

Refrigeration, Air-Conditional & Heating Trainers



RAHT-3000 Refrigeration, Air-conditional & Heating Training System (High-Grade Refrigerator & Air-Conditional)

The Refrigeration, Air-Conditional & Heating Training System is designed for universities & colleges, higher vocational education schools, secondary technical & vocational schools. It is composed of heat-pump split air-conditioner and refrigerator, can fulfill experiments such as refrigeration, heating, dehumidification, automatic ventilation of air-conditioner and refrigeration of refrigerator.

This equipment can let students know refrigeration, air-conditional & heating principle and structure of refrigeration, air-conditional & heating equipments, in addition, over 30 common fault experiments are added to improve students of manipulation skills when learning theories.

Introduction:

This equipment is suitable for teaching, experiments, tests, and appraisal of courses about "refrigeration, air-conditional & heating" in all kinds of universities and colleges, secondary technical schools, vocational schools.

To make the complicated structure simplified and to make students understand & master the complete structure of refrigerator and air-conditioner, after a lot of experiments & demonstrations, we adopt horizontal structure, air-conditioner adopts the structure of heat-pump split, refrigerator is the combination of refrigerated type & wind-cooling type.

To make students master the principle and features of refrigeration structure easily, equipment & pipeline adopts axial extension with clear gradation, different pipelines are differentiated by 3 colors, high-pressure pipeline is red, low-pressure liquid supply pipeline is blue, low-pressure muffler pipeline is yellow.

Two evaporation cases are adopted in refrigerator part: one is refrigerated type, and one is wind-cooling type, driven by one compressor, switched by two electromagnetically operated valves. The refrigerated type mainly demonstrates the basic principle & features of refrigerator, while the wind-cooling focuses on structure & defrosting principle.

The evaporation case adopts organic glass housing, transparent & direct viewing for observation.

To make students understand the refrigeration principle more deeply, we also provide air-conditioner thermodynamic system flow chart board to demonstrate flow of refrigeration, heating, 4-way valve, fluorine reclaiming, discharging and refrigeration principle.

Features

1. There are second capillary and single-way valve on high-pressure liquid supply pipe to reveal the structure and principle of air-conditioner completely.
2. Refrigerator is the combination of refrigerated type & wind-cooling type
3. Can set sundries block & ice block faults in refrigeration system.
4. Can set 30 fault points

Technical Specification

1. Air-conditioner refrigerating compressor, input power : 600W rated current : 3.2A
refrigerant : R22
2. Refrigerator refrigerating compressor, input power : 95W rated current : 0.1A
refrigerant : R12
3. Air-conditioner working pressure : (according to operating condition) range : condensation pressure:
1.4 To 2.0Mpa evaporation pressure: 0.4 To 0.6Mpa
4. Refrigerator working pressure : (according to operating condition) range : condensation pressure: 0.7
To 1.2Mpa evaporation pressure: 0.04 To 0.07Mpa
5. Weight : 180Kg
6. Dimension : length*width*height=1525*755*1435 (mm)
7. Operating environment:
Temperature : -5°C To 40°C
Relative humidity : 25% To 95%
Atmospheric pressure : 86KPa ~ 106Kpa

Remote Controller Specification

1. Start of air-conditioner:
 - 1.1 See diagram-1, press "ON/OFF", air-conditioner will start, press it again, air-conditioner will stop.
 - 1.2 Air-conditioner will delay for 3 minutes from stop to start, if you press this button 2 times continuously, compressor will wait for 3 minutes before start again.
 - 1.2.1 This equipment has 2 delay protection switches, one is on computer control board, another is on installed additionally, computer control board can't satisfy needs of faults setting on K[5], K[6], K[8], K[16], K[18], so we need to install another delay circuit.
2. Air-conditioner operation modes setting:
 - 2.1 Setting methods: See diagram-2, press "mode" to set an operation mode, press again to set another operation mode, altogether 4 operation modes can be set: Refrigeration, dehumidification, heating and automatic temperature sensing.
 - 2.2 Automatic temperature sensing: in refrigeration mode, computer control board will set temperature to 24°C, when outlet temperature of evaporator is equal or below 24°C, air-conditioner will stop automatically, above 24°C, it will start automatically. Here remote controller doesn't work.
 - 2.3 Dehumidification: in this mode, air-conditioner is in refrigeration mode, but wind supply system works at low speed, or doesn't work in order to dehumidify air.
 - 2.4 Refrigeration: in this mode, temperature is set within range of 18°C -32°C.
 - 2.5 Heating: in this mode, temperature is set within range of 18°C - 32°C, when temperature of evaporator pipes is below 30°C, indoor fan won't work, when temperature of evaporator pipes is within range of 30°C - 40°C, indoor fan only can work with low speed, can't be controlled by "Wind speed" button, when temperature of evaporator pipes is within range of 40°C -50°C, indoor fan can be controlled by "Wind speed" button, when temperature of evaporator pipes is above 50°C, indoor fan only can work with high speed, can't be controlled by "Wind speed" button.
 - 2.6 Operation modes can be displayed on operation modes display pane.
3. Temperature setting: See diagram-1

- 3.1 Setting methods: there are 2 temperature regulation buttons to regulate indoor temperature. Press "Temperature setting button-1" each time, temperature will rise by 1°C up to 32°C, press "Temperature setting button-2" each time, temperature will drop by 1°C down to 18°C.
- 3.2 When setting temperature, all temperature set will be displayed on "Temperature display" pane, so you can see temperature displayed to know temperature set.
- 3.3 Purpose: mainly to regulate indoor temperature according to needs. For example, when you set temperature to 25°C in refrigeration mode, when outlet temperature of evaporator reaches 25°C, compressor will stop, when outlet temperature of evaporator is above 25°C, compressor will start to refrigerate. In fact, inlet temperature of evaporator is used to decide what temperature is, here, the purpose for us to set in such a way let students observe temperature sensors and principle of temperature regulation conveniently, inlet of evaporator is behind the air-conditioner, so it isn't convenient for students to observe. Teacher should explain such a point to students.
- 3.4 Temperature regulation range is 18°C - 32°C.
- 3.5 In automatic temperature sensing mode, "Temperature setting" buttons don't work.
4. Wind speed setting: See diagram-2
- 4.1 There is a "Wind speed" button on remote controller for outlet wind speed setting of evaporator. Altogether 4 stages: automatic, low speed, middle speed, high speed. Wind speed types can be displayed on "Wind speed display" pane, see diagram-1 and diagram-3.
- 4.2 In automatic status, computer control board can decide speed of wind supply according to outlet temperature, pipes temperature, operation modes.
- 4.3 Indoor fan uses resistors for speed regulation, no resistors on motor when working with high speed, serial connected with a 700ohm resistor when working with middle speed, serial connected with a 1.2Kohm resistor when working with low speed.
5. Timing ON/OFF.
- 5.1 Press "Timing on" button to set timing start, press "Hour" button to set hour of start, press "Minute" to set minute of start. And time set is displayed in "Time display" pane.
- 5.2 Press "Timing off" button to set timing stop, press "Hour" button to set hour of start, press "Minute" to set minute of start. And time set is displayed in "Time display" pane.
6. Time regulation:
- 6.1 Press "Clock" button to regulate time, press "Hour" button to regulate hour, and press "Minute" to regulate minute, time regulated is displayed on "Time display" pane, when finished, press "Clock" button to return to common status.
7. "Swing" and "Wind direction" buttons are of no use on this equipment.

Faults Setting Phenomena Detection Method

NO.	Faults	Setting	Phenomena	Detection method	Remark
A[1]	Power supply open circuit	A[1] off	Circuit can't work	Measure AC voltage between (13) & (14)	
A[2]	Overload protector open circuit	A[2] off	Compressor COM can't work	Measure AC voltage between (20) & (14)	
A[3]	Wind-refrigerating fan motor M2 can't work	A[3] off, disconnect winding	Wind-refrigerating fan motor M2 can't work	Measure DC resistance between (11) & (3)	Turn power & switch (1) off
A[4]	PTC starter short circuit	A[4] on	Compressor COM start current is too high, can't operate normally		Demonstration
A[5]					
B[1]	Bulb D filament open circuit	B[1] off	Bulb can't work	Check open-close between (13) & (16)	Turn power off
B[2]	Gate switch DK contacts don't close	B[2] off	Bulb D can't work	Check open-close between (16) & (14)	Turn power off

B[3]	Temperature controller WK open circuit	B[3] off	Compressor COM can't work	Measure AC voltage between (18) & (14)	
B[4]	System jam	B[4] off	Low-pressure meter returns to zero, high-pressure meter drops, operating current drops, evaporator frosts	Observe pressure meter, ammeter to judge frosting of evaporator	
B[5]	System ice jam	B[5] on	Low-pressure meter returns to zero, high-pressure meter drops, operating current drops, evaporator frosts, 3 minutes later become normal, 3 minutes later faults appear again, all cycles.	Observe pressure meter, ammeter to judge frosting of evaporator	
C[1]	Defrosting timer CHSH motor open circuit	C[1] off	Defrosting timer CHSH can't time and defrost	Measure DC resistance between (1) & (7), about 8K if normal	Turn power off
C[2]	Temperature fuse Fu open circuit	C[2] off	Can't defrost	Check open-close between (7) & (5)	
C[3]	Heating pipe JR1 & JR2 short circuit	C[3] off	Can't defrost	Measure DC resistance between (5) & (3)	Turn power off
C[4]	Defrosting timer open circuit	C[5] off	Compressor COM can't work	Check open-close between (1) & (11)	
C[5]	Defrosting temperature controller JSHP short circuit	C[5] on	Temperature fuse Fu open circuit	Measure DC resistance between (9) & (7)	Turn power off

Table 3: RAHT-3000 Faults setting and detection methods:

	NO.	Faults	Setting	Phenomena	Detection method	Remark
Faults setting switches	K[1]	Rectification diode open circuit	K[1] off	Electric control doesn't work	Measure DC voltage between (6) & (4)	
	K[2]	7812 Voltage regulator tube open circuit	K[2] off	Electric control doesn't work	Measure DC voltage between (7) & (4)	
	K[3]	Indoor fan FM overheat protection open circuit	K[20] off	Electric control doesn't work	Measure AC voltage between (8) & (2)	
	K[4]	Transformer B first-stage coil open circuit	K[4] off	Electric control doesn't work	Measure DC resistance between (8) & (2)	Turn power off, about 485ohm if normal
	K[5]	Low-voltage protection relay open circuit	K[5] off	Compressor COM & outdoor fan don't work	Check close-open on (9) & (17)	Turn power off
	K[6]	High-voltage protection relay open circuit	K[6] off	Compressor COM & outdoor fan don't work	Check close-open on (17) & (10)	Turn power off
	K[7]	Remote control receiver +5V open circuit	K[7] off	Remote controller doesn't work	Measure DC voltage between (11) & (4)	
	K[8]	Main relay JZ contact open circuit	K[8] off	Compressor COM & outdoor fan don't work	Measure AC voltage between (18) & (2)	
	K[9]	Indoor fan relay JF1 contact open circuit	K[9] off	Indoor fan FW doesn't work	Measure AC voltage between (15) & (2)	

K[10]	4-way switch electromagnetic valve relay JS contact open circuit	K[10] off	No heating	Measure AC voltage between (14) & (2)	
K[11]	4-way switch electromagnetic valve STE coil open circuit	K[11] off	No heating	Measure DC resistance between (14) & (2)	1.5k if normal
K[12]	Thermistor Rt open circuit	K[12] off	See Atten (2)	Measure DC resistance between (13) & (12)	No temperature display, DV=5V
K[13]	Thermistor Rt short circuit	Bridging K[13]	See Atten (2)	Measure DC resistance between (13) & (12)	No temperature display, DV=0V
K[14]	Indoor fan capacitor C1 open circuit	Unavailable			
K[15]	Compressor COM inhaling & exhausting fault (system fault)	K[15] off	Low high-pressure, high low-pressure	Observe High-pressure & low-pressure meter	
K[16]	Overheat & overload protector JI open circuit	K[16] off	Compressor COM can't work	Measure AC voltage between (20) & (2)	
K[17]	Compressor capacitor C2 open circuit	K[17] off	Compressor COM can't start		Demonstration
K[18]	Compressor COM winding open circuit (Winding between C & R)	K[18] off	Compressor COM can't start	Measure DC resistance between (20) & (2), it is infinity for fault, K[21] in normal position	Disconnect outdoor fan, overheat & overload protector, or R=380Ω, close K[18], R=6Ω
K[19]	Condensing fan FW open circuit	K[19] off	Condensing fan FW can't work	Measure DC resistance between (18) & (2)	Set K[16] to fault position
K[T]	Voltage-dependent resistor Rt broken down	K[20] off	Fuse F2 burnt	Measure DC resistance between (8) & (2)	K[20] is in fault position