SP SCIENTIFIC
Making Time for Science

LYOPHILIZER OPERATOR'S MANUAL

VIRTIS ADVANTAGE AND ADVANTAGE PLUS

FREEZE DRYERS

VirTis Genevac FTS Systems Hotpack

Part Number 369282

Rev 003, 06/11

SP Scientific

815 State Route 208
Gardiner, NY 12525 USA

3538 Main Street
Stone Ridge, NY 12484 USA

(800) 431-8232
(845) 255-5000

SP Service **(877) 548-4666**

SP Service Fax **(845) 687-0024**

Website http://www.spscientific.com/

Important Symbols

WARNING!
INJURY OR EVEN DEATH MAY RESULT IF A RECOMMENDATION MARKED WITH THIS SYMBOL IS NOT HEEDED.

ELECTRIC SHOCK DANGER! USE APPROPRIATE CAUTION TO AVOID INJURY OR DEATH.

BURN DANGER! POTENTIALLY HOT SURFACE. USE APPROPRIATE CAUTION.

DO NOT STORE FLAMMABLE MATERIALS IN CHAMBER.

WEAR SAFETY GLASSES.

CRUSH HAZARD. KEEP HANDS CLEAR WHEN OPERATING DOOR.

CORROSIVE CHEMICAL. WEAR SUITABLE GLOVES, SAFETY GLASSES, AND PROTECTIVE CLOTHING.

PROPERTY CAUTION! TO PREVENT DAMAGE TO CHAMBER EQUIPMENT AND/OR LOAD, ADHERE TO PROCEDURES MARKED BY THIS SYMBOL.

PRACTICAL OPERATING TIP. THESE RECOMMENDATIONS STREAMLINE UNIT OPERATION AND PREVENT COMMON OPERATOR ERRORS.

EXPLOSIVE MATERIALS HAZARD! KEEP OBJECTS AWAY FROM HEAT.

Freeze Dryer Safety Warnings

- ✓ *Always assume that shelf, condenser and internal parts may be very cold or very hot. Wear protective equipment to avoid burns.*
- ✓ *Always ensure that only an authorized technician services the refrigeration, heat transfer, vacuum and electrical systems.*
- ✓ *Always ensure that refrigeration air intake is clear and clean.*
- ✓ *Always ensure vacuum pump exhaust is properly ventilated and/or contained.*
- ✓ *Always practice team lifting when moving heavy equipment.*
- ✓ *Always use a maximum one pound regulator if backfilling from an inert gas source.*
- ✓ *Always wear safety glasses when using glass flasks.*
- ✓ *Be sure to carefully read the entire instruction manual before attempting to operate the freeze dryer.*
- ✓ *Be sure to verify that the electric service and other utilities match the unit's requirements before connecting to power.*
- ✓ *Never allow hand or body contact with open vacuum ports.*
- ✓ *Never clean with solvents. Use mild detergent and water only.*
- ✓ *Never operate the unit without all covers in place.*
- ✓ *Never pressurize a freeze-drying chamber unless it has been specially designed and coded as a pressure vessel (e.g., displays an ASME-coded certificate).*
- ✓ *Never stopper vials unless the chamber door is tightly closed.*
- ✓ *Never use acrylic closures if they are cracked or crazed.*
- ✓ *Never use with toxic, corrosive, flammable or organic materials unless special precautions are in place to prevent injury to personnel or damage to equipment.*

Warranty Information

VirTis AdVantage and AdVantage Plus Lyophilizers are warranted by SP Scientific to be free of defects in material and workmanship when operated under normal conditions as specified in the instructions provided in this manual. Please take this opportunity to locate the serial tag on your new VirTis AdVantage and AdVantage Plus and record the information below for future reference. SP Scientific also recommends that you complete and return your unit's warranty registration card.

Model Number _____

Serial Number _____

Part Number _____

Limited Warranty

SP Scientific (the "Company") shall warrant each of its products against defects in material or workmanship for a period of 12 months from the date of installation or 15 months from the date of shipment (whichever comes first) provided that the product is used in a reasonable manner under appropriate conditions and consistent with the applicable operating instructions. In addition, the Company shall warrant the refrigeration system for a period of 24 months provided the system is used in a reasonable manner under appropriate conditions and consistent with the applicable operating instructions.

The obligation of the Company shall be, at its option, to repair or replace, without charge any parts that prove to be defective within the warranty period, if the purchaser notifies the Company promptly in writing of such defect. No product shall be returned to the Company without prior approval of the Company.

This limited warranty shall cover the costs of parts and labor to repair or replace all defective product(s) at the Seller's factory. For all products installed by the Company and located within the Company service travel areas, this warranty shall cover transportation charges to ship the product to and from the Company's factory and/or the costs of travel, room and board if the Company's employees conduct repair at the Buyer's location. In lieu of repair or replacement at the Company's factory, the Company may, in its discretion, authorize a third party to perform the repair or replacement at the Buyer's location, and at the Company's sole expense.

The Company shall not be responsible for labor charges payable with respect to persons other than Company employees. Replacement or repair of parts pursuant to this warranty shall not in any way extend the original warranty period. The Company shall not be responsible for any unauthorized repairs, replacements or product modifications, nor will it be responsible for any product failures resulting from such unauthorized repairs, replacements or product modifications negligently or otherwise made by persons other than Company employees or authorized representatives of the Company. The buyer shall assume transportation charges to ship the product to and from the Company's factory and the costs of travel, room and board if the Company's employees conduct repair at the Buyer's location within the warranty period if the product was not installed by the Company's and/or is not located within the Company's service travel areas.

THE COMPANY DOES NOT MAKE AND EXPRESSLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO THE SALE, INSTALLATION, DESIGN OR USE OF ITS PRODUCTS. ADDITIONALLY, THE COMPANY SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF OR ANY DEFECTS IN ITS PRODUCTS.

The Company's employees are available to provide general advice to customers concerning the use of the Company's products; however, oral representations are not warranties with respect to particular products or their uses and may not be relied upon if they are inconsistent with the relevant product specifications for the items set forth herein.

Notwithstanding the above, the terms and conditions set forth in the Company's formal sales contracts shall be controlling and supersede any inconsistent terms contained herein, and any changes to such contracts must be made in writing and signed by an authorized executive of the Company.

WARNING! THE DISPOSAL AND/OR EMISSION OF SUBSTANCES USED IN CONNECTION WITH THIS EQUIPMENT MAY BE GOVERNED BY VARIOUS FEDERAL, STATE OR LOCAL REGULATIONS. ALL USERS OF THIS EQUIPMENT ARE URGED TO BECOME FAMILIAR WITH ANY REGULATIONS THAT APPLY IN THE USERS AREA CONCERNING THE DUMPING OF WASTE MATERIALS IN OR UPON WATER, LAND OR AIR AND TO COMPLY WITH SUCH REGULATIONS.

Contents

Chapter

1 Introduction

Overview

VirTis AdVantage series freeze dryers incorporate proven technology in an efficient dryer with a convenient benchtop footprint. User-friendly yet technically sophisticated, AdVantage series freeze dryers utilize the powerful Wizard 2.0 control system for monitoring and controlling all aspects of the freeze-dry cycle.

Options include a choice of shelf systems for vial stoppering or bulk tray processing, refrigeration systems to meet almost any application requirement, and a variety of accessories. The optional Wizard Workstation provides access to the Wizard's automated controls and menus, synoptic monitoring screens and historic trend data, and allows you to generate complete cycle documentation.

Standard Features

- Flask and/or shelf drying capabilities.
- Wizard 2.0 control system with manual and automatic drying capabilities., sixteen (16) programmable recipes and digital display of temperatures and setpoints.
- Four Quickseal valves for processing a variety of flask volumes and configurations.
- Up to three (3) usable product shelves for processing in trays or vials.
- 3.5-liter (AdVantage) or 6-liter (AdVantage Plus) condensing capacity.
- Shelf stoppering option with nitrogen gas backfill capability.

Note: *SP Scientific builds each unit according to the options purchased. Review the standard sections, as well as the relevant optional sections of this manual.*

Chapter 2

Getting Started

Initial Inspection

Your AdVantage series lyophilizer was carefully packed and thoroughly inspected before leaving the factory. However, in the unlikely event that shipping damage has occurred, retain all packing material and contact your freight carrier immediately.

DO NOT ACCEPT DAMAGED SHIPMENTS FROM A CARRIER WITHOUT A SIGNED NOTIFICATION OF DAMAGES.

Upon receiving your shipment, inspect all contents of your equipment for damage. Check packing material for small accessory items. Remove all packing material carefully and inspect for concealed shipping damage. Inspect the inside of the machine for any visible damage. If concealed damage or loss is discovered, contact the freight carrier immediately.[1] Keep all contents, packing material and related paperwork intact until a written report is obtained.

Note: *SP Scientific will cooperate in the matter of collecting your claim, but is not responsible for the collection or free replacement of the material. When possible, replacement parts will be shipped and invoiced to you, making them a part of your claim.*

[1] "Concealed damage or loss" refers to damage or loss that does not become apparent until the merchandise has been unpacked and inspected. Should damage or loss be discovered, you may make a written request for inspection by the carrier's agent within 15 days of the delivery date. You may then file a claim with the freight carrier or SP Scientific, depending on the terms of your shipment. If your shipment was "FOB Destination" file your claim with SP Scientific and include the inspection report and any other supporting documents. If your shipment was "FOB Shipping Point" file your claim with the freight carrier and include the inspection report and any other supporting documents.

Service Connections

Make sure that the outlet you intend to use meets the voltage and amperage requirements listed on the serial tag of your unit. Plug your unit into an appropriate outlet and switch on the circuit breaker located at the left hand corner of the lower rear panel. The control panel display will illuminate.

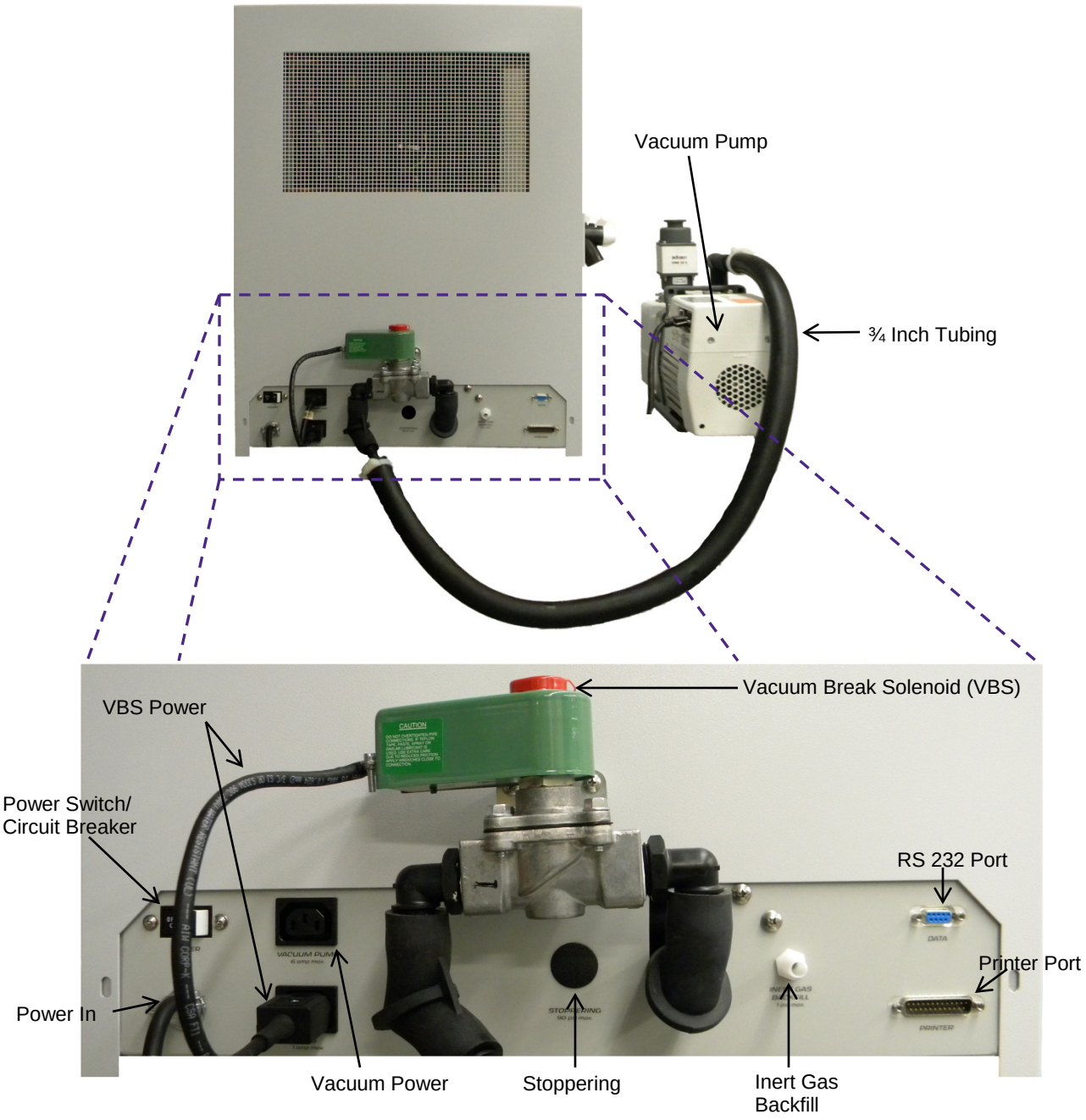
Note: *SP Scientific ships AdVantage series freeze dryers with standard power connectors based on your voltage and amperage configuration. If your outlet configuration requires a different connector, replace the plug according to local electric codes.*

CAUTION! ONLY A QUALIFIED ELECTRICIAN SHOULD CONNECT THE UNIT TO THE AVAILABLE ELECTRICAL SUPPLY.

Vacuum Pump Installation

A remotely mounted vacuum pump (sold separately) is required for operation. The vacuum pump must be a two-stage, high-vacuum pump or suitable dry pump, and must not exceed the maximum allowable amperage shown on the rear panel of your AdVantage series freeze dryer. SP Scientific recommends using a vacuum pump with a minimum capacity of 65 liters per minute (Lpm) at 60 Hz, as well as installing an Oil Mist Eliminator (OME) if not venting the pump externally. Vacuum pumps operating at 50 Hz should have a minimum capacity of 60 Lpm.

AdVantage Series Freeze dryer (Rear View)
Note: *Actual locations may vary.*



Notes: *If you are installing a previously used vacuum pump, refer to the vacuum pump manual and the General Maintenance section of this manual. Ensure that the pump is properly maintained prior to installation.*
A vacuum pump inlet port adapter and sufficient tubing are required for connection to the vacuum pump. If you need assistance, please contact SP Scientific.
The voltage, phase and frequency of the vacuum pump must match the voltage, phase and frequency specified on the rear panel of the freeze dryer.

1. Disable power to your AdVantage series freeze dryer.
2. Position the vacuum pump near the freeze dryer to ensure that the pump will be easily accessible during routine maintenance.
3. Locate the inlet port on your vacuum pump.
4. Remove all material with the exception of the inlet filter screen and gasket.
5. Place the adapter on the inlet port and secure with a fitting.
6. Remove and retain all objects from the vacuum pump outlet port.
7. Check the vacuum pump oil level. The oil level should read halfway up the sight glass. Add oil only if necessary.
   Note: *Vacuum pumps are typically shipped with oil in them. Do not overfill.*
8. Plug the vacuum pump into the IEC connectors marked VACUUM PUMP on the back of the unit.

Oil Mist Eliminators

SP Scientific recommends the installation of an Oil Mist Eliminator (OME) to reduce fumes from the vacuum pump and/or vent the vacuum exhaust externally.

Stoppering

The stoppering system requires a constant supply of compressed air or nitrogen regulated at 60 psig (90 psig maximum) to support the shelves and operate the stoppering piston. The Stoppering Air Inlet connection is a ¼ inch Female Pipe Thread located on the rear service panel of your unit.

Inert Gas Backfill

For a unit equipped with stoppering, inert gas may be admitted into the chamber through the inert gas port (with a 3/8 in Hose Barb fitting) and the Vacuum Release Solenoid valve, storing your product in an optimal, oxygen-free environment.

WARNING! NEVER CONNECT A GAS SOURCE WITHOUT A PRESSURE REGULATOR. THE PRESSURE REGULATOR MUST BE ABLE TO REDUCE SUPPLY PRESSURE TO 1 PSIG (70 MBAR OR 7 KPA), OR LESS.

Related Parts

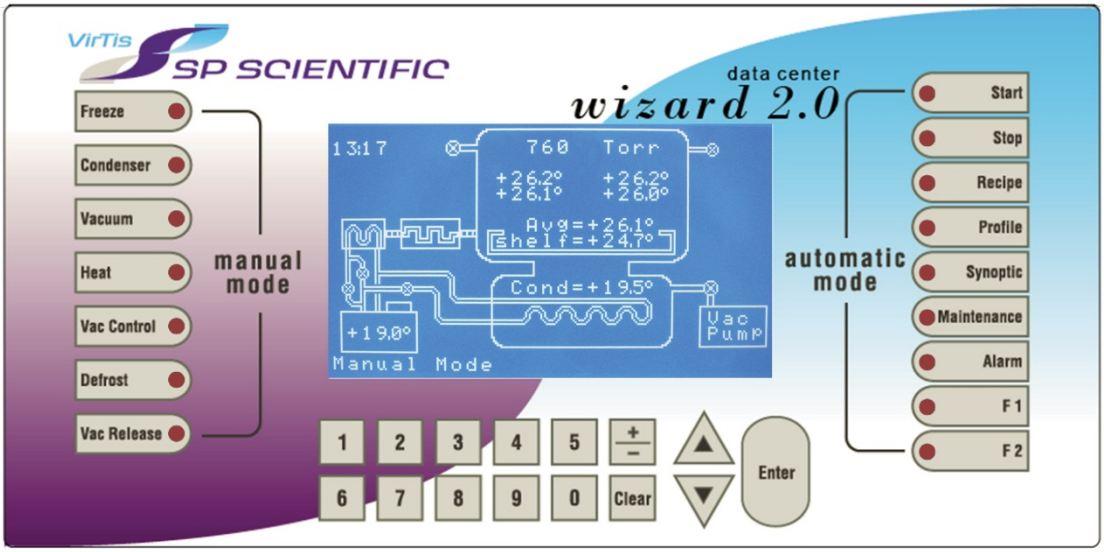
- Oil Mist Eliminator Plastic for Alcaltel 2005SD Vacuum Pump (p/n 448303).
- Oil Mist Eliminator Plastic for Oerlikon Leybold TRIVAC E – D2.5E Vacuum Pump (p/n 414203).
- Oil Mist Eliminator Metal for Oerlikon Leybold TRIVAC E – D2.5E Vacuum Pump (p/n 446900).

Operating Your Lyophilizer

	PRACTICAL OPERATING TIP. YOUR LYOPHILIZER IS SUPPLIED WITH A SOPHISTICATED CONTROL SYSTEM. REVIEW YOUR CONTROL SYSTEM OPERATOR'S MANUAL BEFORE OPERATING YOUR FREEZE DRYER.
	WHEN IN OPERATION, ALWAYS ASSUME THE LYOPHILIZER CHAMBERS ARE UNDER VACUUM. ALL GLASSWARE UNDER VACUUM REPRESENTS A SIGNIFICANT IMPLOSION HAZARD. INSPECT ALL GLASSWARE USED IN THE LYOPHILIZER FOR VISIBLE DEFECTS (CRACKS, CHIPS, OR SCRATCHES) PRIOR TO USE. DO NOT USE GLASSWARE THAT IS DEFECTIVE.
	LIQUID NITROGEN IS A HAZARDOUS MATERIAL THAT BOILS AT -194 °C. LIQUID NITROGEN PRESENTS A SEVERE FROSTBITE HAZARD. WHEN USING LIQUID NITROGEN, WEAR PROPER EYE PROTECTION AND PROTECTIVE GLOVES.
	WEAR APPROPRIATE EYE PROTECTION AT ALL TIMES WHEN WORKING WITH OR ANYWHERE NEAR A LYOPHILIZER.

The Wizard 2.0 Controller

The following instructions assume that you are operating your AdVantage unit using the Wizard 2.0 Control System.



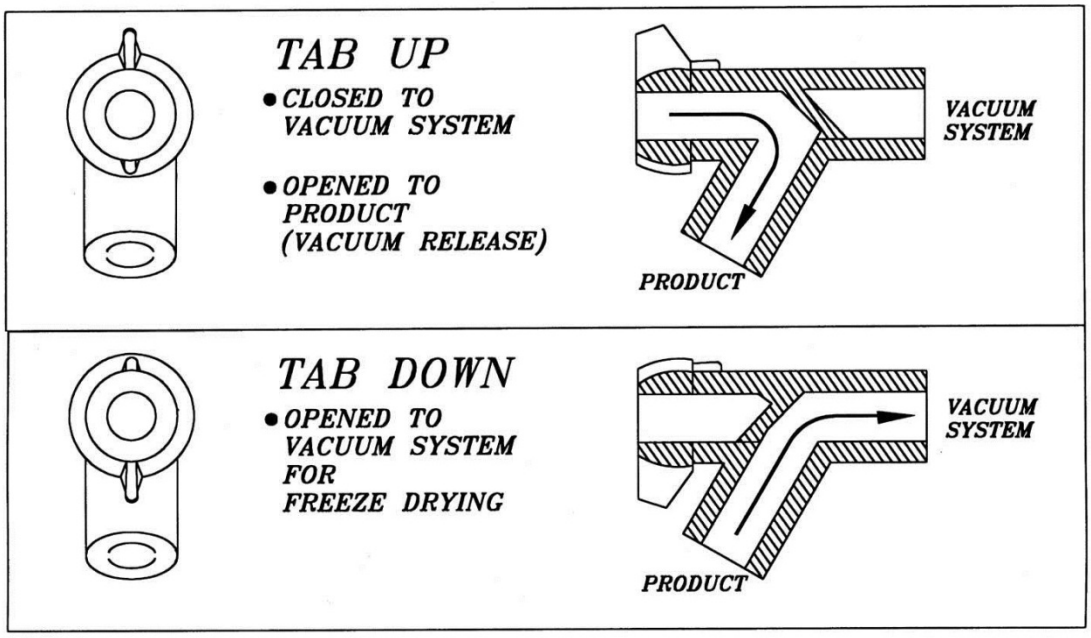
Getting Started

Freeze-drying can remove up to 98% of the moisture within the product without compromising the product's integrity. The process may take approximately 24-72 hours, depending on product characteristics and the recipe programmed.

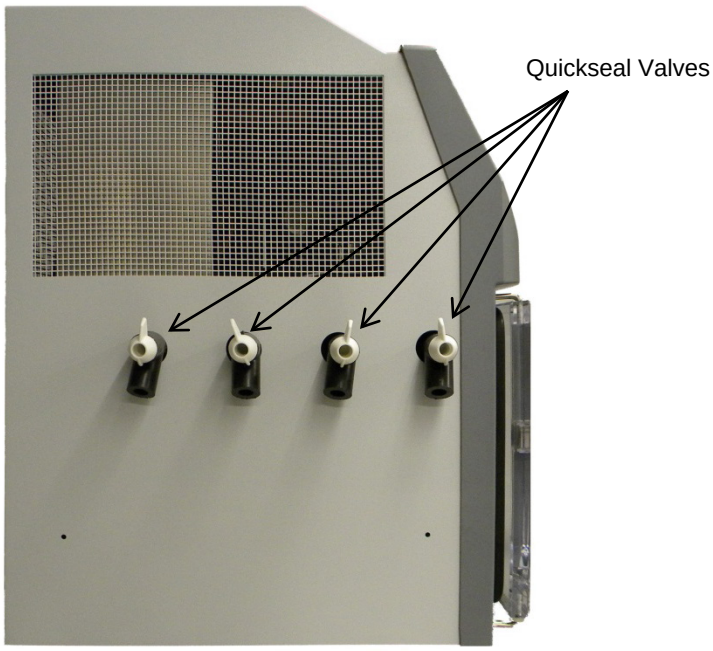
Prior to operating your AdVantage freeze dryer, ensure that the product chamber, shelves and condenser coil are clean and dry. If your unit is equipped with the stoppering option, check that the stoppering lever is in the up position before proceeding.

Quickseal Valves

Quickseal valves are utilized in many methods of drying. They permit the attachment of flasks for *in vitro* freeze-drying, and are also used to break vacuum after a cycle completes. Quickseal valves operate as follows:



Note: *Quickseal valves are an integral part of the freeze-drying process, and they must be maintained as such. Refer to the Maintenance section of this manual for information regarding upkeep and service of Quickseal valves.*



Note: *AdVantage freeze dryers come equipped with four (4) Quickseal valves.*

Flask/Manifold Drying

Product Preparation

AdVantage Series Freeze Dryers include Quickseal valves for processing samples using flasks or other glassware. To prepare samples using glassware:

1. Fill flasks with your product. Do not fill more than half of the flask's total capacity. When using wide mouth flasks, ensure that the filter paper and O-ring are positioned correctly within the flask cover. Snap the cover securely onto flask.[2]
2. Pre-freeze product samples in a laboratory freezer, dry ice bath or shell bath freezer. Freezing to -40 °C is adequate for most products.[3]

PRACTICAL OPERATING TIP. TO MINIMIZE DRYING TIME, ALWAYS FREEZE PRODUCTS IN AS THIN A LAYER AS POSSIBLE. NEVER FILL A CONTAINER TO MORE THAN HALF ITS TOTAL CAPACITY.

[2] Wide Mouth Flasks are the most popular glassware type, but other types of flasks, vials and ampoules are available. If you are not certain how to use glassware accessories, contact SP Industries.

3 Dry ice methods can freeze a product to approximately -78 °C, while liquid nitrogen (N2(liq)) methods can freeze a product to approximately -190 °C.

Running a Freeze-Drying Cycle

Notes: *If you are processing samples on the shelf (or shelves) within the product chamber, proceed to the Shelf Drying section.*

Product must remain frozen at a temperature below its eutectic temperature throughout the drying process.

1. Verify that all connections and ports are secure, all Quickseal valves are closed and that the drain plug fitting is removed from the drain valve.
2. Press the **Condenser** button to begin cooling the condenser.
3. Allow the condenser to approach its lowest possible temperature (*i.e.*, -40 °C or lower) before proceeding. This will take approximately 20 to 30 minutes.
4. Press the **Vacuum** button to evacuate the product chamber.
5. Allow the system vacuum to reach at least 200 millitorr before proceeding. This will take approximately 30 minutes, depending on the size and type of your vacuum pump.
6. Secure the glassware adapter to the flask top. [4]
7. Attach a flask containing your pre-frozen sample to one of the four Quickseal valves. Additional flasks may be connected to the system if the condenser has sufficient total ice capacity.
   Note: *When adding a flask, the chamber vacuum will increase temporarily. Vacuum should recover within 20 minutes. The duration between adding flasks should be spaced accordingly to avoid possible condenser overload and/or periods of poor vacuum.*
8. Open the Quickseal valve by turning the white selector knob 180 degrees to the down position.
   Note: *To remove a flask, turn the Quickseal valve to the closed (up) position and remove the flask.*
9. Wait for the vacuum to recover sufficiently before attaching an additional flask.
10. Ensure that all critical system parameters (*i.e*., shelf temperature, condenser temperature and vacuum) remain within acceptable ranges.
11. The frozen product inside the glassware gradually sublimes as the frost on the outside of the glassware recedes. When the ice disappears completely, approximately 90 to 95% of the moisture has been removed. The Primary Drying phase of the freeze-drying process is complete when the exterior of the glassware reaches approximately room temperature and the product appears dry. Lower moisture content may be achieved by allowing the product to continue to dry for several hours after the end of Primary Drying.
12. Close Quickseal valves and remove glassware.
13. Turn off all functions by pressing the corresponding Manual Mode button until all LED indicators are off.[5] Press Vacuum Release to release vacuum from the system.

[4] Glassware adapter must be capable of being attached to a Quickseal valve.

[5] If the vacuum pump's power connector is not plugged into the AdVantage series freeze dryer, it will need to be switched off manually.

14. When the chamber returns to atmospheric pressure, turn the handle and open the door.
15. Defrost the system and remove melted condensate immediately.
Note: *Refer to the Defrost section of this manual for more information.*

Preventing Glassware Breakage

- Avoid cleaning glassware with a wire brush as metal-to-glass abrasion creates microscopic scratches which can cause breakage.
- Never fill a flask to more than half of its total capacity (*e.g.*, a 600 mL flask has a working capacity of 300 mL).
- When pre-freezing samples in a storage freezer, tilt glassware at a 30 to 45 degree angle to increase surface area and reduce stress on the glass.
- To prevent glass-to-glass abrasion when placing flasks in glassware washers, do not allow contact with metal racks or other glassware.

Shelf Drying

AdVantage series units offer up to three useable 10 x 14 inch shelves for processing product in vials or trays.

Note: *AdVantage Plus units with the stoppering option require a constant supply of compressed air at 60 psig; this pressure is used not only to lower and raise the shelves during stoppering, but also to support the shelves during the Drying phase. A manual valve may be installed to limit pressure drops and allow the air source to be shut off or otherwise removed.*

Product Preparation

To process samples on the shelf (or shelves) within the product chamber:

1. Fill tray(s) or vials with your product.[6] Do not exceed half the container's total capacity.
2. If desired, insert product probes into the product. For accurate temperature readings, probe ends should make point contact with the bottom of the container at the bottom of the product.[7]
3. If your unit is equipped with the stoppering option and you are processing your product in vials, partially insert a split rubber stopper into each vial.
4. Load samples onto the shelf (or shelves) using removable bottom or bulk trays. If you are using product probes, connect the probes to the thermocouple jacks provided.
5. Close the door and check that the Quickseal valves are in the closed position.

[6] For a list of standard serum vial capacities, refer to Appendix B.

[7] For precise positioning of probes in vials, contact SP Industries about optional MVP Probe Holders.

Running a Freeze-Dry Cycle (Manual Mode)

Notes: *If you are processing samples using the manifold or in flasks, refer to the Flask / Manifold Drying (Manual Mode) section.*

Product must remain below its eutectic temperature throughout the drying process.

To access the Manual Mode Settings Menu, press the Maintenance button and select Manual Mode Settings.

1. Press Freeze to begin freezing below the product's eutectic or collapse temperature (typically -40 °C or colder).
2. Wait for the product to freeze to a solid before continuing. If product probes are used, monitor the product temperatures to determine when the product is frozen.
3. Press the Condenser button to begin cooling the condenser.
4. Allow the condenser to approach its lowest possible temperature (*i.e.*, -40 °C or lower) before proceeding. This may take approximately 20 to 30 minutes.
5. Verify that all connections and ports are secure, all Quickseal valves are closed and that the drain plug fitting is removed from the drain valve.
6. Press the Vacuum button to evacuate the product chamber. If desired, press Vac Control button to enable vacuum level control. Vacuum will control at vacuum level control setpoint.
7. Allow the system vacuum to reach at least 200 millitorr before proceeding. This may take approximately 30 minutes, depending on the size and type of your vacuum pump.
8. Set the Manual Heat Setpoint of the shelf (or shelves) from the Manual Mode Settings Menu.
9. Press Synoptic to return to the Synoptic screen.
10. Press Shelf Control to begin raising the shelf temperature to the Manual Heat Setpoint.
11. Manually adjust the shelf temperature as needed during the cycle.
12. When drying is complete, turn off all functions by pressing the corresponding Manual Mode button until all LED indicators are off.[8] Press Vacuum Release to release vacuum from the system.
13. When the chamber returns to atmospheric pressure, turn the handle and open the door.
14. Unplug all product probes and remove the product tray(s).
15. Defrost the system and remove melted condensate immediately.

    Note: *Refer to the Defrost section of this manual for more information.*

[8] If the vacuum pump's power connector is not plugged into the AdVantage series freeze dryer, it will need to be switched off manually.

Running a Freeze-Drying Cycle (Automatic Mode)

1. Press the Recipe button to program a recipe. Up to 16 full-cycle recipes may be programmed.

   Note: *If your unit is equipped with the optional Wizard Workstation, you may program recipes from the workstation.*

2. Configure all appropriate alarm settings for your cycle. To modify alarm settings, press the Maintenance button and select Alarm Settings.
3. Press the Start button on the Wizard 2.0 controller, or begin your automatic cycle from the optional Wizard Workstation.
4. Ensure that all critical system parameters (*i.e.*, shelf temperature, condenser temperature and vacuum) remain within acceptable ranges.
5. When drying is complete, press Stop and then press F2 at the end of the cycle. The cycle will end and shut down all functions including Freeze, Condenser, Vacuum and Heat. The system will automatically release vacuum.
6. When the chamber returns to atmospheric pressure, turn the handle and open the door.
7. Unplug all product probes and remove the product tray(s).
8. Defrost the system and remove melted condensate immediately.

   Note: *Refer to the Defrost section of this manual for more information.*

Defrost

CAUTION: DO NOT CHIP AWAY AT ICE WITHIN THE CONDENSER AS DAMAGE TO THE CONDENSER MAY RESULT.

CORROSIVE CHEMICAL CAUTION: IF CONDENSATE CONTAINS CORROSIVE OR ORGANIC SOLVENT RESIDUE, FLUSH ALL CONTACT AREAS TO REMOVE IT AND COMPLETELY DRAIN THE CONDENSER.

Note: *To access the Manual Mode Settings Menu, press the Maintenance button and select Manual Mode Settings.*

1. Obtain and prepare a suitable container for the collection of melted condensate from the product chamber.
2. Connect a drain line to the plastic quick-connect fitting.[9] The fitting acts like a valve:
3. To open the valve, push the fitting into the drain receptacle on the front of your AdVantage series freeze dryer.
4. To close the valve, press the small gray release button on the top of the receptacle. The fitting will pop out.

   Note: *The quick-connect fitting must be removed prior to freeze-drying to achieve sufficient vacuum pressure.*
5. Press the Defrost button to begin melting the ice buildup in the condenser coils. The condenser temperature will rise to a preset temperature (up to 60 °C) and hold the temperature for a specified period.
6. If desired, you can modify the defrost temperature and time from the Manual Mode Settings Menu on the Wizard 2.0 controller. The required defrost time is dependent upon the amount of ice collected during the freeze-dry process, but is typically less than one hour.
7. Thoroughly clean and rinse the product chamber and condenser coils with a mild detergent or baking soda solution (to neutralize acids).
8. Wipe all moisture from the condenser and blow air into the drain hole to remove all condensate residue.

After removing the ice and melted condensate from the condenser chamber, thoroughly clean and rinse the condenser with a mild detergent or baking soda solution to neutralize any acids that may be present.

[9] Only AdVantage Plus units are equipped with the quick connect fitting. Standard units have a drip tray.

Meltback or Collapse

Meltback is a process defect commonly associated with freeze-drying that describes the condition of a product when it melts or defrosts before subliming. Products that have low freezing points are more prone to meltback during the freeze-drying process.

If meltback occurs, experiment with the following guidelines:

Note: *These guidelines apply to drying product in flasks on the manifold ports only.*

1. Decrease the volume and depth of the product or the number of samples connected.
2. Insulate the product container to decrease the rate of sublimation due to the ambient heat source.
3. Verify that the equipment is functioning properly.
4. If you are processing samples using flasks or other glassware, ensure that room temperature is approximately 20 °C.
5. Consider reformulating the product or diluting it with water.
6. Lower the shelf temperature and vacuum level to decrease the product temperature during drying.
7. Increase Primary Drying time before proceeding to Secondary Drying.

Stoppering

The Stoppering option applies pressure to the stoppers of processed vials, forcing them into the vials while sealing the product under the current system vacuum. Stoppering can be operated at atmospheric pressure under vacuum or after backfilling the chamber with an inert gas.[10] All stoppering must be performed in full trays with vials of equal height to ensure uniform stoppering force distribution and prevent vial shifting.

Activate the stoppering feature only after:

1. The product is fully dried
2. The vacuum system is turned off
3. The heat shelf control is disabled
4. The product chamber has been backfilled with an inert gas, if applicable.

Notes: *SP Scientific recommends performing a test run to ensure familiarity with the stoppering process before adding your product.*

AdVantage Plus units with the stoppering option require a constant supply of compressed air regulated at 60 psig; this pressure is used not only to lower and raise the shelves during stoppering, but also to support the shelves during the Drying phase. A manual valve may be installed to limit pressure drops and allow the air source to be shut off or otherwise removed.

Inert Gas Backfill

Backfilling with inert gas is preferred for long-term storage of product samples that are unstable in the presence of oxygen. For a unit equipped with stoppering, inert gas may be admitted into the chamber through the inert gas port (with a 3/8 inch Hose Barb fitting) and the Vacuum Release Solenoid valve, storing your product in an optimal, oxygen-free environment.

Note: *Products may also be stoppered under vacuum by skipping the inert gas backfill procedure.*

WARNING! IF INERT GAS BACKFILL IS PERFORMED, ENSURE THAT ALL PRODUCT SAFETY RULES ARE OBSERVED IN REGARD TO THE MSDS (AND OTHER APPLICABLE CAUTIONS) FOR THE INERT BACKFILL GAS. DO NOT OVERFILL WITH BACKFILL GAS.

WARNING! NEVER CONNECT A GAS SOURCE WITHOUT A PRESSURE REGULATOR. THE PRESSURE REGULATOR MUST BE ABLE TO REDUCE SUPPLY PRESSURE TO 1 PSIG (70 MBAR OR 7 KPA), OR LESS.

[10] AdVantage series freeze dryers must be connected to a low-pressure (1 psig or less) inert gas source when backfilling with an inert gas.

To backfill with inert gas:

1. Connect the gas source to the Inert Gas Backfill port on the back of your AdVantage series freeze dryer.
2. If in Manual Mode, set the pressure regulator on the inert gas bottle to provide a slight positive pressure.
3. If in Automatic Mode, configure backfill by going into the Configuration Settings Menu. Set the Backfill option to 1 and specify the Backfill Pressure.
4. Press the Synoptic button to return to the Synoptic screen.

To remove the inert gas backfill container:

1. If in Manual Mode, ensure that the valve on the backfill container is sealed and that no indicator lights are illuminated on the Wizard 2.0 controller before removing the backfill container.
2. If in Automatic Mode, ensure that the backfill cycle has ended before removing the backfill container. “Manual Mode” will appear on the Synoptic screen.

Stoppering Procedure

The stoppering system requires a constant supply of compressed air or nitrogen regulated at 60 psig (90 psig maximum) to support the shelves and operate the stoppering piston. The Stoppering Air Inlet connection is located on the rear service panel of your unit.

To operate the stoppering mechanism:

1. If backfilling with an inert gas is desired, connect the gas source to the Inert Gas Backfill port on the back of your unit.

   Note: *Refer to the Inert Gas Backfill section for more information.*

2. Disable the vacuum pump:
   a. If in Manual Mode, press the Vacuum button to turn off the vacuum pump.[11]
   b. If in Automatic Mode, press Stop and then press F2. The cycle will end and shut down all functions including Freeze, Condenser, Vacuum and Heat, [11] and the chamber will backfill to setpoint. If the backfill options are not properly configured, the vacuum will release fully and expend all available backfill gas.
3. Complete the backfill portion of the cycle:
   a. If in Manual Mode, press the Vacuum Release button.
   b. If in Automatic Mode, observe as the system backfills to the specified pressure setpoint.
4. Switch the stoppering lever (located on the front panel) to the down position**.** This will lower the stoppering mechanism. The stoppering plate will move downward and press the stoppers firmly into the vials. The plate will automatically stop when the vials are fully stoppered.

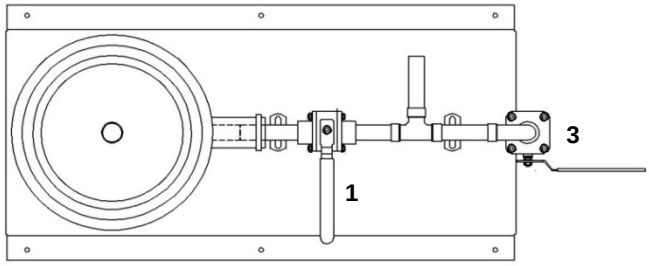
[11] If the vacuum pump’s power connector is not plugged into the AdVantage series freeze dryer, it will need to be switched off manually.

5. Return the stoppering mechanism to the original position by returning the stoppering lever to the up position.
6. Ensure that all function indicator lights are off and that no automatic cycles are currently running.
7. Press Vacuum Release to release any pressure from the system.
8. When the chamber returns to atmospheric pressure, open the product chamber door.
9. Unplug product probes and remove product tray(s).
10. Defrost the system and remove melted condensate immediately.

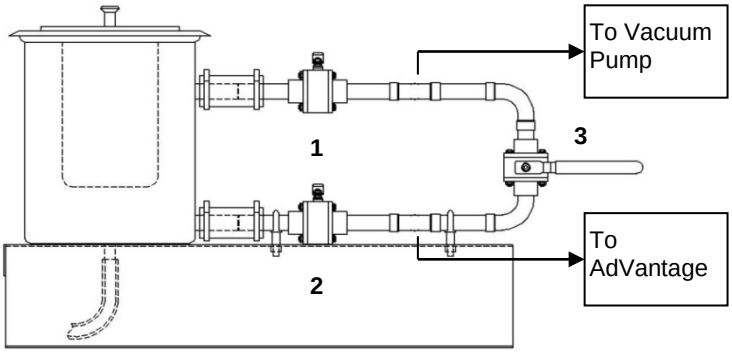
    Note: *Refer to the Defrost section of this manual for more information.*

Liquid Nitrogen Trap

The optional Liquid Nitrogen (N_2(liq)) Trap protects your vacuum pump from the corrosive properties of acid and alkaline vapors, as well as the low temperatures and organic solvents associated with the freeze-drying process. The trap is available in both 2.8- and 5-liter capacities.



Top View



Side View

To operate a liquid nitrogen trap:

1. Enable the condenser and wait for the system to reach operating temperature.
2. Remove the plastic cover from the stainless steel vessel and add a small amount of liquid nitrogen to the center well. If adding liquid nitrogen from a tank, use adequate ventilation to protect from gaseous vapors.

   Note: *The liquid nitrogen will expand and bubble when it meets the warm center well. Wear protective eyewear and gloves to avoid contact with skin.*

3. Replace cover and wait one minute.
4. Open center well and slowly fill with liquid nitrogen (2.8 or 5 liters, depending on capacity).
5. Open valves 1 and 2, and close valve 3 (see diagram above).
6. Enable the vacuum and wait until vacuum pressure reaches 100 mT.
7. Trap is now in operation. Liquid Nitrogen evaporates rapidly over time and solvent is condensed. Check center well often and refill with liquid nitrogen as needed.

Filter Trap

SP Scientific filter traps protect your vacuum pump from damaging and corrosive vapors released during freeze-drying. If purchased, the filter trap is typically located between your freeze dryer and the vacuum pump.

Disposable Sodasorb®, activated charcoal, and molecular sieve trap drop-in wire mesh cartridges are available and must be purchased separately.

To install the filter trap:

1. Connect the vacuum pump to the port marked OUT.
2. Connect the rest of the system to the port marked IN.

Degassing Filter Trap Cartridges

WARNING! BE SURE TO PROPERLY HANDLE AND DISPOSE OF USED CARTRIDGES.

Filter trap cartridges are highly absorbent and may require degassing prior to freeze-drying. If you do not degas filter trap cartridges, vacuum pump-down may take significantly longer. Degassing is also necessary each time you change your filter trap cartridge. Most filters require an overnight degassing to achieve proper vacuum.

To degas the filter trap cartridge:

1. Unscrew the clear polypropylene housing from the white plastic top.
2. To begin degassing, enable the vacuum pump, open the gas ballast valve slightly and close all ports.

   ***Note**: See Vacuum Pump Gas Ballast Valve in Chapter 8: General Maintenance for more information.*
3. Degassing is complete when vacuum reaches 50 mT, or less. Prior to turning off the pump, close the gas ballast.

   ***Note**: Degassing may take between 12 and 24 hours.*

Filter trap cartridges are disposable. Their lifespan depends on frequency of use and the volume of contaminants they absorb. The Sodasorb® cartridges contain an “Absorbent Exhaustion Indicator,” which turns purple to signify the need for replacement. Full exhaustion is indicated by a deep purple color.

The activated charcoal cartridges contain no absorption limit indicator. Pump oil must be routinely checked for clarity to assess the charcoal's absorbing capacity. Depending on the usage and concentration, changing the charcoal cartridge every three to six months may suffice.

Shell Bath

Shell freezing is a classic method for preparing samples for freeze-drying, allowing products to be frozen in the thinnest cross-section possible. Shell bath freezing increases the product's surface area and decreases product depth by freezing a thin layer of product to the inner surface of a flask.

Optional Benchtop Shell Freezing Bath units provide a simple and efficient means for pre-freezing numerous flasks of product simultaneously. The process produces a thin, even coating of product, which helps eliminate long freeze-drying time, damaged flasks, and meltback. Shell bath benchtop units can accomodate flasks up to 2000 mL with bath temperatures as low as -75 °C.

Two motor-driven stainless steel rollers rotate freeze-drying flasks in the bath, evenly distributing a thin coating of liquid product around the inside "shell" of the flask until it is frozen solid. Flask lift devices elevate flask caps, forming a conical coating inside the flasks as they rotate. This prevents fouling of the lid, filter or stoppering plug. Contact your SP Scientific representative for more information.

Windmill

The Windmill option can be an excellent indicator of the rate of water vapor transfer and assist in determining the end of the drying phase. The Windmill is used in manual mode. It will stop turning when the product contained in the connected flasks is no longer undergoing sublimation and has completed the primary and secondary drying phases of the freeze-dry cycle.

Note: *The Windmill is not available for AdVantage Plus freeze dryers.*

Accessories

Ampoules and tear drying bulbs can be heat-sealed while connected to the Quickseal valve, allowing the product to be preserved under vacuum. Additionally, screw cap vials can be stoppered under vacuum using stoppering adapters. For a list of available accessories, please contact SP Scientific.

Chapter 6

General Maintenance

Overview

Proper routine maintenance is the key to an efficiently operating lyophilizer with minimal downtime, and will likely extend the life of your equipment, sub-systems and components.

Maintenance should be performed a minimum of four times a year. Because system use and application varies from one facility to another, system maintenance may need to be performed more frequently.

Vacuum System

Vacuum Pump

Note: *The AdVantage series freeze dryers do not include a vacuum pump. However, SP Scientific recommends the following protocols for vacuum pump maintenance. For additional information, refer to your specific vacuum pump manual.*

Clean oil is necessary for optimal vacuum and overall efficiency of the vacuum system. Checking and changing the oil on a regular basis will greatly extend the life of the vacuum pump. Check the vacuum pump oil after each freeze-dry cycle by draining a small amount (~100 mL) from the pump drain line. Use a clear container to capture the sample. Oil should be changed as needed.

When visually checking the oil, use the following guidelines:

- 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.

Changing Vacuum Pump Oil

Change the oil immediately after shutting down the pump while the oil is still hot.

1. Protect your hands from the hot oil. Make sure vacuum is released from the system.
2. Remove the top fill plug and open the drain valve located at the bottom of the pump. Drain the contaminated oil into a suitable container.
3. When the oil has completely drained, close the valve and add new oil to the pump while visually checking the sight glass to ensure proper level (near the MAX line). Reinstall the fill plug.
4. If pump oil is particularly contaminated, operate the vacuum pump for 10 to 15 minutes to flush any residual oil from the system's interior components. Repeat steps 2 and 3 to complete the process.

PROPERTY CAUTION! IF YOUR PRODUCT CONTAINS CORROSIVE MATERIALS OR ORGANIC SOLVENTS, OIL MUST BE CHECKED AND CHANGED MORE FREQUENTLY. IN ADDITION, A FILTER TRAP MAY BE INSTALLED TO PROTECT THE VACUUM PUMP AND PUMP OIL.

Scheduling Oil Changes

After clean oil is loaded into the vacuum pump and all necessary connections have been made between the vacuum pump and the freeze dryer, perform a full capacity test cycle.

Have a qualified technician check the oil after the test cycle. If the oil appears dirty, you may need to change the oil after every use. If the oil appears clean, check the oil again after two uses or cycles. If the oil remains clean after two cycles, check the oil again after four cycles. Continue to monitor the vacuum pump oil after each cycle until a change of condition is noted or a period of one month elapses. If the oil remains clean after several cycles, changing the oil once per month may be sufficient.

Optional Secondary Traps

Most water-based products will completely condense or trap on the condenser when an appropriate cycle has been completed. However, products that contain compounds with freezing points near or below the operational temperature of the condenser coil may bypass the condenser and enter the vacuum pump instead. The result can be severely reduced vacuum performance and/or vacuum failure.

Optional secondary traps are available for applications where acid or solvent vapors may bypass the condenser and extra protection is required for the vacuum pump.

If your unit was ordered with a cartridge-type trap, the cartridges may need to be replaced periodically.

There are two types of cartridges—a Sodasorb cartridge for acid-based applications and an activated charcoal cartridge for solvent-based applications. The Sodasorb cartridge has an indicator that will change to a blue color when replacement is required. The activated charcoal cartridge contains no indicator, so replacement at regular intervals is required. Depending on the usage and concentration, changing the charcoal cartridge every three to six months may suffice.

Gas Ballast Valve on the Vacuum Pump

The gas ballast valve removes some contaminants from the pump oil. During freeze-drying, vapors may bypass the condenser and end up in the vacuum pump. If this occurs, the vapors will degrade the oil, causing excessive wear and higher vacuum pressure.

When the ballast is open, it allows a controlled amount of air into the second stage pump cylinder. This reduces the partial pressure, increases the pump's operating temperature and releases the vapors.

Note: *Refer to the vacuum pump manual for the location of the gas ballast valve.*

Vacuum Tubing and Gaskets

Inspect tubing and gaskets periodically for signs of wear (*e.g.*, cracking or dried appearance). Check gaskets by removing and inspecting interior surfaces for potential problems. A light coating of vacuum grease on the exterior surfaces will protect gaskets and tubing. Reapply grease as needed.

The shroud must be removed to access the vacuum tubing. To remove the shroud and inspect tubing:

1. Remove all Quickseal valves.
2. Remove the screws located at the lower rear of the shroud.
3. Gently lift the rear of the shroud and then pull back.
4. Remove the tubing and inspect it for excessive wear. If the tubing is acceptable, apply a small amount of high vacuum grease to the inside of the tubing and squeeze it together. This will distribute the grease evenly on the inside of the tubing.
5. If the tubing needs to be replaced, contact SP Scientific. The required length is approximately two feet.
6. Reattach tubing to the unit.

Door Gasket

The door gasket should be routinely inspected for cracks.

To inspect the door gasket:

1. Remove the door gasket.
2. Grasp the gasket in both hands and turn it inside out.
3. Inspect the inside of the gasket. This is where you are most likely to find a potential problem.
4. If any inconsistencies are found (*e.g.*, cuts, cracks, dry rot, rippling) on the inside of the gasket, it should be replaced immediately.
5. Always install door gaskets on a clean, grease-free metal rim. Remove excess grease from the metal using isopropyl alcohol on a fresh paper towel or cloth. The gasket may also be cleaned with isopropyl alcohol.
6. Once the new or cleaned gasket is installed, apply a very thin coating of high vacuum grease to the outer surface of the gasket only. The gasket should appear slightly moist.

Quickseal Valves

All AdVantage series freeze dryers come equipped with four Quickseal valves. These valves should be serviced at least once each year.

To service Quickseal valves:

1. Remove the valves from the ports located on the right side of the unit.
2. Twist and pull the white selector until it is dislodged from the black rubber body. If the valve is difficult to turn and very sticky, the grease may have dried up. This increases the potential for leaks.
3. Clean the valves thoroughly with isopropyl alcohol to remove old grease and dirt.
4. Inspect each cleaned selector carefully.

   Note: *Use of broken flask adaptors can damage the selector.*
5. If scratches or cracks are found, the selector part(s) should be replaced.
6. Apply a thin film of high vacuum grease to acceptable selector(s) and reassemble.

Refrigeration System

Air-Cooled Condenser

It is very important to keep the air-cooled condenser clean. This is where high-pressure vapor from the compressor is converted to liquid refrigerant by rejecting the heat gained from the vapor condenser into the ambient air. Reduced airflow over the condenser can result in severely reduced performance and may shorten the life of the compressor.

To maintain the air-cooled condenser and compressor:

1. Remove the louvered intake grill and vacuum the fins.
2. Always maintain at least six inches of clearance in front of the air-cooled condenser grill, which is located on the left side of the unit.
3. Always maintain a room temperature approximately 20 °C. Higher temperatures may result in reduced performance and shorten the life of the compressor.
4. Inspect the fan for proper operation.
    a. Place your hand in front of the louvers located above the Quickseal valves. You should feel warm air being gently exhausted.
    b. Place a paper towel flat in front of the air-cooled condenser intake louvers. A properly operating fan will pull in enough air to hold the towel in place. Remember to remove the paper towel before operating your unit.
    c. If problems persist, contact SP Scientific Service.

Compressor(s)

Depending on the model of your freeze dryer, your unit may contain one or two compressors. ES and XL models contain one compressor, while EL models contain two compressors.

When a cooling system problem is suspected, have a qualified refrigeration service technician check the refrigerant charge, or contact SP Service directly. Each refrigeration system contains a specified charge. This charge is listed on a black charge tag which is attached to the back of the unit. The charge tag indicates the refrigerant type and static pressure.

A qualified refrigeration technician may check the charge after the unit has been off after several hours at room temperature. This will allow internal pressures to equalize. The shroud will need to be removed to allow the high and low side access valves to be visible. If the actual system pressure matches the pressure specified on the charge tag (±5 %), a refrigeration leak should be ruled out. If the actual system pressure is more or less than 5 % of the specified charge, it may be necessary to perform a leak check on the system and repair the leak.

If a refrigeration problem is suspected, a qualified technician should check for frost on the suction line. If the line is warm or just slightly cool to the touch, it usually means that a loss of refrigerant has occurred, and that the condenser and shelf are experiencing cooling problems. Contact SP Scientific for more information.

Acrylic Parts

Clean acrylic parts with a mild detergent. Use a soft cloth or Kimwipes® to avoid scratching the acrylic.

The following table may be used as a general guide to acrylic's chemical resistance.

CAUTION! DO NOT USE ORGANIC SOLVENTS OR ABRASIVE CLEANERS.

Chemical Resistance Chart

Chemical	Code	Chemical	Code	Chemical	Code
Acetic Acid (5%)	R	Ethyl Alcohol (50%)	LR	Nitric Acid (10%)	R
Acetic Acid (Glacial)	N	Ethyl Alcohol (95%)	N	Nitric Acid (40%)	LR
Acetic Anhydride	LR	Ethylene Dichloride	N	Nitric Acid (Conc.)	N
Acetone	N	Ethylene Glycol	R	Oleic Acid	R
Acetonitrile	N	2-Ethylhexyl Sebacate	R	Olive Oil	R
Ammonium Chloride (Saturated)	R	Formaldehyde (40%)	R	Phenol Solution (5%)	N
Ammonium Hydroxide (10%)	R	Gasoline (Regular, Leaded)	LR	Soap Solution (Ivory)	R
Ammonium Hydroxide (Conc.)	R	Glycerine	R	Sodium Carbonate (2%)	R
Aniline	N	Heptane	R	Sodium Carbonate (20%)	R
Battery Acid	R	Hexane (Commercial Grade)	R	Sodium Chloride (10%)	R
Benzene	N	Hydrochloric Acid	N	Sodium Hydroxide (1%)	R
Benzyl Alcohol	N	Hydrofluoric Acid (40%)	R	Sodium Hydroxide (10%)	R
Butyl Acetate	N	Hydrogen Peroxide (3%)	R	Sodium Hydroxide (60%)	R
Calcium Chloride (Sat.)	R	Hydrogen Peroxide (28%)	N	Sodium Hypochlorite (5%)	R
Calcium Hypochlorite	R	Isooctane	R	Sulfuric Acid (3%)	R
Carbon Tetrachloride	N	Isopropyl Alcohol	LR	Sulfuric Acid (30%)	R
Chloroform	N	Kerosene	R	Sulfuric Acid (Conc.)	N
Chromic Acid (40%)	N	Lacquer Thinner	N	Toluene	N
Citric Acid (10%)	R	Methyl Alcohol (50%)	LR	Transformer Oil	R
Cottonseed Oil (Edible)	R	Methyl Alcohol (100%)	N	Trichloroethylene	N
Detergent Solution (Heavy Duty)	R	Methyl Ethyl Ketone (MEK)	N	Turpentine	LR
Diesel Oil	R	Methylene Chloride	N	Water (Distilled)	R
Diethyl Ether	N	Mineral Oil	R	Xylene	N
Dimethyl Formamide	N	Naphtha (VM&P)	R	Trifluroacetic Acid	N
Dioctyl Phthalate	N				
Ethyl Acetate	N				

CODES

R = Resistant (withstands long periods of exposure at temperatures up to 50 °C).

LR = Limited Resistance (withstands short periods of exposure at room temperature).

N = Not Resistant (immediate damage may occur upon exposure).

Appendix A: Troubleshooting

Vacuum Problems

Remember optimal vacuum is only achievable with a clean, dry system. Initial vacuum will be affected by the amount of product loaded on the unit. For efficient freeze-drying, vacuum should be below 200 millitorr. When using the Quickseal valves, product may need to be introduced in stages to keep the vacuum below acceptable levels.

The following list poses questions to help eliminate possible vacuum-related problems:

- Was the condenser defrosted and drained after the last run?
- Is the chamber dry?
- Are all accessory ports, valves or filters closed tightly? Check all connections for integrity.
- Is the door gasket clean and properly greased?
- Are all the Quickseal valves in the closed position?
- Are the Quickseal valves in good condition? Is a light coating of vacuum grease visible on the valve plug and on the stainless steel valve port?
- Is the vacuum pump oil clean and at the proper level? Check the sight glass.
- Is the condenser maintaining the proper temperature? If the temperature rises due to refrigeration problems, moisture may be leaving the condenser walls and migrating to the vacuum pump, causing poor vacuum.

If you get a vacuum reading below 500 millitorr (on the front panel or vacuum gauge) within 15 to 30 minutes, you can rule out any problem with the pump, vacuum probe and vacuum tubing connections. Recheck the chamber and gasket for joint separations and dirty or rough surfaces.

If you do not get a normal vacuum reading on the front panel display or vacuum gauge within 15 to 30 minutes, start checking components individually.

1. Change and flush the oil in vacuum pump (refer to the vacuum pump manual).
2. Disassemble all vacuum tubing connections, clean with a mild alcohol such as methanol, apply a light coating of vacuum grease and reassemble.
3. Check all threaded and welded connections and seal with vacuum sealant.

If poor vacuum persists or testing vacuum with a second, calibrated gauge indicates a good vacuum reading, the problem is likely related to the vacuum probe. Replace the vacuum probe tube and retest.
Note: *If following this checklist does not resolve the vacuum problem, contact SP Scientific Service and a trained technician will assist you.*

Product Melting

The most common reason for product melting is insufficiently low vacuum pressure. Adequate vacuum is required to keep products in a frozen state. Check for a vacuum leak or possible restrictions in the vacuum hose as described above.

If the unit is functioning properly, but the product is still melting, the product's freezing point (eutectic temperature) may be too low to remain in a frozen state. Re-test using a water sample to determine if a mechanical or product-related problem exists.

Appendix B: Serum Vial Capacities

Serum Vial Capacities Chart

Part number (p/n)	Height (mm)[12]	Body OD (mm)	Capacity (ml)	Qty per Tray
179077[13]	35	18	2	285
179275[14]	85	12	2	560
179101[13]	40	22	6	202
179085	47	23	5	174
179143[13]	50	23	10	174
179135	54	26	10	143
178855[13]	62	28	20	120
178830	58	33	20	80
178897	63	37	30	63
178921	73	43	50	45
178954	95	52	100	30
178988	107	54	125	30

[12] Add 8mm for partially inserted stopper.

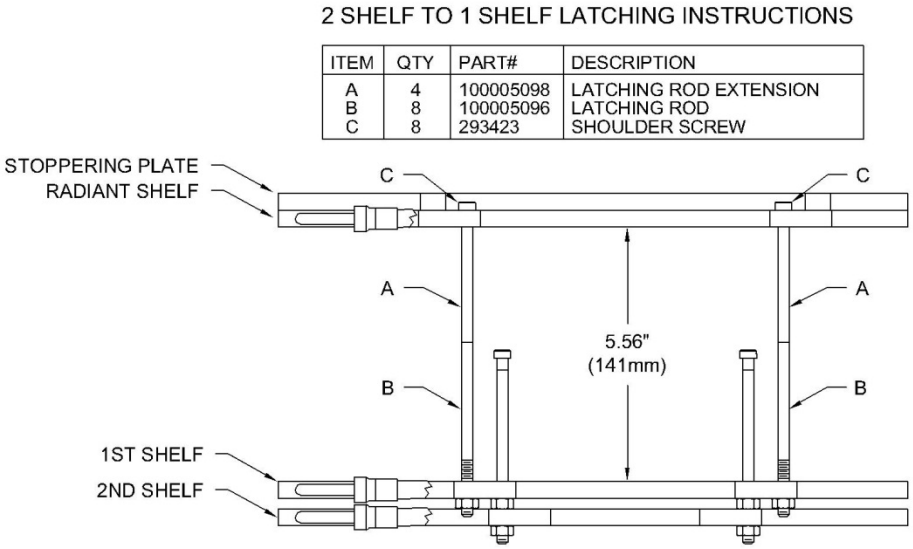
[13] Thin Wall.

[14] Special Stoppering Ampoule (add 10mm for partially inserted stopper).

Appendix C: Shelf Latching for Advantage Plus Units

Shelf Latching Instructions

To latch shelves together on an AdVantage Plus:

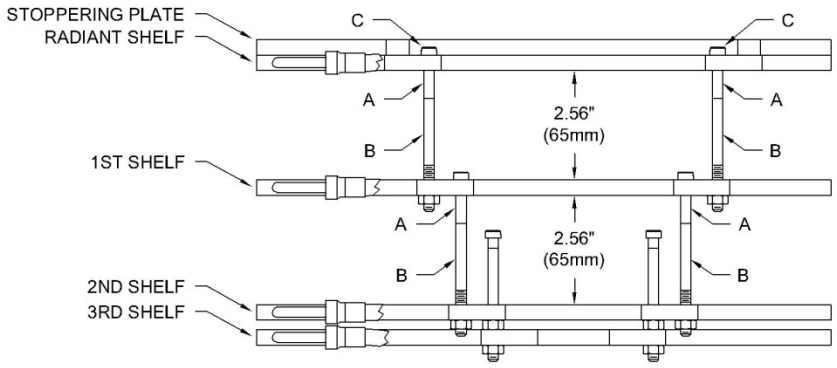


Configuration A

1. Ensure that all shelves are empty.
2. Turn the stoppering valve to the Down position to allow the Pneumatic Cylinder Rod to extend fully.
3. Remove the four (4) upper shoulder screws (Item C) and install latching rod extensions (Item A). Remove only the upper shoulder screws installed in the four corners of the top shelf.
4. Replace and secure the four (4) upper shoulder screws (Item C).
5. Turn the stoppering valve to the Up position to allow the shelf stack to return to its original position.
6. To return to a two-shelf arrangement, repeat the process and remove the latching rod extensions (Item A). Ensure that the shoulder screws are secured before raising the shelf stack.

3 SHELF TO 2 SHELF LATCHING INSTRUCTIONS

ITEM	QTY	PART#	DESCRIPTION
A	8	100005099	LATCHING ROD EXTENSION
B	12	100005097	LATCHING ROD
C	12	293423	SHOULDER SCREW



Configuration B

1. Ensure that all shelves are empty.
2. Turn the stoppering valve to the Down position to allow the Pneumatic Cylinder Rod to extend fully.
3. Remove the eight (8) upper shoulder screws (Item C) and install latching rod extensions (Item A). Remove only the upper shoulder screws installed in the four corners of the top two shelves.
4. Replace and secure the eight (8) upper shoulder screws (Item C).
5. Turn the stoppering switch to the Up position to allow the shelf stack to return to its original position.
6. To return to a three-shelf arrangement, repeat the process and remove the latching rod extensions (Item A). Ensure that the shoulder screws are secured before raising the shelf stack.

SP Scientific

815 State Route 208
Gardiner, NY 12525 USA

3538 Main Street
Stone Ridge, NY 12484 USA

www.SPScientific.com
(800) 431-8232
(845) 255-5000