

# LARGE FILTRATION UNIT

## Operating instructions

REV No.	DATE	DESCRIPTION	EDITED	CHD.	APPD.
1.0	20.2.2020	Initial version	SRa		
1.1	16.6.2020	Piston head instructions revised	SRa		
1.2	18.6.2021	Piston head instructions revised	SRa		

## Large filtration unit

There are two filtration units in the Fibre Spinning lab, Room 261. These instructions are for the bigger, automated filter press. This unit is equipped with several safety features, a changeable piston, adjustable piston pressure and speed, plus other optional functions and features.

The filter press has three main panels (See Figure 1), which are used to control or to monitor the filter press. On the left-hand side is the Heating Panel that has gauges for pressure & temperature (at the time of writing). To change the values, use up and down arrows and confirm with set.

On the right-hand side, there is the Control Panel, which is used to control the piston. On the lower right-hand side, there is the Vacuum Panel, which is at the time of writing not in use.

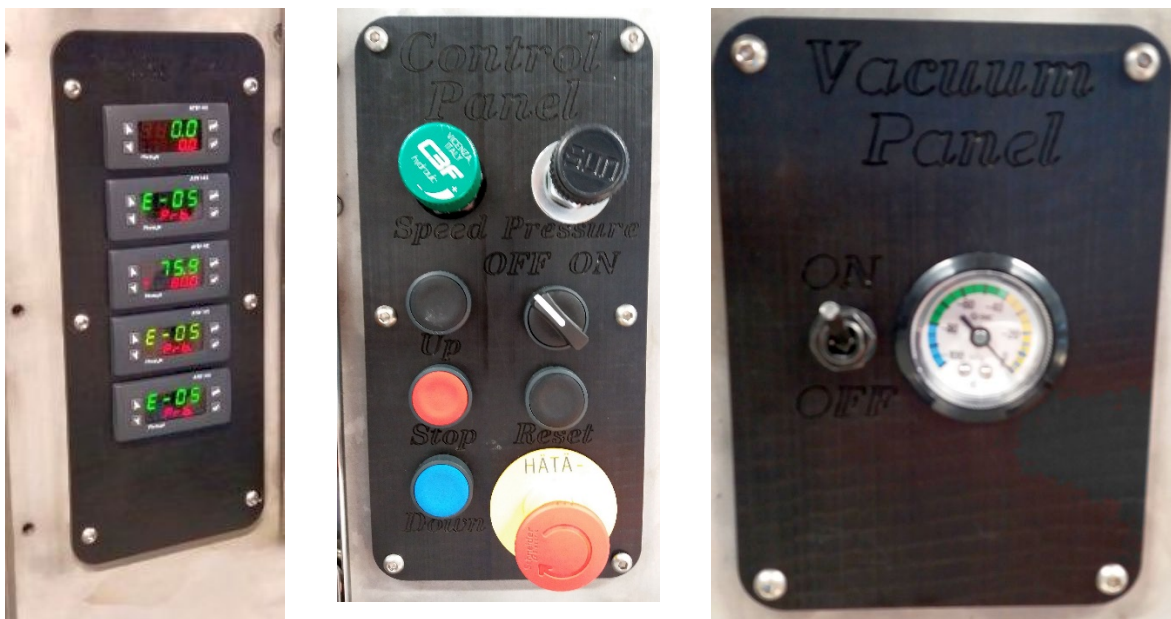
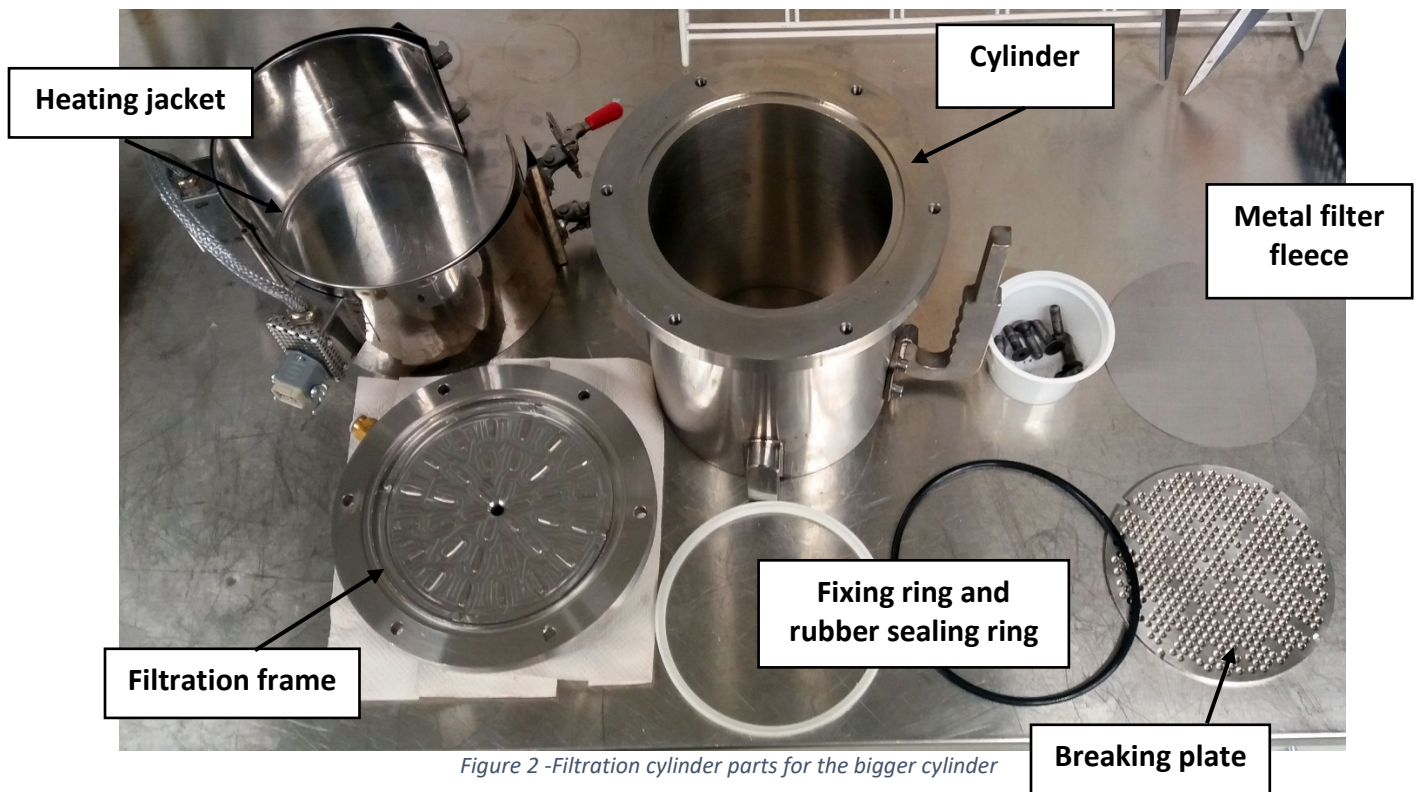


Figure 1 – Filter press panels

## Filtration Unit Parts

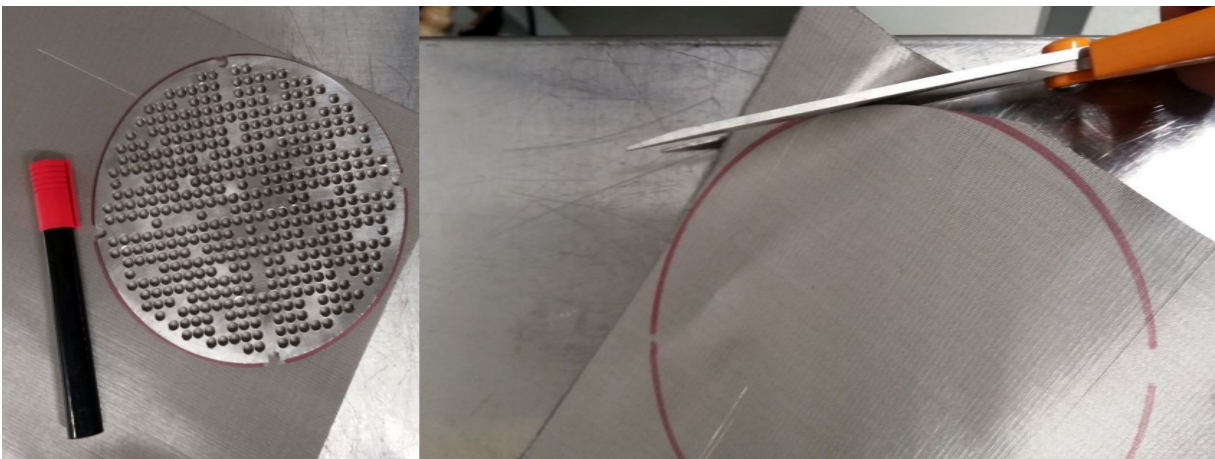


There are at the moment two different filtration cylinders (and pistons) for the big filtration unit. They differ in volume and in the pressure attainable using the filtration unit. Assembly of the bigger cylinder is depicted in Figure 2.

### Preparations

Before assembling the unit, you will need to cut the actual filter for it. The filters are cut from bigger metal filter fleece sheets. There might be pre-cut or smaller sheets in cabinet J3. **Make sure you are using the right filtration material!** Majority of the filtration is done using multi-layered GDK Ymax2 metal filter.

Rolls with the filter materials are stored in ABio -hall shelf, next to the stairs up to the balcony (technical staff). The shelf is labelled. It is a good practice to at least draw the outlines on the whole width of the roll, minimizing the waste.



*Figure 3 -Metal filter fleece cutting.*

You may use the breaking plate as a template (Figure 3). Use the bigger pair of **general use** scissors from Spinlab to cut the material. Cut along the inner curve of the markings, making it a bit smaller diameter. Trim accordingly.

## Changing the piston

Replace the piston on the filtration unit to match the cylinder to be used. The pistons are heavy, so be careful and use the lifting unit (Figure 4) for support.

The pistons have inner threads for twisting onto the threaded driving shaft. Make sure the threads are aligned. Rotate the piston all the way clockwise to fasten, counterclockwise to detach. There is no need to (over)tighten the piston by rotating, but it needs to reach as far as it goes.



Figure 4- Pronomic lift

The larger piston has one hex bolt on the surface side of the Teflon plate (See Figure 5). It is by design a bit loose to allow the plate to move vertically, reducing negative pressure when lifting the piston after filtration. Make sure the end of the bolt is level with the plate - it does not protrude from the surface nor is it inside the plate.





*Figure 5 - Large piston*

## Assembling the filtration unit

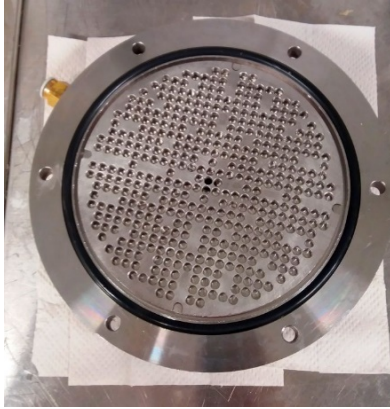
Always check the bolts before using them. If there is evidence of rounding, replace with a new one (Cabinet G2). The replacement bolts may be in storage oil, so wash and dry before installation.

Use thermal grease (Cabinet G2) on the bolt threads.

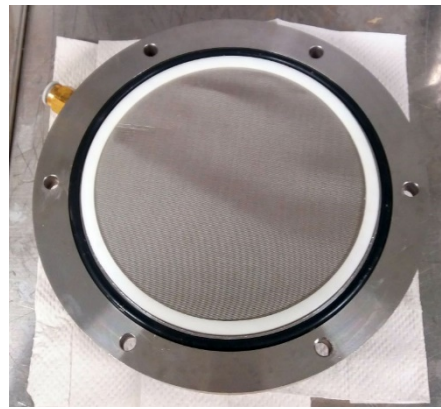
When tightening or opening the bolts, make sure the hex key is entirely inside the hex opening. Preferably use the torque wrench for tightening (15 Nm), holding the bit in place with one hand.

## Larger cylinder

a.



b.



c.



d.



Figure 6 - Assembling steps for larger cylinder

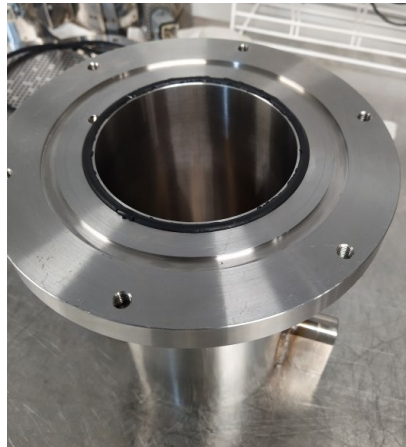
First place the sealing O-ring and the breaking plate on the filtration frame (Figure 5a). Place the cut metal filter fleece on top of the breaking plate with the finer side up. Fix it in place using the fixing ring (Figure 5b). Slide the heating jacket over the cylinder, minding the orientation, and secure it (Figure 5c) with the clamps.

Turn the assembled filtration frame and slide it carefully over the cylinder, making sure the parts do not fall. Secure with bolts, tightening it gradually from opposing sides (Figure 5d).

## Medium sized cylinder

The medium size cylinder has one extra O-ring and its own heating jacket. It uses the same bottom plate as the bigger one.

*Figure 7 - Small cylinder with O-ring attached*



First place the sealing O-ring and the breaking plate on the filtration frame (Figure 5a). Place the cut metal filter fleece on top of the breaking plate with the finer side up. Fix it in place using the fixing ring (Figure 5b).

Slide the heating jacket over the cylinder, minding the orientation, and secure it with the clamps.

Install the O-ring on the cylinder. Turn the assembled filtration frame and slide it carefully over the cylinder, making sure the parts do not fall. Secure with bolts, tightening it gradually from opposing sides.



## Preparing for the filtration

Due to the weight of the filtration cylinder, a lifting unit (Figure 4) is used for the transfers. Move the Pronomic lift next to the worktop you have the assembled and upright filtration cylinder on. Adjust the height from the controller so, that the top of the grabbing jaws is level with the bottom plate (see Figure 4). Carefully slide the cylinder on the jaws. Move the assembled filtration unit to the filtration unit.

Figure 8 – Heating up the filtration unit



The cables are on the left-hand side of the filter press. Connect the one labelled “Filter” to the heating jacket.

You turn on the filter press from the main switch located on the right side of the unit. When the main power is on, all the sensors will activate. In addition, the heating jacket will start to heat immediately, according to the set temperature on the temperature gauge (See Figure 6). Default temperature is 80 °C and it takes around 30 minutes to reach it.

**Please use the fume extractor!** You can position it so that you can still operate the safety door.

Using too cool cylinder may cool down the dope and eventually affect the filtration speed!

## Filtration



*Figure 9 – Installing the filtration unit*

Transfer the prepared spinning solution into the pre-heated cylinder. Make sure both latches are in open position – moved to their outer positions.

Raise the filtration cylinder with the lift so that the wings are above the front edge of the support brackets. The cylinder needs to be aligned perpendicular to the brackets and vertically up straight. Push the cylinder in so that the wings rest against the bracket back edge (See Figure 7). Now lower it so the wings slide down inside the brackets and rest on them.

Lock the unit in place by moving both latches to inner position. Make sure they are all the way down.

Slide the plastic safety door all the way down, minding the temperature sensor socket. The door needs to be all the way down to engage the safety switch. Align the active fume extraction snorkel above the filtration unit.

Turn the piston control on from the Control Panel by turning the switch ON. Press the reset button. You should hear a hum start. If not, check the latches and safety door.

Place a clean plastic sheet beneath the extrusion hole to collect the filtered solution. Now that everything is set up, you can start filtering by pushing the down button once. This will start the piston to descend and the actual filtration.

You can change the piston velocity and pressure from the console during the process. Let the system run until no more solution is extruded.

**Handle the filtered spinning solution like you would any hot material.**

Collect a small sample for rheology in a piece of plastic sheet. Actual measuring sample size is around 0.5 ml - a disc with a diameter of 25 mm and thickness of 1 mm. Ideally you flatten out the solution when preparing the sample. Wrap the rheology sample airtight in Parafilm.

Collect the filtered solution and shape it accordingly. While shaping, keep the plastic taut to prevent it being trapped inside the solution. Still hot solution will deform.

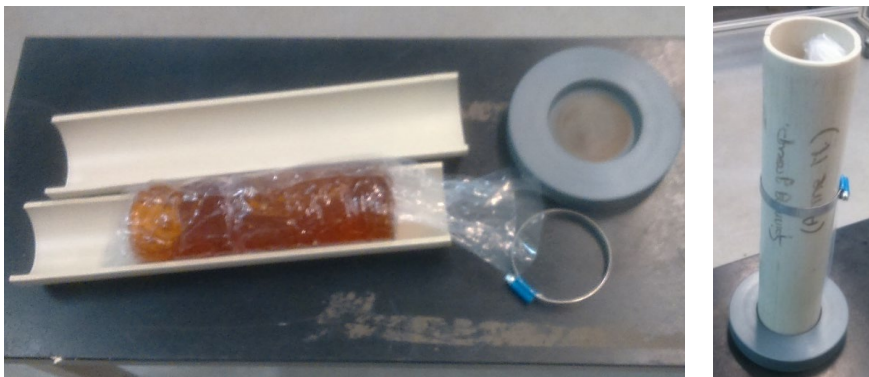


Figure 10 – Spinning solution in a mould for KS42

Keep in mind the dimension of the target spinning cylinder, shaping the solution smaller. Moulds, specific for each unit, are available (E.g. Figure 8).

Protect the solution from picking up humidity. When using Parafilm, keep in mind that too hot solution will melt it.

Label both the packed rheology sample and actual solution, preferably with a printed sticker, using the following format:

D\_<percentage of cellulose>%\_<YYMMDD>.<running number>\_<First letter of first name><First two letters of surname>

For example a second spinning solution or dope prepared on January 19<sup>th</sup> 2020, with **13** weight percentage of cellulose, prepared by Jukka **E**pistola would be labelled D\_13%\_200119.2\_JEp

Leave the mould containing the solution in the refrigerator to cool down. After solidification you can remove and return the mould back to the laboratory.

## Cleaning up and finishing

Use temperature protective gloves for handling the hot parts. Water will regenerate the spinning solution. Don't unnecessarily expose the bolts to water, dry if needed.

Use the control panel to **raise the piston all the way up** as far as it goes, by holding the UP button. Turn the **control panel switch OFF**. Turn off the filtration unit from the **main switch**.

**Open the safety door** all the way up. Open the **locking latches** by moving them all the way to outer sides. **Disconnect** the heating jacket **cable** and replace in the holder.

**Remove the cylinder** from the frame using the lift. Transfer the cylinder for cleaning near to a sink.

**Make sure the piston has not spun open during the filtration process – twist close if need be.** **Clean the piston** using wet paper towels.

Disassemble the filtration unit: **Untighten the bolts in similar fashion as when assembling the unit. Do not use a torque wrench for opening!** Detach the bottom plate from the main cylinder and bring both parts under cool running water in a sink.

Use a brush to clean the cylinder walls under running water. Wipe with moist paper towel to remove all the cellulose film sticking to the walls.

Remove the o-gasket on the bottom plate. Remove the fixing ring. Detach and dispose of the metal fleece filter. Remove all spinning solution with water and moist paper towels.

**DO NOT pry the breaker plate away as it will damage the frame.** Use one of the two screws in the filtration unit tool basket – screw it in one of the two holes with threads on the breaker plate. This will detach the plate from the bottom plate frame. Remove all traces of cellulose and solution leftovers.

Leave the parts to dry on top of the metal table (Table J) on top of a dishcloth or paper towels.

Return used tools to the basket. **Return the lift next to the filtration unit** and leave it to charge if need be (See Charging the lift).



## Charging the lift

In case the lift needs recharging, the Pronomic charger is stored in Cabinet G2 (See LABMAP). Plug in the charger and the connector in the back of the lift. There is a wall socket behind the filtration unit. Charging the battery takes overnight. Take the charger back after use.

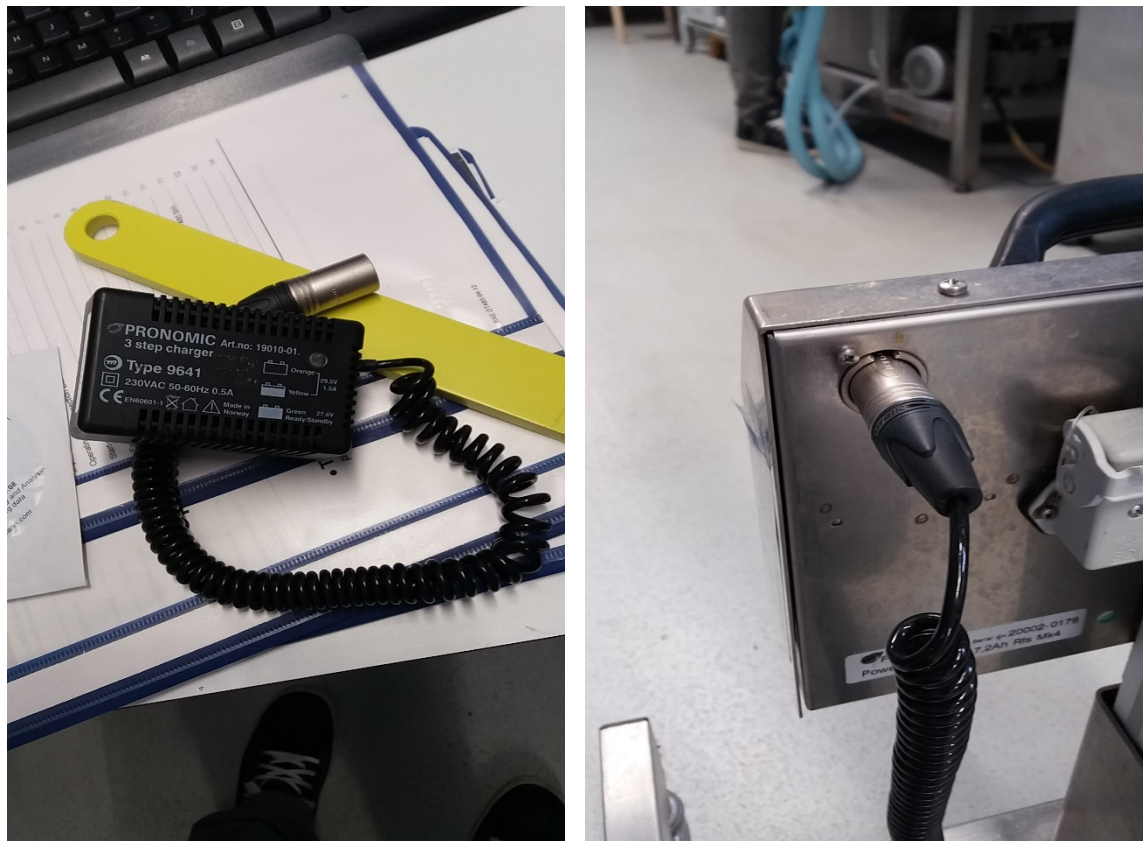


Figure 11 - Charging the lift