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Operating Instructions

BENCTOP 8 & FREEZEMOBILE 8

The VirTis Company, an SP Industries Company
815 Route 208
Gardiner, NY 12525
Phone (845) 255-5000
Watts (800) 431-8232
Fax (845) 255-5338
Repair/Service Dept. Fax (845) 255-1189
E-Mail: info@virtis.com

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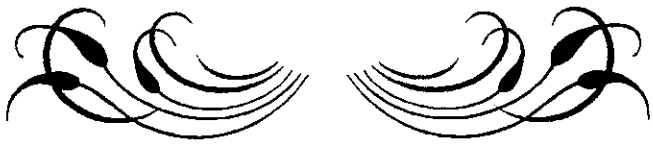


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INTRODUCTION

Thank you for choosing VirTis for your freezedrying needs. In keeping with our tradition of quality, reliability, and technical innovation, our newest freezedryers have many exclusive features for convenient and trouble free operation.

The microprocessor based "Sentry" or optional "Auto-Sentry" system control will monitor your drying process with the touch of a switch. You'll have full visibility of our stainless steel condenser through an acrylic veiwing port. There's an easy swingout front access door to make maintenance a snap. And whichever refrigeration system you chose, you can rest assured knowing you have our exclusive two year refrigeration system warranty.

All our designs are azide proof and we have many valuable options. All of this combines to make a system that is standardized yet flexible enough to suit your particular needs.
Your rugged, easy-to-use new VirTis Freeze Dryer will give years of dependable, troublefree service.

Please take time to read the Installation and Operation sections of this manual before attempting operation, and refer to the Maintenance section to keep your freezedryer in top running condition. The Operating Principle section is a helpful outline of mechanical functions, especially useful when training a new operator.

It's a good idea to keep this booklet on hand for quick reference, but if you can't find the answer to your question here, please call and we'll be glad to help.

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INSPECTION

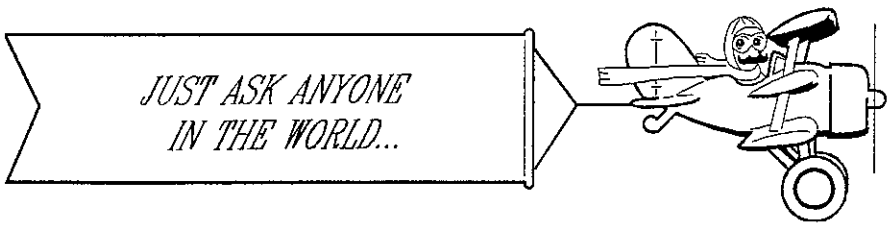
1. Inspect contents of this shipment immediately upon arrival. Check packing material for possible small accessory items. If damage is obvious, DO NOT ACCEPT shipment from carrier without a signed notification of damages.

2. When concealed damage and/or loss is discovered, contact the delivering carrier immediately to make an inspection report. Keep the contents and packing material and any paperwork intact until the written report is obtained.

a. If your shipment is F.O.B. destination, file your claim with VirTis by sending the inspection report and other supporting documents to us.

b. If your shipment is F.O.B. factory, file your claim with the delivering carrier, accompanied by the inspection report and other supporting documents.

VirTis will cooperate in the matter of collecting your claims, but we are not responsible for the collection or free replacement of the material. Replacement parts will be shipped and invoiced to you, making them a part of your claim.



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WARRANTY CERTIFICATE

1. VirTis equipment is guaranteed to be free of defects in workmanship and/or material for a period of 1 year after date of delivery.

2. During this warranty period, parts found upon our inspection to be defective in workmanship and/or material will be replaced. Parts, expendable items, and labor will be supplied at no charge F.O.B. factory.

3. All VirTis base units feature a special 2 year warranty on the refrigeration compressor and basic refrigeration system components. Parts and labor will be provided at no charge under the same conditions as the first year whole unit warranty.

4. If prior approval is obtained from the factory service department, VirTis will reimburse the cost of repairs or service made at customer's expense, of items covered by this warranty.

5. Travel time and direct travel expenses incurred by our personnel are not covered by this warranty.

6. Shipping damage is not covered by this warranty. Claims for shipping damage should be made against carriers responsible for the shipment.

7. Damage to the vacuum pump is not covered by warranty if the damage has been caused through improper operation of the freeze dryer (see installation and operation instructions) or through the introduction of corrosive chemicals in the products being freeze dried.

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I. OPERATING PRINCIPLE

The new VirTis Freezemobiles and Benchtop Freezedryers are designed to remove the aqueous portion or other solvents from the product materials under carefully controlled conditions. The four basic requirements in this process are:

FREEZING Rapid cooling of the product to a point below its eutectic. (A compound's eutectic is the common freezing point for all of its components).
VACUUM Removal of air and other non-condensable vapors from the chamber to facilitate vapor migration.
HEATING Carefully controlled heat input to the frozen product to speed the drying process.
CONDENSING Trapping of water vapor molecules in the form of ice on the condenser surface.

The following is a brief description of the mechanical systems in the VirTis freezedryers responsible for the four basic requirements of freeze-drying.

FREEZING The main reason to pre-freeze a product is to lock its particles into a solid matrix so that water and other solvents can be removed without causing physical or chemical changes in the compound. Freezing the product to below -40 C is usually sufficient.
VirTis' 8 Liter units use manifold heads for drying. Pre-freezing for these units are done separately by using an external source, or a shell bath. Instructions for shell freezing are found in the annex of this manual.

VACUUM The purpose of the vacuum system is to continually evacuate all non-condensable gasses from the drying chamber. This reduces the resistance encountered by water vapor molecules migrating from the product to the condenser. It also encourages the vapor pressure differential necessary for sublimation and helps to prevent oxidation by removing air.

A high vacuum pump always has two stages, roughing and high vacuum. These are represented inside the pump by two cylindrical chambers containing off-set, concentrically driven rotors. As the rotors are driven, sliding vanes fitted into slots in each rotor allow a volume of gas to be expanded, cut off, compressed and then pumped.
The pumping unit (2 stage) is submerged in a high quality, specially compounded, low pressure oil. This insures a vacuum-tight seal between stages and acts as a coolant and lubricant for the pump's moving parts. A conveniently located sight glass makes quick checks on the oil level easy, and the gas ballast (see pump booklet) helps prevent oil contamination while pumping condensable vapors, reducing the number of necessary oil changes.



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HEATING When flasks are dried on a manifold, the ambient (or room temperature) air surrounding the flasks will normally supply enough heat.
Heat is applied to the frozen product to maintain vapor migration from the product to the condenser. Ambient heat supplies the necessary energy to drive off the vapors, insuring continued sublimation.
Freezedrying occurs in two phases: Primary and Secondary drying. Primary drying is characterized by sublimation from totally frozen product. Secondary drying is continued desorption of trapped moisture until desired consistency is obtained.

CONDENSING When water vapor molecules leave the product ice they migrate toward the low pressure areas in the vacuum system—first to the area just above the product ice, then to the low pressure area surrounding the condenser. Upon contacting the condenser, the vapors give up their heat energy and turn to ice.
The Freezemobile's and Benchtop's condenser is fully visible from above, through its clear acrylic viewing port. The condensing surface is helical in shape and made of 304 stainless steel. Housed within the coil are the refrigeration lines. The standard air cooled refrigeration system uses a hermetic compressor and specially selected refrigerants provide optimum vapor condensing temperatures. Cooling air for the refrigeration unit is drawn through the grill at the front of the cabinet and warmed air exits at the back.



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II. INSTALLATION

1. Check voltage, frequency and amperage as listed on the serial tag, against your available electric supply; your power supply must be adequate and match that of your unit.
2. For shipping purposes Freezemobile, casters may have been removed from bottom of the freezemobile unit, and will be found in a small bag inside the unit or attached to the base of the wooden crating. To re-assemble, simply insert stem of caster into plastic insert in outside corners of stainless steel tubular frame. No casters are provided with Benchtop units.
3. Position Freezemobile on a firm level floor, or lab Bench for Benchtop, and in an area providing adequate air circulation. Its back and sides should be at least 4 inches away from the wall. The ideal room temperature is +20 C (+68 F) for efficient operation.

SET UP for all Freezemobiles or Benchtop (8 Liters)

1. Open the hinged front vent grille by lifting gently on the right side and pulling outward.
2. If your unit was purchased with a vacuum pump, it is installed inside the cabinet. Remove the shipping plug in the exhaust port and make sure the vacuum pump is plugged into the receptacle marked VACUUM.
3. Check the vacuum pump oil level. The pump is shipped with oil in it. Add oil only if necessary. DO NOT OVERFILL. The oil level normally should be halfway up the sight glass.

NOTE: For your protection and well-being may we suggest your facility make arrangements for an adequate vacuum pump exhaust system - pump vapors are quite unpleasant in the lab and cannot be tolerated in a clean room. Exhaust lines should have an I.D. size no smaller than that of the pump. Filters are available, a hood may be used, or the pump can be vented to the outside. The exhaust line should go horizontally from the pump to a "T" with drainable trap, then 90 degrees vertical to outside vent. Place trap as close to the pump as possible.

4. Place the drum manifold provided over the condensing coil. It is advisable to apply a very light film of Dow Corning High Vacuum Grease to the outside of the manifold gaskets prior to the first run. Only a sheen on the surface is needed. There should be no visible layer. Make sure this film is intact. Do not grease the back side of the gasket where it grips the manifold lip.
5. Make sure all Quickseal Valves (port closures) are in closed (up) position. Place lucite viewing port lid on drum manifold (grease gasket sparingly as before). If you have purchased a bulk drying assembly with your manifold, refer to instruction found elsewhere in this manual.
6. Check one final time that voltage, amperage and frequency of your power line match those specified on the serial tag. Make sure all switches are in the "off" position and connect the line cord to the proper electrical outlet.

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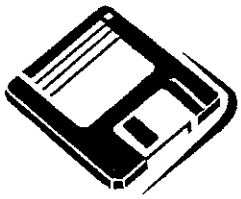
7. Upon connection to the power line, the Sentry monitor will begin a self test routine. Within approximately 15 seconds it will display all zeros while it completes its start-up routine After approximately 30 seconds, it will display condenser temperature, point C1, and begins automatically scanning the other data points. The Sentry performs this routine each time power is connected or restored following power failure and otherwise remains on. The scan button should not be pressed before the self test is complete, and the C1 temperature value has appeared. These represent the internal set points for the condenser and vacuum status lights and are used only for calibration.

8. The Sentry displays condenser temperature (C1), vacuum (V1), ambient temperature (AT), line voltage (LV) and run time (RT). If your unit is equipped with a shell bath, its temperature (T1) will also display. To halt the display at any point simply press the scan/reset button once. To restart the automatic scan press the button again. All data points are continuously monitored and updated regardless of the scan status.

9. To indicate an over range condition, the vacuum will initially display as "8888" until vacuum reaches 2000 millitorr. It will then read the correct system vacuum.

10. The run timer resets to zero and begins counting when the "refrigeration" switch is turned on. When the switch is turned off the timer stops and is reset to zero. To reset during a run, halt the display on run time and hold in the scan/reset button. In a few seconds, the left most position on the display will flash a zero. In a few more seconds, it will stop flashing then disappear as the timer is reset. If you release the button before reset occurs, the timer will continue unchanged.

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III. OPERATION

IMPORTANT! Before going ahead, make sure you have completed the "Installation" section of the manual. Failure to pay attention to these suggestions could result in serious damage to your unit, possibly voiding its warranty.

1. Make sure all valves and the condenser drain line are closed.

The condenser should be clean and dry. Check the drain line for residual moisture which can be drawn up into the condenser when vacuum is applied, causing a slow pumpdown.

Check vacuum pump oil level and clarity. Change or add as needed. The oil in the sight glass on the front of the pump indicates level only. Check clarity of the oil by draining approximately 20 ml (a little less than an ounce) from the drain hose and examining closely.

2. Switch on "Refrigerate". Condenser status light will come "ON". Wait until condenser status light indicates "OK" before proceeding.

3. Switch on "Vacuum". Vacuum status light will come "ON". Wait until vacuum status light indicates "OK" before proceeding.

4. Drying - Knowing your product's eutectic can conserve time and energy and insures the highest quality freeeze-dried product. If lacking the instrumentation for determining eutectic, make sure that your product is well frozen, preferably to below -40 C.

a. Manifold Drying - Whenever both status lights indicate "OK", you may connect a pre-frozen sample to a Quickseal valve and turn valve to "OPEN" position. Depending on the volume of air in the flask being added, the vacuum "OK" light may go out briefly. Wait until it comes back on before adding another flask.

5. Continue freeze drying until dryness is determined by one or more of the following indicators:

- The condenser temperature will approach its maximum low. (If drying a very small amount of product, the condenser temperature will have remained low throughout the drying process.)
- Vacuum will approach a constant low reading.

Appearance of the product may indicate the extent of dryness:samples uniformly powdery or fluffy,lack of frost on container, container at room temperature.

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- Optional product temperature indicator or recorder shows product temperature closely paralleling heat source temperature.

- When samples are dry, close Quickseal valves and remove the containers.

Once all containers have been removed, break vacuum by opening Quickseal valve to admit air.

6. After vacuum is broken, IMMEDIATELY switch OFF "Vacuum".

7. Switch OFF "Refrigerate".

8. Defrosting - After the product has been removed,the Freezemobile or Benchtop unit is ready to be defrosted.
Remove the drum manifold from the unit, exposing the coiled condenser to ambient temperature. Remove plug from condenser drain hose and let drain into large container. Ice on the coil will rapidly melt, but this can be facilitated by several hot water rinses. Depending on ice load, defrost times may vary. Hot water rinses may take between 1-2 hours, and room temperature melting as long as 24 hours.
NOTE: Do not chip ice off the condensing coils, this may damage coils and make extensive repairs necessary.

9. Shutdown - make sure all switches are off. Properly drain, clean and dry all parts of the condenser, drum manifold, and drain hose. This prevents residual buildup of corrosive and contaminating materials on interior surfaces,protecting both the machine and the next product to be processed. Baking soda or another mild buffering agent may be added to the rinse water to help neutralize acidic residue, and a siphon-type squeeze bottle is useful to direct the rinse spray into corners.

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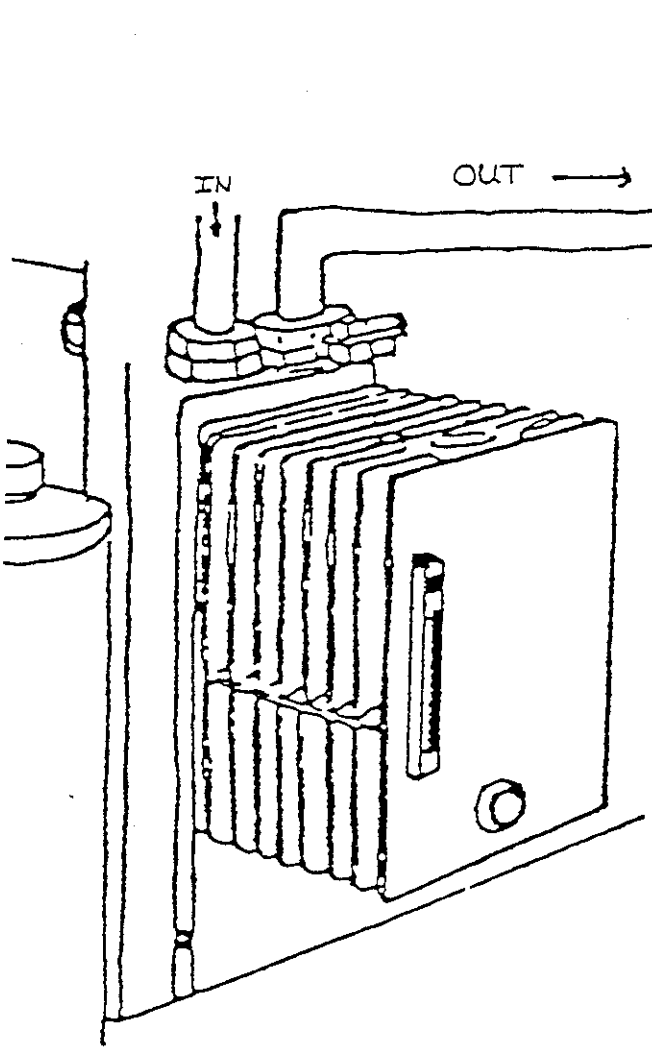
ANNEX



TO
OPTIONAL
ACCESSORIES

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The exhaust line should go horizontally from the pump to a "T" with drainable trap, then 90 vertical to outisde vent. Place trap as close to the pump as possible. See Figure.



FOR DRAINING CONDENSABLE VAPORS AND CONTAMINATED OIL

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OPTIONAL SHELL BATH

A product which is "stub frozen" on the bottom of a flask can damage the flask, prolong freeze drying time and create melt back. A thin, even coat of product helps to eliminate these problems:

The VirTis shell freezing bath comes with the following:

- Two flask lift devices
- Two lift device chains
- Two polypropylene plugs
- One clear PETG plastic shell bath cover

Check to be sure all are included with your shell bath.

1. Fill flasks no more than halfway with product. Replace the cover and insert a polypropylene plug.

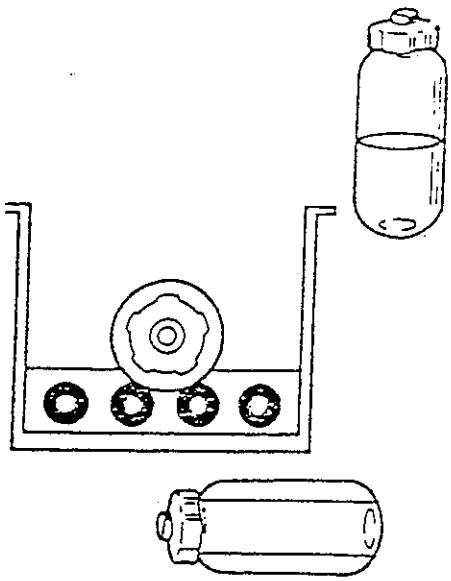
2. Fill shell bath with a sufficient amount of solvent with a freezing point lower than your bath temperature to cover rollers, approximately 2-3 liters, depending on desired depth.
   CAUTION: Be careful to handle and dispose of toxic or flammable materials properly.

3. Press "REFRIGERATE" switch on your freeze dryer. This will activate the condenser as well as your shell bath. The maximum low temperature for your shell bath will vary depending on the refrigeration option. Your shell bath temperature is read on your SENTRY digital indicator, and is designated by T1.

4. When the bath has become sufficiently cold, place flask lift device, with chain fully extended, across the bath. The device may be placed in either of two positions for high or low support. Select the one best suited for your flask. Put in polypropylene plug.

5. Hold the flask at an angle so that the product just reaches the flask neck without touching the filter inside the cap. Position the flask under the lift device, resting it on the rollers. (See diagram #2)

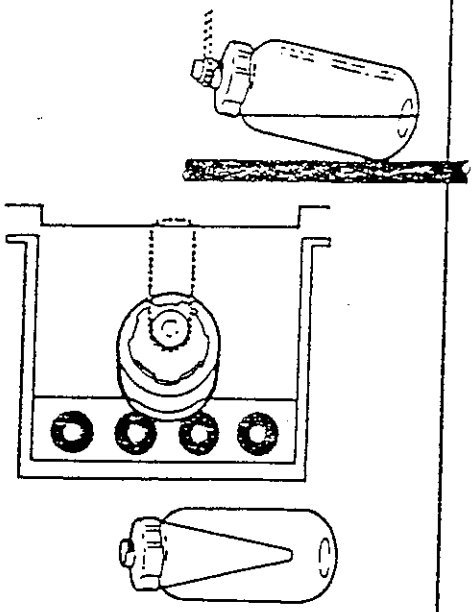
6. Shorten the lift device chain (pull up through middle hole in device, to secure, slide it to one side) until it rides in the groove of the polyproplylene plug and supports the flask at the correct angle. (See diagram # 1)



A flask filled halfway with product and laid on its side on the rollers in the bath will produce a uniform coating.

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A flask lift device supporting the flask on an angle will produce a conical coating accommodating more product without risk of filter contamination.



7. Depress the "ROLLERS" switch on the SENTRY control panel to activate rollers. Flasks should freely rotate on suspended chain. Continue until product is fully frozen.

8. Frozen samples should be placed on manifold for freeze drying or stored in freezer immediately.

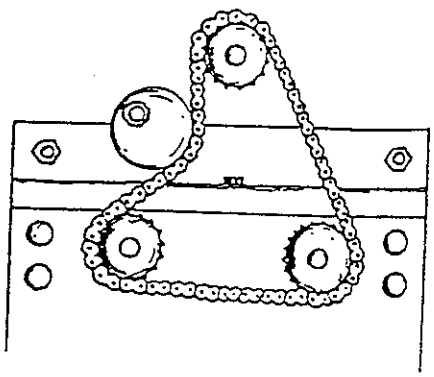
9. By using this procedure, bottles of various sizes can be shell frozen without changing the depth of fluid in the bath. The shell bath can handle the following flasks at one time:

3 ea	150 ml	flasks
2 ea	300 ml	flasks
2 ea	600 ml	flasks
1 ea	1200 ml	flask
1 ea	2000 ml	flask

10. To clean and maintain the VirTis shell bath, periodically drain bath liquid by removing drain plug in hose located inside the cabinet. Flush with a mild detergent or a baking soda solution with warm water to clean the stainless steel bath and rollers. Replace drain plug before refilling with solvent.

11. If a more thorough cleaning is required, the roller assembly may be removed by loosening the two hex nuts holding it to the bath wall, lifting the opposite end of the assembly and disengaging the chain drive from the sprocket. When reassembling, be sure to replace and tighten the washers and nuts (see diagram).

12. Drive chain tension is easily adjusted using the nylon cam on the end of the bath.



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OPTIONAL FILTER TRAP

The VirTis Filter Trap protects your vacuum pump from damaging and corrosive vapors released during freeze drying. Your factory installed Filter Trap is located on the "vacuum pump" side of your freeze dryer. The Filter Trap assembly includes the following:

- Polypropylene clear housing
- Stainless steel mounting bracket
- White plastic top with inlet and outlet ports
- Choice of drop in disposable wire mesh cartridges which must be ordered separately
  - * Soda Sorb Cartridge # 250365
  - * Activated Charcoal Cartridge # 250373

Operation:

1. Unscrew clear polypropylene housing from white plastic top.

2. Due to the highly absorbent nature of filter trap cartridges, it may be necessary to subject them to vacuum (de-gassing) before beginning the freeze drying process. Without degassing, vacuum pumpdown will be significantly longer than usual.

   To start, turn on the "VACUUM" switch. Make sure the gas ballast is slightly opened on your vacuum pump, and all ports are closed. When the vacuum reaches 50 microns, (or less) close gas ballast valve. It may take between 1-2 hours for de-gassing to be complete.

   NOTE: De-gassing is necessary each time you change your filter trap cartridge.

3. Now you may add your product and begin freeze drying.

4. Your cartridges are disposable. Their life depends on frequency of use and the volume of contaminants they readily absorb. The Soda Sorb cartridge contains a dye which indicates need for replacement when a complete purple color change is evident. The activated charcoal cartridge contains no color indicating dye. Pump oil must be routinely checked for clarity to assess the charcoal's absorbing capacity.
   CAUTION: Be careful to properly handle and dispose of used cartridges.

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OPTIONAL AUTO SENTRY

Located on your SENTRY control panel is an "Auto" switch which will initiate an automatic start up sequence. The Auto-Sentry will over-ride the standard operational procedures under Section III, steps 2 and 3. In addition, in the event of a power failure, the Auto SENTRY re-starts the freeze drying process in the proper sequence.

1. After satisfying installation requirements, you are ready to begin freeze drying. Press "Auto" Switch on your SENTRY control panel. The refrigeration system will be activated and the condenser temperature will begin to drop. The condenser status light, indicating "ON", will illuminate.

2. When chamber drying, product can be pre-frozen in chamber and held at low temperature by using shelf refrigeration. Make sure product is prefrozen before switching on Auto Sentry.

3. When the condenser has reached within 10 degrees C of its maximum low, the vacuum pump will be automatically initiated. At this time the condenser "OK" light will be illuminated, as well as the vacuum "ON" light, indicating all systems are performing.

4. When the sufficient vacuum for freeze drying has been achieved (100 millitorr), the vacuum "OK" light will illuminate indicating satisfactory conditions for freeze drying exist.

5. Product flasks may now be added to the manifold or the chamber heat cycle may be initiated.

6. Following completion of drying, release vacuum in your system and immediately switch off auto. This will turn off both the vacuum pump and refrigeration system.

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OPTIONAL ELECTRIC PURGE SYSTEM

The Electric Purge System includes an electrically operated valve to isolate the vacuum pump from the freeze dryer's vacuum system. Working with the gas ballast, it purges water and other volatile contaminants from the pump oil.

1. Open gas ballast located on your vacuum pump (see your vacuum pump manual for location and operation of gas ballast).

2. At the end of your freeze drying cycle with the refrigeration system off, turn on your vacuum pump, by pressing the "VACUUM" switch.

3. Press the "PURGE" switch on your SENTRY control panel. The purging process will take between 1-24 hours depending on the amount of dissolved contaminants. To determine whether pump oil is adequately clean, turn off the purge system and vacuum pump and drain a few milliliters of oil into a clean container. Visually inspect the oil for clarity. Repeat if necessary.

4. When purging is complete, turn off "PURGE".

5. Turn off "VACUUM".

NOTE: Purging is an excellent way to clean your oil of volatiles and prolong the life of your vacuum pump. However, checking and changing your oil regularly is the only way to insure this. Refer to the Maintenance Section of your vacuum pump manual for further details.

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OPTIONAL LIQUID NITROGEN TRAP

The LN2 Liquid Nitrogen Trap is a convenient way to protect your vacuum pump from the corrosive action of acid and alkaline vapors as well as low temperature and organic solvents that can be released during freeze drying.

The LN2 Trap consists of the following:

- Stainless steel vessel with inlet and outlet ports and drain line
- Center well and cover
- Vacuum by-pass assembly with three lever-activated ball values (see diagram for each valve's function)

1. Switch on "REFRIGERATE" and wait for condenser to reach its specified 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 LN2 from a tank, provide adequate ventilation from gaseous vapors. Liquid Nitrogen expands and bubbles when it comes in contact with the warm center well.
3. Replace cover and wait one minute. Open well and slowly fill to capacity (2.8 liters or 5 liters depending on center well size). Be sure to wear protective gloves and avoid skin contact.
4. Open valves 1 and 2 (see diagram) and close valve 3.
5. Switch on vacuum until adequate pressure is reached. (Below 100 microns)
6. Trap is now in operation. Liquid Nitrogen evaporates rapidly over time and solvent is condensed, so occasionally check and refill center well.
7. Excessive accumulation of condensed vapors can result in loss of vacuum and is an indication that the trap needs defrosting. Check this by isolating the trap (close valves 1 and 2). Break vacuum to trap by removing drain plug from the drain hose located under stainless steel vessel. Lift center well slightly. When the well cannot be easily moved, defrost immediately!

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8. To defrost your Liquid Nitrogen Trap, first remove any Liquid Nitrogen left in center well.

   CAUTION: Be sure to handle and dispose of solvents properly.

9. Place an appropriate container under trap and remove drain hose plug.

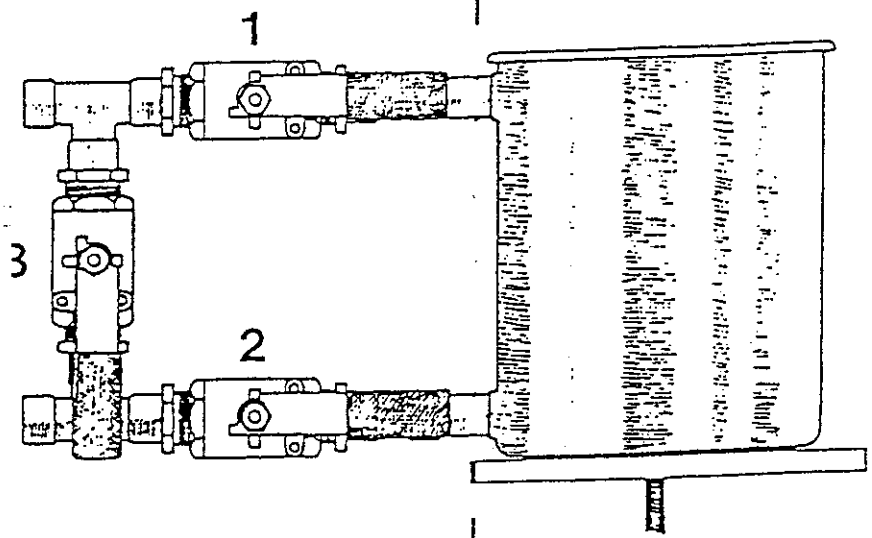
10. If condensate permits, remove center well and rinse off any remaining condensate.

11. Condensate melting can be accelerated by putting hot water in center well.

12. Rinse the interior of the trap. Be sure to insert 3/4" diameter plugs in the vacuum "inlet" and "outlet" ports before rinsing trap; water in the vacuum line can cause poor vacuum and/or pump damage.

13. Wipe the trap dry and reassemble. Make sure that any plugs you have inserted in the ports are removed and the plug in the drain line is replaced.

14. Be sure that all stainless steel parts exposed to acids are thoroughly rinsed with water and baking soda or mild detergent after each defrosting. Under no circumstances should thawed condensate be allowed to remain in the trap.



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LIQUID NITROGEN AND FILTER TRAP ASSEMBLY IN SERIES

1. Prior to freeze drying run, remove excess moisture in Soda Sorb using degassing procedure (see Optional Filter Trap Step 2 annex). Valve 2 should be open, keep valves 1 and 3 closed.

2. Valves 1, 2 and 3 closed allows for purging of the vacuum pump by opening gas ballast valve.

3. Valves 1 and 2 open and 3 closed allows passage through both traps from the ice collecting condenser to the vacuum pump.

4. Valves 1 and 2 closed and 3 open bypasses both traps, allowing direct passage from ice collecting condenser to vacuum pump.

5. Since both traps are in series, they may be used independently of each other by simply leaving out the filter cartridge or LN2. All else remains the same.

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FREEZEMOBILE SERIES
FREEZE DRYER SPECIFICATIONS

VER: 001 DATE: 1/4/94

FREEZEMOBILE 8 SERIES	SL	ES	SE	XS	EL
Condenser Blank-Off Temperature: °C	-55	-53	-50	-70	-85
Condenser Capacity in 24 Hours: Liters	4.1	4.1	4.1	4.1	4.1
Deposition Rate in Liters per Hour	0.17	0.17	0.17	0.17	0.17
Condenser Surface Area: In^2/cm^2	170 (1097)	170 (1097)	170 (1097)	170 (1097)	170 (1097)
Total Condenser Capacity: Liters	8	8	8	8	8
Number of Compressors	1	1	1	1	2
Compressor Horsepower	1/2	1/2	3/4	1/2	2x,1/2
System Refrigerants	R13B1 Mix	V55C	R22	V70C	R22,R23
Refrigerant Type	Std.	CFC Free	CFC Free	CFC Free	CFC Free
Defrost Method	Hot Water	Hot Water	Hot Water	Hot Water	Hot Water
Average Current Consumption: Amperes					
Optional Bath Temperature: °C	-45	-43	-40	-60	-70
Recommended Optional Vacuum Pumps: Liters/Minute	127 195	127 195	127 195	127 195	127 195

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FREEZEMOBILE 8 SERIES	SL	ES	SE	XS	EL
Average Evacuation Time: Minutes	14	14	14	14	14
Cabinet Dimensions					
Narrow Inches	25 Wide x 26.5 Deep x 36.5 High				
Centimeters	63.5 Wide x 67.3 Deep x 92.7 High				
Wide: Inches	40 Wide x 26.5 Deep x 36.5 High				
Centimeters	101.6 Wide x 67.3 Deep x 92.7 High				
Range of Weight: Pounds (Gross)	265–415				
Kilograms	120–188				

NOTE: All temperature specifications based on an ambient temperature of 20 degrees C.

Specifications are subject to change without notice. Contact VirTis for latest revision.

APPROVAL CODE	
Chief Engineer:	Date: 5/5/94
Sales Manager:	Date: 5/5/94

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BENCH-TOP SERIES
FREEZE DRYER SPECIFICATIONS

VER: 001 DATE: 6/14/94

BENCH-TOP 8 SERIES	SL	ES	SE	XS	EL
Condenser Blank-Off Temperature: °C	-55	-53	-50	-70	-85
Condenser Capacity in 24 Hours: liters	4.1	4.1	4.1	4.1	4.1
Deposition Rate in liters per hour	0.17	0.17	0.17	0.17	0.17
Condenser Surface Area: in^2/cm^2	170 (1097)	170 (1097)	170 (1097)	170 (1097)	170 (1097)
Total Condenser Capacity: liters	8	8	8	8	8
Number of Compressors	1	1	1	1	2
Compressor Horsepower	1/2	1/2	3/4	1/2	2x,1/2
System Refrigerants	R13B1 Mix	V55C	R22	V70C	R22,R23
Refrigerant Type	Std.	CFC Free	CFC Free	CFC Free	CFC Free
Defrost Method	Hot Water	Hot Water	Hot Water	Hot Water	Hot Water
Average Current Consumption: amperes					
Optional Bath Temperature: °C	-45	-43	-40	-60	-70
Recommended Optional Vacuum Pumps: liters/minute	127 195	127 195	127 195	127 195	127 195

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BENCH-TOP 8 SERIES	SL	ES	SE	XS	EL
Average Evacuation Time: minutes	14	14	14	14	14
Cabinet Dimensions					
Narrow inches	25 Wide x 26.5 Deep x 15.25 High				
centimeters	63.5 Wide x 67.3 Deep x 38.7 High				
Wide: inches	40 Wide x 26.5 Deep x 15.25 High				
centimeters	101.6 Wide x 67.3 Deep x 38.7 High				
Range of Weight: pounds (Gross)	265–415	110 – 250			
kilograms	120–188	49.9 – 113.4			

NOTE: All temperature specifications based on an ambient temperature of 20 degrees C.

Specifications are subject to change without notice. Contact VirTis for latest revision.

APPROVAL CODE	
Chief Engineer:	Date: 6/15/94
Sales Manager:	Date:

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