R454b 60Hz Universal Outdoor 14.3 SEER2 Series Technical Manual

Content

Part 1. General Information 2
1. Model Names of Indoor/Outdoor Units 3
2. External Appearance 4
3. Features 5
Part 2. Indoor Unit 9
1.Dimension 9
2.Service Space 9
3.Four-way installation 10
4.Air Filter (Not Factory Installed) 12
5.Electric heater 13
6.Airflow performance 14
7.Wiring Diagrams 15
8.Electric Characteristics 15
9.The Specification of Wiring 16
10.Field Wiring 18
11.Exploded View 20
Part 3 Outdoor Unit 21
1.Dimensions 23
2.Service Space 24
3.Wiring Diagrams. 25
4.Electric Characteristics 26
5.Operation Limits 26
6.Sound Levels 26
7.Exploded View 27
8.Troubleshooting 29
Part 4 Function introduction 44
1.Electrical Components Description 44
2.Anti-Cold Air & Heating Fan Delay Function 43
3.Indoor Coil Anti-Freezing Function 45
4.Outdoor gas return temperature Anti-Freezing Function 45
5.R454B Leakage Detection Function 46
6.Defrost Description 46
Part 5 Installation 48
1.Precaution on Installation 48
2. Oil return bend installation 50
3.Vacuum Dry and Leakage Checking 51
4.Additional Refrigerant Charge 53
5.Insulation Work 53
6.Test Operation 57

Part 1. General Information

1. Model Names of Indoor/Outdoor Units. **Error! Bookmark not defined.**
2. External Appearance ..... **Error! Bookmark not defined.**
3. Features ..... **Error! Bookmark not defined.**

1. Model Names of Indoor/Outdoor Units

1.1 Indoor Units

Model name	Dimension(W×H×D)(inch)	Power supply
CWM6-18-15（371）	20-1/2×36-1/2×15	208/230V-1Ph-60Hz
CWM6-24-15（372）	20-1/2×36-1/2×15	208/230V-1Ph-60Hz
CWM6-30-15（373）	22×39-1/2×19	208/230V-1Ph-60Hz
CWM6-36-15（374）	22×39-1/2×19	208/230V-1Ph-60Hz

1.2 Outdoor Units

Model name	Dimension(W×H×D) (inch)	Power supply
BAH6-18-15（36M）	21-4/5×25×21-4/5	208/230V-1Ph-60Hz
BAH6-24-15（36N）	21-4/5×25×21-4/5	208/230V-1Ph-60Hz
BAH6-30-15（36P）	29-1/7×25×29-1/7	208/230V-1Ph-60Hz
BAH6-36-15（36Q）	29-1/7×25×29-1/7	208/230V-1Ph-60Hz
BAR6-18-15（318）	21-4/5×25×21-4/5	208/230V-1Ph-60Hz
BAR6-24-15（319）	21-4/5×25×21-4/5	208/230V-1Ph-60Hz
BAR6-30-15（31A）	29-1/7×25×29-1/7	208/230V-1Ph-60Hz
BAR6-36-15（31B）	29-1/7×25×29-1/7	208/230V-1Ph-60Hz

2. External Appearance

		14.3 SEER2 TDU	
capacity	1.5/2 Ton	2.5/3 Ton	
pic			
14.3 SEER2 AHU			
capacity	1.5/2 Ton	2.5/3 Ton	
pic			

3. Features

3.1 Wide operation range.

3.2 Well-known brand LG scroll compressor, reliable quality.

3.3 Condenser coils constructed with copper tubing and enhanced golden fins.

3.4 Use PISTON as expansion device

3.5 DC fan motors, provide selections of air flow to meet desired applications.

3.6 ECM fan motor for air handlers, higher efficiency, lower noise, constant speed.

3.7 24V control, time delay relay, fan relay and transformer included.

3.8 R454b environment friendly refrigerant.

3.9 The indoor unit has a refrigerant leakage sensor, providing safer protection.

3.10 AHRI certification, ETL certification.

3.11 Multiple defrosting modes are available.

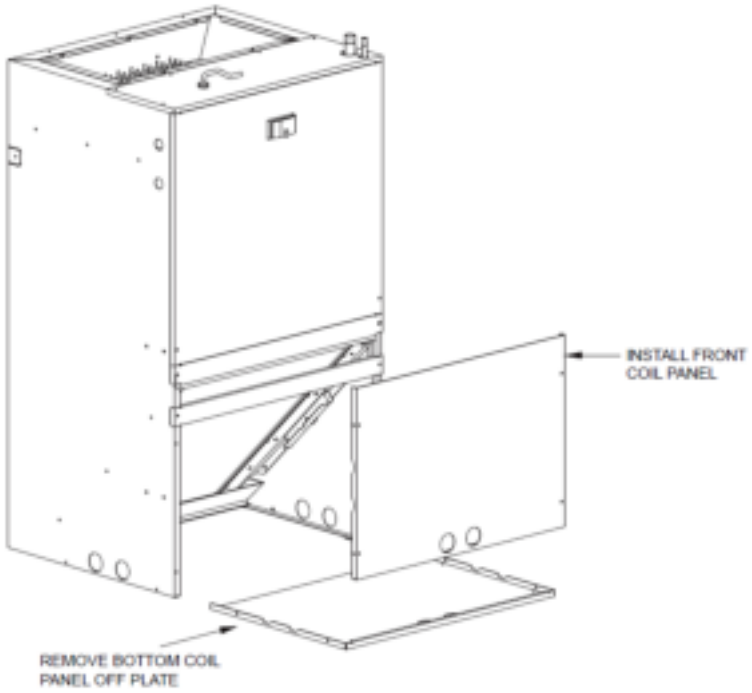
3.12 Refrigerant leakage sensor is configured to detect the refrigerant content in the air

3.13 Intelligent oil return program to provide operating life

3.14 coils constructed with Oxygen-free copper tubing and enhanced aluminum fins

3.15 Detachable air filter for cleaning or renewal

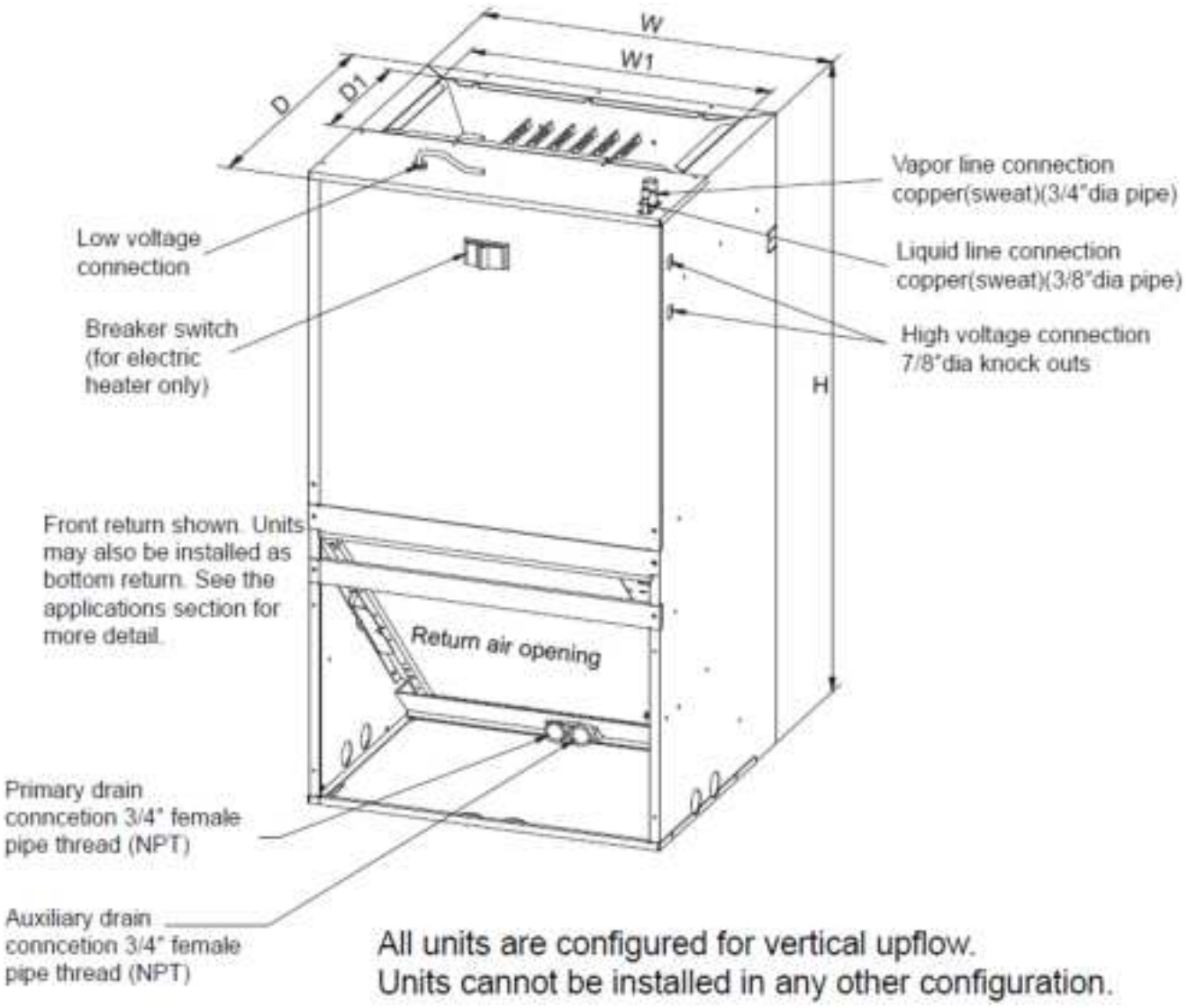
3.16 DIFFERENT AIR SUPPLY BOTTOM RETURN


INSTALL FRONT
COIL PANEL
REMOVE BOTTOM COIL
PANEL OFF PLATE

Part 2. Indoor Unit

1.Dimension....9
2.Service Space....10
3.Four-way installation....11
4.Air Filter (Not Factory Installed)....13
5.Electric heater....13
6.Airflow performance....15
7.Wiring Diagrams....16
8.Electric Characteristics....16
9.The Specification of Wiring....17
10.Field Wiring....18
11.Exploded View....21

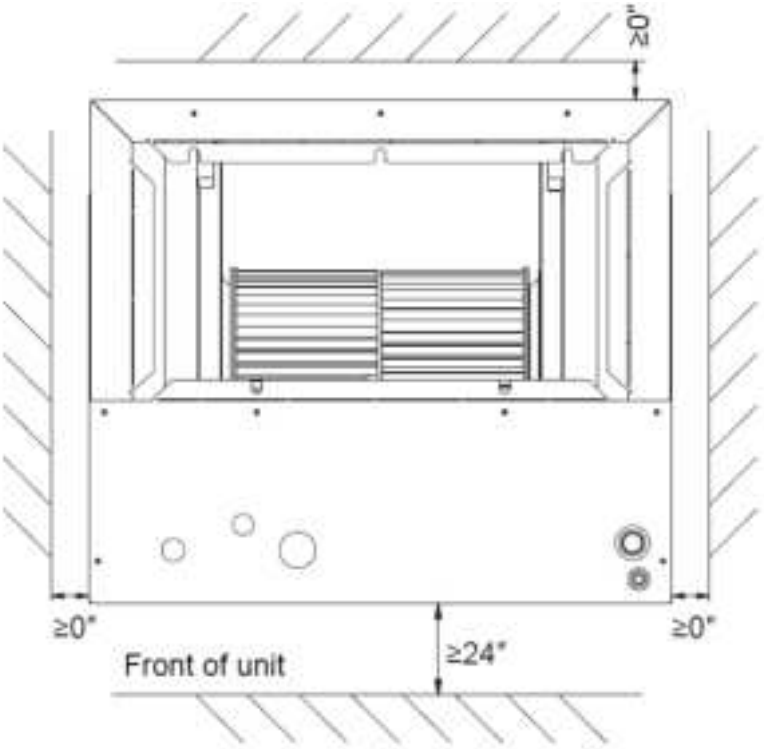
1.Dimension



Model Size	Unit Height "H" in. [mm]	Unit Width "W" in. [mm]	Unit Length "D" in. [mm]	Supply Duct "W1"	Unit Weight (lbs.[kg])
18	36-1/2 [927]	20-1/2 [526]	15 [381]	17-1/2 [446]	81.4 [37]
24	36-1/2 [927]	20-1/2 [526]	15 [381]	17-1/2 [446]	81.4 [37]
30	39-1/2 [1004]	22[559]	19 [483]	18-4/5 [478]	105 [48]
36	39-1/2 [1004]	22 [559]	19 [483]	18-4/5 [478	105 [48]

2.Service Space

The distance between the air outlet or return air and the wall must be at least 40 inches, and the front of the indoor unit must be at least 25 inches away from the wall.



3. installation

Wall Mount

The air handler comes standard with an upper and lower wall mount bracket. Reference Figure 3.1 for more detail.

1.Remove lower wall mounting bracket from the back of the unit by removing one screw which attach-es the bracket to the air handler. Note: Discard the screw after you have removed the wall mounting bracket.

2.Install bracket on the wall by using 3 wood screws (not provided). Make sure the bracket is level to provide proper drainage from the unit. Note: Do not attach the wall mounting bracket into un-supported dry wall. Make sure that the wood screws are going into a structure that can support a minimum load of 150 lb.

3.Lift the air handler above the wall mounting bracket and attach the unit to the installed bracket. Reference Figure 4.1.

4.Install the additional bottom plate for extra support for this type mounting (see Figure 4.1).

Note: The additional plate is shipped in the bottom of the shipping carton (only for 30/36k unit).

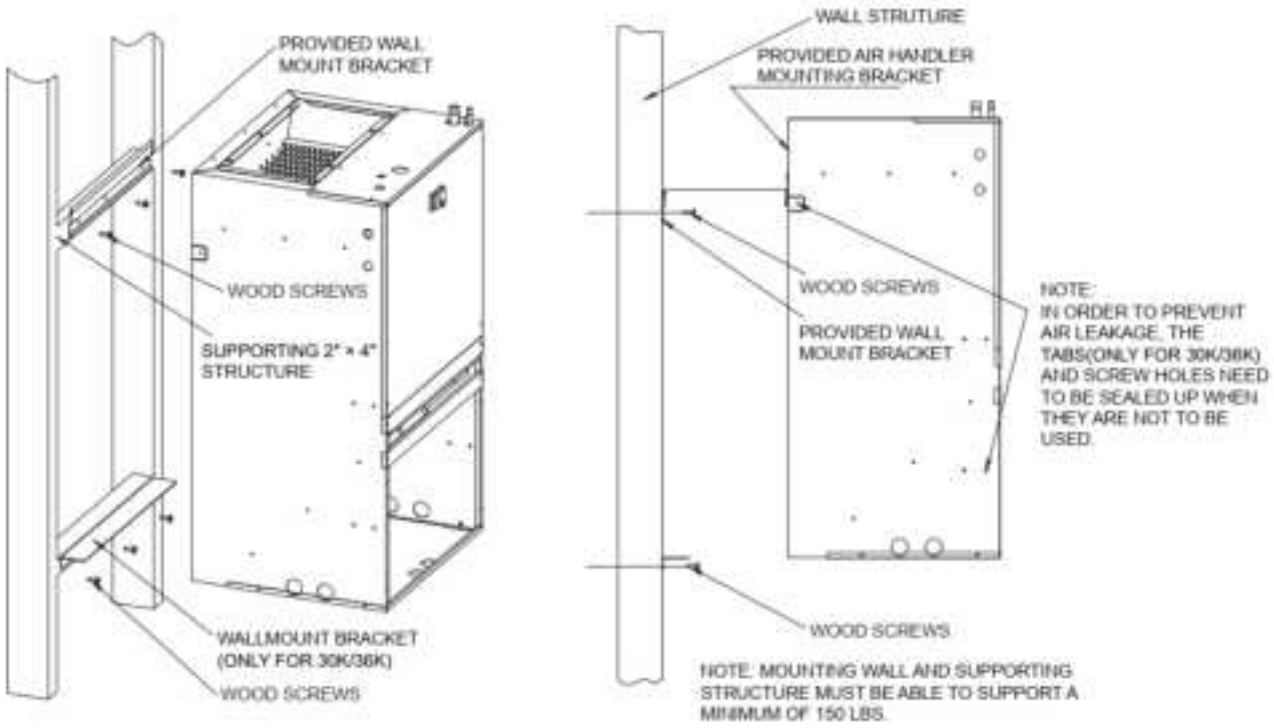
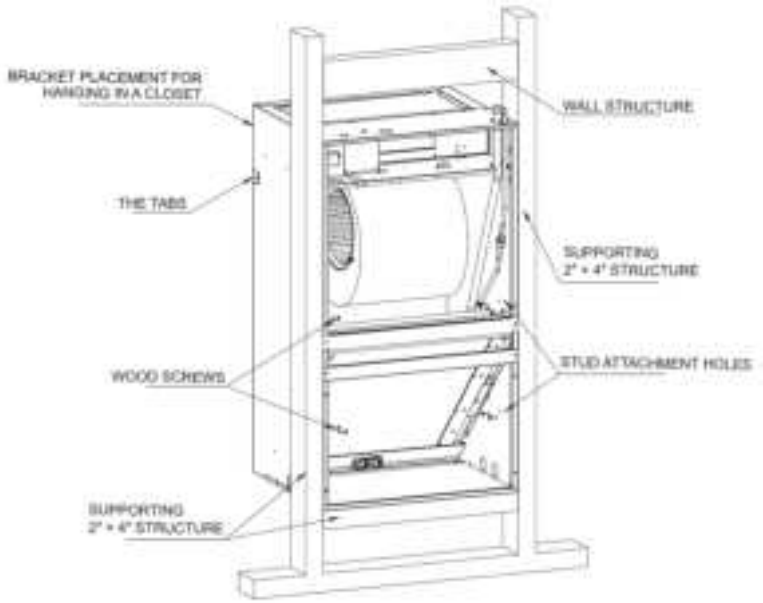


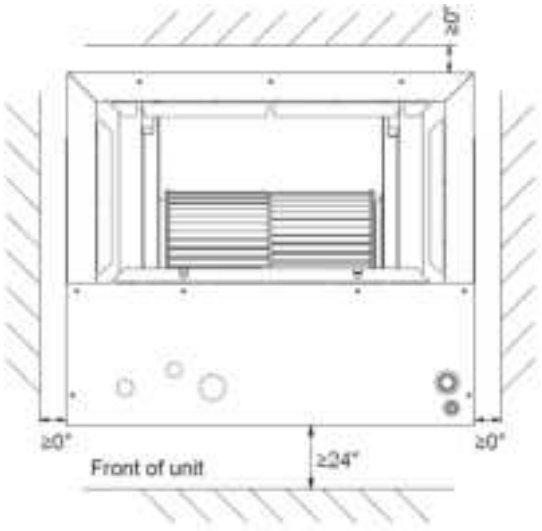
FIGURE 4.1

Frame Mount

The air handler comes with 8 clearance holes (4on each side). These holes are used to mount the air handler inside of a frame structure (see Figure 3.2). When mounting in this fashion, make sure that the wood screws are mounted from within the air handler and not outside of the unit. Install the screws from outside the unit and avoid damaging the coil. If the frame does not provide support in the front of the unit and additional support is needed, open the tabs and fix the unit to the frame or other support structure with screws (only for 30K/36K). Select a solid and level site to ensure proper installation of the frame mount. Verify that there is sufficient space for installation and maintenance. (See Figure 3.3) IMPORT-ANT: The (8) wood screws are not provided with the unit.

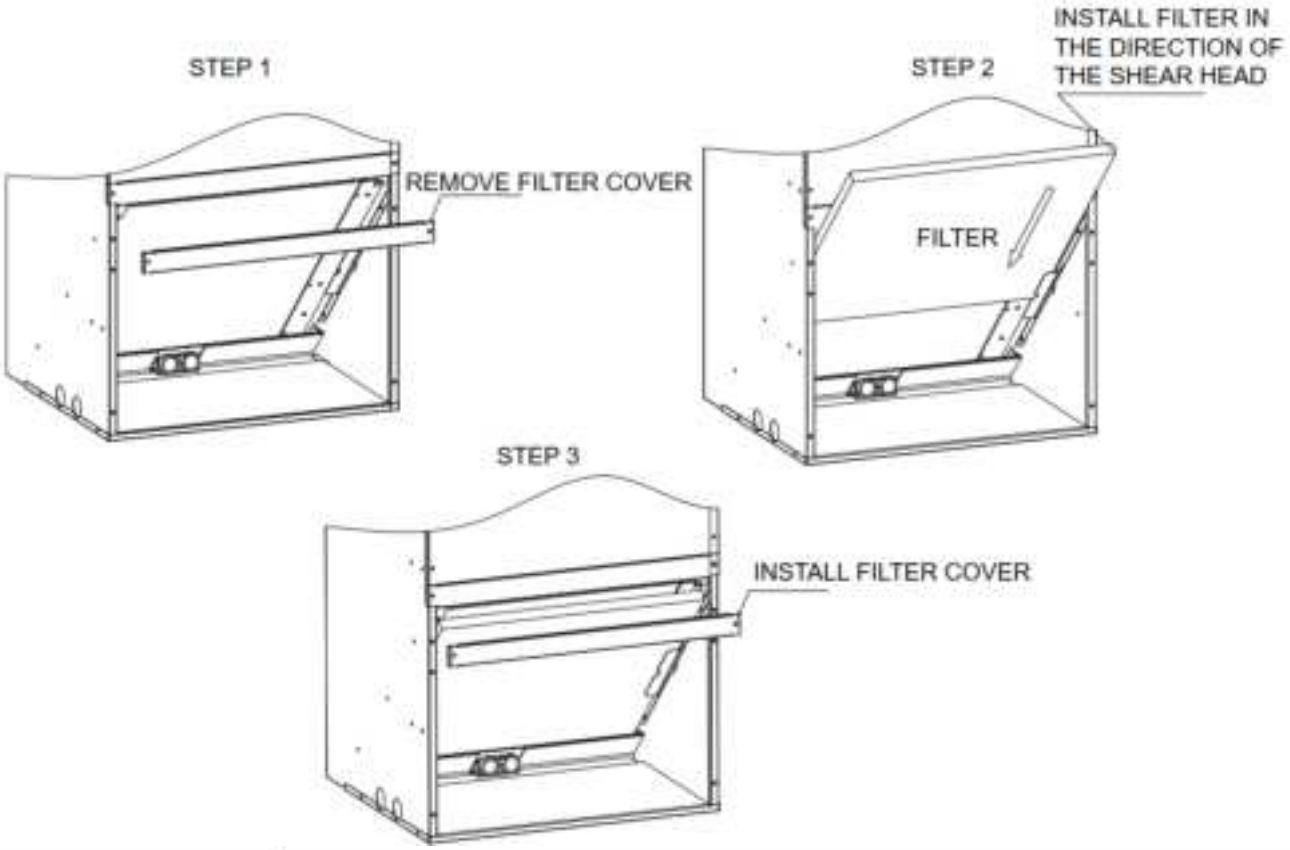
#12 x 1 ½˝ wood screws are recommended. When the unit is installed on a wood frame, the screws should be used to fix the unit to the studs. If they are not used, the unit may fall or cause other damage. (See Figure 3.2) for frame mount installation.





4.Air Filter (Not Factory Installed)

The filter is not included in the device and must be provided on site.
The size of external filters or other filtering devices must me et the maximum flow rate of 300ft/min or meet the recommended value of filter type.
The application and placement of filter is very important for airflow, which may affect the performance of heating and cooling system. Reduced airflow will shorten the life of the main components of the system, such as motors, components, thermal relays, evaporator coils or compressors. Therefore, we recommend that the return air duct system has only one filter position. For systems without return air filter grids, multiple filter grids can be installed at each return air opening.
If a high-efficiency filter screen or electronic air filtration system is used, it is very important that the air flow rate is not reduced. If the air flow decreases, the overall performance and efficiency of the device will decrease. It is strongly recommended to contact professional installation technicians to ensure the correct installation of such filtration systems.



Model	Filter size inches [mm]
18K/24K	16×20[406×508]
30K/36K	20×20[508×508]

- Manually remove the bolts and remove the filter cover, as shown in Figure 9.1.
- Hold the edge of the strainer and pull it out.
- Install a new filter so that the arrow on the filter screen is consistent with the airflow direction.
- If a reusable filter is used, please clean it according to the manufacturer's specifications before reinstalling it.
- The filter needs to meet UL 900

5.Electric heater

Heat kit model	AHU model	electric heat(kW) 208/230VAC	Current (A) 208/230VAC	MCA (A) 208/230VAC	MAX Fuse or Breaker (HACR) Ampacity		Fan speed				
					208 VAC	230 VAC	1	2	3	4	5
CHE6W-05B	18K	3.8/5	19.66/22.68	25/29	30	35	●	●	●	●	●
CHE6W-08B		5.6/7.5	29.50/34.04	37/43	40	45	×	×	●	●	●
CHE6W-05B	24K	3.8/5	19.66/22.68	25/29	30	35	●	●	●	●	●
CHE6W-08B		5.6/7.5	29.50/34.04	37/43	40	45	×	×	●	●	●
CHE6W-10B		7.5/10	39.32/45.37	50/57	55	60	×	×	×	●	●
CHE6W-05B	30K	3.8/5	19.66/22.68	25/29	30	35	●	●	●	●	●
CHE6W-08B		5.6/7.5	29.50/34.04	37/43	40	45	×	●	●	●	●
CHE6W-10B		7.5/10	39.32/45.37	50/57	55	60	×	×	●	●	●
CHE6W-05B	36K	3.8/5	19.66/22.68	25/29	30	35	●	●	●	●	●
CHE6W-08B		5.6/7.5	29.50/34.04	37/43	40	45	×	●	●	●	●
CHE6W-10B		7.5/10	39.32/45.37	50/57	55	60	×	×	●	●	●

● Heat kit applicable for AHU 4-way position installation.

● Ampacities for MCA and Fuse/breaker including the blower motor.

● The heat pump system needs specific airflow. Each ton of cooling requires 350 to 450 cubic feet (CFM) of air per minute, or nominally 400 CFM.

Heat kit model	Description	18	24	30	36
CHE6W-05B	5 kW heating kit, single-pole circuit breaker	●	●	●	●
CHE6W-08B	7.5 kW heating kit, single-pole circuit breaker	●	●	●	●
CHE6W-10B	10 kW heating kit, single/double pole circuit breaker	×	●	●	●

● indicates availability, and × indicates unavailability

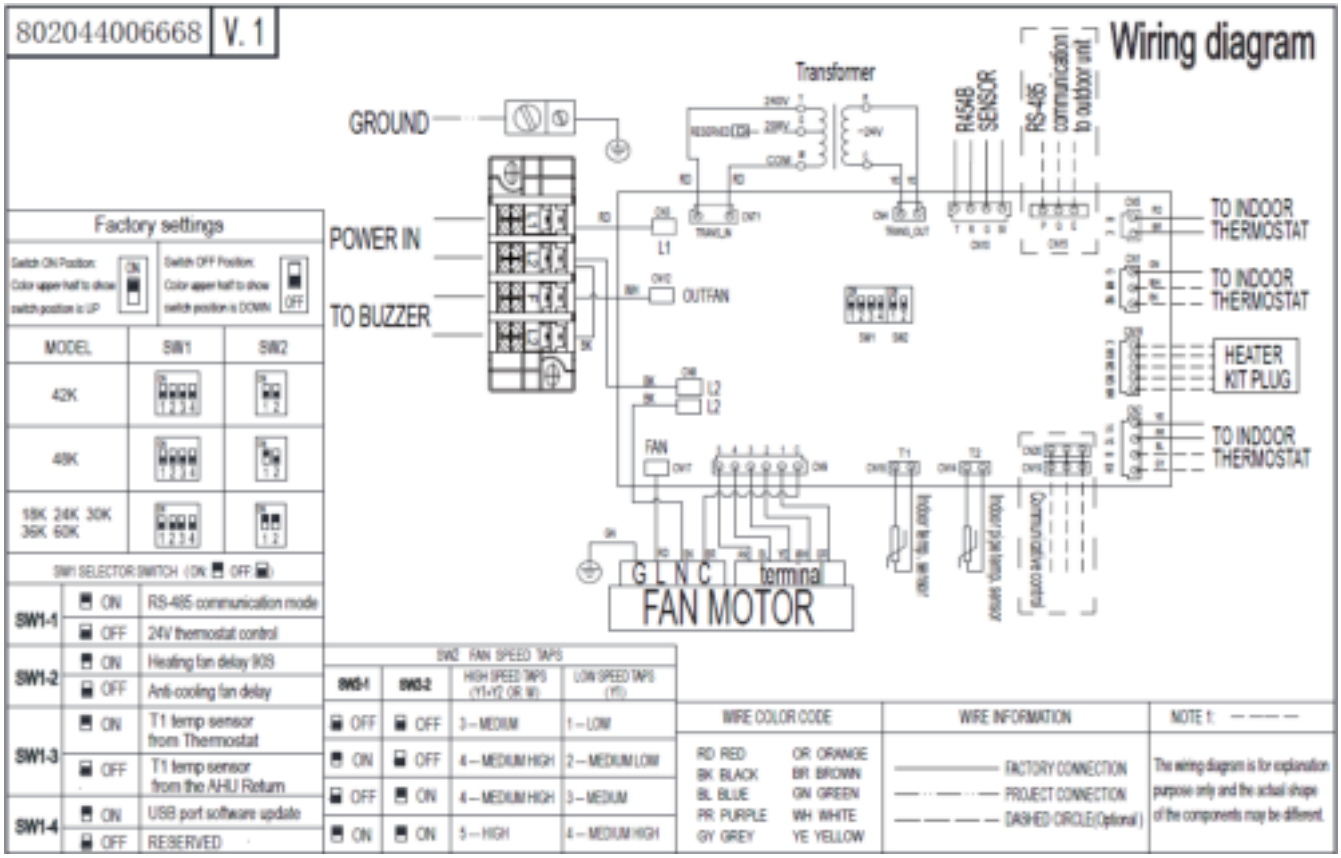
6.Airflow performance

The air flow data is based on the cooling performance of coil and without filter. Performance table, select the appropriate product.
External static pressure ESP should be kept within the minimum and maximum limits shown in the following table to ensure the normal operation of cooling, heating, and electric heating.

Model size of air processor	Motor speed		SCFM						
			External Static Pressure-Inch Water Column [kPa]						
			0[0]	0.1[.02]	0.2[.05]	0.3[.07]	0.4[.10]	0.5[.12]	0.6[.15]
18K	Tap (5)	SCFM	917	898	853	821	789	761	730
		Watts	179	182	189	195	200	205	210
	Tap (4)	SCFM	872	837	804	770	737	709	679
		Watts	156	161	165	171	176	181	186
	Tap (3)	SCFM	814	776	739	705	671	639	606
		Watts	126	133	138	143	147	151	156
	Tap (2)	SCFM	708	664	622	580	542	496	432
		Watts	93	97	102	105	110	114	121
	Tap (1)	SCFM	633	585	538	494	438	382	340
		Watts	69	73	77	81	85	91	98
24K	Tap (5)	SCFM	917	898	853	821	789	761	730
		Watts	179	182	189	195	200	205	210
	Tap (4)	SCFM	872	837	804	770	737	709	679
		Watts	156	161	165	171	176	181	186
	Tap (3)	SCFM	814	776	739	705	671	639	606
		Watts	126	133	138	143	147	151	156
	Tap (2)	SCFM	708	664	622	580	542	496	432
		Watts	93	97	102	105	110	114	121
	Tap (1)	SCFM	633	585	538	494	438	382	340
		Watts	69	73	77	81	85	91	98
30K	Tap (5)	SCFM	1318	1282	1241	1205	1165	1113	1071
		Watts	268	276	282	289	296	304	311
	Tap (4)	SCFM	1230	1192	1151	1110	1055	1013	971
		Watts	223	230	236	243	250	257	263
	Tap (3)	SCFM	1129	1071	1025	976	933	886	840
		Watts	172	178	184	191	197	203	209
	Tap (2)	SCFM	1039	976	926	876	826	779	718
		Watts	136	142	147	153	159	165	172
	Tap (1)	SCFM	894	836	781	725	668	595	524
		Watts	98	103	108	112	118	124	129
36K	Tap (5)	SCFM	1318	1282	1241	1205	1165	1113	1071
		Watts	268	276	282	289	296	304	311
	Tap (4)	SCFM	1230	1192	1151	1110	1055	1013	971
		Watts	223	230	236	243	250	257	263
	Tap (3)	SCFM	1129	1071	1025	976	933	886	840
		Watts	172	178	184	191	197	203	209
	Tap (2)	SCFM	1039	976	926	876	826	779	718
		Watts	136	142	147	153	159	165	172
	Tap (1)	SCFM	894	836	781	725	668	595	524
		Watts	98	103	108	112	118	124	129

The highlighted area indicates the airflow within the required range of 300-450cfm/ton.

7.Wiring Diagrams



8.Electric Characteristics

Model	Indoor Units					
	Hz	Voltage	Min.	Max.	MCA	MOP
18K	60	208-230V	187V	253V	4.0	6.0
24K	60	208-230V	187V	253V	4.0	6.0
30K	60	208-230V	187V	253V	5.0	6.0
36K	60	208-230V	187V	253V	5.0	6.0

9.The Specification of Wiring

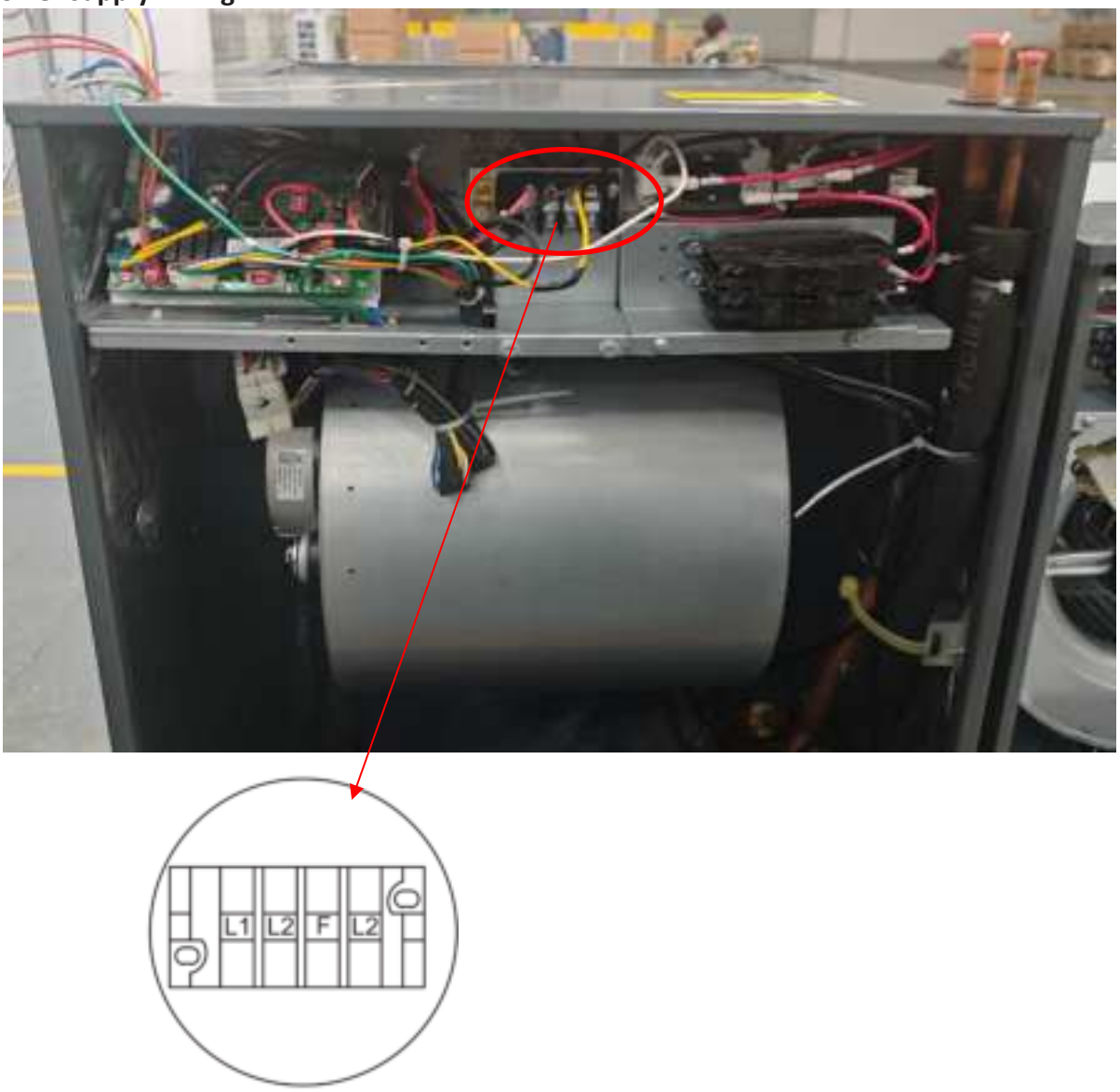
Note:
The cross-section areas of wires or lines should not be less than the corresponding ones listed in the table below; Besides, if the power wires is quite long from the unit, please choose the windings with larger cross-section guarantee the normal power supply.

Model	Indoor power wire /Diameter (AWG)	24V Signal wire Diameter (AWG)	Outdoor power wire /Diameter (AWG)
18K	3*16	18	3*14
24K	3*16	18	3*14
30K	3*16	18	3*12
36K	3*16	18	3*12

10.Field Wiring

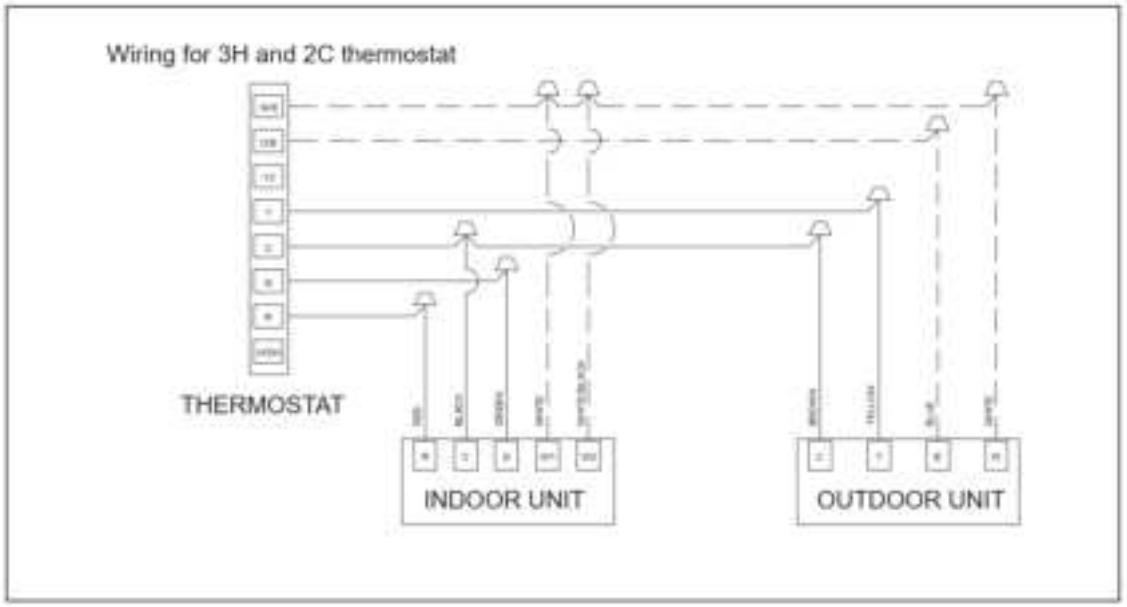
1. To avoid the electrical shock, please connect the air conditioner with the ground lug.
2. The main power plug in the air conditioner has been joined with the ground wiring, please don't change it freely.
3. The power socket is used as the air conditioner specially.
4. Don't pull the power wiring hard.
5. When connecting the air conditioner with the ground, observe the local codes.
6. If necessary, use the power fuse or the circuit, breaker or the corresponding scale ampere.

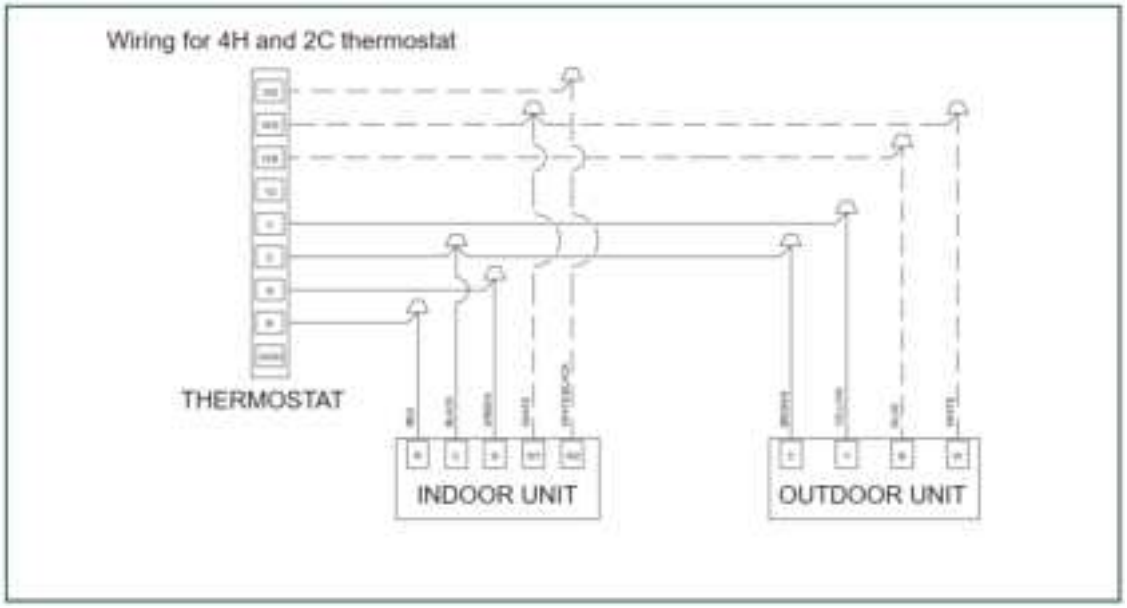
power supply wiring

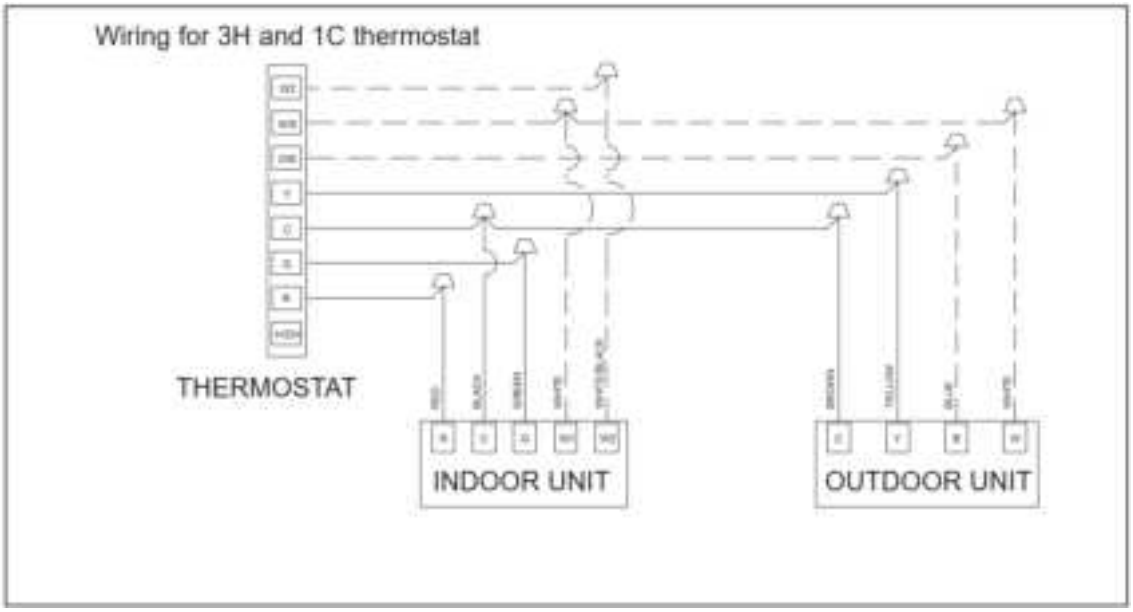


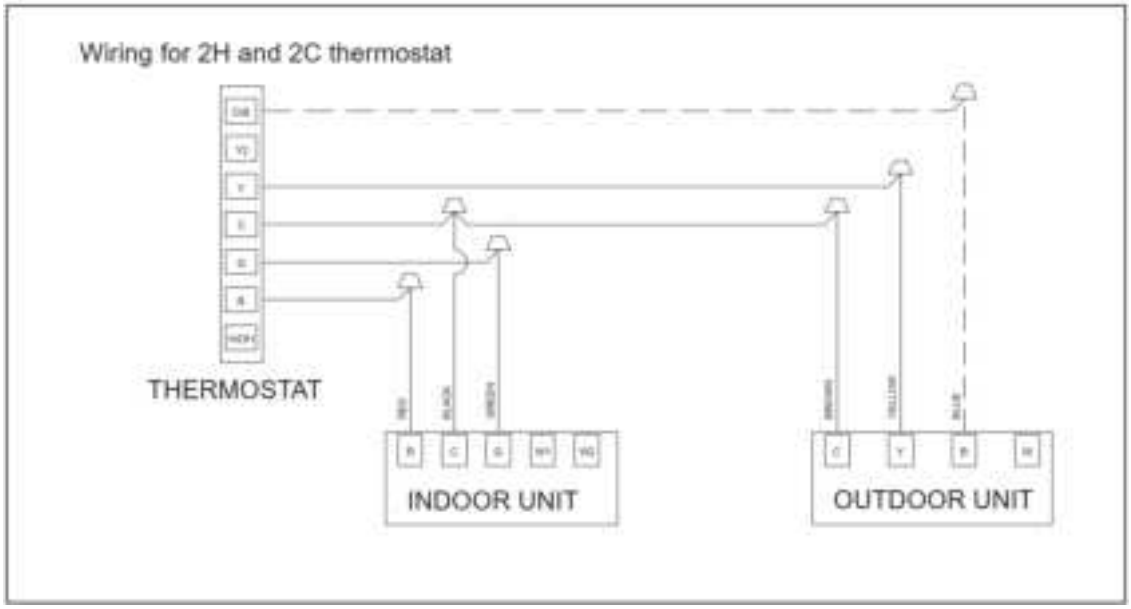
During installation, a buzzer or alarm light needs to be installed and connected to the terminal of AHU F/L2. When the AHU detects refrigerant leakage, F/L2 will output 220V voltage. Therefore, the buzzer will receive the signal and respond in time. When the refrigerant concentration reaches the threshold, the indoor airflow will run at the highest gear and the outdoor unit will stop.

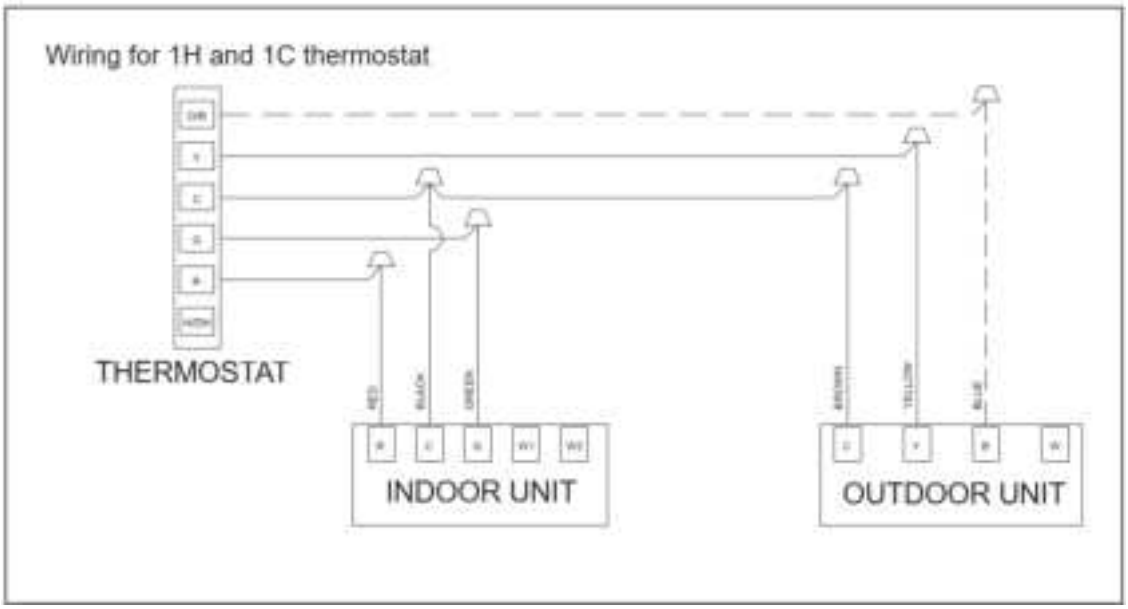
Thermostat wiring

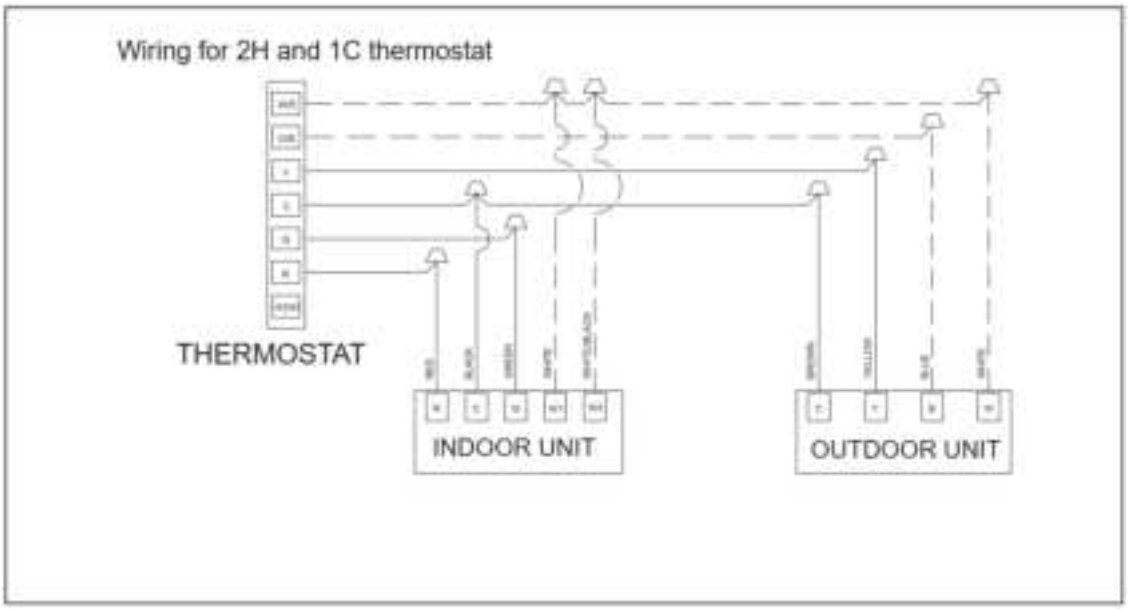




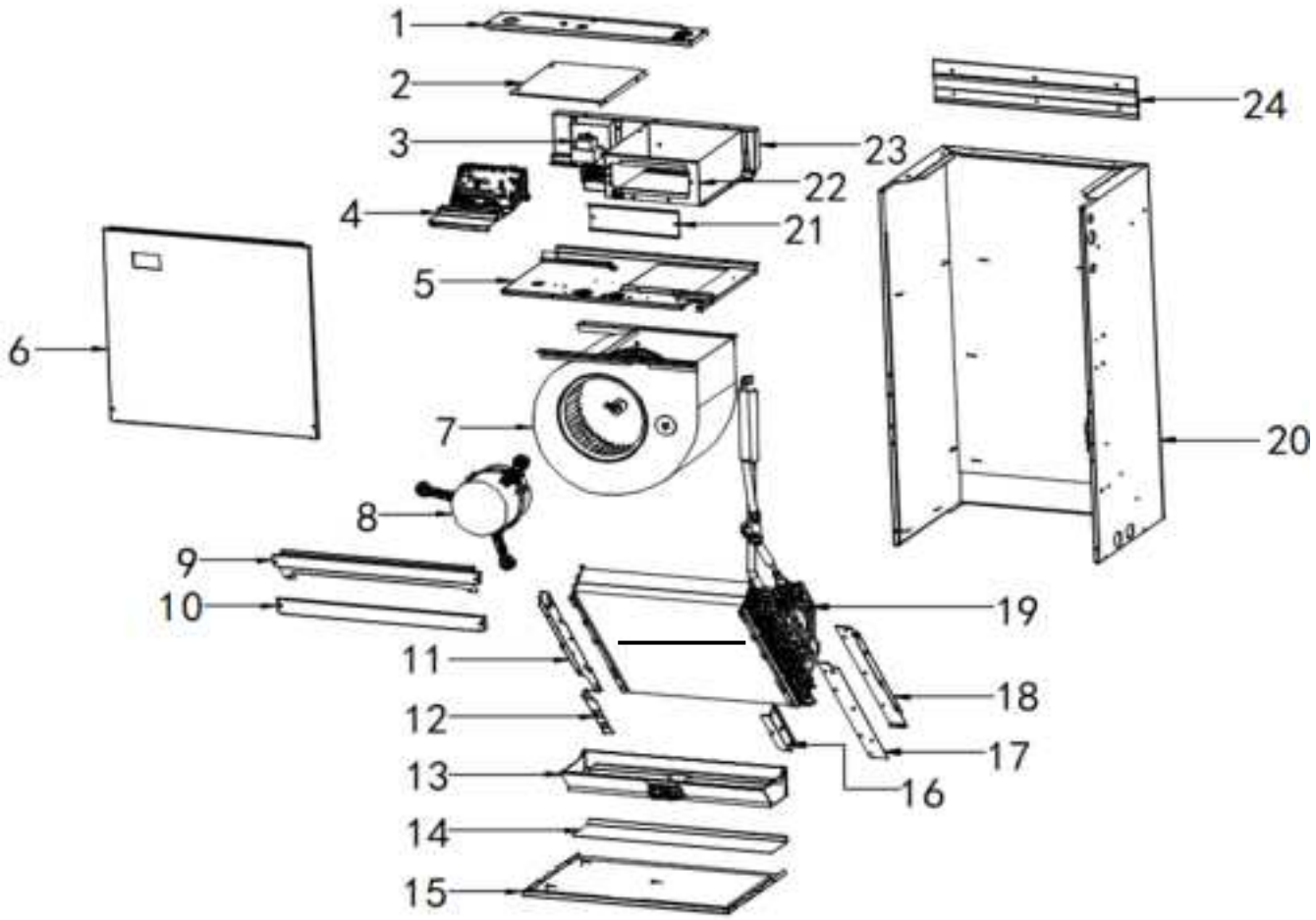



Wiring for 2H and 2C thermostat
THERMOSTAT
INDOOR UNIT
OUTDOOR UNIT


Wiring for 1H and 1C thermostat
THERMOSTAT
INDOOR UNIT
OUTDOOR UNIT


Wiring for 2H and 1C thermostat
THERMOSTAT
INDOOR UNIT
OUTDOOR UNIT

11.Exploded View

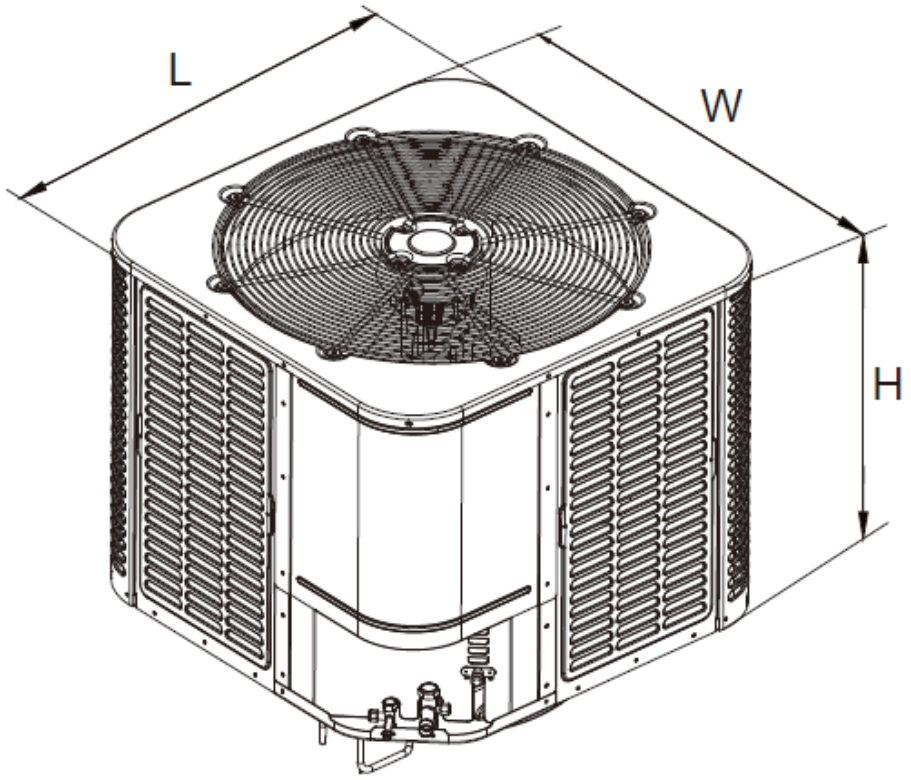


No.	Part Name	Quantity	No.	Part Name	Quantity
1	Control box cover assembly	1	**14**	Water tray support plate	1
2	Control box cover	1	**15**	Bottom plate sponge assembly	1
3	Transformers	1	**16**	Filter cover	1
4	Indoor electric control box assembly	1	**17**	Evaporator connecting plate	1
4.1	Indoor main control panel components	1	**18**	Evaporator front fixing plate	1
4.2	Electric control mounting plate	1	**19**	Evaporator parts	1
5	Wind wheel fixing plate assembly	1	**19.1**	Evaporator input pipe assembly	1
6	Front panel sponge assembly	1	**19.2**	Evaporator output pipe assembly	1
7	Wind wheel assembly (left type)	1	**20**	Rear panel sponge assembly	1
8	Brushless DC motor	1	**20.1**	leakage sensor	1
9	Evaporator support plate assembly	1	**21**	Fixed block	1
10	Evaporator connecting plate assembly	1	**22**	Air duct front side plate	1
11	Evaporator rear fixing plate	1	**23**	Wind wheel fixing block	1
12	Filter cover	1	**24**	Indoor unit mounting plate	2
13	Water tray assembly	1			

Part 3 Outdoor Unit

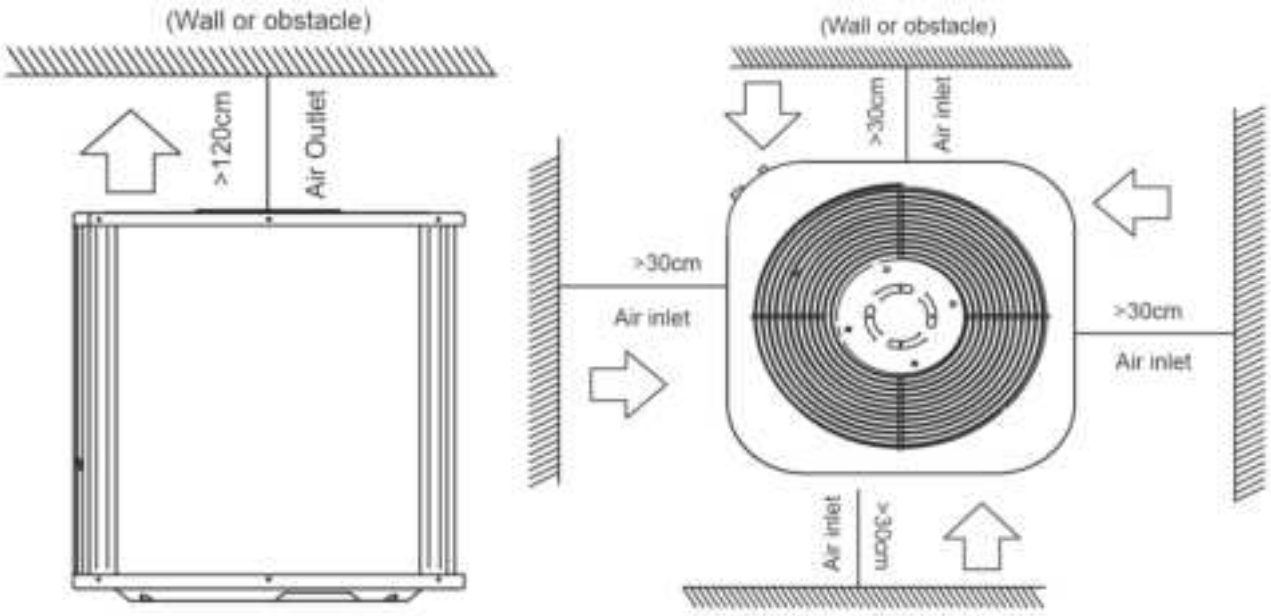
1.Dimensions ..... **Error! Bookmark not defined.**
2.Service Space ..... **Error! Bookmark not defined.**
3.Wiring Diagrams ..... **Error! Bookmark not defined.**5
4.Electric Characteristics ..... **Error! Bookmark not defined.**6
5.Operation Limits ..... **Error! Bookmark not defined.**6
6.Sound Levels ..... **Error! Bookmark not defined.**6
7.Exploded View ..... **Error! Bookmark not defined.**7
8.Troubleshooting ..... **Error! Bookmark not defined.**

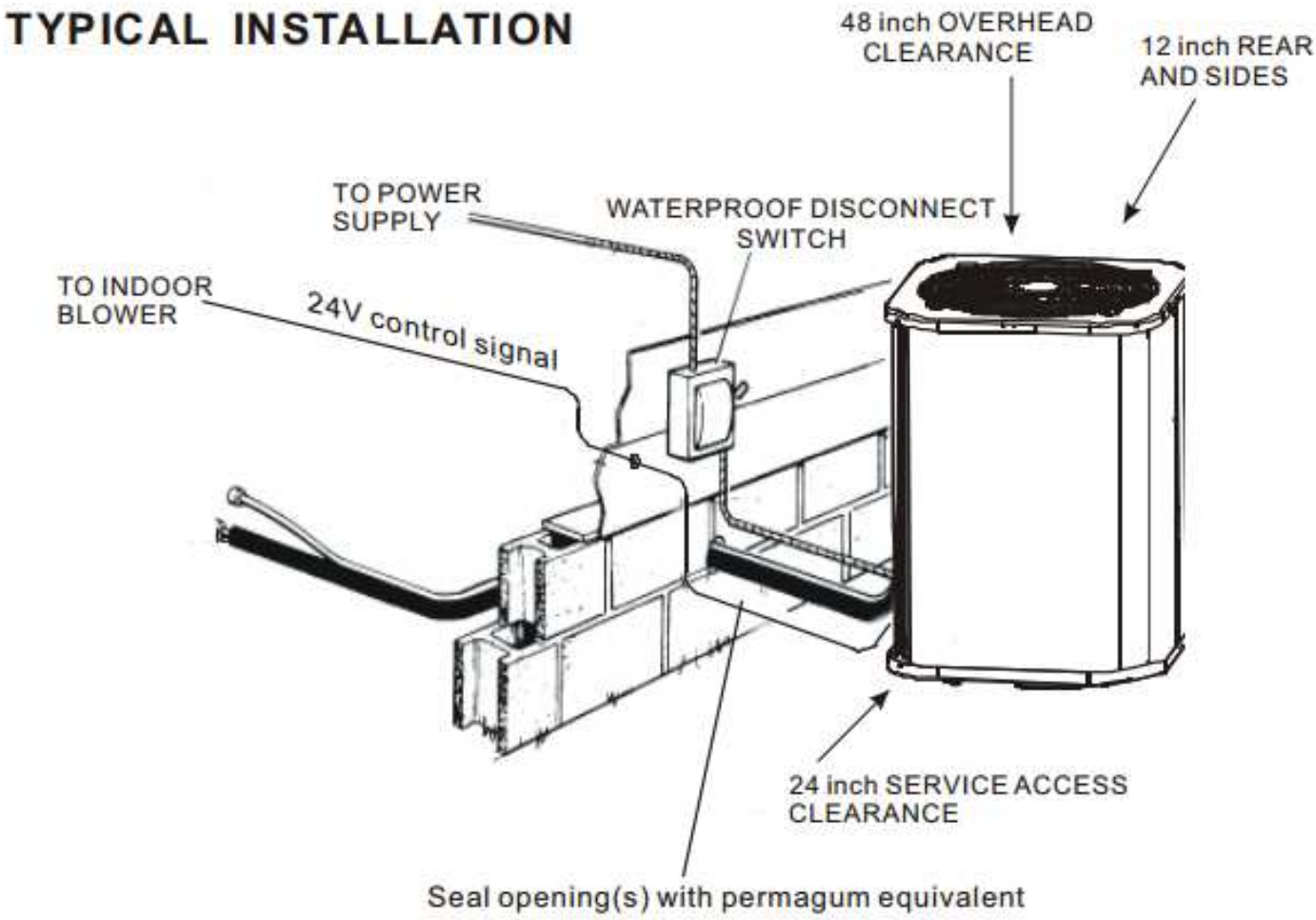
1.Dimensions



model	H×W×L (inches)
18K/24K	25 × 21-4/5 × 21-4/5
30K/36K	25 × 29-1/7 × 29-1/7
42K/48K/60K	32-7/8 × 29-1/7 × 29-1/7

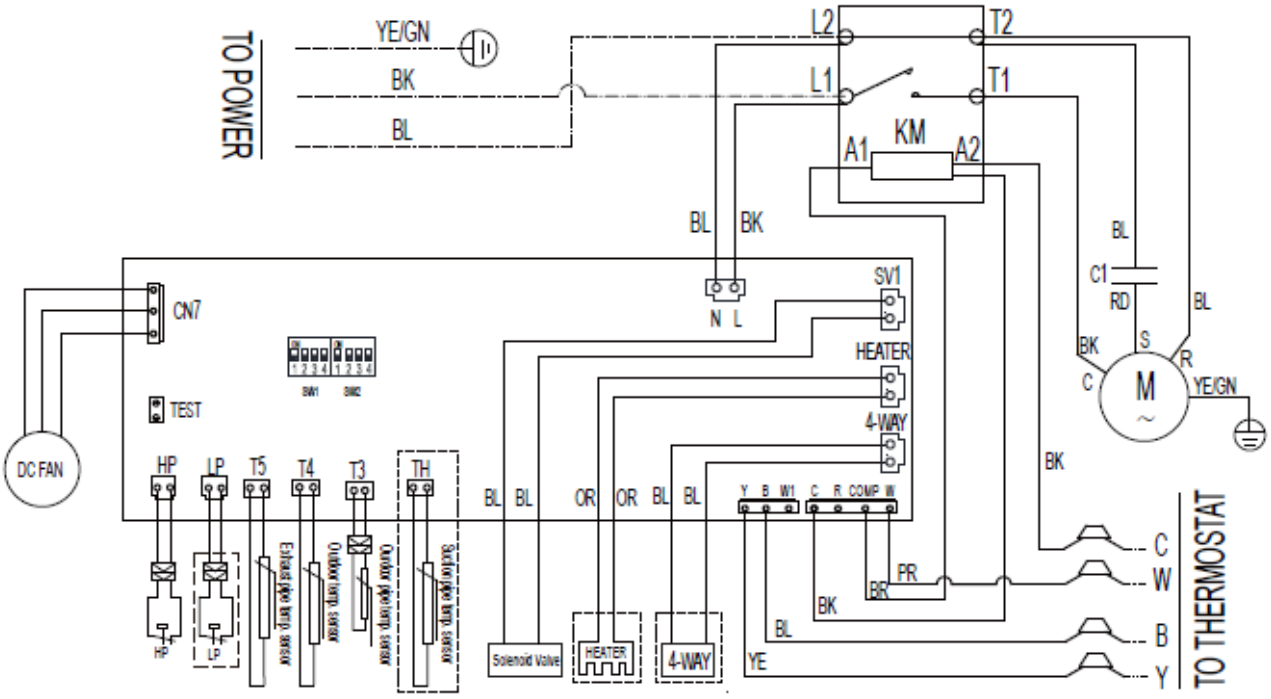
2.Service Space



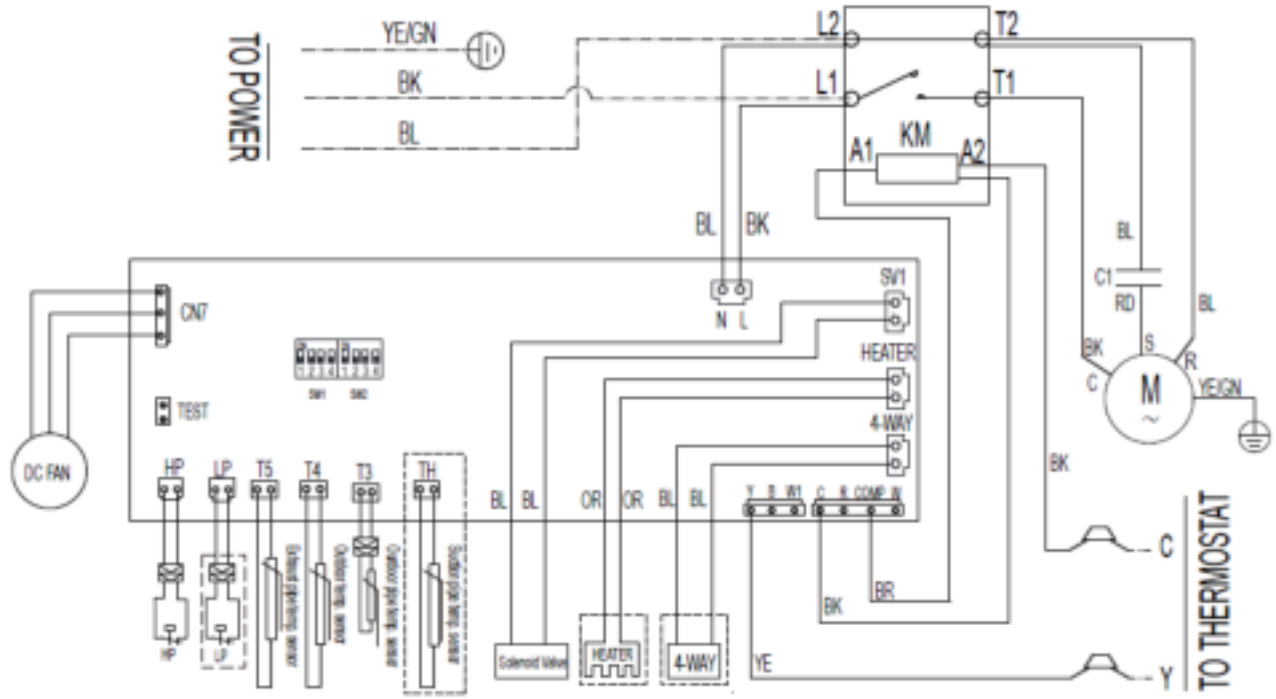


3.Wiring Diagrams.

Heat pump unit



Cooling only unit



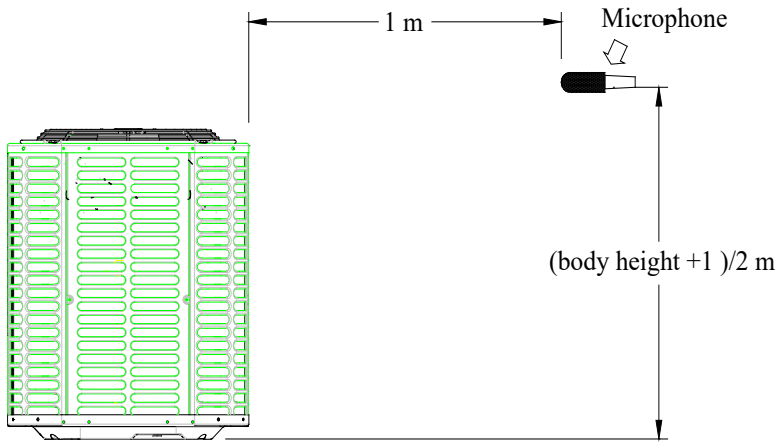
4.Electric Characteristics

Model	Outdoor Unit					
	Hz	Voltage	Min.	Max.	MCA	MOP
18K	60	208~230V	187V	253V	16	25
24K	60	208~230V	187V	253V	20	30
30K	60	208~230V	187V	253V	23	35
36K	60	208~230V	187V	253V	30	45

5.Operation Limits

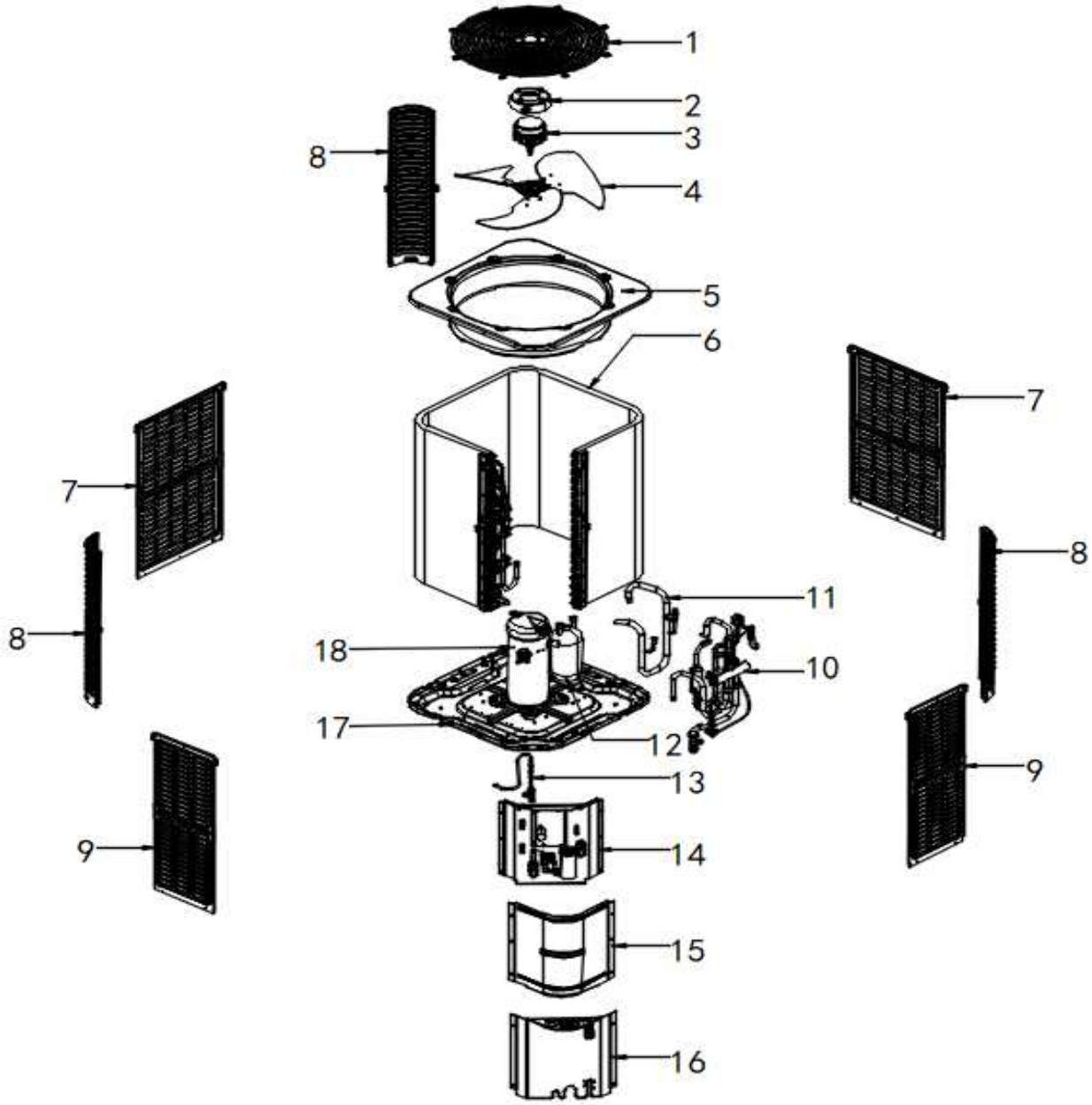
Operation mode	Outdoor temperature(°F)	Room temperature(°F)
Cooling operation	53—120	61—90
Heating operation	5—80	61—90

6.Sound Levels



Note: Sound level is measured at a point 1 m in front of the unit, at a height of (Unit body height +1)/2 m.

7.Exploded View



No.	Part Name	Quantity	No.	Part Name	Quantity
1	Cover net	1	14	electric control box components	1
2	DC Motor Mount	1	14.1	Electronic control board	1
3	Outdoor motor	1	13.2	High pressure switch	1
4	Axial-flow fan	1	13.3	Low pressure switch	1
5	Top cover assembly	1	13.4	Condenser temperature sensor (T3)	1
6	Condenser assembly	1	13.5	Ambient temperature sensor (T4)	1
6.1	Condenser inlet pipe assembly	1	13.6	Exhaust temperature sensor (T5)	1
6.2	Condenser output pipe assembly	1	13.7	Return temperature sensor (TH)	1
7	Rear side-panel	2	13.8	Solenoid valve	1

8	Support board	3	13.9	AC contactor	1
9	Left side-panel	2	13.10	Compressor capacitor	1
10	Four way valve assembly	1	15	Top panel	1
11	Suction air pipe weld assembly	1	16	Bottom side panel	1
12	Gas-liquid separator	1	17	Chassis assembly	1
13	High pressure valve assembly	1	18	Compressor	1

8.Troubleshooting

8.1 Error conde

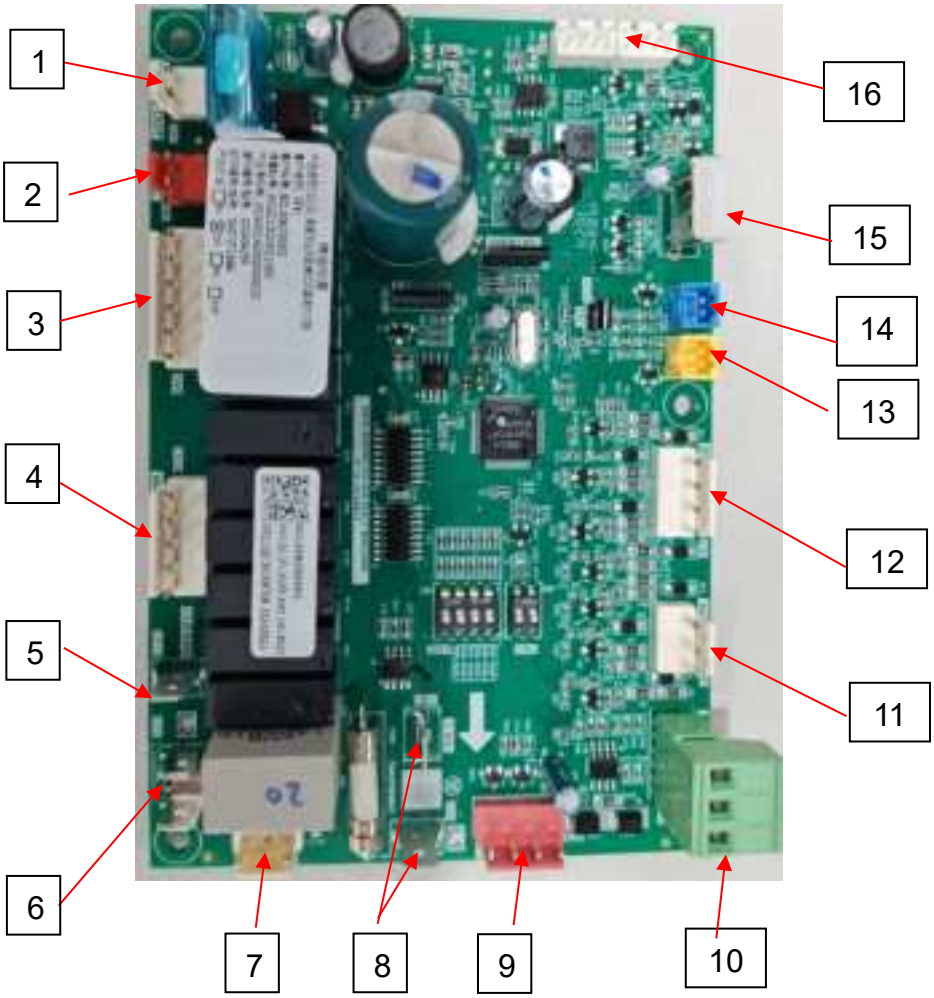
Indoor unit

Number of green light flashes	Fault description
2	T1 sensor fault
3	T2 sensor fault
4	Refrigerant concentration sensor fault
5	Refrigerant leakage
6	Anti-freeze protection
7	Mainboard chip fault
8	Motor protection
9	IDU and ODU unit communication fault (RS485 communication mode)
10	Wire controller communication fault (RS485 communication mode)

Outdoor unit

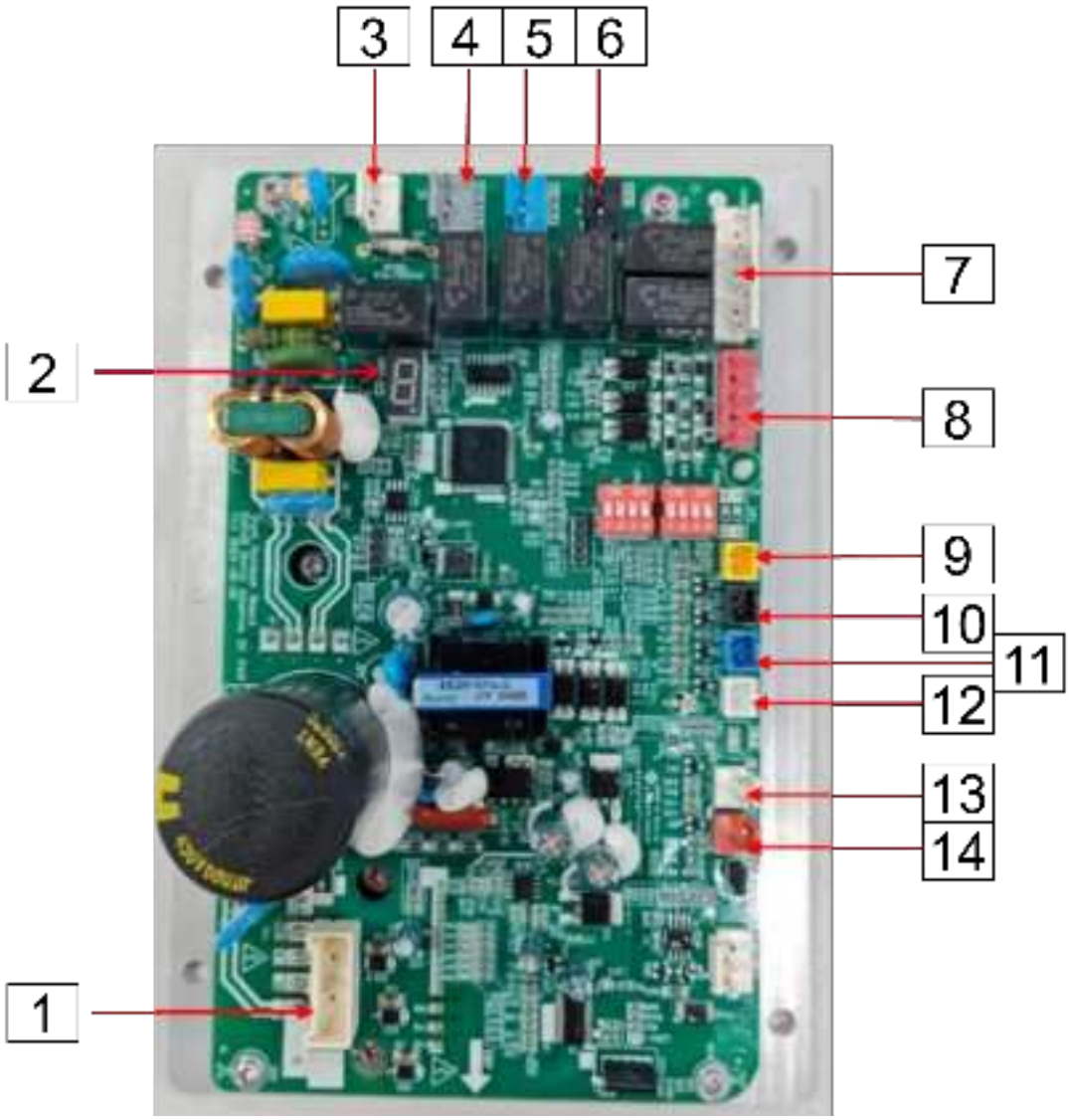
status code	System status
0	Standby Mode
1	Cooling Mode
2	Heating Mode
3	T3 Sensor Error
4	T4 Sensor Error
5	T5 Sensor Error
6	Low Pressure Protection
7	High Pressure Protection
8	Outdoor Fan Error
9	T3 High Temperature Protection
A	T4 Ambient Temperature Protection
C	T5 High Compressor Discharge Temperature Protection
E	TH Sensor Error
F	TH Anti-freeze Protection
6.	6 times Low Pressure Protection within 60 minutes
7.	6 times High Pressure Protection within 60 minutes
8.	4 times Outdoor Fan Error within 60 minutes
C.	3 times T5 Temperature Protection within 60 minutes
F.	8 times TH Anti-freeze Protection within 200 minutes

8.2 Indoor unit control board



NUM	Port definition	NUM	Port definition
1	Transformer output（24v）	9	Refrigerant leakage sensor
2	24V thermostat power supply R, C	10	PQE indoor and outdoor communication
3	DC motor communicate port	11	Electric heater port (to 24V thermostat)
4	Electric heater port (connected to electric heater)	12	24V terminal connected to 24V thermostat
5	Power supply of control board and DC motor N (L2)	13	T1 sensor
6	Power supply (L2)	14	T2 sensor
7	Transformer input(230v)	15	Debug port
8	Power supply of control board and DC motor L (L1)	16	Smart controller port (only active functional in RS485 communication mode)

8.3 Outdoor unit control board



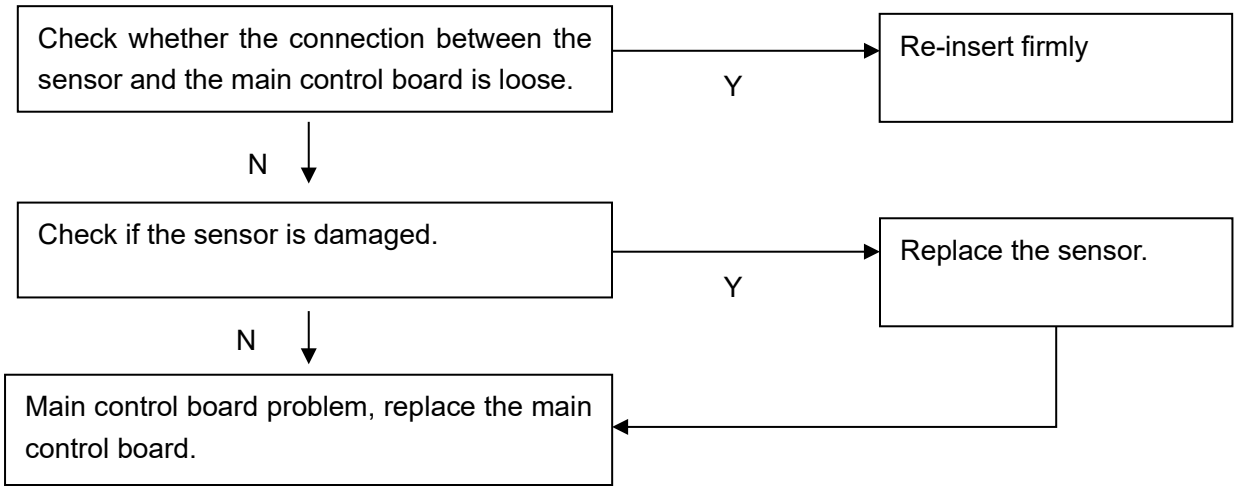
NUM	Port definition	NUM	Port definition
1	DC motor communicate port	8	24V communication (Y/B)
2	Digital display tube	9	Return air temperature sensor
3	Power supply	10	Condenser temperature sensor
4	Crankshaft heating belt	11	ambient temperature sensor
5	Four-way valve	12	Exhaust temperature sensor
6	Solenoid valve	13	Low pressure switch
7	24V communication (W/C)	14	High pressure switch

8.4 Troubleshooting guide

8.4.1 T1/T2/ sensor fault, R454b sensor fault (Indoor unit sensor failure)

8.4.2 T3/T4/T5 sensor fault (Outdoor unit sensor failure)

Reason: Sensor reading error



- Confirm whether the sensor is firmly connected and check the sensor connector to ensure it is firmly connected.
- Unplug the sensor and use a multimeter to measure the resistance to check whether it is open circuit or short circuit. If so, replace the sensor; if not, replace the main control board.

- Sensor resistance table see Appendix 1

8.4.3 Refrigerant leakage fault

Reason: Refrigerant leakage detected

- Firstly, open windows for ventilation and extinguish indoor open flames.
- Then check if there is any leakage in the copper pipe. If it is confirmed to be leaking, the pipe needs to be repaired by welding.
- If no leakage is found, it may be a false alarm fault on the main control board. Replace the indoor board first. If the fault is not resolved, replace the refrigerant sensor.

8.4.4 Indoor control board chip failure

Reason: The indoor control board chip is broken

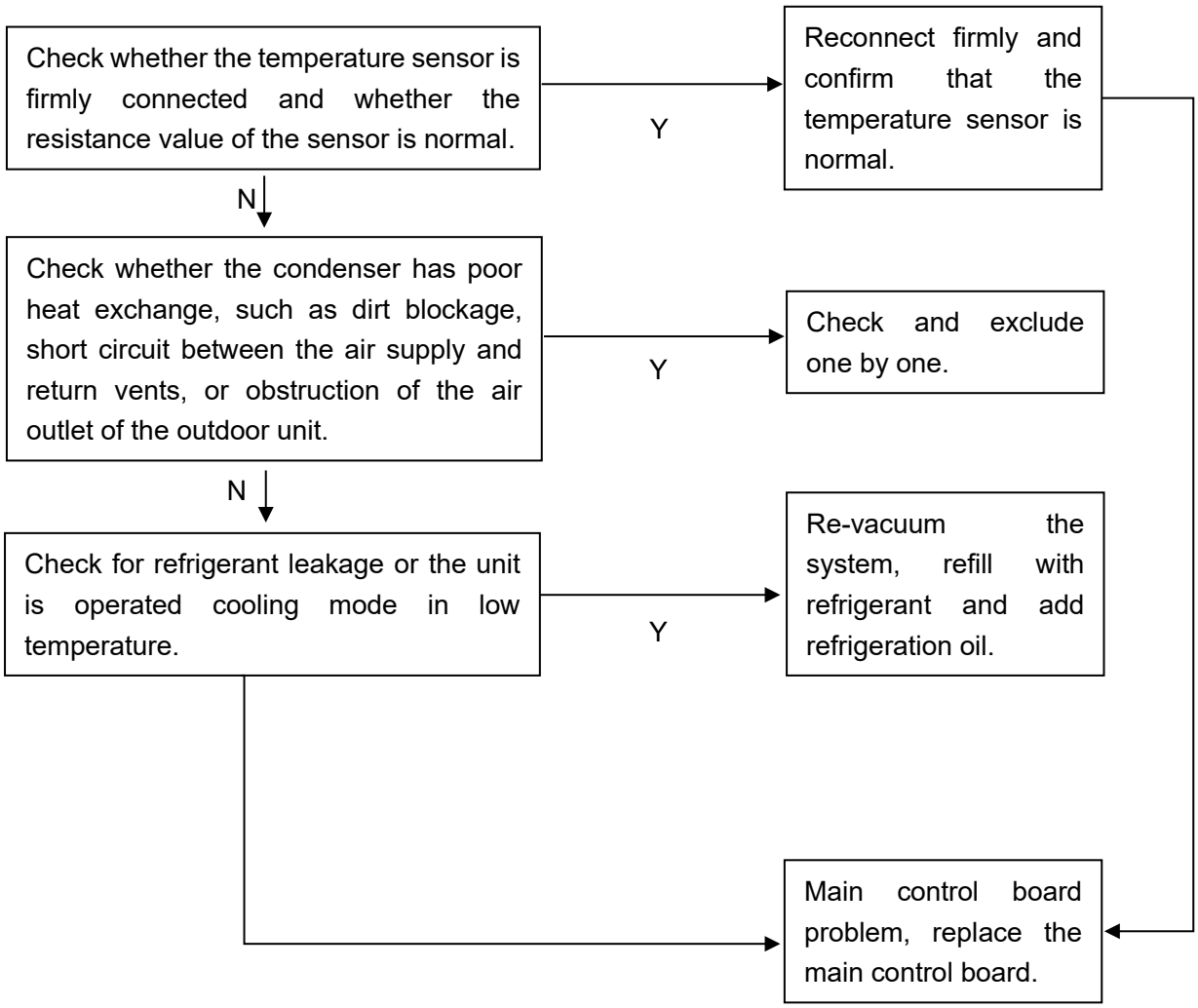
- **Replace the indoor control board.**

8.4.5 Anti-freeze protection

Reason:

Indoor unit: The T2 sensor detects that the evaporator temperature is too low(T2＜0℃)

Outdoor unit: The TH sensor detects that the gas return temperature is too low(T2＜0℃)



- Check if the actual temperature of the evaporator is very low or even frozen.
- If the evaporator is frozen, please check if the air conditioning system is blocked or if the refrigerant is leaking, etc. If no, then you need to clean the pipes, re-evacuate, and recharge refrigerant.
- If the evaporator is not frozen, use a multimeter to measure whether the resistance of the temperature sensor is normal (see the appendix for the R-T table). If it is not normal, you need to replace the sensor.
- If the sensor resistance is normal, then you need to replace the main control board of the indoor unit.

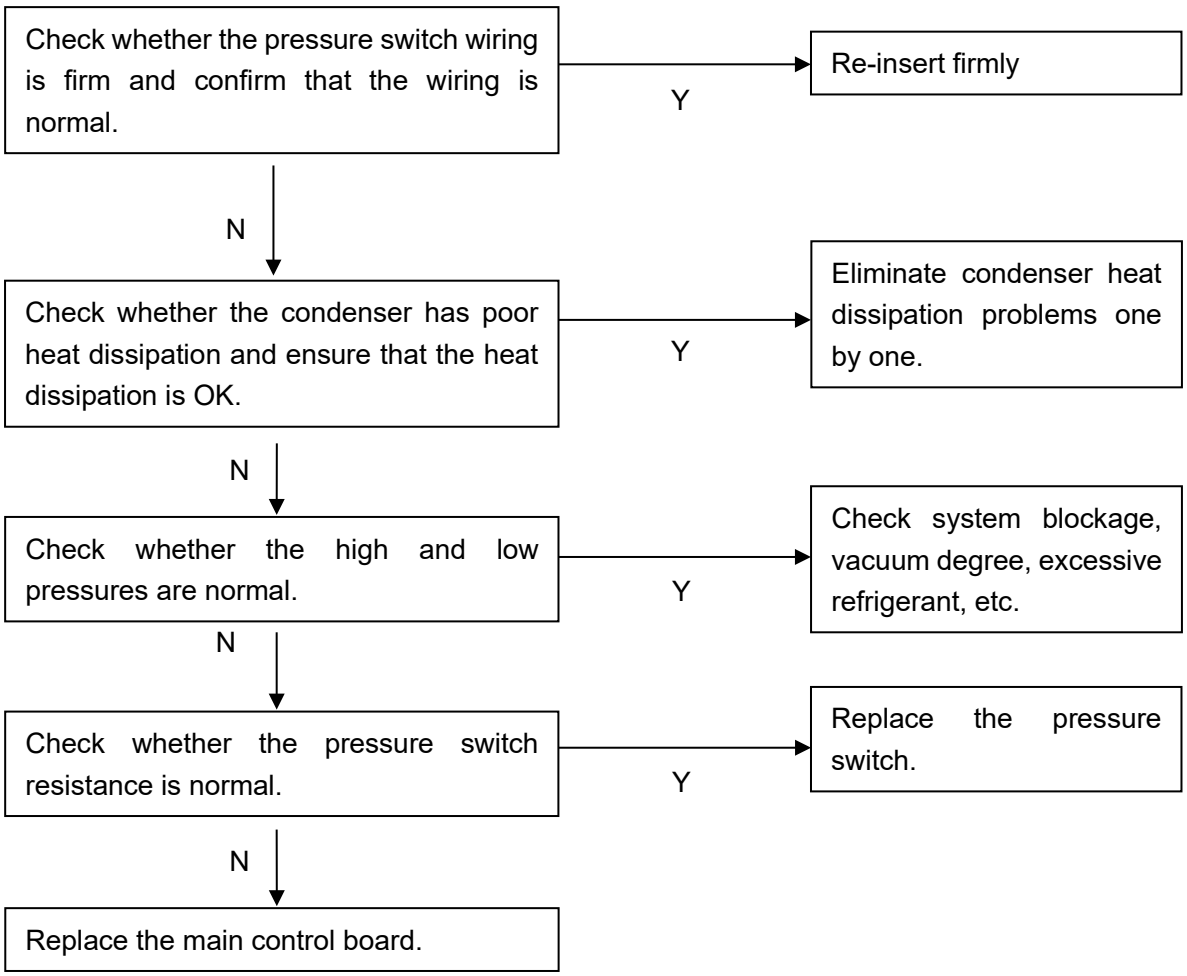
8.4.6 Indoor fan protection

Reason: The DC fan motor of the indoor unit has issue

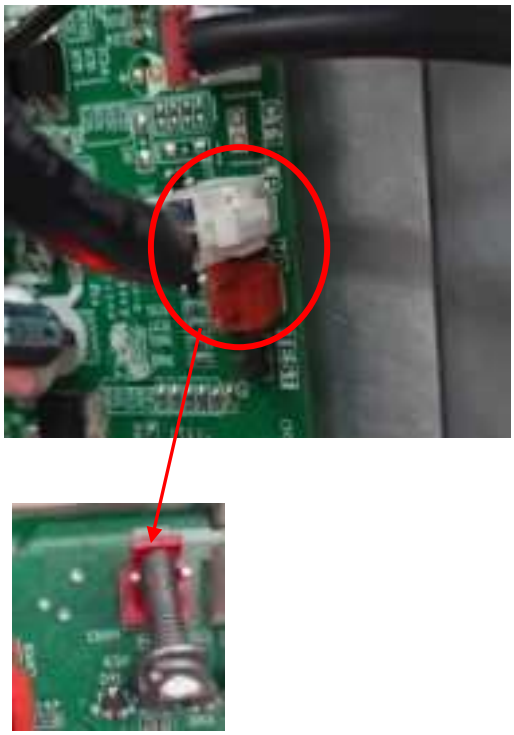
- Replace the control board of the indoor unit.
- If not resolved, replace the motor.

8.4.7 High /Low pressure protection

Cause: The high and low-pressure switch is continuously in the disconnected state



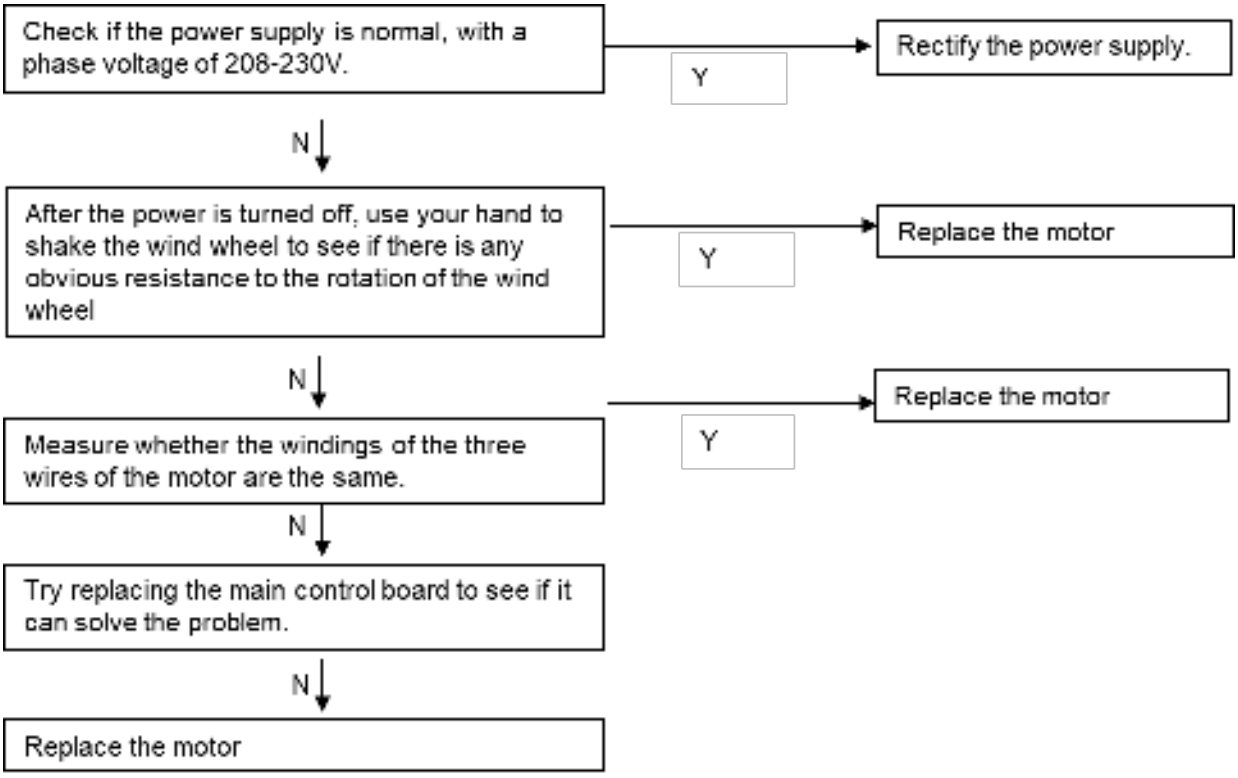
- Then turn off the power of the machine and then turn on the power, and use the controller to start the machine.
- If the machine fails after running for a while, there may be a problem with the refrigerant system and the system needs to be checked.
- If the machine fails as soon as it is powered on, there may be a problem with the pressure switch or the outdoor main board.
- Use a jump cap or metal short-circuit to connect the pressure switch port of the electronic control board, then turn off the power and restart the machine, and observe whether the fault disappears.
- If the fault is resolved, replace the pressure switch.
- If the fault is not resolved, replace the main control board.



The high-pressure switch port can be short circuited by using a screw clamped between two pins.

8.4.8 DC fan malfunction

Cause： Abnormal detection of fan motor.

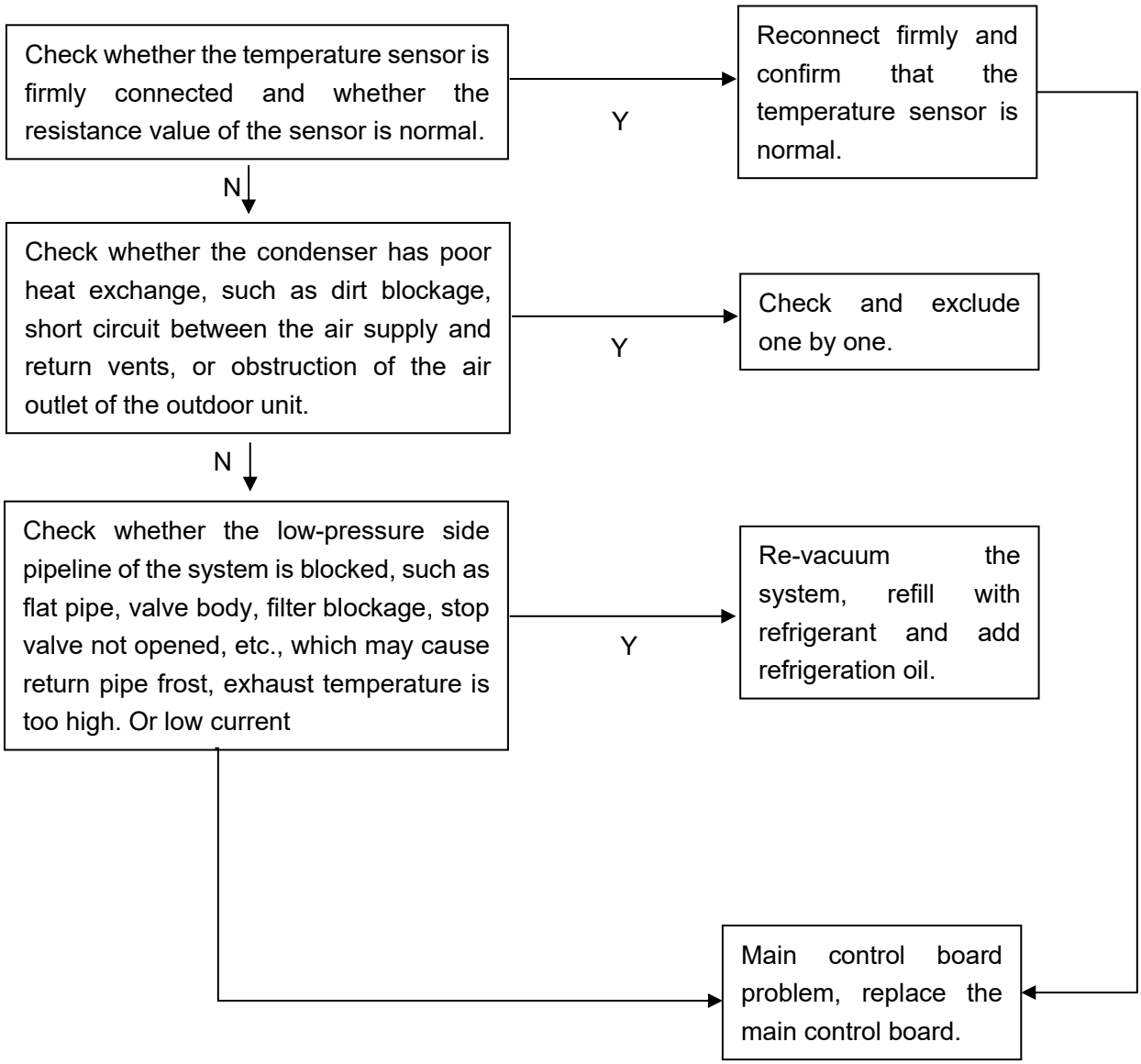


- Check if the power supply is normal, with a phase voltage of 208-230V, and confirm that the power supply is functioning properly.

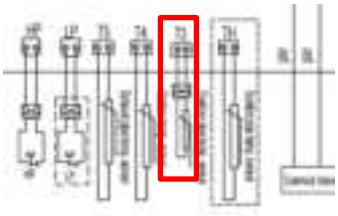
- After the power is turned off, use your hand to shake the wind wheel to see if there is any obvious resistance to the rotation of the wind wheel. If you find that the wind wheel does not rotate smoothly when you turn it by hand, replace the motor, otherwise proceed to the next step.
- Measure whether the windings of the three wires of the motor are the same. If the winding cannot be measured, or the measured resistance is different, replace the motor.
- Try replacing the main control board to see if it can solve the problem.
- Replace the motor.

8.4.9 Outdoor coil temperature over-high protection (cooling mode) T3＞60℃

Cause: The condenser temperature sensor detected that the temperature was too high



- Check if the heat dissipation of the condenser is normal, ensuring that there are no dirty blockages, short circuits in the air supply and return ports, etc.
- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. Please see the appendix for R-T table



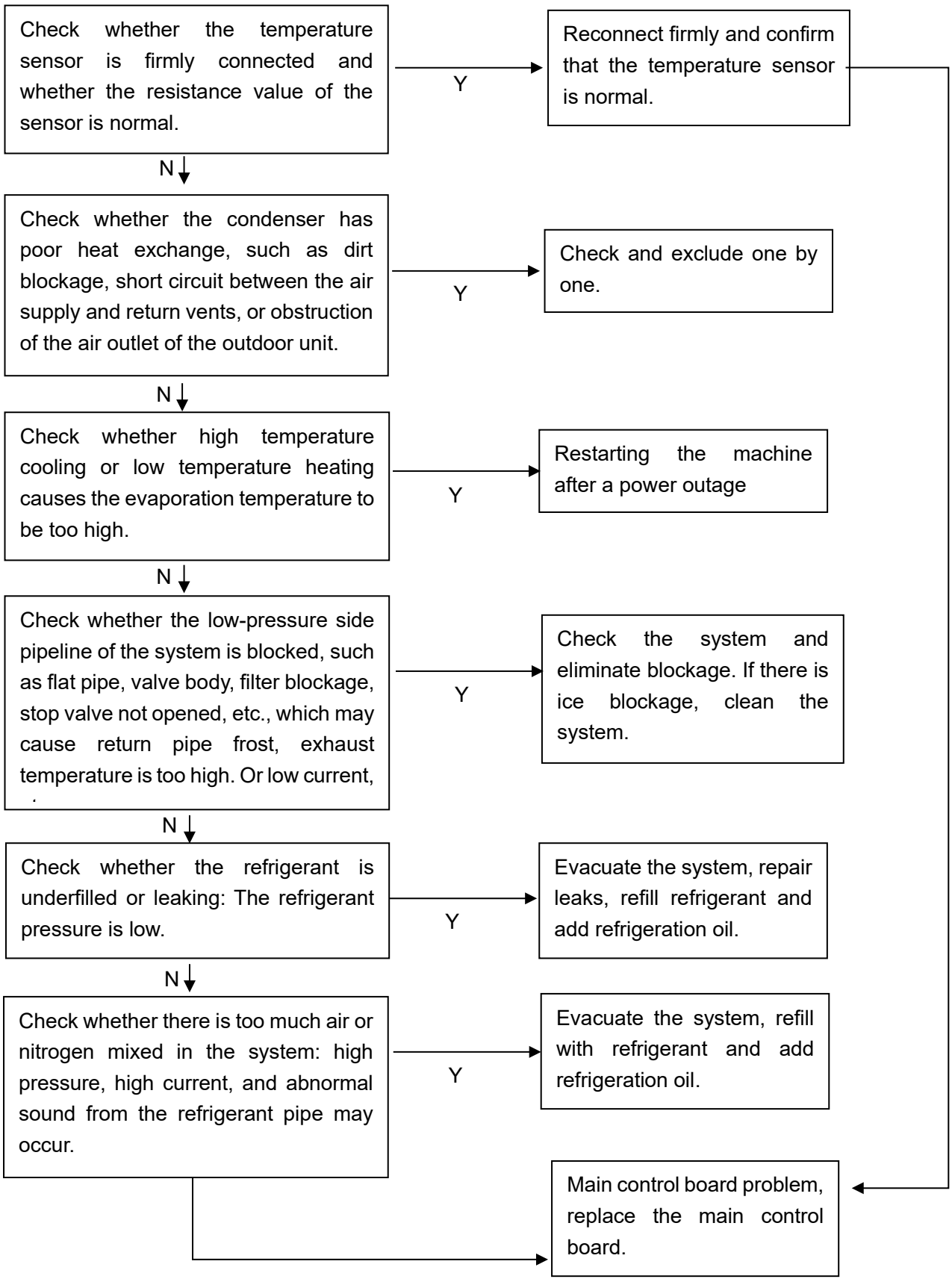
- If the temperature sensor resistance is normal, check the exhaust temperature in item 8 and compare it with the actual exhaust temperature (use a infrared thermometer to measure the exhaust temperature). If the temperature of the main control board is unreasonable, replace the

main control board.

- If the above steps are normal, check whether the refrigerant system is normal, such as return air blockage, poor evaporation, compressor wear, etc.

8.4.10 Exhaust temperature too high protection ＞120℃

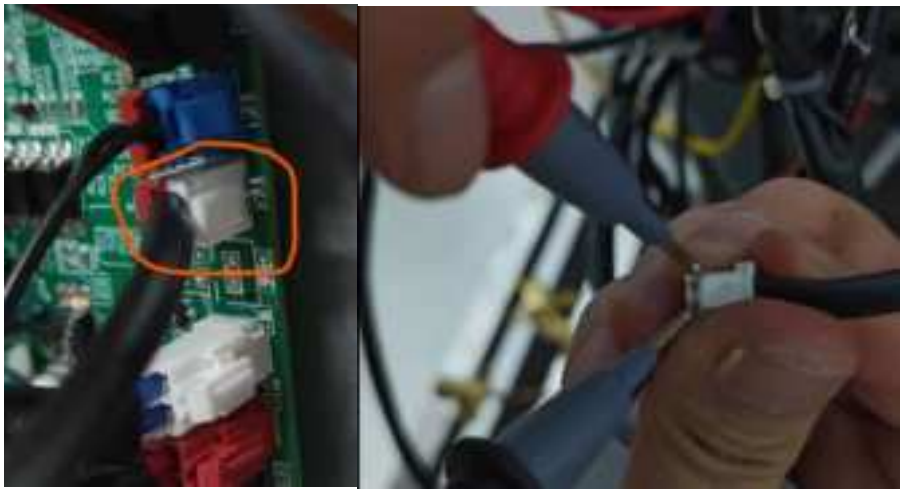
Cause: The exhaust temperature sensor reads a temperature that is too high



- Connect a pressure gauge to measure whether the return gas pressure is too low (normally 0.7-0.9MPa). If the pressure is too low, add refrigerant.

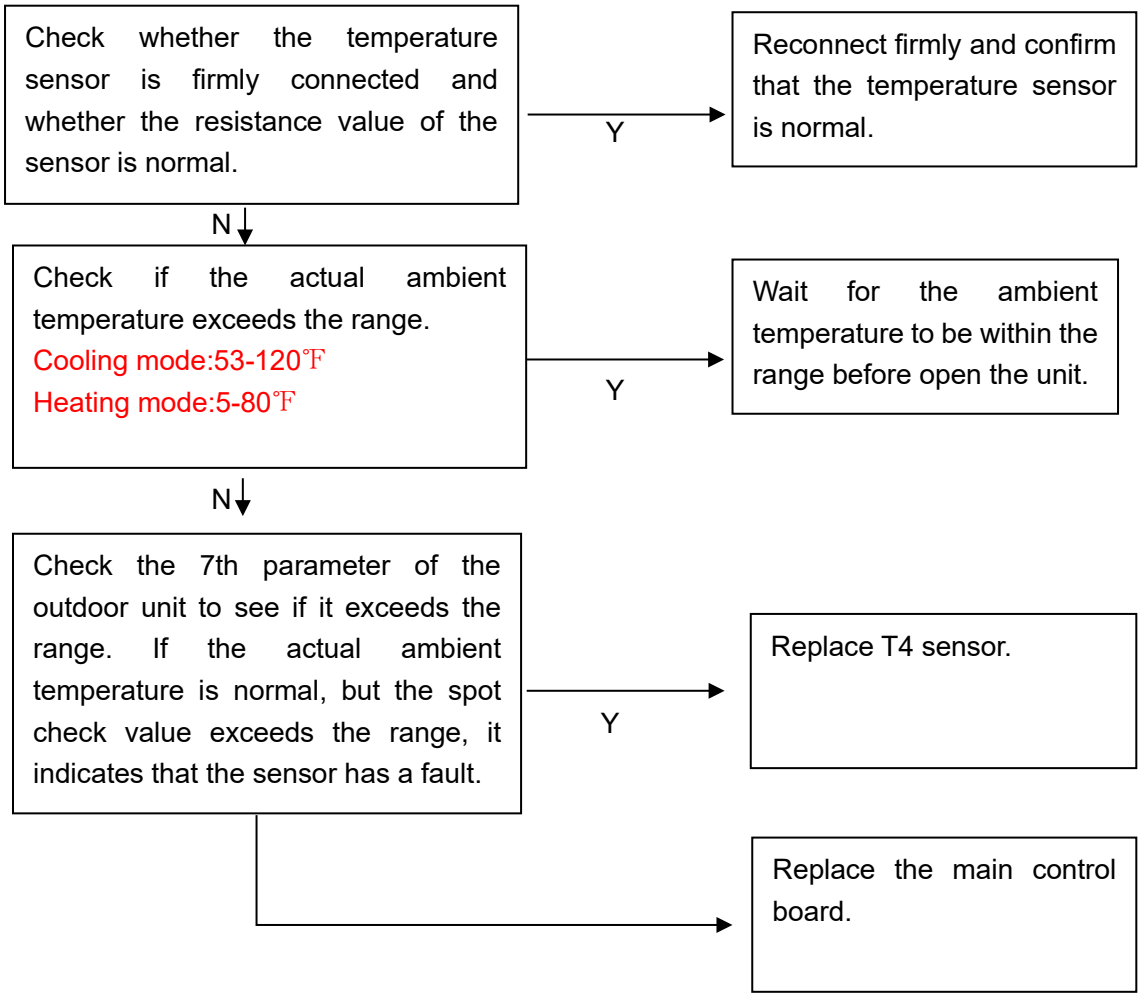
- Measure the resistance of the temperature sensor and check whether it drifts by comparing it with the resistance table. If it drifts, replace the sensor. Please see the appendix for R-T table

- If the above steps are normal, check whether the refrigerant system is normal, such as return air blockage, poor evaporation, compressor wear, etc.



8.4.11 Overtemperature protection

Cause: Outdoor sensor T4 detects that the ambient temperature exceeds the range



Part 4 Function introduction

1.Electrical Components Description ..... **Error! Bookmark not defined.**
2.Anti-Cold Air & Heating Fan Delay Function 44
3.Indoor Coil Anti-Freezing Function 45
4.Outdoor gas return temperature Anti-Freezing Function 45
5.R454B Leakage Detection Function 46
6.Defrost Description 46

1.Electrical Components Description

Temperature Sensor

T1: IDU Ambient Temperature

—capacity demand control (R485 mode)

— Defrost control (heating mode)

T2: Indoor Coil Temperature

— Anti-Cold Air Function (heating mode)

— Anti-Freezing Function

T3: Outdoor Coil Temperature

— High/Low temperature protection

—Outdoor fan control (cooling mode)

— Defrost control (heating mode)

T4: ODU Ambient Temperature

— Operating condition permission

— Defrosting condition (heating mode)

— Outdoor fan control (heating mode)

T5: Compressor Discharge Temperature

— High temperature / Low superheat protection

— Electronic Expansion Valve (EEV) control

Reversing value operation

— Reversing value energizes during heat mode and de-energizes in cool

Compressor Crankcase Heater Description

— Refrigerant migration during the OFF cycle can result in noisy start-ups, therefore a Crankcase Heater (CCH) is used to minimize refrigerant migration thereby minimizing start-up noise and/or bearing “wash out”. All CCHs must be installed around the lower half of the compressor shell. Its purpose is to warm the compressor during the OFF cycle, driving refrigerant from compressor. After extended shutdown periods in cold weather, it is recommended to allow CCH to be energized for at least 12 hours prior to compressor operation by applying line voltage to heat pump with thermostat OFF.CCH operation energizes:

2.Anti-Cold Air & Heating Fan Delay Function

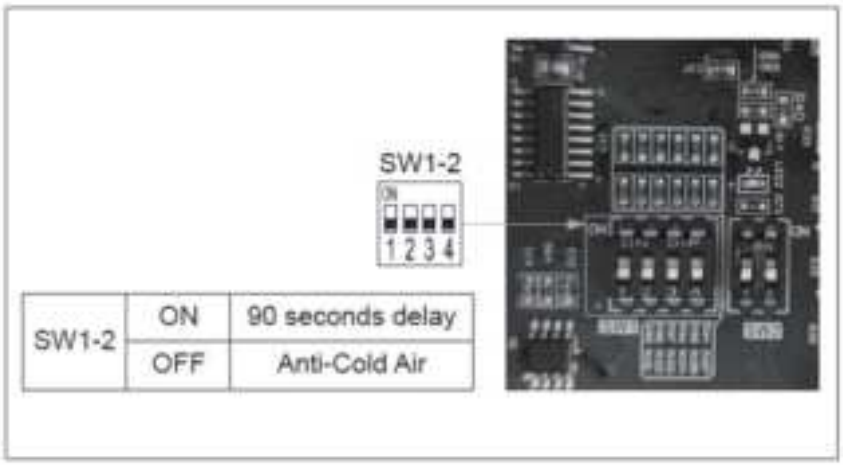
Anti-Cold Air Function（Only effective in heating mode）

When SW1-2 is in the OFF position and running heating mode, the fan will not start when the coil temperature (T2) ＜82.4 ℉.

When T2 ≥ 82.4 ℉, the fan will start immediately, or when the electric heat kit is manually turned on, the fan will also start immediately

Heating Fan Delay Function

When the dip switch SW1-2 is set to “ON” and the indoor unit is in heating mode, the fan will operates with 90 seconds delay each time it starts. Fan speed determined by the Y1/Y2 signal from thermostat.



3.Indoor Coil Anti-Freezing Function

The function utilizes the indoor coil sensor(T2) to determine whether the indoor coil is freezing or not. The feature prevents the unit running at low evaporating temperature as well as low suction superheat. When all the following conditions are met, the Anti-Freezing Function will activate， and the compressor will be turned off.

A. T2＜32℉ Duration exceeding 1 minute.

B. T2≤26.6℉ Duration exceeding 30 seconds.

when T2≥42.8℉, the Anti-Freezing Function will deactivate:

4.Outdoor gas return temperature Anti-Freezing Function

The function utilizes the Outdoor gas return temperature (TH) to determine whether the indoor coil is freezing or not. The feature prevents the unit running at low evaporating temperature as well as low suction superheat.

Only valid in cooling mode and after the compressor has been running for 3 minutes.

When the gas return temperature TH≤TH1 for “t” minutes, or the gas return temperature TH≤TH2, the compressor and the outdoor fan will be stopped, and the anti-freezing protection will be reported

	TH1	TH2	t
T4≤8℃	-1	-4	0
8℃<T4≤16℃	-1	-4	20+5*(T4-12)
16℃＜T4≤35℃	-1+0.15*(T4-16)	-4+0.3*(T4-16)	40
T4＞35℃	2+0.2*(T4-35)	2+0.1*(T4-35)	40

When the return air temperature is greater than 10 degrees or the shutdown time reaches 6 minutes, start the compressor and external fan (the minimum start interval is 5 minutes).

5.R454B Leakage Detection Function

The function utilizes a R454B refrigerant sensor to detect the R454B concentration. Terminal F/L2 is

reserved for connecting buzzer if needed.

When R454B leakage occur in the indoor coil and the concentration is above 10%LEF, the unit will perform as the following:

A. Cut off power to thermostat to stop compressor operation.

B. Electric Heat kit will be turned off.

C. High voltage will be output between terminal F and terminal L2.

D. The indoor fan is running at high wind speed, and at the same time, the fault light on the indoor mainboard is flash.

6.Defrost Description

According to the actual situation on site, the machine has multiple defrost modes to choose from:

Auto defrost:

the machine measures the ambient temperature and the temperature of the outdoor coil through sensors and calculates the condensation pressure and machine running time to determine whether to enter defrost mode. When the temperature of the coil exceeds the set value, the machine automatically exits defrosting mode.

Manual defrost mode:

Through SW2-1, it can manually force the machine to enter defrost mode.

Fixed time defrosting:

You can choose to activate the defrost function every 30 minutes or 60 minutes. When the temperature of the coil exceeds the set value, the machine automatically exits defrosting mode.

Defrosting choice	SW2-1	SW2-2	SW2-3	SW2-4
ON	Manual defrost mode	Fix timed defrost	Timer 30 min	Reserve
OFF	Auto Defrost (factory default)	Auto Defrost (factory default)	Timer 60 min （factory default）	Reserve
Remark	Defrosting：control mode selection	Cycle time selection	Only applicable to fix timed defrosting timer and the Minimum Runtime Timer	Do not to adjust this dial

If SW2-2 is ON, the fixed defrost time is determined by SW2-3 dial selection

Part 5 Installation

1.Precaution on Installation ..... **Error! Bookmark not defined.**
2. Oil return bend installation 50
3.Vacuum Dry and Leakage Checking 51
4.Additional Refrigerant Charge 53
5.Insulation Work 55
6.Test Operation 57

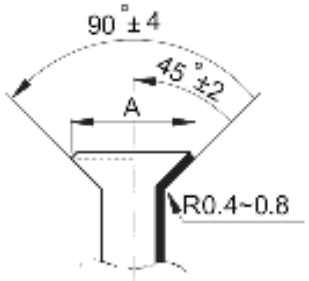
1.Precaution on Installation

1.1. Measure pipe length

Measure the necessary length of the connecting pipe and make it by the following way.
Connect the indoor unit at first, then the outdoor unit.
Bend the tubing in proper way.
Please refer to the table below for the length dimensions of the connection pipe

Refrigerant line		Capacity (Kbtu/h)			
		24K	36K	48K	60K
Liquid suction	In.	3/8-3/4	3/8-3/4	3/8-7/8	3/8-7/8
Max.Refrigerant Line Length*	Ft.	100			
Max.Elevation* Vertical Lift**	Ft.	50			

CAUTIONS:
Daub the surfaces of the flare pipe and the joint nuts with frozen oil, and wrench it for 3~4 rounds With hands before fasten the flare nuts.
Be sure to use two wrenches simultaneously when you connect or disconnect the pipes.

Pipe gauge	Tightening torque	Flare dimension A Min (mm)	Max	Flare shape
Φ6.35	15～16N.m (153～163 kgf.cm)	8.3	8.7	
Φ9.52	25～26N.m (255～265kgf.cm)	12.0	12.4	
Φ12.7	35～36N.m (357～367kgf.cm)	15.4	15.8	
Φ15.9	45～47N.m (459～480 kgf.cm)	18.6	19.1	
Φ19.1	65～67N.m (663～684kgf.cm)	22.9	23.3	

The stop value of the outdoor unit should be closed absolutely (as original state). Every time you connect it, first loosen the nuts at the part of stop value, then connect the flare pipe immediately (in 5 minutes). If the nuts have been loosened for a long time, dusts and other impurities may enter the pipe system and may cause malfunction later. So please expel the air out of the pipe with refrigerant before connection.
Expel the air after connecting the refrigerant pipe with the indoor unit and the outdoor unit. Then fasten the nuts at the repair-points.

1.2. Locate The Pipe

Drill a hole in the wall (suitable just for the size of the wall conduit), then set on the fittings such as the wall conduit and its cover.
Bind the connecting pipe and the cables together tightly with binding tapes. Do not let air in, which will

cause water leakage by condensation.

Pass the bound connecting pipe through the wall conduit from outside. Be careful of the pipe allocation to do no damage to the tubing.

1.3. Connect the pipes.

1.4. Then, open the stem of stop values of the outdoor unit to make the refrigerant pipe connecting the indoor unit with the outdoor unit in fluent flow.

1.5. Be sure of no leakage by checking it with leak detector or soap water.

1.6. Cover the joint of the connecting pipe to the indoor unit with the soundproof / insulating sheath (fittings), and bind it well with the tapes to prevent leakage.

2. Oil return bend installation

Note that the length of the connecting line from the outdoor unit to the indoor unit cannot exceed 100 feet.

● If all long lines are in a horizontal state, no additional measures are required;

● If there is a vertical height difference in the long line, it needs to be installed according to the following requirements:

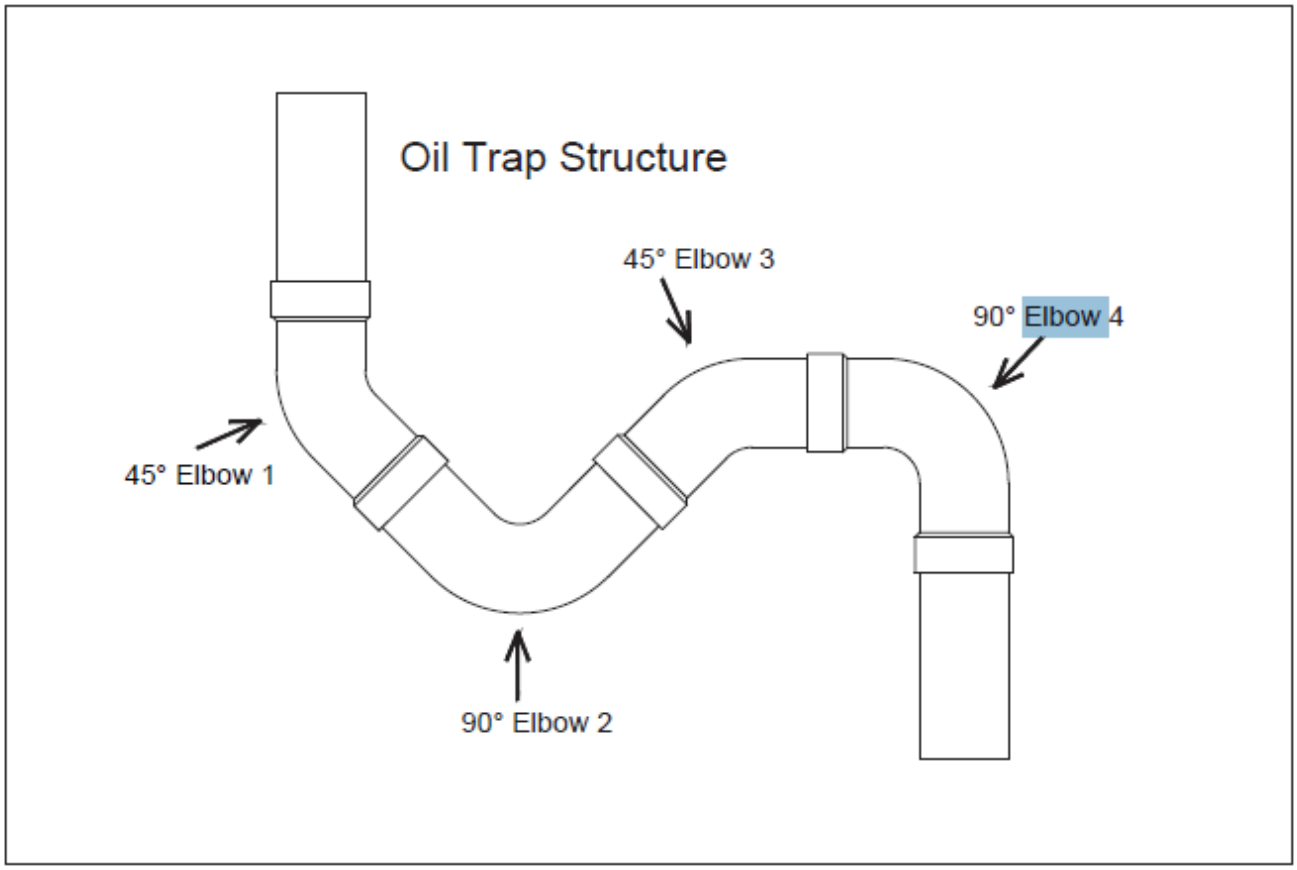
● When the vertical height difference is 0＜h≤16.5feet, no additional measures are required;

● When the vertical height difference is 16.5feet＜h≤33feet, an oil return bend needs to be added in the middle of the height difference.

● When the vertical height difference is 33feet＜h≤50feet, two oil return bends need to be added at an equal distance in the height difference.

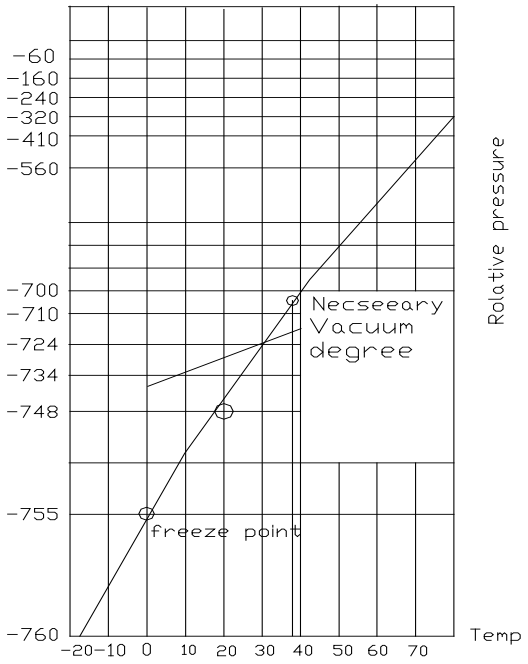
NOTE: The vertical height difference between the outdoor unit and the indoor unit cannot exceed 50 feet.

The following is the connection method of the oil return bend.



3.Vacuum Dry and Leakage Checking

3.1 Vacuum Dry: use vacuum pump to change the moisture (liquid) into steam (gas) in the pipe and discharge it out of the pipe to make the pipe dry. Under one atmospheric pressure, the boiling point of water(steam temperature) is 100℃. Use vacuum pump to make the pressure in the pipe near vacuum state, the boiling point of water falls relatively. When it falls under outdoor temperature, the moisture in the pipe will be vaporized.



3.2 Vacuum dry procedure

There are two methods of vacuum dry due to different construction environment: common vacuum dry, special vacuum dry.

①. Common vacuum dry procedure

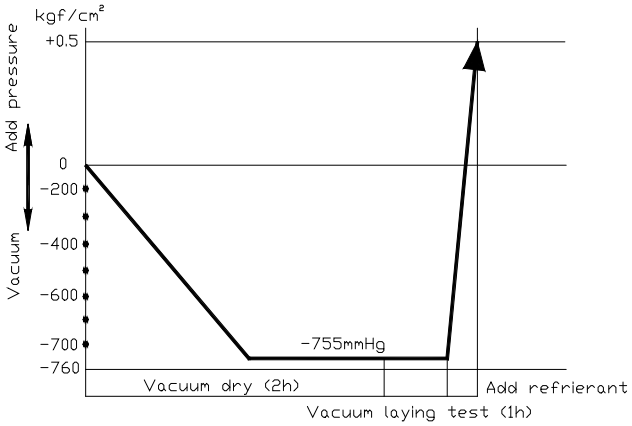
Vacuum dry (for the first time) ---connect the all-purpose detector to the inlet of liquid pipe and gas pipe, and run the vacuum pump more than two hours (the vacuum pump should be below -755mmHg) If the pump can't achieve below -755mmHg after pumping 2 hours, moisture or leakage point will still exist in the pipe. At this time, it should be pumped 1 hour more.

If the pump can't achieve -755mmHg after pumping 3 hours, please check if there are some leakage points.

Vacuum placement test: place 1 hour when it achieves -755mmHg, pass if the vacuum watch shows no rising. If it rises, it shows there's moisture or leakage point.

Vacuuming from liquid pipe and gas pipe at the same time.

Sketch map of common vacuum dry procedure.



② Special vacuum dry procedure

a. Vacuum dry for the first time 2h pumping

b. Fill nitrogen to 0.5Kgf/cm2

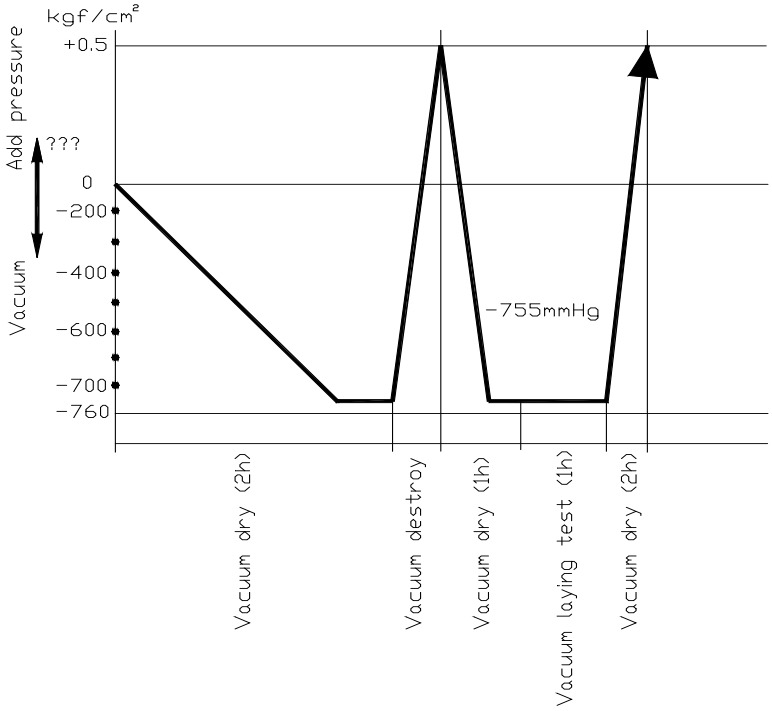
Because nitrogen is for drying gas, it has vacuum drying effect during vacuum destroy. But if the moisture is too much, this method can't dry thoroughly. So, please pay more attention to prevent water entering and forming condensation water.

c. Vacuum dry for the second time for 1h pumping

If -755mmHg can't be achieved in 2h, repeat procedure "b" and "c".

d. Vacuum placing test …… 1h

e. Sketch map of special vacuum dry procedure



4.Additional Refrigerant Charge

Caution

● Refrigerant cannot be charged until field wiring has been completed.

● Refrigerant may only be charged after performing the leak test and the vacuum pumping.

● When charging a system, care shall be taken that its maximum permissible charge is never exceeded, in view of the danger of liquid hammer.

● Charging with an unsuitable substance may cause explosions and accidents, so always ensure that the appropriate refrigerant is charged.

● Refrigerant containers shall be opened slowly.

● Always use protective gloves and protect your eyes when charging refrigerant.

Weigh-In Method

The factory charge in the outdoor unit is sufficient for 25 feet of standard size interconnecting liquid line. Additional 0.54 oz/ft refrigerant is needed when length of pipe is more than 25 feet.

Additional Refrigerant Guidelines

Piping length (ft)	Additional charge (oz)
25.0	0.00
50.0	13.5
75.0	27
100.0	40.5

Subcooling Method (10°F ± 2°F)

Check the ambient temperature. Subcooling method (cooling mode) is only for outdoor temperature between 68°F and 113°F, and indoor temperature between 68°F and 89°F. For temperature out of the range, use the weighing method mentioned above.

1. Start "forced cooling" mode.

Press the "Check" (K4) button for about 5 seconds to enter Force cooling mode. The LED display will show “dC”.

2. Wait until the system is basically stable.

Wait for twenty (20) minutes after "forced cooling" mode started. Compressor will maintain a specific frequency in "forced cooling" mode.

3. Calculate subcooling value.

Calculate subcooling value with measured liquid line temperature and pressure. If calculated subcooling value is lower than the design subcooling value of 10°F ± 2°F, refrigerant should be added. If calculated subcooling value is higher than the value shown in table "R-454B Refrigerant Physical Property") , refrigerant should be recovered.

4. Adjust refrigerant.

Connect service tools to unit and adjust refrigerant according to analysis in step 4.

5. Wait for stabilization of system.

Wait for 5 minutes, and repeat steps 4 through 5 until subcooling value matches the design subcooling value mentioned in step 4.·

6. Recover normal mode.

Remove service tools and short press "Check" (K4) " button to quit "forced cooling" mode. Symbol "dC"

should disappear when "forced cooling" mode quitted.

Liquid Line Temp (°F)	Subcooling Value(°F)							
	6	7	8	9	10	11	12	13
	Liquid Gauge Pressure (PSI)							
55	164	167	170	172	175	178	181	184
60	178	181	184	187	191	194	197	200
65	194	197	200	203	206	210	213	217
70	210	213	217	220	223	227	230	234
75	227	230	234	238	241	245	249	252
80	245	249	252	256	260	264	268	272
85	264	268	272	276	280	284	288	292
90	284	288	292	297	301	305	309	314
95	305	309	314	318	323	327	332	336
100	327	332	336	341	346	351	355	360
105	351	355	360	365	370	375	380	385
110	375	380	385	390	396	401	406	412
115	401	406	412	417	422	428	433	439
120	428	433	439	445	450	456	462	468
125	456	462	468	474	480	486	492	498

Subcooling (°F)		Ambient Temperature (°F)				
		68~77	77~86	86~95	95~104	104~113
Model	24K	10±2	8±2	8±2	6±2	6±2
	36K	10±2	8±2	8±2	6±2	6±2
	48K	8±2	8±2	8±2	6±2	6±2
	60K	8±2	8±2	8±2	6±2	6±2

5.Insulation Work

5.1 Insulation material and thickness

5.1.1. Insulation material

Insulation material should adopt the material which is able to endure the pipe's temperature: no less than 70℃ in the high-pressure side, no less than 120℃ in the low-pressure side(For the cooling type machine, no requirements at the low-pressure side.)

Example: Heat pump type----Heat-resistant Polyethylene foam (withstand above 120℃)

Cooling only type----Polyethylene foam (withstand above 100℃)

5.1.2. Thickness choice for insulation material

Insulation material thickness is as follows:

	Pipe diameter (mm)	Adiabatic material thickness
Refrigerant pipe	Φ6.4—Φ25.4	10mm
	Φ28.6—Φ38.1	15mm
Drainage pipe	Inner diameterΦ20—Φ32	6mm

5.2 Refrigerant pipe insulation

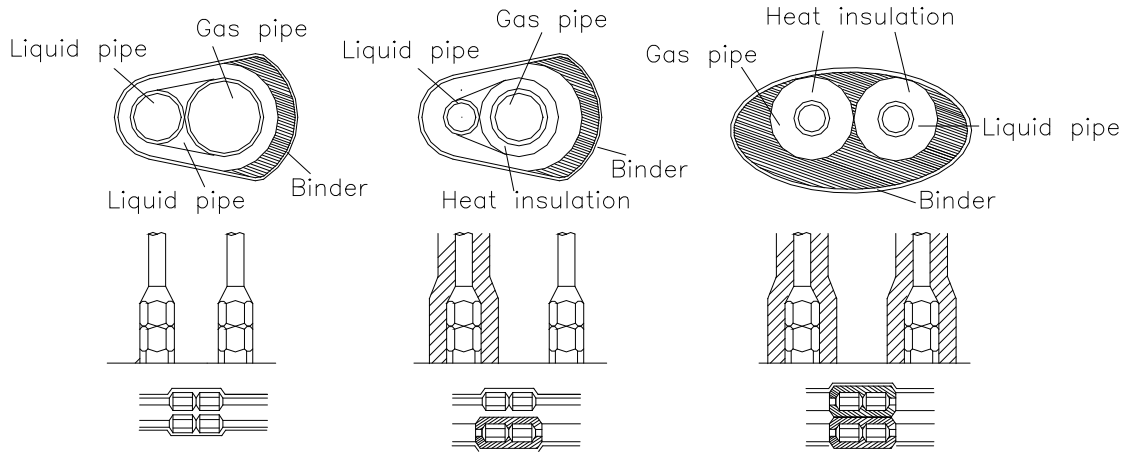
5.2.1. Work Procedure

① Before laying the pipes, the non-jointing parts and non-connection parts should be heat insulated.

② When the gas proof test is eligible, the jointing area, expanding area and the flange area should be heat insulated.

5.2.2. Insulation for non-jointing parts and non-connection parts

wrong	right	
Gas pipe and liquid pipe should not be put together to insulate	Insulate the gas pipe (cooling only)	Insulate the gas pipe and liquid pipe

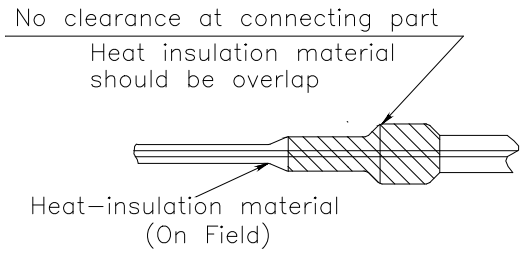


For construction convenience, before laying pipes, use insulation material to insulate the pipes to be deal with, at the same time, at two ends of the pipe, remain some length not to be insulated, in order to be welded and check the leakage after laying the pipes.

5.2.3. Insulate for the jointing area, expanding area and the flange area

① Insulate for the jointing area, expanding area and the flange area should be done after checking leakage of the pipes

② Make sure there's no clearance in the joining part of the accessorial insulation material and local preparative insulation material.



5.3 Drainage pipe insulation

The connection part should be insulated, or else water will be condensing at the non-insulation part.

5.4 Note

5.4.1 The jointing area, expanding area and the flange area should be heat insulated after passing the pressure test.

5.4.2 The gas and liquid pipe should be heat insulated individually, the connecting part should be heat insulated individually.

5.4.3 Use the attached heat-insulation material to insulate the pipe connections (pipes' tie-in, expand nut) of the indoor unit.

6.Test Operation

(1) The test operation must be carried out after the entire installation has been completed.
(2) Please confirm the following points before the test operation.
The indoor unit and outdoor unit are installed properly.
Tubing and wiring are correctly completed.
The refrigerant pipe system is leakage-checked.
The drainage is unimpeded.
The ground wiring is connected correctly.
The length of the tubing and the added stow capacity of the refrigerant have been recorded.
The power voltage fits the rated voltage of the air conditioner.
There is no obstacle at the outlet and inlet of the outdoor and indoor units.
The gas-side and liquid-side stop values are both opened.
The air conditioner is pre-heated by turning on the power.
(3) According to the user's requirement, install the 24v thermostat
(4) Test operation
Set the air conditioner under the mode of "COOLING" with the thermostat.
, and check the following points.
Indoor unit
Whether the fan motor operate normally.
Whether the room temperature is adjusted well.
Whether the indicator lights of indoor board normally.
Whether the drainage is normal.
Whether there is vibration or abnormal noise during operation.
Outdoor unit
Whether there is vibration or abnormal noise during operation.
Whether the generated wind, noise, or condensed of by the air conditioner have influenced your neighborhood.
Whether any of the refrigerant is leaked.

Compressor discharge temperature sensor (50K) **Exhaust temp sensor (T5/)**

T (ºC)	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)	T (ºC)	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)
0	157.7	161.2	164.7	56	14.16	14.48	14.81
1	150.2	153.4	156.7	57	13.65	13.96	14.28
2	142.9	145.9	148.9	58	13.15	13.46	13.77
3	136.1	138.9	141.7	59	12.69	12.99	13.30
4	129.7	132.3	134.9	60	12.23	12.53	12.83
5	123.6	126.0	128.4	61	11.80	12.09	12.39
6	117.8	120.0	122.3	62	11.39	11.67	11.96
7	112.2	114.3	116.4	63	10.98	11.26	11.54
8	107.1	109.0	111.0	64	10.60	10.87	11.15
9	102.1	103.9	105.7	65	10.23	10.50	10.77
10	97.42	99.08	100.8	66	9.880	10.14	10.41
11	92.97	94.51	96.06	67	9.537	9.792	10.05
12	88.74	90.17	91.61	68	9.211	9.460	9.715
13	84.73	86.05	87.38	69	8.897	9.141	9.391
14	80.92	82.14	83.37	70	8.595	8.834	9.078
15	77.29	78.42	79.56	71	8.306	8.539	8.778
16	73.84	74.89	75.95	72	8.028	8.256	8.490
17	70.57	71.54	72.51	73	7.759	7.983	8.212
18	67.46	68.35	69.25	74	7.501	7.720	7.944
19	64.49	65.32	66.15	75	7.254	7.468	7.687
20	61.68	62.44	63.20	76	7.016	7.225	7.440
21	59.00	59.70	60.40	77	6.786	6.991	7.201
22	56.44	57.09	57.74	78	6.565	6.765	6.971
23	54.02	54.61	55.20	79	6.352	6.548	6.749
24	51.70	52.25	52.80	80	6.147	6.339	6.536
25	49.50	50.00	50.50	81	5.950	6.138	6.331
26	47.37	47.87	48.37	82	5.761	5.944	6.133
27	45.34	45.84	46.34	83	5.578	5.757	5.942
28	43.41	43.91	44.41	84	5.401	5.577	5.758
29	41.59	42.08	42.57	85	5.231	5.403	5.580
30	39.84	40.33	40.82	86	5.069	5.237	5.410
31	38.18	38.66	39.15	87	4.912	5.076	5.245
32	36.59	37.07	37.55	88	4.760	4.921	5.087
33	35.07	35.55	36.03	89	4.615	4.772	4.934
34	33.64	34.11	34.58	90	4.474	4.628	4.787
35	32.27	32.73	33.20	91	4.338	4.489	4.645
36	30.95	31.41	31.87	92	4.207	4.354	4.506
37	29.70	30.15	30.61	93	4.081	4.225	4.374
38	28.50	28.95	29.40	94	3.958	4.099	4.245
39	27.37	27.81	28.25	95	3.840	3.978	4.121
40	26.29	26.72	27.16	96	3.726	3.861	4.001
41	25.24	25.67	26.10	97	3.616	3.748	3.885
42	24.25	24.67	25.09	98	3.509	3.639	3.773
43	23.31	23.72	24.14	99	3.407	3.534	3.665
44	22.41	22.81	23.22	100	3.308	3.432	3.560
45	21.53	21.93	22.33	101	3.212	3.333	3.459
46	20.71	21.10	21.50	102	3.119	3.238	3.361
47	19.92	20.30	20.69	103	3.030	3.146	3.267
48	19.056	19.54	19.92	104	2.942	3.056	3.174
49	18.44	18.81	19.058	105	2.858	2.970	3.086
50	17.75	18.11	18.48	106	2.778	2.887	3.000
51	17.08	17.44	17.80	107	2.699	2.806	2.917
52	16.44	16.79	17.14	108	2.623	2.728	2.837
53	15.84	16.18	16.53	109	2.549	2.652	2.758
54	15.26	15.59	15.883	110	2.479	2.579	2.683
55	14.69	15.02	15.35				

Other temperature sensors(5K) **Outdoor ambient（T4）/coil(T3)/TH /T1/T2 temperature sensor**

T (ºC)	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)	T (ºC)	Rmin (KΩ)	Rnom (KΩ)	Rmax (KΩ)
-15	25.017	25.660	26.297	30	4.126	4.176	4.226
-14	23.908	24.520	25.110	31	3.981	4.031	4.081
-13	22.857	23.430	23.985	32	3.842	3.892	3.942
-12	21.859	22.390	22.918	33	3.709	3.759	3.808
-11	20.912	21.410	21.907	34	3.581	3.631	3.680
-10	20.013	20.480	20.947	35	3.459	3.508	3.557
-9	19.0546	19.590	20.023	36	3.340	3.389	3.438
-8	18.322	18.740	19.0546	37	3.226	3.275	3.323
-7	17.540	17.930	18.314	38	3.117	3.165	3.213
-6	16.797	17.160	17.524	39	3.012	3.060	3.107
-5	16.090	16.431	16.773	40	2.912	2.959	3.006
-4	15.418	15.739	16.060	41	2.815	2.861	2.908
-3	14.779	15.080	15.382	42	2.722	2.768	2.814
-2	14.170	14.454	14.737	43	2.633	2.678	2.724
-1	13.591	13.857	14.124	44	2.547	2.592	2.637
0	13.040	13.290	13.540	45	2.464	2.509	2.553
1	12.505	12.739	12.974	46	2.385	2.429	2.473
2	11.995	12.215	12.436	47	2.308	2.352	2.395
3	11.509	11.717	11.924	48	2.235	2.278	2.321
4	11.047	11.241	11.436	49	2.164	2.207	2.249
5	10.606	10.789	10.971	50	2.096	2.138	2.180
6	10.186	10.357	10.529	51	2.030	2.071	2.112
7	9.785	9.946	10.107	52	1.966	2.006	2.047
8	9.403	9.554	9.705	53	1.904	1.944	1.984
9	9.028	9.180	9.322	54	1.844	1.884	1.923
10	8.690	8.823	8.956	55	1.787	1.826	1.865
11	8.357	8.482	8.607	56	1.732	1.770	1.809
12	8.040	8.157	8.274	57	1.679	1.717	1.754
13	7.736	7.846	7.957	58	1.628	1.665	1.702
14	7.446	7.550	7.653	59	1.579	1.615	1.652
15	7.169	7.266	7.363	60	1.531	1.567	1.603
16	6.900	6.991	7.082	61	1.485	1.521	1.556
17	6.644	6.729	6.814	62	1.441	1.476	1.511
18	6.398	6.478	6.558	63	1.399	1.433	1.467
19	6.163	6.238	6.313	64	1.357	1.391	1.425
20	5.938	6.008	6.078	65	1.318	1.351	1.384
21	5.723	5.789	5.854	66	1.279	1.312	1.344
22	5.517	5.578	5.640	67	1.242	1.274	1.306
23	5.320	5.377	5.434	68	1.206	1.237	1.269
24	5.131	5.185	5.238	69	1.171	1.202	1.233
25	4.950	5.000	5.050	70	1.137	1.168	1.199
26	4.771	4.821	4.871	71	1.105	1.135	1.165
27	4.599	4.649	4.699	72	1.074	1.103	1.133
28	4.434	4.485	4.535	73	1.043	1.072	1.101
29	4.277	4.327	4.377	74	1.014	1.043	1.071