



TurboVap[®] 500

**Closed Cell Concentrator
User's Manual**



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P/N C128100 Rev. 02

Preface

Copyright

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Content

The information in this manual may contain typographical errors or technical inaccuracies and is subject to change without notice. Modifications may also be made to the product described in this manual at any time.

Proper Equipment Operation

The TurboVap 500 Closed Cell Concentrator uses a patented gas vortex shearing technique to concentrate samples quickly. It is a microprocessor-controlled instrument for simultaneous, automated concentration of multiple samples with unattended operation, convenience, and speed. It is the customer's responsibility to design suitable methods for evaporation of their own samples.

WARNINGS



- *The TurboVap 500 is **NOT** designed for in vitro testing or for use with highly corrosive acids.*
- *To reduce the risk of electric shock, do not remove the cover. No user serviceable parts are inside. Refer to qualified service personnel if help is required.*
- *Use this product only in the manner described in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.*

AVERTISSEMENTS



- *Pour réduire le risque de choc électrique, ne pas retirer le couvercle. Ce produit ne contient aucune pièce pouvant être réparée par l'utilisateur. Au besoin, confier l'appareil à un réparateur qualifié.*
- *Ce produit ne doit être utilisé que comme décrit dans ce manuel. Si cet appareil est utilisé d'une manière autre que celle spécifiée par le fabricant, la protection fournie par l'appareil peut être entravée.*

Product Safety Warning

The TurboVap 500 power switch is the same type of power switch used on most laboratory equipment such as gas chromatographs, spectrophotometers, liquid chromatographs, and computers. The TurboVap products are safely used in the laboratory when “Good Laboratory Practices” are followed as with any other lab equipment. All fans are brushless motor fans and will not ignite vapors. The TurboVap is not classified as “Explosion Proof” and its use is at the discretion and risk of the operator or laboratory supervisor/manager. Your TurboVap product has been designed with safety as a foremost consideration. These products are equipped with a non-arcing fan, solid state electronics, and provisions for vapor collection. Do not change the configuration of the TurboVap 500 ventilation system. Please consult with Biotage if you have any questions or concerns regarding this subject.

WARNING



TurboVap products are NOT classified as “Explosion Proof.” The power switch is an arcing source and could ignite explosive vapors if present.

Contact Biotage 1-Point Support

Biotage 1-Point Support provides expert services including telephone troubleshooting of products, repair instructions, service dispatching and replacement part information.

Before you call:

Check the online Help and the manual for a probable cause and solution to your question.

Have the following information available for the customer support representative:

- Workstation serial number(s)
- If applicable, the error displayed on the LCD display

To reach the **Biotage 1-Point Support**:

US: 1-800-446-4752 or US-1-pointsupport@biotage.com

Europe and Asia-Pacific Regions: +46 18 56 57 11 or
EU-1-pointsupport@biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Biotage Product Repair Depot

The Biotage Product Repair Depot offers product repair services, upgrades, refurbishment and installation at reasonable costs and with quick turnaround for all customer-owned equipment and accessories. For further information or to obtain a quotation for services, contact the Depot:

US: 1-800-446-4752 or US-1-pointsupport@biotage.com

Europe and Asia-Pacific Regions: +46 18 56 57 11 or
EU-1-pointsupport@biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Features of the Biotage Product Repair Depot:

- Factory-trained repair technicians
- Two week turnaround from receipt at Biotage

Shipping:

Customers are responsible for shipments both to and from Biotage, specifying the carrier and choice of service.

Return Policy:

To ensure a safe environment for all our technicians, it is mandatory for each returned product to include our chemical questionnaire stating contact chemicals, chemicals used during application and cleaning steps taken prior to shipment.

Processing:

Once the product is returned, it is evaluated for necessary repairs. The customer is contacted with an estimate and may choose to go ahead with the repair or decline service. If service is denied, a minimum evaluation charge may apply. Upon completion of the repair, a purchase order or appropriate means of payment is required before return shipment.

Service and Customer Support Plans

Biotage offers a full range of services to ensure your success. From our original factory warranty through a comprehensive line of customer support plans, Biotage AB offers you Field Service Engineers and In-house Specialists who are dedicated to supporting your hardware, software and application development needs.

US: 1-800-446-4752 or US-1-pointsupport@biotage.com

Europe and Asia-Pacific Regions: +46 18 56 57 11 or EU-1-pointsupport@biotage.com

Japan: +81 422 28 1233 or JP-1-Pointsupport@biotage.com

Our programs can include such useful services as:

- preventative maintenance
- diagnostic servicing performed on-site by Biotage AB field service engineers
- extended use of the Biotage AB 1-Point Support Center
- automated, remote troubleshooting
- software updates
- after-hour, weekend and holiday support
- repair depot servicing
- parts, labor and travel expense coverage
- other customized services upon request

FCC

This device complies with part 15 of the FCC (United States Federal Communications Commission) Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

CE

This device complies with all CE rules and requirements.

NOTE

Changes or modifications to this equipment not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

REMARQUE

Tout changement ou modification apporté à cet instrument non expressément approuvé par l'entité responsable de la conformité peut annuler l'autorisation d'opérer l'appareil accordée à l'utilisateur.

Table of Symbols

Table 1 contains symbols that identify particularly important information and alert you to the presence of hazards. These symbols may appear in this manual and/or on the product it describes.

Table 1. Important Symbols

Symbol Symbole	Description Description
	DANGER: An imminently hazardous situation, which, if not avoided, will result in death or serious injury. DANGER: Situation présentant un danger imminent qui, s'il n'est pas éliminé, peut entraîner des blessures graves, voire la mort.
	WARNING: Caution, risk of danger. Refer to the User's documentation. AVERTISSEMENT: Attention, danger potentiel. Se reporter à la documentation de l'utilisateur.
	NOTE: A cautionary statement; an operating tip or maintenance suggestion; may result in instrument damage if not followed. REMARQUE: Énoncé indiquant une précaution à prendre, un conseil de fonctionnement ou une suggestion d'entretien; son non-respect peut provoquer des dommages à l'instrument.
	Hazardous voltage; risk of shock injury. Tension dangereuse; risque de blessure par électrocution.
	Crush hazard. Risk of body parts, hair, jewelry, or clothing getting caught in a moving part. Danger d'écrasement. Faire attention que les parties corporelles, les cheveux, les bijoux ou les vêtements ne soient pas pris dans une pièce mobile.

Table 1. Important Symbols (Continued)

















Symbol Symbole	Description Description
	Risk of puncture injury. Risque de blessure par piqûre.
	Risk of eye injury; wear safety glasses. Risque de lésion oculaire; porter des lunettes de sécurité.
	Risk of exposure to biohazards. Risque d'exposition à biohazards.
	Risk of fire. Risque d'incendie.
	Risk of poison. Risque d'empoisonnement.
	Risk of explosion. Risque d'explosion.
	Hazardous fumes. Émanations dangereuses.
	Hot surface; risk of burns. Surface chaude; risque de brûlures.
	Protective ground symbol. Symbole de terre de protection.
	Ground symbol. Symbole de terre.
	Fuse. Fusible.
	Alternating current. Courant alternatif.
	On (supply). Marche (alimentation).
	Off (supply). Arrêt (alimentation).
	CE compliance mark. Marque de conformité CE.
	Signifies that the unit has passed safety tests for grounding, power line transience, and current leakage. Signifie que l'appareil a réussi les tests de sécurité pour la mise à la terre, le courant transitoire de ligne d'alimentation et la perte de courant.

Table 1. Important Symbols (Continued)




Symbol Symbole	Description Description
	Input. Entrée.
	Output. Sortie.
Equipment labels are color coded: Les étiquettes de l'appareil sont codées couleur:	Yellow Caution, risk of danger Red Stop Blue Mandatory action Green Safe condition or information Jaune Attention, danger potentiel Rouge Arrêter Bleu Intervention obligatoire Vert Condition sûre ou informations de sécurité
	Helpful hints, additional information Conseils utiles, informations supplémentaires

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Introduction

The Biotage TurboVap 500 Closed Cell Concentrator is a microprocessor-controlled concentrator that provides automated sample concentration using a helical gas flow and sensor endpoint detection technology.

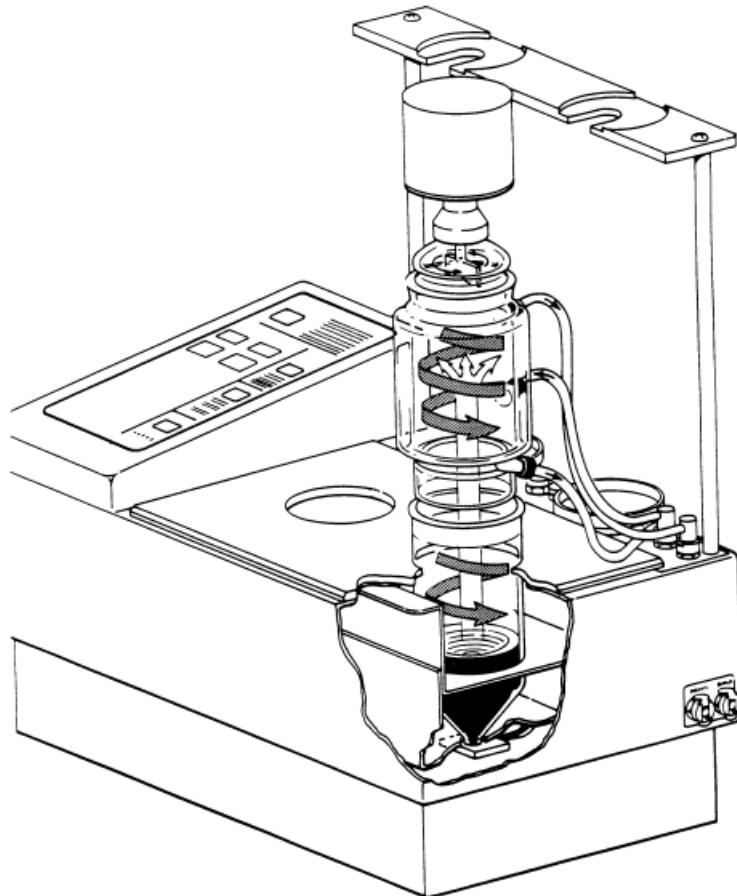


Figure 1. The TurboVap 500

Gas Vortex Shearing Action

The concentrator uses a patented gas vortex shearing action that maintains high concentration rates regardless of sample height in the tubes. A helical flow of air (see [Figure 1](#)) is created by a motor-driven fan. The helical flow sets up a vortexing action that promotes sample homogeneity and continuous rinsing of the tube wall. The solvent vapors rise, enter the condenser, condense on the side walls, and then run out the drain into a suitable waste or reclamation container.

Automated Concentration

The TurboVap 500 uses an integrated microprocessor to automatically time the concentration, control the water bath temperature, turn off the fans, and perform operational diagnostics.

Sensors

Optical sensors in the water bath enable the TurboVap 500 to automatically stop the concentration when the sample level in the tube passes below the optical sensor. The final volume of the concentration, either 0.5 mL or 0.75 mL, depends on the size of the sample tube being used. The optical sensor tracks any slow changes in the optical density of the sample to assure that darkening or brightening samples do not stop the concentration prematurely. Once the sample passes below the optical sensor and remains below the sensor for a few seconds, the TurboVap 500 stops the concentration or starts the timer to concentrate for additional time.

The stem size of the concentrator tubes determines the final volume when using the sensor endpoint. Tubes with a 0.5 mL stem concentrate to 0.5 mL; tubes with a 1.0 mL stem concentrate to 0.75 mL and have a calibrated mark on the tube for you to reconstitute to 1.0 mL.

Adjustable

The TurboVap 500 enables you to:

- concentrate for a set time,
- use the sensor endpoint to detect a level of 0.5 mL or 0.75 mL,
- continue concentrating for a set time after reaching the sensor endpoint,
- concentrate until stopped manually,
- optimize the concentration rate by adjusting the water bath temperature and the fan speed.

NOTE



- *Time, temperature, and fan speed may be changed at any time.*

Convenience

The TurboVap 500 enables you to start a run of samples and leave the instrument unattended. When the concentration has finished, the fans turn off automatically and the concentrator sounds an alarm every 30 seconds until the samples are removed or **Start/Stop** is pressed.

Mild Conditions

The water bath provides sufficient warming without harming sample recovery.

Multiple Sample Processing

The concentrator has two tube positions. This allows either one or two samples to be processed simultaneously.

Independent Operation

Concentration for each cell can be independently started or stopped at any time.

Requires No Hood

The vent tubing permits the unit to be placed on the bench rather than taking up valuable hood space.

Vapor Removal

The solvent vapors are removed by the fans through the Vent tubing. The vent tubing must be routed to a suitable outside ventilation system.

TurboVap 500 Hardware

TurboVap 500 - Front

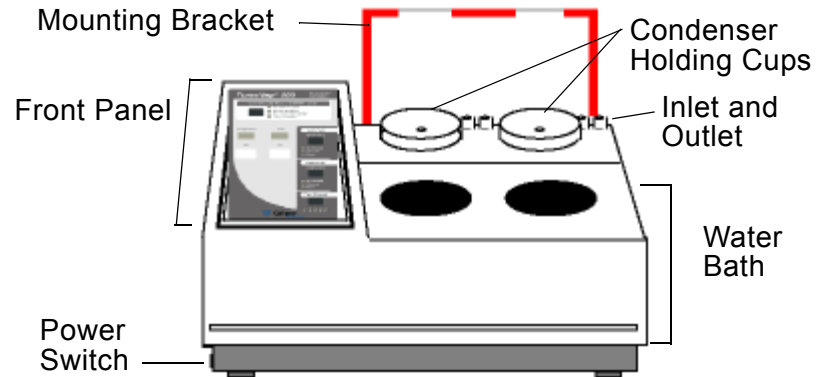


Figure 2. TurboVap 500 Parts

Mounting Bracket

Holds the motor assembly when not in use.

Front Panel

Controls the setup and operation of the concentrator. See [“Front Panel” on page 17](#) for details.

Power Switch

Turns the power ON or OFF.

WARNING



The power switch is an arcing source and could ignite excessive explosive vapors if present. DO NOT change the position of the unit's on/off power switch when explosive vapors are present.

Condenser Holding Cups

Hold the condensers when not is use.

Water Bath

Warms the sample tubes during concentrations.

WARNING



Fire and burn hazard. Do NOT operate the TurboVap 500 without water in the water bath.

TurboVap 500 - Rear

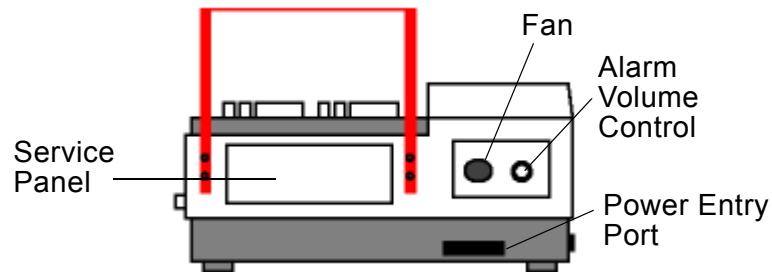


Figure 3. TurboVap 500 Hardware, Rear View

Fan

Cools the internal components. Do not block the fan opening.

Alarm Volume Control

Adjusts the loudness of the buzzer that signals when the endpoint is reached or a button is pressed.

Power Entry Port

Supplies power to the unit and houses the fuses.

WARNING



- *To avoid the risk of fire or electrical shock, plug the power cord securely into a properly grounded outlet.*
- *Replace fuses ONLY with the same type and rating.*

Service Panel

Provides access to the motor and sensor connectors.

WARNING



To avoid electrical shock and other injuries, turn OFF the power and unplug the power cord before removing the service panel.

TurboVap 500 - Side

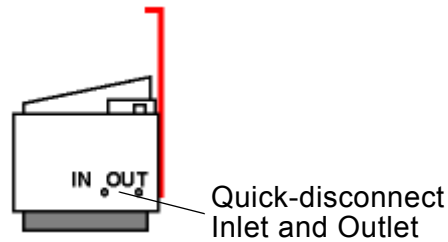


Figure 4. TurboVap 500, Side View

Quick-disconnect Inlet and Outlet

Supplies coolant (tap water or chilled water) to the condensers.

Front Panel

The control panel allows you to control concentration in the two tube positions. (Samples are not required in each position.) The microprocessor constantly monitors the control panel settings, enabling you to change the settings at any time during evaporation. Lights indicate when each cell is evaporating or has reached the selected endpoint. The Start/Stop buttons enable you to stop the evaporation manually if desired. The two displays on the front panel display the bath temperature and time elapsed.

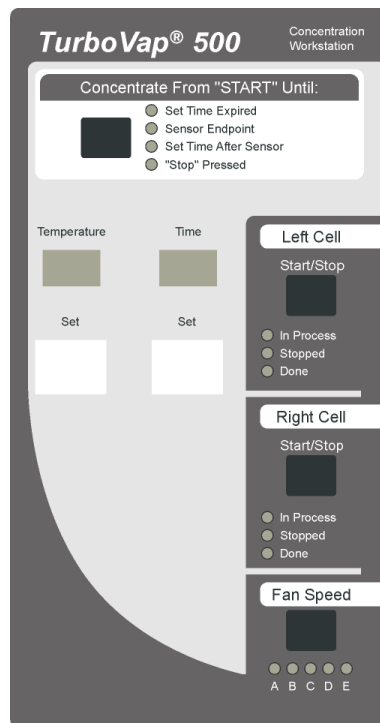


Figure 5. TurboVap 500 Control Panel

Concentrate Until Options

Concentrate Until Button

Used to select the desired endpoint for the concentration:

- **Set Time Expired** - to concentrate for the period of time in minutes specified by the Time setting on the panel
- **Sensor Endpoint** - to concentrate until the sensor detects a level of 0.5 or 1.0mL (depending upon the style of concentrator tube)
- **Set Time After Sensor** - to concentrate past the 0.5mL or 1.0mL setting by the amount of time in minutes specified by the Time setting
- **Stop Pressed** - to concentrate until the operator presses the **Start/stop** button for the individual cell (Manual operation)

Temperature Pushwheel

Sets the desired water bath temperature in degrees Centigrade.

WARNING



DO NOT operate at temperatures greater than 60°C with the sensors in place. See [“Removing and Replacing the Sensors” on page 54](#) for operation at temperatures above 60°C.

Temperature Display

Displays the *actual* water bath temperature.

NOTE: The display blinks if the actual water bath temperature is 2 or more degrees different than the set temperature.

WARNING



To avoid the risk of fire or burn injuries, do NOT operate the TurboVap 500 without water in the bath.

Time Pushwheel

Sets the desired time in minutes (total concentration time or additional time after sensor endpoint detection).

Time Display

Displays the time *elapsed*. The display indicates the left or right cell by flashing “L=” or “r=” before the time elapsed display. “SE” is displayed if sensor detection is being used.

Cell Selections and Functions

Cell Button and Lights	Function
Start/Stop Button	Used to start or stop concentration for each cell.
In Process Light	On when the cell is performing concentration.
Stopped Light	On when the Start/Stop button is pressed during concentration.
Done Light	On when the cell has reached its endpoint.

Fan Speed Selections and Functions

Fan Speed Selection	Function
A through E	to set the speed of the cell cap fans. A = 4000 rpm B = 5000 rpm C = 6000 rpm D = 7000 rpm E = 8000 rpm

WARNING



Always keep body parts, hair, jewelry, and clothing away from the fans.

Note: The fan speed button is also used to run diagnostics (see [“Software Diagnostics” on page 63](#)).

Closed Cell Parts and Functions

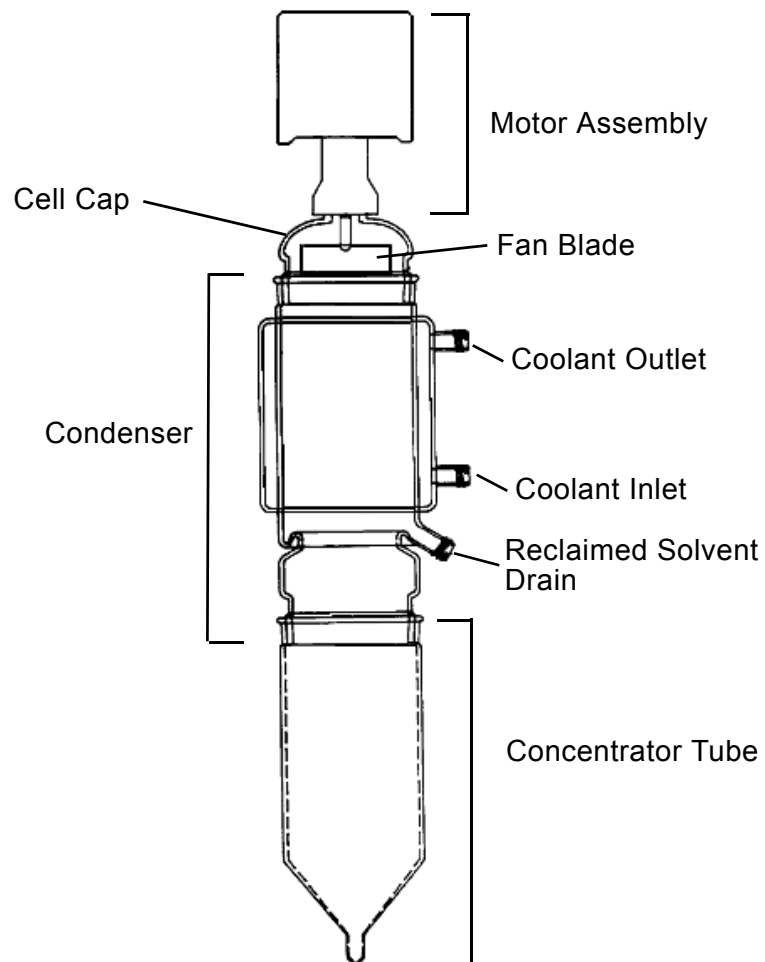


Figure 6. Closed Cell Glassware

Motor Assembly

Holds the motor that drives the fan blades.

Cell Cap

Encloses the fan blade.

WARNING



Always keep body parts, hair, jewelry and clothing away from the fan blades.

Condenser

Condenses and reclaims the solvent. Includes an inlet and outlet for the coolant (tap or chilled water) and a drain for the reclaimed solvent.

WARNING



The liquid exiting the solvent drains may be corrosive, flammable and/or toxic. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Do not touch drainage.*
- *Keep drainage from heat or flame.*
- *Dispose of drainage and container properly.*
- *Avoid direct contact with this liquid.*
- *Periodically check drainage tubes for damage.*
- *Make sure drain flow is not inhibited.*
- *Only use waste containers large enough to hold the drainage.*

Concentrator Tube (Sample Tube)

Contains the sample to be concentrated. Sample tubes for endpoint detection at either 1.0mL or 0.5mL are available.

Installing the TurboVap 500

Unpacking the TurboVap 500

Unpack the shipping container and verify that all items listed below are present. If anything is damaged or missing, contact the Biotage 1-Point Support Center (see [page 4](#)).

Parts Supplied

The Biotage TurboVap 500 Closed Cell Concentrator comes with the following parts:

- Concentrator Unit
- two Motor Assemblies
- Motor Mounting Bracket Kit
 - Bracket
 - two Post Covers
 - four screws
- Glassware in boxes
 - two Condensers
 - two Cell Caps
 - two Sample Tubes with 1.0mL stems
- PTFE Sleeve Kit
 - Sleeve Installation Tool
 - four PTFE Sleeves
- Fan Blade Kit
 - two Fan Blade Assemblies
 - two sets of PTFE Seals (2 large and 2 small seals)
 - Allen Wrench, 0.050"
- two Drain Tubing Kits, each containing
 - Drain Tubing assembly with two different tubings
 - 1/8" I.D. Bevaline V tubings, 5 feet, for vent line
 - two Tubing Clips
 - Waste Cap with U.S. 38-430 threads
 - Cap Insert
 - Insert Modifier (optional use)
 - Vent Line Restrictors
 - Instructions

Parts Supplied (Continued)

- Condenser Cooling Tubing Kit
 - four Condenser coolant line tubing lengths with screw-on cap and Quick-disconnect fitting
 - two Quick-disconnect fittings, 1/4" barb, for Coolant Supply tubing
 - 15 ft. 1/4" ID tubing for Coolant Supply
 - Instructions
- *Clear Bath*[™] Kit
- two plastic Water Bath Covers
- Power Cord(s) - 220V models include two power cords, one for EU and one for UK
- Auxiliary Rack
- Siphon
- Spare seals
- Reference Card and Solvent Warning Sheet
- User's Manual CD

Other Required Items

- Condenser coolant supply (the chiller) or cold tap water

Tools Needed

To install the concentrator, you will need

- Flatblade screwdriver
- Wire cutters or scissors.

Site Preparation Requirements

You must have an appropriate location with power and water sources available as specified by these site preparation requirements before installing the TurboVap 500 Closed Cell Concentrator.

Space

Dimensions of the concentrator:

- Height: 24 inches (60.9 cm)
- Width: 21.2 inches (53.8 cm)
- Depth: 12 inches (31 cm)
- Weight: 40.5 lbs (18.5 Kg) with the water bath empty

Work Area:

Flat, level, stable surface

Power:

100/120VAC model	220/240 VAC model
100/120VAC +/- 10%	220/240 VAC +/- 10%
50 - 60 Hz	50 - 60 Hz

Fuses:

100/120VAC model	220/240 VAC model
(1) 10A, T250V (P/N C39164)	(2) 5A, T250V (P/N C44412)

Condenser Water Supply:

- 1/4" ID supply
- 1/4" ID drain
- Tap water or chilled water without antifreeze

Chiller (if used):

- Chiller must be able to absorb approximately 60 watts/sample.

Bath Capacity:

- 6.4L maximum distilled water. DO NOT overfill.

WARNING

Burn hazard. DO NOT move the unit when the bath is full.

Clear Bath Additive:

2 oz. kit supplied with unit

WARNING

Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures when dealing with liquids. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquids and containers properly.*
- *Do not overfill containers.*

Installing the TurboVap 500

Select the Location for the TurboVap 500

Select a flat, stable, dry bench location within reach of the required power and water sources.

Clean the Glassware

Ensure that the TurboVap 500 closed cell concentrator glassware is clean, according to your standard laboratory practices. [“Methods of Cleaning the Glassware” on page 50](#) describes some common cleaning methods.

Remove the Sensors for Operation Above 60°C

If you will be operating the TurboVap 500 at water bath temperatures above 60°C, you must remove the sensors. See [“Removing and Replacing the Sensors” on page 54](#) for detailed instructions on removing the sensors.

Install the Motor Mounting Bracket

Tools and parts required:

- flatblade screwdriver
- four screws
- motor mounting bracket
- two post covers

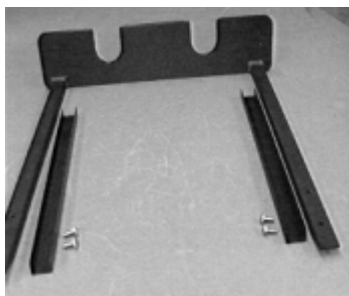


Figure 7. Motor Bracket Parts

To install the motor mounting bracket:

- 1 Position the mounting bracket against the back of the concentrator with the two cutouts in the top of the bracket toward the front of the concentrator. Line up the two holes on each bracket post with the two holes on each side of the rear service panel as shown in [Figure 8 on page 26](#).

Install the Motor Mounting Bracket (Continued)

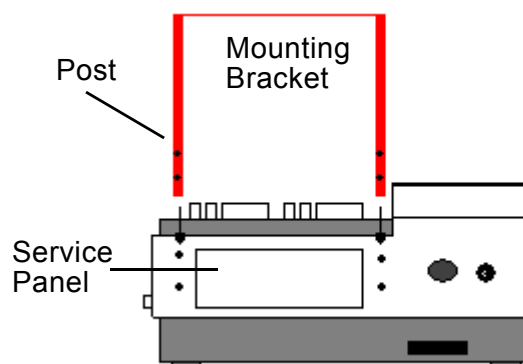


Figure 8. Mounting Bracket Position, Back of TurboVap

- 2 Using a flatblade screwdriver, secure the mounting bracket with the screws provided.
- 3 Place the two motor assemblies onto the top of the mounting bracket.
- 4 Thread the motor wires into the channels on the mounting bracket posts.
- 5 Snap the post covers in place over each channel, lining up the dimples with the holes in the channel.

Assemble the Motor, Cell Cap, and Fan Blade

Tools and parts required:

- 0.05" Allen wrench (supplied)
- small and large PTFE seals
- fan blades
- two glass cell caps
- two motors

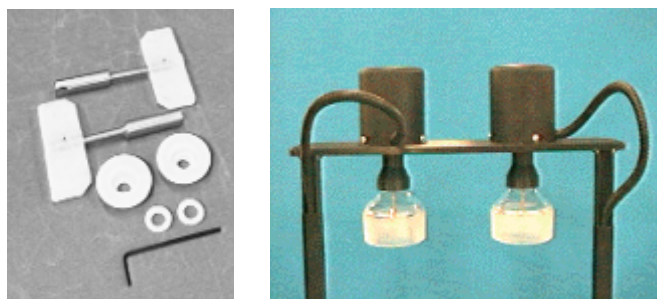


Figure 9. Fan Blade Parts and Glass Cell Caps

Assemble the Motor, Cell Cap, and Fan Blade (Continued)

- 1 Insert the small PTFE seals into the cavities of the larger white PTFE seals as shown in [Figure 10](#).

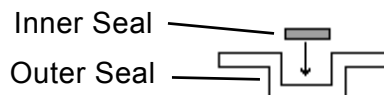


Figure 10. Assembling the PTFE Seals

- 2 Place the two seals into the top of each glass cell cap as shown in [Figure 11](#).

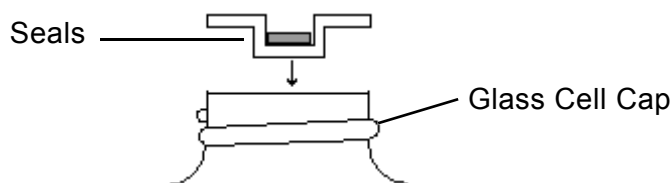


Figure 11. Placing the PTFE Seals

NOTE



You must remove these seals before you bake the glass cell caps.

- 3 Loosely screw the cell cap and seals into the motor assembly.
- 4 Install the fan blade into the motor assembly:
 - a Align the flat on the fan blade with the set screws in the motor coupling as shown in [Figure 12](#).



Figure 12. Installing the Fan Blade

- b Tighten the set screw with the 0.05" Allen wrench (supplied).

Add PTFE Sleeves to the Ground Glass Fittings

The TurboVap 500 comes with four PTFE sleeves and a sleeve installation tool. The sleeves are placed on the ground-glass ends of the Cell Caps and the condensers. The sleeves (shown in [Figure 13](#)) eliminate vapor leaks, providing a better seal during concentrations. The sleeves also allow easier separation of the glassware.

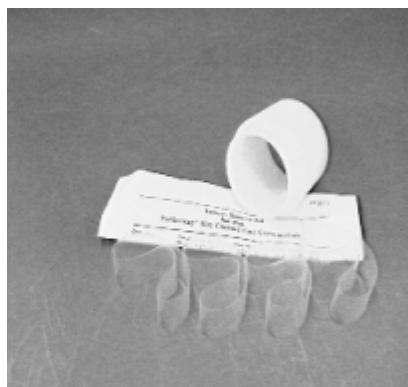


Figure 13. PTFE Sleeves

NOTE



You must remove the sleeves before you bake the glassware.

- 1 Place the lower end of a cell cap onto the lip of the installation tool.
- 2 Starting with the wider opening of the PTFE sleeve, place the sleeve onto the tool as shown in [Figure 14](#).

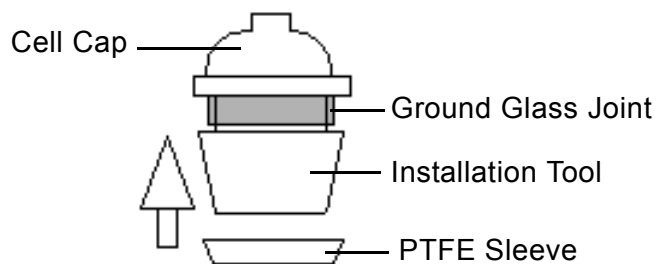


Figure 14. Installing the PTFE Sleeves

- 3 Pull the sleeve along the tool until it fits onto the cell cap. Remove the tool.
- 4 Repeat this procedure to add a sleeve onto the other cell cap and onto both condensers as shown in [Figure 15 on page 29](#).

Add PTFE Sleeves to the Ground Glass Fittings (Continued)

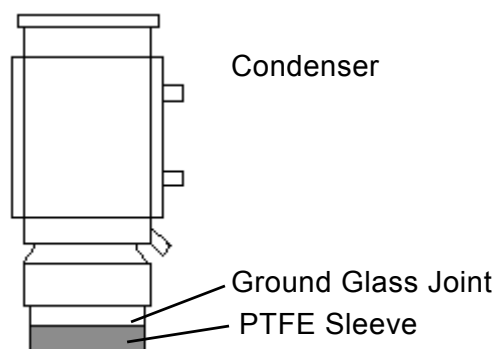


Figure 15. PTFE Sleeve on Condenser

Assemble the Closed Cell Glassware

Assemble the glassware as shown in [Figure 16](#) and place the assemblies into the water bath racks.

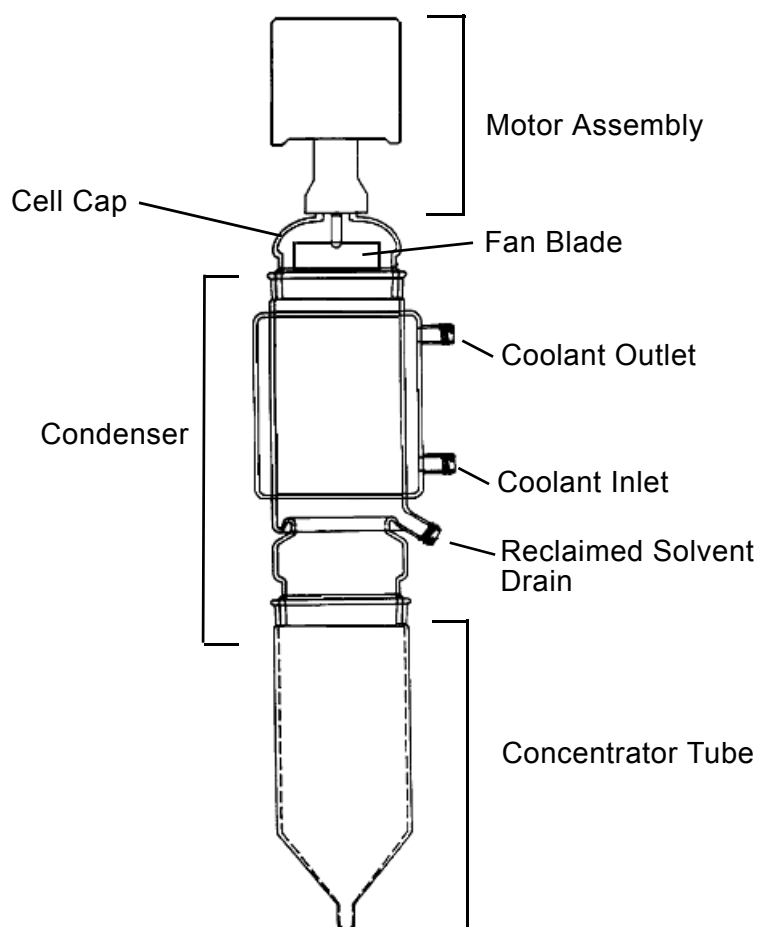


Figure 16. Assembled Closed Cell Glassware

Select an Appropriate Waste Container

Consider the following recommendations when selecting a waste container for each condenser:

- A 4 L solvent bottle, placed on the floor is an ideal waste container.
NOTE: Follow an appropriate chemical hygiene plan for your laboratory; a *second* overflow waste container may be required.
- Use a waste container with a standard U.S. 38-430 thread pattern.
(A cap insert modifier is included for use with European 38-430 bottles)
- Select a container that will allow a gravity-feed fluid flow *down* the tube.
- Select at least a 500mL container. The waste container must hold at least the total amount of evaporating solvent plus an additional 100 mL.

Connect the Drain (Solvent Reclamation) Tubing

The contents of the Drain Tubing Kit are shown in [Figure 17](#):



Figure 17. Drain Tubing Kit

To connect the drain tubing:

- 1** Select a Solvent Reclamation/Waste Container for each condenser. Place the containers *below* the condensers.
- 2** With the condensers and concentrator tubes assembled and in place in the water bath racks, attach the screw-on fitting end of the drain tubing line assembly to the reclaimed solvent drain fitting (the lowest fitting on the condenser).
- 3** Route the drain lines to the waste containers and secure the tubing to the rear panel of the unit:
 - a** Slide the tubing clips onto the drain tubing.

Connect the Drain (Solvent Reclamation) Tubing (Continued)

- b Fasten the clips to the service panel using the lower-left and lower-center service panel screws as shown in [Figure 18](#).

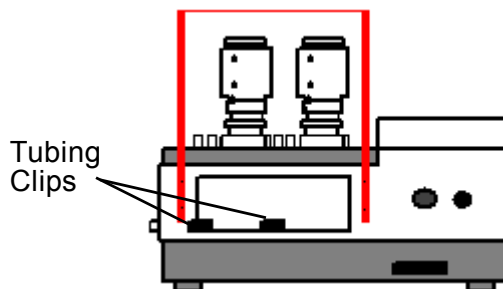


Figure 18. Tubing Clips

- 4 Place the cap insert into the supplied plastic cap (see [Figure 19](#)), screw the cap onto the waste container and attach the drain tubing to the large barb fitting.

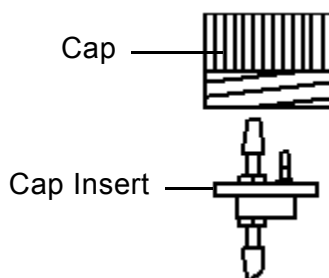


Figure 19. Cap Insert

- 5 Connect the small ID vent tubing to the small barb on the cap insert.
- 6 Insert the vent line restrictor into the open end of the vent tubing and route the vent tubing line to a hood or outside ventilation source.

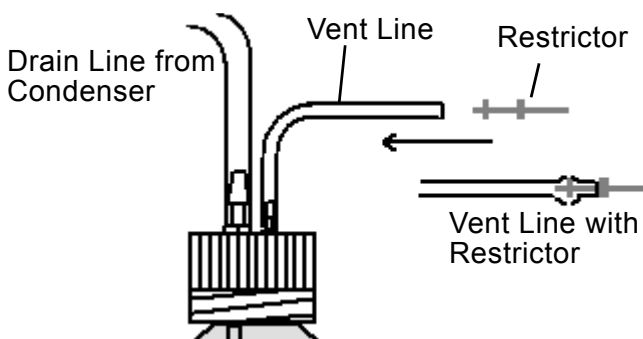


Figure 20. Vent Line Restrictor

- 7 If the cap and insert don't fit tightly onto the waste container, add the insert modifier to the cap insert.

Connect the Coolant Tubing Lines

The coolant system assembly requires twelve tubing line connections. (Note: Consult the instructions for your chiller as required.)

Use the four tubing assemblies to make the connections between the TurboVap 500 *condenser's* coolant inlet and outlets and the unit's coolant IN and OUT connections.

Use the 15' length of supplied $\frac{1}{4}$ " I.D. tubing and two $\frac{1}{4}$ " barb quick-disconnect fittings to connect the TurboVap 500 to the external coolant supply (not supplied).

- 1 Connect the TurboVap 500 to the external coolant supply:



Figure 21. Coolant Tubing

- a Cut the 15' $\frac{1}{4}$ " I.D. tubing in half.
- b Attach one $\frac{1}{4}$ " barb quick-disconnect fitting to one end of each tubing length.

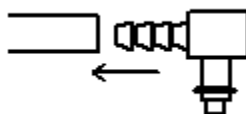


Figure 22. Coolant Line Fitting

- 2 Insert the barbed fitting on one of the lengths of tubing into the TurboVap 500 coolant supply INLET port on the side of the TurboVap 500, and connect the other end to the external coolant supply OUT.

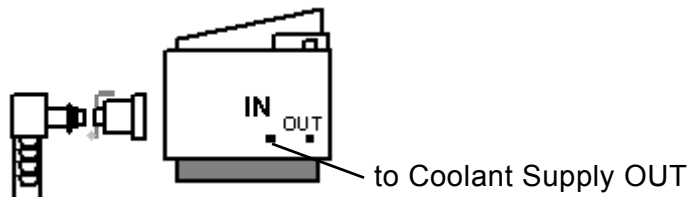


Figure 23. Coolant Supply Out Connection

Connect the Coolant Tubing Lines (Continued)

- 3 Insert the barbed fitting on the other length of tubing into the TurboVap 500 coolant supply OUT port on the side of the TurboVap 500, and connect the other end to the external coolant supply RETURN.

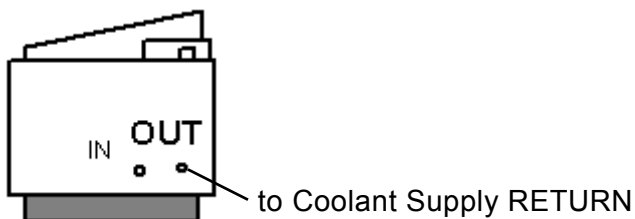


Figure 24. Coolant Supply Return Connection

- 4 Connect the condensers to the unit's coolant IN and OUT ports on the top of the TurboVap 500:



Figure 25. Condenser Tubing

- a Connect the screw-on caps on the tubing to the condenser IN and OUT fittings.
- b Attach the top condenser fitting (coolant OUT) to the TurboVap 500 OUT and the lower condenser fitting (coolant IN) to the TurboVap 500 IN as shown in [Figure 26](#).
- c Place the condensers on the resting blocks. Place the concentrator tubes into the Auxiliary Rack.

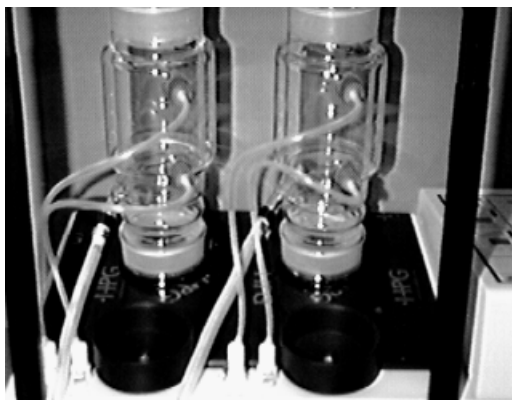


Figure 26. Condenser Connections, viewed from the back

Fill the Water Bath

When filling the water bath, make sure that:

- the level of water in the bath is as high as the initial solvent level in the sample tube.
- placing the sample tubes in the water bath does not cause an overflow.

To fill the water bath:

- 1 Pour about 1 Liter of distilled water into the bath.
- 2 Add 15 drops of *Clear Bath* additive.
- 3 Add distilled water until the water is at the recommended height.

WARNING



Fire and burn hazard. Do not operate the TurboVap 500 without water in the bath.

- 4 Place the plastic water bath covers over both of the water bath positions.

Connect the Power Cord

- 1 Plug the power cord securely into the receptacle on the back of the unit. Make sure the plug is fully inserted.
- 2 Connect the 3-pronged end to an appropriate power source.

WARNING



To avoid the risk of fire or electrical shock, plug the power cord into a properly grounded outlet.

Turn ON the Power

To turn on the concentrator, turn ON the switch located on the lower left side of the TurboVap. When the power is turned on, the Power-Up diagnostics described below will run automatically.

Note: Upon power up, the **Start/Stop** button for the six cells will not work until an endpoint and fan speed have been selected.

Power Up Diagnostics

When power is first turned on, the following diagnostics occur:

Display Test - During the first four seconds after power up, *all* display lights are lit. Confirm that no lights are out.

Normal operation begins after four seconds. (See [“Software Diagnostics”](#) on page 63 for other Power-Up diagnostics.)

Determine Optimal Concentration Conditions

You should determine the settings that will best concentrate your samples before operation. You should determine the best:

- water bath temperature
- condenser coolant temperature
- fan speed
- endpoint selection

Set up a concentrator tube with the typical volume of sample or solvent and some analytes of interest. Then experiment with the various selections. The more efficient the concentration, the better the analyte recoveries. Optimizing the water bath and coolant temperatures, the endpoint and fan speed will yield the best results when using the TurboVap 500 unit.

To prepare the TurboVap 500:

- 1 Turn the evaporator's power ON.

NOTE: The unit should always be ON whenever it contains samples so that the fan can remove exhaust.

- 2 Remove all tubes from the evaporator.

Water Bath Temperature Description

Concentrator tubes are placed in one of two positions in the temperature-controlled water bath. Since the concentrator's high concentration rates eliminate the need for a high temperature water bath, the bath operates over a mild temperature range of ambient to 90°C. This eliminates "hot" spots and improves sample recovery for more volatile compounds. The water bath also can be brought down below room temperature by using evaporative cooling. Cooling ability varies with the concentration rate.

WARNING



To avoid the risk of fire or burn injuries, do NOT operate the TurboVap 500 without water in the bath.

Water Bath Temperature Considerations

When selecting the water bath temperature, consider the following:

- Faster evaporation occurs as the water bath temperature is increased. However, highly volatile analytes can be lost if allowed to sit for extended periods of time in a warm bath.
- You can select a water bath temperature just *below* the boiling point of the solvent in the sample tube. Ensure that the sample, especially in the stem, will not boil. Boiling the solvent affects sensor operation and can risk loss of sample.
- A temperature setting of “00” turns off the heaters.

Setting the Water Bath Temperature

- 1 Set the water bath temperature using the numeric pushwheel.
- 2 Place a plastic cover over any empty water bath position.
- 3 Allow the bath to come to temperature (the display stops blinking) before using the concentrator.

NOTE



As the bath warms up, bubbles may form around the sensor. If given enough time (approximately 1/2 hr.), bubbles should dissipate. In most cases, sample tube insertion will free bubbles.

Condenser Coolant Temperature Considerations

Coolant supply to the condenser may be either cold tap water or water that is supplied by a chiller. When selecting the coolant supply and temperature, consider the following:

- the condenser coolant temperature affects the evaporation rate.
- coolant water should **NOT** contain antifreeze.
- a stable system, without temperature fluctuations, is necessary to prevent freezing at the lowest coolant temperatures.

NOTE



Coolant temperature should always be greater than 4°C to avoid the possibility of FREEZING the coolant.

Fan Speed Considerations

When selecting the fan speed, consider the following:

- higher fan speed causes faster evaporation rates.
- excessively high speed can cause loss of analyte due to splashing.
- for semi-volatile analytes, best recoveries have been obtained at the lower fan speeds A or B (4000 to 5000 rpm).

Selecting the Fan Speed

To establish the optimal fan speed setting, run test samples at various speeds and compare the analyte recoveries. Choose the fan speed that gives the best analyte recoveries.

Press the Fan Speed button until the light for the desired speed is lit; each press advances to the next speed.

While the button is depressed, the selection's speed appears in the Temperature and Time displays.

Selection	Fan Speed (rpm)
A	4000
B	5000
C	6000
D	7000
E	8000

The displays return to normal when the button is released.

Selecting the Endpoint and Time Settings

There are four concentration methods:

- concentrating for a set time (in minutes)
- concentrating until the sensor detects a meniscus
- concentrating for a set time *after* the sensor detects a meniscus
- concentrating until the operator presses Start/Stop (manual mode)

The table below describes when you should use each method, and the sections that follow describe how to use each method.

When to Use Each Method

The following table gives some examples of when you would choose a particular endpoint selection.

Use...	When...
Set Time Expired	<ul style="list-style-type: none"> • the sensors are removed because water bath temperature is greater than 60°C. • sample coats the glass or darkens rapidly. • sample evaporates too slowly.
Sensor Endpoint	<ul style="list-style-type: none"> • your extracts are either opaque or slowly darkening. • you want full automation of sample concentration to a fixed endpoint (acceptable for most samples at a water bath temperature under 60°C).
Set Time After Sensor	You want to concentrate past the endpoint of the glassware (1.0mL or 0.5mL) or to dryness (acceptable for some samples at a water bath temperature under 60°C).
Stop Pressed	<ul style="list-style-type: none"> • water bath temperature is greater than 60°C so the sensors are removed. • sample coats the glass or darkens too rapidly. • you need to concentrate for a time longer than 99 minutes. • you want to restart with a shorter time than previously programmed.

Set Time Expired - Concentrating for a Set Time

To concentrate for an exact length of time, use the Set Time Expired option:

- 1 Press the Concentrate Until button until **Set Time Expired** is selected.
- 2 Use the Set Time buttons to select the desired time, in minutes, for concentration.
- 3 Press the **Start/Stop** button for the cell position(s).

Reading the Time Display during a Timed Concentration

The **Time** display shows the actual elapsed time alternately for each cell. “**L=**” precedes the left cell value, and “**r=**” precedes the right cell value.

Sensor Endpoint - Concentrating Until the Sensor Detects the Endpoint

To use the optical sensors to concentrate to a volume of either 1.0mL or 0.5mL, select the Sensor Endpoint option. The volume at which concentration stops depends on the stem length of the concentrator tube. To set up a Sensor Endpoint concentration:

- 1 Press the Concentrate Until button until **Sensor Endpoint** is selected.
- 2 Press the **Start/Stop** button for the cell position(s).

Reading the Time Display during a Sensor Endpoint Concentration

The Time display shows “SE”

Sensor Endpoint Considerations

Two conditions affect optical sensing:

- 1 **Water Bath Temperature**
Remove the sensors if the water bath temperature is set above 60°C. (See [page 54](#) for detailed instructions.)
- 2 **Sample Clarity** - Clear, slowly darkening, or opaque (at 940 nm) samples reliably operate when using the endpoint detector. Samples which darken too rapidly as concentration proceeds may activate the sensor prematurely. If this happens, press the **Start/Stop** button for the sensor to start with a new baseline reading and continue concentration.

If starting a new baseline is unacceptable, determine concentration time and use the Set Time Expired option, or operate manually by using the Stop Pressed selection.

Set Time After Sensor - Concentrating for a Set Time Past Endpoint Detection

To continue concentration *after* the sensor detects a 0.5mL or 1.0mL endpoint (depending on glassware), select the Set Time After Sensor option. To set up a Set Time After Sensor concentration:

- 1 Press the Concentrate Until button until **Set Time After Sensor** is selected.
- 2 Use the Set Time buttons to set the desired time, in minutes, for concentration to continue after endpoint detection.
- 3 Press the **Start/Stop** button for the cell position(s).

Reading the Time Display during a Set Time After Sensor Concentration

The **Time** display shows “SE” until the endpoint is reached. Once the endpoint is reached, the actual elapsed time after the endpoint is displayed for each cell.

Set Time After Sensor Endpoint Considerations

The same considerations exist for this selection as for the **Sensor Endpoint** selection. See [“Sensor Endpoint Considerations” on page 40](#).

Stop Pressed - Concentrating Until the Start/Stop Button is Pressed

To operate the TurboVap 500 manually, use the Stop Pressed option. To set up a Stop Pressed concentration:

- 1 Press the Concentrate Until button until **Stop Pressed** is selected.
- 2 Press the **Start/Stop** button for the cell position(s).

Reading the Time Display during a Stop Pressed Concentration

The **Time** display shows the actual elapsed time alternately for each cell. “**L=**” precedes the left cell value, and “**r=**” precedes the right cell value.

If the elapsed time exceeds 99 minutes, the number display is replaced with \equiv .

General Guidelines For Achieving the Best Recoveries

Clean and bake the concentrator tubes according to the standard cleaning techniques for your method.

Adjust the concentration conditions as needed:

- operate at a fan speed that will generate adequate pressure
- If the concentrator tubes are initially FULL, start with a low fan speed, and increase the speed as the volume in the tube decreases.
- select a water bath temperature carefully.
For methylene chloride acceptable temperatures can range from 38 to 45°C (depending upon the other conditions set)

Remove samples promptly, once the endpoint is achieved

Use the proper technique for removing the samples from their concentrator tubes.

Achieving Excellent Recoveries with 1.0mL Sample Stem Tubes

1mL tubes can eliminate the need for traditional triple quantitative transfer techniques. The final crude or cleaned up extract can be taken to 1mL directly in the TurboVap concentrator tube.

- 1 Set the TurboVap 500 parameters as desired, selecting the Sensor Endpoint option.
- 2 Working on the bench or in a fume hood, add the sample to the TurboVap tubes. Do not add samples to the tubes while the tubes are in the TurboVap.
- 3 Start the concentration.
- 4 When the alarm sounds, remove the sample tube from the water bath. Failure to remove the tube promptly may result in analyte loss.
- 5 With a Pasteur pipette, add solvent to the 1mL line.
- 6 Take the entire 1mL sample into the Pasteur pipette and rinse the lower 25% of the TurboVap tube (i.e. 2 inches above the cone shape on the cylinder wall) two to three times as shown in [Figure 27 on page 43](#).

Achieving Excellent Recoveries with 1.0mL Sample Stem Tubes (Continued)

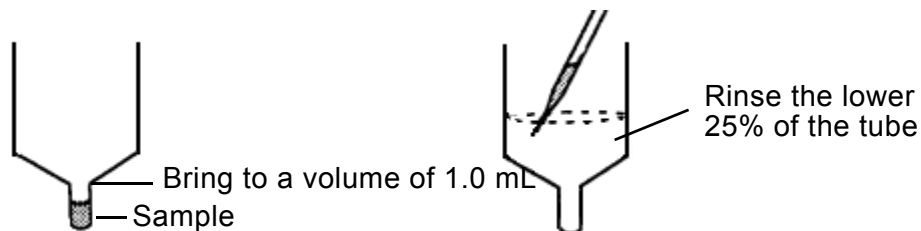


Figure 27. Rinsing the Sample Tube

- 7 Solvent evaporation during this rinsing will have reduced the volume. Add fresh solvent to bring the sample to 1mL. Rinse the tube walls two more times and transfer the sample to an autosampler vial.

Final Concentration Conditions Established for Your Sample

After experimenting with the selections presented in this section, you should have established your settings for the following concentration conditions:

Water Bath Temperature: _____ °C

Condenser Coolant

- Tap _____
- Chilled: _____
Temperature: _____ °C

Endpoint Selection

- Set Time Expired _____
Time: _____ minutes
- Sensor Endpoint _____
- Set Time After Sensor _____
Time: _____ minutes
- Stop Pressed _____

Fan Speed: _____

Use this information when following the operating steps in the next section.

Operation

This section describes how to operate the Biotage TurboVap 500 Closed Cell Concentrator using the following procedures:

- 1 Preparing the unit (see below)
- 2 Adding the sample and assembling the closed cell (see [page 45](#))
- 3 Starting the concentration (see [page 45](#))
- 4 Stopping the Concentration (if running in manual mode or need to interrupt) (see [page 46](#))
- 5 Disassembling the closed cell (see [page 46](#))
- 6 Removing the concentrated sample (see [page 47](#))
- 7 Shutting down after operation (see [page 47](#))

Preparing the Unit

Prepare the concentrator by performing the following steps:

- 1 Check the water level in the water bath. It should be at least as high as the initial solvent level in the sample tube.
- 2 Turn the TurboVap power ON.
- 3 Select the water bath temperature. The display blinks until the water reaches the set temperature.
- 4 If the condenser coolant supply connections are not already attached, connect the coolant supply to the condenser (see [“Connect the Coolant Tubing Lines” on page 32](#)).
- 5 Connect the solvent drain hose and ensure that the solvent waste container has the capacity to hold the solvent drainage (see [“Connect the Drain \(Solvent Reclamation\) Tubing” on page 30](#)).
- 6 Turn on the coolant supply.

NOTE



If a chiller is used, allow time for the chiller to reach operating temperature. The glass condenser reaches coolant temperature quickly.

Adding the Sample and Assembling the Closed Cell

- 1 Support the concentrator tube in the rack provided and add the sample.
- 2 Remove one of the plastic covers from the water bath and place the sample tube into the water bath.
- 3 Grasp the entire condenser and motor assembly and carefully place the condenser on top of the sample tube to assemble the closed cell. Repeat for the second sample.

NOTE



To minimize evaporation from the water bath, cover the unused position if you are running only one sample.

Starting the Concentration

To start concentrating the sample:

- 1 Determine the concentration method desired, and press the Concentrate Until button until the desired option is selected.
- 2 If applicable, set the Time pushwheel, to the desired time.
- 3 Press the Fan Speed button until the amber light indicates the desired speed.
- 4 Press the Start/Stop button for each cell position used.

Time Display During Operation

While the concentrator runs, the Time display shows the actual elapsed time alternately for each cell. “L=” precedes the left cell value, and “r=” precedes the right cell value.

The Time display shows information other than time when:

- operating until the sensor endpoint — a display of “SE” is displayed instead of a time,
- operating for a set time after the sensor endpoint — a display of “SE” is displayed until the endpoint is reached. Once the sensor endpoint is reached, the additional elapsed time for each cell is displayed,
- manual operation exceeds a time of 99 minutes — a display of “≡≡” is displayed instead of a time.

See [“Software Diagnostics” on page 63](#) for other display characters and what they mean.

Fan Behavior During Operation

When you are concentrating until either of the sensor endpoints, the fan may slow down, or stop and start several times, as the meniscus of the sample approaches the sensor optics.

Stopping the Concentration

When...	Then...
running manually (Stop Pressed selection)	Press Start/Stop button for the corresponding cell.
you need to interrupt or stop the concentration process unconditionally	press Start/Stop button for the corresponding cell. (This resets the time.)

When the Endpoint is Reached

When a cell reaches the selected endpoint, the green DONE light blinks and the alarm sounds briefly every thirty seconds.

To Silence the Alarm

Press the Start/Stop button twice.

If running manually, the amber Stopped light comes on after you press the Start/Stop button.

Disassembling the Closed Cell

- 1 Grasp the motor assembly and condenser as a unit and separate the condenser from the sample tube.
- 2 Separate the motor assembly/cell cap from the condenser and place the motor assembly back on the bracket. Place the condenser on the holder.
- 3 Remove the sample tube from the water bath and place it into the holding rack.

NOTE



Prompt removal of the completed sample tube is important. Highly volatile samples can be lost if allowed to sit for an extended period of time.

- 4 Replace the plastic water bath covers.

Removing the Sample from the Tube

The gas vortex shearing action automatically rinses the vertical side walls as evaporation occurs, but for optimum recoveries, you should rinse the lower, angled portion of the sample tube to recover any sample left behind. See [“Achieving Excellent Recoveries with 1.0mL Sample Stem Tubes”](#) on page 42.

Turning the Power Off

When the unit is no longer in use:

- 1 Turn the power off.
- 2 Turn off the chiller recirculation unit.
- 3 Place the plastic covers on each cell position.
- 4 Clean the glassware according to your laboratory practice.

Maintaining the TurboVap 500

This section of the manual includes:

- “Daily Maintenance” on page 48
- “Routine Maintenance” on page 49
- “Water Bath Maintenance” on page 50
- “Glassware Maintenance” on page 50
- “Replacing the Fuses” on page 52
- “Cleaning the Water Bath” on page 53
- “Refilling the Water Bath” on page 54
- “Removing and Replacing the Sensors” on page 54
- “Long Term Storage” on page 58

Daily Maintenance

- During Power-Up diagnostics, confirm that all displays are operational.
- Check to ensure water bath is full and clean.
- Check that the waste container is not full.
- Avoid spilling any solvents on the control panel.
- Avoid spilling any solvents in the water bath.

Cleaning:

- **Panel:** To clean, use a mild cleaning solution on a damp cloth. Do not spray cleaner directly onto the control panel.
- **Exterior:** Clean exterior surfaces with a damp cloth and mild cleaning solution when necessary.

WARNING



Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures when dealing with liquids. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquid and container properly.*
- *Do not overfill containers.*

Routine Maintenance

The routine maintenance procedures listed below should be performed every one to three months, or as necessary.

- Empty, clean, and refill the water bath (see [“Cleaning the Water Bath” on page 53](#)).
- Perform Power-Up Diagnostics and Cell Diagnostics (see [“Software Diagnostics” on page 63](#)).

Other Preventative Maintenance

To protect the motors from possible corrosive and damaging fumes, inspect and replace the bearings and seals at least once a year (every 6 to 9 months if the unit is frequently used).

Typical Yearly Consumables

- Sample Tubes: 2 tubes are included. Additional tubes can be purchased in cases of 2 tubes
- Sensors: 2 sensors are included. Additional sensors can be purchased individually.
- Auxiliary rack: 1 included with the unit. Additional racks can be purchased separately.
- Condenser: 2 condensers are included. Additional condensers can be purchased individually. Replace the condenser *only* if it is cracked or broken.

Sensors

The sensors in the TurboVap 500 are optical sensors. Sensors have a wear life of up to 1 year with average use and up to 6 to 9 months for labs operating two shifts daily. Two sensors come installed and ready to operate.

To prolong the life of the sensors, keep the water bath clean and free of solvent. Solvent in the water bath can quickly damage the sensors. To check sensor operation, follow the [“Cell Diagnostics” on page 65](#). As routine maintenance, run the sensor diagnostics periodically to confirm proper operation.

Water Bath Maintenance

Always use distilled or de-ionized water. Add *Clear Bath* additive whenever the water is changed.

WARNING



Exposure to liquids may cause bacterial or viral hazards. Liquids can also be corrosive, flammable and/or toxic. Use good laboratory operating procedures. Refer to the MSDS (Material Safety Data Sheet) for detailed information.

- *Avoid direct contact with liquids.*
- *Wear protective gloves and safety glasses.*
- *Dispose of liquid and container properly.*
- *Do not overfill containers.*

Periodically change the water in the bath using the siphon provided. With average use, change the water at least every 2 months, or sooner if it becomes cloudy. The cleaner the water is, the better the sensors operate. If residue begins to build up in the bath, the sensors may give false readings

Glassware Maintenance

Clean and rinse the TurboVap sample tubes following your laboratory protocol. Residue remaining on either the inside or outside of the sample tube stem can impact sensor operation. The condenser glassware does not usually require cleaning. However, high sample levels may require that you also rinse the condenser glassware with the appropriate solvent. The sections below describe some common methods of cleaning the glassware.

Methods of Cleaning the Glassware

The method used for cleaning the glassware depends on your samples, solvents, and laboratory practices. Use good laboratory practices appropriate for your site. In many cases, only the sample tubes need to be washed between runs. Three options are described:

- rinsing the glassware with solvent (see [page 51](#))
- evaporating solvent (see [page 51](#))
- baking washed glassware (see [page 51](#))

Solvent Rinsing Method

- 1 Rinse the condenser, cell cap, and fan blade with an appropriate solvent:
- 2 Place a beaker in the condenser holding cup.
- 3 Holding the condenser over the beaker, rinse the inside walls of the condenser using a squirt bottle of solvent.
- 4 Hold the motor assembly over the beaker and rinse the inside of the cell cap and surface of the fan blade using the squirt bottle of solvent.

NOTE



Avoid dripping solvent into the water bath. Methylene dichloride can quickly cause disintegration of the sensors. Other solvents can also damage the sensors.

Solvent Evaporation Method

Wash the inside surfaces with freshly distilled solvent:

- 1 Add 100mL of pure solvent to the sample tube.
- 2 Set appropriate conditions for the solvent to evaporate (water bath temperature just below the boiling point).
- 3 Collect the condensed solvent.

Baking the Glassware Method

Remove the glassware from the TurboVap, clean, bake, and then reassemble:

- 1 Disassemble the glassware and remove the PTFE sleeves.
- 2 Clean all glassware with appropriate techniques.
- 3 Bake the Pyrex glassware at a temperature up to 450°C.
- 4 Replace the PTFE sleeves and reassemble the glassware.

NOTE



Do NOT bake the PTFE seal or PTFE sleeves.

Replacing the Fuses

Fuse requirements

100/120VAC model	220/240 VAC model
(1) 10A, T250V (P/N C39164)	(2) 5A, T250V (P/N C44412)

WARNING



- *Electrical shock hazard. Disconnect the power supply before changing the fuses.*
- *For continued fire protection, replace fuses only with ones of the same type and rating.*

- 1 Turn OFF the AC power and unplug the power cord.
- 2 Locate the Power Entry Port fuse holder on the side of the unit. 220/240V units have two fuse holders in the power entry port. Always replace both fuses at the same time.
- 3 Use a flatblade screwdriver to remove the fuse holder (see [Figure 28](#)).

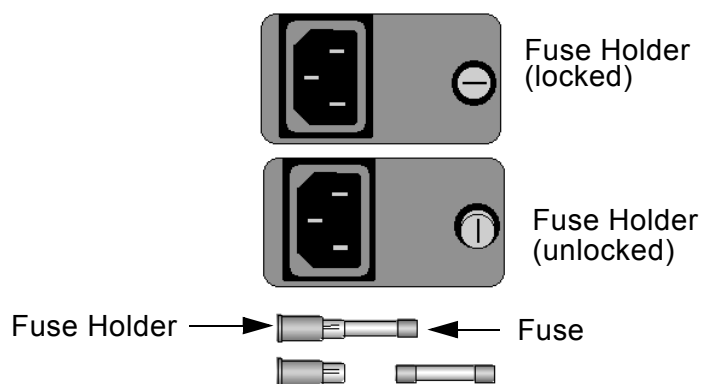


Figure 28. Replacing the Fuses

- 4 Remove the fuse and replace it with one of the same type and rating.
- 5 Replace the fuse holder(s) in the power entry port.
- 6 Plug in the power cord and turn on the AC power.

Cleaning the Water Bath

Turbid water may affect sensor operation. The addition of *Clear Bath* (a biological growth retardant) helps eliminate the need for frequent cleaning. Keep the water in the bath clean to ensure excellent recoveries.

Tools required:

- Phillips head screwdriver
- Water bath siphon (supplied with unit)
- Cleaning supplies
- *Clear Bath*

To clean the water bath:

- 1 Turn the unit OFF and unplug the power cord.
- 2 Remove all glassware.
- 3 Remove the condenser holding cups and the top plate.
- 4 Carefully lift the rack out of the bath.
- 5 Siphon the water out of the bath by following these steps:
 - a Close siphon bulb vent.
 - b Place siphon's suction tube in water bath.
 - c Place drain tubing in sink.
 - d Squeeze siphon bulb to start.
- 6 Wipe and rinse the bath walls. Siphon the rinse water out of the bath.
- 7 Clean the rack by rinsing with water.
- 8 Replace the rack in the water bath.
- 9 Replace the top plate and holding cups.

WARNING



Fire and burn hazard. Do NOT operate the TurboVap 500 without water in the water bath.

Refilling the Water Bath

To refill the water bath:

- 1 Place one concentrator tube in position in the bath.
- 2 Pour about 1 Liter of distilled water into the bath.
- 3 Add 15 drops of *Clear Bath*.
- 4 Add more distilled water until the water level is as high as the initial solvent level in the sample tube without causing an overflow when both tubes are in position.
- 5 Plug in the power cord and turn the power on.
- 6 Allow 20-30 minutes for the bath to reach temperature, for the air air to come out of solution, and for most of the bubbles to dissipate.
- 7 Dislodge any remaining bubbles (see [“Procedure for Dislodging Bubbles” on page 63](#)).

Removing and Replacing the Sensors

This section describes how to remove and replace the optical sensors. You must remove all of the sensors from the bath whenever the water bath temperature is set at or above 60°C.

Normal maintenance procedures require replacing each worn sensor as required. You should complete the Sensor Test in [“Cell Diagnostics” on page 65](#) whenever you replace a sensor.

Tools Required

Tools used in this procedure are:

- Flatblade screwdriver
- Phillips head screwdriver
- Wire cutters

Remove the Covers and Unplug the Connectors

Follow these disassembly steps before removing the optical sensors:

- 1 Remove all glassware from the unit.
- 2 Turn the concentrator's power off and unplug the power cord.
- 3 Using the Phillips screwdriver, remove the two condenser holding cups and the four screws that secure the bath cover. Set aside the holders, bath cover, and screws.

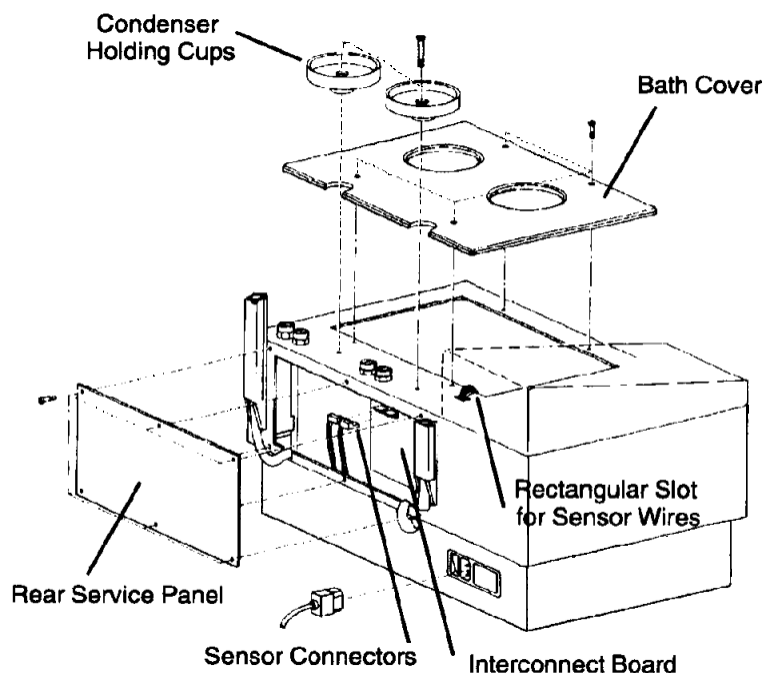


Figure 29. Condenser Holding Cups

For high temperature operation it is NOT necessary to disconnect the sensors from the interconnect PC board. The sensors will not operate in air.

- 4 If you are removing the sensors:
 - a Use the flatblade screwdriver to remove the rear service panel screws. Set the screws and service panel aside.
 - b Unplug the two sensor connectors from their receptacles on the sensor interconnect board. Note that the receptacles and connectors are numbered 1 and 2. If you are replacing a single sensor, only disconnect and remove the one that needs to be replaced.
 - c Use wire cutters to carefully cut any ty-wraps from the sensor wires.

Disconnecting the Sensors from the Sensor Mounts

- 1 Gently lift the rack out of the bath, allow the water to drain, and place the rack upside down to access the sensors on the underside of the rack.
- 2 Remove the sensor holding screws and use a flatblade screwdriver to push both of the sensors out of their holders. Store the screws in a safe place if you intend to replace the sensors at a later date.
DO NOT remove the sensors by pulling on the wires.

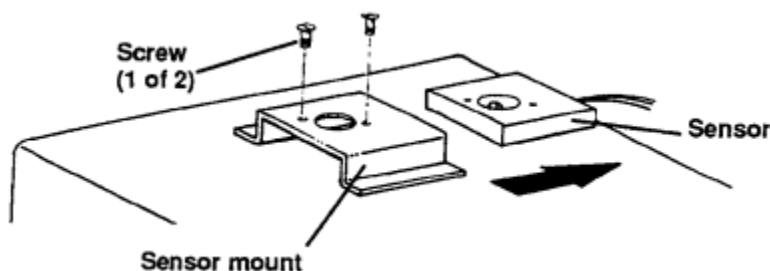


Figure 30. Removing the Sensor

- 3 Cut the ty-wraps and remove the sensor wires from the clips on the edge of the rack.
- 4 If you are removing the sensors for high-temperature operation, place the wires into the slot on the panel, and hang the sensors over the rear panel of the unit. The sensors will not operate in air.

If you are replacing the sensor, remove the sensor from the unit.

Replace the Rack and Covers to Operate Without Sensors

Continue with these steps if you plan to operate the TurboVap 500 with water bath temperatures at or above 60°C. Otherwise follow the instructions for installing a new sensor on [page 57](#).

- 1 Replace the rack in the bath, making sure the holes on the top of the rack align with the holes on the upper lip of the bath.
- 2 Position the black top plate over the rack, making sure the cutout on the underside of the plate faces the back of the unit.
- 3 Secure the top plate with four Phillips screws.
- 4 Plug in the power cord and turn the unit on.

Operating Requirements When Sensors Are Removed

You *must* only use **Set Time Expired** or **Stop Pressed** endpoint selections when the sensors are removed.

Installing the Sensors

To reinstall all of the sensors or to replace a single sensor, follow the steps below.

- 1 Follow the steps in [“Remove the Covers and Unplug the Connectors” on page 55](#) to access the sensor mounts on the bottom of the rack.
- 2 Observe the lengths of the sensor wires and route both sensors to their mounts, making sure that the holes in the sensor align with the holes in the mount.
- 3 Use the screws previously removed to fasten the sensor to the mount. Make sure that the sensor’s wires run in the same direction as the existing sensors.
- 4 Fit the sensor wires into the rack’s retaining clips.
- 5 If you are installing new sensors, feed the connector through the back corner of the unit and plug the connector into the properly numbered receptacle on the interconnect PC board.
- 6 Replace the rack in the bath, making sure the holes on the top of the rack align with the holes on the upper lip of the bath.
- 7 Position the black top plate over the rack, making sure the cutout on the underside of the plate faces the back of the unit.
- 8 Secure the top plate with four Phillips screws.
- 9 Replace the rear service panel and secure with the flathead screws if the panel was removed.
- 10 Fill the water bath, plug in the power cord, turn the unit on, and dislodge any bubbles that may have formed around the sensor optics.
- 11 Confirm correct sensor placement and connection by completing the [“Cell Diagnostics” on page 65](#).

Long Term Storage

If the TurboVap will be stored for an extended period of time:

- 1 Turn the unit off and unplug the power cord.
- 2 Remove all glassware.
- 3 Disconnect and empty any waste containers.
- 4 Remove the condenser holding cups and the top plate.
- 5 Empty the bath.
- 6 Wipe the bath walls with an appropriate cleaner. Rinse and re-siphon the water from the bath.
- 7 Remove, clean, and replace the rack.
- 8 Replace the condenser holding cups and the top plate.
- 9 Wait until the inside is completely dry.
- 10 When dry, cover the unit to prevent dirt or dust accumulation.

Troubleshooting

This section provides:

- Charts for troubleshooting your concentrator.
- Procedures referenced in the Solution columns.

If the solution listed is to contact Biotage 1-Point Support, see [page 4](#).

Troubleshooting the Concentration Process

To diagnose problems related to the concentration process, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Fan slows down or keeps turning on and off near the end of concentration (using Sensor Endpoint or Set Time After Sensor)	Meniscus of sample approaches the sensor optics	Normal behavior.
Fan keeps turning on and off and the tube is still full	Air bubbles around the sensor optics	Perform <i>“Procedure for Dislodging Bubbles”</i> on page 63 , evaluate status of the concentration, reset, and restart.
	Faulty motor	Perform the <i>“Motor Test Procedure”</i> on page 67 . Replace the motor if necessary.
Fan noisy or sounds slow	Faulty motor	Perform the <i>“Motor Test Procedure”</i> on page 67 . Replace the motor if necessary.
Stops prematurely (using Sensor Endpoint or Set Time After Sensor)	Sample darkens too rapidly	Restart to establish a new baseline reading or use the Stop Pressed selection.
	Air bubbles around sensor optics	Perform the <i>“Procedure for Dislodging Bubbles”</i> on page 63 , evaluate status of the concentration, reset and restart.
	Faulty or worn sensor	Perform the <i>Sensor Test Procedure</i> (see page 65), and replace sensor if necessary.

Condition	Probable Cause	Solution
Doesn't stop (using Sensor Endpoint or Set Time After Sensor)	Sample concentrates too slowly or opaque sample coats the glass	Use Set Time Expired or Stop Pressed selection or change conditions to speed concentration.
	Faulty or worn sensor	Perform <i>Sensor Test Procedure</i> (see page 65), and replace sensor if necessary.
	Turbid bath water	Clean and use <i>Clear Bath</i> additive.
Concentration rate too slow	Low water bath temperature	Increase bath temperature.
	Low fan speed	Increase fan speed.
	Fan blade loose or not installed	Check fan blade.
	Faulty motor	Perform the " <i>Motor Test Procedure</i> " on page 67 . Replace motor if necessary.
Concentration rate too fast	High water bath temperature	Decrease bath temperature.
	High fan speed	Decrease fan speed.
Sample splashing	High fan speed	Decrease fan speed.
Low recovery of sample	Sample boiling (high bath temperature)	Decrease bath temperature.
	Sample left too long after completion of concentration	At the end of concentration, remove the sample promptly.
	Sample splashing (high fan speed)	Decrease fan speed.
	Improper sample removal	Reconstitute to 1.0mL and use this volume to rinse the angled part of the tube and stem several times.
Leaking vapors	Worn seal: ground-glass condenser joints require PTFE sleeves	See " Add PTFE Sleeves to the Ground Glass Fittings " on page 28 .

Troubleshooting the Panel Display

To diagnose unexpected behavior of the panel display, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Temperature display blinking	Temperature not in range	Allow enough time to come to temperature. Contact Biotage 1-Point Support if continues.
Temperature display shows “St”, unit beeps rapidly, and bath heater turns off	Temperature setting exceeds maximum allowed when the sensors are installed in the unit (60°C).	Decrease temperature setting OR remove sensors and use an endpoint selection that doesn't use the sensors.
Temperature display shows “Lo”	Bath temperature sensor shorted	Contact Biotage 1-Point Support (see page 4).
Temperature display shows “hi”	Bath temperature sensor open or unplugged	Contact Biotage 1-Point Support (see page 4).
Time display shows “≡”	Elapsed time has exceeded 99 minutes - using Stop Pressed selection	Normal behavior.
Time display shows “SE”	using Sensor Endpoint or Time After Sensor selection	Normal behavior.
Endpoint selection and fan speed lights blinking and Time=00	Power failure occurred	Evaluate the concentration status, reset, and restart.
Light out on panel	Faulty LED	Replace the electronics cover or contact Biotage 1-Point Support (see page 4).
Temperature or Time display does not work	Faulty display board	Replace the electronics cover or contact Biotage 1-Point Support (see page 4).
Temperature or Time pushwheel does not work or shows the wrong value in the display	Faulty pushwheel switch	Perform the “ Pushwheel Connection Test ” on page 64 . If it is not a connection problem, replace the electronics cover.

Troubleshooting the Unit

To diagnose problems with the unit, locate the description of the condition in the table below.

Condition	Probable Cause	Solution
Unit inoperative	Power switch off	Check that power switch is turned on.
	Loose power cord	Check that power cord is fully seated.
	Faulty fuse	Replace fuse.
	Faulty control board	Replace control board or contact Biotage 1-Point Support (see page 4).
Turbid bath water	Bacterial growth	Clean and use <i>Clear Bath</i> additive
Leaking vapors	ground-glass condenser joints require PTFE sleeves	See “ Add PTFE Sleeves to the Ground Glass Fittings ” on page 28 .
Difficulty separating glassware	PTFE sleeves on ground glass joints not installed	See “ Add PTFE Sleeves to the Ground Glass Fittings ” on page 28 .

Procedure for Dislodging Bubbles

As the water bath begins to warm up, air comes out of solution and bubbles may form around the sensor's optics. Also, whenever you have removed the water bath rack for servicing, replacing the rack may trap air bubbles.

In most cases, sample tube insertion frees any bubbles trapped around the sensor's optics.

In case bubbles trapped in the sensor's optics affect the concentration process (described in the Diagnostic chart), perform the following steps to dislodge the bubbles:

- 1 Grasp the sample tube, and using a pumping motion, raise and lower the tube about one inch. Pump the tube up and down several times.
- 2 Perform step 1 on the other cell position.
- 3 Test the sensors by performing the ["Sensor Test Procedure"](#) on page 65.

Software Diagnostics

The concentrator software provides diagnostic capabilities to test the function of hardware and check the software version. The following diagnostics are provided:

Power-Up Diagnostics to:

- test the lights on the unit
- check the software version running the unit
- test the Time and Temperature pushwheel connections

Cell Diagnostics to:

- test the sensors
- test the motors

Power Up Diagnostics

The Power Up diagnostics are available each time the power is turned on. Within the first four seconds of turning on the unit, the lights are tested and you can check the software version and the Time and Temperature pushwheel connections.

Display Test

Within the first four seconds of turning power on to the unit, all display lights are lit. If any lights are out, check to make sure all connectors are seated. If condition persists, order the Electronics Cover Replacement Kit. (See [“Replacement Parts”](#) on page 70)

Software Version

Press the **Fan Speed** button within the first four seconds to display the software version in the Temperature display.

Pushwheel Connection Test

The Time and Temperature pushwheel connections should be tested after replacing the control board or electronics cover.

To test the pushwheel connections:

- 1 While pressing and holding the Fan Speed button, press the top endpoint selection button.
- 2 Confirm that Temperature and Time display the pushwheel settings.
- 3 Set each digit to all ten values; the corresponding display should “track” the switch.

If the displays do not reflect the pushwheel settings, the cables may not be connected in the right orientation or at the right receptacle.

IF setting the pushwheel affects the wrong side of the corresponding display, **then** cables are plugged into the correct connector, but in the wrong orientation.

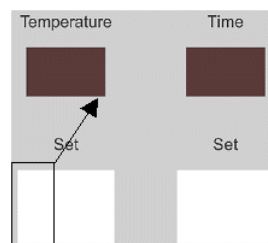


Figure 31. Wrong Orientation

IF setting the pushwheel affects the display for the other pushwheel, **then** cables are plugged into the wrong connector.

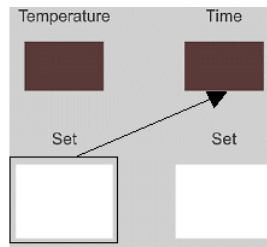


Figure 32. Wrong Connector

- 4 Release the fan speed button and the Display Test will resume (for 4 seconds).

Cell Diagnostics

Any time after the Display Test has run, even during operation, cell diagnostics can be performed to test the sensors and the motors.

Enter the Cell diagnostics by pressing either the left cell or the right cell Start/Stop button while holding in the Fan Speed button.

Fan Speed + Cell Start/Stop = Cell diagnostics

Time display = Sensor value

Temperature display = Motor value

The Temperature display reports a value for the brightness of the sensor optics for that cell (left or right). The Time display reports a value for the motor current for that cell (left or right).

Sensor Test Procedure

You should test the sensors:

- when performing routine maintenance
- when suggested by the diagnostic charts.

To test the sensors:

- 1 Remove any tubes from the unit.
- 2 While holding the Fan Speed button, press the cell Start/Stop button.
- 3 Record the value reported in the Temperature display.
no tube: _____
- 4 Place a clean, empty tube in the position.

- 5 Record the value reported in the Temperature display.
Empty tube: _____
- 6 Repeat steps 2-5 for the other cell position.
- 7 Press the Fan Speed button once to exit the diagnostic mode.

Expected Sensor Values

When...	Then...
no tube is in place	value should be between 10 and 40.
empty tube is in place	value should be higher (by about 10) than the “no tube” value.

The table below describes the possible causes for incorrect values.

When...	Then...
the value is too high or low	there are bubbles around the sensor optics <i>or</i> the water level in the bath is below the level of the sensor <i>or</i> the sensor may be <ul style="list-style-type: none"> • improperly connected • defective • expired and must be replaced

Perform the [“Procedure for Dislodging Bubbles” on page 63](#) and check the water bath level and sensor connections. After these conditions are ruled out, replace the sensor.

Motor Test Procedure

You should test the motors:

- when performing routine maintenance
- when suggested by the diagnostic charts.

To test the motors:

- 1 Select the Stop Pressed endpoint.
- 2 Press the Fan Speed button until 6000 (C) is selected and KEEP HOLDING THE FAN SPEED BUTTON IN while pressing a cell Start/Stop button.
- 3 Release the Fan Speed button and press the cell's Start/Stop button to start the fan.
- 4 Once the fan reaches a steady speed, record the value reported in the Time display.
6000 rpm: _____
- 5 Press the cell's Start/Stop button to stop the concentration.
- 6 Repeat steps 2-5 for the other cell position.
- 7 Press the Fan Speed button once to exit the diagnostic mode.

Expected Motor Current Values

When...	Then...
no concentration is in process	value should be 0 or 1.
a steady speed is reached at: 4000rpm 5000rpm 6000rpm 7000rpm 8000rpm	value should be between 2 and 6. value should be between 3 and 7. value should be between 4 and 8. value should be between 4 and 9. value should be between 5 and 10.

The table below describes the possible causes for incorrect values.

When...	Then...
The value is above 15 when the motor is running	Check for a rubbing shaft or other source of friction.
The value continues to climb, or exceeds 30	Check that the fan shaft is free to turn and that the motor is plugged in correctly.

Check for the conditions described. After these conditions are ruled out, replace the motor.

Specifications

Capacity:	2 samples, up to 500mL each
Water Bath Temperature Range:	ambient to 95°C Can cool below ambient by using the evaporation as a cooling source. Sensors must be removed to use above 60°C.
Condenser Coolant Temperature Range:	4°C- 20°C Using low temperatures, without freezing, will increase the concentration rate and improve solvent reclamation and sample recovery.
Dimensions:	Height: 24.0" (60.9 cm) Width: 21.2" (53.8 cm) Depth: 11.9" (30.2 cm) Weight: 40.5 lbs (18.47 Kg) - empty water bath
Operating Temperature	59° to 95°F (15° to 35°C)
Operating Humidity	0% to 85% relative humidity, non-condensing
Storage Temperature	50° to 122°F (10° to 50°C)
Storage Humidity	0% to 85% relative humidity, non-condensing
Altitude	Up to 2000M
Indoor Use Only	
Input Voltage	100/120VAC +/- 10% 220/240 VAC +/- 10%
Line Frequency	50 - 60 Hz
Fuses	100/120VAC: (1) 10A, T250V (P/N 39164) 220/240 VAC: (2) 5A, T250V (P/N 44412)

Containers:	<p>Biotage glass concentration tubes with 0.5mL or 1.0* mL stem Pyrex – can be baked at up to 450°C *When using sensor endpoint detection and tubes with 1.0mL stems, concentrate to a volume of 0.75mL. There is a calibrated mark on the sample tube indicating a volume of 1.0mL if you want to reconstitute the sample to this volume.</p> <p><i>Accuracy of 1.0mL stem and graduated glassware:</i> 1.0mL graduation: ± 0.02 mL 5, 10, and 50mL graduations:± 0.5 mL 100 and 200mL graduations:± 2.0 mL</p>
Time Range:	1-99 min.
Fan Speed:	5 settings - 4000, 5000, 6000, 7000 and 8000 rpm
Solvent Reclamation:	95% of solvent vapors under typical conditions

Replacement Parts

TurboVap Units

Units	Part Number
TurboVap 500, 110/120V , — includes 1.0mL stem tubes, caps, blades, auxiliary rack and sleeve kit & tool NOTE: 1.0mL recommended for best recoveries with semi-volatiles 0.5mL stem tubes for non-volatiles are also available	C103202
TurboVap 500, 230V , — includes 1.0mL stem tubes, caps, blades, auxiliary rack and sleeve kit & tool NOTE: 1.0mL recommended for best recoveries with semi-volatiles 0.5mL stem tubes for non-volatiles are also available	C103203

Accessories

Accessories	Part Number
Auxiliary Rack, 2-position, 500mL tubes	C45400
Closed Cell Assembly Set 1.0mL stem includes 1 ea: sample tube, condenser and cell cap	C128142
Closed Cell Assembly Set 0.5mL stem includes 1 ea: sample tube, condenser and cell cap	C128143
Glass Covers for 500mL sample tubes (2 ea)	C45412

Glassware

Glassware	Part Number
Condenser	C128136
Cell Caps (2/set)	C45210
Concentration Sample Tube, 1.0mL stem, 500mL (2 ea) recommended for best recoveries with semi-volatiles	C128140

Glassware	Part Number
Concentration Sample Tube, 0.5mL stem, 500mL (2 ea) recommended for best recoveries with non-volatiles	C128137
Concentration Sample Tube, flat bottom, 500mL (2 ea) recommended for best recoveries with non-volatiles	C128141

Replacement Kits

Replacement Kits	Part Number
Electronics Cover Replacement Kit (with keypad)	C103211
Control Board Replacement Kit	C45711
Drain Tubing Replacement Kit	C45709
Sensor Replacement Kit	C45713
Motor Replacement Kit	C46803
Condenser Tubing Replacement Kit	C50197
Bath Replacement Kit	C46985

Spare Parts

Spare Parts	Part Number
Motor Cover	C45224
Fitting-coupling, panel-mount, 1/8 — <i>inlet/outlet couplings on unit</i>	C45350
Fitting-coupling insert, right angle, 1/8 barb — <i>connects Condenser tubing to unit</i>	C45351
Fitting-coupling, right angle, 1/4 barb — <i>connects 1/4" chiller tubing to unit</i>	C45352
Cap, screw-on — <i>connects drain tubing to Condenser</i>	C45355
Fan Assembly (<i>internal cooling fan</i>)	C45362
Interconnect Board	C45705
Drain Cap Insert (1 ea)	C45771
Gasket — <i>on fitting in screw cap which to Condenser</i>	C45776

Spare Parts	Part Number
PTFE Sleeve Kit (4/pkg) — <i>for ground glass joints: requires 46433</i>	C46431
PTFE Sleeve Installation Tool — <i>required for 46431</i>	C46433
PTFE Washer, 0.45 OD x 0.25 ID x 0.02 THK — <i>in PTFE seal placed in glass Cell Cap</i>	C46686
Fan Blades and Shaft (2/set)	C46801
PTFE Seals for Fan Shaft (10 ea/pkg)	C46802
Bearing, 0.6 OD x 0.25 ID x 0.2 ED, 0.69 diameter — <i>in motor mount</i>	C47568
Mount for the Motor and Bearing — <i>mount only; no bearings or hardware</i>	C47569

Miscellaneous Items

Miscellaneous Items	Part Number
Water Bath Additive, <i>Clear Bath</i> - 8 oz. bottle	C44316
Bath Siphon	C46381

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