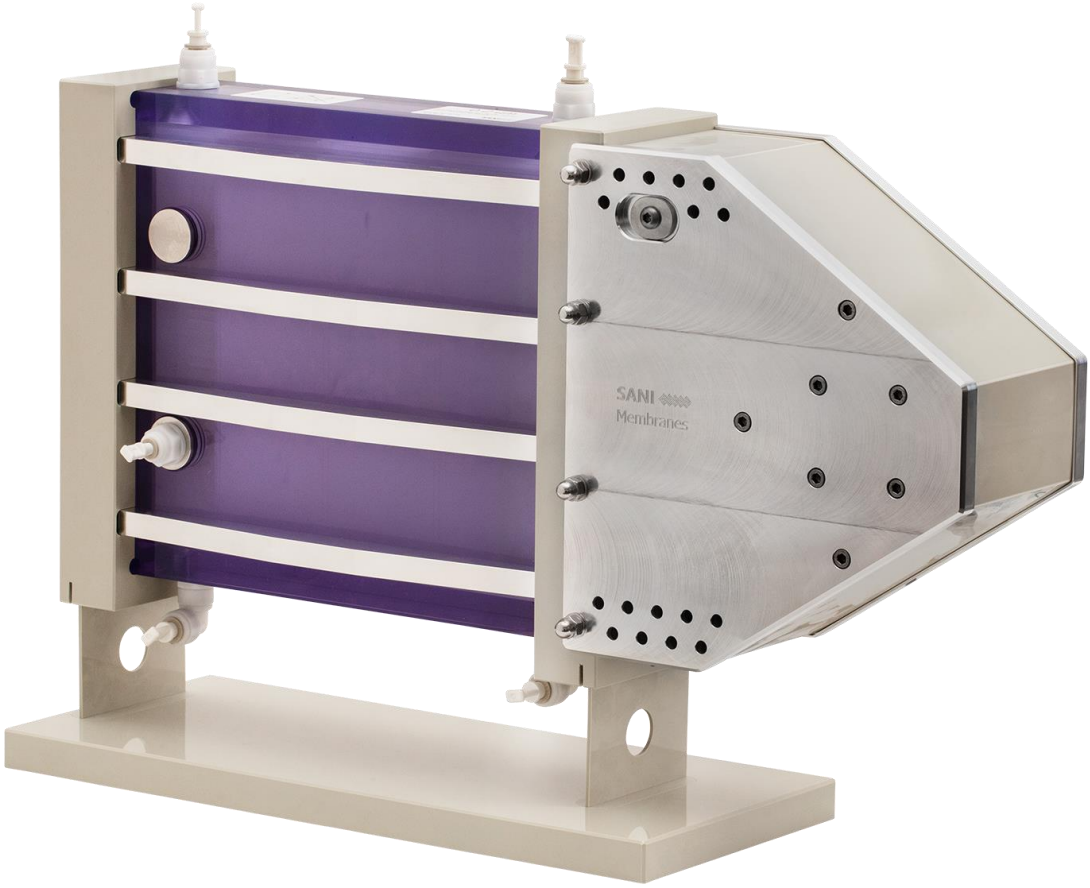
SANI Membranes

Vibro-Lab3500 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

Version: 20221102

Contents

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Description

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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 module 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.

The Free Flow Plate™ 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.

Multiple plates are welded together to form the Free Flow Plate Laboratory Element (HPL). The HPL holds 0.35 m^2 membrane area in a rigid Free Flow Plate™ membrane element.

The HPL is mounted in a translucent filter housing that allows operation at up to 3 bar(g) at room temperature. The clear plastic 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.

Validity

This manual applies to the Vibro-Lab3500 in the following versions:

- Vibro-Lab3500 Series 1

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

- All MF and UF membrane modules with Free Flow Plate™ Laboratory Membrane Elements (HPL) from SANI Membranes.
- Standard feed pump from SANI Membranes

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.

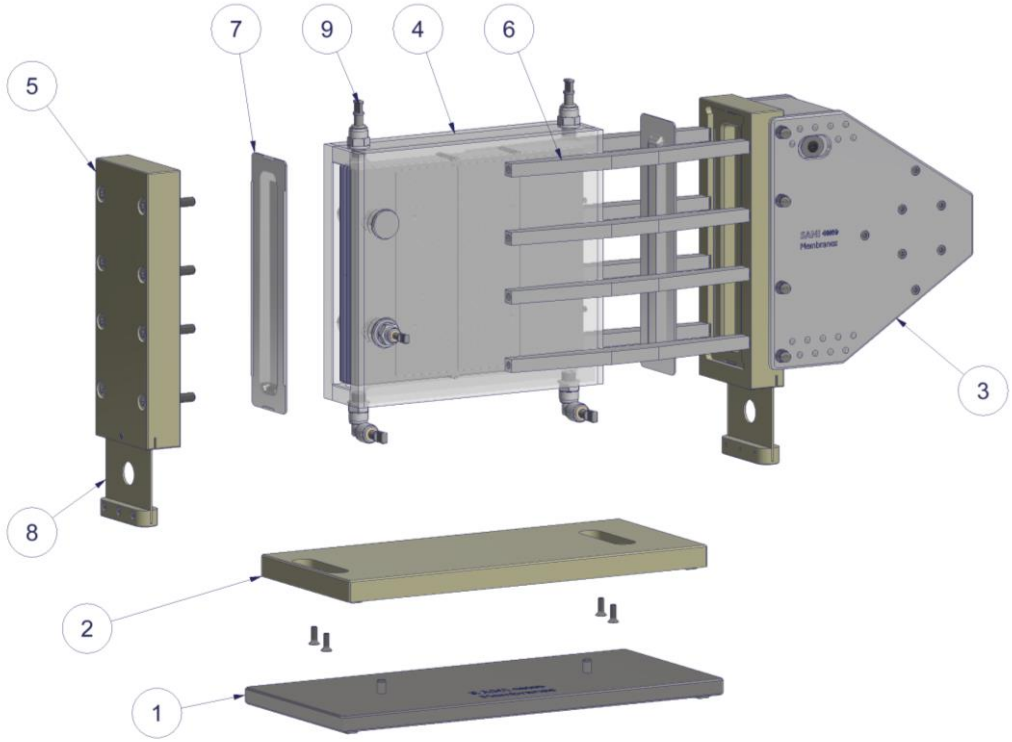
⚠ CAUTION

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.

System



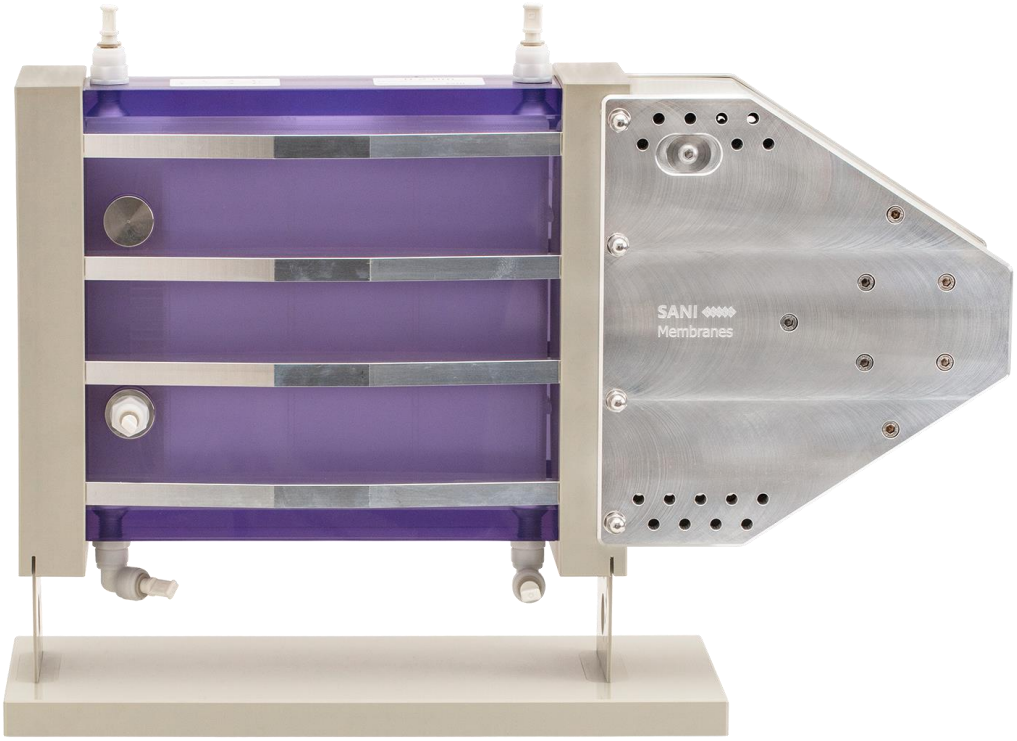
Parts list

1. 1 Damper steel base
2. 1 Base plate
3. 1 Vibro-Lab3500 Drive
4. 1 HPL membrane module including a membrane housing, a Free Flow Plate™ Laboratory Element (HPL), media inlet/outlet ports, and permeate outlet channels
5. 2 housing side plates
6. 8 module side rods
7. 2 air cushions
8. 2 leaf springs
9. 1 set of mounted fittings and plugs for the media inlet/outlet ports and the permeate outlet

System description

The membrane housing has 2 media inlet/outlet ports at the top and 2 media inlet/outlet ports at the bottom, all with ¼" thread for mounting fittings. The membrane housing has 2 circular holes running through it for mounting the membrane element rigidly with the permeate outlets channels. As standard, one is used as permeate outlet and has a ¼" thread for tube fittings and the other is a blind plug with no fluid connection.

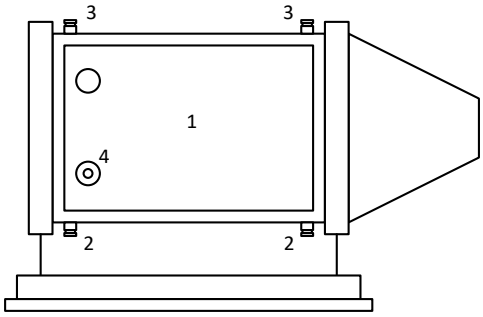
The membrane housing has a rectangular opening at each end, where impermeable air cushions are placed to divide the media from the housing side plates. Each housing side plate has a cavity that makes up the air cushion volume. At the bottom of each housing side plate there is a slit for placing the assembly on the leaf springs of the base plate.



When facing front the Vibro-Lab3500 Drive is mounted with 4 bolts through the right housing side plate. The whole assembly consisting of the membrane housing and the Vibro-Lab3500 Drive is placed on the Leaf Springs. The Vibro-Lab3500 Drive delivers the vibrating motion of the entire assembly and the air cushions make the media stationary inside the membrane module.

The Vibro-Lab3500 assembly is placed on the damper steel base in order to reduce vibrations from the unit.

1: Membrane Element (HPL)
2: Media inlet ports (8 mm)
3: Media outlet ports (8 mm)
4: Permeate outlet port (6 mm)



The standard way to run the Vibro-Lab3500 is to feed media in through one of the media inlet ports (2) in the bottom of the membrane module (1). The second inlet port in the bottom is usually not used and therefore plugged, used for drainage or connected to a manometer.

The retentate is bleeded out of the media outlet port (3) in the top opposite of the port used as feed inlet. The other media port on the top is usually not used and therefore plugged or connected to a manometer.

The permeate is taken out through the bottom permeate outlet (4).

SANI Membranes offers a feed pump for use with the Vibro-Lab3500, but it can be operated with any suitable feed system for use with the specific application.

See examples of use in the Operation section.

Safety

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Intended use

The Vibro-Lab3500 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 0.35 m^2 HPL 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. The Vibro-Lab3500 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 HPL membrane element 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 incompatible with PP, PVC, Stainless Steel, Silicone, EPDM or other materials in the Vibro-Lab3500, HPL membrane element or feed system used.

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.

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 (PP, PVC, Stainless Steel, Silicone, EPDM) and the feed system used. **ATTENTION**

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

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**

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**

Moving parts

Body parts can be crushed when they come into contact with moving parts, e.g. the membrane 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**

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**

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 system is capable of providing more than 3 bar(g) a CE approved safety valve set to maximum 3 bar(g) must be used. 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:

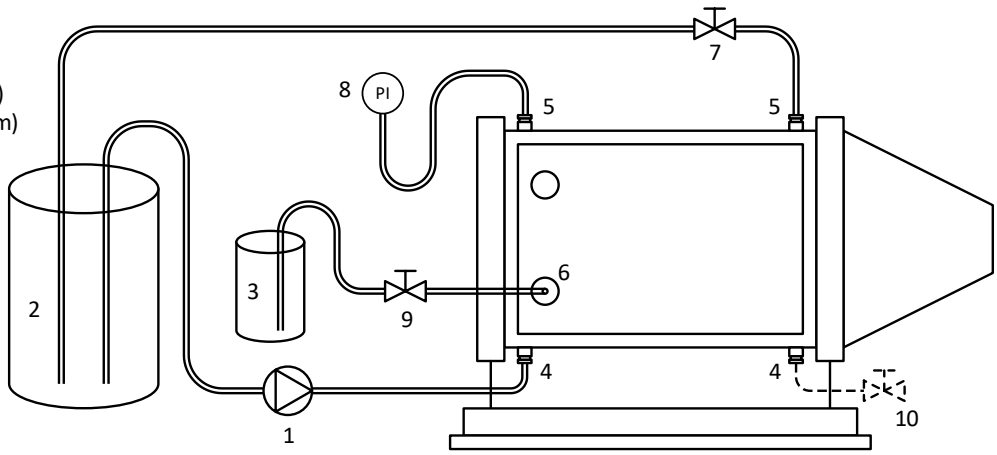
- Severe personnel injury ⚠ **WARNING**
- Damage to the device ⚠ **WARNING**
- Malfunctions of the device **ATTENTION**
- Device failure **ATTENTION**

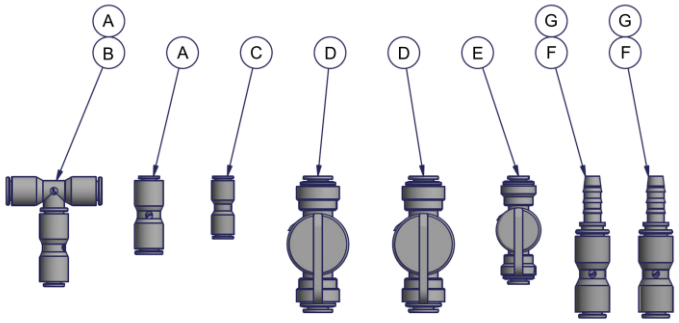
Only use accessories, consumables and spare parts that are in technically perfect condition. The use of accessories, consumables and spare parts **not** approved by SANI Membranes is the sole responsibility of the operator.

Assembly

The Vibro-Lab3500 can be configured in many ways. The standard configuration is shown in detail in section a. below utilizing the standard feed pump system from SANI Membranes. Several other examples are shown in the Operation section.

1: Feed pump
2: Feed / retentate vial
3: Permeate vial
4: Media inlet ports (8 mm)
5: Media outlet ports (8 mm)
6: Permeate port (6 mm)
7: Regulation valve
8: Manometer
9: Permeate valve
10: Optional drain valve





Fittings set included with the Vibro-Lab3500:

A: 2 off tubing connectors from 6 mm to 8 mm

B: 6 mm T-Piece with two female connectors

C: 6 mm tubing connector

D: 2 off 8 mm valves for regulation / drain

E: 6 mm permeate valve

F: 2 off tubing connectors from 8 mm to 10 mm

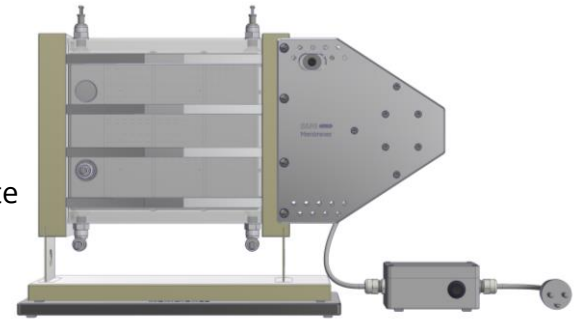
G: 2 off hose barb adaptors to 7 mm to 10 mm

Assembly of a system with the SANI Membranes feed pump for 0-1 bar batch MF/UF

1. Connect all fluid connections with flexible tubing:
   a) Place a pump tubing from the feed/retentate vial (2) through the feed pump (1)
   b) Use a hose barb adaptor (G) to connect the feed pump outlet tubing
   c) Connect a piece of 8 mm hard tubing from the adaptor to one of the media inlet ports (4)
   d) Connect the media outlet port diagonally opposite (5) to a regulation valve (7/D) using hard 8 mm tubing
   e) Connect the regulation valve to the feed/retentate vial (2) with 8 mm hard tubing
   f) Connect a manometer (8) to the second media outlet port (5)
   g) Optionally, connect a drain valve (10/D) to the second media inlet port. Alternatively, plug this mMedia inlet port with a blind plug.
   h) Use 6 mm hard tubing from the permeate outlet (6) to a permeate collection vial (3). Include an on/off valve (9/E) on this tubing. The valve should always be open, except during storage of the unit.

The system above can also be used for continuous filtration by collecting the retentate in a separate retentate reservoir.

Assembly and removal of the Vibro-Lab3500 Drive



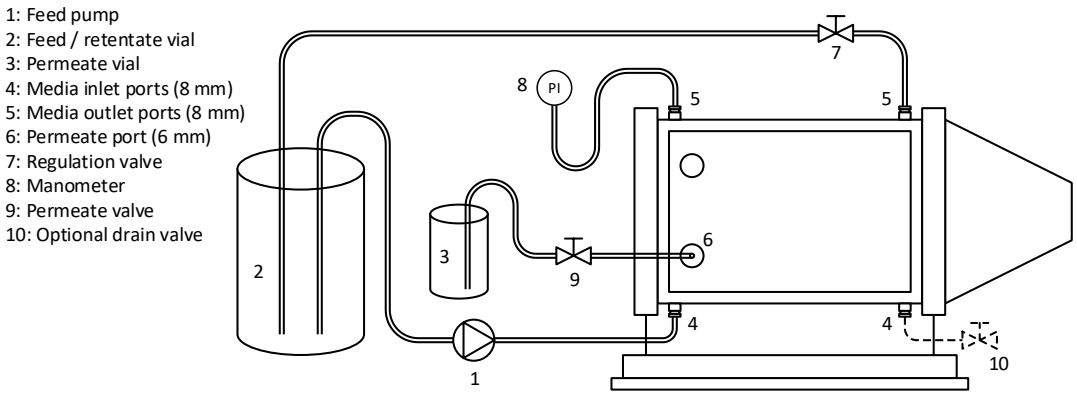
1. Assembly of the Vibro-Lab3500 Drive
   a) Place the membrane assembly on a table resting on chamber side 1 with the base plate outside the table perimeter
   b) Place and align the Vibro-Lab3500 Drive on chamber side 2
   c) Put the 4 bolts in and tighten them

2. Removal of the Vibro-Lab3500 Drive
   a) Place the Vibro-Lab3500 on a table resting on chamberside 1 with the base plate outside the table perimeter
   b) Remove the 4 bolts connecting the motor to chamber side 2
   c) Remove the Vibro-Lab3500 Drive

Operation

Introduction

The Vibro-Lab3500 is very simple to set up and operate. SANI Membranes offers a standard peristaltic feed pump but it can be used with other suitable pumps or feed systems.



The membrane chamber is filled by feeding media carefully through the media inlet port (4) with the regulation valve (7) and permeate valve (9) open.

Start the Vibro-Lab3500 Drive when the chamber has been filled with media, before applying pressure. Turn off the Vibro-Lab3500 Drive before draining the chamber for media. Severe fouling will occur if you stop the Vibro-Lab3500 Drive while running with pressurized media in the chamber.

The pressure is regulated to the desired operating pressure by adjusting the regulation valve (7). The term “transmembrane pressure” (TMP) is often used for membrane systems. It is an

average of the pressure difference along the membrane. Using the Vibro® technology, these conditions are very uniform. With the permeate open to ambient pressure a single pressure at the feed inlet or at the retentate outlet is sufficient to define the process. Still, we use the term “transmembrane pressure”.

General guidance for operation of the membrane system:

- Avoid operating the unit at excessive flux leading to fast and often irreversible fouling of the membranes
- Optimal transmembrane pressure for microfiltration is often in the range 0.05 - 1 bar
- Optimal transmembrane pressure for ultrafiltration is higher, typically 1 - 3 bar

The anti-fouling effect does not depend on the retentate flow but is controlled by the vibrations. However, a certain retentate flow should be applied to avoid a dead-end filtration and to keep the liquid moving around in the system. Typically, a retentate flow rate of 100-200 L/h will be sufficient for dilute liquids. For more concentrated liquids the flow rate may be increased and a mix-flow can be set up if needed (see later examples of process configurations)

When the filtration process is finished, the regulation valve (7) is opened again and the system is drained for retentate and permeate. The system is now ready for cleaning with an appropriate CIP protocol for your membrane and application. Remember to CIP the drain and manometer hose as well.

For storage, fill the system with an appropriate storing solution.

Before using a new membrane with product it should be prepared for use. New membranes are provided with a protective layer of water-soluble glycerin and / or preservative solutions that should be removed before first use. This is done by flushing the membrane for 30 minutes with clean hot water (50-55 °C). Do not recirculate the water but lead both the retentate and the permeate to drain. After this rinse it is recommended to perform a CIP cycle

and finally to measure the clean water flux of the new membrane. This value is used as a benchmark for evaluating the efficiency of the CIP regime after each production.

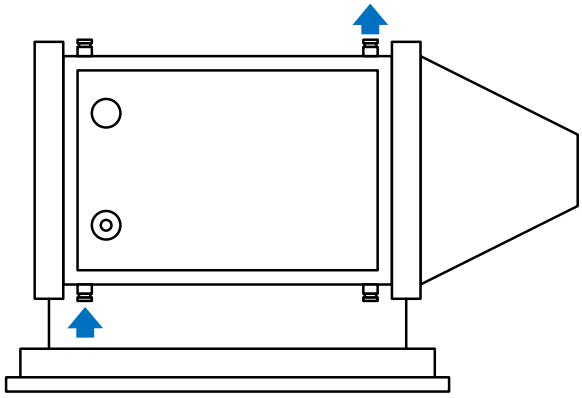
Attention:

Organic membranes must never be allowed to dry out after initial wetting.

Attention:

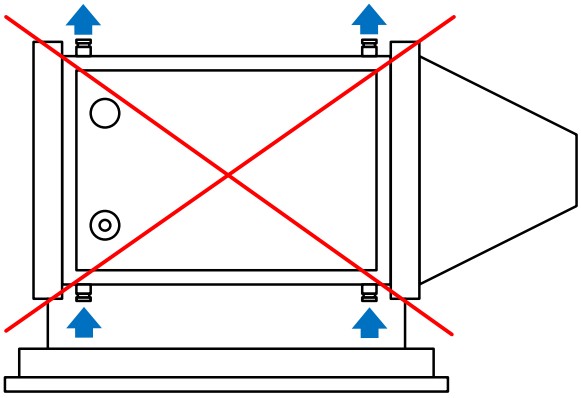
Always maintain a positive trans membrane pressure when operating Your Vibro-Lab3500.

Permeate outlet (5) must be kept open when the unit is in operation.



Always run the feed flow across the membrane element

(a mix flow could be added to optimize the flow path further)

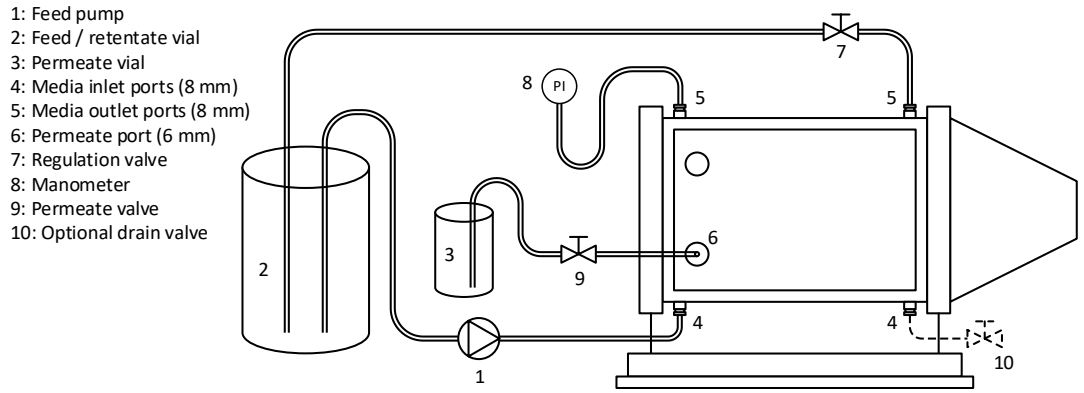


Never run the feed flow alongside the membrane element

General guidelines – process

1. Maintain a positive trans membrane pressure (min 0.02 bar) when vibration mode is on and keep the permeate valve open at all times.
2. Maintain a retentate flow to avoid dead-end type filtration. The minimum retentate flow is highly application dependent.
3. Operating Pressure: 0-3 bar(g) at 5-35 °C and 0-1 bar(g) at up to 55 °C
4. When filtering media with high viscosity or high solids load a mix flow of at least 200 l/h can be established from corner to corner (orthogonal to the feed/retentate path) to avoid severe fouling. (see later examples of process configurations)
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. Keep the flux low by applying a minimum membrane pressure.
8. As an option, a second peristaltic pump can be used to control the permeate flow during microfiltration and hereby limit the flux.

Batch MF/UF filtration with the SANI Membranes standard feed pump



1. Start with a fully assembled and drained Vibro-Lab3500 system as shown above with all valves closed.
2. Fill the feed/retentate vial(2) with your feed solution.
3. Open the regulation valve (7) and the permeate outlet valve (9).
4. Fill the membrane chamber by slowly starting your feed pump (1). Follow the filling of the membrane chamber visually.
5. When the membrane chamber is full Start the Vibro-Lab3500 Drive.
6. Start collecting permeate in a suitable vial (3).
7. Measure the retentate flow and adjust the feed pump (1) speed to give the desired retentate flow (typically of 100-200 l/h)
8. Adjust the regulation valve (7) to the desired operation pressure.
9. Repeat step 7 and 8 as required (the retentate flow will be reduced due to the increased permeate rate and due to increased flow resistance for the pump).

10. Measure the permeate rate at intervals and note the volume reduction in the feed/retentate vial(2) to calculate the concentration. The system volume of the retentate side of the system is approximately 500 ml.
11. As the liquid is getting more concentrated the pressure and retentate flow may change. Repeat steps 7 and 8 from time to time to ensure that the process parameters are controlled.
12. When the desired volume reduction is reached the experiment should be stopped.
13. Open the regulation valve (7), stop the feed pump (1) and the Vibro-Lab3500 Drive.
14. Empty the system into the feed/retentate vial (2) by reversing the feed pump (1). Note: The retentate tube should be above the liquid to let air into the membrane chamber.
15. Remaining liquid in the membrane chamber can be drained by opening the optinal drain valve (10).
16. Clean the system with the appropriate CIP protocol for your membrane and application, see separate section about CIP Operation below.
17. Always finish by filling the system with an appropriate storing solution for your membrane and application, see separate section about storage of membranes below.

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.

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.

For each cleaning step ensure that liquid flows through the permeate line. This is done by closing the retentate valve slightly to generate sufficient membrane pressure. As the membranes gets more clean the permeate flow increases and the retentate pressure may be reduced.

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

1. A 55 ºC hot water flush to warm up the system before CIP.
2. A 30 min 55 °C caustic wash at pH 11 with an appropriate CIP chemical.
3. A water flush to replace the caustic liquid
4. A 15 min 55 °C acid wash at pH 2 with an appropriate CIP chemical
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.

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 wetted, 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.

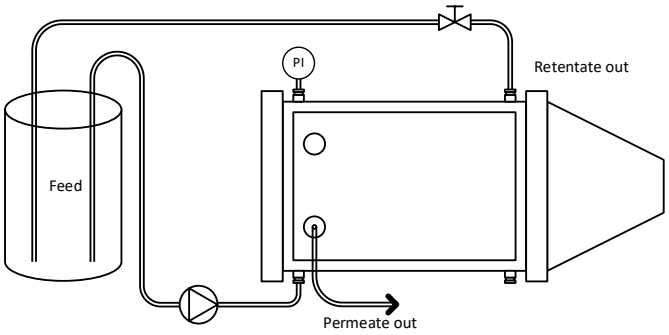
When preparing the membrane module for storage it is important to evacuate the permeate compartment from air. This is best done by recirculating the storage solution at a pressure suitable for the given membrane until air does not appear in the permeate outlet. Once the membrane module is evacuated from air all valves should be closed off. Unused ports should be closed by plugs.

Examples of process configurations

The system can be configured and operated in a number of 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.

In the following a number of other configurations are listed along with a brief description of the main purpose of each one.

Batch mode membrane filtration



- Simple configuration using a pump (eg. a peristaltic pump) to feed the media into the membrane system
- Feed flow and membrane pressure is regulated with the feed pump speed and the regulation valve
- The concentrated medium is collected in the feed container
- Note:
  If the feed pump can deliver more than 3 bar(g) a safety valve at max. 3 bar(g) must be included on the feed line to protect the membrane module

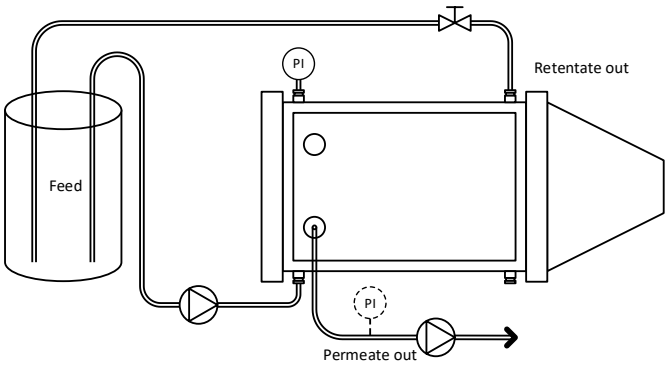
Batch mode microfiltration with permeate flow control

- For microfiltration applications that require low, uniform transmembrane pressure an additional pump can be added to control the permate flow
- Feed flow and membrane pressure is 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

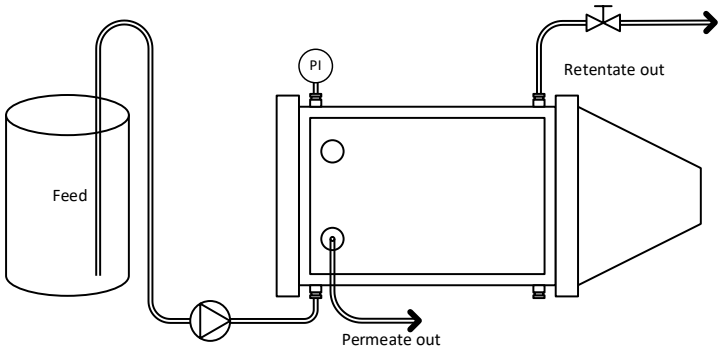
  An additional manometer for the permeate is recommended to measure the transmembrane pressure

  If the feed pump can deliver more than 3 bar(g) a safety valve at max. 3 bar(g) must be included on the feed line to protect the membrane module



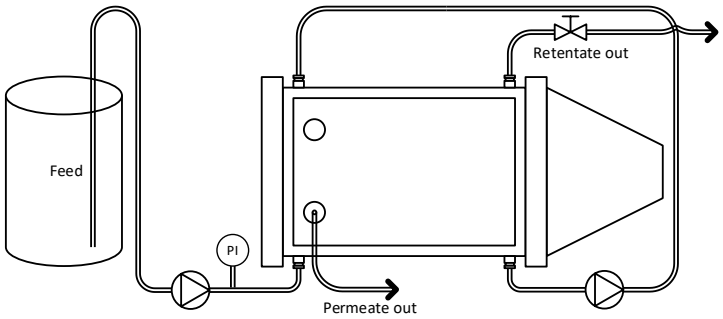
Continuous single-pass membrane filtration using the standard feed pump

- Standard configuration using a pump to feed the media into the membrane system
- Suitable for viscosities up to 'cream' level.
- Feed flow and membrane pressure is regulated with the feed pump speed and the regulation valve
- The concentration factor is achieved by adjusting the retentate flow rate relative to the permeate flow rate
- Notes:
  Risk for severe fouling for some high fouling applications
  If the feed pump can deliver more than 3 bar(g) a safety valve at max. 3 bar(g) must be included on the feed line to protect the membrane module



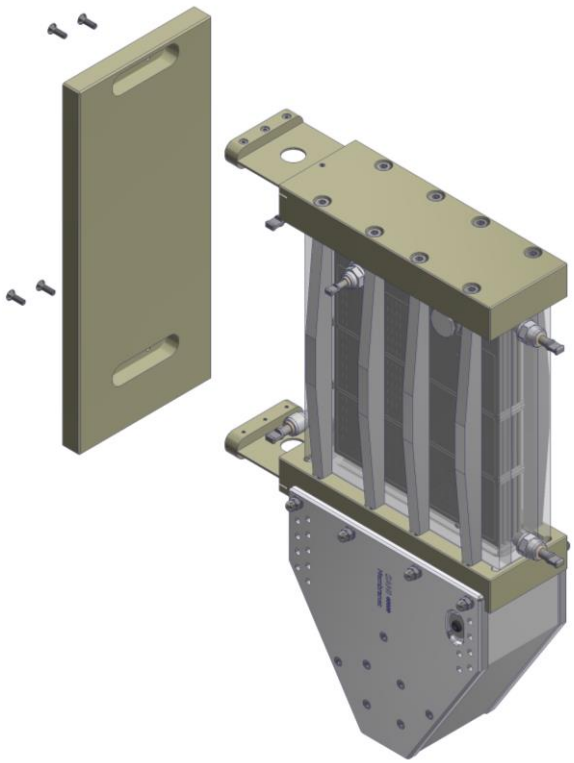
Continuous membrane filtration using standard the standard feed pump and a Mix Flow pump – high solids or high viscosity

- The previous configuration combined with a Mix Flow loop to keep the concentrated liquid in the Membrane Module flowing
- Configuration suitable for high viscosity or high solids load
- Feed flow and membrane pressure is regulated with the feed pump speed and the regulation valve
- The concentration factor is achieved by adjusting the retentate flow rate relative to the permeate flow rate
- Notes:
  Risk for severe fouling for some high fouling applications
  If the feed pump can deliver more than 3 bar(g) a safety valve at max. 3 bar(g) must be included on the feed line to protect the membrane module



Membrane exchange and storage

Disassembly of the membrane assembly

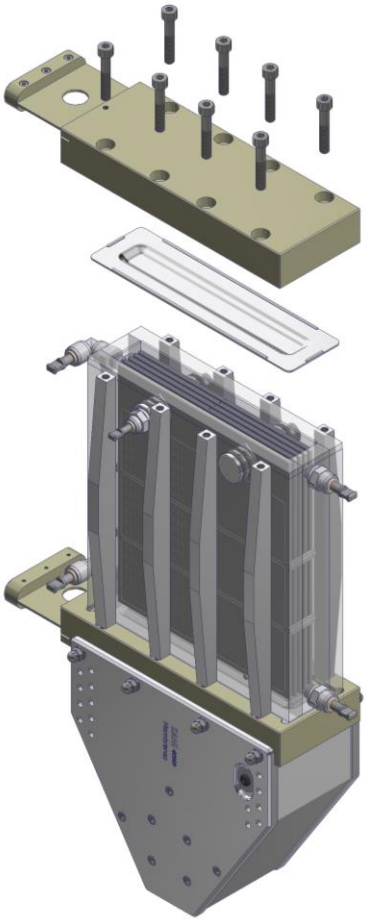


Attention: The membrane surface is extremely fragile. Do not touch the membrane surface at any time.

1. Start with a cleaned and drained system with all tubing's disconnected.
2. Turn the Vibro-Lab3500 90° with the permeate outlets upwards and standing on the Vibro-Lab3500 Drive. Be careful that it does not tumble (alternatively – remove the Vibro-Lab3500 Drive first for a more stable unit)

Removing the base plate (see also illustration to the right):

3. Remove the 4 M5 allen bolts securing the membrane assembly from the backside of the base plate and release the base plate from the membrane assembly.

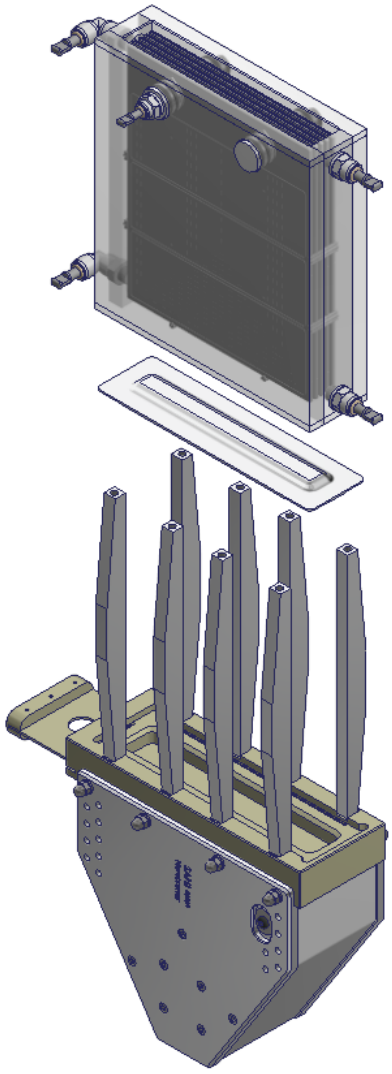


Remove the chamber side 1 (see also illustration to the left):

4. Remove the 8 M8 allen bolts from chamber side 1.
5. Remove chamber side 1 from the membrane assembly.
6. Remove the air cushion gasket between chamber side 1 and the membrane module.

Remove the membrane module (see also illustration to the right):

7. Slide the membrane module out of chamber side 2.
8. Remove the air cushion gasket between chamber side 2 and the membrane module.
9. It is recommended to remove the fittings from the media inlet/outlets and from the permeate outlet before storage.



10. You can choose to store the membrane module in a larger container with preservation liquid. Position the membrane module with the permeate outlets upwards to allow air from permeate chamber to be evacuated. See section **c** below.

Assembly of the membrane assembly

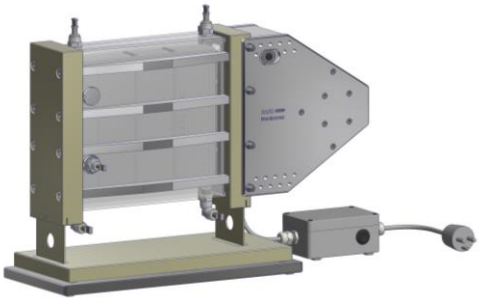
Attention: The membrane surface is extremely fragile. Do not touch the membrane surface at any time.

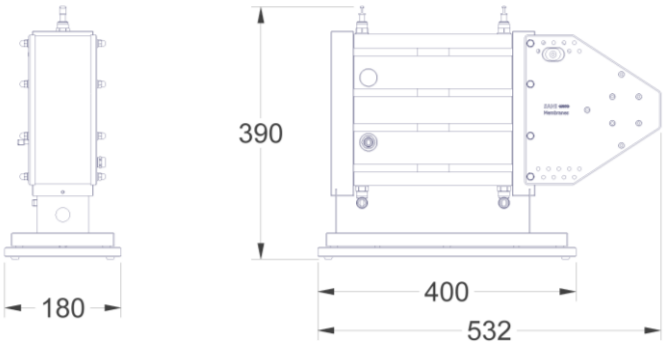
1. Start with cleaned and dry parts.
2. Mount all fittings on the membrane module
3. Place the Vibro-Lab3500 on the Vibro-Lab3500 Drive and be careful that it does not tumble (alternatively – on chamber side 2 with the Vibro-Lab3500 Drive removed)
4. Put an air cushion gasket in chamber side 2. Make sure that the built in o-rings are aligned with the groves in the chamber side.
5. Carefully slide in the membrane module in the correct orientation while making sure that the air cushion gasket is in place.
6. Place an air cushion gasket inside the chamber side 1 and carefully position this on top of the membrane module. Observe that the chamber side 1 is placed with the leaf spring crevice in the correct orientation.
7. Put in the 8 M8 allen bolts and cross tighten them very carefully (1st corner ,3rd corner, 2nd corner, 4th corner, etc.) until they are all finger tight (It is hard to tighten with only your little finger 5 cm out on a standard allen key).
8. Slide the baseplate onto the leaf spring feet and secure the base plate to the membrane assembly with the 4 M5 allen bolts.

Storage of used membrane modules

The membrane module (membrane chamber with HPL membrane element and permeate outlets) can be exchanged fast and easily with another HPL membrane module. The used membrane module can be stored in a container with preservation liquid (for instance 0.1 N NaOH, 20% ethanol or 20% isopropanol) until next use. It is recommended to remove all fittings before storing. It is crucial to evacuate all air in the permeate compartment by placing the permeate outlets upwards in the preservation liquid container.

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
Membrane	0.35 m^2 HPL element
Internal Retentate volume	700 ml, fully drainable
Internal Permeate volume	170 ml, fully drainable
Operating Pressure	0-3 bar(g) at 5-35 °C and 0-1 bar at up to 55°C
Temperature Range	5–55 °C
Vibro-Lab3500 Drive	Electric
Power Consumption	230V, 40W excl. feed system
Noise Level	50-65 dBA

Vibro-Lab3500 Accessories and Spare Parts

Standard feed pump, 0-1 bar(g)	Peristaltic feed pump including pump tubing
Mix Flow pump	Peristaltic Mix Flow pump including pump tubing
Accessory set	2 air cushion gaskets, manometer, tubing and all necessary fittings
Fittings set	4 media inlet/outlet fittings and 1 permeate outlet fitting

Membrane Module Data

Membrane module	HPL membrane element mounted in a PVC housing including permeate channels, 4 media inlet/outlet fittings and 1 permeate outlet fitting
HPL membrane element	Free Flow Plate™ laboratory element, fused polypropylene with the selected membrane
Membrane type	Most organic micro- and ultrafiltration membranes
Membrane area	0.35 m^2
Dimensions (L x W x H)	256 mm x 76 mm x 234 mm (excluding fittings)
pH Range	1-13, membrane dependent

Free Flow Plate Laboratory Element (HPL) 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	0.2 µm, 0.45 µm, 1.0 µm	PES, PVDF, hydrolphilic PTFE

The HPL can be equipped with your membrane of choice. SANI Membranes have a line of standard MF and UF membranes from Synder Filtration, Microdyn-Nadir and others on stock. Most commercially available membranes can however also be used with the HPL. Please, do not hesitate to contact us with your membrane wishes.

Conformity

The Vibro-Lab3500 system is CE marked to demonstrate compliance with relevant regulations including the European Machine, Electrical and Pressure Directives.