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# User's Manual

## CentriVap<sup>®</sup> Centrifugal Concentrators and Cold Traps

### **Models**

78100 Series  
78110 Series  
74600 Series  
73850 Series  
79820 Series  
79830 Series  
79840 Series  
74750 Series

To receive important product updates,  
complete your product registration card  
online at [register.labconco.com](http://register.labconco.com)

**Please read the User's Manual before operating the equipment.**

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## **Warranty**

Labconco Corporation provides a warranty to the original buyer for the repair or replacement of parts and reasonable labor as a result of normal and proper use of the equipment with compatible chemicals. Broken glassware and maintenance items, such as filters, gaskets, light bulbs, finishes and lubrication are not warranted. Excluded from warranty are products with improper installation, erratic electrical or utility supply, unauthorized repair and products used with incompatible chemicals.

The warranty for CentriVap® Centrifugal Concentrators and Cold Traps will expire one year from date of installation or two years from date of shipment from Labconco, whichever is sooner. Warranty is non-transferable and only applies to the owner (organization) of record.

Buyer is exclusively responsible for the set-up, installation, verification, decontamination or calibration of equipment. This limited warranty covers parts and labor, but not transportation and insurance charges. If the failure is determined to be covered under this warranty, the dealer or Labconco Corporation will authorize repair or replacement of all defective parts to restore the unit to operation. Repairs may be completed by 3<sup>rd</sup> party service agents approved by Labconco Corporation. Labconco Corporation reserves the rights to limit this warranty based on a service agent's travel, working hours, the site's entry restrictions and unobstructed access to serviceable components of the product.

Under no circumstances shall Labconco Corporation be liable for indirect, consequential, or special damages of any kind. This warranty is exclusive and in lieu of all other warranties whether oral, or implied.

## **Returned or Damaged Goods**

Do not return goods without the prior authorization from Labconco. Unauthorized returns will not be accepted. If your shipment was damaged in transit, you must file a claim directly with the freight carrier. Labconco Corporation and its dealers are not responsible for shipping damages.

The United States Interstate Commerce Commission rules require that claims be filed with the delivery carrier within fifteen (15) days of delivery.

## **Limitation of Liability**

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 required to become familiar with any regulations that apply in the user's area concerning the dumping of waste materials in or upon water, land, or air and to comply with such regulations. Labconco Corporation is held harmless with respect to user's compliance with such regulations.

## **Contacting Labconco Corporation**

If you have questions that are not addressed in this manual, or if you need technical assistance, contact Labconco's Customer Service Department or Labconco's Product Service Department at 1-800-821-5525 or 1-816-333-8811, between the hours of 7:30 a.m. and 5:30 p.m., Central Standard Time.

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# Chapter 1: Introduction

Congratulations on your purchase of a Labconco CentriVap Concentrator System. Models are available for operation on 115V or 230V.

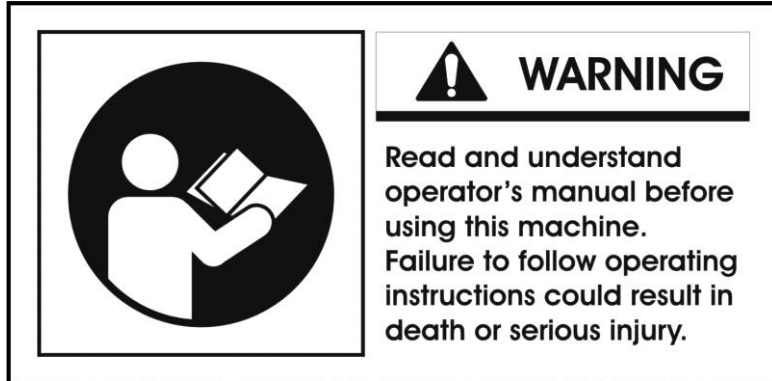
The CentriVap Concentrator, when combined with the CentriVap Cold Trap, uses centrifugal force with heat and vacuum to rapidly evaporate and condense solvents from biological and analytical samples. Centrifugation eliminates bumping and foaming as vacuum is applied and also concentrates the solute in the bottom of the vial. This allows recovery of solutes from sample volumes as small as a few microliters. The concentrator is equipped with a 300 watt heater to speed evaporation by warming the chamber during processing. A timed outlet for the vacuum pump connection delays the start of the pump until the rotor reaches operating speed. A safety switch prevents the concentrator from starting when the lid is in the open position and a latch prevents the lid from being opened while the rotor is turning. The compact, low profile design allows the concentrator to be placed on a benchtop or other laboratory work surface.

The microprocessor, which controls the operation of the heater and the motor, provides excellent regulation and reproducibility of protocols. The end of the run can be signaled by a manually preset timer. Nine different protocols can be stored in memory so exact test parameters can be easily repeated.

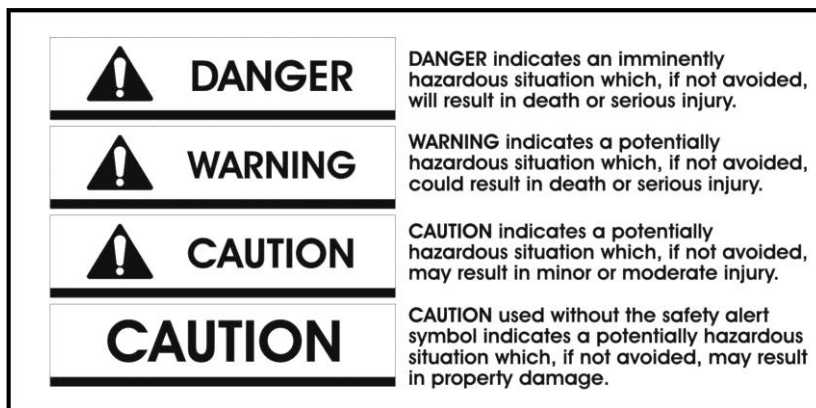
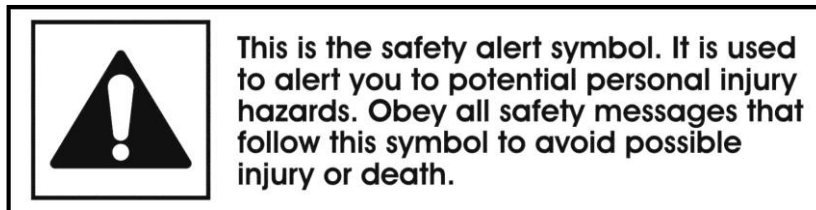
As the companion to the Concentrator, the CentriVap Cold Trap protects the vacuum pump by trapping moisture, vapors and corrosive fumes as they evaporate from the samples. The stainless steel trap is used for aqueous and organic applications. For corrosive applications, the optional Glass Trap insert should be used. The 230V 50Hz models comply with CE regulations.

## Safety Symbols

Your CentriVap Concentrator was designed with safety in mind, however conditions may exist that could be hazardous.



Throughout this manual potentially hazardous conditions are identified using the following words and symbols.



It is important that you understand the warnings listed throughout this manual before you operate the CentriVap Concentrator.

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## **Chapter 2: Prerequisites**

Before you install your CentriVap, you need to prepare your site for installation. You must be certain that the area is level and of solid construction. In addition, a means to exhaust the vacuum pump must be provided. An electrical source must be located near the installation site.

Carefully read this chapter to learn:

- The electrical supply requirements.
- The exhaust requirements.
- The vacuum pump requirements.

Refer to Appendix C: CentriVap Specifications for complete electrical and environmental conditions, specifications and requirements.

## Electrical Requirements

The CentriVap Concentrator requires a dedicated grounded electrical outlet. This outlet requires a 15 Amp circuit breaker or fuse for models rated at 115V (60 Hz). An 8 Amp circuit breaker or fuse is required for models rated at 230V (50/60 Hz). If the power cord supplied with the Concentrator does not match the available receptacle, replace it with an approved power cord of the suitable style. See CentriVap Components in Chapter 3 for power cord specifications.

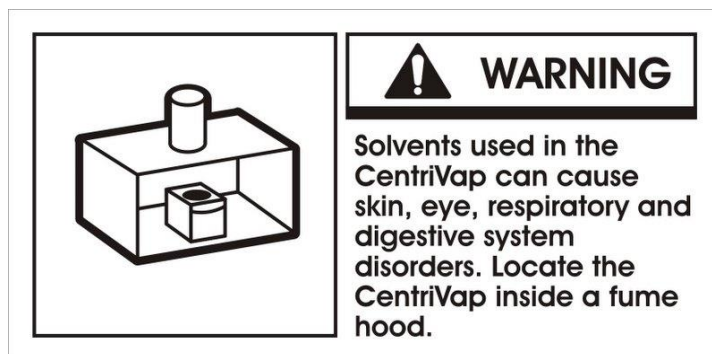
The CentriVap Cold Trap requires a dedicated electrical outlet. 115V (-50°C & -85°C) Models require a 15 Amp circuit breaker or fuse rated at 115V (60 Hz). 115V (-105°C) Models require a 20 Amp circuit breaker or fuse rated at 115V (60 Hz). 230V Models require an 8 Amp circuit breaker or fuse rated at 230V (50/60 Hz). If the power cord supplied with the Cold Trap does not match the available receptacle, replace it with an approved power cord of the suitable style. See CentriVap Components in Chapter 3 for power cord specifications.

## Location and Exhaust Requirements

The CentriVap Concentrator should be located on a surface that is stable, flat and level.

**WARNING: The CentriVap System should be located within a fume hood if hazardous or flammable solvents are used. Heating of materials could lead to the liberation of hazardous gases. In all cases, regardless of the solvent used, it is strongly recommended that the vacuum pump is vented in a fume hood. An accessory secondary trap is available to minimize the exhausting of solvents into the atmosphere. This does not, however, negate the need to exhaust the vacuum pump into a fume hood. Failure to properly vent the CentriVap will expose personnel to potentially harmful chemicals.**

The CentriVap has not been evaluated by an approval agency for the use of biological, radio toxins or flammable liquids or materials.





## Vacuum Pump Requirements

A vacuum pump must be provided by the user. A vacuum pump with a free air flow rate of 82 liters per minute and < 2 mBar ultimate pressure is adequate for aqueous samples. More volatile samples can be satisfactorily processed using a diaphragm pump with a free airflow of 42 liters per minute and 200 mBar vacuum. The inlet fitting on the vacuum pump must be suitable for 0.50 ID hose.

Vacuum pumps used with 115V models should be equipped with a 115V, 15 Amp NEMA 5-15P plug. Vacuum pumps used with 230V models should be equipped with a “reverse” IEC 320 plug. This will allow the vacuum pump to be plugged into the receptacle on the back of the CentriVap.

**IMPORTANT NOTE: To ensure that aggressive samples used in the CentriVap do not damage the vacuum pump, it is recommended that all internal wetted parts are PTFE or PTFE coated.**

**When selecting the vacuum pump it is very important to consider the flammability of the solvent that will be used. If the solvents are flammable, an explosion-proof vacuum pump or one suitable for the solvents to be processed is recommended. See Chapter 3 Solvent Safety Precautions for solvents suitable for use in the CentriVap.**

## Vacuum Line Traps

When using a mechanical pump that is not corrosion resistant, the CentriVap Cold Trap or equivalent trap must be used in the vacuum line to prevent damage from solvent vapors. When evaporating acids, it is advisable to include a soda lime acid secondary trap in the vacuum line. This adds additional protection for the pump.

**NOTE: Several components within the CentriVap are made from stainless steel or aluminum and can be degraded if exposed to acids. Contact Labconco before evaporating acids.**

A moisture trap, solvent trap and radioisotope trap are also available. Refer to Chapter 6: Accessories for Your CentriVap for ordering information.

## Space Requirements

Refer to Appendix C: CentriVap Specifications for dimensional drawings of the CentriVap.

No person or any hazardous material should be within 12 inches of the CentriVap Concentrator while it is operating.

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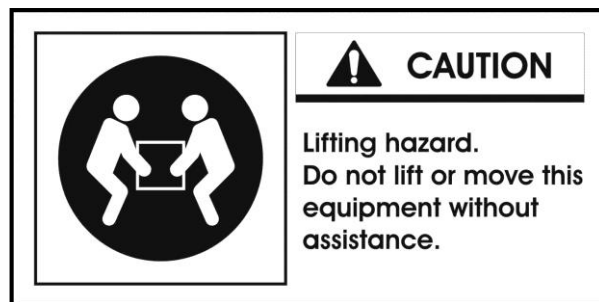
## Chapter 3: Getting Started

Now that the site for your CentriVap is properly prepared, you are ready to unpack, inspect, install, and test your CentriVap. Read this chapter to learn how to:

- Unpack and move your CentriVap.
- Set up your CentriVap.
- Connect the electrical supply source to your CentriVap.
- Properly exhaust your CentriVap.
- Safely use solvents with your CentriVap.

**CAUTION: The CentriVap Concentrator weighs over 42 lbs. (19 Kg). The carton allows for lifting with a mechanical lift truck or hand truck. If you must lift the CentriVap manually, use at least two (2) persons and follow safe lifting guidelines.**

**The CentriVap Cold Trap weighs over 70 lbs. (33 Kg). The carton allows for lifting with a mechanical lift truck or hand truck. If you must lift the Cold Trap manually, use at least two (2) persons and follow safe lifting guidelines.**



## Unpacking Your CentriVap

Carefully unpack your CentriVap and inspect it for damage that may have occurred in transit. If your CentriVap is damaged, notify the delivery carrier immediately and retain the entire shipment intact for inspection by the carrier.

The United States Interstate Commerce Commission rules require that claims be filed with the delivery carrier within fifteen (15) days of delivery.

Do not discard the carton or packing material for your CentriVap until you have checked all of the components and installed and tested the CentriVap.

**NOTE: Do not return goods without the prior authorization of Labconco. Unauthorized returns will not be accepted. If your CentriVap was damaged in transit, you must file a claim directly with the freight carrier. Labconco Corporation and its dealers are not responsible for shipping damage.**

## CentriVap Components

Locate the model of CentriVap you received in the following tables. Verify that the components listed are present.

Cold Traps																	
Description				Power Cords								Accessories					
Catalog #	Temperature Rating	Voltage (V)	Frequency (Hz)	Connector: IEC C13 Plug: NEMA 5-15	Connector: IEC C13 Plug: CEE 7/7	Connector: IEC C13 Plug: BS 1363	Connector: IEC C13 Plug: CH1-10P	Connector: IEC C13 Plug: NEMA 6-15	Connector: IEC C19 Plug: NEMA 5-20	Connector: IEC C19 Plug: CEE 7/7	Connector: IEC C19 Plug: BS 1363	Connector: IEC C19 Plug: CH2-16P	Connector: IEC C19 Plug: NEMA 6-20	Tubing	clamps (2)	Wire Assembly	User's Manual
7811020	-50°C	115	60	X										X	X	X	X
7811030	-50°C	230	50		X									X	X	X	X
7811035	-50°C	230	50			X								X	X	X	X
7811037	-50°C	230	50				X							X	X	X	X
7811040	-50°C	230	60					X						X	X	X	X
7460020	-85°C	115	60	X										X	X	X	X
7460030	-85°C	230	50		X									X	X	X	X
7460035	-85°C	230	50			X								X	X	X	X
7460037	-85°C	230	50				X							X	X	X	X
7460040	-85°C	230	60					X						X	X	X	X
7385020	-105°C	115	60						X					X	X	X	X
7385030	-105°C	230	50							X				X	X	X	X
7385035	-105°C	230	50								X			X	X	X	X
7385037	-105°C	230	50									X		X	X	X	X
7385040	-105°C	230	60										X	X	X	X	X

Concentrators													
Description				Power Cords					Accessories				
Catalog #	Options	Voltage (V)	Frequency (Hz)	Connector: IEC C13 Plug: NEMA 5-15 1334500	Connector: IEC C13 Plug: CEE 77 1336100	Connector: IEC C13 Plug: BS 1363 1332600	Connector: IEC C13 Plug: CH1-10P 1332700	Connector: IEC C13 Plug: NEMA 6-15 1338000	Tubing 7828606	clamps (2) 1488800	Coupling Insert (Std.) 7397601	Coupling Insert (AR) 7396206	User's Manual 7539800
7810010	standard	115	60	X					X	X	X		X
7810011	standard	230	60					X	X	X	X		X
7810012	heat boost	115	60	X					X	X	X		X
7810013	heat boost	230	60					X	X	X	X		X
7810014	glass lid	115	60	X					X	X	X		X
7810015	glass lid	230	60					X	X	X	X		X
7810016	acid resistant	115	60	X					X	X		X	X
7810017	acid resistant	230	60					X	X	X		X	X
7810030	standard	230	50		X				X	X	X		X
7810031	heat boost	230	50		X				X	X	X		X
7810032	glass lid	230	50		X				X	X	X		X
7810033	acid resistant	230	50		X				X	X		X	X
7810034	standard	230	50			X			X	X	X		X
7810035	heat boost	230	50			X			X	X	X		X
7810036	glass lid	230	50			X			X	X	X		X
7810037	acid resistant	230	50			X			X	X		X	X
7810038	standard	230	50				X		X	X	X		X
7810039	heat boost	230	50				X		X	X	X		X
7810040	glass lid	230	50				X		X	X	X		X
7810041	acid resistant	230	50				X		X	X		X	X

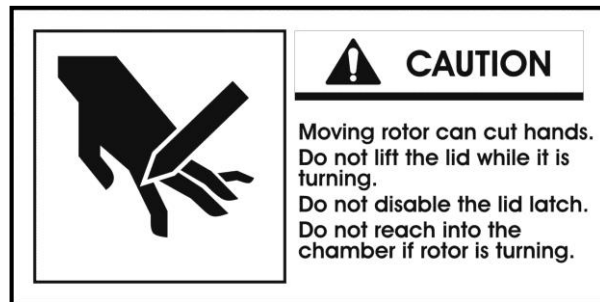


If you do not receive one or more of the components listed for your CentriVap, contact Labconco Corporation immediately for further instructions.

### Emergency Access into the Chamber

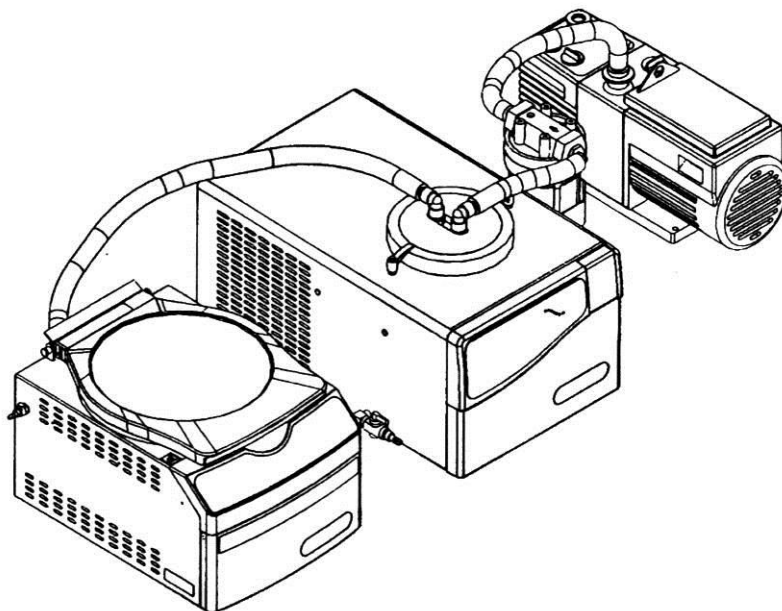
The CentriVap is designed to prevent access to the chamber in the event of a power disruption. If it is necessary to open the lid when there is no electrical power connected to the CentriVap, insert a small screwdriver or similar instrument into the small round hole on the left side of the case near the top behind the control panel. This will unlock the lid latch mechanism. While holding the screwdriver in place, raise the lid with the other hand.

**CAUTION: Never attempt to defeat the latch or open the lid while the CentriVap is running. Personnel injury can result from moving parts and chemicals.**



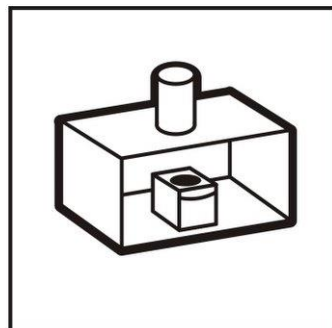
### Component Orientation & Hose Connections

The relative position of the CentriVap Concentrator, Cold Trap and the vacuum pump may be as shown or may be reversed. The refrigeration system in the Cold Trap draws air in through the right side of the cabinet and exhausts air through the left side of the cabinet. A minimum of 3" should be allowed between the sides of the Cold Trap and the adjacent wall surfaces. Restriction of the airflow through the cabinet during operation could adversely affect performance.



After positioning the components, it is necessary to join the system together using the hoses provided. Attach one hose to the tube that extends out the back of the Concentrator. Attach the other end of this hose to one of the barb fittings on the Cold Trap Cover Assembly. Secure the hoses with the clamps supplied. Attach another hose to the remaining barb fitting on the Cold Trap Cover and clamp securely. If the accessory Secondary Trap is not used, attach the other end of the hose to the inlet port on the vacuum pump. If the accessory Secondary Trap is used, install the Secondary Trap as explained in *Chapter 6: Accessories for Your CentriVap*. Then attach the hose from the Cold Trap Cover to the “out” connector on the Secondary Trap and clamp securely. Attach another hose from the remaining connector on the Secondary Trap to the inlet port on the vacuum pump and clamp securely.

**WARNING:** It is recommended that the vacuum pump be located inside a fume hood or other laboratory ventilation device if hazardous solvents are used in the CentriVap. If this is not possible, the vacuum pump should have a hose attached to the exhaust port and the other end of the hose should be positioned inside the fume hood or ventilation device.

**WARNING**

Solvents used in the CentriVap can cause skin, eye, respiratory and digestive system disorders. Locate the CentriVap inside a fume hood.

## Electrical Connection

Plug the power cord into the receptacle on the back of the CentriVap Concentrator and plug the other end into a suitable power receptacle. Plug the power cord into the receptacle on the back of the CentriVap Cold Trap and plug the other end into a suitable power receptacle. Plug the power cord from the vacuum pump into the receptacle on the back of the Concentrator. If the vacuum pump has an off/on switch, turn the switch ON. The vacuum pump will be controlled by the Concentrator.

## Rotor Installation

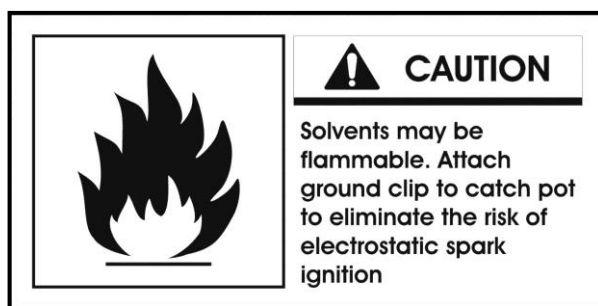
Place the rotor onto the shaft of the Concentrator. Rotate the rotor slightly to engage the drive pin in the shaft with the slots in the rotor hub. The top of the shaft should be in line with the top of the rotor hub.

**IMPORTANT NOTE: Do not use a rotor if it shows any signs of damage. Failure of a spinning rotor could damage the CentriVap or cause samples to be lost.**

## Ground Wire

Attach one end of the included ground wire to the stainless steel elbow on the drain tubing on the right or left side (depending on model) of the Cold Trap.

**CAUTION: When draining the CentriVap Cold Trap always attach the other end of the grounding clip to the solvent catch pot to eliminate the risk of electrostatic spark ignition.**



## Chemical Resistance of CentriVap Components

Your CentriVap Centrifugal Concentrator and Cold Trap are designed to be chemical resistant to most compounds that are commonly used in concentration processes. However, by necessity, the CentriVap is comprised of a number of different materials, some of which may be attacked and degraded by corrosive chemicals. The degree of degradation is obviously dependent on the concentration and duration of exposure. Some major components of the CentriVap that are susceptible to degradation are as follows:



COMPONENT	MATERIAL	Acids							Bases	Solvents														
		Acetic Acid 20%	Boric Acid	Formic Acid	Hydrobromic Acid 20%	Hydrochloric Acid 20%	Nitric Acid 20%	Sulfuric Acid 10%	Trifluoroacetic Acid (TFA)	Ammonium Hydroxide	Acetone	Acetonitrile	Chloroform	Dimethyl Formamide	Dimethyl Sulfoxide (DMSO)	Ethanol	Ethyl Acetate	Hexanes	Isopropanol	Methanol	Methylene Chloride	Methyl t-Butyl Ether (MTBE)	Toluene	Water
<b>Standard CentriVap</b>																								
Chamber	Epoxy coated Aluminum			C				D					C	D										
Lid	Acrylic							C	D	C		D	D	D	D	C			D	C	D		D	
Bearings	High Carbon Steel	D	D	D	D	D	D	D		D				D									D	D
Lid Gasket	EPDM					D	D	D				D		D								C	C	D
Rotor Shaft	Stainless Steel				D	D	D																	
Valve	Stainless Steel				D	D	D																	
O Rings	Viton (Fluorocarbon)							C					C	C									C	
Fittings	Polypropylene	D																						
Rotor	Anodized Aluminum					D	D																	
Rotor Hub	Acetal (Delrin)	C		C	C	D	D	D	C					D										C
Tubing	PVC	D	C			D	D	D				D	D	D	D	D	C	D	D			D		D
<b>Acid Resistant CentriVap</b>																								
Chamber	Teflon coated Aluminum																							
Lid	Glass																							
Bearings	Stainless Steel				D	D	D																	
Lid Gasket	EPDM						D	D				D		D								C	C	D
Rotor Shaft	Hastelloy																							
Valve	Teflon																							
O Rings	Viton (Fluorocarbon)							C					C	C									C	
Fittings	Polypropylene	D																						
Rotor	Teflon coated Aluminum																							
Rotor Hub	Polypropylene	D																						
Tubing	PVC	D	C			D	D	D				D	D	D	D	D	C	D	D			D		D
<b>Cold Trap -50°C</b>																								
Chamber	Stainless Steel				D	D	D																	
Lid	Acrylic							C	D	C		D	D	D	D	C	D			D	C	D		D
Cold Trap Gasket	Neoprene		D		D	C	D	D				C	D	D	D							D	C	D
<b>Cold Trap -84°C &amp; -105°C</b>																								
Chamber	Stainless Steel				D	D	D																	
Lid	Stainless Steel				D	D	D																	
Cold Trap Gasket	Neoprene		D		D	C	D	D				C	D	D	D							D	C	D
C- Moderate Degradation- Questionable use																								
D- Severe Degradation- Infrequent use recommended- immediate thorough cleaning required																								

- If a rotary vane vacuum pump is used, frequent oil changes are required. Most compounds used in the CentriVap will degrade the oil if allowed to enter to pump.
- Diaphragm vacuum pumps sold by Labconco have wetted parts either made from PTFE or protected by PTFE coatings and are suitable for nearly all procedures.
- When using compounds in the CentriVap that are hostile to the materials of construction, it is imperative that the equipment is appropriately maintained. After each run, clean up all residues, spills and materials that might have splashed in the chamber.

- Drain the Cold Trap immediately after the collected ice is melted to prevent corrosive liquids from residing in the trap. Flush out the trap with water after draining.

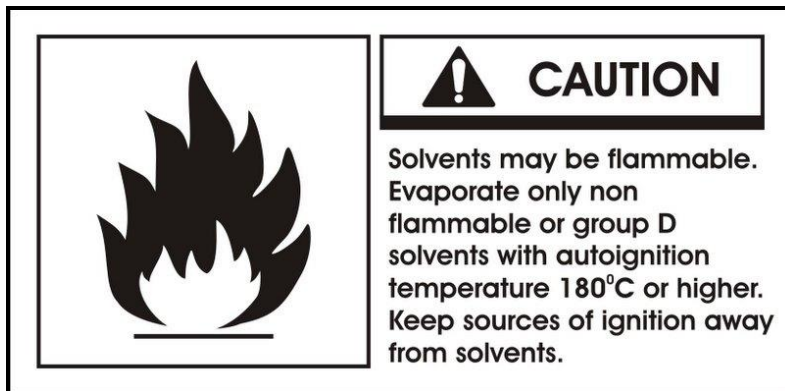
DO NOT chip ice off the Cold Trap walls as damage may occur.

DO NOT start a rotary vane pump when the Cold Trap contains any liquid. The liquid will be drawn into the pump and will contaminate the vacuum pump oil.

- If the compounds used attack acrylic, consider using the optional glass chamber lid. See Chapter 6: Accessories for Your CentriVap.
- If the stainless steel cold trap chamber is attacked by the compounds in use consider using the optional Glass Trap insert. See Chapter 6: Accessories for Your CentriVap.
- When using a rotary vane vacuum pump the oil in the pump should be checked often. It must be changed if it is cloudy, shows particles or is discolored. The useful life of vacuum pump oil can be extended if the vacuum pump is operated for an extended of time after the CentriVap run is over. This allows contaminants to be purged from the hot oil. This must be done with the inlet to the pump blocked off to prevent air from free flowing through the pump. If the pump is operated at an elevated vacuum level, oil will be expelled from the pump and damage will occur.
- If optional secondary traps are used, monitor their condition often and replace them when they are saturated. A new acid trap is off-white and changes color to purple when used up. A new moisture trap is blue and changes color to pink when used up. The solvent trap molecular sieve does not change color when saturated so extra care must be taken to determine when a replacement cartridge should be installed.

## Solvent Safety Precautions

**CAUTION: The CentriVap is not classified as “explosion proof.” It has been designed with safety as a primary consideration and should be used in a prudent manner using “good laboratory practices.” It has been designed for use with compounds as described in the United States National Electrical Code Class I, Group D. The heater may be programmed to run as hot as 100°C, however, the heater element may normally run at 110°C. A thermal fuse limits the heater to a maximum temperature of 141°C. It is important that the solvents used are compatible with these temperatures. Do not evaporate solvents that have an autoignition temperature below 180°C. Do not evaporate solvents that are classified as Group A, B, or C by the National Electrical Code. Evaporate only non-flammable or Group D solvents with autoignition temperatures 180°C or above. Use of other compounds could cause an explosion.**



**CAUTION:** Solvents used in the CentriVap may be flammable or hazardous. Use extreme caution and keep sources of ignition away from the solvents. When using flammable or hazardous solvents, both the CentriVap and the vacuum pump should be operated inside a fume hood.

If a sample is spilled in the chamber it must immediately be cleaned up. Hazardous materials, such as strong acids or bases, radioactive substances and volatile organics, must be handled carefully and promptly cleaned up if spilled.

Do not store flammable or hazardous solvents within 12 inches (300 mm) of the CentriVap.

**IMPORTANT NOTE:** The disposal 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 user's area concerning the dumping of waste materials in or upon water, land or air and to comply with such regulations.

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## Chapter 4: Using Your CentriVap

After your CentriVap has been installed as detailed in *Chapter 3: Getting Started*, you are ready to begin using your CentriVap. Read this chapter to learn how to:

- Set operating parameters.
- Operate the controls.
- Properly select and position glassware inside your CentriVap.
- Understand the display.
- Interrupt a cycle after it has begun.

**Note:** See **Appendix C: CentriVap Specifications** for electrical requirements.

**Note:** Do not store or stack supplies or equipment on top of the CentriVap.

### Planning

Thoroughly understand procedures and the equipment operation prior to beginning work. The unique performance of the CentriVap is dependent upon the proper balance of heat, vacuum and centrifugal force. If the proper balance is not established, it is possible to damage or lose a portion of the sample. Therefore, if you are unfamiliar with the CentriVap or are attempting a new protocol, it may be helpful to make a trial run that is void of the sample you are attempting to concentrate.

### Glassware Selection

Normally, sample tubes should be filled no more than approximately half full. Select the size of the sample tube so it is compatible with the rotor and the desired sample size. Tubes should not be loose in the rotor. Rotors are available with holes for various size tubes. Refer to Chapter 6: Accessories for Your CentriVap for available rotor sizes.

## Loading Glassware into the CentriVap

Smooth operation of the CentriVap is dependent upon proper balance of the machine. Therefore, if less than a full load of samples is run, it is important to load samples into the CentriVap in a fairly symmetrical manner distributing the weight of the samples evenly in the sample rotor.

## Temperature Setting Guidelines

The evaporation rate achieved by the CentriVap is dependent upon a variety of factors. These include the nature of the solvent, the temperature and the pressure in the vacuum system.

As a general guideline, to speed the evaporation process, the CentriVap temperature should be set as high as possible as long as the temperature will not damage the sample or cause the sample to bump.

## Time Setting Guidelines

The CentriVap Concentrator has two timers. The “RUN TIME” turns the entire concentrator off after the user set period of time. This stops the rotation, turns off the heater and vacuum pump and bleeds vacuum from the system. The heater may be turned off prior to the concentrator turning off so heat-sensitive samples may be protected from exposure to excessive heat after the solvent has evaporated. To turn the heater off prior to stopping the entire system, enter a set time into the memory at the “HEATER TIME.” When the programmed time expires, the heater will turn off but the rotation and vacuum will continue until the run time expires.

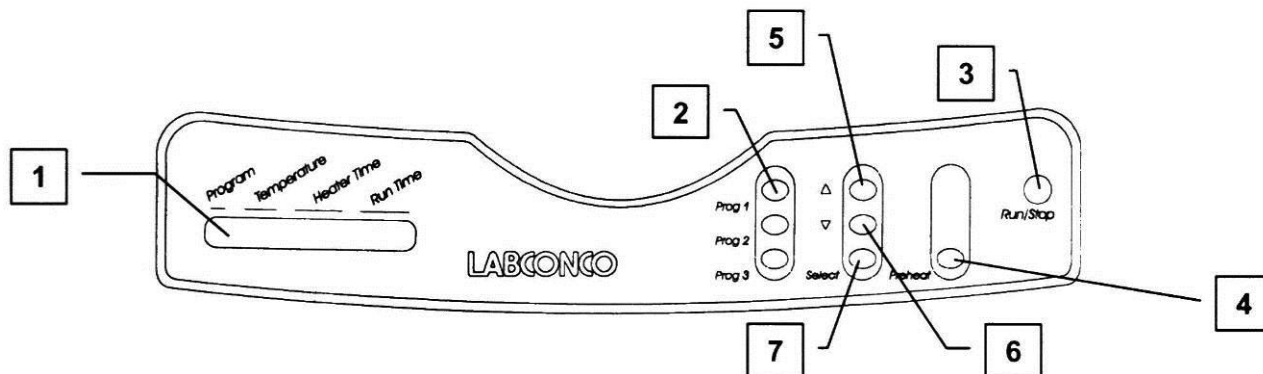
The tables in Appendix C: CentriVap Specifications indicate approximate times required to evaporate various common solvents. Actual times must be determined by the user. The CentriVap can be set to alarm after a preset period of operation. When the time expires, the CentriVap will give an audible alarm and turn itself off.

## Heat Boost Operation

Some CentriVap models are equipped with a secondary “Heat Boost” heater, which is positioned on the sidewall of the chamber near the top. It provides additional heat to the samples to speed evaporation. The “Heat Boost” heater is controlled by the microprocessor to maintain the set point temperature at the bottom of the chamber to prevent excessive overheating of the samples.

## CentriVap Controls

The control panel for the CentriVap is shown below with a description about its function.



1. Display – The liquid crystal display (LCD) shows set point parameters and actual measured conditions.
2. Program Buttons – Used to initiate the start of a run with the use of just one button.
3. Run/Stop Button – Press this to start or stop a run.
4. Preheat Button – Used to turn on the heater to preheat the chamber prior to loading samples.
5. Increase Button – When pressed, the last selected set point will increase.
6. Decrease Button – When pressed, the last selected set point will decrease.
7. Set Point Select Button – To select a parameter to change, press the select button. Arrows on the display will point to the parameter that may be altered.
8. Heat Boost Button (not shown) – If the model is so equipped, pressing the button will activate or deactivate the auxiliary Heat Boost heater.

## Operating the CentriVap Controls

### Preheat:

To preheat the chamber, press the “PREHEAT” button. The display will show:

SP:   XXX   ACT:   XXX

Press the increase or decrease button until the desired set point (SP) is displayed. The actual chamber temperature, (ACT) is displayed to the right. When power is being supplied to the heaters, a bar under the actual temperature will illuminate. The chamber will continue to preheat until either the “PREHEAT” button is pressed again or the “RUN” button is pressed.

**Select existing program:**

Operating parameters can be stored in memory so protocols can be repeated. Nine programs can be stored. To select a program, press the set point “SELECT” button until arrows point to the program number indicating that this set point can be run or altered. To change the program number, press the increase or decrease button until the desired program number is displayed. When the program number is changed, all its set points change also to indicate the last entered parameters for that program.

Store frequently run protocols in program 1, 2, or 3. Then, by pressing “PROG 1,” “PROG 2” or “PROG 3,” the stored program will be initiated without having to press any other button. Pressing just the one button starts the rotor, the heater, the timers and the vacuum pump.

**Change “Temperature” Set Point:**

To change the “Temperature” set point, press the set point “SELECT” button until arrows point to the “Temperature” set point, which can be changed from - (OFF) up to 99° by pressing the increase or decrease buttons. The set point is 100°C if the display shows “HI.” The last entered set point is stored in memory.

**Change “Run Time” or “Heater Time” set point:**

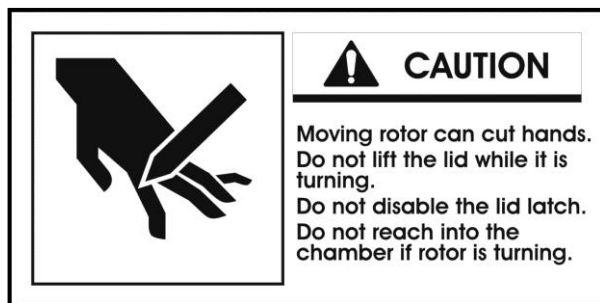
To change the time set point, press the set point “SELECT” button until arrows point to the “Heater Time” or “Run Time” set point which can be changed from 1 to 999 minutes by pressing the increase or decrease buttons. If it is desired to have the CentriVap run continuously without alarming at the end of a time period, press the increase button until the “Run Time” display says “ON.” The last entered set point is stored in memory.

If during a run the “STOP” button is pressed, the timers remember the time at which stop occurred. If “RUN” is then pressed, the timers continue to count down from the time at which they were stopped. If you are running program 1, program 2 or program 3, pressing “PROG 1,” “PROG 2” or “PROG 3” resets the timers to the original set point time and the CentriVap starts a new run.

To reset the timers to the original set point time when running programs other than program 1, program 2 or program 3, press the start button and hold it for five seconds. The display will indicate that the timer is reset.

## Operating the CentriVap

**CAUTION: To avoid personnel injury; Do not operate the CentriVap if the lid is scratched or nicked, or shows signs of damage. A damaged lid could fail under vacuum.**



While the CentriVap Concentrator is operating, do not lean on the lid, do not stand near it longer than necessary and do not place hazardous materials within 12 inches.

1. Press the Cold Trap “ON” switch. The top amber indicator will illuminate. Additional indicators will illuminate, as the Cold Trap gets colder. A green indicator will illuminate when the Cold Trap reaches operating temperature.
2. Press the CentriVap “ON” switch.
3. Select a program or set the set point parameters.
4. Preheat the chamber if desired.
5. Turn on Heat Boost if the CentriVap is so equipped and additional heat is desired.
6. Place samples in vials. Normally the vials should be no more than half full. Place vials in a rotor.
7. Load the rotor with samples into the chamber.
8. Close the lid. A safety switch prevents the CentriVap from starting when the lid is open.
9. Press “RUN.” If the display was showing set point parameters, it will change to show actual parameters. Press “RUN” again. The “S” (STOP) in the display changes to “R” (RUN). The program on the display alternately displays “R” or the number of the program that is running. If you intend to run program 1, 2 or 3, simply press “PROG 1,” “PROG 2” or “PROG 3” to start the CentriVap. A latch will activate to lock the lid closed, the rotor will start, the vacuum break valve will close and the vacuum pump will start after the rotor reaches operating speed.



10. Set point parameters can be altered at any time during a run by first selecting the parameter using the set point “SELECT” button and then pressing the “INCREASE” or “DECREASE” switch.
11. If the time set point is used, at the end of the set time an alarm sounds. All functions cease.
12. Press “STOP” to terminate operation if the CentriVap has not already stopped itself.
13. When the evaporation is complete, allow the rotor to stop moving, lift the lid and remove the samples.

### Operational Notes

As solvent is evaporated in the Concentrator and then condensed in the Cold Trap, it is normal for the Cold Trap temperature to rise as its load increases.

Depending on which solvent is used, the volume of the sample and the system operating parameters, the Cold Trap may warm up sufficiently to cause the “GREEN” indicator to turn off. As the sample reaches completion, the load on the Cold Trap will decrease and its temperature will decrease. The “GREEN” indicator will once again illuminate.

When the CentriVap is turned ON, the CentriVap returns to the same mode (“RUN” or “STOP”) that it was in when the power was turned OFF. If the CentriVap was in the “RUN” mode when the power was turned OFF, when the power is turned ON, the CentriVap attempts to return to the programmed set points and continue the run.

### Cycle Interruption

At any time during a run, the cycle may be stopped by pressing the “STOP” button. This shuts off all operating functions. After the rotor stops, the lid may be opened. If it is necessary to re-start the CentriVap, close the lid and press “RUN.” The CentriVap resumes operation at the same set point parameters and the timer continues to count down from the time at which the CentriVap was stopped.

### Safety Precautions

Special precautions must be observed if the materials used in the CentriVap Concentrator are known to be hazardous, toxic, radioactive, or contaminated with pathogenic micro organisms. These actions should include but are not limited to the following:

- Refer to the World Health Organization Laboratory Biosafety Manual, paying special attention to information about centrifuges and the handling of hazardous materials.
- Operate or vent the CentriVap Concentrator inside a suitable fume hood or ventilation device. Load rotors in a ventilation device.
- Periodically inspect all parts of the CentriVap Concentrator including the lid, gasket, chamber, plumbing components and rotors.

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## Chapter 5: Maintaining Your CentriVap

Under normal operation, the CentriVap requires little maintenance. The following maintenance schedule is recommended. Before servicing the CentriVap, disconnect electrical power. Special precautions must be observed if materials used in the CentriVap Concentrator are known to be hazardous, toxic, radioactive or contaminated with pathogenic micro organisms. Before servicing, the CentriVap Concentrator must be suitably decontaminated. Wear appropriate eyewear, gloves and other safety apparel.

### **As needed:**

Before using any cleaning or decontamination method except those recommended by the manufacturer, users should check with the manufacturer that the proposed method will not damage equipment.

1. Clean up all spills; remove liquids from the chamber. Clean or decontaminate all surfaces using agents suitable for the substance spilled.
2. Clean lid and gasket using soft cloth, sponge or chamois and a mild, non-abrasive soap or detergent.
3. Check oil level of the vacuum pump, if applicable. It should be between MIN and MAX. If the oil level is less than an inch (25.4 mm) above MIN, add oil to proper level.
4. If oil shows cloudiness, particles or discoloration, drain the pump and replace with fresh oil.
5. Utilization of acids requires immediate cleaning and neutralization after a run or physical damage to the collection chamber will result.
6. Check the Cold Trap for condensed or frozen solvents and dispose of appropriately. Completely empty the trap before the next run. The Cold Trap cover is removed by first lifting and rotating the two retainers that secure the lid in place. If solvents are frozen in the glass trap, run it under cold water immediately after operating.

**NOTE: IF THE ICE HAS MELTED, THE GLASS TRAP INSERT MUST BE EMPTIED BEFORE THE COLD TRAP IS STARTED AGAIN.**

7. If the Glass Trap is used, check to see that the ethanol in the stainless steel trap is free of ice or water. Drain the ethanol and replace it with fresh ethanol.
8. If the media in the cartridge in the optional clear canister has changed color, discard and replace the insert with a new insert. For the radiochemical trap insert, no indicator exists; therefore, it should be discarded after each use. In radioactive applications, the system should be monitored with a Geiger counter.
9. Check rotors for loose or missing parts. Tighten or replace as required. Do not use defective rotors.
10. Inspect the chamber to insure that there are no cracks or structural damage. Call Labconco if defects exist.
11. Check the continuity of the protective earth between the ground terminal on the power inlet and a bare metal housing panel. Contact Labconco if there is no continuity.
12. Repair any defects to the surface where the CentriVap is installed.

### **Monthly:**

1. The rubber components on the CentriVap may eventually deteriorate and require replacement. The effective life of rubber parts depends upon both their usage and the surrounding environment. Check all rubber hoses and gaskets and replace any that show signs of hardening, permanent set or deterioration.
2. Using a soft cloth, sponge or chamois and a mild, non-abrasive soap or detergent, clean the glass lid.
3. Using a soft cloth, sponge, or chamois and a mild, non-abrasive soap or detergent, clean the exterior surfaces of the unit. Liquid spray cleaners and polishes may be used on the exterior surfaces. Do not use solvents to remove stains from the exterior surfaces as they may damage the finish.

### **Annually:**

1. Every 12 months, or more often, if the Cold Trap is operated in a dusty environment, the refrigeration system condenser of the Cold Trap should be cleaned. Using a vacuum cleaner with brush attachment, clean the condenser to ensure proper airflow for peak performance. Disconnect power to the Cold Trap prior to removing covers.

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## Chapter 6: Accessories for Your CentriVap

The configuration of your CentriVap can be changed to accommodate your needs. If the solvents used in the CentriVap degrade the acrylic lid, it may be replaced with an optional glass lid to gain added chemical resistance. You may wish to add a secondary trap to trap vapors exhausted from the vacuum pump. To observe the samples while they are processing, an optional CentriZap Strobe light may be installed. Read this chapter to learn how to:

- Install a glass lid
- Install a chemical trap.
- Install a vacuum gauge.
- Install a CentriZap™ strobe light.
- Install a glass trap in the Cold Trap chamber.

The following accessories are available for the CentriVap Concentrator and Cold Trap System.

<b>PART #</b>	<b>DESCRIPTION</b>
7462900 7462901*	Rotor (DNA) Holds (72) 0.5 ml microcentrifuge tubes and (60) 1.5 ml microcentrifuge tubes or (60) 2.0 ml microcentrifuge tubes
7450700 7450701*	Rotor (1.5 ml) Holds (132) 1.5 ml microcentrifuge tubes or (132) 2.0 ml microcentrifuge tubes
7455000 7455001*	Rotor (15 ml) Holds (44) 12 x 55 mm tubes or (36) 12 x 75 mm tubes or (36) 12 x 95 mm tubes or (36) 13 x 75 mm tubes or (36) 13 x 100 mm tubes and (24) 16 x 100 mm tubes or (18) 16 x 120 mm conical tubes or (18) 17 x 95 mm tubes or (18) 17 x 100 mm centrifuge tubes or (18) 17 x 120 mm tubes
7455100 7455101*	Rotor (12-13 mm) Holds (40) 1.5 ml microcentrifuge tubes or (40) 2.0 ml microcentrifuge tubes and (16) 12 x 55 mm tubes or (100) 12 x 75 mm tubes or (64) 12 x 95 mm tubes or (100) 13 x 75 mm tubes or (64) 13 x 100 mm tubes
7455200 7455201*	Rotor (50 ml) Holds (32) 1.5 ml microcentrifuge tubes or (32) 2.0 ml microcentrifuge tubes and (12) 28 x 115 mm conical tubes or (12) 28 x 135 mm conical tubes or (12) 28 x 140 mm conical tubes
7461900 7461901*	Rotor (96 well plate) Holds (4) Standard 96 well plates or (2) Deep well 96 well plates
7460900	Clear Canister - Accommodates inserts listed below
7814800	Acid Trap Insert
7814900	Moisture Trap Insert

\*PTFE Coated

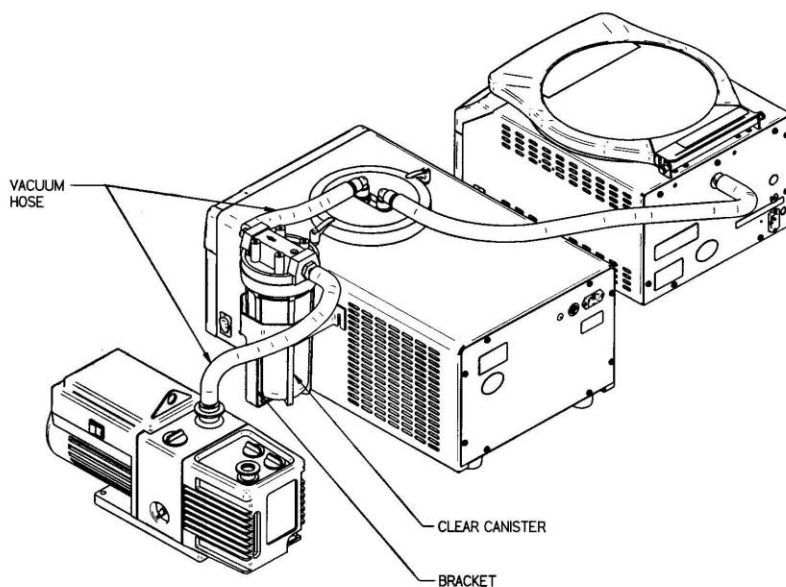
7995600	Ammonia Trap Insert
7815000	Radiochemical Trap Insert
7815200	Solvent Trap Insert
7456600	Glass Lid for Concentrator – Direct replacement for standard equipment acrylic lid. For use with chemicals that could craze acrylic.
7464300	CentriZap™ Strobe Light – For observing samples while the rotor is spinning.
1472100	Direct Drive Vacuum Pump – 117 liters/minute pumping capacity with gas ballast. Ultimate pressure $1.3 \times 10^{-4}$ mBar. 115 VAC, 60 Hz, single phase, 4.6 amp.
1467700	Direct Drive Vacuum Pump – 195 liters/minute capacity with gas ballast. Ultimate pressure $1.3 \times 10^{-4}$ mBar. 115 VAC, 60 Hz, single phase, 7.8 amp.
7739402	Direct Drive Vacuum Pump – 117 liters/minute. Same as 1472100 except 220/208-230 VAC, 50/60 Hz, single phase, 2.4 amp operation.
7739403	Direct Drive Vacuum Pump – 195 liters/minute. Same as 1467700 except 220/208-230 VAC, 50/60 Hz, single phase, 4.0 amp operation.
7393000	Diaphragm Vacuum Pump – Corrosion resistant, 115V, 50/60 Hz, 3.5 amps, single phase, 82 liters/minute, < 2 mBar vacuum.
7393001	Diaphragm Vacuum Pump – Corrosion resistant, 230V, 50/60 Hz, 2.0 amps, single phase, 82 liters/minute at 60Hz, < 2 mBar vacuum.
1473400	Vacuum Pump Exhaust Filter – Installs on pumps PN 1472100, 1467700, 7739402 and 7739403 to eliminate oil mist from the exhaust.
7397700	Two Place Freeze Dry Manifold – Manifold has 1/2" neoprene valves and is used for freeze drying small volume samples.
7397605	Glass Trap for Cold Trap.
1988000	Vacuum Pump Oil, 1 Liter A molecularly distilled hydrocarbon oil with low vapor pressure. For vacuum pumps 1472100, 1467700, 7739402 and 7739403.
1473400	Pump Exhaust Filter Disposable filter that removes visible oil mist and odor from vacuum pump exhaust. Fits vacuum pumps 1472100 and 7739402.
1473200	Replacement Element, Oil Mist, Pump Exhaust Filter Fits pump exhaust filter 1473400.
1473300	Replacement Element, Odor and Pump Exhaust Filter (package of 5) Fits pump exhaust filter 1473400 or vacuum pumps 1472100 1467700, 7739402, and 7739403.

## Installing a Glass Lid

Turn off the CentriVap. Unplug the power cord from the wall receptacle. Pull outward on the hinge pin knob. Lift and remove the old lid. To install the new lid, reverse the process.

## Installing a Secondary Chemical Trap

An accessory secondary chemical trap is available to minimize the exhausting of solvents into the atmosphere. It may be attached to either side of the Cold Trap. After selecting the side, remove the two small plastic hole plugs. Attach the bracket to the side of the Cold Trap housing using the screws provided. Attach the hose from the Cold Trap Lid Assembly to the “out” connector of the canister housing. Connect another hose from the remaining fitting on the Secondary Trap to the inlet port on the vacuum pump. Clamp hoses securely. Unscrew the clear bowl of the canister housing from the head. Remove both the upper and lower caps from the filter cartridge and insert the small end of the cartridge into the hole in the center of the head. Reinstall the clear bowl.



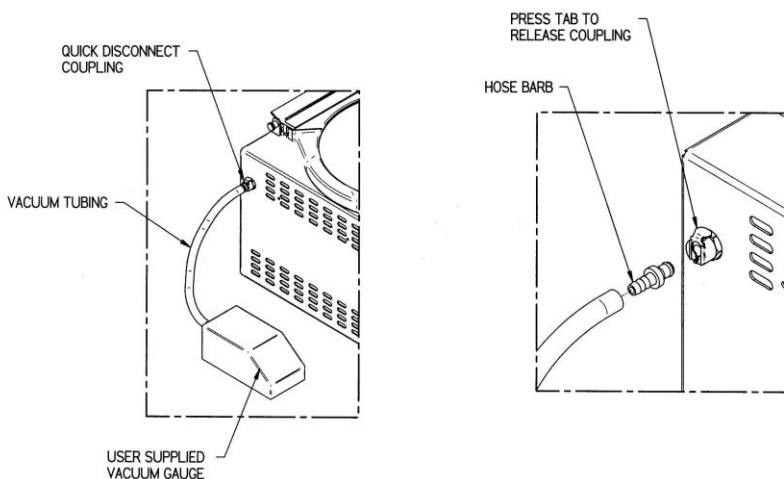
Be sure to use the proper cartridge for your application. The moisture cartridge is used to trap water vapor. The acid cartridge is used to trap acid vapors. The solvent cartridge is used to trap solvent vapors and the radiochemical cartridge is used to trap radioactive waste.

When the media in the insert has changed color, discard the insert and replace it with a new insert. For the radiochemical trap insert, no color indicator exists therefore it should be discarded after each use. Use a Geiger counter to monitor the pump exhaust.

**NOTE: This radiochemical cartridge does not meet NRC filter design recommendations. After operating, properly dispose of all hazardous materials in compliance with all applicable codes. Labconco is not responsible for improper disposal of any materials.**

## Installing a Vacuum Gauge

A user-supplied vacuum gauge may be attached to the CentriVap to monitor the vacuum level. Attach the vacuum gauge to the barb end of the Quick Disconnect Coupling fitting that was supplied with the CentriVap using a length of suitable rubber hose. The Quick Disconnect Coupling fitting can then be pushed into the mating connector on the left side of the CentriVap located towards the rear. The Quick Disconnect Coupling fitting can be removed from the mating connector by pressing on the tab on the connector and then pulling out the Quick Disconnect Coupling fitting. Always remove the Quick Disconnect Coupling from the CentriVap if a vacuum gauge is not attached to it.

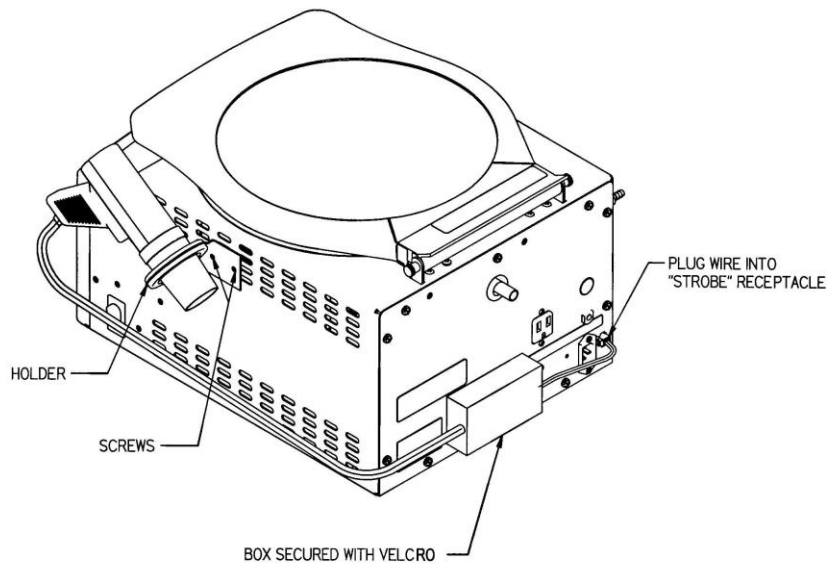




## Installing a CentriZap™ Strobe Light

An accessory strobe light is available to enable you to see the samples as they are rotating in the rotor. Attach the holder to the right hand side of the CentriVap Concentrator using the screws provided. Plug the connector on the strobe light harness into the receptacle on the back of the CentriVap marked “STROBE OUTLET.” Peel the protective backing off the enclosed Velcro® and attach it to the back of the Concentrator. Secure the power supply box on the harness to the Velcro. Place the light in the holder.

To use the strobe light while the CentriVap is operating, remove the light from its holder, press the trigger and shine the light on the samples in the rotor.

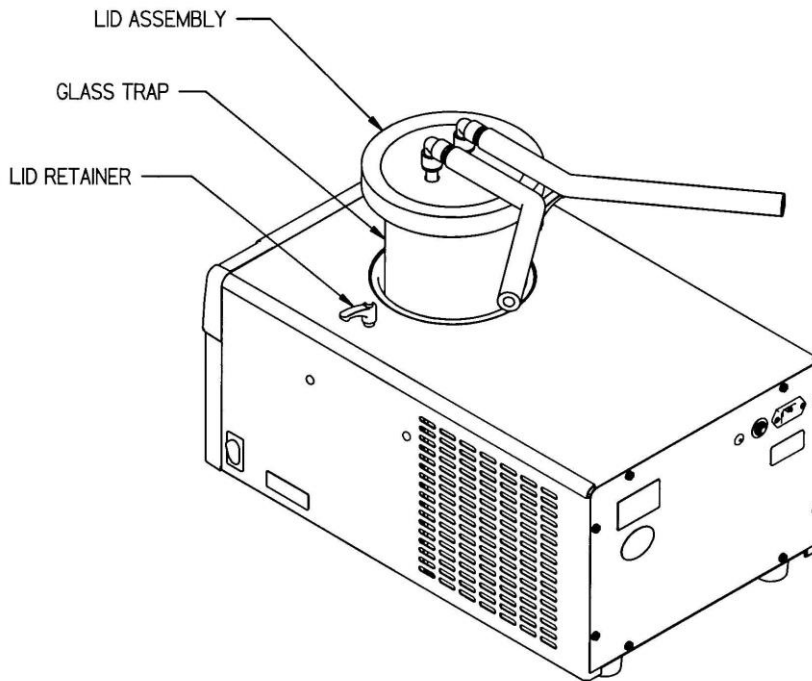


\*Velcro is a registered trademark at Velcro Industries B.V.

## Installing a Glass Trap in the Cold Trap

An accessory Glass Trap is available for use in the Cold Trap for use when corrosive chemicals are used that could attack the stainless steel chamber of the Cold Trap. Lift and rotate the two lid retainers. Disconnect the hose and remove the Cold Trap Lid Assembly. Attach the hose from the Concentrator to the fitting on the center tube of the Glass Trap and clamp securely. Attach the hose from the vacuum pump or Secondary Trap to the other fitting on the Glass Trap and clamp securely. Be certain that the drain valve is closed. Add approximately 500 ml of ethyl alcohol to the stainless steel trap or enough to insure that the Glass Trap is at least two-thirds immersed. Place the Glass Trap inside the stainless steel trap, lift and rotate the two retainers to hold the Glass Trap in place.

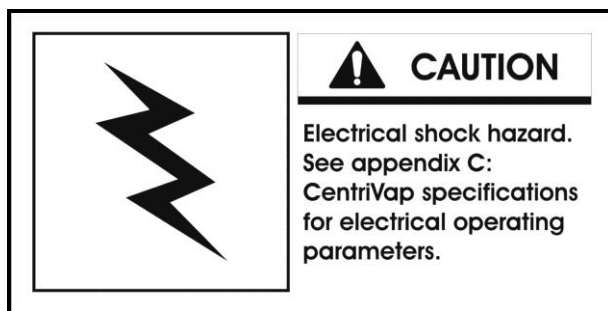
**NOTE: After a run, if the ice in the glass trap has melted, the trap must be emptied before the cold trap is started again to prevent it from breaking.**



# Chapter 7: Troubleshooting

Refer to the following if your CentriVap fails to operate properly. If the suggested corrective actions do not solve your problem, contact Labconco for additional assistance. The following failure codes may appear on the display when problems are sensed by the internal self check systems.

**CAUTION: Disconnect power before corrective action is taken.**



DISPLAY ERROR CODE	CAUSE	CORRECTIVE ACTION
Heat Sensor	Sensor failure	Replace sensor assembly.
	Connection failure	Repair connection.
Close Lid	Lid open	Close lid.
Latch Fail	Solenoid failure	Check component.
	Switch or sensor failure	Check connections.
Mem Fail P1	Memory failure	Push program button #1.
	New memory IC chip	Push program button #1.
	Bad memory IC chip	Call Labconco – Replace IC chip or control PCB.
MOTOR ERROR	Defective motor	Replace motor.
	Hall effect sensor failure	Replace sensor.
	Wire failure	Replace wire.

Other corrective actions for potential problems are as follows:

<b>PROBLEM</b>	<b>CAUSE</b>	<b>CORRECTIVE ACTION</b>
Unit will not operate	<b>Unit not connected to electrical power</b>	<b>Connect unit to proper electrical receptacle.</b>
	<b>Circuit breaker blown</b>	<b>Correct electrical problem and reset circuit breaker by pressing button.</b>
	<b>Lid open</b>	<b>Close lid.</b>
Excessive vibration	<b>Sample tubes not located symmetrically in rotor</b>	<b>Reposition sample tubes.</b>
Sample odor in lab	<b>Vent hose exhausting into lab area</b>	<b>Redirect hose to fume hood.</b>
Evaporation rate is reduced	<b>Heater inoperable</b>	<b>Contact Labconco.</b>
	<b>Vacuum pump failure</b>	<b>Check pump.</b>
	<b>Obstruction in hose</b>	<b>Remove obstruction or replace hose.</b>
	<b>Lack of adequate vacuum</b>	<b>See below.</b>
No vacuum/poor vacuum	<b>Pump not on</b>	<b>Turn on pump.</b>
	<b>Control valve open</b>	<b>Check control valve.</b>
	<b>Leaks in lines or connectors or gasket</b>	<b>Locate and repair.</b>
	<b>Foreign material on lid gasket</b>	<b>Clean gasket and lid.</b>
	<b>Pump is not functioning properly</b>	<b>Check pump by locating vacuum gauge closer to pump and close off rest of system. Check pump oil for cloudiness or particles and change.</b>
		<b>If pump is faulty, seek authorized service or replace pump.</b>
	<b>Cold Trap or Concentrator gasket is not sealing properly</b>	<b>Check gasket for cleanliness. Adjust gasket as needed.</b>
<b>Cold Trap lid not seated</b>	<b>Hold lid down until vacuum is initiated.</b>	

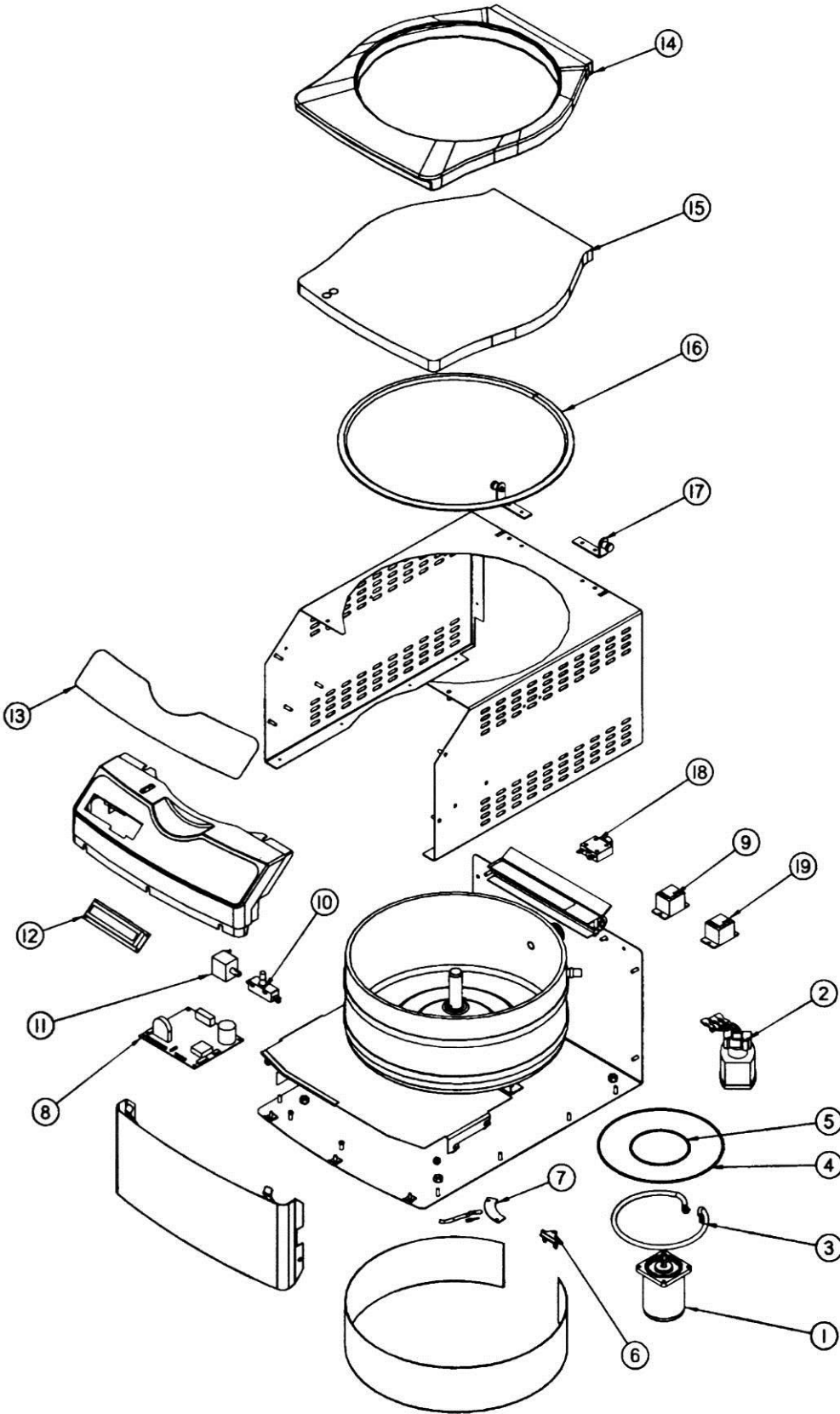
<b>PROBLEM</b>	<b>CAUSE</b>	<b>CORRECTIVE ACTION</b>
No vacuum/poor vacuum (cont.)	<b>Ice formed on Cold Trap lid sealing surface</b>	<b>Defrost and wipe dry.</b>
	<b>Secondary Trap Cannister not fitted properly</b>	<b>Tighten all connections to and from the Secondary Trap Cannister.</b>
	<b>Secondary Trap Insert is spent</b>	<b>Replace with new insert.</b>
	<b>New Secondary Trap has moisture in it</b>	<b>Run vacuum pump for 24 hours to remove moisture.</b>
Recovery of condensate in Cold Trap is less than normally expected	<b>Cold Trap is not ON</b>	<b>Check to make sure switch is ON and condensing unit fan is moving air out of the rear of the cabinet.</b>
	<b>Cold Trap does not cool down</b>	<b>Turn vacuum pump OFF and allow Cold Trap to cool for at least 30 min. to reach temperature.</b>  <b>-50°C temperature can be checked with a solvent thermometer or digital thermometer.</b>
Frequent oil change needed in pump	<b>Secondary Trap insert is spent</b>	<b>Change insert often.</b>
	<b>Cold Trap is not emptied after each run and dried</b>	<b>Empty the traps (glass or stainless steel) after each run and replace.</b>
	<b>Vacuum too strong for chemical</b>	<b>Use a Secondary Trap insert and diaphragm pump.</b>
Unit starts and shuts off	<b>Latch optical sensor improperly calibrated</b>	<b>Unplug power cord. Wait 10 seconds. Plug in power cord.</b>

# Appendix A:

## CentriVap Components

The following pages list components that are available for your CentriVap. The parts shown are the most common replacement parts. If other parts are required, contact Product Service.

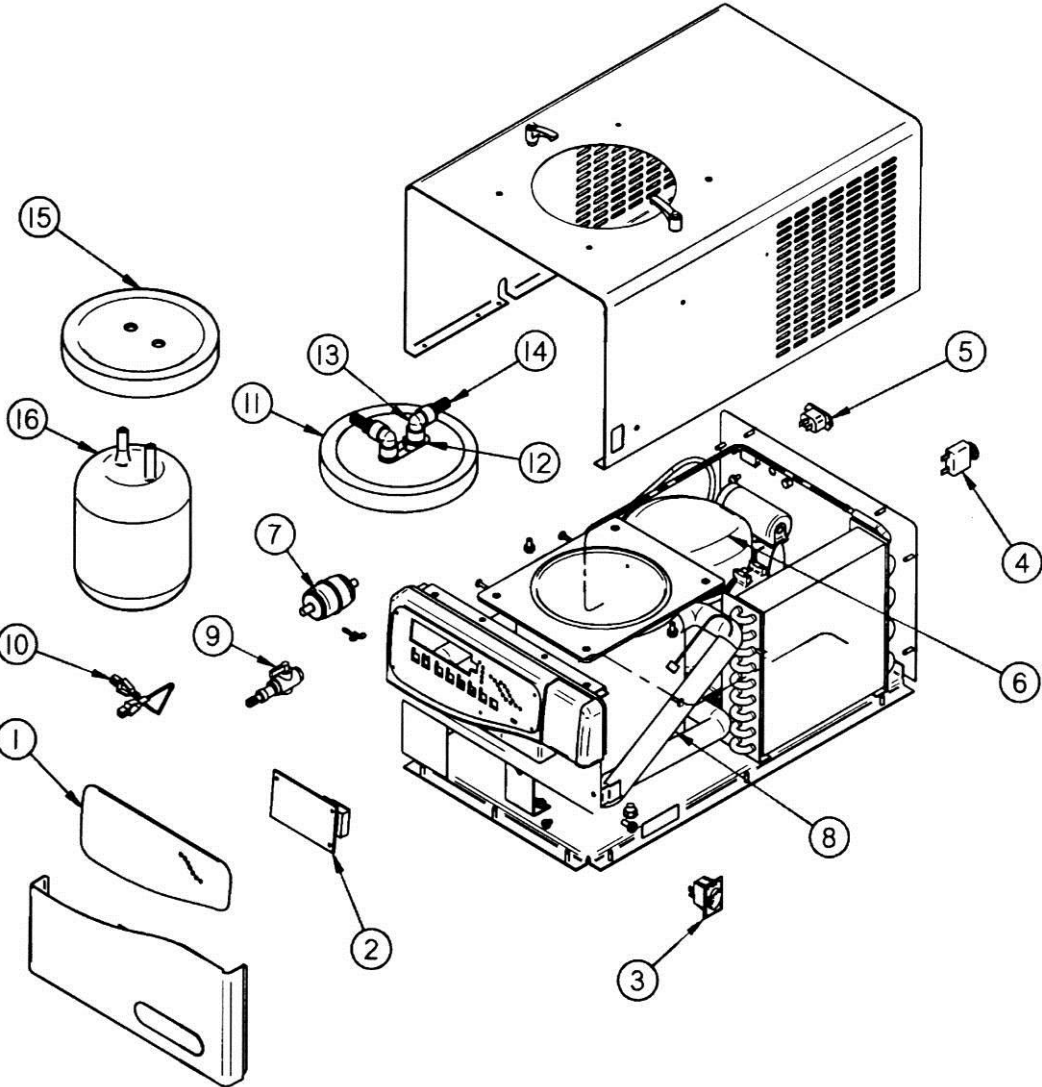
Item	Quantity	Part No.	Description
1	1	7459000	Motor w/Capacitor
2	1	7481700	Valve, Vacuum Break (115V)
2A	1	7481701	Valve, Vacuum Break (230V)
2B	1	7396308	Valve Assy, PTFE (Acid Resistant Models)
3	1	7453500	Heater (115V)
3A	1	7453501	Heater (230V)
4	1	1647106	O-Ring, Outer
5	1	1647105	O-Ring, Inner
6	1	7975902	Fuse, High Temp Limiter
7	1	7456000	Harness, Temp & Speed Sensor
8	1	7479400	Printed Circuit Board
9	1	1289200	Relay Vacuum Pump (115V)
9A	1	1289100	Relay Vacuum Pump (230V)
10	1	7826000	Switch, Latch
11	1	7478700	Solenoid, Latch
12	1	7403701	Display
13	1	7398400	Label/Switch Pad
13A	1	7398401	Label/Switch Pad with Heat Boost
14	1	7452600	Gasket, Lid
15	1	7456600	Lid, Glass
15A	1	7452500	Lid, Acrylic
16	42.2 inch	7451700	Extrusion
17	2	7452200	Hinge, Bracket Assembly
18	1	1289300	Circuit Breaker (115V)
18A	2	1289308	Circuit Breaker (230V)
19	1	1289200	Relay – Heat Boost (115V and 230V)
20	1	1334500	Power Cord 115V
20A	1	1336100	Power Cord 230V EU (Not Shown)
20B	1	1332600	Power Cord 230V UK (Not Shown)
20C	1	1332700	Power Cord 230V China (Not Shown)
20D	1	1338000	Power Cord 230V US (Not Shown)



**CentriVap Cold Trap Components (-50°C Models)**

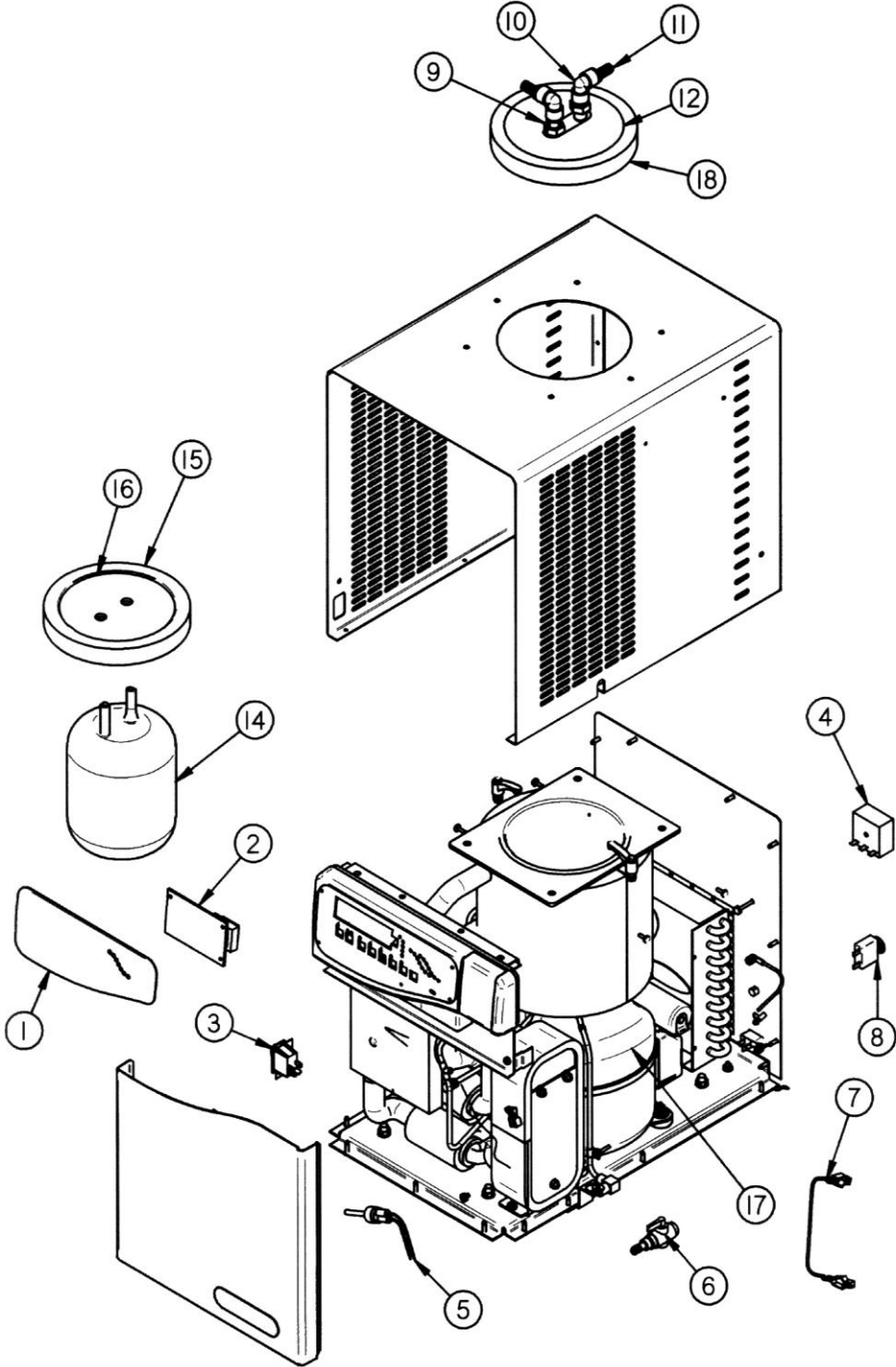
<b>Item</b>	<b>Quantity</b>	<b>Part No.</b>	<b>Description</b>
1	1	7398100	Label
2	1	7394400	Printed Circuit Board
3	1	1302300	Switch
4	1	1327208	Circuit Breaker (115V)
4A	2	1327204	Circuit Breaker (230V)
5	1	1333800	Power Cord Inlet
6	1	7437700	Compressor (115V)
6A	1	7437701	Compressor (230V/50Hz)
6B	1	7734402	Compressor (230/60Hz)
7	1	7936200	Drier
8	1	7387300	Line Assembly
9	1	1360500	Valve
10	1	7464600	Wire Assembly – Ground
11	1	7399700	Lid Assembly
12	2	1554800	Stem Adapter
13	2	1554900	Elbow
14	2	1554700	Stem
15	1	7397606	Lid Assembly for Glass Trap
16	1	7871500	Glass Trap
17	1	1334500	Power Cord 115V (Not Shown)
17A	1	1336100	Power Cord 230V EU (Not Shown)
17B	1	1332600	Power Cord 230V UK (Not Shown)
17C	1	1332700	Power Cord 230V China (Not Shown)
17D	1	1338000	Power Cord 230V US (Not Shown)





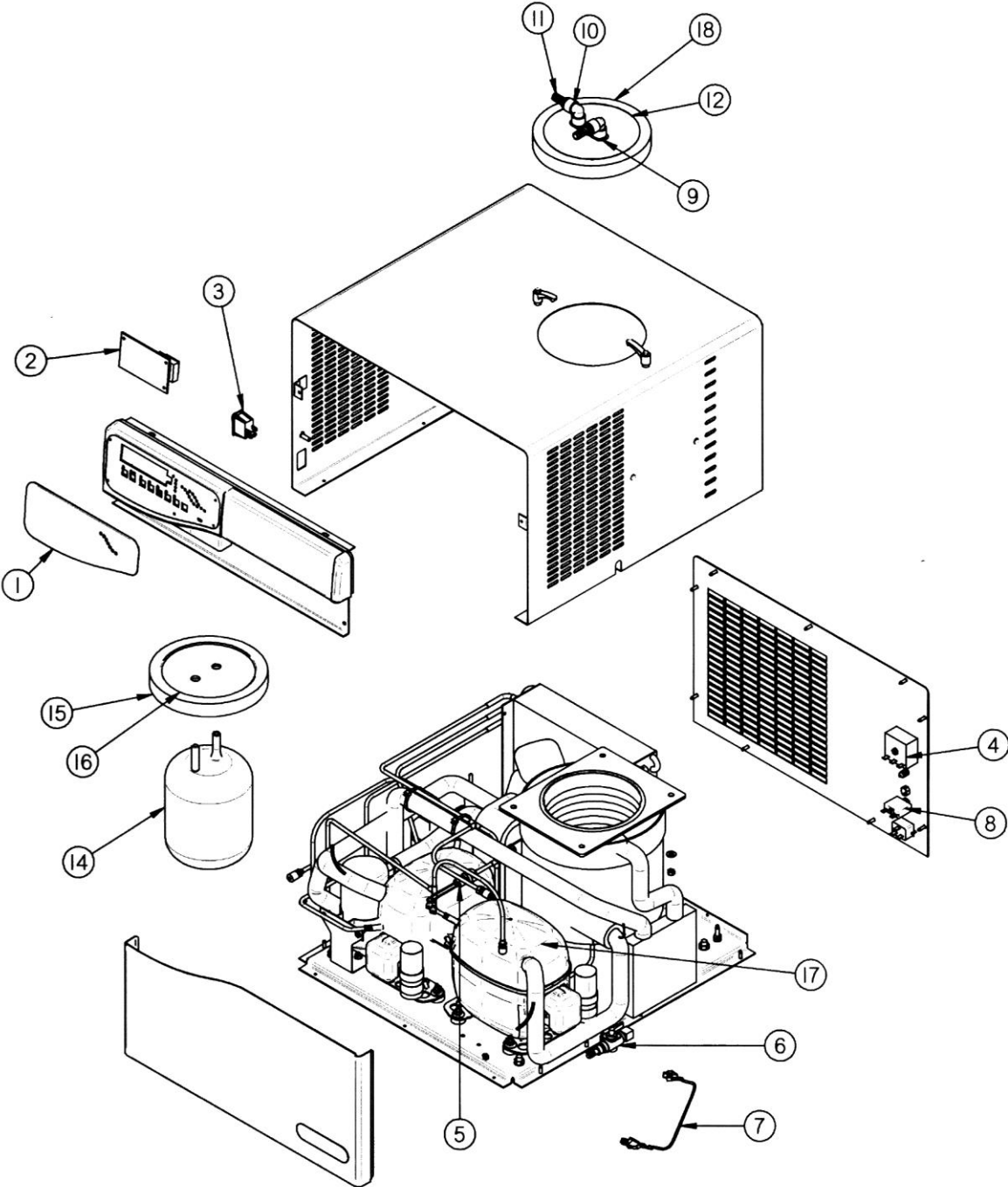
**CentriVap Cold Trap Components (-85°C Models)**

<b>Item</b>	<b>Quantity</b>	<b>Part No.</b>	<b>Description</b>
1	1	7398100	Label
2	1	7394402	Printed Circuit Board
3	1	1302300	Switch – Power
4	1	7474200	Timer (115V)
4A	1	7474400	Timer (230V)
5	1	7431700	Switch – Pressure
6	1	1360500	Valve
7	1	7464600	Wire Assembly – Ground
8	1	1327207	Circuit Breaker (115V)
8A	2	1327208	Circuit Breaker (230V)
9	2	1548603	Stem Adapter
10	2	1544501	Elbow
11	2	1548101	Stem
12	1	7398900	Insulation – Lid Assembly
13	1	1334500	Power Cord 115V (Not Shown)
13A	1	1336100	Power Cord 230V EU (Not Shown)
13B	1	1332600	Power Cord 230V UK (Not Shown)
13C	1	1332700	Power Cord 230V China (Not Shown)
13D	1	1338000	Power Cord 230V US (Not Shown)
14	1	7871500	Glass Trap
15	1	7397606	Lid Assembly Complete, Glass Trap
16	1	7397608	Insulation – Glass Trap
17	2	7591800	Compressor 115V
17A	2	7591801	Compressor 230V/50Hz
17B	2	7591802	Compressor 230V/60Hz
18	1	7399700	Cover Assembly Complete, Acrylic



**CentriVap Cold Trap Components (-105°C Models)**

<b>Item</b>	<b>Quantity</b>	<b>Part No.</b>	<b>Description</b>
1	1	7398100	Label
2	1	7394402	Printed Circuit Board
3	1	1302300	Switch – Power
4	1	7474200	Timer (115V)
4A	1	7474400	Timer (230V)
5	1	7431700	Switch – Pressure
6	1	1360500	Valve
7	1	7464600	Wire Assembly – Ground
8	1	1289315	Circuit Breaker (115V)
8A	2	1289308	Circuit Breaker (230V)
9	2	1548603	Stem Adapter
10	2	1544501	Elbow
11	2	1548101	Stem
12	1	7398900	Insulation – Lid Assembly
13	1	1336400	Power Cord 115V (Not Shown)
13A	1	1336500	Power Cord 230V EU (Not Shown)
13B	1	1332601	Power Cord 230V UK (Not Shown)
13C	1	1332701	Power Cord 230V China (Not Shown)
13D	1	1342100	Power Cord 230V US (Not Shown)
14	1	7871500	Glass Trap
15	1	7397606	Lid Assembly Complete, Glass Trap
16	1	7397608	Insulation – Glass Trap
17	2	7591800	Compressor 115V
17A	2	7591801	Compressor 230V/50Hz
17B	2	7591802	Compressor 230V/60Hz
18	1	7399700	Cover Assembly Complete, Acrylic

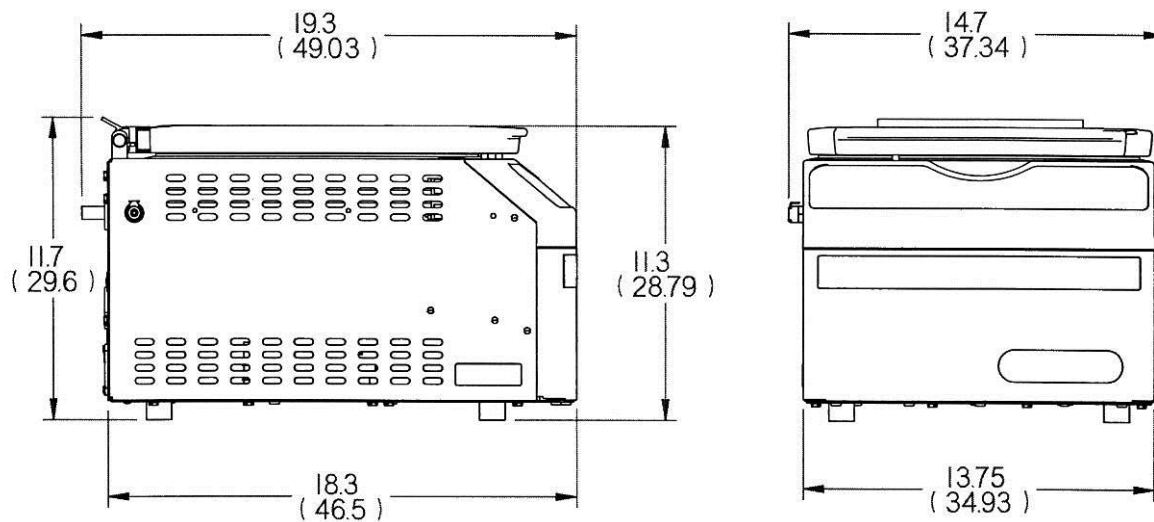


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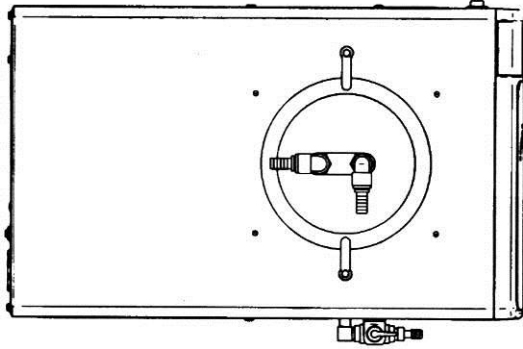
# Appendix B: CentriVap Dimensions

## CentriVap Concentrator

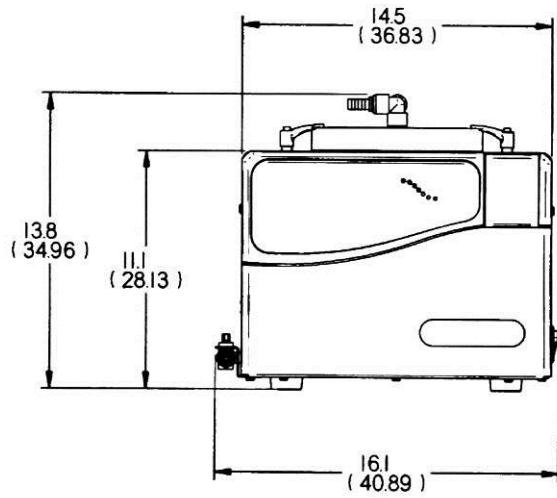
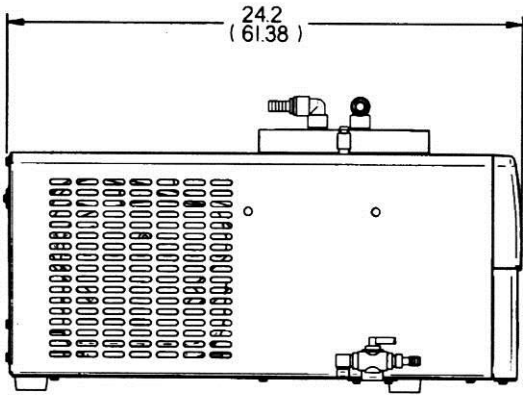
INCHES  
(CENTIMETERS)



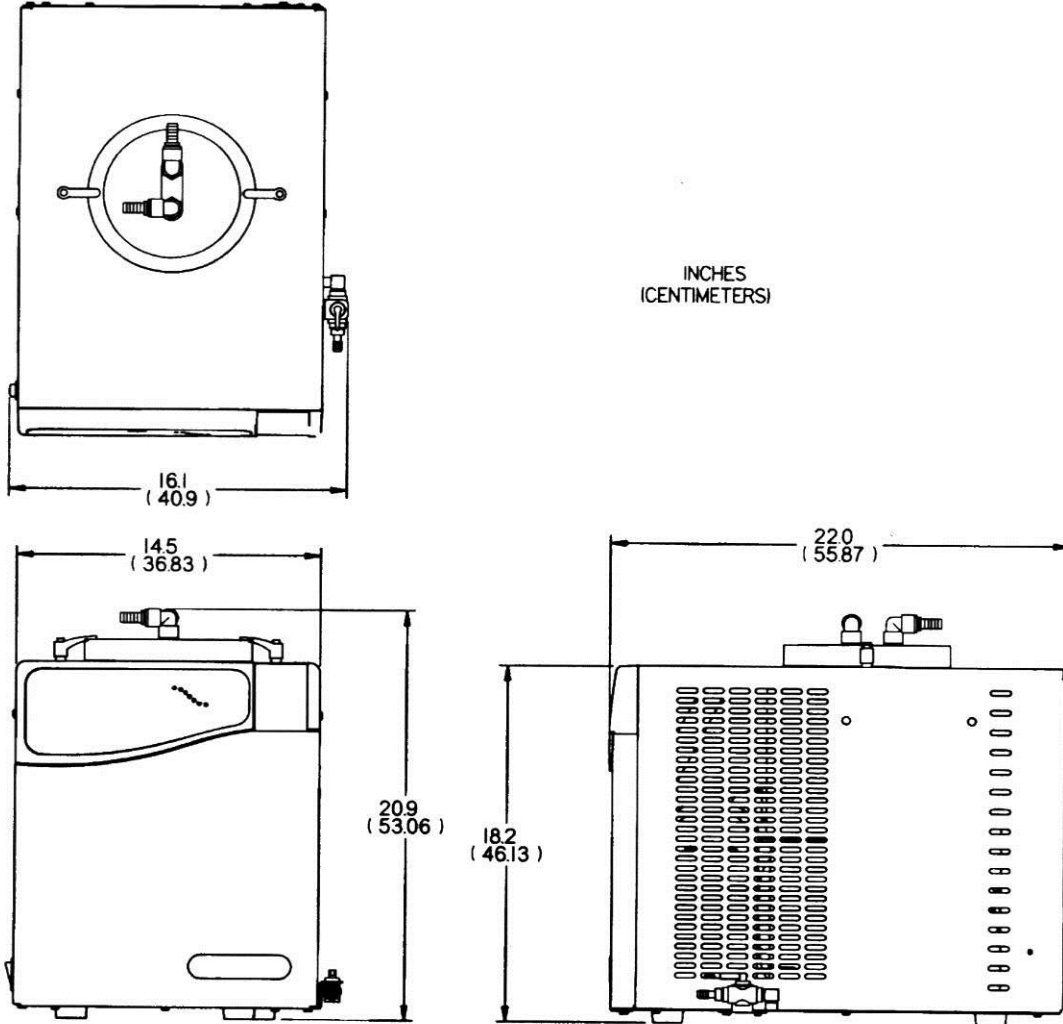
CentriVap Cold Trap (-50°C Models)



INCHES  
(CENTIMETERS)

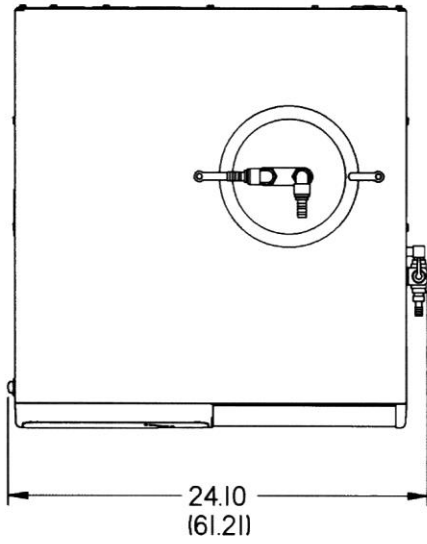


CentriVap Cold Trap (-85°C Models)

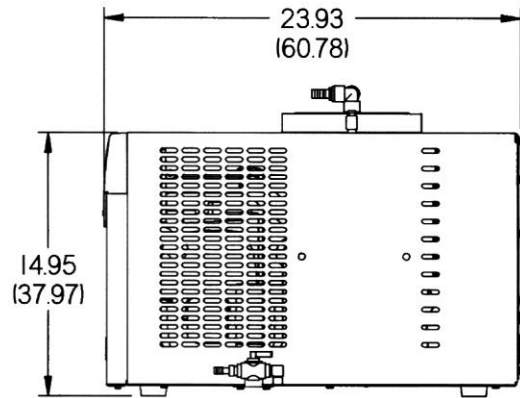
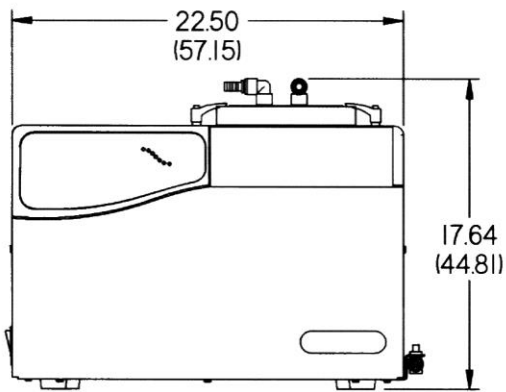




CentriVap Cold Trap (-105°C Models)



INCHES  
(CENTIMETERS)



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# Appendix C:

## CentriVap Specifications

This Appendix contains technical information about the CentriVap including specifications, environmental operating conditions, wiring diagrams and evaporation rates.

### Electrical Specifications

- Nominal amperage for 115V CentriVap Concentrator (model 7810010, 7810014 & 7810016) (excluding vacuum pump): 3.1A (with vacuum pump) 12.00A max.
- Nominal amperage for 230V CentriVap Concentrator (model 7810011, 7810015 & 7810017) (excluding vacuum pump): 1.6A (with vacuum pump) 6.0A max.
- Nominal amperage for 115V CentriVap Concentrator (model 7810012) (excluding vacuum pump): 5.1A (with vacuum pump) 12.0A max.
- Nominal amperage for 230V CentriVap Concentrator (model 7810013) (excluding vacuum pump): 2.6A (with vacuum pump) 6.0A max.
- Nominal amperage for 115V/60Hz Cold Trap (-50° Models): 6.0A.
- Nominal amperage for 230V 50/60Hz Cold Trap (-50° Models): 2.5A.
- Nominal amperage for 115V/60Hz Cold Trap (-85° Models): 10.0A.
- Nominal amperage for 230V 50/60Hz Cold Trap (-85° Models): 5.1A.
- Nominal amperage for 115V 60Hz Cold Trap (-105°C Models): 13A.
- Nominal amperage for 230V 50/60Hz Cold Trap (-105°C Models): 7A.
- Frequency: All Concentrators – 50/60 Hz.
- Phase: Single
- Rotor Speed: Up to 1,725 RPM

### Environmental Conditions

- Indoor use only.
- Maximum altitude: 6562 feet (2000 meters).
- Ambient temperature range: 41° to 104°F (5° to 40°C).
- Maximum relative humidity: 80% for temperatures up to 88°F (31°C), decreasing linearly to 50% relative humidity at 104°F (40°C).
- Main supply voltage fluctuations not to exceed  $\pm 10\%$  of the nominal voltage.
- Transient overvoltages according to Installation Categories II (Overvoltage Categories per IEC 1010). Temporary voltage spikes on the AC input line that may be as high as 1500V for 115V models and 2500V for 230V models are allowed.
- Used in an environment of Pollution degrees 2 (i.e., where normally only non-conductive atmospheres are present). Occasionally, however, a temporary conductivity caused by condensation must be expected, in accordance with IEC 664.

## Evaporation Rates

Tube Size (ml)	Number of Samples	Sample Size (ml)	Heater Temp (C)	Heat Boost	Vacuum Pump	Time to Dry (min)	Cold Trap	Rate Overall (ml/min)
<b>Methylene Chloride</b>								
<b>bp 40</b>								
50	12	25	45	off	Diaphragm	80	no	3.75
50	12	25	45	on	Diaphragm	78	no	3.85
15	18	10	45	off	Diaphragm	45	no	4.00
15	18	10	45	on	Diaphragm	45	no	4.00
<b>Toluene</b>								
<b>bp 111</b>								
50	12	25	45	off	Diaphragm	204	no	1.47
50	12	25	45	on	Diaphragm	187	no	1.60
50	12	25	100	off	Diaphragm	96	no	3.13
50	12	25	100	on	Diaphragm	66	no	4.55
15	18	10	45	off	Diaphragm	119	no	1.51
15	18	10	45	on	Diaphragm	99	no	1.82
15	18	10	100	off	Diaphragm	42	no	4.29
15	18	10	100	on	Diaphragm	34	no	5.29
<b>Acetonitrile</b>								
<b>bp 82</b>								
50	12	25	45	off	Diaphragm	184	no	1.63
50	12	25	45	on	Diaphragm	181	no	1.66
50	12	25	100	off	Diaphragm	81	no	3.70
50	12	25	100	on	Diaphragm	77	no	3.90
15	18	10	45	off	Diaphragm	106	no	1.70
15	18	10	100	off	Diaphragm	52	no	3.46
15	18	10	100	on	Diaphragm	45	no	4.00
1.5	132	1	45	off	Diaphragm	55	no	2.40
1.5	90	1	45	off	Diaphragm	47	no	1.92
1.5	132	1	60	off	Diaphragm	37	no	3.57
1.5	132	1	75	off	Diaphragm	33	no	5.74
1.5	132	1	100	off	Diaphragm	21	no	6.29
1.5	132	1	100	on	Diaphragm	17	no	7.76
<b>Methanol</b>								
<b>bp 65</b>								
50	12	25	45	off	Diaphragm	233	no	1.29
15	18	10	45	off	Diaphragm	141	no	1.28
1.5	132	1	35	off	Diaphragm	88	no	1.50
1.5	132	1	45	off	Diaphragm	64	no	2.06
1.5	132	1	60	off	Diaphragm	50	no	2.64
1.5	90	1	75	off	Diaphragm	38	no	2.37
1.5	132	1	75	off	Diaphragm	39	no	3.38
1.5	132	1	100	off	Diaphragm	25	no	5.28
1.5	132	1	100	on	Diaphragm	22	no	6.00
<b>Water</b>								
<b>bp 100</b>								
50	12	25	45	off	Diaphragm	1397	no	0.21
50	12	25	100	off	Diaphragm	445	no	0.67
50	12	25	100	on	Diaphragm	430	no	0.70
15	18	10	45	off	Diaphragm	841	no	0.19
1.5	132	1	45	off	Diaphragm	427	no	0.30
1.5	132	1	60	off	Diaphragm	303	no	0.44
1.5	132	1	75	off	Diaphragm	196	no	0.67
1.5	132	1	100	off	Diaphragm	117	no	1.13
1.5	132	1	100	on	Diaphragm	108	no	1.22
50	12	25	45	off	rotary vane	1002	yes	0.30
50	12	25	100	off	rotary vane	424	yes	0.70
50	12	25	100	on	rotary vane	373	yes	0.80
15	18	10	45	off	rotary vane	565	yes	0.32
15	18	10	60	off	rotary vane	456	yes	0.39
1.5	132	1	45	off	rotary vane	299	yes	0.44
1.5	132	1	75	off	rotary vane	207	yes	0.64
1.5	132	1	100	off	rotary vane	131	yes	1.01
1.5	132	1	100	on	rotary vane	122	yes	1.08

Vacuum Pumps:

Diaphragm – Rated at 12 mbar ultimate vacuum and 34 L/min displacement

Rotary vane – Rated at  $2.0 \times 10^{-3}$  mbar ultimate vacuum and 195 L/min displacement

Chamber preheated prior to each run to run temp