

StonyLab[®]

Freeze Dryer

Operation Manual

(Please read the instruction carefully before you use the machine)

Contents

1. Overview	1
2. Features and Technical Specifications	1
2.1 Product Features	1
2.2 Technical Specifications	2
3. Operating Conditions	2
3.1 Normal Operating Conditions	2
3.2 Transportation and Storage Conditions	2
3.3 Safety Classification	3
4. Instrument installation and Pre-freezing	3
4.1 Installation	3
4.2 Pre-freezing	3
5. Vacuum Drying	4
5.1 Standard Configuration	4
5.2 Stoppering Configuration	5
5.3 Manifold Configuration	5
6. Shutdown Procedure	6
7. Control Interface Overview	6
8. Precautions	7
9. Common Faults and Troubleshooting	8
9.1 No-load Vacuum ≥ 10 Pa	8
9.2 Vacuum Pump Oil Leakage	8
9.3 Device Fails to Power On	9
9.4 High Cold Trap Temperature	9
9.5 Vacuum Pump Fails to Start	9
10. Quality Assurance	9

1. Overview

Vacuum Freeze-Drying Technology, also known as sublimation drying, is a method where moisture-containing materials are pre-frozen and then subjected to a vacuum environment, allowing the ice to sublime directly into vapor.

Materials processed via freeze-drying retain their original biological and chemical properties and are suitable for long-term storage. Upon rehydration, the substance returns to its pre-lyophilized state while maintaining its original biochemical characteristics. Consequently, freeze-drying technology is extensively utilized in pharmaceuticals, food processing, chemical engineering, and the production of biological products.

The FreezeDryer-3 L freeze dryer is available in 4 configurations:

- Standard Drying Configuration - Materials are pre-frozen on trays and then dried.
- Stoppering Configuration - Vials containing the material are pre-frozen and dried. After drying is complete, the vial stoppers are manually pressed in under vacuum, providing an effect equivalent to vacuum sealing.
- Manifold Drying Configuration - Materials are pre-frozen in dedicated bottles and connected to the freeze-drying chamber via rubber valves. During the freeze-drying process, bottles can be replaced at any time by opening or closing the valves. Different types of materials can be freeze-dried simultaneously. Up to eight dedicated bottles of different volumes can be connected at the same time, resulting in high drying efficiency.
- Manifold Stoppering Drying Configuration - A hybrid system that combines the advantages of both internal and external processing. It allows for the drying and stoppering of vials inside the chamber while simultaneously supporting external flask drying via the manifold. This configuration maximizes overall operational throughput.

2. Features and Technical Specifications

NOTE: Upon delivery, please ensure the unit is placed upright and remains stationary for 6–8 hours before initial operation.

2.1 Product Features

- (1) The system employs compressor-based refrigeration, providing rapid cooling and low freezing temperatures.
- (2) A LCD display shows temperature and vacuum level, with curve visualization for accurate and intuitive monitoring.

- (3) The drying chamber is equipped with a clear, colorless acrylic (organic glass) cover, allowing unobstructed observation of the entire freeze-drying process.
- (4) The vacuum pump is connected to the main unit via an international standard KF quick connector, ensuring a simple and reliable connection.
- (5) The unit features stable performance, easy operation, and low noise.
- (6) Electric defrosting accelerates defrosting and shortens the overall production cycle.

2.2 Technical Specifications

- (1) Cold Trap Temperature: -60°C (no load), or -80°C (no load).
- (2) Ultimate Vacuum: Below 10 Pa (no load).
- (3) Drying Capacity (Standard Type): Equipped with 4 material trays (diameter: $\phi 200$ mm). Total capacity of 1250 ml for bulk material (at a material thickness of 10 mm), or accommodates 256 vials.
- (4) Drying Capacity (Stoppering Type): Equipped with 3-layer material trays (diameter: $\phi 200$ mm). Accommodates 190 vials.

3. Operating Conditions

3.1 Normal Operating Conditions

- (1) Ambient Temperature: 10°C to 26°C.
- (2) Relative Humidity: $\leq 70\%$.
- (3) Power Supply: Single-phase 220 V $\pm 10\%$, 50 Hz.
- (4) The operating environment must be free of conductive dust, explosive or corrosive gases, and strong electromagnetic interference.

3.2 Transportation and Storage Conditions

- (1) Ambient Temperature: -40°C to 50°C.
- (2) Relative Humidity: $\leq 93\%$.
- (3) The storage environment should be well ventilated and free of corrosive gases.

3.3 Safety Classification

(1) Classification: Class I, Type B.

4. Instrument installation and Pre-freezing

4.1 Installation

(1) Vacuum Connection: The vacuum pump and the main unit are connected via a vacuum-rated pressure hose. Both ends utilize standard quick-release clamps. Ensure a rubber sealing ring is properly seated within each clamp before securing the connection.

(2) Power Connection: Locate the "Main Power" socket on the rear panel of the main unit. Insert the power cord into this socket and connect the other end to a grounded power supply. The "Vacuum Pump" power socket is located adjacent to the main power socket; plug the vacuum pump power cord directly into this designated outlet.

(3) Vacuum Pump Inspection: Please read the vacuum pump "Instruction Manual" thoroughly before operation. Inspect the pump to confirm it is filled with the appropriate vacuum pump oil. Do not operate the pump without oil. The oil level must not fall below the centerline of the sight glass. Ensure the gas ballast valve is tightly closed.

(4) Sealing and Assembly: Ensure the O-ring on top of the cold trap, the manifold adapter (transition plate), and the glass cylinder gaskets are clean and correctly positioned. Place the acrylic (Plexiglass) bell jar securely over the assembly.

(5) System Initialization: Toggle the "Main Power" switch on the rear panel to the "ON" position to energize the control system. On the interface, tap "Enter System".

(6) Pre-cooling: Press the "Cool" button on the touchscreen to activate the cooling system. The host pre-cooling process will begin.

NOTE: Allow the machine to run for 30-60 minutes before loading samples.

4.2 Pre-freezing

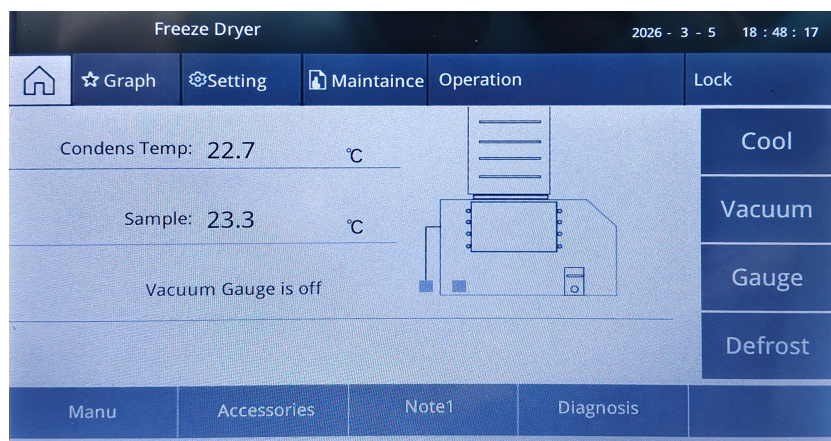
(1) Standard Configuration: Place the material into the product trays, then load the trays onto the pre-freezing rack. Finally, lower the pre-freezing rack into the cold trap.

(2) Stoppering Configuration: Dispense the material into vials, then place the vials into the product trays. Load the trays onto the pre-freezing rack and place the

assembly into the cold trap.

(3) **Manifold Configuration:** Transfer the material into the selected drying flasks. Place the flasks into a low-temperature freezer (below -40°C). If possible, it is highly recommended to use a rotational pre-freezing method (shell freezing) to ensure the material freezes uniformly against the flask wall. This increases the surface area and facilitates a more efficient sublimation process.

NOTE: The pre-freezing duration is typically between 4 and 6 hours, ensuring the product reaches a completely solidified state.



5. Vacuum Drying

5.1 Standard Configuration

(1) Remove the pre-frozen trays from the cold trap and promptly place them onto the drying rack. Position the drying rack above the cold trap, then install the acrylic chamber cover. Ensure that the lower edge of the cover makes full contact with the O-ring seal.

(2) Confirm that the black valve on the side panel is closed (the valve is open when the arrow points toward the drain outlet; it is closed when the arrow points away from the drain outlet). Press the "Vacuum" and "Gauge" buttons to start the vacuum pump. The displayed vacuum level will decrease rapidly. A vacuum level below 15 Pa is considered normal, and the freeze-drying process begins.

NOTE: To reduce the risk of oil backflow into the system, the vacuum pump should be placed at a level lower than the main unit.

(3) After approximately 24 hours, when the material appears to be completely dried, open the side black valve to vent the system. Then press the "Vacuum Pump" and "Gauge" buttons to stop the vacuum pump, and turn off the "Cool" function.

(4) Remove the acrylic cover, take the trays off the drying rack, and package the

dried material. The drying process for the standard configuration is now complete.

(5) Place a suitable container beneath the side drain outlet and press “Defrost” to allow the ice in the cold trap to melt and drain.

NOTE: All water and ice must be completely removed before the next operation. The defrost function should be stopped after 30-60 minutes.

5.2 Stoppering Configuration

(1) Place the pre-frozen vials (on trays) into the stoppering drying rack. Position the rack above the cold trap and install the stoppering acrylic cover. Ensure that the lower edge of the cover fully contacts the O-ring seal.

(2) Confirm that the side black valve is closed (see valve orientation description above).

Press the “Vacuum” and “Gauge” buttons. The vacuum level will decrease rapidly. When it reaches below 15 Pa, freeze drying begins.

(3) After approximately 24 hours, when the material appears completely dried, rotate the handle on top of the acrylic cover. This drives the threaded mechanism of the stoppering assembly, lowering the stoppering plate and pressing the stoppers into the vials, thereby completing stoppering under vacuum.

(4) Vent the chamber, stop the vacuum pump, remove the acrylic cover, take out the vials for storage, and drain the meltwater. (Refer to the standard configuration for the cover removal procedure.)

5.3 Manifold Configuration

(1) Install the drying rack or stoppering drying rack above the cold trap. Load the material to be freeze-dried onto the rack, then install the manifold acrylic cover or manifold stoppering acrylic cover (models 10 N and 12 N are split-type; model 18 N is an integrated type).

(2) Remove the flask-shaped drying bottles from the low-temperature freezer. Fit each bottle with a standard manifold rubber valve, insert the valve stem into the bottle neck, and rotate the valve wing so that it points vertically downward. This connects the interior of the bottle to the chamber. (For wide-mouth bottles, use the appropriate adapter.)

(3) Confirm that the side black valve is closed (see valve orientation description above). Press the “Vacuum” and “Gauge” buttons to start evacuation. When the vacuum level drops below 15 Pa, freeze drying begins. During freeze drying, if it is necessary to replace a drying bottle or remove a bottle that has already completed drying, rotate the valve wing upward to the vertical position. This vents the bottle to atmosphere while isolating it from the chamber, allowing the bottle to be safely

removed.

(4) Once all materials in the bottles and on the trays inside the chamber have been fully dried, first remove the drying bottles. Then vent the chamber, remove the manifold, take off the acrylic cover, and remove the material for packaging and storage. Do not remove the cover with bottles attached. (Refer to the standard configuration for the cover removal procedure.)

6. Shutdown Procedure

- (1) Turn off the Main Power switch to shut down the entire control system.
- (2) Unplug the main power cord and the vacuum pump power cord.
- (3) Wipe clean the cold trap, shelves, and acrylic chamber cover.
- (4) When the vacuum pump is not in operation, cover the exhaust port to prevent dust from entering the pump.

7. Control Interface Overview

(1) Turn on the Main Power switch. The system will display the company logo and name. Press the “Confirm” button to automatically enter the “Operation and Status Display” interface (See Figure 7-1).

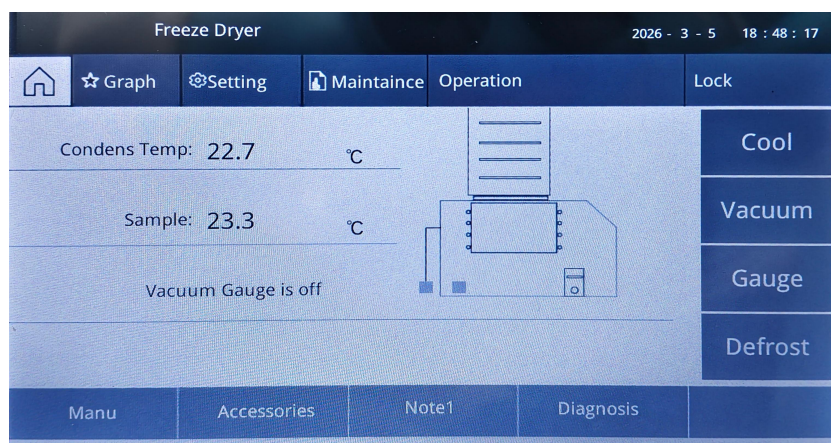


Figure 7-1: Operation and Status Display Window

(2) Trend Curves: Displays and records temperature and vacuum level data during operation (See Figure 7-2).

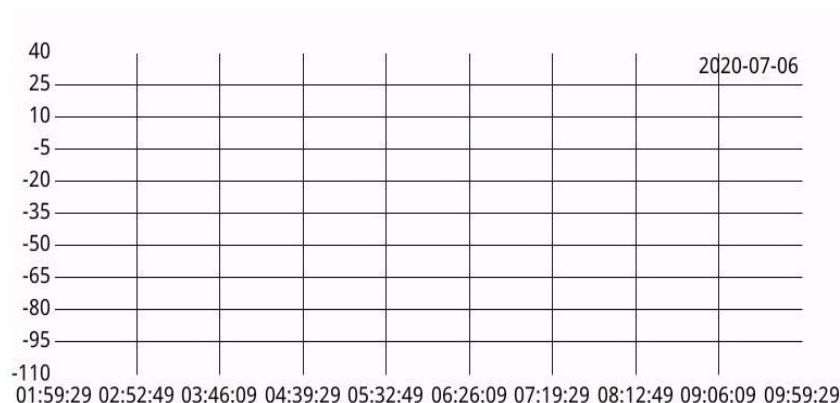


Figure 7-2: Displays and records temperature and vacuum level data during operation

(3) Settings: Used to configure all operating parameters of the system (See Figure 7-3).

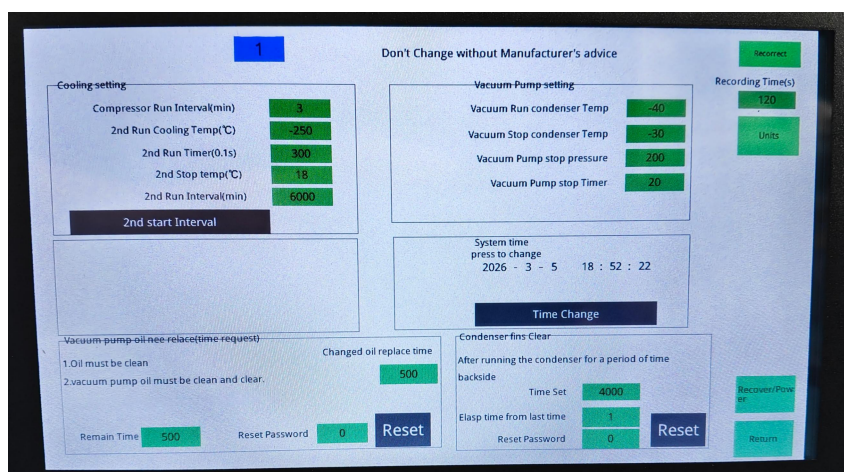


Figure 7-3: Various operating parameters of the system

NOTE: Please contact the manufacturer's technical support before making any changes to these settings.

(4) Routine Maintenance: Provides guidelines for daily maintenance of the main unit and the vacuum pump.

8. Precautions

(1) Place the vacuum pump on the floor at a lower level than the main unit to help prevent oil backflow in the event of a sudden power failure. If a power outage occurs, immediately open the vent valve to admit air into the chamber, promptly remove the samples, and store them properly.

(2) Environmental Requirements: Operating temperature $\leq 28^{\circ}\text{C}$, relative humidity $\leq 80\%$.

(3) When shutting down the system, always vent the chamber first and then turn off the vacuum pump to prevent pump oil from backflowing and contaminating the samples.

(4) The acrylic chamber cover is sealed to the main unit by an O-ring. Ensure that the cover is carefully positioned and properly seated.

(5) Use a properly grounded power outlet. Keep the sealing rings clean, and do not clean them with organic solvents. Protect the contact surfaces between the acrylic cover and the O-ring from impact, scratches, or other damage.

(6) Replace the vacuum pump oil after approximately 200 hours of continuous operation, or sooner if the oil shows signs of emulsification or deterioration. Perform maintenance and servicing as recommended in this manual.

(7) Do not frequently switch the power supply or the refrigeration system on and off. If the refrigeration unit stops due to such operation, wait at least 3 minutes before restarting the refrigeration system.

9. Common Faults and Troubleshooting

9.1 No-load Vacuum ≥ 10 Pa

Check the following items:

(1) Verify that the connection between the vacuum pump and the main unit is secure and that the clamp is properly fastened.

(2) Check whether the lower sealing surface of the acrylic chamber cover is clean and free from damage.

(3) Inspect the O-ring for cleanliness and confirm that it is correctly seated.

(4) Ensure that the cold trap is tightly fitted against the black sealing plate and that no gaps are present.

(5) Confirm that the vacuum pump is operating normally and that the pump oil is clean and uncontaminated.

(6) Check that the vent valve is fully closed.

9.2 Vacuum Pump Oil Leakage

Inspect the pump housing and related components, and replace any damaged or worn parts as required.

9.3 Device Fails to Power On

Check whether the fuse located below the main power inlet has blown.

9.4 High Cold Trap Temperature

This may be caused by an excessively high ambient temperature or inadequate heat dissipation. If a refrigeration system fault is suspected, contact StonyLab Customer Service.

9.5 Vacuum Pump Fails to Start

Check whether the cold trap temperature has reached below -40°C, and verify that the vacuum pump power cable is properly connected.

10. Quality Assurance

Warranty is effective from the date of purchase and is non-transferable.

For more details about the warranty, please refer to the link below:
stonylab.com/pages/warranty

For any inquiries or assistance, feel free to contact us:

Company: StonyLab Inc.

Email: support@stonylab.com

Phone: 631-406-6080

Website: stonylab.com

This instruction manual is subject to change without prior notice.