General Purpose Freeze Dryer

Models 24DX24 and 24DX48

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Warranty

Provides details on coverage and transportation damage

Please take this opportunity to complete and return the warranty registration card for your General Purpose Freeze Dryer.

At this time find the serial tag on your new General Purpose Freeze Dryer (located on the back of the unit next to the electrical cord) and record the information below for future reference.

The VirTis Company			
Serial #		Part #	
Voltage:	Amps	Hz	Ph
Date:			

Your General Purpose Freeze Dryer is warranted by VirTis to be free of defects in material and workmanship when operated under normal conditions as specified in the instructions provided in this manual.

Covered:

- All parts and labor for a period of one (1) year from date of delivery.
- On-site labor by either VirTis personnel or an authorized third party service organization if it is approved by the VirTis service department prior to service.

Not Covered:

- Travel time and expenses incurred by VirTis service personnel if on-site service is requested.
- Transportation charges to return equipment for service.
- Damage caused by abuse or lack of maintenance.
- Maintenance items such as vacuum pump oil or vacuum grease.

Shipping Damage:

- Any shipping damage is the responsibility of the transportation carrier. If damage has occurred, notify the carrier immediately and keep all packing materials for inspection.

Service contracts, extended warranties and maintenance programs are available, contact the VirTis Service Department for further information.

Introduction

VirTis has been manufacturing Freeze Dryers for specimen and floral applications since 1963. The General Purpose Freeze Dryer was designed to meet the needs of a growing market. Freeze Drying has become a widespread method of preserving flowers and specimens. The primary purpose of botanical or specimen freeze drying is to remove moisture from a product without affecting its physical characteristics such as shape, color or appearance.

A basic understanding of the freeze drying process is necessary in order to operate the freeze dryer effectively. Please carefully read this manual before operating the unit.

Freeze Drying guidelines set basic parameters in which the process works. It is not possible to write an exact recipe (in terms of considering time and temperature) that will work for every product without some experimenting. Since each product varies so will the freeze drying process as it is completely product dependent. You will need to experiment with variations of the freeze drying process until you reach an optimal result. On average, drying times will be between 5-10 days.

Your General Purpose Freeze Dryer controls the radiant temperature conditions in order to dry the product in the least amount of time. The Freeze Drying process requires a delicate balance, if too much heat is applied in a short period of time to the product, it will cause it to melt. If not enough heat is applied then long, inefficient drying times will result. So, experimenting will be necessary to establish a protocol for each product being freeze dried.

The product and your quality requirements determine the fastest freeze drying cycle.

Initial Set Up

1. Remove carefully all packing materials and inspect for concealed shipping damage such as leaking fluids, damaged panels or castors.

   If you observe any damage, retain all packing material and immediately contact the transportation carrier.

2. The unit was shipped under vacuum. To release vacuum, remove the condenser drain plug. If you do not observe a release of vacuum then a component within the vacuum system may have been loosened or damaged in transit. Refer to Trouble Shooting section on page 26 or call the VirTis Service Department

3. Make certain that the dedicated outlet you intend to use has the same voltage and capacity as listed on the serial tag located on the back of your unit.

   In some locations where electrical connections vary (for example 220V 50Hz) the unit has been shipped without a plug. Make the appropriate plug connection.

4. Remove packing from exhaust port on vacuum pump. Refer to the Vacuum Pump Manual for more detailed description.

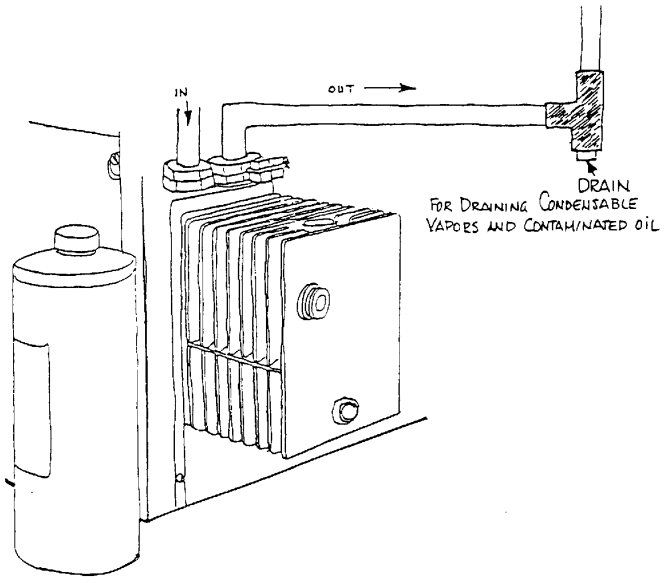
5. If the unit has refrigeration compressor(s) mounted on springs, loosen the hex nuts securing the refrigeration compressor(s) to the base. Turn counter-clockwise until top of hex nut is flush with its bolt. For proper operation, compressors must move freely on mounting springs.

In order to become familiar with your new Freeze Dryers, you should perform a 24 hour test run without product to insure that unit performs properly and that you understand the freeze drying process.

The following is a basic checklist that insures the longest life possible for your freeze dryer.

- Operate unit in a clean, dust-free environment with a room temperature of between 55°F to 75°F.
- Position unit so it is basically level insuring components will operate as designed.
- Allow at least 24" space on all sides of unit for proper airflow and cooling.
- Exhaust vacuum pump outside to eliminate moisture, odor and oil fumes in work area. Exhaust tubing should be the same or larger in diameter as the exhaust port on the vacuum pump and should be at least 8 feet in length.

The exhaust line must be level or running downward from the machine to eliminate oil being trapped in a low spot, thus restricting exhaust. A deflector is required on the outside of the building so that rain cannot enter the exhaust tube. In very cold conditions, the exhaust line should be checked frequently, and kept clear of any ice buildup that may restrict exhaust flow. If the point of exhaust must be located above pump level, a "T" is required for use as an oil and moisture trap that can be occasionally drained so that exhaust fumes will not be restricted.



An oil mist eliminator easily installs on the vacuum pump. Contact VirTis for the correct model and part number.

Start-Up Instructions

After the unit is hooked up as explained under Setup Procedures, start the unit as follows:

1. Check door gaskets. A light film of vacuum grease has been applied at the factory. A very light film is all that is required. (Please note: Only grease exterior of gasket).

   VirTis Part #357699 – High Vacuum Grease, 10 ea. of .5 oz tubes.

2. Start refrigeration units on both the specimen chamber and condenser with the function switches. Allow both units to run until operating temperatures have been reached, -5°F for specimen chamber, -50°F (minimum) for condenser. The specimen chamber and condenser may take 1 ½ to 2 hours to reach these temperatures.

3. Close ballast valve on vacuum pump, (a separate manual has been supplied by the manufacturer of the vacuum pump). Ensure drain plug is in place.

Operation of Unit

Product Freezing

1. Load product onto stainless steel shelves.

   NOTE: If you product is already frozen, pre-freeze the Specimen Chamber for 2 ½ hours then load your product.

2. Turn on the Specimen Chamber.

3. Adjust the Specimen Chamber Control to 7 (lowest setting) on units without an optional heat programmer.

   NOTE: If the optional Heat Programmer is installed and not turned on then the unit will automatically cool to its' lowest temperature.

4. Wait a minimum of 8 hours for the product to be solidly frozen.

Condenser Refrigeration

5. Turn on Condenser Refrigeration Switch.

6. Wait for the condenser temperature to reach -40° before proceeding.

Vacuum System

7. Ensure the condenser drain plug has been replaced.

8. Close the Product Chamber and Condenser Door.

9. Press the Vacuum Switch located on front panel.

10. Wait until the Sentry Monitor indicates that the vacuum level is 100 millitorr or less. (approximately 15 minutes)

Primary and Secondary Freeze Drying

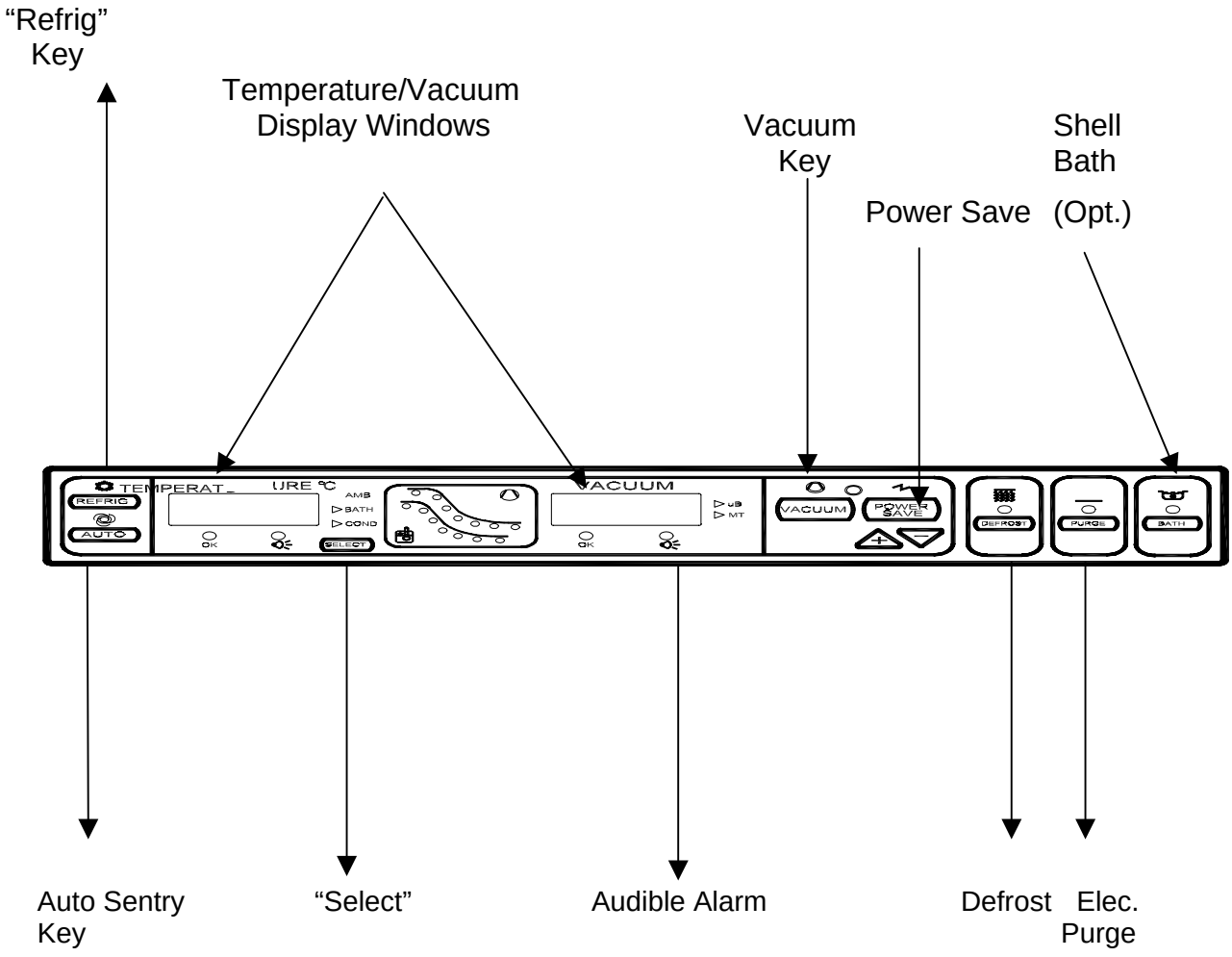
11. Moisture will be extracted over the next 5 – 10 day period.

12. Determine when the process is complete by examining or weighing the product. When the product's weight remains the same or increases for three days, drying is complete (museum specimens).

13. Defrost the condenser when it is fully loaded with ice. Refer to Defrosting Condenser page 21 for complete instructions.

Unit Functions and Controls

Super Sentry Control Module



1. Heat Switch (only supplied with HTP-8) Activates the internal heat system. This needs to be turned on if using HTP 8 to provide heat control to the inner coils and specimen chamber walls.

2. HTP 8 (Optional) – This "Heat Transfer Programmer" automates the process by allowing recipes for heating and cooling the product chamber to be stored and retrieved as needed. Up to four recipes consisting of six steps each can be pre-programmed and retrieved. For further information see pages 13 - 15.

3. Sentry Monitor – This microprocessor-based monitor digitally scans and displays all relevant freeze drying parameters including vacuum condenser temperature, ambient (room) temperature, and bath (product chamber temperature). Operational status lights for refrigeration and vacuum indicate when unit is ready for freeze drying. For further information see pages 10 -13.

4. Power Switch – Activates the basic unit, will need to be turned on to use unit.

5. Bath Button – Activates the product chamber refrigeration system. In most applications, this switch can always remain on allowing for continuous use of the unit.

6. Condenser Button – Activates the refrigeration system cooling the condenser to allow proper moisture accumulation. This switch will be turned off when defrosting condenser.

7. Vacuum Button – Activates the vacuum pump. This should be turned on when the condenser reaches a minimum temperature of -40°F.

8. Defrost Button – Activates a cartridge type heater to melt ice bond on the condenser wall so the ice inside the high capacity condenser can be removed.

9. Isolation Valve Switch – Closes the 3-inch solenoid valve between the product chamber and the condenser, maintaining vacuum in the product chamber during a defrost cycle (if equipped).

10. Specimen Chamber Temperature Control – (Not supplied when optional HTP 8 is installed). The specimen chamber temperature range is set by this control. The thermostat provides control by turning the refrigeration system on and off based on the temperature requirements. Rotate the specimen chamber temperature control warmer or colder based on the type of specimen or product processed. The thermostat wide On/Off range offers low power consumption as the refrigeration system runs only 50% of the time. For floral application, the control should be set at approximately 5 ½, which will allow the chamber to warm to -5°F before starting the cooling process again.

Super Sentry Control Module

The Super Sentry Control Module is the nerve center of your VirTis freeze dryer. Its microprocessor and unique software functions permit complete control and monitoring of the entire process. Large display windows for temperatures and vacuum can be read from across the room. Graphic symbols and the extensive use of embedded indicator lights make operation highly intuitive. The polycarbonate membrane panel with its tactile feedback keys is impervious to virtually any chemicals and moisture. The Super Sentry is completely software configurable and calibratible using the panel keys.

1. Data Displays

Pressing the "Select" key cycles the temperature displayed in the left hand window from "Ambient" to "Condenser" and "Bath".,

Temperature is also indicated graphically on the LED "wave" display. Each light represents, from top to bottom, ten degrees Celsius from +10 to –50.

The vacuum is displayed in the right-hand window. Vacuum units displayed are selectable as either Millitorr (MT) or Microbar (ub). To change the displayed vacuum units press and hold the "Vacuum" key. Watch the vacuum display window until a decimal between the third and fourth digit shows, then let go of the vacuum key and press "Select". The vacuum pump is then turned on with the vacuum key. Follow the same steps to switch back between Millitorr and Microbar.

2. Manual Operation

Press "Select" until condenser temperature is displayed on the temperature display.

Pressing the "Refrig" key activates condenser refrigeration. When the condenser reaches an appropriate freeze drying temperature, the "OK" light turns on, indicating that vacuum may be started by pressing the "Vacuum" key. You may follow the progress of the condenser temperature pull-down in either the temperature display window or on the temperature LED graph.

Initially the vacuum will indicate out of range by displaying four dashes in the display. Once the vacuum reaches the calibrated range below 2000 units, the value will continuously display in the window and the "wave" lights will begin to light in sequence. When the vacuum reaches an appropriate preset value, the vacuum "OK" light will turn on indicating that you may begin normal freeze drying.

3. Auto Mode

The "Auto" mode automates the pull down of condenser and vacuum to prepare your freeze dryer for drying with one touch of the "Auto" key. Once the "Auto" key is pressed, "Refrig" is enabled until the condenser "OK" point is reached, then "Vacuum" is enabled until the vacuum "OK" point is reached. Your freeze dryer is then ready for normal freeze drying.

4. Power Save Functions

The unique “Power Save” system performs several functions by controlling the on-off cycle of the vacuum pump. In freeze drying, the purpose of the vacuum pump is to remove non-condensable gases from the system to allow unimpeded vapor flow from the product to the condenser. In a leak-free freeze dryer, very little non-condensable gas is evolved during freeze drying. This fact allows the vacuum pump to be turned off for up to 95% of time. During its off cycle, product vapor continues to flow from the product to the condenser where it is removed from the system in the form of ice.

The “Power Save” system controls the on-off cycle of the vacuum pump at a user selectable vacuum value. With “Power Save” enabled by pressing its key, vacuum is turned on until the set point is reached, where the pump is turned off. When the vacuum value rises above the set point, the pump is turned on again. This action controls the vacuum at the selected level. A selectable deadband is also provided to prevent short cycling of the vacuum pump.

“Power Save”, therefore, provides several benefits:

--First is the automatic control of vacuum around the selected value. This is often useful in improving the drying process.

--Second is the saving of electric power and wear and tear on the pump by the percentage of the off cycle.

--Third is the dramatic reduction of vacuum pump oil backstreaming because of the closing of the built in anti-suckback valve and/or VBS valve and the reduced operating temperature of the pump.

The “Power Save” control point is set by pressing and holding either arrow key. The control point will display in the vacuum display window. Pressing the up or down arrows increases or decreases the control point. The Super Sentry returns automatically to normal mode after about five seconds without pressing a key. The deadband is set by pressing and holding both up and down arrow keys until the deadband value is displayed in the vacuum window. Pressing the up or down arrows increases or decreases the deadband. Again, the Super Sentry returns automatically to normal mode after about five seconds without pressing a key.

Program the required or desired values as described above, and press the “Power Save” key to start. Simply pressing the “Vacuum” key will disable the Power Save Mode and continue with uninterrupted vacuum pumping. Go back to “Power Save” if desired, with the Power Save key.

“Power Save” may be used independently in vacuum mode only, in manual freeze drying mode or in “Auto” mode. In either manual or “Auto” mode, pressing the “Power Save” key initiates the mode, but delays its action until the condenser “OK” temperature is reached. While in this delay status, the “Power Save” LED blinks to indicate that the mode is enabled.

5. Condenser Defrost

On equipment where quick defrost is provided, pressing the “Defrost” key enables the defrost and a defrost timer for 60 minutes. At the end of 60 minutes the defrost is turned off automatically. Defrost may also be turned off manually by pressing the key again. Defrost is locked out when condenser refrigeration is on.

6. Electric Vacuum Pump Purge

If so equipped, pressing the “Purge” key starts the vacuum pump and closes a vacuum valve to “deadhead” the pump. Running the pump this way and opening the gas ballast valve purges water or other contaminants which may have reached the vacuum pump oil. Pressing the key again cancels the function. Having any other vacuum function on, locks out “Purge”.

7. Power Outage Recovery

If a power outage occurs while the system is in operation, the Super Sentry returns the system to its previous operating status when power is restored. Both display windows indicate “pout” and the audible alarm is sounded. Pressing any key clears the audible alarm and restores normal displays.

8. Warning Alarms

In freeze drying, it is important that condenser temperature and vacuum remain within reasonable limits. If they degrade due to overloading or system failure, products may “melt back” or “collapse”, ruining them. For this reason the Super Sentry has several built-in alarms.

Action should be taken to correct the cause of any alarm before proceeding to avoid product loss.

Configuration and Calibration

Reconfiguration and calibration should only be attempted by qualified service people. Please see the separate maintenance section for information on these topics.

Instructions for Heat Programmable Controller

The Model 981 is a full-function PID controller with the additional benefit of programmability. For additional detail and troubleshooting, see the Watlow Series 981/982 User’s Manual included in your instruction manual.

Familiarization

After applying power to the equipment, allow the control to warm up at least 30 minutes for best calibration accuracy. Then check the following parameters before running shelf heat control.

1. Check that the two display windows light up. Press the display button repeatedly to cycle the lower window. It will display the set point value, deviation of the process variable from set point, the percent power output and the measuring units, degrees C or F, in sequence. Leave the display on set point.

2. Press the up and down arrow keys to adjust the set point. It should be adjustable to cover the full range of control of your equipment, normally +70 to -100° C.

Keypad Security

1. The 981 is shipped in a "locked" condition which disables the MODE and Run/Hold keys. This is done to prevent accidental "scrambling" of the control set-up parameters. If you are simply running the 981 as a controller, we suggest leaving it "locked".

2. To do programmed cycles, it is necessary to unlock the keypad. To do this, press the up and down arrow keys simultaneously for about three seconds. A setup menu will appear indicated by "Set" displayed in the lower window. **Caution: do not change any of these parameters except the one specified!** At any time, you can return to the normal condition of the control by pressing the display button.

3. Press either of the arrow keys until "gLbL" appears in the upper window. Then press the MODE key repeatedly until "LOC" appears in the lower window and "2" appears in the upper window. Use the arrow keys to change the value to "0". Finally, press the display key to return to the operating mode. All keys should now function. Reverse the process to restore the locked condition. For added security in normal operation, setting the "LOC" value to "3" will lock out even set point changes.

Programming

1. Programming a shelf heat profile is easy. **Again, please be careful not to change parameters other than the program steps.** The program section consists of four files, each with six steps. Each file can be thought of as a separate recipe of up to six steps or the files can be linked together to form fewer, longer recipes.

2. Program steps can be one of five types, Set Point (StPt), Soak (SoAh, Jumploop (JL), Link File (LfiL) or End.

    a. Set Points (StPt) are used to specify a new temperature for control. If time is specified with it, it becomes a ramp, linearly changing the control temperature over the time period. If the time is set to zero, its rate of change is limited only by the response of the machine. Once the shelf temperature is within 3°C of the set point, the program proceeds to the next step. When the shelf temperature is more than 3° C of the set point, the program proceeds to the next step. When the shelf temperature is more than 3° from the set point, the message "gSd", for guaranteed soak deviation, flashes in the lower window.

b. Soaks (SoAh) are fixed temperature periods of specified duration. The duration of either a set point or a soak can be from zero to 23 hours, 59 minutes and 59 seconds. The final prompt for soaks is one called “WPr”, Wair for process crossover. These should normally be set to “dSbl”, disable.

c. Jumploops (JL) allow you to loop back to a previous step within the same file up to 255 times. These steps are instantaneous. For a typical freeze drying cycle, these normally will not be used.

d. Link Files (LfiL) allow you to like files together so that the second through sixth step in one file can now flow to the first step of another file. In this way, we can make a longer program of up to twenty ramps or ten holds or a combination of the two. The link steps are also instantaneous. In a link step you must specify a file number other than the one you are programming to link to.

e. The end step is always the last step in a recipe. It tells the program mode to end. Your specify whether control holds at the final set point value or turns off.

3. Press MODE and then two up arrows to enter the Program (Prog) menu. Then press MODE three times to select file 1, step 1 and step type (StYP). Use the arrows to select the first step type then MODE to move through the other prompts, entering your selections as required with the arrow keys. Pressing MODE repeatedly moves you through all the prompts and on to the next step. To look back at a previous file or step, enter its number when the file and step numbers are displayed. The last step should always be “End” and it should normally be set to hold at the last temperature.

4. When you have finished the program, press the display key to exit.

Running and Stopping a Program

1. Press the Run/Hold key once to display the file to be run-the Run LED flashes. At this point you can use the arrow keys to select a different file number. Pressing the MODE key displays the step number to be run. Press the Run/Hold key again to run the displayed file and step-the Run/Hold LED stays on while the program is running. By pressing the MODE key while the program is running you will display the file number, step number, and time remaining in that step.

2. To stop the program press the Run/Hold key once-the Run LED goes out.

   a. To resume from where you stopped, press the Run/Hold key once-the Run LED flashes. Now press the MODE key to advance to the resume (rESU) parameter and press the Run/Hold key again.

   b. To start the program over from the beginning, press the Run/Hold key twice.

General Freeze Drying Information

Freeze Drying works by a process known as sublimation which removes moisture by taking a sample from a frozen state to a vapor state. The liquid stage is bypassed so the samples' composition is retained.

A low condenser temperature is critical to trap the vapors into ice particles, effectively removing them from the system. Creating a vacuum effectively reduces the resistance to the flow of vapors migrating from the sample to the condenser.

These four conditions are necessary for freeze drying:

1. Product must be solidly frozen below eutectic (freezing) point.
2. Condensing surface must be lower than -40°F.
3. System should have a vacuum (absolute pressure) of 300 millitorr or less.
4. A source of heat must be applied to drive water from a solid to vapor state.

- *Water vapor pressure surrounding an ice crystal is determined by its temperature.*
- *The difference in water vapor concentration causes the remaining water vapor to diffuse through the dried portion of the product.*
- *The Vacuum Pump creates a pressure-free environment so the water vapor can flow to the condenser.*
- *A product's drying time is determined by the temperature difference between the condenser and product chamber.*
- *The rate of drying decreases as the product dries.*

- *A product is dry when its weight remains constant.*

Freeze Drying Concepts

Phase 1. Product Freezing

Product needs to be solidly frozen below its eutectic point. The eutectic or freezing point is the temperature at which the water content and the retained material are solid enough to withstand the rigors of the dry process. A general guideline is between –5° F to -15°F but it depends on the product.

You should begin with a fresh product in good condition. It is not possible to restore product (old or discolored) to its original vitality by freeze drying. Freeze Drying is meant to capture its vitality.

See sections on Rotational Loading and Final Product.

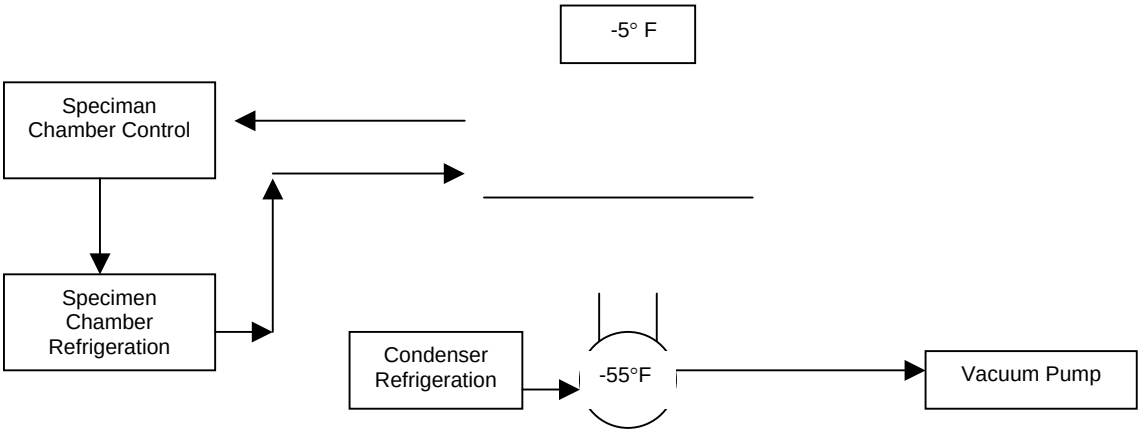
Phase 2. Condenser Refrigeration

The condenser system collects the water vapor released by the product during the freeze drying process.

Phase 3. Vacuum System

The vacuum system consists of a two stage vacuum pump which removes air molecules from the system. This allows water vapor from your product to freely flow to the ice collecting condenser.

Vacuum displays on the Super Sentry Monitor, in terms of millitorr, represents the measurement of reduced pressure approaching a vacuum. Normal atmospheric pressure is approximately 15 pounds per square inch which equals 760,000 millitorr. So at 675 millitorr 99.91% of air in system has been removed. When vacuum reaches 100 millitorr, 99.99% of the air has been removed allowing efficient freeze drying.



Phase 4. Primary and Secondary Freeze Drying

Primary drying removes all of the free ice from the product that has separated out during the freezing process. The moisture removed from the product in the form of water vapor migrates to the condenser.

The freeze drying process can be controlled by adding radiant heat to speed the process. Raising the specimen chamber temperature with the specimen chamber control or the optional heat programmer will increase the rate of sublimation and decrease the total drying time.

If too much heat is applied, then 'melt back' can occur. Melt back is a common phrase in freeze drying used to describe the condition of the product when it melts or defrosts before sublimating. If this occurs, the quality of the product will be lost.

The heat of sublimation provides the energy to convert the product's ice crystal directly to vapor which then migrates to the colder ice collecting condenser. As the product dries, the freeze drying front (ice>>no ice) will move inward toward the center of the specimen.

Secondary Drying

Secondary drying is required to desorb any water that has been chemically combined with the product. Moisture will be extracted over the next 5 – 10 day period.

Initially after placing fresh product in the chamber, the vacuum reading will be as high as 700-800 millitorr reflecting the amount of moisture being released from the fresh product.

The freeze drying process is complete when the 'product's' weight remains the same or slightly increases. A minimum of three days should be allowed for this final check.

See Section on Defrosting Condenser page 21 – 22 when condenser is fully loaded with ice.

In order to establish vacuum in the chamber, the vacuum release valve must be closed, the plug must be in the condenser drain, and a light but complete seal using vacuum grease must be established on the chamber and condenser door gaskets. When the vacuum is then turned on,

the unit will further seal the gaskets (you will see a dark large sealing surface develop on the condenser gasket through the Lucite door).

Shut Down and Rotational Loading (Biological Specimen Drying)

Follow these steps to shut down the unit to inspect, add or remove product.

1. Release vacuum via removing the drain plug.

2. Turn off vacuum pump.

3. Open the chamber and condenser doors when the system returns to atmospheric pressure.

4. Leave both condenser and product chamber switches on if you are just loading and unloading the unit and/or weighing product.

Remember to keep the chamber door closed, as much as possible, during the reloading or weighing of product to minimize frost buildup on the inside of specimen chamber.

Typical Museum Biological Specimens or Artifacts:

The correct protocol for utilizing your new unit should be to use no more than one-half of the product chamber volume during the first week of operation. After this period, rotate product in and out as space permits. Fresh product should always be placed in the far back of the specimen chamber and moved toward the front of the chamber when a new specimen takes its place. This rotational loading will assist in easy weight checks for determining final moisture removal. Product will stop losing weight or gain weight slightly when the freeze drying process is complete. A minimum of three days should be employed for this final check.

Floral Applications:

This type of application requires continuous batch loads. Drying times are completely product dependent.

Power Failure Procedure

In the event of any unwanted power failure and while running with the gas ballast open, the following procedure must be followed:

1. Release the system's vacuum as soon as possible by removing condenser drain plug. Oil vapors may be carried by leakage through the gas ballast valve and may deposit on your specimens or product.

2. Do not open the specimen chamber or condenser door. This will prevent your specimen from experiencing any unwanted warming. The insulation factor of these chambers should keep your specimens frozen for approximately six to eight hours.

3. After the power has been restored, the condenser and specimen chamber refrigeration systems will restart. After reaching correct operating temperatures, the vacuum release should be closed and the pump restarted.

Condenser Defrost during a cycle

Defrosting the condenser during a freeze drying cycle when an isolation valve is installed:

1. Turn on the switch for the isolation valve (if so equipped).

2. Turn off the switch for the condenser.

3. Turn off the vacuum pump. Break vacuum in the condenser by removing the drain line plug.

4. Place the drain line into a suitable container.

5. Remove the condenser door and gasket.

6. Switch defrost on. The defrost time is approximately 60 minutes. At this time the electric heater will not begin freeing the ice accumulation from the condenser wall. The ice plug can be removed as soon as it is free.

7. Remove ice plug and wipe out all moisture on the inside of the condenser and on the gasket surface. Any additional water can be removed with condenser drain line.

8. Turn the defrost switch off.

9. Replace the condenser line drain plug.

10. Re-grease and reinstall gasket and door. Remember, only a light film of grease is necessary to achieve a good seal.

11. Turn on the condenser switch (allow 15 minutes.)

12. Turn on the vacuum pump switch (allow 15 minutes).

13. Turn off the isolation valve switch when the vacuum reaches 1000 millitorr.

Condenser Defrost after a cycle

Defrosting the condenser after a complete drying cycle:

1. Break the vacuum on the system by removing the drain line plug.

2. Wait 2-3 seconds.

3. Turn off the vacuum pump.

4. Turn the condenser system off.

5. Remove the condenser door and gasket. Leave the product chamber switch on, if a new cycle will be started or turn off for later use.

6. Switch defrost on. The defrost time is approximately 60 minutes. At this time the electric heater defrost will begin freeing the ice accumulation from the condenser wall. The ice plug can be removed as soon as it is free.

7. Remove ice plug and wipe out all moisture on the inside of the condenser and on the gasket surface. Any additional water can be removed with condenser drain line.

8. Turn the defrost switch off.

9. Replace the condenser line drain plug.

10. Re-grease and reinstall gasket and door. Remember, only a light film of grease is necessary to achieve a good seal.

To proceed with another freeze drying run:

11. Turn the condenser switch on (allow 15 minutes).

12. Turn on the vacuum pump switch (allow 15 minutes).

General Maintenance

Proper periodic maintenance is the key to an efficiently operating unit with minimal down time.

Vacuum Pump:

Clean oil is necessary for the best vacuum and overall efficiency of the entire system. Checking and changing the oil on a consistent basis will greatly extend the life of the vacuum pump. Vacuum pump oil should be changed on as "as-needed" basils by checking the oil after each freeze drying run. The following is a basic guideline to visually checking the oil. Drain a small amount (approximately 100 ml) of oil by removing the plug from the pump drain line. Use a clear container to capture the sample.

- Pale yellow or clear vacuum pump oil – indicates good condition
- Dark vacuum pump oil – indicates acid contamination
- Cloudy gray vacuum pump oil – indicates water contamination

Use only VirTis vacuum pump oil or equivalent when changing the oil as this particular oil is specially refined for vacuum pumps.

Changing the vacuum pump oil

Change the oil right after shutting the freeze dryer down, while the oil is still hot.

1. Protect hands from the hot oil.
2. Drain the contaminated oil into a suitable container.
3. Add the new oil while visually checking the sight glass to insure proper level.

4. Operate pump for 10-15 minutes to flush any residual contaminated oil from interior components.

5. Repeat steps 2 and 3 to complete the process.

VirTis offers an oil charging pump to make changing the oil more convenient.

VirTis Part #174730 – Oil charging pump

If corrosive materials are frequently being freeze dried then oil must be checked and changed more frequently. In addition, a VirTis filter trap should be installed to protect the vacuum pump.

VirTis Part #254185 – Filter Trap for Field Installation

VirTis Part #250365 – Soda sorb cartridge for acid

VirTis Part # 250373 – Activated charcoal cartridge for organic solvents

VirTis Part # 266783 – Molecular sieve cartridge for water vapor
Please note cartridges must be ordered separately.

Condenser:

The condenser is fabricated from stainless steel and under normal use can be rinsed and kept clean with a mild detergent.

If corrosive materials are being freeze dried then thoroughly clean and rinse all parts of the freeze dryer that came in contact with product moisture. This prevents residual build-up of corrosive and contaminating materials on interior surfaces, protecting the freeze dryer and the next product to be processed. Add baking soda or any mild buffering agent to the rinse water to help neutralize acidic residue. Note: A siphon type squeeze bottle can be used to direct the rinse spray into difficult to reach area.

Failure to property neutralize corrosive materials will damage your freeze dryer and void the warranty.

Lucite Door:

Clean Lucite door with a mild detergent. Do not use organic solvents or abrasive cleaners.

Vacuum Tubing and Gaskets:

Inspect tubing and gaskets periodically for signs of age such as cracking or a dried appearance. Check gaskets by removing and inspecting interior surfaces for potential problems. A light coating of Dow Corning Vacuum Grease on the exterior surfaces will protect gaskets and tubing. Replace as needed.

VirTis Part #196287 – ¾” ID X 3/8” wall vacuum tubing, sold per inch

VirTis Part #196253 - 5/16" ID wall vacuum tubing, sold per inch

VirTis Part #198408 – Condenser Door Gasket

Refrigeration:

Remove side panel to check and periodically clean finned grill when freeze dryer is shut down. (Do not place hands near fan when freeze dryer is turned on.)

Efficiency of the refrigeration unit is greatly affected by the condition of the finned grill. If the fins become clogged with dirt and dust, the fan cannot pull air through it. Without this air flow, the condenser will not properly cool the refrigerant or cool the compressor motor. A soft brush, vacuum cleaner or compressed air can be used to remove dirt and dust. If using an air hose then blow in the opposite direction of normal air flow (from the fan side to the outside of the unit).

Have a qualified Service technician check the static refrigeration charge every 18 months to insure a proper charge.

The hermetically sealed refrigeration unit is greatly affected by the condition of the finned grill. If the fins become clogged with dirt and dust, the fan cannot pull air through it. Without this air flow, the condenser will not properly cool the refrigerant or cool the compressor motor. A soft brush, vacuum cleaner or compressed air can be used to remove dirt and dust. If using an air hose then blow in the opposite direction of normal air flow (from the fan side to the outside of the unit.)

Have a qualified Service technician check the static refrigeration charge every 18 months to insure a proper charge.

The hermetically sealed refrigeration compressors do not require maintenance other than keeping the finned grill clean as described above. The unit has a charging tag (located on the back of the unit next to the serial tag and electrical cord) listing the gas used and the static charge at a +70°F room temperature. The static charge should be checked periodically to insure that metal fatigue or vibration has not caused a loss of the refrigerant.

Allow at least four inches of space on all sides of the unit for proper air flow and cooling.

Any questions? Please contact The VirTis Service Department at 1-800-431-8232 and a trained technician will assist you.

Trouble Shooting

Vacuum Problems

Remember the only way to get maximum vacuum (5 millitorr) is with a clean, dry system. With a fresh, wet load, the vacuum may not go below 200 microns for several days. If vacuum remains high, check the following items:

1. Is the condenser drain plug replaced?

2. Are gaskets and gasket surfaces clean and properly greased?

3. Is vacuum pump oil at proper level and clean?

4. Does the product chamber contain any unfrozen product?

5. Is the isolation valve open?

6. Is condenser temperature maintaining a maximum low temperature? If temperature in condenser rises due to refrigeration problems, moisture may be bypassing the walls of the condenser and going into the vacuum pump, causing poor vacuum.

If none of the above apply, try to isolate the problem by removing the condenser door and placing a ½" thick, stiff rubber pad, about 3" square, over the end of the tube in the center of the condenser. This will seal the vacuum tube and when the vacuum pump is operated, a good check on the components between the pump and the end of the tube will be obtained.

YES – If you get a good vacuum in about 1 minute, this check eliminates any problem with the plump, vacuum probe, vacuum release valve, or rubber hose connections. At this point recheck door gaskets for possible cuts, joint separations, and dirty or rusted surfaces.

NO – If you do not get a good vacuum in about 1 minute, start checking the components one by one.

Change and flush oil in pump (refer to page 23.)

Disassemble all vacuum tubing connections, clean with methanol, apply a light coating of vacuum grease and reassemble.

Check all threaded and welded connections and seal with vacuum sealant.

If after re-testing, poor vacuum persists, the probably cause may be the vacuum gauge or probe, which will have to be replaced.

VirTis Part #153650 – Vacuum probe tube

Sample Programs for Freeze Drying Roses

These programs have been used successfully on VirTis equipment with a vertical internal heat coil for freeze drying long-stemmed roses. *Variations in product and equipment may require that the programs be adjusted to obtain optimum results.*

If you have the Model 981 Programmable Controller on your equipment, enter the following program. Refer to the separate programming instructions if necessary.

Be sure that the flowers are completely frozen and the specimen chamber is as cold as possible before turning on the heat switch and starting the program.

File #	Step #	Type	Time	Temperature (C)
1	1	StPt	0	-28
	2	SoAH	6:00	-28
	3	StPt	12:00	-24
	4	StPt	19:30	-18
	5	StPt	21:00	-12
	6	LFiL 2		
2	1	StPt	22:30	-6
	2	StPt	8:00	-4
	3	StPt	30:00	+2
	4	StPt	8:00	+4
	5	StPt	30:00	+12
	6	LFiL 3		
3	1	StPt	14:00	+16
	2	StPt	26:00	+24
	3	StPt	18:00	+30

4	End

This program will hold the +30 degree setting after the last step is completed until you determine that the load is done and turn off the heat.