between indoor and outdoor unit	φ9.52×0.75mm	φ6.35×0.75mm	0.02
	φ12.7×1mm	φ6.35×0.75mm	0.02
	φ15.88×1mm	φ9.52×0.75mm	0.05
	φ19.05×1mm	φ9.52×0.75mm	0.07
	φ19.05×1mm	φ12.7×1mm	0.09



#### 4.2.7 Others

**Users to install the air conditioner at site shall ensure that the oil can return to the unit smoothly.**

- ◇ Horizontal pipes should incline toward the outdoor unit using a 20:1 slope
- ◇ If there is a height difference between the indoor and outdoor unit, oil loops should be installed in the interconnecting gas (large) pipe;
  - When the vertical pipe height difference is less than 5 meters, an oil loop should be installed at the bottom of the gas (large) pipe;
  - When the vertical pipe height difference is more than 5 meters, then for every 5 meters an oil loop must be installed at the bottom of the gas (large) pipe, and a short loop (liquid ring) should be installed at the exit of the indoor unit liquid (small) pipe;
  - When the connecting gas pipe vertical height difference is less than 5 meters but the constant rise distance is too long, an oil loop should be installed in the gas (large) pipe every 10 meters.
- ◇ When the outdoor and indoor units are at the same elevation, the oil deposit bend and liquid ring do not need to be installed, if the horizontal connecting pipe length is less than 10 meters.
- When the horizontal connecting pipe length is more than 10 metres, install an oil loop in the gas (large) pipe every 10 metres



**Note: This chart is for explanation purposes. An actual installation will differ from this according to the site conditions.**

**When making an oil trap the radius of the bend should be between 1.5 and 2 times the pipe diameter.**

## 5. Electrical connection

### 5.1 Electrical connection precaution

<b>Warning</b>	Installation of electric items must be carried out by qualified, professional technicians. An isolated circuitry should be fixed with whole-pole disconnection devices, which is with at least 3mm gap of touch point. Power supply and indoor to outdoor connection should use special cable. Providing the necessity of installation or replacement, the professional technician of service store appointed by manufacturer must be required, while self-operation by users is prohibited.
	In case of any electric shock accident, the creepage protection devices /power supply on-off and breaker must be required with power supply.
	The specification of fuse for single phase control board is F5AL 250V, while for 3 phase control board, both indoor and outdoor unit, it is F3.15AL 250V.
	Machine must be earthed surely. If not, it'll be probably caused creepage.
	Equivalent 227IEC53(RVV) type of power cord of GB5023 or the excelled must be required. The cords should be fixed properly against broken, while ends/joints of cords is under outside force. Improper connection or fixation will cause disaster like fire...etc. Equivalent 245IEC57(YZW) type of power cord of GB5023 or the excelled must be used as connection line of indoor and outdoor.
<b>Notice</b>	The earth line is neither allowed to connect to gas pipe, water pipe or circuitry of telephone or lighting rod, nor to the earth line of other devices.
<b>Others</b>	<ul style="list-style-type: none"> <li>●Please fix power supply cord and connection wires of indoor and outdoor, in accordance with circuit diagram</li> <li>●Fix the cords into terminal boards properly and safely with cable fixation tools to avoid any danger caused by the power cord under outside forces.</li> <li>●After fixation, use bind tape (affixed) to bind wires avoiding any collision with other components like compressor, copper pipes...etc</li> </ul>

### 5.2 Electrical connection

#### 5.2.1 Wiring diagram of indoor & outdoor, refer to section of selection

#### 5.2.2 Recommendation of power supply cord

power supply cord

Cooling capacity (Btu/h)	Model	Power supply spec.	Power cable(Indoor)	Power cable (Outdoor)	Connection wires
48000	SAD48 HD1-A	Outdoor unit 380-415V3N~50Hz			
60000	SAD60 HD1-A	Indoor unit 220-240V~50Hz Indoor and outdoor input separately	3×1 mm <sup>2</sup>	5×2.5mm <sup>2</sup>	2×1mm <sup>2</sup>

**Notice:**

◇ Above mentioned power supply cord is the cable which connect air on-off of indoor to indoor/outdoor unit. Power supply cord of indoor/outdoor unit is the power supply cable connecting indoor and outdoor unit

◇ The section area of power supply cord core is minimized one. To avoid voltage pressure dropped down, while longer power supply cord needed, the section area should be enlarged for one gauge.

◇ The connection wires to indoor unit is the cable of 27IEC53(RVV) type, 300/500V; while the connection wires to outdoor unit and the connection wires from outdoor to indoor unit is the multi-end of cable (neoprene) of 245IEC57(YZW)type,300/500V. if the single core with double skin type of cable is chosen for installation,, please choose 1# gauge of section area and wrapped with special jacket for electrician.

**5.2.3 Indoor wire connection**

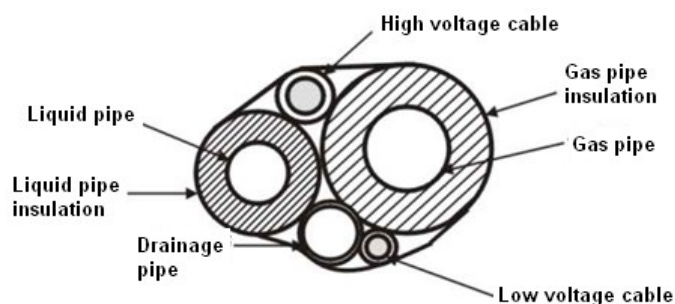
Remove electric control box cover of indoor unit, connect the wires in accordance with the electric diagram mentioned on the back of the cover. The wire ends must be tightly fixed into terminal boards without ease. The earth wire must be fixed into appointed position.

**5.2.4 Outdoor wire connection**

◇ Remove the electric item cover, which is positioned in the right side of outdoor unit, connect the wires in accordance with the electric diagram on the back of the cover.

◇ Be sure that pressing the wires tightly with the terminal boards while it through the board, the wire ends must be tightly fixed into terminal boards. The earth wire must be fixed into appointed position.

◇ After all the wire connected, bundle connection pipe, connection wires and drainage pipe with strips like mentioned drawing below:

**Notice:**

◇ Compressor of AL-(H)24B5(T)、AL-(H)36A5(T)、AL-(H)42A5(T)、AL-(H)48A5(T) 、AL-(H)60A5(T) are 3 phase power supply with phase sequence protection in its outdoor control board. Please be careful with wire connection.

◇ Be sure do't make the drainage pipe flat while bundled!

**6. Commissioning**

After installation, machine can be started commissioning.

**6.1 Check installation condition**

◇ Check indoor/outdoor unit installation and wire connection in accordance with the requirement of service manual.

◇ Check the power supplying, diameter of wires, air on-off and make it sure that the items can be matched with machines and, earth wire connection safety.

◇ Check air inlet/outlet duct and make it sure that the items is clean, operating smoothly.

## 6.2 Commissioning

- During winter, the first run of performance should be supplied power 8 hours in advance to warm-up the crankcase.
- During winter, while after 8 hours power off, the performance test should be 2 and half hours power on later:
  - ★ Power on, run machine with cooling mode.
  - ★ After 3 minutes compressor protection, check if there is normal cooling air come from indoor unit and if there is abnormal noise come from indoor/outdoor units
  - ★ Configure the mode with “fan” and check if there is high air come from indoor unit.
  - ★ Operate “swing” mode, check if the louver is properly swaying.
  - ★ Press the other buttons on the remote controller and check if the complete unit is on proper working condition
  - ★ Operate machine 1 hour with “cooling” mode and check if the drainage system is on proper condition
  - ★ Switch the mode for “heating” and check if there is warm air come from indoor, if there is abnormal noise come from indoor/outdoor units
  - ★ After confirmation of normal working condition, press the “on-off” to stop running machine.


Then and there, train the end users with operation, maintaining and special notice.

## Chapter III Use and maintenance

### 1. Operation introduction

#### 1.1 Remote controller's operation introduction

##### 1.1.1 Basic condition of remote controller

Name	Figure	Basic condition for operation
Remote controller		<ol style="list-style-type: none"> <li>1. Power source Use 2 pcs No 7 batteries, working voltage: 2.0V-5.0V;</li> <li>2. Signal frequency: infrared frequency 38kHz;</li> <li>3. Remote distance: max working distance is 7m.</li> </ol>
		<p>Key operation introduction:</p> <ol style="list-style-type: none"> <li>1. Temperature setting range 16℃-32℃ ;</li> <li>2. when heating: When indoor coil temp. is lower than request, the fan will change into low speed,. After the temp. reach to the request temp., it will change into setting fan speed.</li> </ol>





**Operation of remote controller**

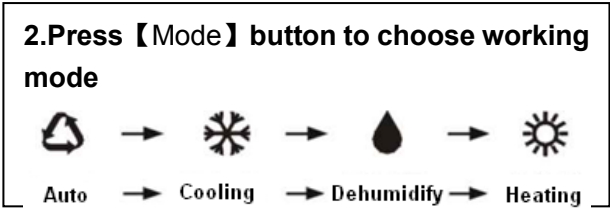
◇ **After** putting the battery in, press [Power ON/OFF] button, the running light of indoor unit will be bright, the unit is on;

Press [Power ON/OFF] button again, the running light of indoor unit will be extinct, the unit is off.

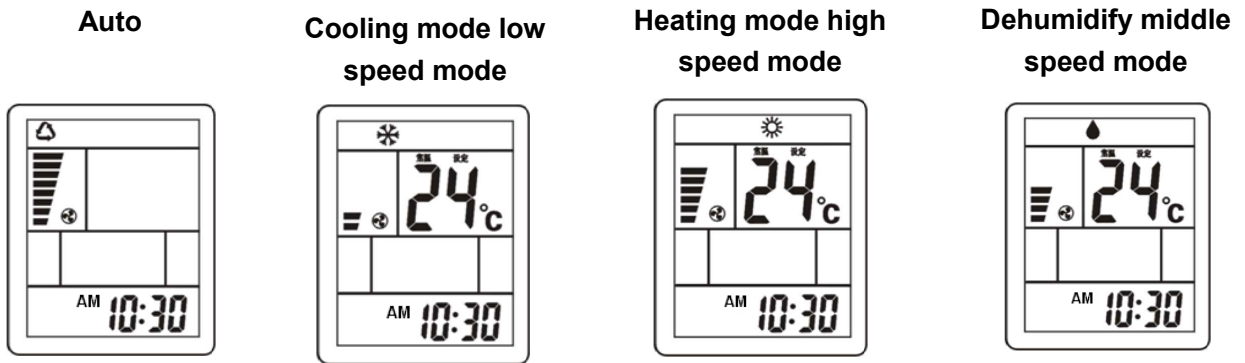
**【Auto】 - 【Cooling】 - 【Dehumidify】 - 【Heating】 mode**

4. Press **【Fan speed】** button to set fan speed

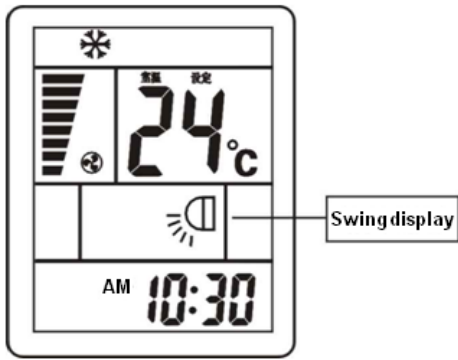
1. Press **【Power ON/OFF】** button to start the unit



3. Press **【+】**, **【-】** button to set temp.  
Temp. range: 16~32℃  
Under auto mode can't set temp.



**【Air swing angle setting】**



**5.Press 【Swing】button to set air swing angle**

**Fix air swing angle setting:**  
 When air blade goes to wanted angle, press  
**【Swing】** again ,it will be fixed at that position.

**【CLOCK SETTING】 --- 【TIMING】 OPERATION****Clock setting**

○,1 First time clock setting: after putting the battery in, the time display area will flicker;

During the usage period of clock setting : press

【Timing/clock】 button for 5seconds, the time display area will flicker;

② Press 【+】、【-】 to adjust time, it is “12 hour system with AM”&“PM”, long press 【+】 or 【-】 can set time quickly.

**Attention: All the operation is valid after opening the controller**

**Timing ON setting**

○,1 when unit is off, press 【Timing/clock】 button, “ON” will display and flicker;

② Press 【+】、【-】 to adjust time, it is “12 hour system with AM”&“PM”, long press 【+】 or 【-】 can set time quickly;

③ Press 【Timing/clock】 button again, confirm timing setting;

④ After setting mode, temperature, swing, fan speed, etc. The display screen will show all the settings and remain unchanged. When clock time is same as the setting time. the

**Timing OFF setting**

○,1 when unit is on, press 【Timing/clock】 button, “OFF” will display and flicker;

② Press 【+】、【-】 to adjust time, it is 12 hour system with “AM”&“PM”, long press 【+】 or 【-】 can set time quickly;

③ Press 【Timing/clock】 button again, confirm timing setting;

④ When clock time is same as the setting time, the air-conditioner will automatically

**Cancel timing switch**

After setting timing, press 【Timing/clock】 button, can cancel the timing setting

**Attention:**

“Timing ON” can be set only when unit is off;

“Timing OFF” can be set only when unit is on.



**【SLEEP】 OPERATION**

**Sleep setting**

Press【Sleep】button, sleep sign will display, sleep function is activated; press 【Sleep】 again, or press 【Power ON/OFF】 button cancel sleep function ,sleep sign

**Under sleep mode, unit working condition:**

- ,1When cooling: After unit running for 1 hour, the setting temperature will automatically increase 1℃, after running for 1 hour again, the setting temperature will automatically increases another 1℃;
- ②When heating: After unit running for 1hour, the setting temperature automatically decreases 2℃, after running for 1 hour again, the setting temperature will automatically decrease another 2℃;

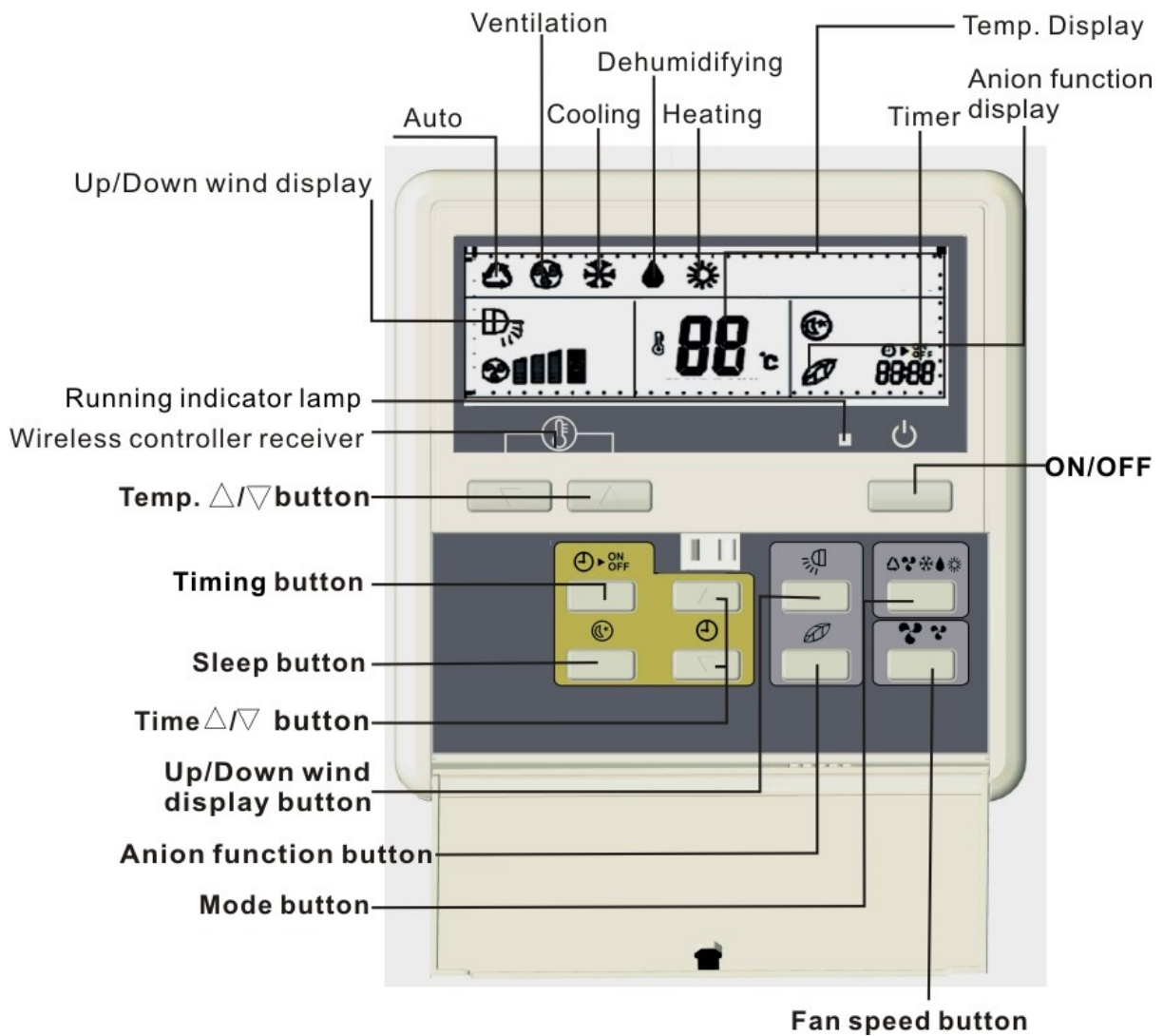
**Attention:**

Under sleep mode, mode change is available.

### 1.1.3 Remote controller's operation introduction

## Wired controller's operation introduction

### 1.2.1 Basic condition of wired controller



### 1.2.3 Operation of wired controller

Virtually all functions of the wired controller are the same as those of the remote controller and you should refer to the remote controller instructions. The exception is the LOCK function

- ◇ LOCK button: meantime press 【temp-】 and 【temp+】 ;
- ◇ The wired controller may be used at the same time as the wireless model by pointing the REMOTE controller at the wired controller receiver shown above

### 1.2.4 Installation of wired controller

- ◇ First, take apart the base panel from the wired controller.;
- ◇ According to the two installation holes on the install board, use two screws to fix the base panel to the wall as shown below;
- ◇ Ensure that the connecting cable of the controller is accessible before connecting the wired controller to the base panel.;
- ◇ Join the wired controller connection cable to the indoor unit using the cable provided.

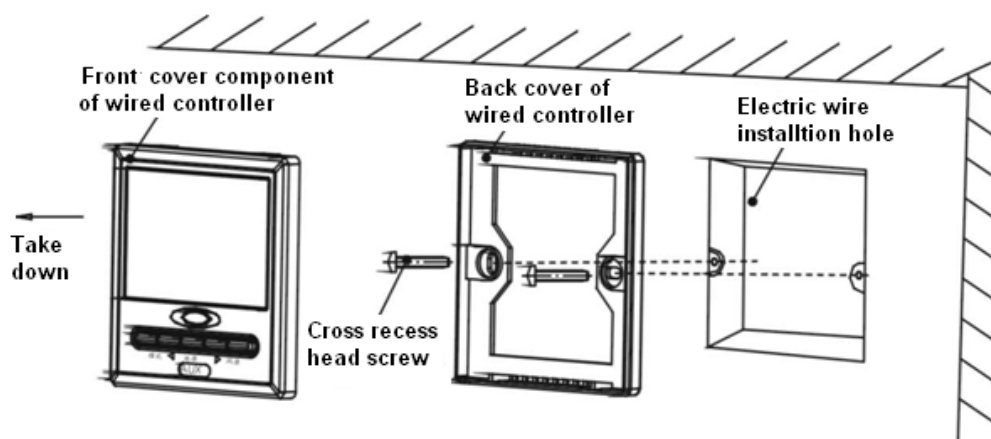


Figure 1



## 2. Daily maintenance

### 2.1 Clean inhaled

#### 2.1.1 Filter cleaning precaution

- ◇ Before cleaning the filter, ensure the unit is switched off and the power is off;
- ◇ Forbidden to use water clean the filter, it will hurt PCB or get an electric shock;
- ◇ When cleaning filter net, be sure you are standing steady, if you use ladder or others, please be careful.

#### 2.1.2 Washing filter net

- ◇ Use vacuum or water to clean the net;
- ◇ In order to ensure the best performance from your air conditioner clean the air filter regularly  
We recommend cleaning once a month or more frequently if required.
- ◇ When the filter is very dirty it can be washed in detergent and hot water (below 45oC);
- ◇ Ensure the filter is fully dry before reinstallation to avoid risk of electric shock or short circuiting;
- ◇ Do not dry the filter using direct sunlight;



## 2.2 Check at the beginning of each season

◇ Check whether there are no physical obstructions at the air inlet or outlet of either indoor or outdoor unit;

◇ Check whether there are some garbage at the water outlet;

◇ Check whether electrical cables are in good condition, particularly the earth cable;

◇ When power on, check weather letters display on the screen of the wired controller.

**Note:**

**working in winter, must connect power for 8 hours before switch on unit.**

## 2.3 Check at the end of service season

◇ Operate for 2 3 hours under the ventilation condition; remove the moisture of the indoor unit.;

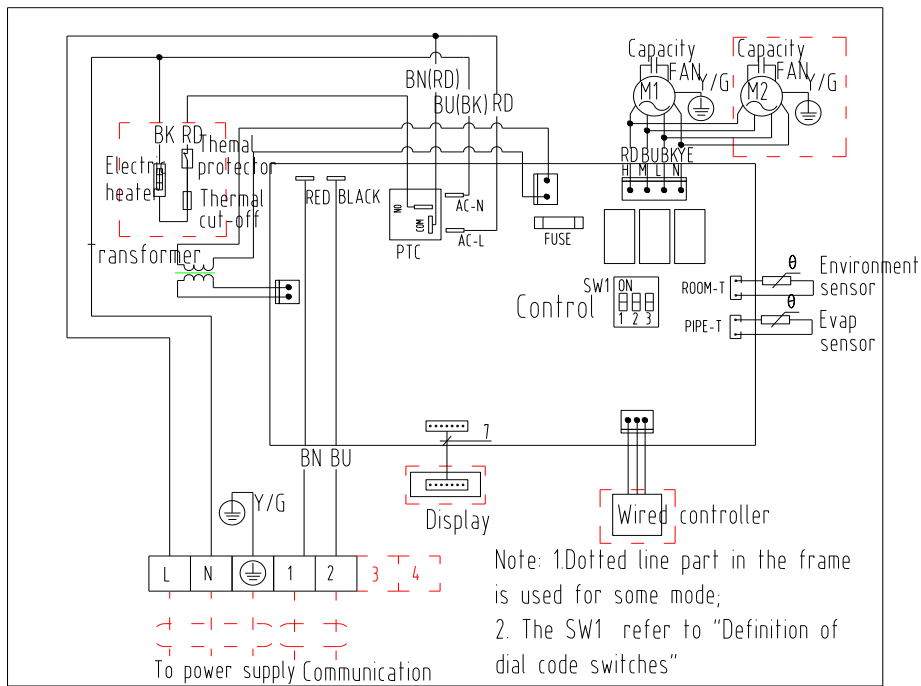
◇ If not use air conditioner in a long time, please close the power to save energy, the letter will disappear on wired controller;

◇ Take the batteries out of remote controller;

◇ Suggest that use dustproof to cover the outdoor unit.

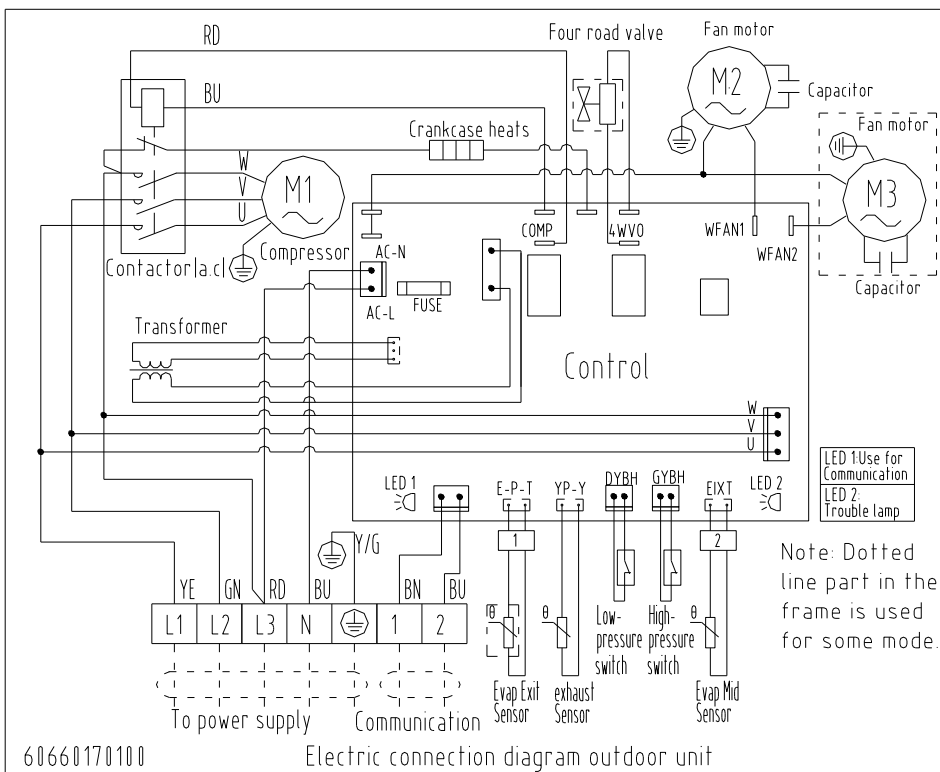
## 2. 2.1 Indoor unit wiring diagram

SAD48HD1-A, SAD60HD1-A



## 2.2 Outdoor unit wiring diagram

### Heat pump AU48U1-A, SAU60U1-A



### 3. Unit control functions

#### 3.1 Main function

##### ◆ Forced switch

When air conditioner is on, press forced switch, the unit will be turned off; or when air conditioner is off, press the forced switch, unit will be turned on and enter into auto mode operation. Once receiving signal from remote control or wired control, the unit will run in setting mode.

##### ◆ Commissioning

Press forced switch for 5 seconds until buzzer sounds twice, then controller gets into commissioning. At the state of commissioning, press the forced switch, the unit will be turned off. The commissioning time will last for 30 minutes and the mode is cooling.

- a) In the mode of commissioning, inlet air temperature sensor is ineffectual. Compressor runs after 3 min protecting.( 3 min protecting are not available in the first time power),indoor fan is running in low speed.
- b) In the mode of commissioning, no protection is valid except the three phase protection and the 3 min protection for the compressor.

##### ◆ Auto operation

When remote control select auto mode, the unit will choose cooling, dehumidify or heating according to indoor temperature and automatically runs at selected mode.

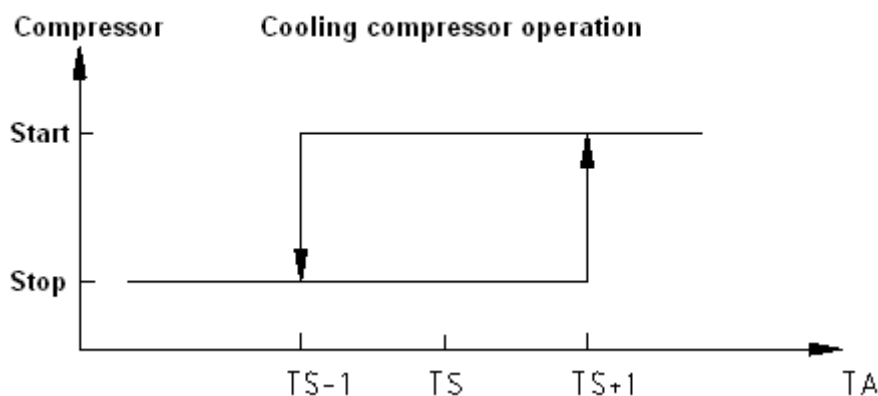
- a) When getting into auto mode, the indoor unit runs at low wind for 20 seconds while other equipment not start, after 20 seconds, indoor fan stops, the units enters into mode judgment.
- b) Once the room temperature over 27°C the units run in cooling mode of setting wind and setting temperature 24°C.
- c) When the room temperature is between 20°C and 27°C, the units run in dehumidifying mode of setting wind and setting temperature 24°C
- d) When the room temperature is under 20°C, the unit run in heating mode (Cooling-only in ventilation mode) of setting wind and setting temperature 24°C
- e) The system mode do not change according to temperature fluctuation, restarting or mode changing, operation mode should be selected by the controller.

##### ◆ Cooling operation

Temperature is set by remote controller or wired controller, it can be adjusted from 16°C - 32°C by pressing “temperature +”, “temperature -” on the remote controller (or wired controller). Press “fan speed” button to choose fan speed among auto wind, high speed wind, medium speed wind, low speed wind.

##### Operation state

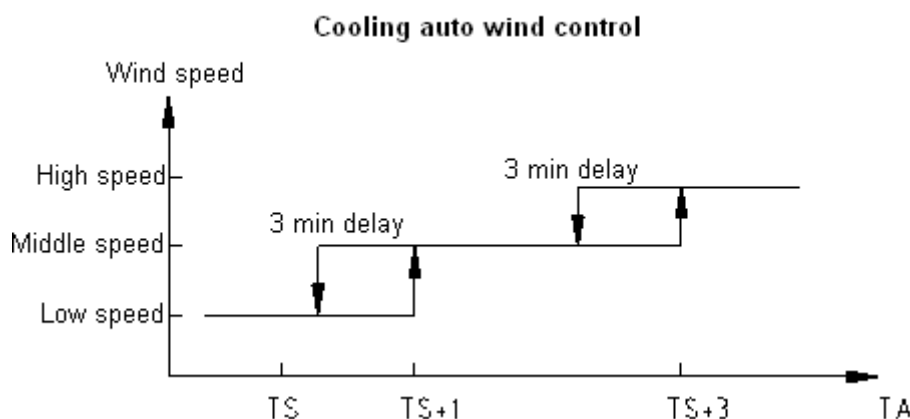
- a) The indoor fan motor always runs at the speed set by remote controller or wired controller.
- b) When the indoor temperature  $TA$ -setting temperature  $TS \geq 1^\circ\text{C}$ , the compressor starts as well as outdoor fan after compressor meets 3 min protection
- c) When  $TA = TS$ , The unit operation state keep the same.
- d) When indoor unit temperature  $TA$  – setting temperature  $TS \leq -1$ , the compressor and outdoor fan stop after compressor meets 3 min protection



### Auto wind control

When unit is set to auto wind by remote controller or wired controller, indoor wind speed will be controlled abide by regulation as follow

- a) When  $TA - TS \geq 3^{\circ}\text{C}$ , at high speed
- b) When  $TS + 1^{\circ}\text{C} \leq TA < TS + 3^{\circ}\text{C}$ , at medium speed
- c) When  $TA - TS < 1^{\circ}\text{C}$ , at low speed
- d) There is no 3 min delay when wind speed switch from low to high, contrary to wind speed switch from high side to low side.

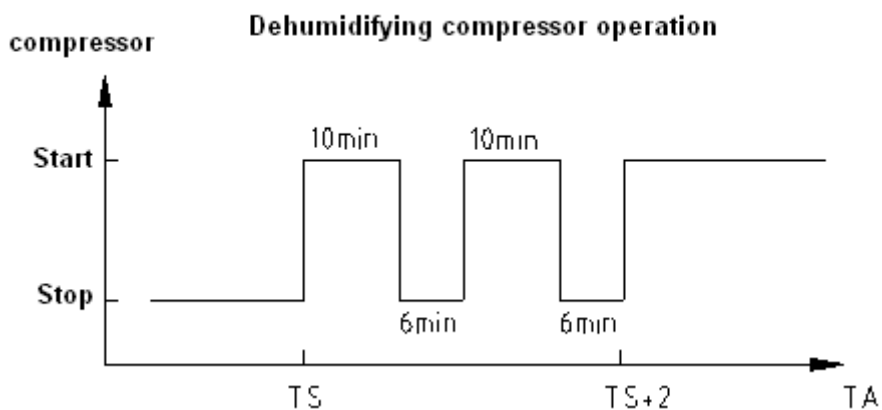


### ◇ Dehumidify operation

Temperature is set by remote controller (or wired controller), temperature adjustable range from  $16^{\circ}\text{C}$ -  $32^{\circ}\text{C}$ , user can adjust temperature through "temperature +" and "temperature -" button on remote controller or wired controller. Press "fan speed" button to choose fan speed among auto wind, high speed wind, medium speed wind, low speed wind.

#### Operation state

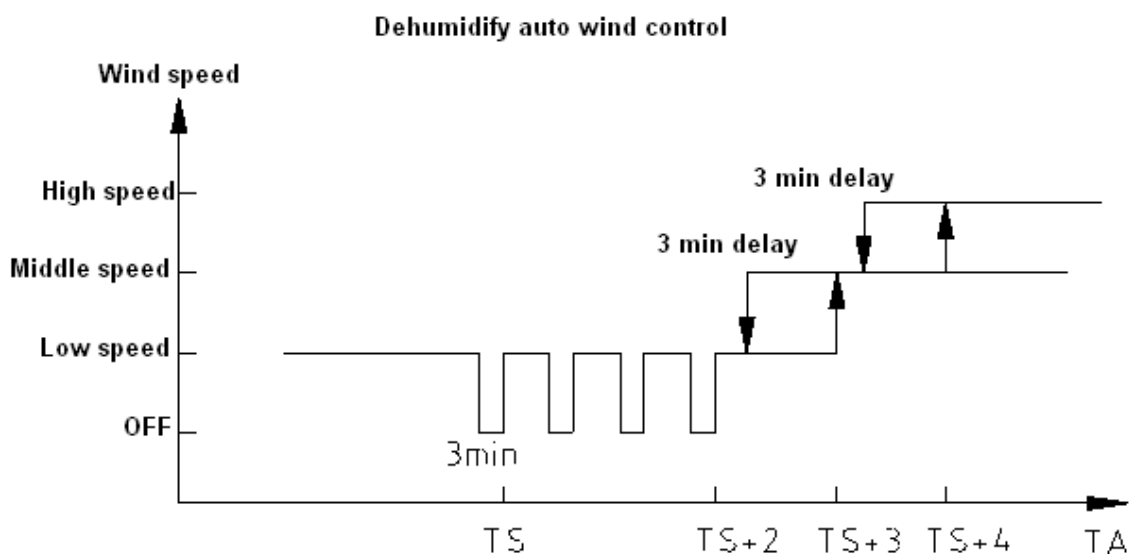
- a) When  $TA \geq TS + 2^{\circ}\text{C}$ , and 3 min protection can be satisfied, the compressor and outdoor fan will run continuously and wind speed run at set speed.
- b) When  $TS \leq TA < TS + 2^{\circ}\text{C}$  and 3 min protection can be satisfied, the compressor and outdoor fan keep 10 min on while off in another 6 min, indoor fan keeps 13 min on while off in subsequent 3 min, the indoor fan will start at low wind speed after the compressor stops for 3 min.
- c) When  $TA < TS$  and 3 min protection can be satisfied, the compressor, outdoor fan and indoor fan stops running, the indoor fan restart at low wind speed after the compressor stops 3 min



**Auto wind control**

When unit is set to auto wind by remote controller or wired controller, indoor wind speed will be controlled abide by regulation as follow

- a) If  $TA - TS \geq 4^{\circ}C$ , at high speed
- b) If  $TS + 3^{\circ}C \leq TA < TS + 4^{\circ}C$ , at medium speed
- c) If  $TS + 2^{\circ}C \leq TA < TS + 3^{\circ}C$ , at low speed
- d) If  $TS \leq TA < TS + 2^{\circ}C$ , at low speed intermittently
- e) If  $TA < TS$ , the indoor fan will restart after stop for 3 min, and operates at low wind.



**◇ Ventilation operation**

Outdoor unit stay closed, indoor fan motor operates at set wind and wind speed can be set at high, medium, low by remote controller.

**◇ Heating operation**

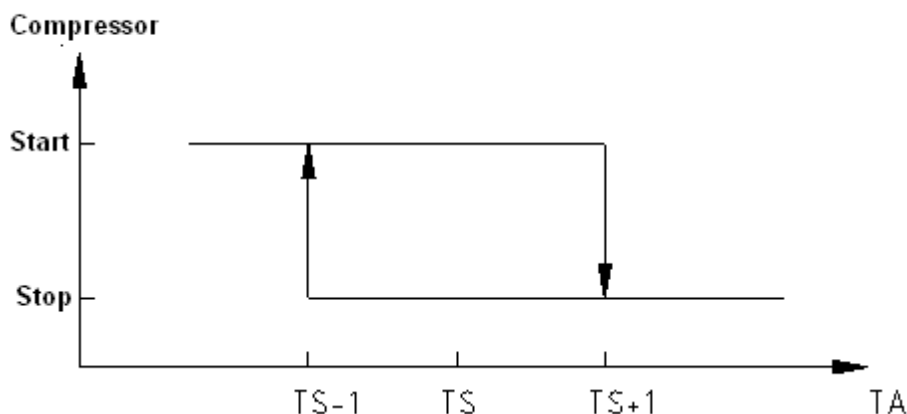
Temperature is set by remote controller (or wired controller), temperature control range from 16°C-32°C, user can adjust temperature through “temperature + ”and “temperature -” button on remote controller or wired controller. Press “fan speed” button to choose fan speed among auto wind, high speed wind, medium speed wind, low speed wind.

**Operation state**

- a) When  $TA - TS \leq -1^{\circ}C$ , if compressor meets 3 min protection, the compressor and outdoor fan start, indoor fan runs according to Anti-cold air condition
- b) When  $TA - TS \geq 1^{\circ}C$ , if compressor meets 3 min continuous operation, the compressor and outdoor fan stop, indoor fan runs according to Anti-cold air condition

c) If  $T_A = T_S$ , stay in the previous state.

### Heating compressor operation



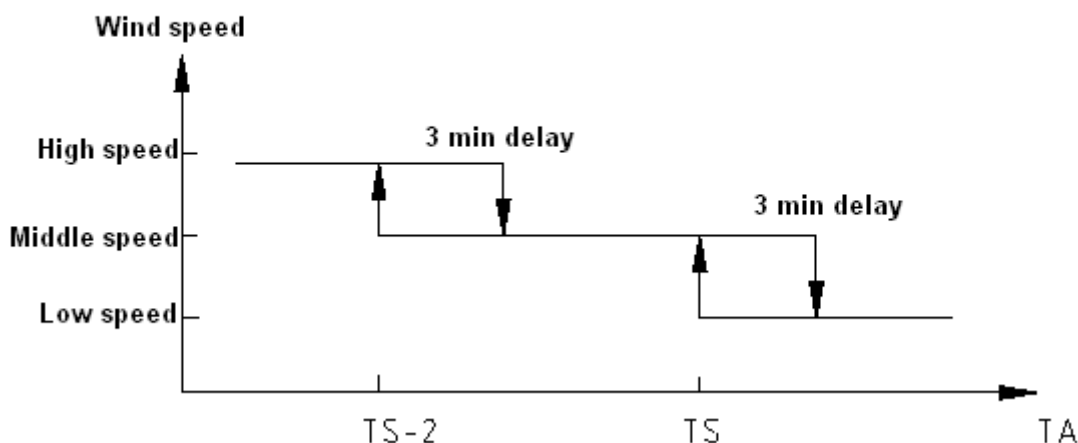
### Compressor initial start control

When the outdoor coil temperature  $\geq 7^\circ\text{C}$ , the compressor starts after 4-way valve turns on for 10 seconds, 2 seconds later, the outdoor fan starts, indoor fan motor operates according to Anti-cold air mode. When the coil temperature  $< 7^\circ\text{C}$ , the compressor starts first, when One of the following conditions is satisfied: the outdoor coil temperature  $\geq 12^\circ\text{C}$  or unit keep running for 10 minutes; then the outdoor fan starts, 10 seconds later, the compressor shut off; 15 seconds later, the four way valve turns on; 5 seconds later, the compressor restart and the indoor fan runs according to Anti-cold air mode.

### Auto wind control

- When  $T_A < T_S - 2^\circ\text{C}$ , at high wind speed
- When  $T_S - 2^\circ\text{C} \leq T_A < T_S$ , at medium wind speed
- When  $T_A \geq T_S$ , at low wind speed
- There is no 3 min postpone when wind speed switch from low to high, contrary to wind speed switch from high to low.

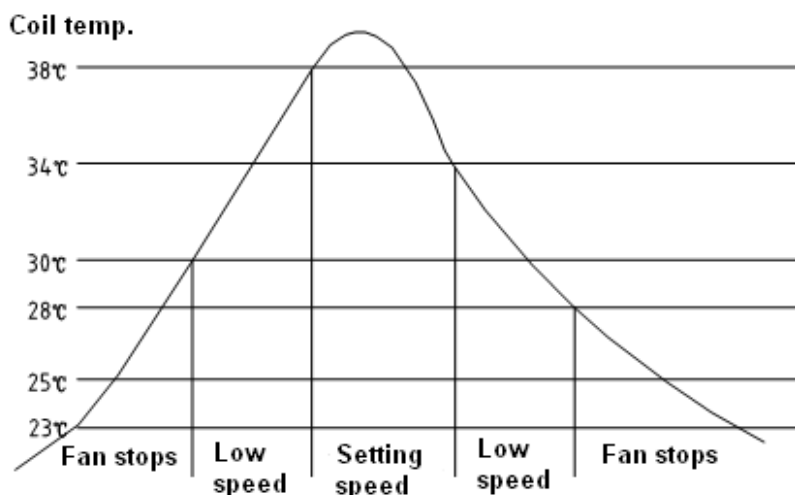
### Heating auto wind control



### Anti-cold air

- Anti-cold air when the compressor is running
  - When TE is raising and  $TE < 30^\circ\text{C}$ , indoor fan stops, if  $30^\circ\text{C} \leq TE < 38^\circ\text{C}$ , indoor fan runs at low wind speed.
  - When  $TE \geq 38^\circ\text{C}$ , indoor fan runs at setting speed

When TE is descending and  $TE > 34^{\circ}\text{C}$ , indoor fan runs at setting speed. When  $28^{\circ}\text{C} < TE \leq 34^{\circ}\text{C}$ , indoor fan runs at low wind. When  $TE \leq 28^{\circ}\text{C}$ , indoor fan stops..



b) Anti-cold air when the compressor is off

When  $TE > 30^{\circ}\text{C}$ , if indoor fan is originally on then it blows low wind( last for maximum 30S).

When  $TE \leq 30^{\circ}\text{C}$ , indoor fan stops.

#### Blowing surplus heat

When indoor temperature reach set temperature or turn off the unit , if  $TE > 35^{\circ}\text{C}$ , indoor fan motor operates at low wind, if indoor temperature  $\leq 35^{\circ}\text{C}$ , indoor fan stops running.

#### ◇ Timing

The largest timing time is 24 hours, minimum scale is 1 min, single timing style, timing function will keep valid when mode change, and indication lamp keep light once set.

#### Timing off

Only when the unit is running, this function can be set, set range is 1min-24h and unit will automatically shutdown when time runs out.

#### Timing on

Only when the unit is running, this function can be set, set range is 1min-24h and unit will automatically shutdown when time runs out.

Turn on or turn off after timing set, original timing and sleeping functions will be canceled automatically.

#### ◇ Sleeping

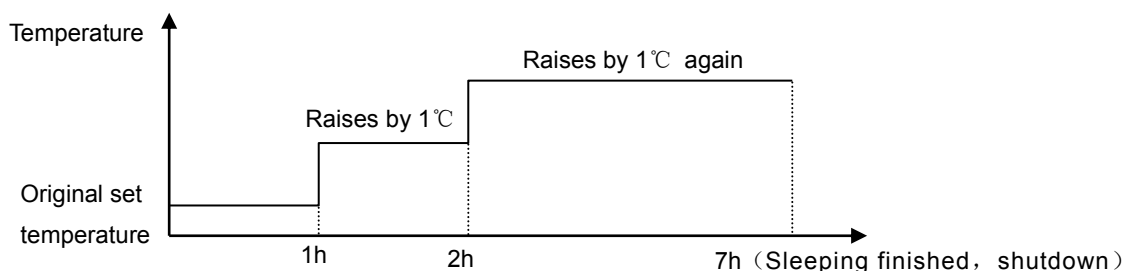
The sleeping function is valid in auto, cooling, dehumidifying, heating operation, indoor fan blows low wind once enters into sleeping mode and sleeping indication lamp turns to light. Press the sleep button and enters to sleeping operation, for cooling operation the set temperature raises by  $1^{\circ}\text{C}$  1 h later, and for heating operation the set temperature descends by  $2^{\circ}\text{C}$  1 h later. After another 1h operation, for cooling operation the set temperature raises by  $1^{\circ}\text{C}$  again, and for heating operation the set temperature descends by  $2^{\circ}\text{C}$  again. After the sleeping mode runs for 7h the unit shutdown.

When enters into sleeping operation, mode switch will be valid, however sleeping function will be cancel after mode switch and if press "temperature +" button the unit will adjust temperature according to " new set temperature + amending temperature."

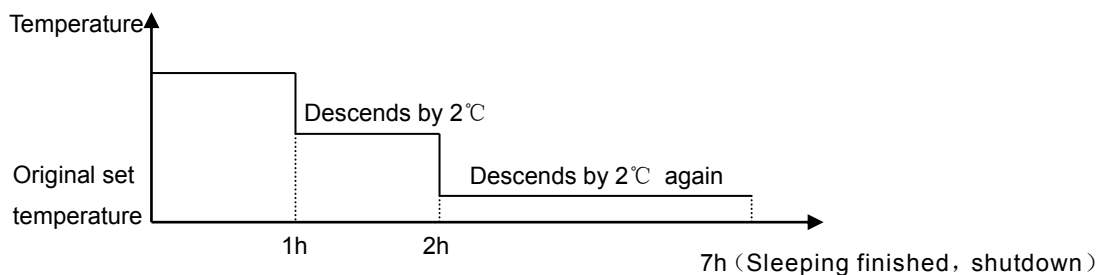
At the state of sleeping mode, press "sleep" button, mode button or turn off the unit, the sleeping mode will be canceled.

Sleeping in cooling operation:





Sleeping in heating operation:



#### ◇ Long distance control

- Control board has function of long distance control
- The switch of long distance control can be masked through indoor unit DIP switch.
- When long distance switch is off and unit turns off, the remote controller and wired controller shall not be able to turn on the unit.
- When long distance switch is on and unit starts in auto mode, mode can be changed by remote controller or wired controller.

#### ◇ Self-check operation

Press the forced switch at the same time power on, the buzzer sounds twice and enters into self-check operation process

Electric heating motion, indoor fan operates at high speed → operation lamp light for 1s → timing lamp light for 1s → power lamp light for 1s → indoor fan runs at low speed and medium speed both for 1s → compressor motion 1s → four ways valve motion 1s → outdoor motion 1s → buzzer sounds once then close and unit enters into ready state, ending self-check.

### 3.2 Control function

#### ◇ Anti-freezing protection

- The protection is to prevent indoor evaporator from frosting in large area.
- When indoor coil temperature  $\leq -2$  and lasts for 10s, in addition, the compressor keeps running for 5 min or longer, the compressor and outdoor fan stops running, indoor fan runs at setting speed.
- If indoor coil temperature  $\geq 7^{\circ}\text{C}$ , unit quits the protection, once the compressor meets 3 min protection the unit restart.
- This function is valid only when cooling or dehumidifying.

#### ◇ Anti over-heating protection

- This protection is to avoid wind temperature is too high in heating to cause user feel uncomfortable.

- b) When indoor coil temperature  $TE \geq 57^{\circ}\text{C}$  and lasts for 10s, outdoor unit stops, when indoor coil temperature  $TE \geq 64^{\circ}\text{C}$  and lasts for 10s, the compressor stops and indoor unit fan speed keep unchanged.
- c) When  $TE < 52^{\circ}\text{C}$ , unit quits this protection, after the compressor meets 3 min protection, unit returns to normal operation.
- d) This function is only valid when heating.

#### ◇ Cooling high pressure protection

- a) This protection is to prevent outdoor motor failure which leads to compressor exhaust pressure over using range to cause compressor damage.
- b) When outdoor coil temperature  $> 64^{\circ}\text{C}$ , and lasts for over 20s, the compressor stops running, when the coil temperature  $< 52$  degree and the 3 min compressor protection is satisfied, the compressor returns to normal running.
- c) Once high pressure protection appears 3 times in half an hour, the whole unit stops running and indoor unit alarms high pressure protection.

#### ◇ Shortage of refrigerant or four valves failure protection

- a) This protection is to prevent refrigerant shortage of system and four ways valve failure to turn direction when heating, both of which lead to cycle liquid be greatly produced which damage the compressor
  - ① Make a record of indoor coil temperature T1 before compressor starts, when the compressor keeps running for 6 hours, indoor temperature is T2, and if  $T1 - T2 > 5^{\circ}\text{C}$
  - ② The compressor keeps running for 6 min then room temperature - indoor coil temperature  $< 5^{\circ}\text{C}$
- c) Heating operation: Satisfy the following two conditions and lasts for 10s:
  - ① Make a record of indoor coil temperature T1 before compressor starts, the compressor keeps running (except defrost operation) for 8 min, indoor coil temperature is T2, if  $T2 - T1 \leq 8^{\circ}\text{C}$
  - ② The compressor keeps running (except defrost operation) for 8 min, if  $T2 - T1 < 8^{\circ}\text{C}$

#### ◇ Exhaust temperature protection

- a) This function is to prevent exhaust temperature be too high to reduce the compressor operation longevity
- b) When the compressor started, exhaust temperature  $TP > 120^{\circ}\text{C}$  and lasts for 3s, exhaust temperature protection will be activated, the compressor stops, as well as outdoor fan, and alarm outdoor protection.
- c) When exhaust temperature falls to  $85^{\circ}\text{C}$ , quits this protection, the failure code will not disappear but the unit can resume after restart.

**Note: This function is available for three phase power supply**

#### ◇ High and low pressure protection

- a) This protection is to guarantee the unit runs in allowing range, free from the compressor damage
- b) High pressure protection: High pressure switch off and lasts for 3s, high pressure protection appears, the compressor and fan motor all stops, alarm outdoor unit protection, and failure code will not disappear even when high pressure switch returns to normal, but the unit can resume when restart.
- c) Low pressure protection
  - ① Checking low pressure failure after the unit starts for 5 min, low pressure switch off and lasts for 3s, low pressure protection appears, the compressor and fan motor stop, alarming outdoor protection, failure code disappear after low pressure switch return to normal, when the compressor 3 min protection is satisfied unit returns to normal running.
  - ② When low pressure appears 3 times in 30 min, the protection is unable to resume, the whole

unit stops and the unit can resume after the failure is solved and restart

③Do not check low pressure when defrosting.

**Note: This function is available for three phase power supply**

**◇ Phase sequence protection**

a) This protection is to prevent the compressor rollback or lack phase lead to over current, and finally destroy the compressor

b) When outdoor unit appears lack phase or phase sequence incorrect, the unit stops immediately and enters into protection, alarming outdoor protection, even phase sequence or lack phase switch return to normal the failure code will not disappear, the unit can resume when restarting

**◇ Outdoor fan motor control**

The unit has function of low ambient cooling and high ambient heating, when cooling take outdoor coil temperature as basis and when heating take indoor coil temperature as basis, the outdoor fan automatic carries out stepless speed adjustment to keep the unit in normal operation state.

**◇ Defrosting control**

a) On the situation that the outdoor sensor is in good condition, once following conditions are satisfied defrosting begins, the operation lamp will shine when running defrosting.

- ① Outdoor coil temperature below definite temperature and lasts for 2 min
- ② The compressor running time surpass defrosting internal time (defrosting internal time recalculates when power off by accident or remote controller), the compressor keeps running continuously for over 5 min. When defrosting begins, the compressor, indoor fan, outdoor fan will stop, 15s later 4-way valve will be closed, and 5 more seconds later the compressor enters into defrosting operation.

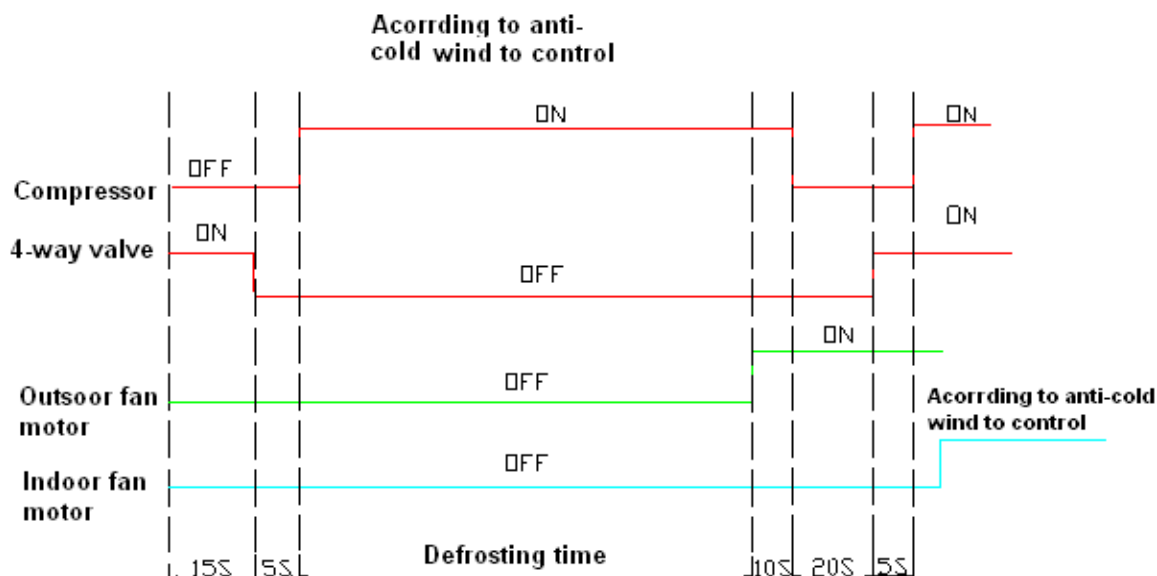
d) Ending defrosting condition (one of the following conditions is satisfied defrosting ends)

- ① Outdoor coil temperature  $\geq 12^{\circ}\text{C}$
- ② Defrosting time up to 10 min
- ③ Mode switch or turning off the unit by remote controller, defrosting exits immediately.

After the defrosting is finished, outdoor fan will start, 10 s later the compressor will stop, and 15 s later four ways valve will open, 5 more seconds later the compressor will start, the unit returns to normal heating operation, and indoor fan runs as anti-cold wind mode

c) Defrosting entering temperature and heating internal time will auto-adjusted by outdoor defrosting time

d) Defrosting time sequence drawing



### ◇ Intelligent defrosting function(only in the case of outdoor coil is damaged this function is carried out)

#### Entering conditions

On the condition of running intelligent defrosting operation, one of following 7 conditions is satisfied (As for secondary condition in upper condition, it is only valid that all secondary condition be satisfied at the same time)

#### a) Condition No.1

- ① The outdoor fan enters into over-load protection and stops running.
- ② Outdoor fan stops running then restarts and keeps running over 10 min
- ③ The compressor accumulating running time  $\geq 45$ min
- ④ The compressor continuous running time  $\geq 20$ min
- ⑤  $TE \leq 48^{\circ}\text{C}$ .

#### b) Condition No.2

- ① Enter into heating mode 5 min later or finish defrosting 5 min later, catch the max difference value between TE and TA  
If  $TE \geq 38^{\circ}\text{C}$ , when the difference between TE and TA decrease by  $5^{\circ}\text{C}$  or more and lasting time  $\geq 3$ min  
If the difference between TE and TA decrease by  $3^{\circ}\text{C}$  or more and lasting time  $\geq 3$ min
- ② The compressor continuous running time  $\geq 5$ min
- ③ The compressor accumulating running time  $\geq 45$ min
- ④  $TE \leq 48^{\circ}\text{C}$ ;

Note: If there is wind modification, and when indoor fan wind speed descends 1 grade, temperature modification  $-1^{\circ}\text{C}$ .when indoor fan wind speed climbs 1 grade, temperature modification  $+1^{\circ}\text{C}$

#### c) Condition No.3

- ① The compressor accumulating running time  $\geq 3$ h
- ② The continuous compressor running time  $\geq 5$ min
- ③ The min. difference between TE and TA  $< 16^{\circ}\text{C}$

#### d) Condition No.4

- ① The min. difference between TE and TA  $< 16^{\circ}\text{C}$  continuously last for 5 min
- ② The compressor accumulating running time  $\geq 45$  min
- ③ The compressor continuous running time  $\geq 20$ min

If the condition is satisfied unit will enter into defrosting, current TE will be recorded before defrosting. When the defrosting is over, and the compressor continuously runs for 10 min, then compare current TE with TE before defrosting, if the latter doesn't high than former by  $3^{\circ}\text{C}$  or more, next time unit will not enter into defrosting at this condition, until mode switch, turn off then restart to heating or go through a defrosting yet.

#### e) Condition No.5

Begin to calculate time once air conditioner enters into over-heating protection, enters into compulsory defrosting after 2 h later.

#### f) Condition No.6

- ① 5 min later after enters into heating mode for the first time, catching max value of TE, if  $TE < 38^{\circ}\text{C}$
- ② The compressor continuous running time  $\geq 5$ min

- ③The compressor accumulating running time  $\geq 45$  min

**g) Condition No.7**

- ①At heating mode and the compressor accumulating running time is over 2h.

- ②Within the 2 h never carry out defrosting

- ③The compressor continuous running time  $\geq 5$ min, catching max value of TE, if TE  $< 30$  and lasting time  $\geq 3$ min.

**Quit conditions**

One of following 3 conditions is satisfied unit quit the intelligent defrosting

- a) Intelligent defrosting time  $\geq 9$ min

- b) Intelligent defrosting time lasts for 4 min, if TE  $\geq 0^{\circ}\text{C}$ , and in 10s TE increased by  $2^{\circ}\text{C}$  or more.

- c) Intelligent defrosting time lasts for 5min, if TE  $\geq 5^{\circ}\text{C}$

**Defrosting time sequence**

- a) When the defrosting begins, the compressor, indoor fan, outdoor fan all stop, 30s later 4-way valve will be closed as well, then 15s later the compressor starts and enters into defrosting operation.

- b) When quit from defrosting, the compressor stops and outdoor fan starts, 55s later four ways valve will be open, and 5s later the compressor starts and air conditioner returns to normal operation, indoor fan operates as anti-freezing wind mode.

**◇ Sensor failure**

- a) Indoor room temperature (TA)

When TA is abnormal, the unit stops to run protection, failure code will display (see the failure indication table), failure code will disappear when TA returns to normal.

- b) Indoor coil temperature (TE)

When TE is abnormal, failure code will display (see the failure indication table), failure code will disappear when TE returns to normal

- c) Outdoor coil temperature (TW)

When in cooling or dehumidifying mode, doesn't check TW

When in heating mode, after the unit starts outdoor coil temperature will be checked, if TW is abnormal, unit normal starting is permitted, and defrosting automatically be set as intelligent, failure code will display (see the failure indication table), failure code disappears when TW return to normal, and heating defrosting returns to normal.

- d) Exhaust temperature (TP)

Check the exhaust temperature sensor when power on

When TP is abnormal, unit will start normally and exhaust over-heat protection be canceled, at the same time failure code displays, failure code disappears when TP back to normal, exhaust over-heat protection will be recovery

- e) Outdoor condensation temperature (TL)

When in heating mode, doesn't check TL

When in cooling mode, after the unit starts check the outdoor condensation temperature, if TL is abnormal the unit normal starting is allowed and cancel the low ambient cooling function, at the same time the failure code displays, failure code disappears when TH back to normal, the low ambient cooling function will be recovery.

**◇ Communication failure**

- a) Communication failure between indoor and outdoor units: The indoor and outdoor communication is abnormal, or one of indoor unit and outdoor unit control board is not electrified, then power off and display failure code, when communication returns to normal failure code disappears.

- b) The communication failure of wired controller: when wired controller or main control board doesn't receive correct signal for consecutive 2 min, then turn off and display failure code, when communication returns to normal failure code disappears.

## 4. DIP switch setting and failure code

### Failure code

When air condition has failure, the timing lamp on light board of controller will display different code according to different failure case.

#### Unit failure code for power supply is 380-415V

Suitable for units: SAD48HD1-A, SAD60HD1-A

Failure causing	Display mode1 (indication	Display mode1	Display mode3	Display priority	Phenomenon
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	lamp on display lamp board)	( failure lamp on control board)	( wired controller )		
Communication failure	Flash 5 times and go out 2S	Flash 2 times and go out 2S	F1	1	shutdown
Wired controller communication failure	—	—	E5	1	shutdown
Drainage system failure	Flash 4 times and go out 2S	—	E4	3	shutdown
Outdoor protection( Phase failure )	Flash 6 times and go out 2S	—	E6	2	shutdown
Outdoor protection (discharging over-temperature )	Flash 10 times and go out 2S	Flash 10 times and go out 2S	EA	7	shutdown
High pressure protection	Flash 9 times and go out 2S	Flash 1 times and go out 2S	E9	6	shutdown
Low pressure protection	Flash 9 times and go out 2S	Flash 3 times and go out 2S	E9	6	shutdown
Indoor temp. sensor abnormal(TA)	Flash 1 times and go out 2S	—	E1	4	shutdown
Indoor coil sensor abnormal(TE)	Flash 3 times and go out 2S	—	E3	5	shutdown
Outdoor coil sensor abnormal(TW)	Flash 2 times and go out 2S	Flash 2 times and go out 2S	E2	8	non-stop
Outdoor condensate temp. Sensor abnormal(TL)	Flash 7 times and go out 2S	Flash 7 times and go out 2S	E7	9	non-stop
Discharging temp. sensor abnormal(TP)	Flash 8 times and go out 2S	Flash 8 times and go out 2S	E8	10	non-stop
Refrigerant shortage	Flash 11 times and go out 2S	Flash 11 times and go out 2S	E0	11	shutdown

**Note: When correct signal has not been received by wired control or main control board in 2 consecutive min, then the unit turns off and indicates relative failure code, once communication renew and failure code disappears automatically.**

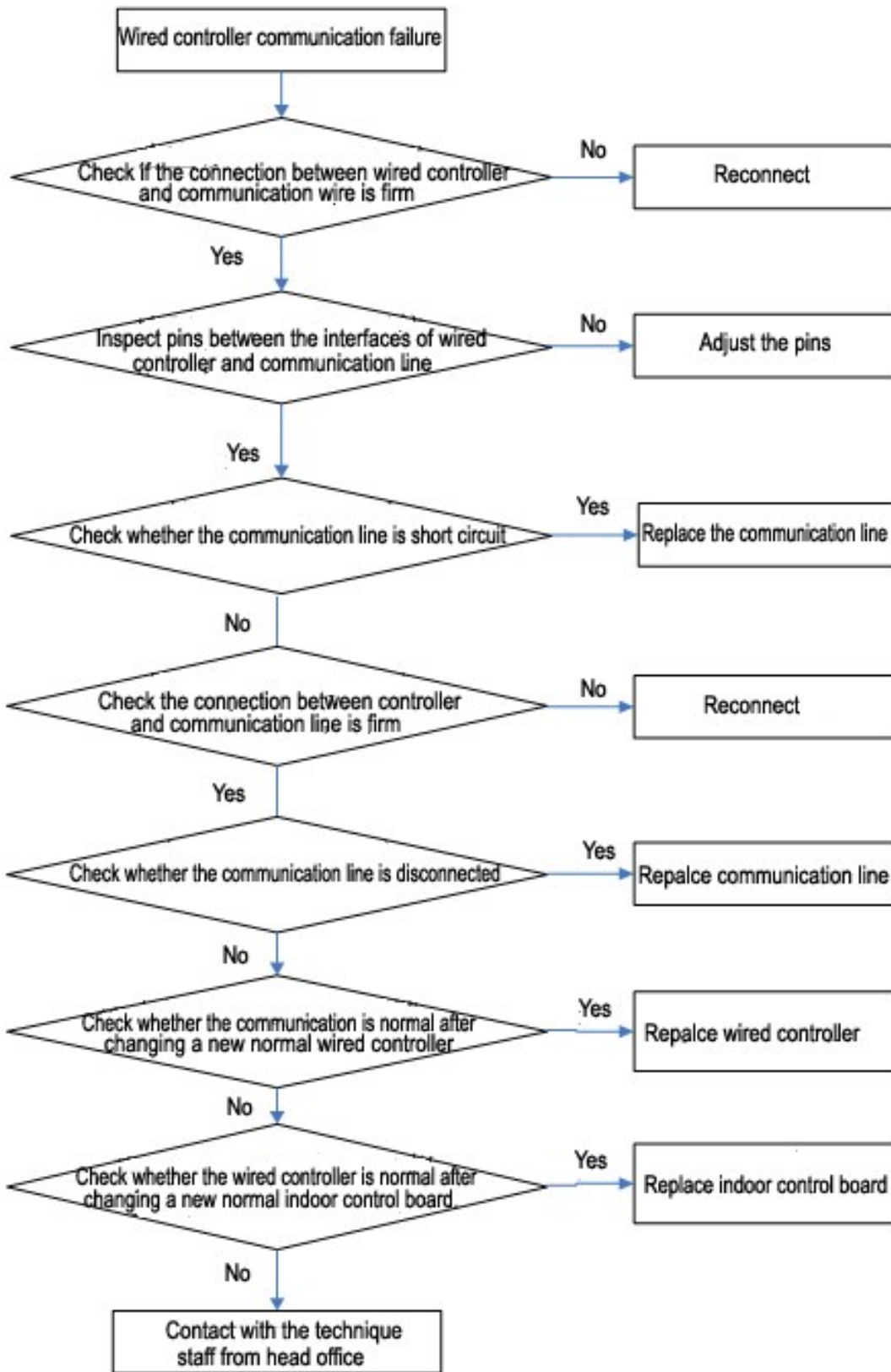




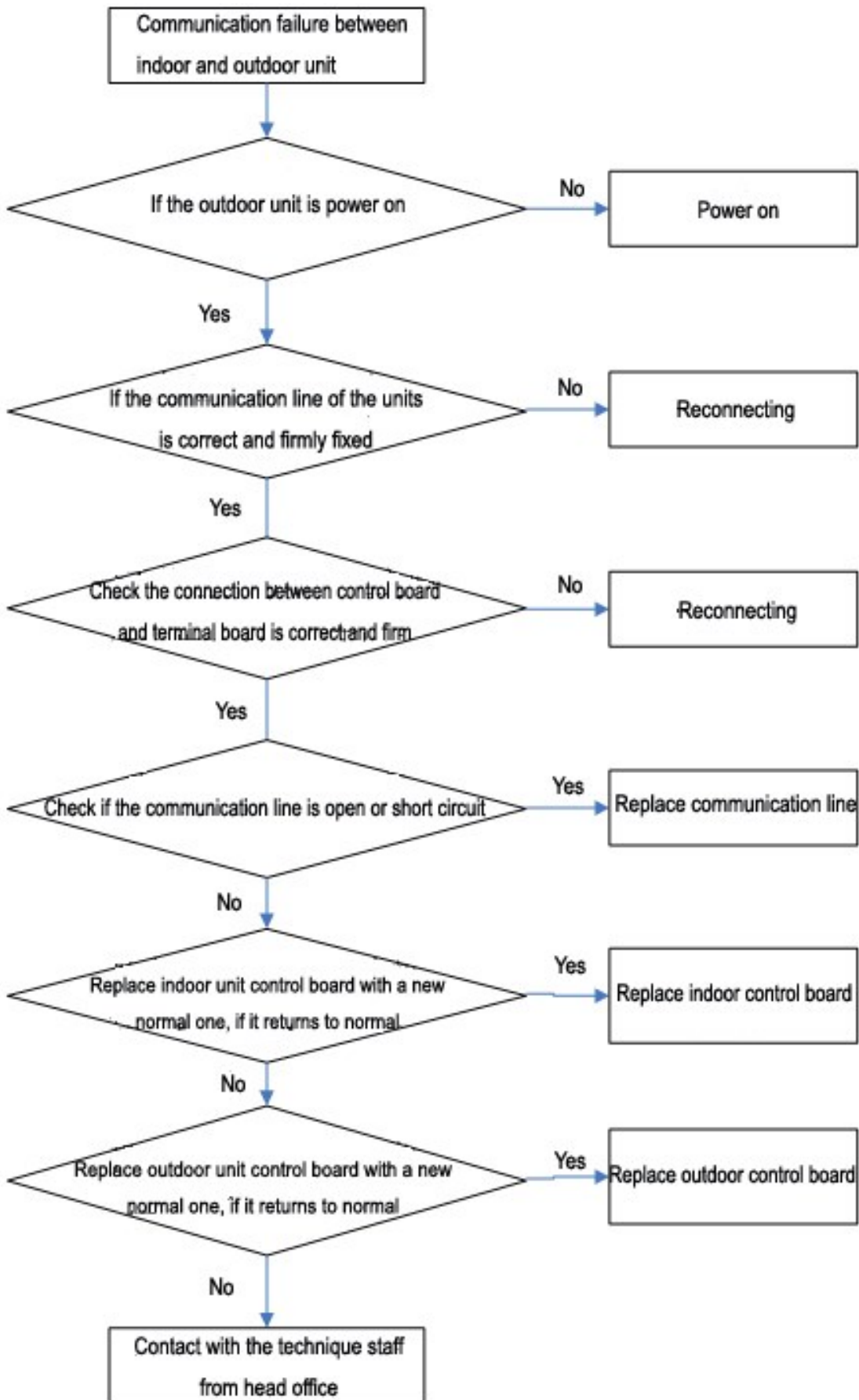
## **5. Failure analysis and elimination**

### **5.1 Analysis and elimination for the failure with failure code**

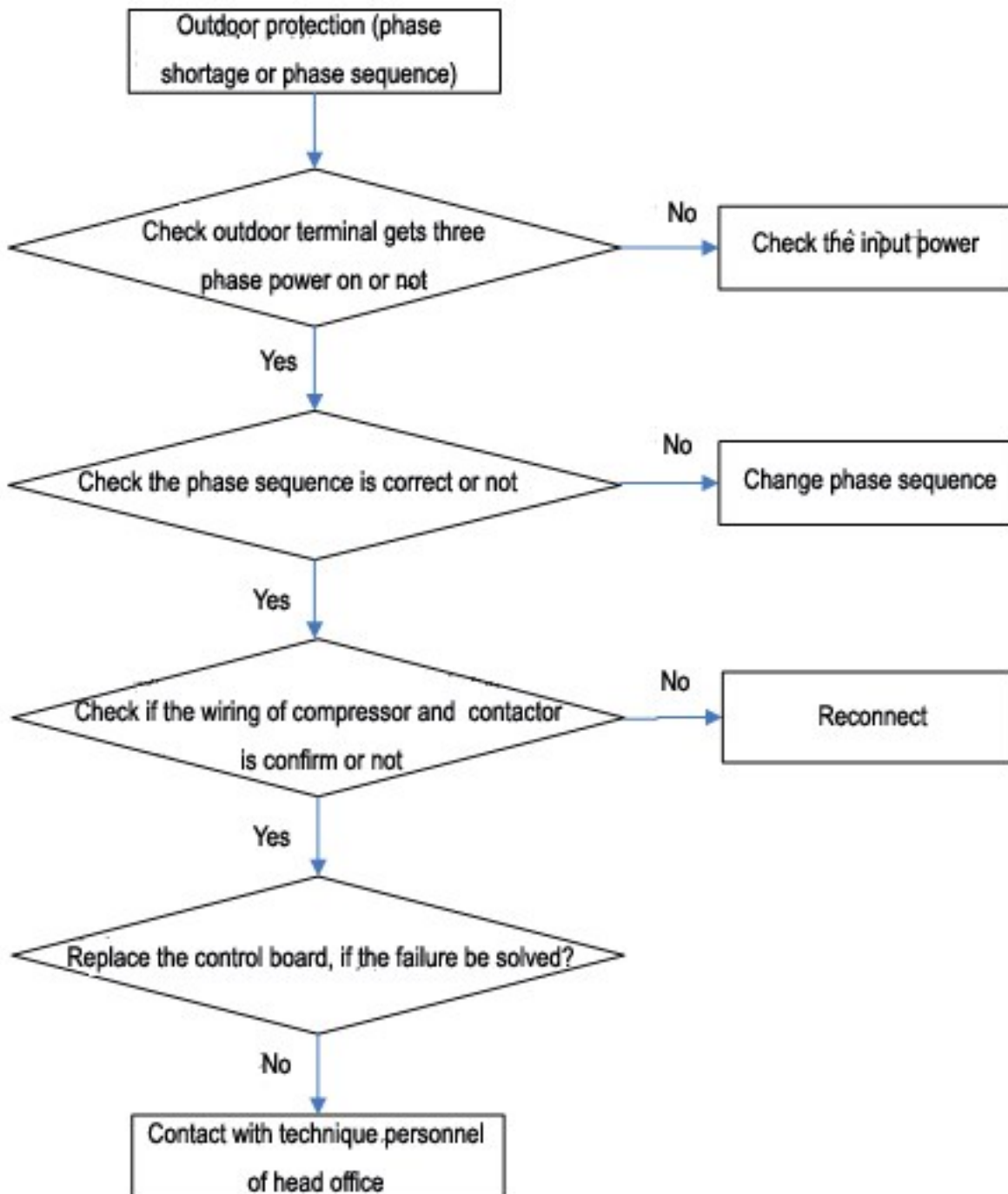
#### **Wired controller communication failure**



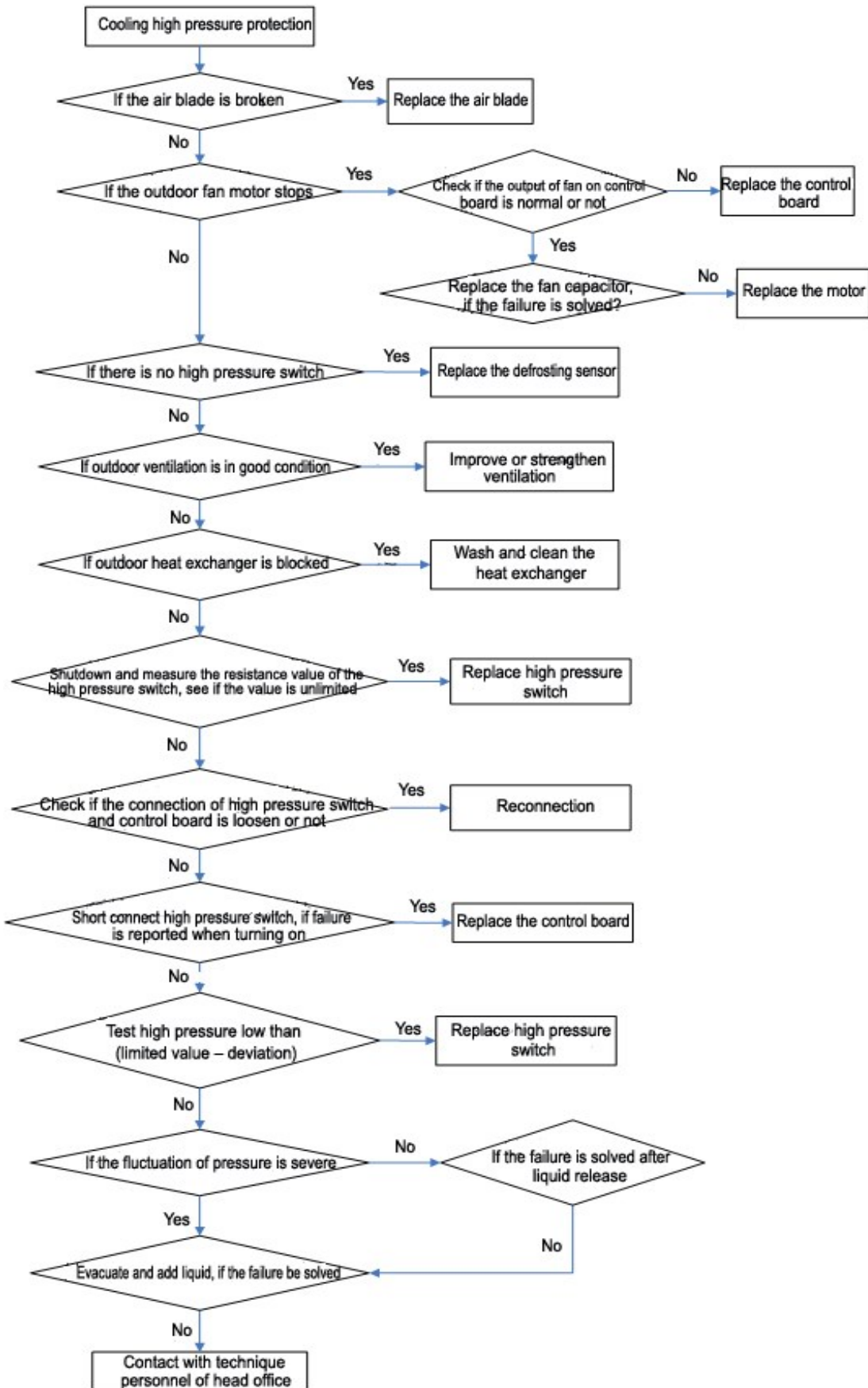
**Communication failure between indoor and outdoor unit**



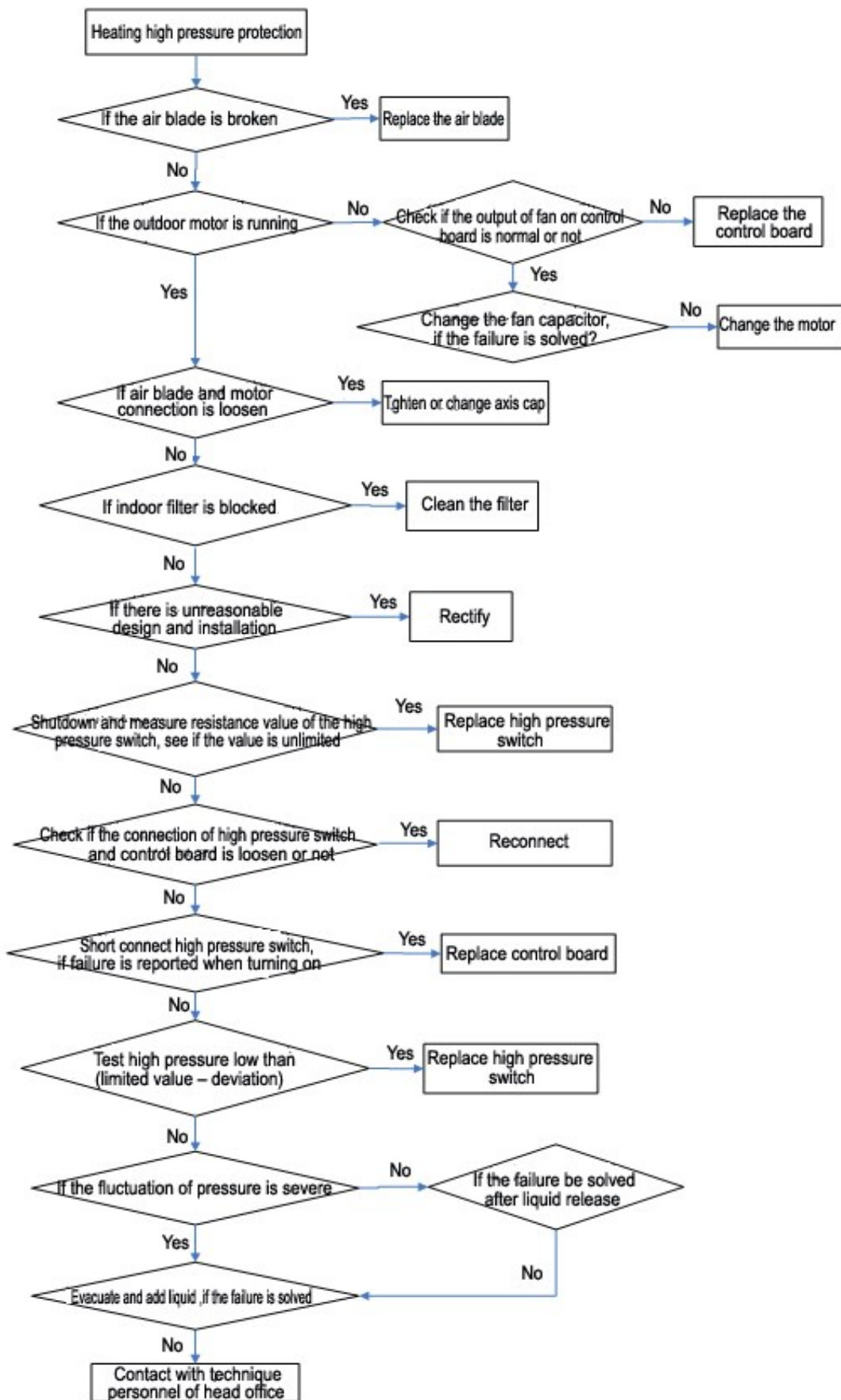
## Outdoor protection(phase sequence)



## **Cooling high pressure protection**

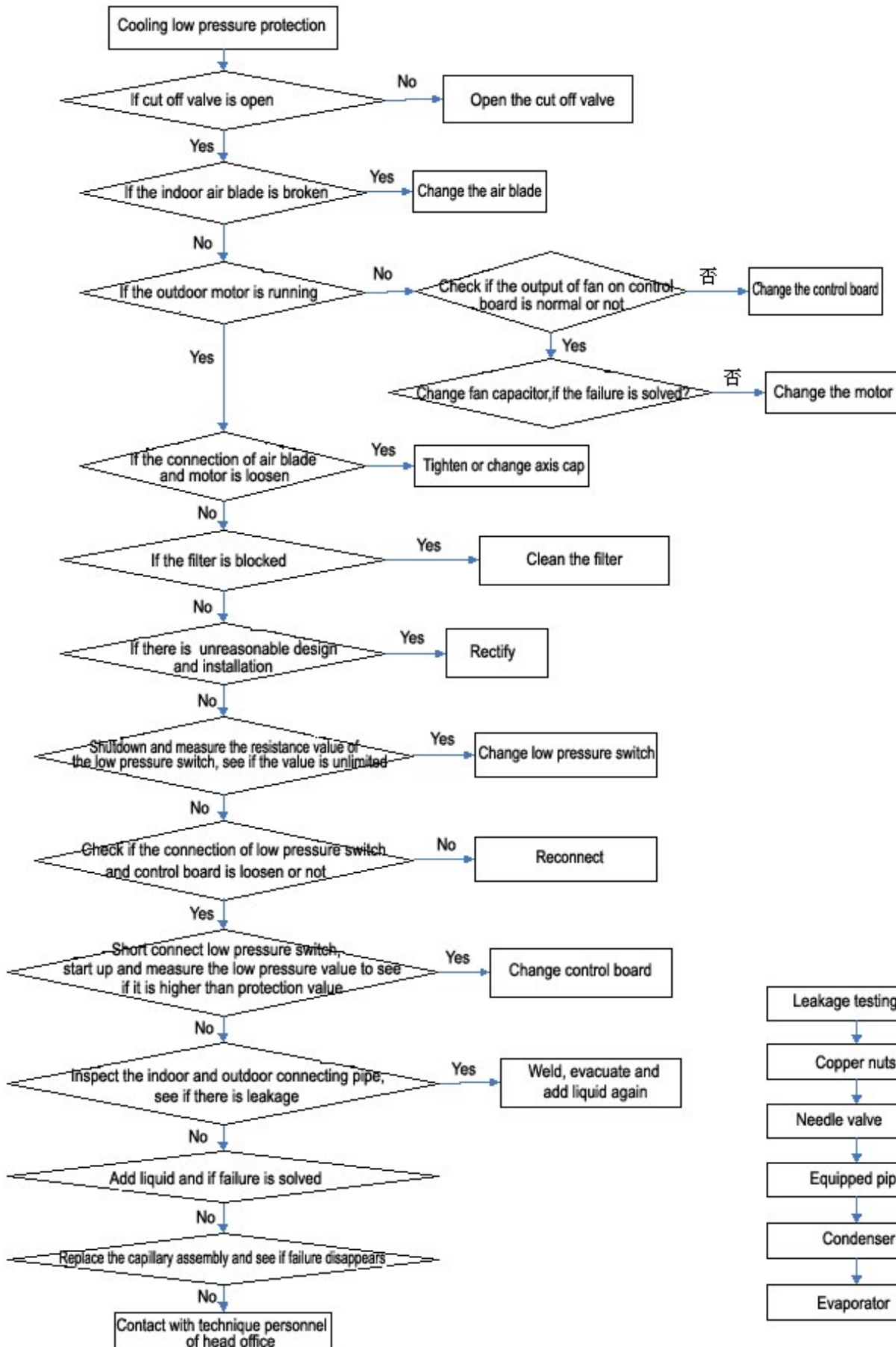


**Heating high pressure protection**

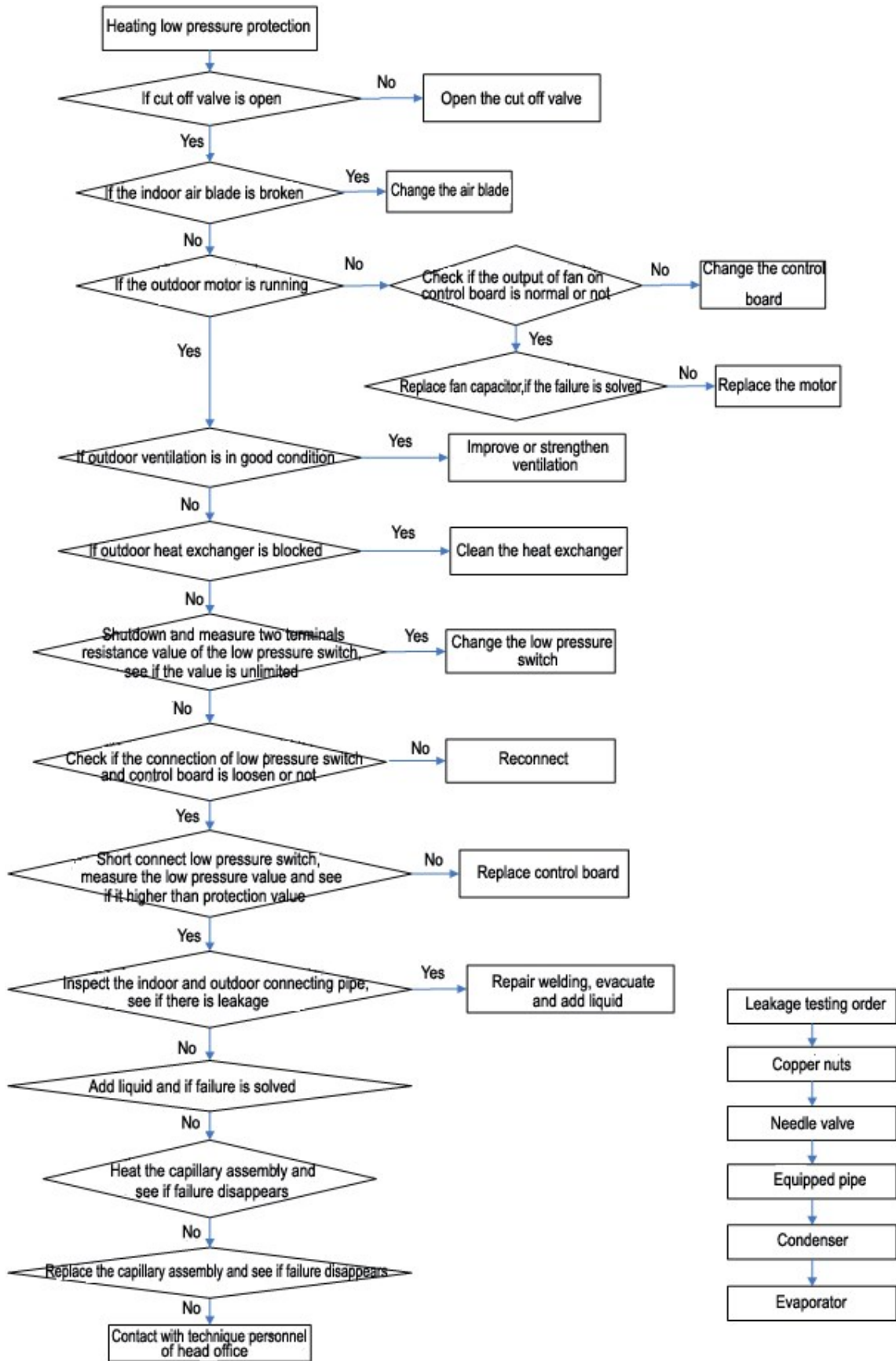


## **Cooling low pressure protection**

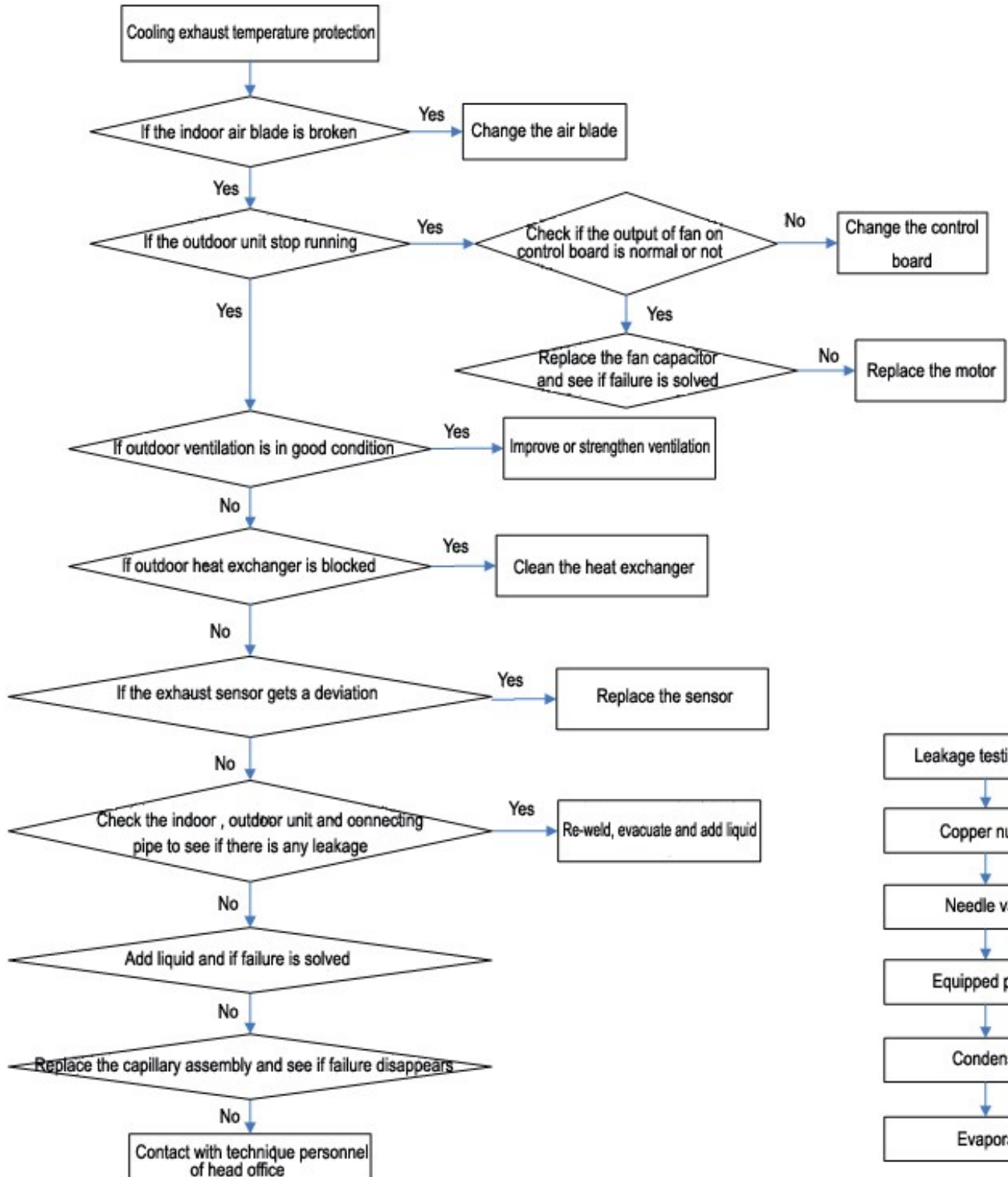




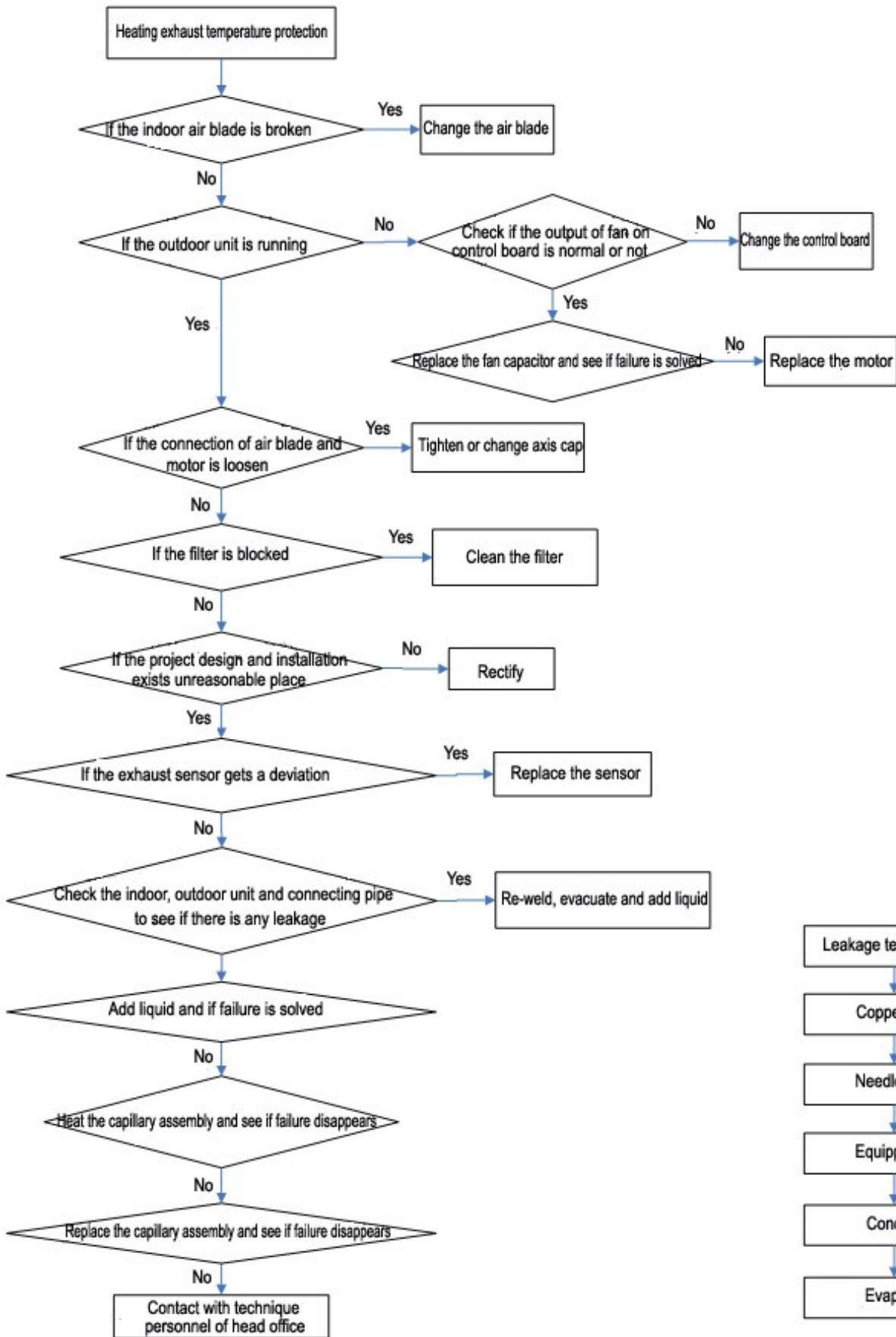
**Heating low pressure protection**



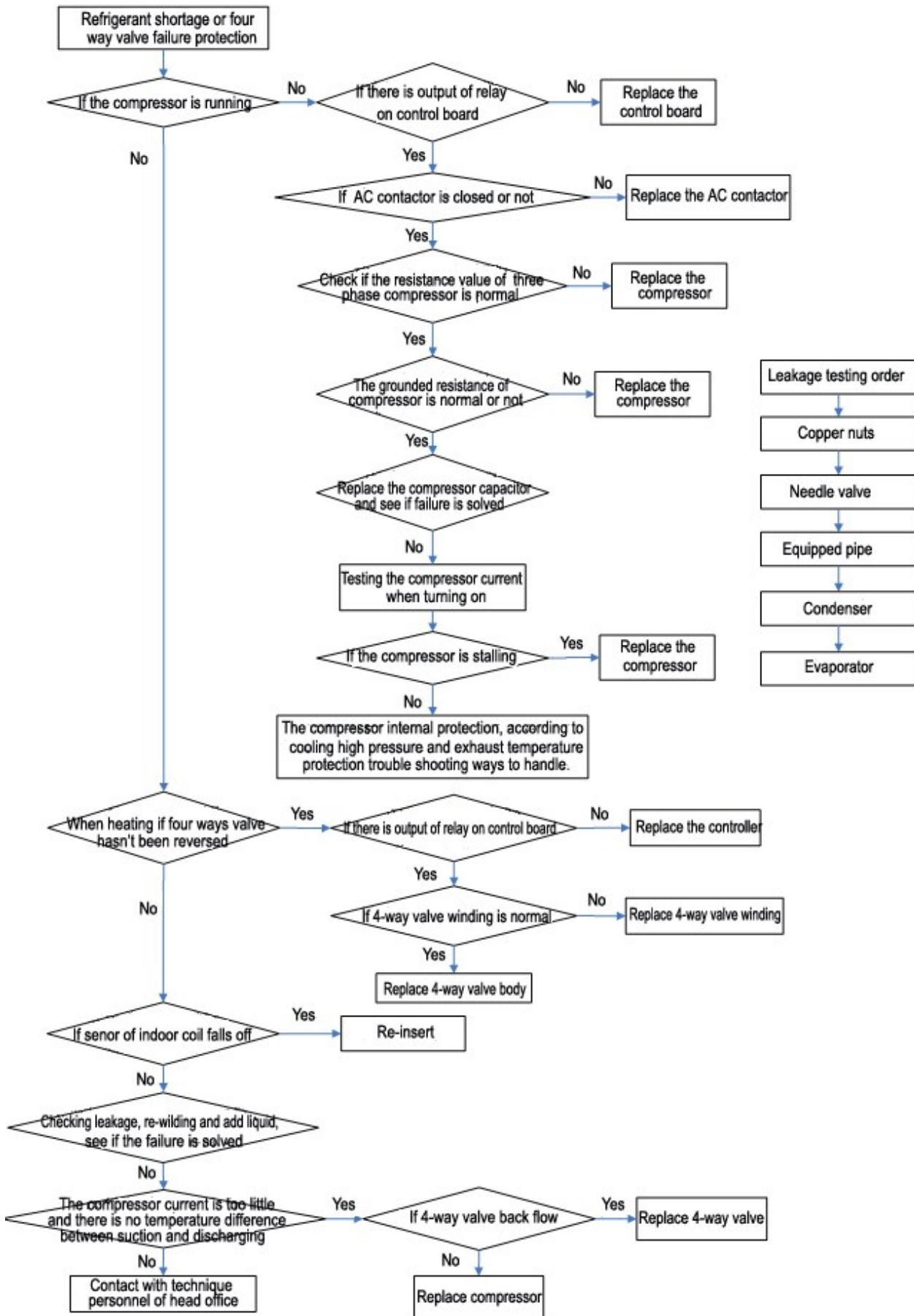
## Cooling exhaust temperature protection



## **Heating exhaust temperature protection**

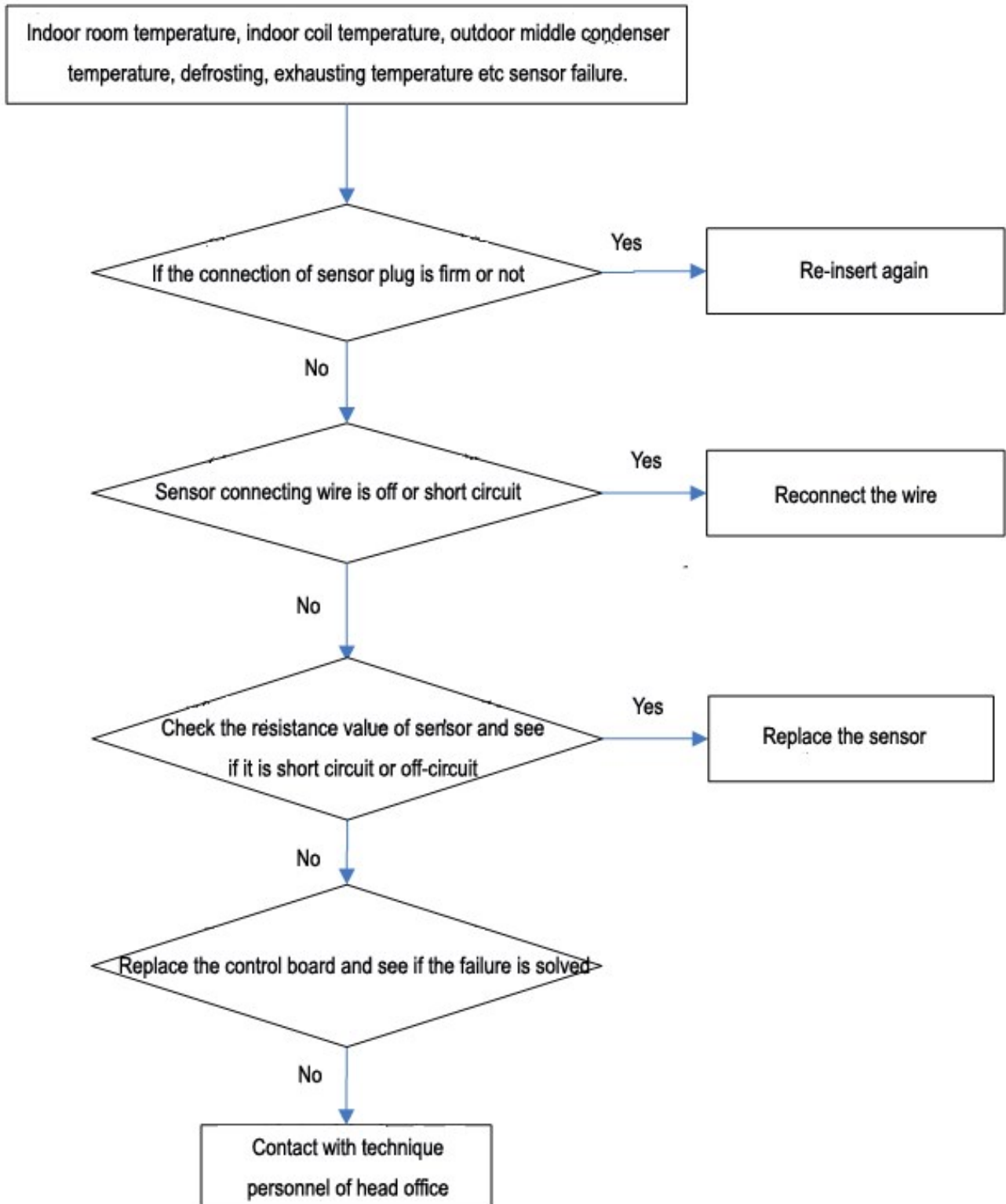


**Refrigerant shortage or four way valve failure protection**



**Sensor failure protection**

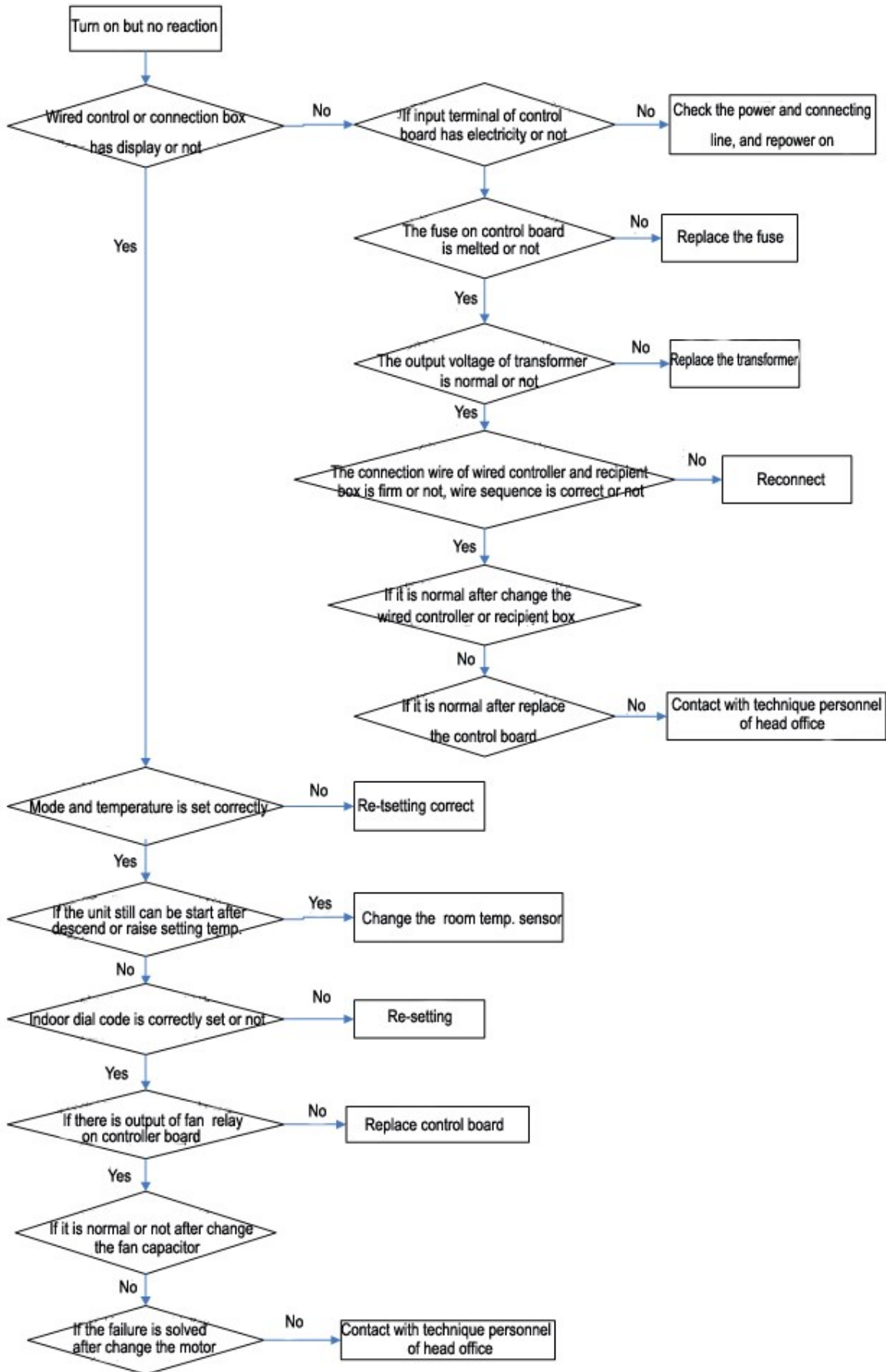




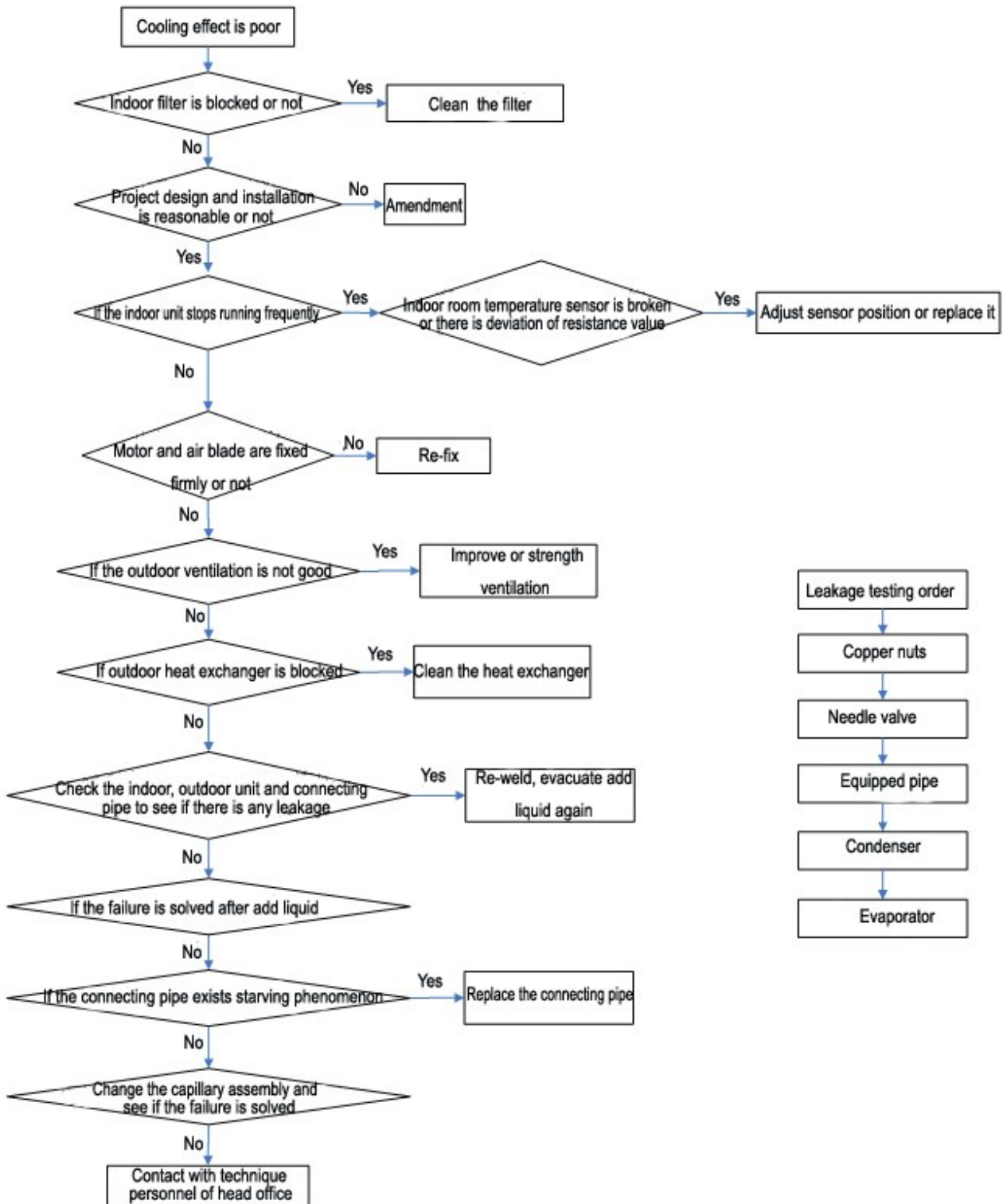
## **5.2 Analysis and elimination for the failure without failure code**

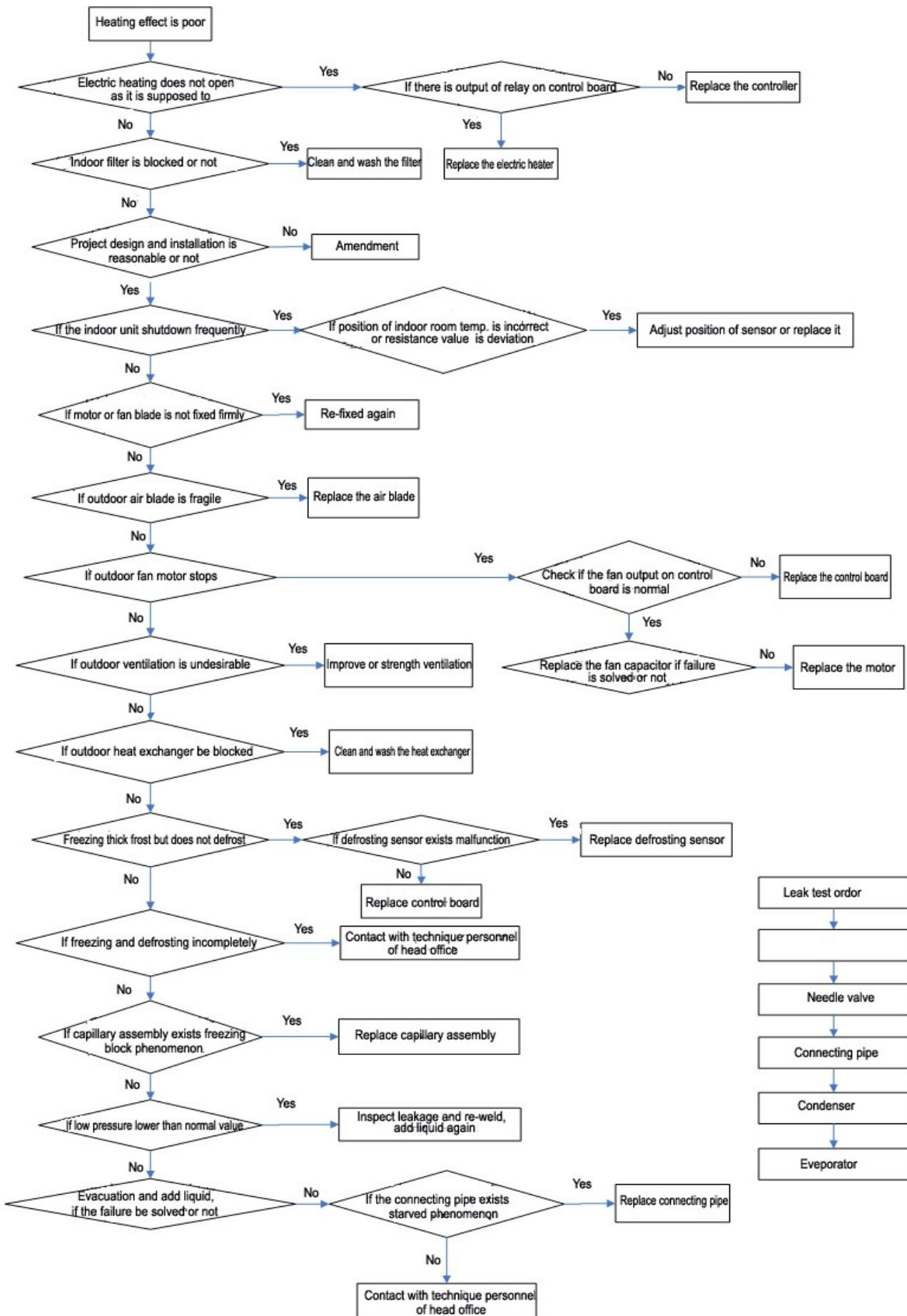
### **5.2.1 No action after power-on**



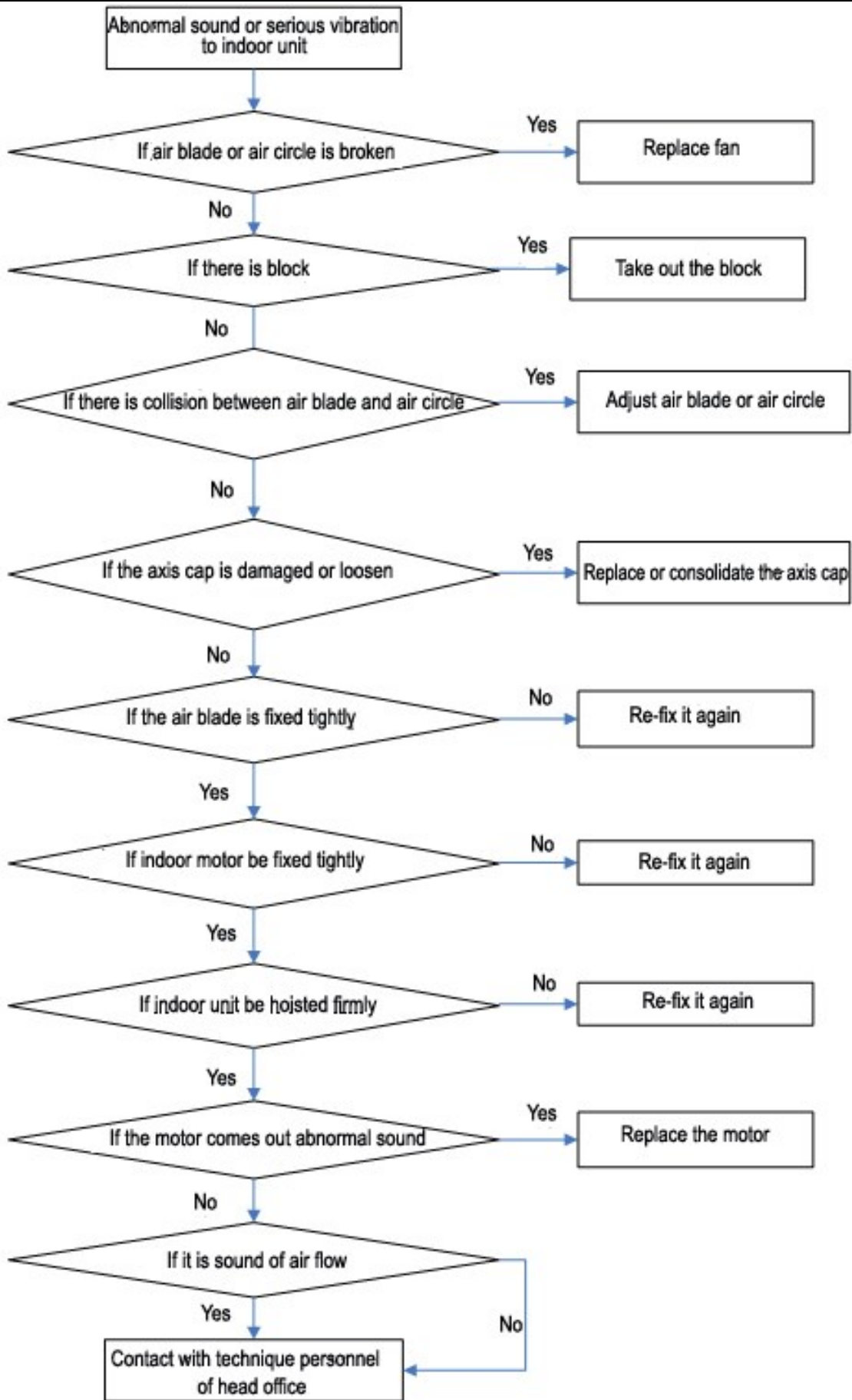


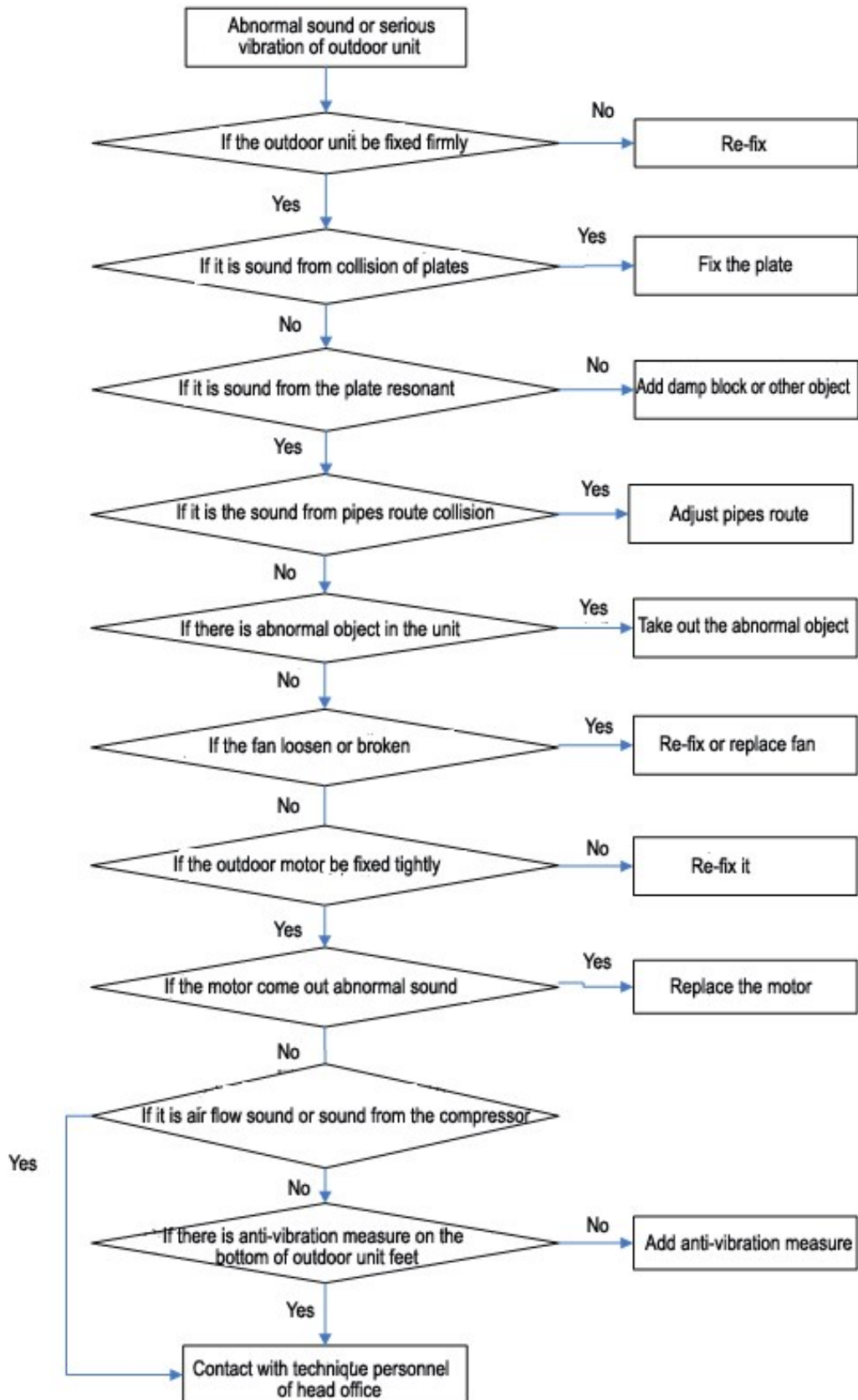
5.2.2 Air conditioner operates, but effect is terrible



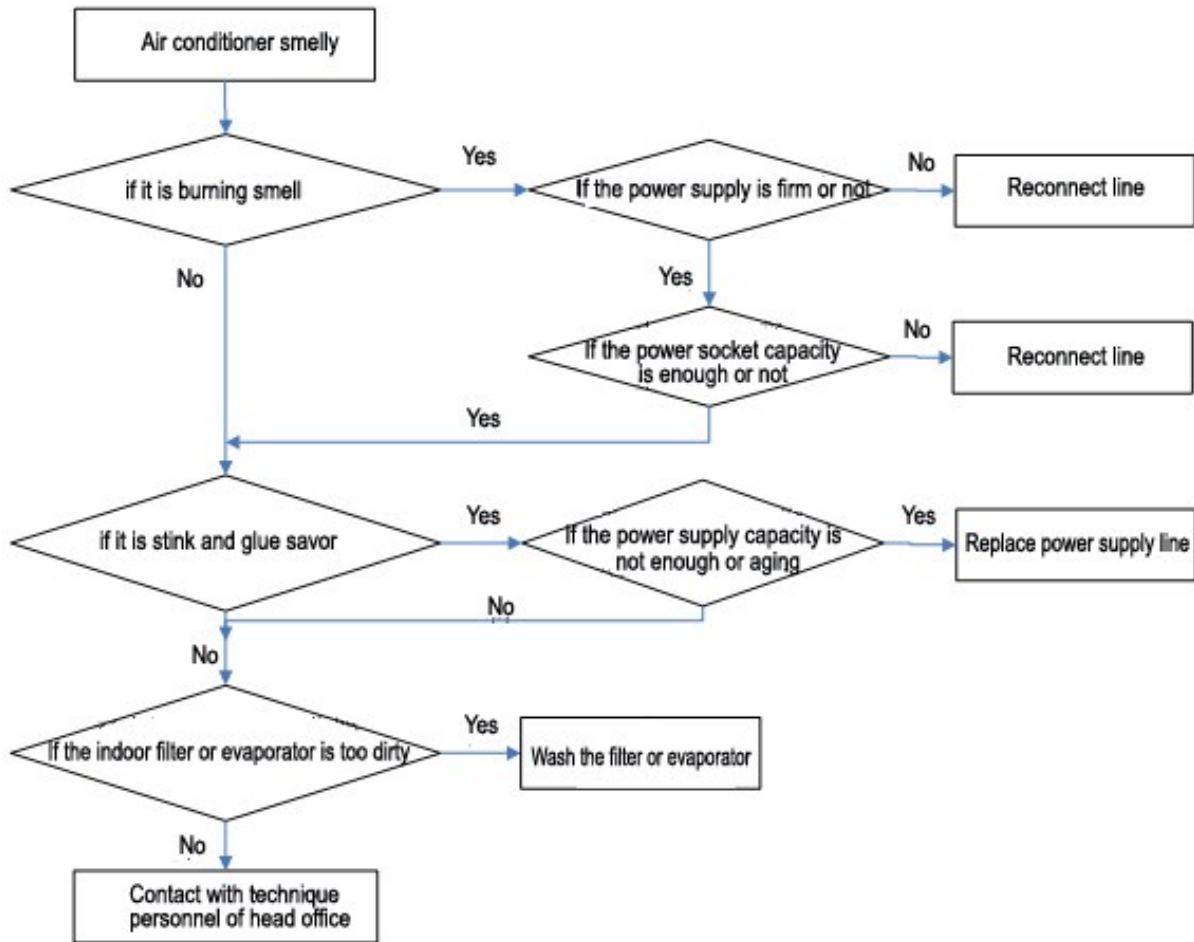


### **5.2.3 Abnormal sound or vibration**



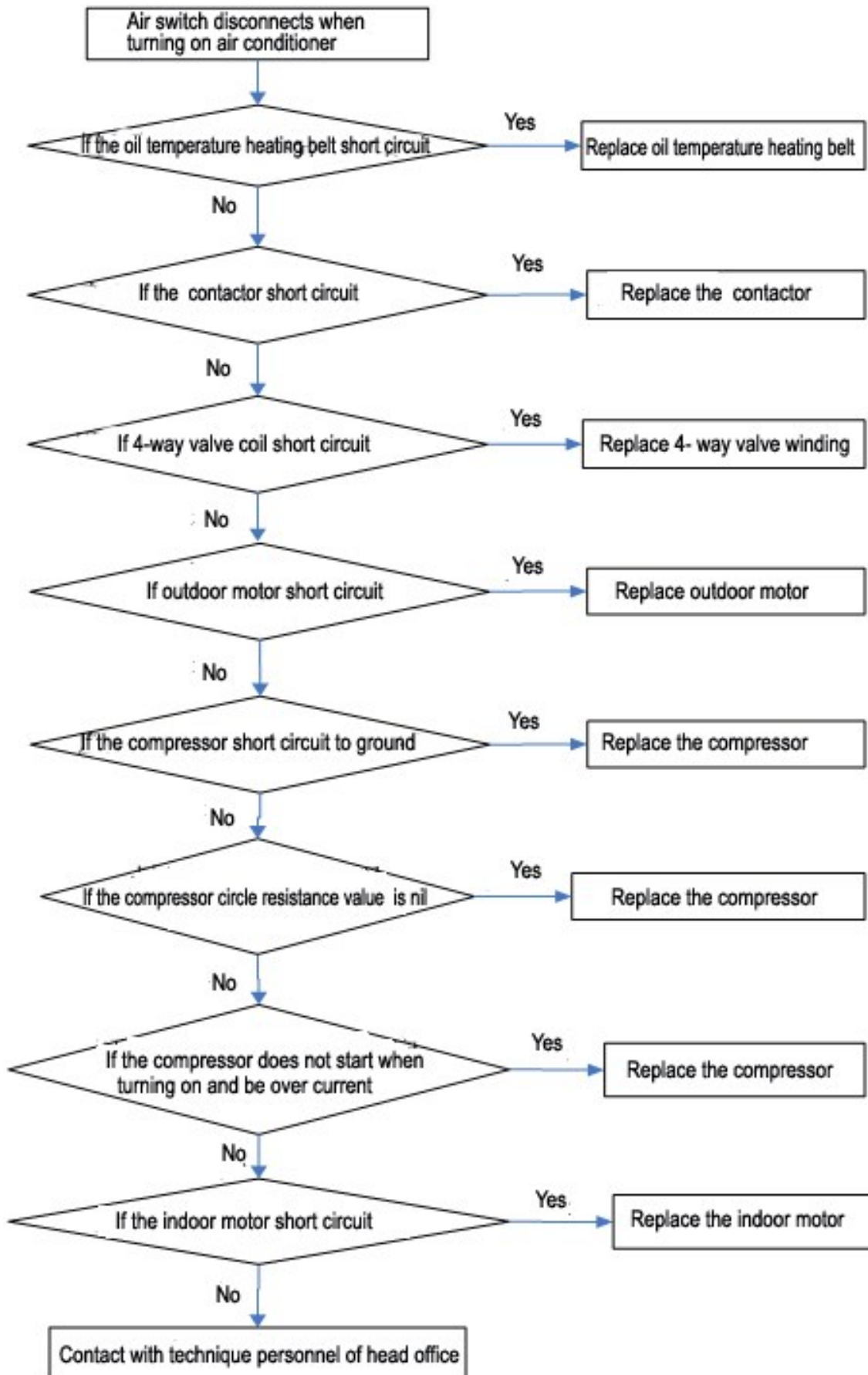


### 5.2.4 Abnormal odor



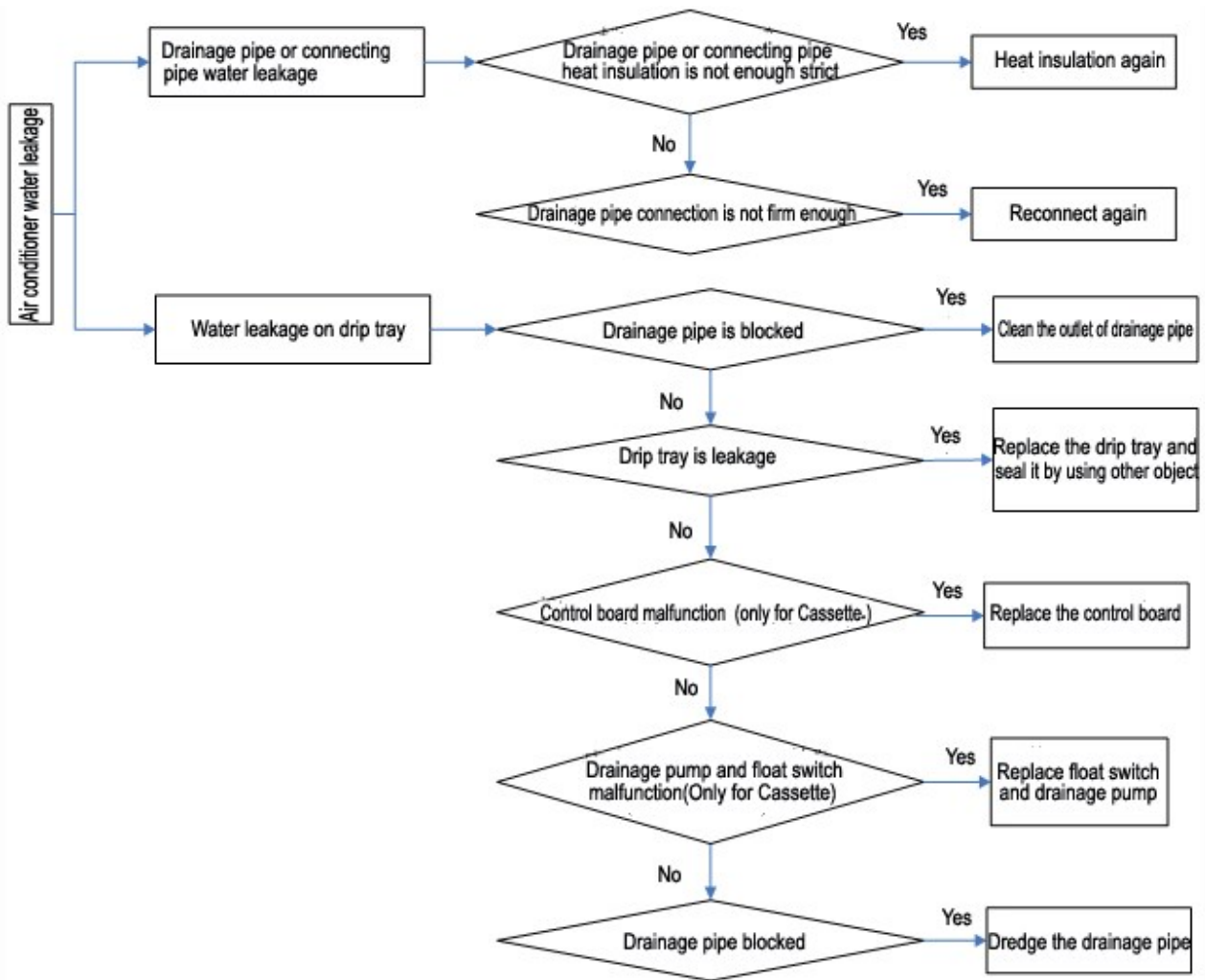


### 5.2.5 Air switch action when air conditioner starting up





### 5.2.6 Air conditioner water leakage



### 5.3 Non-aircon failure

#### 5.3.1 Poor cooling or heating efficiency, but it is not failure

During the process of using air conditioner, some phenomenon seems to be malfunction but actually not. Thus when cooling effect does not achieve to your expectation, the following factors have to be ruled out

Phenomenon	Causing explanation
High outside temperature and too many indoor individuals, even air conditioner runs at full-load operation, the wind blowing out from air outlet is cold, but it is difficult to lower the indoor temperature, this is not malfunction.	When the outdoor temperature is higher, more heat penetrates into indoor space, which increases the cooling load of AC. If there are too many individuals(for example 10 individuals) and every individual gives off 120W, totally 1200W, this will running out of half of AC cooling capacity, and the unit's cooling capacity this time is far from enough, indoor temperature is hard to lower down. It is normal phenomenon and do not mean useless of AC.
Power voltage is too low, causing AC uneasy to start and shut down after starting, or fuse be burned out etc.	It is not malfunction, need to find out the causing, if the causing is the electricity net voltage is too low, user should load a power manostat to keep voltage between 220V-380V for AC normally running
Select high wind speed but indoor temperature still at high side, air flow from the air outlet is too weak.	It is because air filter is too dirty or blocked making cooling capacity fail to be brought by air flow, causing cooling capacity inadequate. Take out filter and wash, the problem will be solved.
Select high wind speed, the vibration and sound of unit are severe.	Fan runs at high speed, severe vibration and sound of unit is normal phenomenon
Temperature controller adjusts improper and max cooling capacity is not utilized completely, thus indoor temperature can't lower down.	Adjust the temperature controller, and problem will be solved.
As for Heat pump air conditioner heating effect is not ideal during cold winter, this is normal phenomenon.	The lowest temperature is $-7^{\circ}\text{C}$ when heating, below this temperature unit cannot heat effectively.
Improper installation will lead to indoor temperature uneven or bad cooling effect.	It is necessary to adjust AC installation position

#### 5.3.2 It means there is failure if following phenomenon is happened

Phenomenon	Causing explanation
Mirage comes out from indoor unit	When the cold air from AC cools the indoor air

Noise	<ul style="list-style-type: none"> <li>●When air conditioner stops running, there will be some noise, and this is because the refrigerant flows contrarily.</li> <li>●AC expand or shrink according to temperature, causing harsh sounds</li> <li>●Liquid sound is from refrigerant flowing</li> </ul>
Sometimes, the room is smelly	<ul style="list-style-type: none"> <li>●The AC itself will not be smelly, if it is smelly, it is because environment smell accumulated</li> <li>● Solution: clean the filter</li> </ul>
when heating, there is no wind at the beginning of starting unit	<ul style="list-style-type: none"> <li>● It is to prevent cold air blowing, please be patient</li> <li>● The unit has auto-restart function, when it is repowered again, unit will run according to the mode which is set before the power off. (Note: default is closed)</li> </ul>

## 6. Electric components malfunction inspection

No	Component name	Inspection methods
1	<b>Compressor</b>	1. Using multi-meter ohm phase, there is correct resistance value among windings (single phase compressor refers to specification, three phase compressor resistance approximately equal), resistance of winding should be infinite.
2	<b>Control board</b>	<ol style="list-style-type: none"> <li>1. Check if any connection part of PCB loosen or drop off, printed tinsel and components have any burn, fade, breaking off or aging phenomenon, all joints exist short circuit phenomenon etc.</li> <li>2. Test the circuit board system in the term of voltage, pulse on, resistance variation, by using testing meter.</li> <li>3. Judge the output and input is normal or not according to electric principle diagram</li> </ol>
3	<b>Contactors</b>	<ol style="list-style-type: none"> <li>1. Press the contactor by hand, the contactor reacts immediately and without question</li> <li>2. The contacting point of contactor has no burn and melt phenomenon</li> <li>3. The winding has resistance value below 1000, but cannot be nil or infinite</li> </ol>
4	<b>4-ways valve winding</b>	The winding has resistance value below 1000, but cannot be nil or infinite
5	<b>Capacitor</b>	<ol style="list-style-type: none"> <li>1. No expansion phenomenon apparently</li> <li>2. Measure capacitor by using capacitor phase of multi-meter( if the multi-meter has no capacitor phase, use ohm phase, contact the two terminal of meter to two feet of capacitor, and quickly switch positive pole and negative pole and reconnect, the resistance should display from nil to infinite quickly. The resistance can't change is always nil or infinite).</li> </ol>

<b>6</b>	<b>Sensor</b>	<ol style="list-style-type: none"> <li>1. Using multi-meter to measure resistance, find out temperature according to resistance table, the temperature should accord with sensor temperature.</li> <li>2. Resistance cannot be nil or infinite</li> </ol>
<b>7</b>	<b>Motor</b>	<ol style="list-style-type: none"> <li>1、 No burning trace apparently</li> <li>2、 Using multi-meter ohm phase, there is correct resistance value among windings (single phase compressor refers to specification, three phase compressor resistance approximately equal), resistance of winding should be infinite.</li> </ol>

## 7. Sensor resistance reference table

### 7.1 Coil and environment temperature sensor 5K3470 resistance reference table

Coil and environment temperature sensor 5K3470					
Tx(°C)	Average (KΩ)	Tx(°C)	Average (KΩ)	Tx(°C)	Average (KΩ)
-20	72.99	21	5.854	61	1.421
-19	35.16	22	5.626	62	1.376
-18	33.43	23	5.408	63	1.334
-17	31.80	24	5.199	64	1.293
-16	30.26	25	5.000	65	1.254
-15	28.80	26	4.811	66	1.215
-14	27.42	27	4.630	67	1.179
-13	26.12	28	4.456	68	1.143
-12	24.88	29	4.291	69	1.109
-11	23.71	30	4.132	70	1.076
-10	22.60	31	3.980	71	1.044
-9	21.55	32	3.835	72	1.013
-8	20.56	33	3.695	73	0.9837
-7	19.61	34	3.562	74	0.9550
-6	18.72	35	3.434	75	0.9273
-5	17.87	72	3.311	76	0.9005
-4	17.06	37	3.193	77	0.8746
-3	16.30	38	3.081	78	0.8496

-2	15.57	39	2.972	79	0.8254
-1	14.88	40	2.869	80	0.8021
0	14.23	41	2.769	81	0.779
1	13.60	42	2.673	82	0.758
2	13.01	43	2.581	83	0.737
3	12.45	44	2.493	84	0.716
4	11.91	45	2.409	85	0.696
5	11.40	46	2.307	86	0.677
6	10.92	47	2.249	87	0.658
7	10.46	48	2.174	88	0.641
8	10.02	49	2.102	89	0.623
9	9.596	50	2.032	90	0.606
10	9.197	72	1.965	91	0.590
11	8.817	52	1.901	92	0.574
12	8.454	53	1.839	93	0.559
13	8.108	54	1.780	94	0.544
14	7.779	55	1.722	95	0.530
15	7.464	56	1.667	96	0.726
16	7.164	57	1.614	97	0.502
17	6.877	58	1.563	98	0.489
18	6.603	59	1.724	99	0.476
19	6.342	60	1.466	100	0.464
20	6.092				

## 7.2 Exhaust temperature sensor 6.339K3954

Exhaust temperature sensor R80: 6.339K $\Omega$ $\pm$ 1% B25/80=3954K $\pm$ 1%							
T [°C]	Rmin [K $\Omega$ ]	T [°C]	Rmin [K $\Omega$ ]	T [°C]	Rmin [K $\Omega$ ]	T [°C]	Rmin [K $\Omega$ ]
-20	440.7	20	60.42	60	12.32	100	3.377
-19	417.0	21	57.79	61	11.89	101	3.279
-18	394.7	22	55.29	62	11.48	102	3.184
-17	373.7	23	52.91	63	11.08	103	3.093
-16	353.9	24	50.65	64	10.70	104	3.003
-15	335.2	25	48.49	65	10.34	105	2.918
-14	317.7	26	46.44	66	9.992	106	2.836
-13	301.2	27	44.49	67	9.652	107	2.755
-12	285.6	28	42.64	68	9.328	108	2.678
-11	271.0	29	40.88	69	9.017	109	2.603
-10	257.1	30	39.19	70	8.717	110	2.530
-9	244.0	31	37.59	71	8.428	111	2.460
-8	231.7	32	36.06	72	8.152	112	2.392
-7	220.0	33	34.59	73	7.885	113	2.326
-6	209.0	34	33.21	74	7.628	114	2.262
-5	198.6	35	31.88	75	7.381	115	2.201
-4	188.7	36	30.60	76	7.143	116	2.141

-3	179.4	37	29.39	77	6.914	117	2.083
-2	170.7	38	28.23	78	6.693	118	2.026
-1	162.4	39	27.13	79	6.480	119	1.972
0	154.5	40	26.07	80	6.276	120	1.920
1	147.1	41	25.06	81	6.075	121	1.868
2	140.0	42	24.09	82	5.881	122	1.819
3	133.3	43	23.17	83	5.694	123	1.772
4	127.1	44	22.29	84	5.514	124	1.725
5	121.1	45	21.44	85	5.340	125	1.680
6	115.4	46	20.64	86	5.175	126	1.636
7	109.9	47	19.86	87	5.014	127	1.594
8	104.9	48	19.13	88	4.859	128	1.552
9	100.0	49	18.42	89	4.711	129	1.513
10	95.43	50	17.74	90	4.567	130	1.475
11	91.07	51	17.09	91	4.429	131	1.437
12	86.93	52	16.46	92	4.294	132	1.401
13	83.00	53	15.87	93	4.166	133	1.365
14	79.26	54	15.30	94	4.040	134	1.331
15	75.71	55	14.74	95	3.920	135	1.297
16	72.33	56	14.22	96	3.803	136	1.266
17	69.13	57	13.71	97	3.691	137	1.234
18	66.08	58	13.23	98	3.583	138	1.204
19	63.18	59	12.77	99	3.478	139	1.174

## 8. Compressor freezing oil brand and standard oil charge

Outdoor model	Brand	Compressor specification	Compressor Lubricating Oil brand	Oil charge (cm <sup>3</sup> )
SAU48U1-A	SANYO	C-SBP170H38A	FV68S	1700
SAU60U1-A	DAKIN	JT170G-P8Y1	DAPHNE FVC68D	1500

## 9. System principle diagram

**Cooling circle:** the Compressor inhales the low-temperature and low-pressure refrigerant vapor from the evaporator, and vapor be turned into high-temperature and high-pressure gas then enters into condenser, the high-temperature and high-pressure refrigerant gas and outdoor air make heat exchange in the condenser, the compressed vapor is then cooled by heat exchange with the outside air, so that the vapor condenses to be a high-temperature and high-pressure fluid, and then through capillary throttling to cooled, low pressure, then the liquid enters into the evaporator and two-phase of gas and liquid refrigerant in the evaporator completely evaporate, thereby cooling the indoor air; from evaporator the vapor is inhaled into compressor again, so it runs continuously cycle to cycle, cooled air is continuous supplied to the air-conditioned area though Duct by fan motor.

**Heating cycle:** It is the contrary cycle of cooling cycle, at this moment the 4-way valve changes

direction, and make refrigerant flow to direction changer, that is, the vapor discharged from the compressor enters into the indoor heat exchanger to condense, the condensation of refrigerant after the capillary expenditure, evaporates in the outdoor heat exchanger, and then inhaled by the compressor after evaporation, so it runs continuously periodically , the heated air is continuous supplied to the air-conditioned area though Duct by fan motor.

**48000,60000 BTU/H (Power supply 380-415V)**

**Heat pump units: SAD48HD1-A, SAD60HD1-A**

