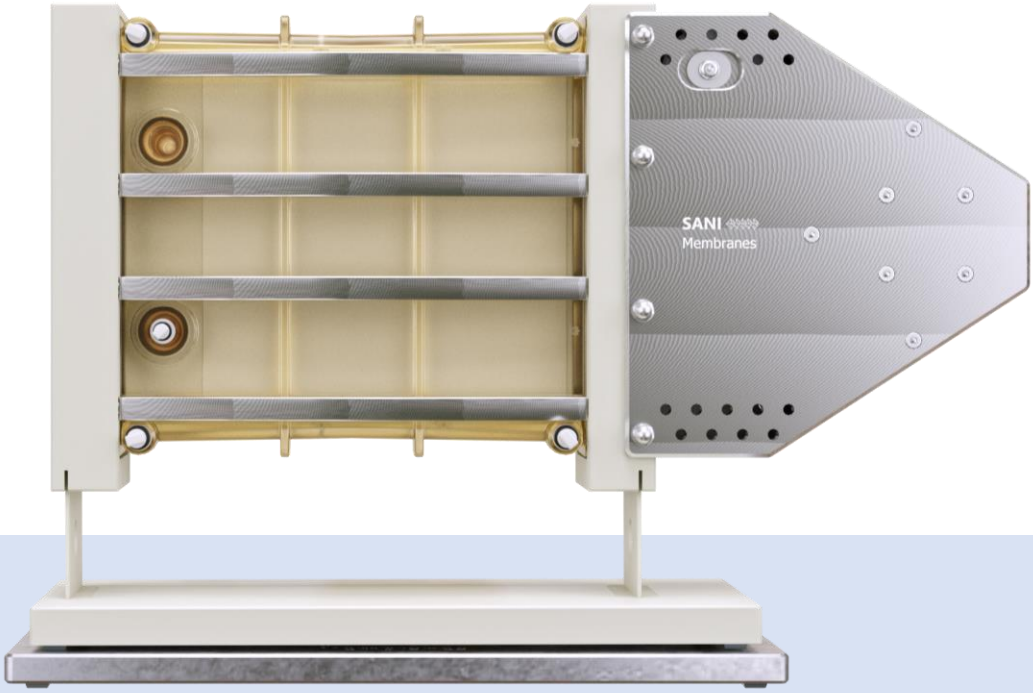
Vibro-Lab3500 User Manual



Please be sure to read this entire user manual prior to use of the equipment.
Please read all safety instructions carefully.

This user manual is part of the product. Keep it in a safe place for future reference.
Replacement manuals can be downloaded from our webpage at:
www.sanimembranes.com

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Vibro-Lab3500 User Manual

Contents

1. Description

1.1. Introduction

The Vibro-Lab3500 is a portable benchtop membrane system for microfiltration and ultrafiltration applications. It is ideal for testing different membranes, optimizing the filtration process, and even for use at small production scale. The Vibro-Lab3500 uses the patented Vibro® technology to create turbulence at the membrane surface by vibrating the membrane relative to the media. This provides a unique control of the separation parameters independent of the liquid flow.

The Vibro® technology can process the most demanding media with high viscosity, high solid loads and even high particulates with unprecedented results. With unique control of separation parameters, the Vibro® technology provides uniform transmembrane pressure that results in less fouling, high product transmission and excellent flux even at high viscosity or high concentration.

The Vibro-Lab3500 utilizes the Free Flow Plate™ technology which is an innovative membrane element design with free flow filtration on flat membrane surfaces.

The Free Flow Plate™ can be configured with most commercially available microfiltration or ultrafiltration membranes. The membrane is fused to the surface of the Free Flow Plate™ by welding.

Multiple plates are welded together to form a Free Flow Plate element. The Free Flow Plate™ element has a 1.7 mm free flow channel between the membranes that allows for filtration with no need for pre-filtration even for high solids loading and high viscosity media. The Free Flow Plate™ element has an integrated and open permeate channel design. Thus, the retentate as well as the permeate can be drained completely and with a minimum of product loss.

The Lab3500 Cartridge holds a 0.35 m^2 Free Flow Plate™ membrane element.

The Lab3500 Cartridge is made of a translucent material that gives excellent visibility of the media and membrane surfaces during operation and cleaning. All media contacting parts are in durable polymeric materials or stainless steel.

1.2. Validity

This manual applies to the Vibro-Lab3500 products including:

- Lab3500 Cartridge (000-0006).
- Vibro-Lab3500 Drive (EU) (001-0021).
- Vibro-Lab3500 Drive (US) (001-0018).

This manual applies to the Vibro-Lab3500 products in combination with the following accessories:

- Standard feed pump from SANI Membranes.

1.3. Symbols

As warning of danger, all text statements in these instructions to be noted will be marked as follows:

WARNING

This symbol denotes a possible danger with medium risk that death or (severe) injury may result if it is not avoided.

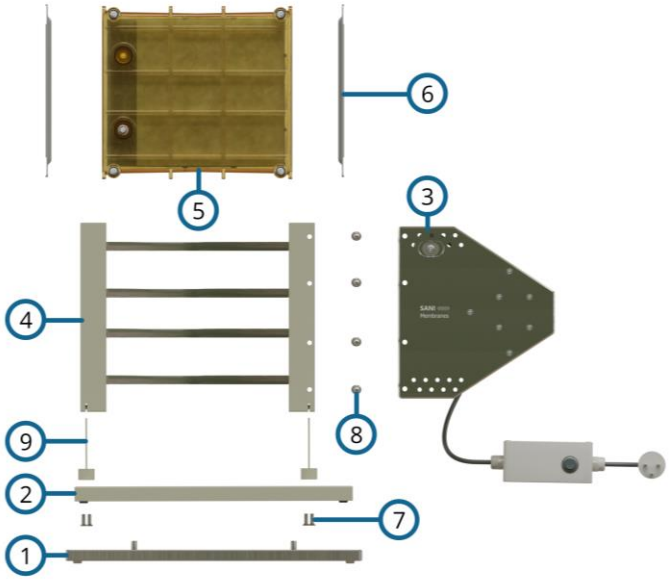
CAUTION

This symbol denotes a possible danger with a low risk that moderate or minor injury may result if it is not avoided.

ATTENTION

This symbol denotes a danger with low risk of damage to property if not avoided.

2. System



Parts list

1. Vibro-Base.
2. Base plate.
3. Vibro-Lab Drive.
4. Vibro-Lab3500 Adaptor.
5. Lab3500 Cartridge
6. 2x air cushions.
7. 4 x M5 Screws
8. 4 x Mounting Rods
9. 2x leaf springs.

2.1. System description

The Lab3500 Cartridge has 2 media ports at the top and 2 media ports at the bottom, all with push-in fittings suitable for 8 mm (OD) tubing. The permeate is collected from a port at the front of the Lab3500 Cartridge, fitted with push-in fitting suitable for 6mm (OD) tubing.

The Lab3500 Cartridge has a rectangular opening at each end, where air cushions are placed to divide the media from the housing side plates. Each side plate of the Vibro-Lab3500 Adaptor has a cavity that makes up the air cushion volume when the cartridge is mounted in the adaptor. At the bottom of each of the Vibro-Lab3500 Adaptor side plates there is a slit for placing the adaptor on the leaf springs of the base plate.

When facing front, the Vibro-Lab Drive is mounted with 4 bolts through the right adaptor side plate. The whole assembly consisting of the Lab3500 Cartridge, the Vibro-Lab3500 Adaptor and the Vibro-Lab Drive is placed on the leaf springs. The Vibro-Lab Drive delivers the vibrating motion of the entire assembly, and the air cushions make the media stationary inside the membrane module.

The whole assembly is placed on the Vibro-Base in order to prevent it from moving during operation, and to reduce vibrations from the unit.

3. Safety

Please be sure to read this entire user manual prior to use of the equipment.
Please read all safety instructions carefully.
This user manual is part of the product. Keep it in a safe place for future reference.

3.1. Intended use

The Vibro-Lab3500 assembly is a manually operated benchtop filtration system for MF and UF filtration. The user should read and understand this manual before use. The Vibro-Lab3500 is intended for use in a laboratory setting or in an industrial, research or teaching facility.

The Vibro-Lab3500 is intended to filter media and can only be used with a membrane element from SANI Membranes.

The Vibro-Lab3500 is designed to operate at maximum 3 bar(g) at room temperature. The feed system could be the standard feed pump from SANI Membranes. Other feed systems can be used but if capable of providing more than 3 bar(g) a CE approved safety valve of maximum 3 bar(g) must be used for protecting the Vibro-Lab3500.

The Vibro-Lab3500 is NOT suited for use in explosive environments. ⚠ **WARNING**

This instruction manual is part of the Vibro-Lab3500 and is intended exclusively for use in accordance with this instruction manual.

The Vibro-Lab3500 must only be used for intended use, the following are examples of improper use ⚠ **WARNING**:

- Unauthorized modifications and technical changes to the Vibro-Lab3500 are improper use.
- Operation outside the permissible physical conditions given in this document (e.g. temperature, pressure, chemical vapors etc.) and given in the specification sheet for the membrane used.
- Installation of unauthorized items on the Vibro-Lab3500.
- Connection of unsuited devices to the Vibro-Lab3500 (e.g. unsuited feed systems).
- Use of media with biological materials in Safety Classes 2 and 3.
- Use of flammable or potentially explosive substances.
- Filtration of unstable media.
- Use of media which are noncompatible with the materials in the Lab3500 Cartridge or feed system used (check specification).

3.2. Personnel qualification

All personnel operating the Vibro-Lab3500 must have read this instruction manual thoroughly and be skilled in the art of pressurized filtration. All personnel operating the Vibro-Lab3500 should be used to conduct themselves in a laboratory environment and have passed mandatory safety courses etc. Students operating the Vibro-Lab3500 must be instructed thoroughly by skilled teachers or other skilled personnel in proper use of the Vibro-Lab3500.

3.3. Media

The media used in the system can be dangerous to handle and cause personnel injuries or equipment damage when not handled correctly.

The operator should always seek the applicable safety information for the media to be filtered (e.g. handling and storage and conduct in emergency situations). ⚠ **WARNING**

Personal safety equipment should always be worn when applicable (e.g. safety goggles, safety gloves etc.). ⚠ **WARNING**

Do not use media with biological materials in Safety Classes 2 and 3. ⚠ **WARNING**

Do not use flammable or potentially explosive substances. ⚠ **WARNING**

Do not use unstable media where concentration changes might start chemical reactions within the media. ⚠ **WARNING**

The operator should always make sure that the media to be filtered is compatible with the materials in fluid connection in the Vibro-Lab3500 and the feed system used. **ATTENTION**

3.4. Pressurized components

If the pressure needed for the membrane assembly is generated by an external feed system (not included), then the membrane assembly, the external feed system and the tubing and fittings between the external feed system and the membrane assembly are one pressurized system. The system must be **operated at maximum 3 bar(g)** at room temperature and if the external feed system is capable of providing more than 3 bar(g) to the pressurized system it must have a CE approved safety valve set at **maximum 3 bar(g)**.

Parts of the system can burst if they are subjected to pressures over 3 bar(g). ⚠ **WARNING**

Operating Pressure: 0-3 bar(g) at 5-35 °C and 0-1 bar(g) at up to 55 °C

3.5. Leaking fluids

If the fluid system is leaking, liquid spill can cause a serious health danger depending on the media. The operator should always seek the applicable safety information for the media (e.g. handling and storage and conduct in emergency situations). Personal safety equipment should always be worn when applicable (e.g. safety goggles, safety gloves etc.). ⚠ **WARNING**

If the fluid system is leaking, liquid spill to the floor can cause a slipping hazard. ⚠ **CAUTION**

3.6. Sharp objects

The leaf springs are sharp objects. Be careful not to get in contact with the leaf springs when assembling or disassembling the system. ⚠ **CAUTION**

3.7. Moving parts

Body parts can be crushed when they come into contact with moving parts, e.g. the vibrating assembly. This can lead to injuries.

⚠ **WARNING**

Lose hair or lose clothing parts can be caught in moving parts and cause injuries. ⚠ **CAUTION**
The Vibro-Lab3500 must be placed on a horizontal non-slippery surface as the vibrating movement can otherwise make the Vibro-Lab3500 move during operation and can cause injuries if it falls to the floor. ⚠ **CAUTION**

3.8. Personal protective equipment

Mandatory personal protective equipment to protect against risks arising from the equipment or the material being processed:

- Tight-fitting work clothing - Protects against being caught by moving parts. ⚠ **CAUTION**
- Head covering - Protects hair from being pulled into moving parts. ⚠ **CAUTION**
- Safety glasses - Protects against substances leaking under high pressure, splashing liquids etc. ⚠ **WARNING**
- Safety shoes - Protects against injuries to the feet caused by mechanical effects. ⚠ **CAUTION**

3.9. Accessories and spare parts

The Vibro-Lab3500 can only be used together with a feed system that provides a maximum pressure of 3 bar(g). If the feed system is capable of providing more than 3 bar(g) a CE approved safety valve set to maximum 3 bar(g) must be used. ⚠ **CAUTION**

The feed system could be the Standard feed pump from SANI Membranes.

The use of unsuitable accessories, consumables and spare parts can be hazardous and have the following consequences:

- Severe personnel injury ⚠ **WARNING**
- Damage to the device ⚠ **WARNING**
- Malfunctions of the device **ATTENTION**
- Device failure **ATTENTION**

Only use accessories, consumables and spare parts that are in technically perfect condition.

The use of accessories, consumables and spare parts **not** approved by SANI Membranes is the sole responsibility of the operator.

4. Assembly

4.1. Tools Needed

Tools needed for assembly:

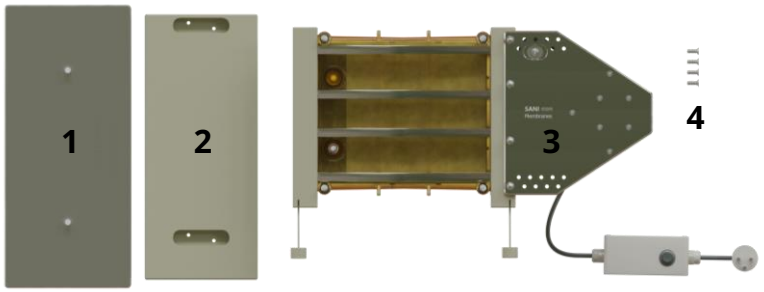
Tools	Size
Hex-Key	3 mm
Hex-Key	6 mm

Tools needed for maintenance:

Tools	Size
2 x Spanner	10

4.2. Assembly of drive

The Vibro-lab3500 comes assembled with the Lab3500 Cartridge installed. Prior to use, the Vibro-Lab3500 only needs to be securely attached to the baseplate & Vibro-Base to avoid damage.



Parts list:
1. Vibro-Base
2. Baseplate
3. Vibro-Lab Drive w. Lab3500 Cartridge
4. 4 x M5 Screws

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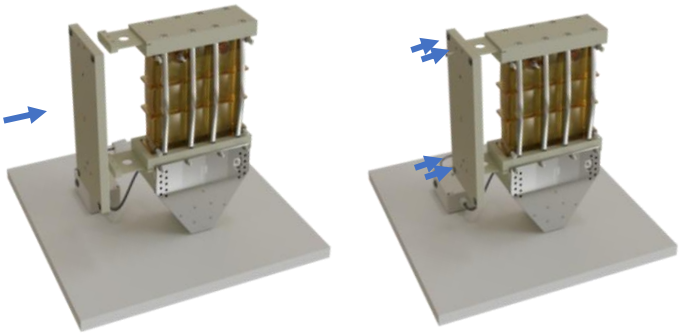
1 Carefully place the Vibro-Lab3500 on the Vibro-Lab Drive as shown to the right.

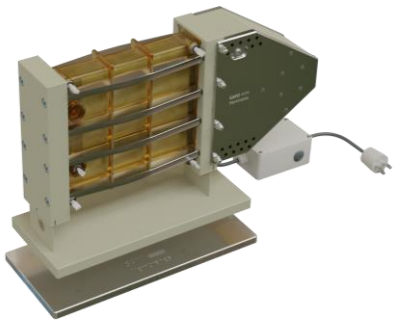
2 Place the leaf springs into the grooves of the baseplate.

3 Secure the springs in place using 4 x M5 screws.



4 Place the Vibro-Base on a planar surface with the two pins facing up.

5 Place the Vibro-Lab3500 onto the Vibro-Base. Make sure to align the two pins with the holes under the baseplate.



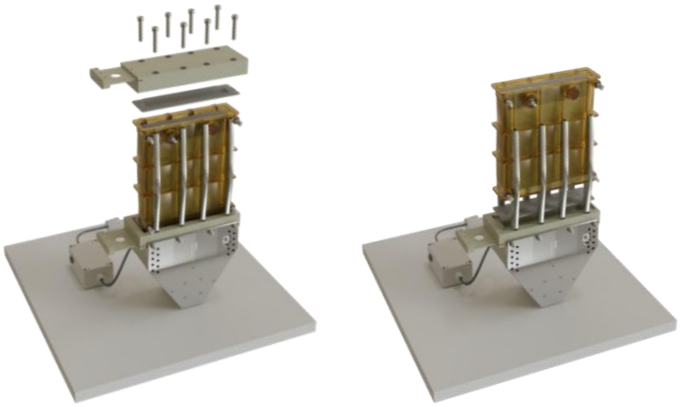
4.3. Replacement of Lab3500 Cartridge

Make sure that the cartridge is completely drained. If unable to drain the cartridge, make sure to remove the Vibro-Lab Drive prior to proceeding (***see 4.4 Removal of Vibro-Lab Drive***).

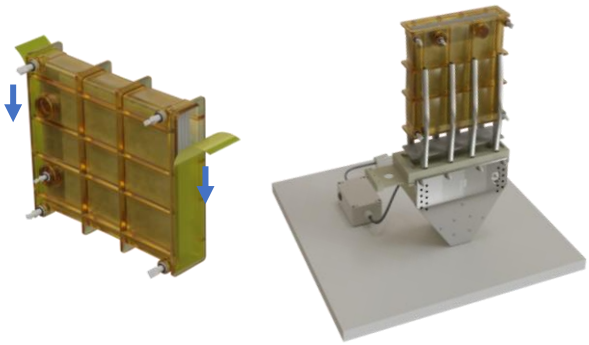
⚠ **WARNING**

Ensure the Vibro-Lab Drive is NOT connected to a power outlet. ⚠ **WARNING**

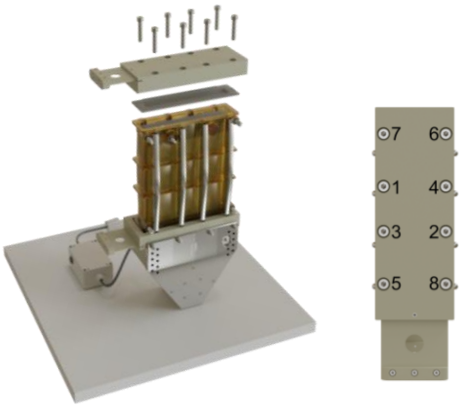
1. Carefully place the assembly on the Vibro-Lab Drive as shown to the right.
2. Unscrew the 8 x M8x45 screws holding the cartridge in place.
3. Remove the side plate and cushion.
4. Carefully slide out the Lab3500 Cartridge and remove the cushion.
   Note: If stuck, carefully tap the side plate with a rubber to assist the release.



5. Carefully remove the tape from the new Lab3500 Cartridge.
6. Insert the new cushion in the side plate and carefully slide the cartridge into the adaptor.
7. Make sure the media ports and the permeate outlet are all facing the front. **ATTENTION**



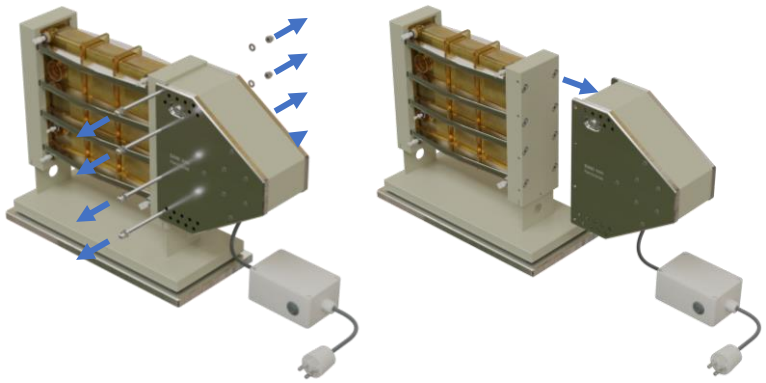
8. Place the cushion onto the Lab3500 Cartridge together with the side plate.
9. Secure the cartridge with 8 x M8x45 screws and make sure to cross tighten. For gentle and uniform tightening use the scheme shown to the right.



4.4. Removal of Vibro-Lab Drive

Ensure the Vibro-Lab Drive is NOT connected to a power outlet. ⚠ **WARNING**

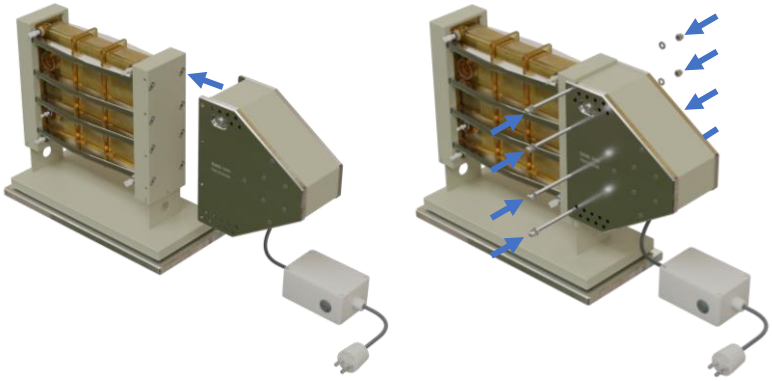
1. Remove cap nuts and washers on one side of the Vibro-Lab Drive.
2. Take out the rods to remove the Vibro-Lab Drive from the adaptor side plate.



4.5. Installation of Vibro-Lab Drive

Ensure the Vibro-Lab Drive is NOT connected to a power outlet. ⚠ **WARNING**

1. Slide the Vibro-Lab Drive onto the side plate of the membrane assembly. Make sure to align the through holes.
2. Secure the Vibro-Lab Drive in place with 4 x 121 mm rods with the 8 x M6 cap nuts and washers.
3. Tighten the cap nuts with approx. 4Nm. Make sure to crosstighten the cap nuts.



5. Operation

5.1. Introduction

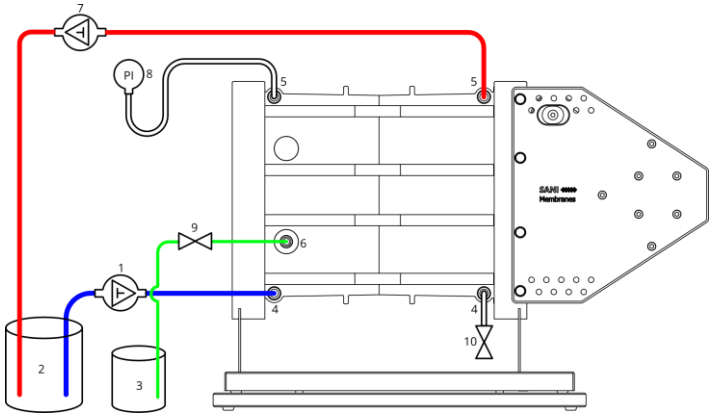
Many new membranes are supplied with a water-soluble glycerin layer for protection. Before introducing product, this should always be conditioned by washing thoroughly with clean hot water. A 20 min warm water wash where both retentate and permeate is discarded continuously is recommended before use.

Always use the best quality water you have access to. Water is many things and parts like carbonates, phosphates, particles etc. present in normal tap water can harm the effectiveness of the membrane and the CIP cleaning.

5.2. Introduction to transmission sensitive microfiltration setup with feed and retentate pumps

The use of two pumps is recommended for microfiltration applications. For highly transmission sensitive applications a very low flux may be required to achieve a high transmission. The below setup is ideal for controlling this.

For ideal operation of microfiltration processes at higher flux rates a setup with a permeate pump is recommended, see next section for such a setup.



1. Peristaltic Feed Pump
2. Feed / Retentate Vial
3. Permeate Vial
4. Media Inlet Ports (8 mm (OD) tubing)
5. Media Outlet Ports (8 mm (OD) tubing)
6. Permeate Port (6 mm (OD) tubing)
7. Peristaltic Retentate Pump
8. Manometer (0 – 1 bar)
9. Permeate Valve
10. Drain Valve (Optional)

Introduction of feed solution:

1. Start with a fully assembled and drained Vibro-Lab3500 unit as shown above.
   Tip: To avoid dilution of the feed solution the system can be drained from water just before introducing the product media.
2. Fill the Feed/Retentate Vial (2) with your feed solution.
3. Start the Peristaltic Feed Pump (1) and the Peristaltic Retentate Pump (7) at the same speed.
   Tip: The recommended retentate flow rate is minimum 100 L/h, which corresponds to around 300-330 RPM on the standard SANI Membranes laboratory pump with the included pump tubing.
4. Turn on the Vibro-Lab Drive as soon as the Lab3500 Cartridge is filled with media.
5. To control the permeate flow rate keep the Peristaltic Retentate Pump (7) at fixed speed, while adjusting the speed of Peristaltic Feed Pump (1). The pressure reading on the Manometer (8) is a good approximation of the transmembrane pressure. Initially, this may be too low to observe.
6. Re-adjust the speed of the Peristaltic Feed Pump (1) throughout the experiment to run at the desired permeate flow rate.
7. Collect the permeate in a separate Permeate Vial (3) to study the process during concentration mode.
8. To study how increasing permeate flow rates may impact on the product transmission the permeate can be returned to the Feed/Retentate Vial (2) to keep the feed solution composition constant.

9. When the experiment is finished the unit can be drained on the feed side: Adjust the Peristaltic Feed Pump back to a speed where the permeate flow is close to zero and stop both pumps. Stop the Vibro-Lab Drive, lift the retentate tubing above the liquid level in the Feed/Retentate Vial and start both pumps running in reverse until the system is emptied.

After draining the system, it is ready for flushing and CIP. Do not leave the system drained, to avoid the membranes drying out.

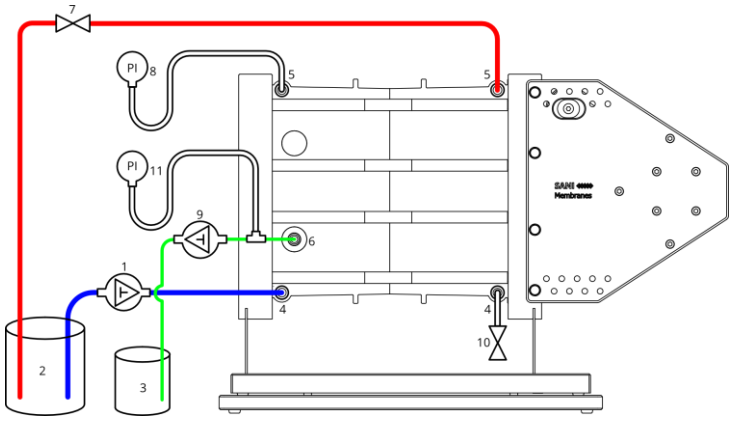
Clean the system with an appropriate CIP protocol for your membrane and application. Turn on the Vibro-Lab Drive when recirculating CIP liquid. Remember to clean the manometer tubing as well. Make sure to run the Peristaltic Feed Pump at slightly higher speed than the Peristaltic Retentate Pump to clean the permeate side too. See separate section for more information about CIP. Finish the CIP by a clean water rinse.

For storage in between use, please see separate section on storage of membranes.

5.3. Introduction to microfiltration setup using a permeate pump.

The use of two pumps is recommended for microfiltration applications. The below setup uses a permeate pump to limit and control the permeate flow rate and this is ideal for many microfiltration applications.

In cases where very low permeate flow rates are required, for instance when processing highly transmission sensitive products, please refer to the previous section.



1. Peristaltic Feed Pump
2. Feed / Retentate Vial
3. Permeate Vial
4. Media Inlet Ports (8 mm (OD) tubing)
5. Media Outlet Ports (8 mm (OD) tubing)
6. Permeate Port (6 mm (OD) tubing)
7. Retentate Valve
8. Manometer (0 – 4 bar)
9. Peristaltic Permeate Pump
10. Drain Valve (optional)
11. Manometer (0 – 1 bar)

Introduction of feed solution:

1. Start with a fully assembled and drained Vibro-Lab3500 unit as shown above.
   Tip: To avoid dilution of the feed solution the system can be drained from water just before introducing the product media.
2. Fill the Feed/Retentate Vial (2) with your feed solution.
3. With the Retentate Valve (7) fully open: Start the Peristaltic Feed Pump (1) to generate a recirculating liquid flow.
   Tip: The recommended retentate flow rate is minimum 100 L/h, which corresponds to around 300-330 RPM on the standard SANI Membranes laboratory pump with the included pump tubing.
4. Turn on the Vibro-Lab Drive as soon as the Lab3500 Cartridge is filled with media.
5. Adjust the Retentate Valve (7) to increase the pressure in the system. As long as the permeate pump is not running, the pressure equalizes across the membrane.
6. Turn on the Peristaltic Permeate Pump (9) to start the permeate flow. Start slowly, and gradually increase the speed until the desired permeate flow rate. The difference between the two manometers is a good approximation of the transmembrane pressure (TMP).
   Note: As the resistance across the membrane increases, the Permeate Pressure may drop and eventually result in negative pressure in the permeate line. This can result in degassing in the liquid and ingress of gas into the permeate line from gaskets and seals. To prevent this, the system pressure can be increased by further adjusting the Retentate Valve (7).
7. Check the retentate flow and if needed re-adjust the speed of the Peristaltic Feed Pump (1) throughout the experiment to keep a suitable recirculating flow.
8. Collect the permeate in a separate Permeate Vial (3) to study the process during concentration mode.
9. To study how increasing permeate flow rates may impact on the product transmission the permeate can be returned to the Feed/Retentate Vial (2) to keep the feed solution composition constant.
10. When the experiment is finished the unit can be drained on the feed side: Stop the peristaltic pumps, lift the retentate tubing above the liquid level in the Feed/Retentate Vial and start the Peristaltic Feed Pump running in reverse until the system is emptied.

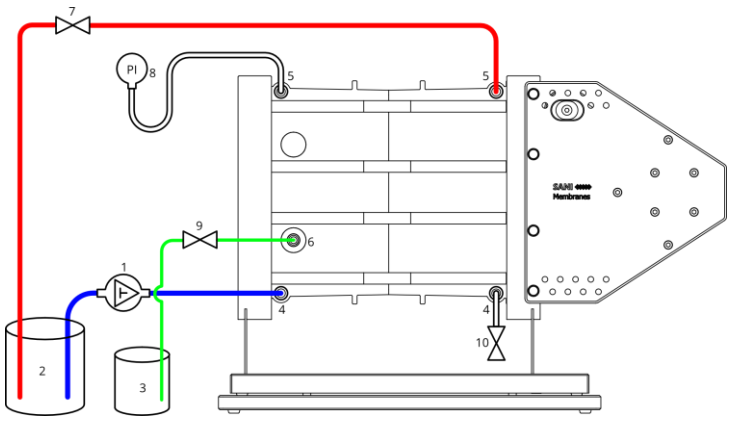
11. After collecting the product in the feed/retentate vial the system should be filled with liquid to prevent the membranes from drying out.

After draining the system is ready for flushing and CIP. Do not leave the system drained, to avoid the membranes drying out.

Clean the system with an appropriate CIP protocol for your membrane and application (Remember to CIP the tubing for the manometers as well). Turn on the Vibro-Lab Drive when recirculating CIP liquid. Make sure to run the Peristaltic Permeate Pump to clean the permeate side too. Finish the CIP by a clean water rinse. For storage until next use see separate section on storage of membranes.

5.4. Introduction to ultrafiltration setup

The setup for ultrafiltration is quite similar to the setup used for traditional Tangential Flow Filtration, see below.



1. Peristaltic Feed Pump
2. Feed / Retentate Vial
3. Permeate Vial
4. Media Inlet Ports (8 mm (OD) tubing)
5. Media Outlet Ports (8 mm (OD) tubing)
6. Permeate Port (6 mm (OD) tubing)
7. Retentate Valve
8. Manometer (0 – 4 bar)
9. Permeate Valve
10. Drain Valve (optional)

Introduction of feed solution:

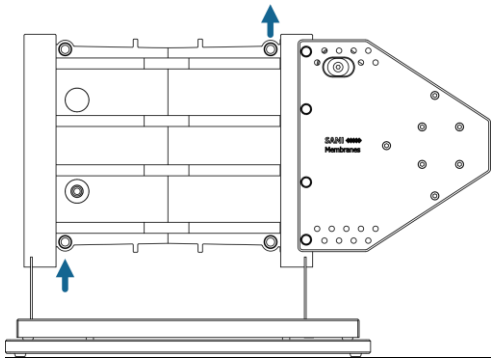
1. Start with a fully assembled and drained Vibro-Lab3500 unit as shown above.
   Tip: To avoid dilution of the feed solution the system can be drained from water just before introducing the product media.
2. Fill the Feed/Retentate Vial (2) with your feed solution.
3. Start the Peristaltic Feed Pump (1).
   Tip: The recommended retentate flow rate is min. 100 L/h, which corresponds to around 300-330 RPM at low pressure resistance on the standard SANI Membranes laboratory pump using the included pump tubing.
4. Turn on the Vibro-Lab Drive as soon as the Lab3500 Cartridge is filled with media.
5. Adjust the Retentate valve (7) until the desired retentate pressure on the Manometer (8) is reached. When increasing this pressure, the retentate flow rate may drop due to the additional resistance for the Peristaltic Feed Pump.
6. When the feed solution becomes more concentrated the resistance in the Retentate valve may also change and the pressure may change as a result:
   a. Check the pressure regularly and make any necessary adjustments on the Retentate Valve.
   b. Check the retentate flow and adjust the Peristaltic Feed Pump if needed to keep a suitable retentate flow rate.
7. To study the process variations at steady-state conditions return the permeate to the feed vial. To study the process during concentration, collect the permeate in a separate vial (3) and measure the permeate flow rate as a result of increasing concentration.
8. When the experiment is finished: Stop the Peristaltic Feed Pump, open the retentate valve and stop the Vibro-Lab Drive. For draining of the concentrated liquid inside the cartridge: Lift the retentate tubing above the liquid level in the Feed/Retentate Vial and start the Peristaltic Feed Pump in reverse until the system is emptied.

After draining the system is ready for flushing and CIP. Do not leave the system drained, to avoid the membranes drying out.

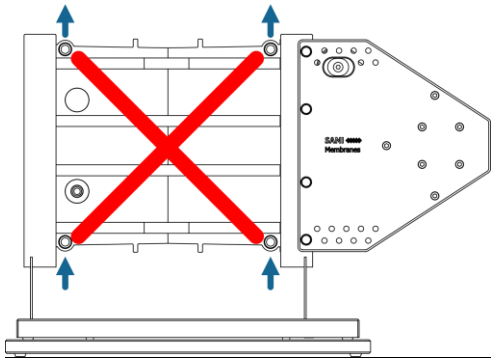
Clean the system with an appropriate CIP protocol for your membrane and application (Remember to CIP the manometer tubing as well). Turn on the Vibro-Lab Drive when recirculating CIP liquid. Make sure to run the Peristaltic Feed Pump at slightly higher RPM than the Peristaltic Retentate Pump to clean the permeate side too. Finish the CIP by a clean water rinse. For storage until next use see separate section on storage of membranes.

5.5. General guidelines – process

1. Aim to have a positive trans membrane pressure whenever the Vibro-Lab Drive is turned on.
2. Maintain a minimum retentate flow to keep the liquid well distributed inside the Lab3500 Cartridge and to avoid dead-end type filtration. The minimum required retentate flow is highly application dependent.
3. The Operating Pressure should be in accordance with the Cartridge specifications.
4. When filtering media with high viscosity or high solids load a mix flow can be established from corner to corner (orthogonal to the feed/retentate path) to avoid severe fouling. The flow rate of this mix flow should be significantly higher than the feed / retentate flow. For more details on how to use mix flow mode contact SANI Membranes.
5. When filtering media with high solids load, the mix flow and vibration must be initiated as soon as the unit is filled to avoid severe fouling.
6. For microfiltration a very low trans membrane pressure often gives the best long-term results.
7. During microfiltration the initial flux can be very high and easily result in severely fouled areas in the Vibro-Lab3500. It is recommended to use two pumps to control and limit the permeate flow to prevent this initial fouling from taking place. See above sections for detailed setup and operation.



Always run the feed flow diagonally across the cartridge (a mix flow could be added to optimize the flow path further).



Never run the feed flow along the cartridge.

Microfiltration (0 – 1 bar)

1. Keep a very low transmembrane pressure: 0.02 to 0.2 bar often gives the best long-time results. For highly transmission sensitive processes even lower transmembrane pressures may be required to prevent the rejection of target molecules.
2. The initial flux can be very high and easily result in severely fouled areas in the Lab3500. Use one of the dual pump setups for efficient control of the permeate flow rate, and hence the flux. See further details in previous sections.

Ultrafiltration (1 – 3 bar)

1. The ideal transmembrane pressure for ultrafiltration is highly product dependent. Typically, the optimal transmembrane pressure for Vibro-filtration is lower than for traditional Tangential Flow Filtration, usually between 1 to 3 bar.
2. Make sure that the system pressure does not exceed the pressure rating of the Lab3500 Cartridge. Depending on the feed system used a safety valve may be required. When using Peristaltic pumps from SANI Membranes with supplied pump-hoses, the pressure is limited by equipment configuration.

5.6. CIP operation

The following procedure is a general guideline for the cleaning of the Vibro-Lab3500 for most normal applications. The individual process and product may require an optimization of the cleaning procedures to achieve satisfactory cleaning results. Please consult a qualified chemicals supplier for application specific cleaning regimes.

ATTENTION: The actual selection of CIP chemicals, their concentration and the temperature used should be in accordance with the chemical compatibility of the individual membrane.

Water flushes, buffer flushes or CIP cleaning must be performed after each run with media in the Vibro-Lab3500. Remember to CIP any dead ends too. Before flushing, the Lab3500 Cartridge may be emptied to make the flushing more efficient. When flushing lead the flushing liquid to drain.

For each cleaning step ensure that liquid flows through the permeate line.

A typical CIP routine for operation with organic material could consist of:

1. A 55 °C hot water flush to remove loosely attached material and warm up the system before CIP.
2. A 30 min 55 °C caustic wash at pH 11-12 with an appropriate CIP chemical (observe membrane compatibility).
3. A water flush to replace the caustic liquid.
4. A 15-20 min 55 °C acid wash at pH 2 with an appropriate CIP chemical (observe membrane compatibility).
5. A thorough water flush.

After cleaning the membrane, the clean water flux should be measured. By comparing the clean water flux after each cleaning cycle with the original membrane performance it is possible to determine if the cleaning regime is sufficient to ensure a good recovery of the membrane. As the clean water flux is temperature and pressure dependent the measurement should be done at the same conditions for direct comparison.
Although it is membrane and use dependent, a recovery of 80% or more of the initial water flux should be expected from a suitable cleaning regime.

5.7. Storage of membranes

The membrane should never be allowed to dry out. When idle the Vibro-Lab3500 should be filled with water or a suitable aqueous solution. For short term storage (hours) it can be left in water. For longer periods it is recommended to add a suitable solution to keep the membranes wet, and to prevent bacterial growth during storage. The storage solution should be selected in accordance with the chemical compatibility of the specific membrane material. Some examples of storage solutions are:

- 0.1 N NaOH
- 20% ethanol
- 20% isopropanol

For long term storage it is recommended to replace the storage solution at regular intervals, for instance every 3-6 months. When preparing the cartridge for storage it is important to evacuate the permeate compartment from air. This is best done by recirculating the storage solution at a pressure suitable for the given membrane until air does not appear in the permeate outlet. Once the cartridge is evacuated from air all valves should be closed off. Unused ports should be closed by plugs.

An alternative storage option is to put the entire cartridge with the membrane in a bucket with the storage solution. In this case, make sure to remove the cushions and that the cartridge is fully submerged. This storage option is recommended in the case where the cartridge is to be replaced by another Lab3500 Cartridge in the Vibro-Lab3500 system.

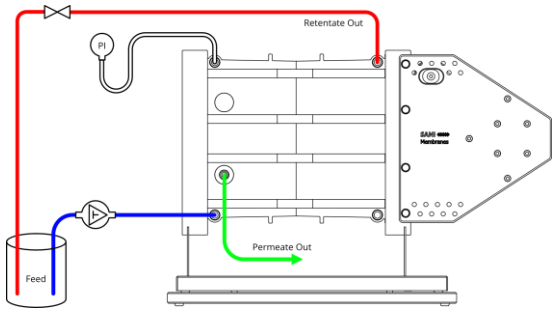
6. Examples of process configurations

The system can be configured and operated in numerous different configurations, depending on the type of product, membrane, and process objective. The most commonly used is the batch configuration described in the previous sections.

The subsequent sections showcase several configurations along with a brief description of its main purpose.

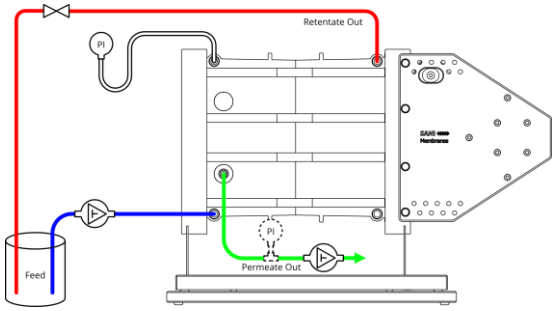
6.1. Batch mode membrane filtration

- A simple configuration that uses a feed pump to feed the media into the cartridge.
- The feed flow and membrane pressure are regulated with the feed pump speed and the regulation valve.
- The concentrated medium is collected in the feed container.



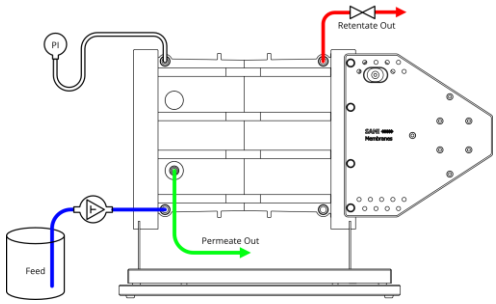
6.2. Batch mode microfiltration with permeate flow control

- For microfiltration applications that require a low, uniform transmembrane pressure an additional pump can be added to control the permeate flow.
- The feed flow and membrane pressure are regulated with the feed pump speed and the regulation valve.
- The transmembrane pressure will be limited by the permeate pump.
- The concentrated medium is collected in the feed container.
- *Note:*
  - *The permeate pump should be a positive displacement type, such as a peristaltic pump.*
  - *It is recommended to use an additional manometer for the permeate (0 – 1 bar) to measure the transmembrane pressure.*



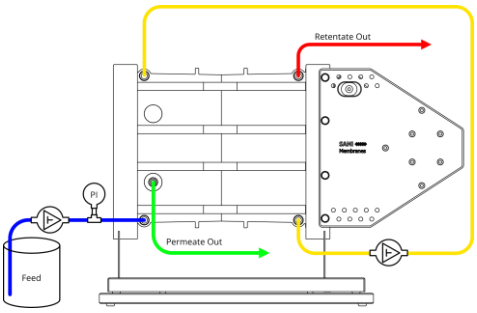
6.3. Continuous single-pass membrane filtration using standard feed pump

- Standard configuration using a pump to feed the media into the cartridge.
- Suitable for viscosities up to 'cream' level.
- The feed flow and membrane pressure are regulated with the feed pump speed and the regulation valve.
- To achieve the concentration factor, the retentate flow rate is adjusted relative to the permeate flow rate.
- *Note:*
  - *Risk of severe fouling for some high fouling applications.*

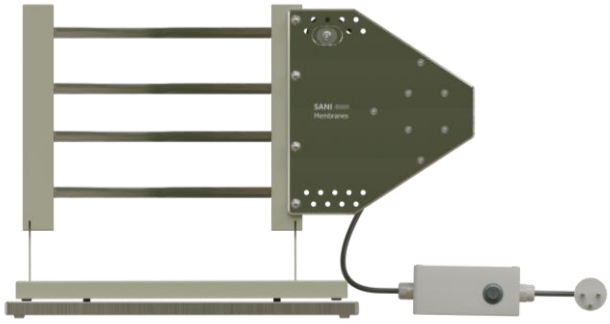


6.4 Continuous membrane filtration using standard feed pump and a mix flow pump

- The addition of a mix flow loop keeps the concentrated liquid in the cartridge well-mixed.
- Configuration is suitable for high viscosity or high solids load.
- The feed flow and membrane pressure are regulated with the feed pump speed and the regulation valve.
- To achieve the concentration factor, the retentate flow rate is adjusted relative to the permeate flow rate.
- *Note:*
  - *Risk for severe fouling for some high fouling applications.*



7. Technical Data



Vibro-Lab3500 Data	
Weight	12.7 kg + damper steel base 8.4 kg
Dimensions (L x W x H)	532 mm x 180 mm x 390 mm
Vibro-Lab3500 Drive	Electric
Power Consumption	230V, 40W excl. feed system
Noise Level	Typically, 50-65 dB (depends on surface and surroundings)

Vibro-Lab3500 Accessories	
Standard feed pump, 0-1 bar(g)	Peristaltic feed pump including pump tubing
Mix Flow pump	Peristaltic Mix Flow pump including pump tubing

Lab3500 Cartridge Specification	
Membrane Area	3500 cm^2
Dimensions	256 mm x 76 mm x 234 mm (excluding fittings)
Internal Retentate volume	500 ml, fully drainable
Internal Permeate volume	170 ml, fully drainable
Media Contact Materials	PSU, PP, Silicon, EPDM, Stainless Steel & Membrane*
Fittings	4 media inlet/outlet push-in fittings (8 mm (OD) tubing) and 1 permeate outlet push-in fitting (6 mm (OD) tubing)

Lab3500 Cartridge Use	
Media Temperature Range	5 – 55 °C
Operating Pressure	0-3 bar(g) at 5-35 °C and 0-1 bar at up to 55 °C
pH Range	1 – 13*
Viscosity Range, apparent	1 – 1000 cap

*Dependent on membrane

Lab3500 Cartridge Standard Membranes		
Membrane type	Cut-off	Available Membrane Material
Ultrafiltration	1 - 300 kDa	PES, PESH, RC & PVDF
Open ultrafiltration / microfiltration	500 – 800 kDa	PVDF
Microfiltration	0.04 µm – 1.2 µm	PES & PVDF

The Lab3500 Cartridge can be equipped with your membrane of choice. SANI Membranes have a line of standard MF and UF membranes on stock. Most commercially available membranes can however also be used with the Lab3500 Cartridge. Please, do not hesitate to contact us if you have specific membrane wishes.

8. Conformity

SANI Membranes are committed to develop and supply products that meet relevant regulatory standards and requirements set by governing bodies. For additional compliance or safety information, please contact SANI Membranes customer support.

The Vibro-Lab3500 system is designed with sanitary execution in mind. All components, independent of the respective material, that are in direct contact with process media, have been selected to comply with relevant regulatory guidelines regarding food approvals. For further material compliance information please contact SANI Membranes customer support.

Electrical and electronic equipment (EEE) contains materials, components and substances that may be hazardous and present a risk to human health and the environment when waste EEE is not handled correctly. Components marked with the crossed-out wheeled bin are EEE and we recommend exercising caution when disposing of it and emphasize the importance of proper sorting. Please adhere to national regulations and consider reaching out to local recycling facilities for guidance and information.

8.1. EU version

The Vibro-Lab3500 system is CE marked to demonstrate compliance with pertinent regulations, including the European Machine, Electrical and Pressure Directives. Hereunder we declare our sole responsibility that, the models mentioned in this manual are, when used as specified, in conformity with the technical requirements of the standards and the provisions of the essential requirements of the EU and other Directives detailed below:

- 2006/42/EU – *Safety of machinery.*
- 2014/35/EU – *Low voltage equipment*.
- 2014/68/EU – *Pressure Equipment.*

CE

8.2 US version

Vibro-Lab3500 Drive incorporates electronic components that comply with UR approval to ensure that these components have all undergone rigorous testing, meeting industry safety and performance standards.