



SMALL KNEADER

Operating instructions

REV No.	DATE	DESCRIPTION	EDITED	CHD.	APPD.
1.0	7.8.2020	Initial version	SRa		
1.1	15.2.2023	Updated images	SRa		

SAFETY

You should always plan your work before starting and go through all the safety issues involved. A risk analysis may be required, consult your supervisor or technical staff. Read through the material safety datasheets (MSDS) and use appropriate safety equipment and procedures.

Read carefully through the instructions. If something is left unclear, always ask for further instructions. You are responsible for the safety of yourself, the equipment, and others in the vicinity.

Label clearly and store your samples appropriately. Minimum information for labels is full name, contact information, date, and chemical contents.

The system involves low vacuum, rotating parts, dust or other small particles, and high temperatures. Be careful of chemical residues before and after the process. Clean and dry the parts thoroughly after your work!

Small Kneader

There are two kneaders, basically heated blade agitators, in room 261. The smaller unit is equipped with two different types of cylinders, adjustable agitation speed, interchangeable blades, with the possibility of using vacuum and heating.

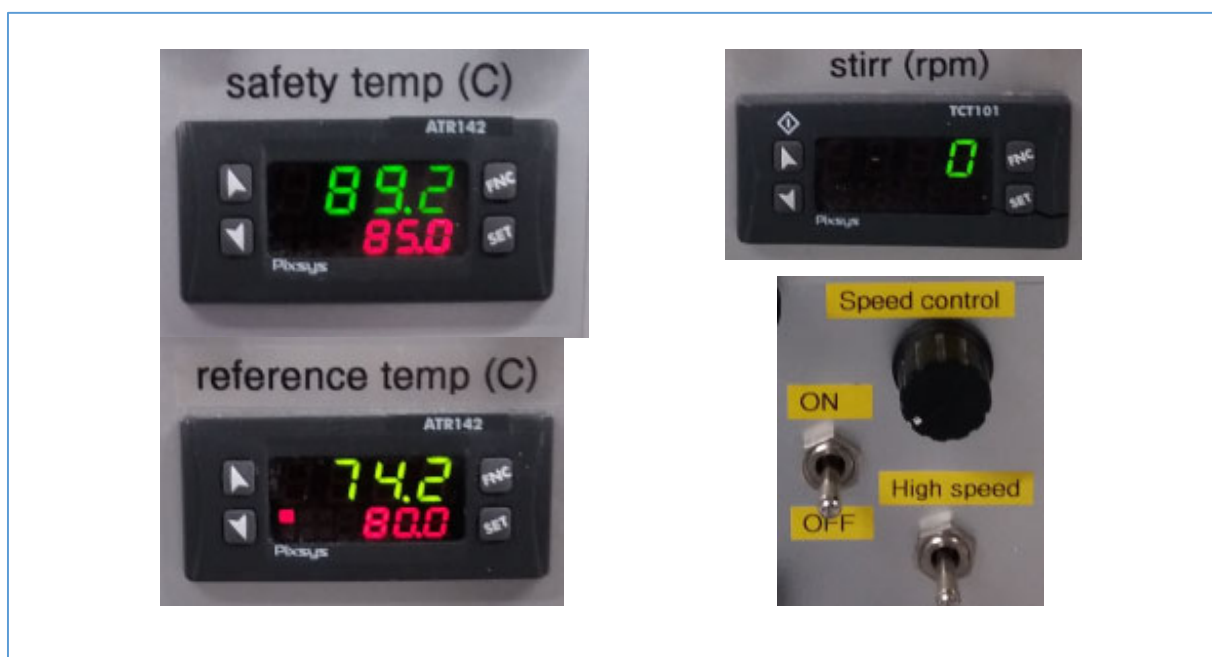
Image 1- Small kneader installation



Level of vacuum is adjustable to an extent, vacuum pump allowing system vacuum down to ~ 1 mbar. Either a jacketed glass cylinder with external temperature control or a metallic cylinder with heating elements can be used. Unfortunately, there is no temperature sensor for actual reactor temperature.

The main panel for the kneader has three control panels: *Safety temp(erature)*, *Reference temp(erature)* and *stirr(ing speed)*. The temperature values can be adjusted with the use of the arrows (left hand side). Additional controls are for the agitator: dial knob for **speed control**, **ON/OFF** switch and **High speed** selection switch.

Image 2 - Main panel controls



Preparations

The cylinder you will be using will define how you need to set up the system. The cylinders are held in place in separate, swivelling holders permanently fixed to the kneader system.

The metallic cylinder is detachable, and fits inside the fixed heating element on the left side. Reference temperature is measured from the bottom of the cylinder, inside the heating element. Safety temperature is measured from the heating element.

The glass cylinder can be connected to a stand-alone heating unit. Temperature control is done through this unit, so the temperature value shown on the control panel is not valid in this case. The cylinder has its own polycarbonate support on the right side.

NOTE! The electronic heating element power connector needs to be detached from the control panel if not using the metallic cylinder.

Setting up

Power on the cooling unit (See Image 3) from the mains switch at the back of the unit. It will flash lights on the control panel, while running a diagnostic program, after which you can start the cooling with the ***RUN/STOP*** button. This will cool down the column capturing exhaust gases from the kneader cylinder, protecting the vacuum pump. **It must reach the set temperature (5 °C) before operating the vacuum pump!**

Image 3 - Cooling unit / control panel



Power the main panel from the mains switch located behind the panel. This will power the **heating element for the metal cylinder (if attached)** and the vacuum gauge. Set the Reference temperature and Safety temperature appropriate for your process needs.

Preferably close the reactor while heating up the system to ensure the mixing blade is heated as well.

Processing

After reaching appropriate temperature, you can fill the reactor with the materials to be processed. Effective filling volume is around **25 millilitres**. **Overfilling may block the vacuum lines, lead to possible breakages, and require maintenance.**

Note that elevated temperature and a low vacuum may remove water or other volatiles during the processing, in addition of degassing. **Try to impregnate powdery/fluffy materials to minimize solids being sucked into the vacuum lines.**

Ensure the gasket/O-ring is in place on the cylinder top. Move the cylinder support up - closing the gap between the reactor and cylinder. Attach the appropriate clamp (one for each cylinder) tightening the flanges together - ensuring airtightness.

If vacuum is required, use the vacuum pump. Close the green pressure relief valve before turning on the pump (See Image 4). Adjust the valve to adjust the attainable vacuum level (50-60 mbar is one recommendation).

Image 4 - Vacuum pump power switch



Turn on the agitator by using the *ON/OFF*-switch. Adjust agitator speed shown on the display with *Speed Control* knob. Using the *High-speed* switch will scale up the speed settings.

When appropriate mixing time has passed, turn off the agitator and vacuum pump, release the vacuum by opening the green valve. Remove clamp and open the reactor. Turn off the main panel to stop the heating.

Cleaning

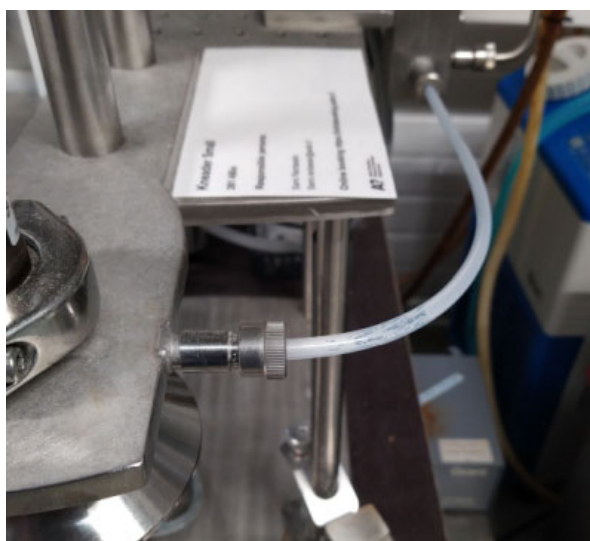
Use appropriate solvents for cleaning the parts, removing all residues. Failing to do this may influence others' work, in worst case causing unpredicted chemical reactions.

Water is often more than sufficient for removing cellulose dissolved in ionic liquids.

The blade is detachable (use the hex key in the basket next to the equipment) along with the PTFE support parts. Ensure there are no residues left between the support parts and top of the kneader, or in the vacuum lines.

You can unscrew the hose connector and use pressured air to remove moisture from the vacuum line between the cylinder and vacuum gauge! (See Image 5)

Image 5 - Vacuum line



After cleaning, dry up the parts. Leave the equipment ready to use for the following operator.