

Operation Manual



BFBT-102-A

Freeze Dryer

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01 Summary

The vacuum freeze-drying technology, which is also called sublimation drying, is a technical method that freezes the samples in advance, and then sublimates its moisture in the vacuum state. Products are easier for long-term preservation after freeze-drying processing. They can be restored to the original state and maintain their chemical and biological characteristics after being watered. So the freeze-drying technology is widely used in medicine, food, chemistry industry and biological products etc.

02 Characteristics and Technical Parameters

1. Main characteristics

- (1) SECOP compressor, refrigeration process is rapid and condenser temperature is low.
- (2) LCD screen control system, simple operation and good function.
- (3) The control system automatically stores data, and data can be viewed in form of curves. Whole freeze-drying process is clear.
- (4) The drying chamber uses the transparent organic glass drum. So you can clearly view sample state and observe the whole freeze-drying process.
- (5) The vacuum pump is connected with host by international standard KF quick joint.
- (6) Performance of machine is stable, easy to operate .

2. Technical parameter

- (1) Minimum condenser temperature: -55°C (no-load)
- (2) Final vacuum: $< 10\text{Pa}$ (no-load)
- (3) Tray size: diameter of tray is 180mm, 3 layers;
- (4) Liquid bulk capacity: 800ml (10 mm thickness)

03 Conditions in Use

1. Ambient temperature in normal working condition: 10°C - 25°C .

Relative humidity: $\leq 70\%$.

Power supply: $220\text{V}\pm 10\%$, 50Hz, single phase

The working environment should be no conductive dust, no explosive and corrosive gases and no strong electromagnetic interference.

2. Transport and storage conditions

Environment temperature: $-40^{\circ}\text{C}\sim 50^{\circ}\text{C}$.

Relative humidity: $\leq 93\%$.

The storage conditions should be well-ventilated, no corrosive gases.

04 Installation and Preparations for Freeze-drying

1. Structure of freeze dryer and name of partition

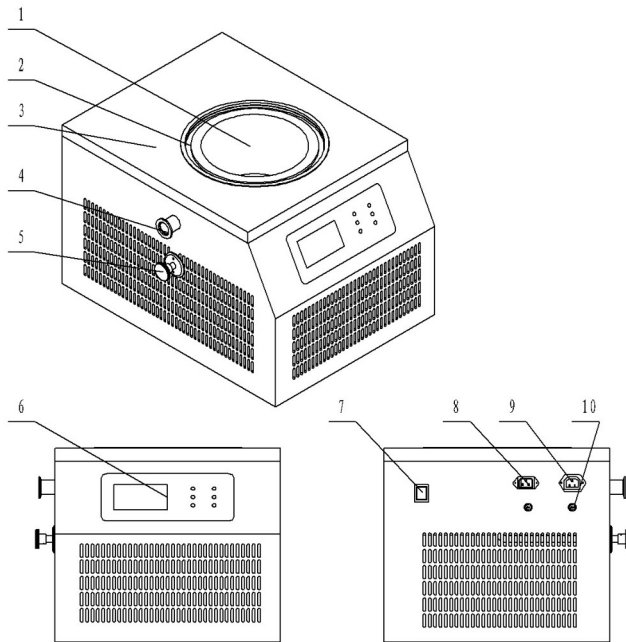


Figure 1-1 Structure of host

- | | | |
|---------------------|---------------------------------|-----------------|
| 1、condenser | 2、sealed ring | 3、workbench |
| 4、vacuum port | 5、drain valve (air inlet valve) | |
| 6、control panel | 7、switch | 8、general power |
| 9、vacuum pump power | 10、fuse | |

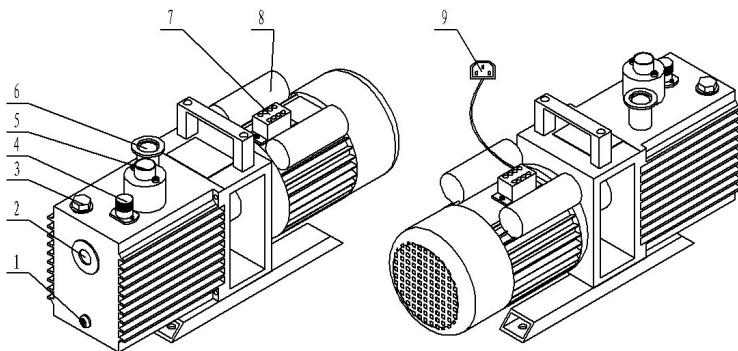


Figure 1-2 structure of vacuum pump

- | | | |
|-----------------------|-------------------|--------------------------|
| 1、oil drain | 2、oil level glass | 3、oil filler hole |
| 4、gas ballast valve | 5、exhaust port | 6、air inlet |
| 7、connecting terminal | 8、capacitor | 9、vacuum pump power cord |

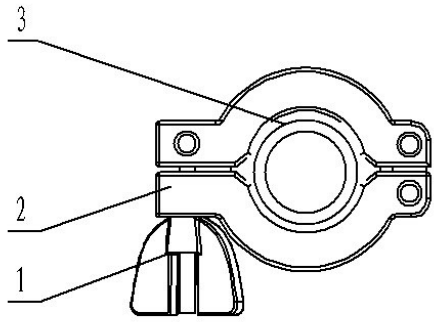


Figure 1-3 structure of clamp

1、screw nut 2、support 3、gasket ring

2.Installation of freeze dryer

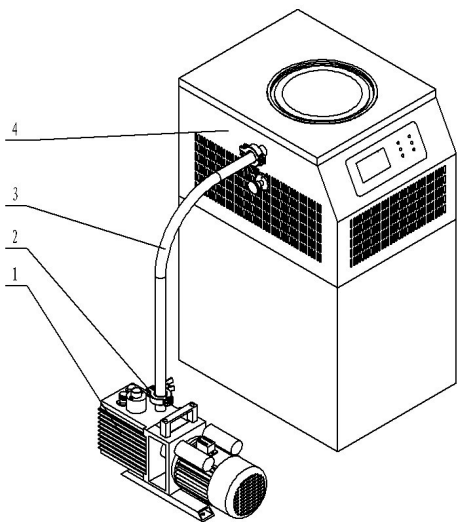


Figure 1-4 connection of the device

1、vacuum pump
2、clamp
3、tube that connects host with vacuum pump
4、host

Installation steps:

- 1) Check accessories complete and undamaged after unpacking box;
- 2) Add vacuum pump oil to middle of level glass
- 3) Connect the air inlet on pump and tube by clamp; the other end of tube connected with vacuum port on host;
- 4) Connect "vacuum pump power cord" with "vacuum pump power "interface on host;
- 5) The general power line is connected to power supply 220V,50Hz,single phase
- 6) Turn on switch and test parameter of freeze dryer (vacuum degree<10Pa, Minimum condenser temperature -55°C).Then the device is put into use.

3. Test of freeze dryer

• Test of condenser temperature

- 1) Cover the pre-freeze lid
- 2) Turn on switch, to enter control system. Touch the screen, to go to main interface. Press “compressor” to turn on compressor to test refrigeration.
- 3) Condenser temperature drops to -55°C within 60 minutes, test is OK.

• Test of vacuum degree

- 1) Press “vacuometer ” to turn on vacuum gauge, standard atmosphere is displayed;
- 2) Put on sealed ring
- 3) tighten the air inlet valve
- 4) place organic glass drum, drum bottom full contact with sealed ring.
- 5) Turn on vacuum pump by touching “vacuum pump”. vacuum degree rapidly decline.
- 6) Vacuum degree goes down below 10 Pa within 10 minutes, test is ok.
- 7) After finishing tests, open air inlet valve on host to inflate host and restore normal pressure. Then the machine is ready for running.

Notices:

1. There are no obstructions behind and at sides of host within 30cm;
2. Make sure that the vacuum pump oil has been filled before starting up.

05 Operation of Pre-freezing and Drying Process

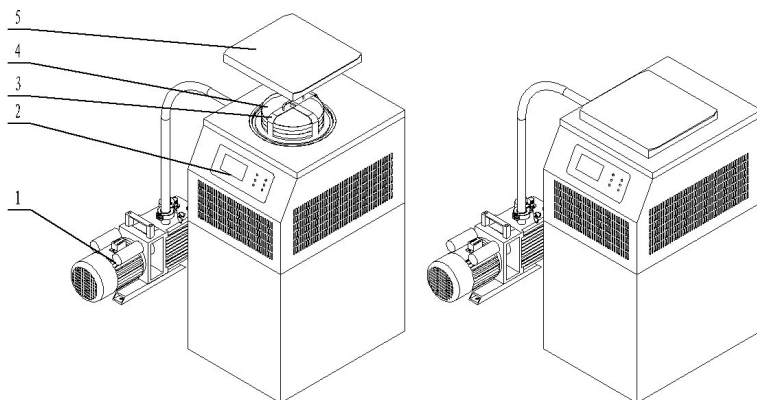


Figure 1-5 pre-freezing process

- 1、vacuum pump 2、control panel 3、pre-freeze shelf
4、material tray 5、pre-freeze lid

The general pre-freezing process with steps:

(If you have low-temperature refrigerator, this process may be skipped.)

1. Turn on machine and start compressor. When condenser temperature drops below -40°C , you begin to freeze material ;

2. Put material into tray (liquid directly into tray, solid material and vials evenly put on tray);
3. Put material tray into pre-freeze shelf and put the temperature sensor into material with full touch, to reduce error of sample temperature and actual temperature;
4. Put pre-freeze shelf into condenser;
5. Cover the pre-freeze lid;
6. When temperature of all parts of material drop below eutectic point, this condition will be still keeping about one hour. Then pre-freezing process is over and ready to make drying process.

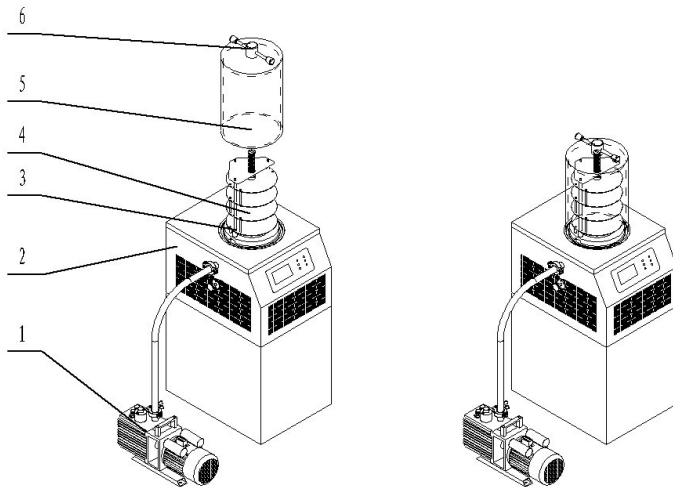


Figure 1-6 drying process

- | | | |
|----------------|-----------------|---------------------|
| 1. vacuum pump | 2. host | 3. drying shelf |
| 4. tray | 5. acrylic drum | 6. top press handle |

Drying process with steps:

1. Take out the material from condenser and put trays on drying shelf;
2. Put the drying shelf on condenser (as shown in above diagram); Put temperature sensor into material. Please note that sensor should be taken out through half round hole reserved at side of flange, in order to prevent damage by drying shelf
3. Check sealed ring intact and without raffle, put on acrylic drum;
- The bottom of drum should be completely in touch with "O" sealed ring.
4. Tighten the air inlet valve on host in clockwise;
5. Turn on vacuum pump and vacuum gauge by touching "vacuum pump" and "vacuometer" on main interface. The vacuum degree declines. It's normal that the vacuum degree is less than 20Pa during drying process;
6. Drying time is different for material property. Generally speaking, material should be dry when material temperature reach room temperature.
7. When drying process is over, first open air inlet valve to inflate host, then turn off vacuum pump by touching "vacuum pump" . Touch "vacuometer" button, the vacuum degree display will vanish. Then, Turn off compressor by touching "compressor" button.

Note: If material is loaded in vials, turn top press handle clockwise, to seal vial at vacuum state. Then open air inlet valve to inflate host.

8. Take off acrylic drum and collect dried material.

9. Close drain valve, machine begins to defrost. After finishing defrosting, open drain valve to drain water. Clean the equipment.
10. When the vacuum pump does not work, please cover the exhaust port to prevent dust.

Notice:

1. Compressor can not be turned off in whole freeze drying process;
2. For different materials, freezing time and drying time are not the same, because of differences in material properties.

06 Turn Off Machine Operation

1. Turn off power switch;
2. Unplug the power cord;
3. Clean condenser, drying shelf and acrylic drum and other parts;
4. When vacuum pump does not work, please cover exhaust port to prevent dust entering.

07 Control System Operation

The control system uses LCD touch screen display, easy to operate and the running status is clear. The system displays sample temperature curve, condenser temperature curve and vacuum degree curve. System adopts a variety of stable measures so that control system runs stable and reliable.

The control system contains following display screens:

1. Turn on switch, system goes into initial interface. Touch the screen center, it enters main interface.



Figure 1: initial interface

2. On main interface, touch "compressor", compressor starts to work. Touch "vacuum pump",

pump starts to work. Touch “vacuometer”, vacuum degree displays. Touch “Real-time curve” for curves check. “History record” for earlier data check.



Figure 2: main interface

3. Touch “real-time curve”, to enter real-time curve interface.

On right side, there are “sample”, “condenser” and “vacuum” buttons to control relative curves.



Figure 3: “real-time curve” interface

4. Click “history record” on main interface, it goes into “history select” interface. User can choose specific file, to check this curve, delete it or output it to U flash disk.



Figure 4: “history select” interface

5. Click “confirm” on “history select” interface, user can see “history curve” interface.

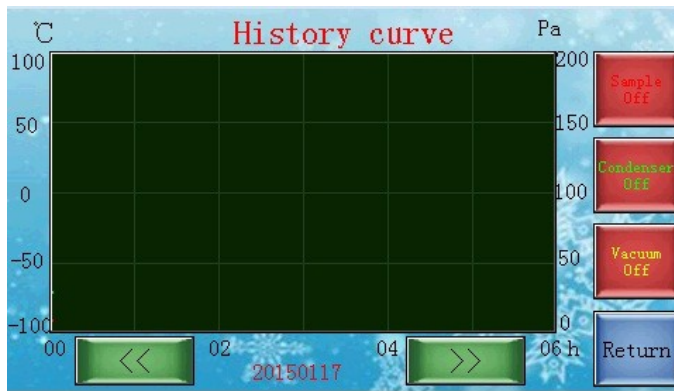


Figure 5: “history curve” interface

6. Click “Delete” button on “history select” interface. Selected file can be removed.



Figure 6: “Delete” interface

7. Click “export to USB” button on “history select” interface. (U disk capacity should be less than 8G) . User needs to insert U disk in advance, then turn on switch to export data. Data can be checked by Excel format.



Figure 7: “export to USB” interface

8. System time set

Please press system time place for some seconds, then you can see a system time set screen.

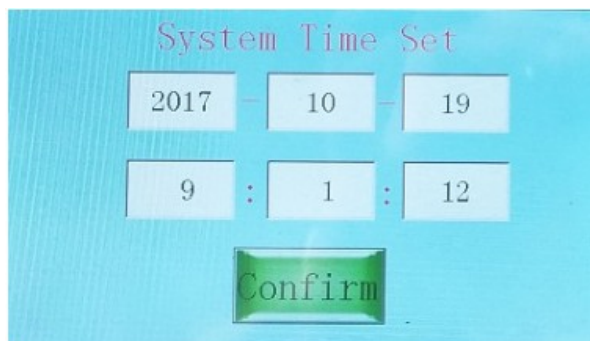


Figure 8 : system time set

08 Notices

- 1.The vacuum pump should be put on ground so that it maintains a certain height difference with host (at least 50cm), to prevent oil return if power is suddenly off. If power off, you should open air inlet valve to inflate the host, take out the samples as soon as possible and properly store samples.
- 2.Working environment temperature should be $\leq 25^{\circ}\text{C}$. Humidity should be $\leq 70\%$.
- 3.When turn off the machine, user should slowly open air inlet valve to inflate host first, then turn off vacuum pump to prevent oil return and sample pollution.
- 4.The acrylic drum is connected with host by "O" sealed ring.
Sealed ring should be kept clean, without organic solvent cleaning; acrylic drum's touch end with sealed ring should be protected from strike and damage.
- 5.Grounding power socket must be used.
- 6.The vacuum pump oil should be replaced regularly after working 200 hours continuously.
- 7.Please don't frequently turn on and turn off power supply and compressor. If compressor stops working because of wrong operation, user needs to restart the compressor after waiting for at least 3 minutes.

09 Common Breakdown and Elimination

1.The vacuum degree can not achieve below 15Pa.

- (1) Check connection between vacuum pump and host, to make sure clamp is tight
- (2) Check whether bottom of acrylic drum is clean , any damage on touch surface
- (3) Check whether the “O” sealed ring is clean , whether its placement is correct.
- (4) Check whether the vacuum pump works normally and whether the pump oil is clean .
- (5) Check whether the air inlet valve is closed tightly

2.High condenser temperature

Ambient temperature is too high, leading to bad heat dissipation. Please place the machine in proper environment with well ventilated condition.



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