FOM
TECHNOLOGIES

FOM SLOT DIE HEADS

OPERATION & MAINTENANCE MANUAL

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1. Introduction

This document is the operation and maintenance manual for the standard FOM Technologies slot die head product line. FOM Technologies offers a wide range of highly precise, easy-to-use slot die heads. Our slot-die heads are precision milled, chemically treated, and painstakingly smoothed to provide outstanding reliability and accuracy for coatings ranging from tens to nanometers to hundreds of microns. When paired with our shim/meniscus guide bundles, FOM Technologies slot die heads provide easy, cost effective control of coating width from R&D experiments up to industrial production. FOM slot die heads and shim/meniscus guide bundles are readily available in a number of standard configurations, with custom sizing possible upon request. The following instructions show our standard "Small" slot die head as an example, but are generally applicable to all of our standard slot die head products. A summary of standard FOM slot die and shim/meniscus guide sizing is provided in the table below.

Table 1.1. A summary of standard sizing for FOM slot die heads and shim/meniscus guide bundles. Custom sizing is possible upon request.

Slot-die	Head width (cm)	Max. coating width (cm)	Std. shim sizes (cm)
Small	6.5	2.5	0.5
			1
			1.3
			2
			2.5
Medium	9	5	5
Large	14	10	10
XL	20	15	15

1.1. Slot die components

The slot die consists of the following components:

1. Front plate: the face through which the coating liquid is pumped from the supply tubing to the slot die's coating lip via the internal distribution channels.
2. Back plate: has the mounting features to match the mounting plate on the machine's slot die mounting gantry. Serves to secure the shim and meniscus guide in place by sandwiching them between itself and the front plate.
3. Shim: thin metal sheet with holes and features matching the back and front plates. Possesses a cut-out section along which the coating liquid will be guided internally downward towards the slot die coating lip.
4. Meniscus guide: thin metal sheet with holes and features matching the back and front plates. Possesses a small protruding 'tooth' feature along the edge which will face down towards the substrate.
5. Alignment pins (2): precision pins which ensure exact alignment of the shim, meniscus guide, front plate and back plate.
6. Securing bolts (4++): these secure front plate, shim (model dependent) and meniscus guide to the back plate.
7. Mounting bolt: holds the slot die head in place when mounted onto the slot die mounting gantry.

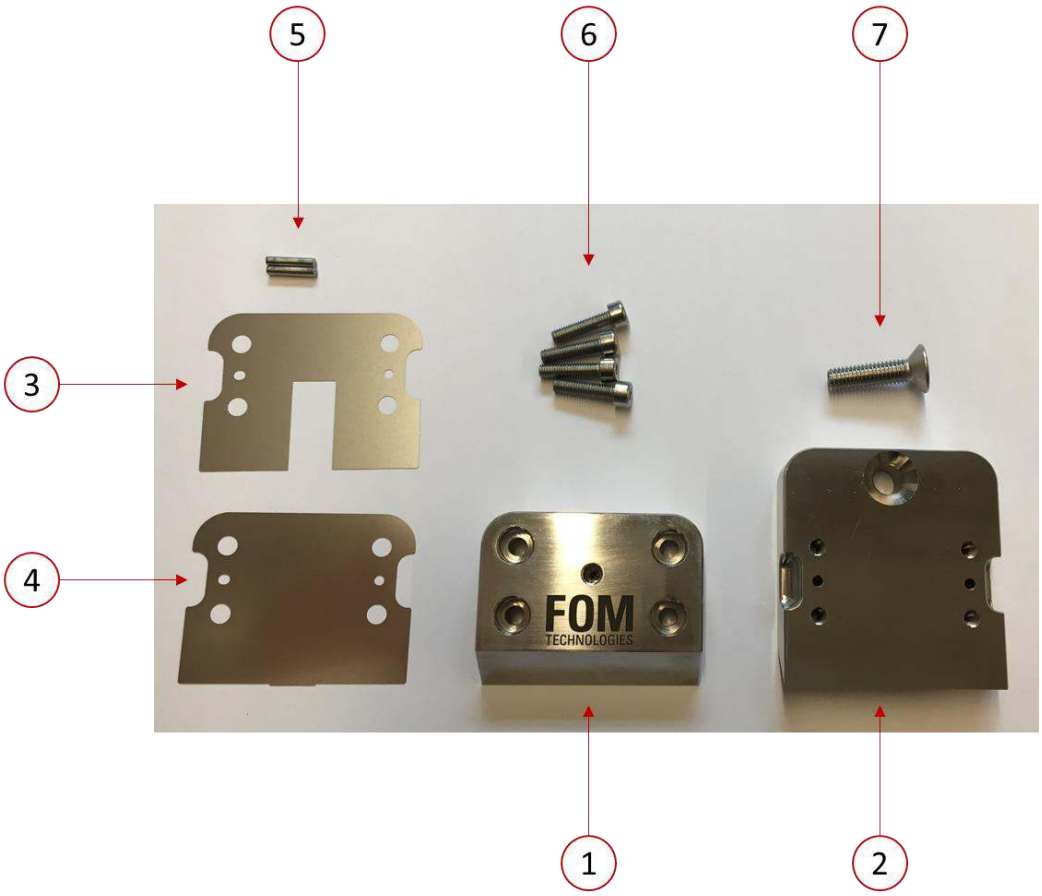

Figure 1.1. All components of a standard FOM Technologies slot die head before assembly. 1 = Front plate, 2 = Back plate, 3 = shim, 4 = Meniscus guide, 5 = Alignment pins, 6 = Securing bolts, 7 = Mounting bolt.

1.2. Disclaimers & equipment hazards

IMPORTANT

In order to ensure successful operation of FOM Technologies slot die head products, and to respect the safety of all lab users, operators should read and understand this manual before beginning with any coating experiments. It is recommended that new users should be trained in the use of this equipment by experienced operators, as deviation from the instructions provided this manual may lead to personal and material damage for which FOM Technologies A/S cannot be held responsible.

Further information on the risks and hazards associated with operation of FOM Technologies slot die head products is provided in Table 1.2 on the following page.

Table 1.2. Risks and hazards associated with the use of the FOM Nano Roll Coater.

Risk	Comment
Hot surfaces	For users who have requested a heated slot die head: operators should avoid touching the surface of the slot die head when it is hot. Temperatures can reach 80 °C during operation. It should be noted that the slot die head may remain hot for some time even after the equipment has been shut down.
Crushing/pinching	Slot die heads are comprised of solid steel that can be significantly damaging to persons or items if not handled with care. Operators should avoid placing their fingers or any other foreign objects between the front and back plates of the slot die head during assembly and disassembly. Operators should also take care to ensure that they do not drop the slot die head or otherwise forcefully place it on their fingers/limbs when mounting or dismounting from the coating equipment.
Cutting	The meniscus guide will protrude slightly from the coating lip of the slot die head when it is fully assembled, appearing as a “tooth-like” feature. Operators should be careful not to run or press their fingers/limbs against this tooth during handling, as it represents a significant cutting hazard.
Chemical exposure	Open coating of heated, solution processed chemical mixtures may lead to the evaporation of solvents and other hazardous materials. Operators should ensure that coating equipment is installed in a suitably ventilated location to avoid unintended exposure to these chemical hazards. Operators should be fully aware of the materials risks associated with their work.

2. Assembly instructions

The following sections describe the steps of assembling and mounting the slot die head, as well as connecting the pump and mounting the substrate onto the support drum to prepare for coating.

2.1. Slot die assembly

Ensure that you have a clean and level surface to work on and that all parts are both clean and dry. Operators should wear protective gloves for safety and to ensure that slot die components are kept free of grease.

To assemble the slot die head, begin by inserting the two alignment pins into the back plate of the slot die head. Do not use force. Carefully guide them into their respective holes until half remains pointing out. It should be noted that the alignment pins can also be inserted into the front plate of the slot die head. This manual shows them inserted into the back plate to provide a clearer visual representation of the build-up and orientation of the shim and meniscus guide within the slot die head.

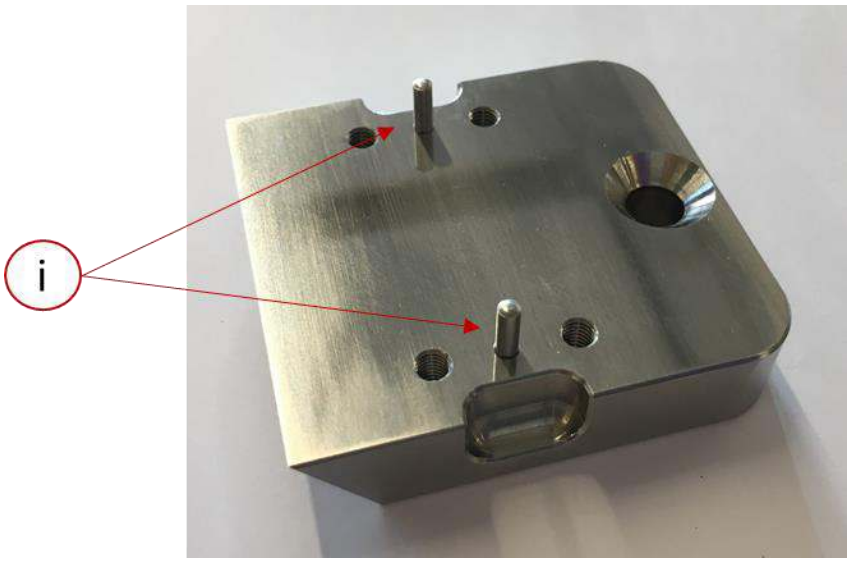

Figure 2.1. Back plate of the slot die head showing (i) alignment pins correctly inserted.

Next, place the meniscus guide and shim onto the alignment pins. The shim should be in contact with the front plate (the meniscus guide will be in contact with back plate). The shim will guide the coating flued from the inlet to the slot die coating lip. Reversing this order will result in the meniscus guide blocking the inlet of the slot die head, preventing any coating fluid from entering. Ensure that all of these components are parallel and flush with each other.

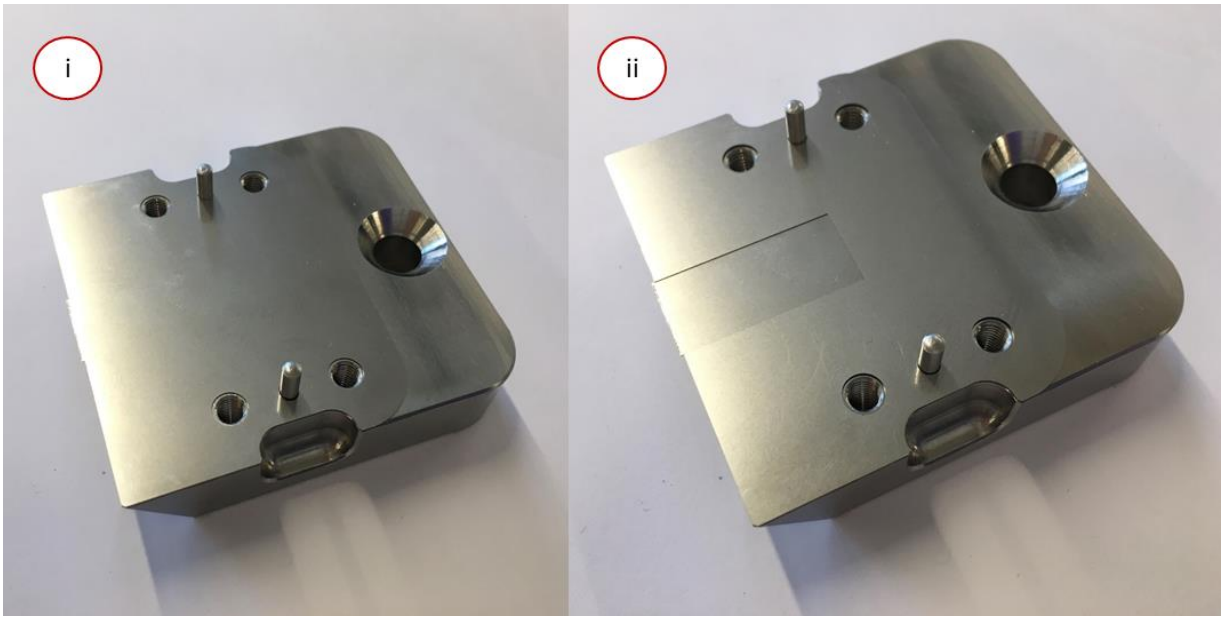

Figure 2.2. (i) The meniscus guide is placed onto the alignment pins, in contact with the back plate. (ii) The shim is placed onto the alignment pins, on top of the meniscus guide, ready for the front plate to be placed on top of it.

Place the front plate on top of the shim to complete the slot die head component stack. Ensure that the front and back plates remains parallel to each other while you press them together. Do not use force. Carefully guide all the parts together until all parts are fully flush with each other. If the parts get stuck or misaligned, take the front plate fully off the alignment pins and start again. Insert all securing bolts a few turns by hand and then gently screw them into place with an appropriate Allen/hex key. The securing bolts should be screwed into place until a slight lock is achieved, but should not be overly tight. The slot die head is now successfully assembled.

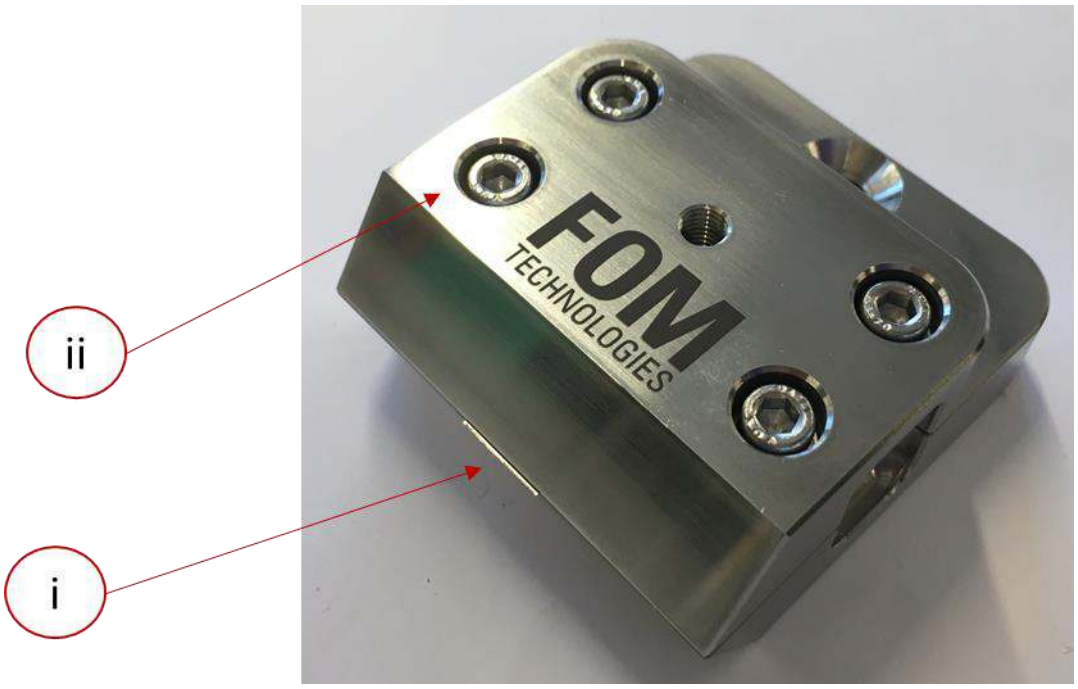

Figure 2.3. Fully assembled slot die head. (i) The shim tooth visibly protrudes from the coating lip of the slot die head. (ii) The securing bolts (x4) are inserted to lock all components together.

2.2. Slot die mounting & adjustment

The slot die head is generally mounted onto its respective coating machine via the provided mounting bolt, as shown below. Please refer to the “Slot die mounting & adjustment” section of your respective equipment manual for further equipment-specific slot-die mounting instructions.

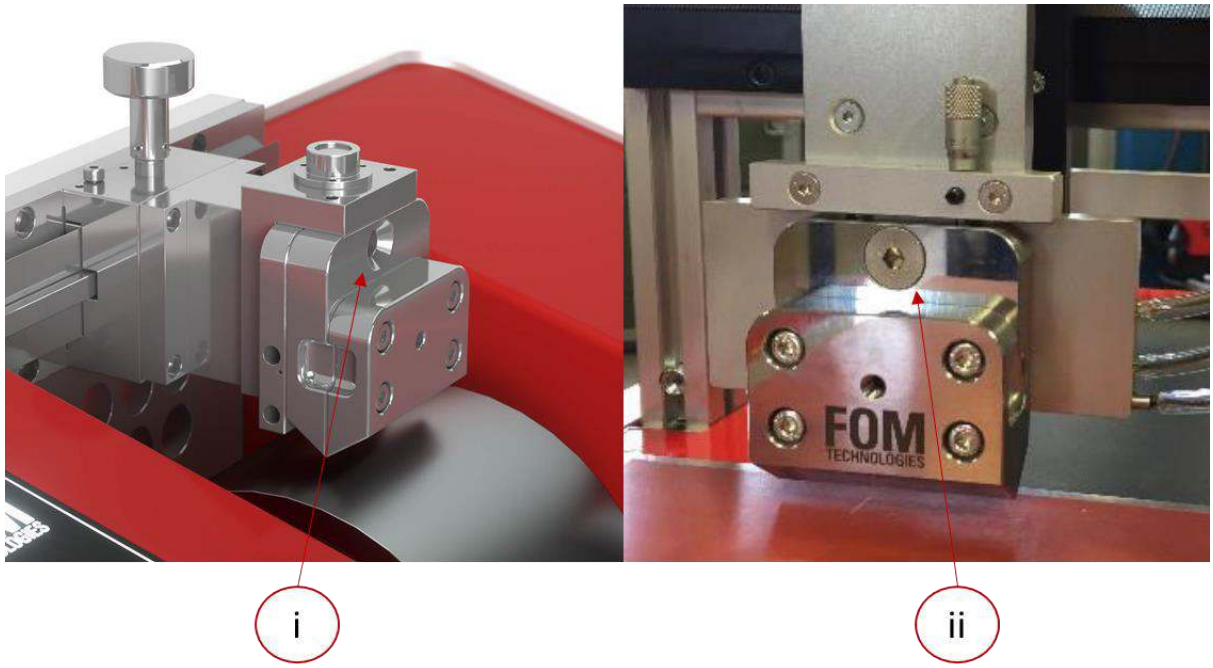

Figure 2.4. (i) The slot die head is placed against the mounting plate on the mounting gantry such that the mounting holes on the slot die back plate and mounting holes are perfectly aligned. (ii) The mounting bolt is inserted to secure the slot die head into place on the mounting gantry.

2.3. Syringe & tubing connection

To connect the slot die head to the sample syringe, begin by applying the supplied fittings to both ends of the supplied tubing as shown below:

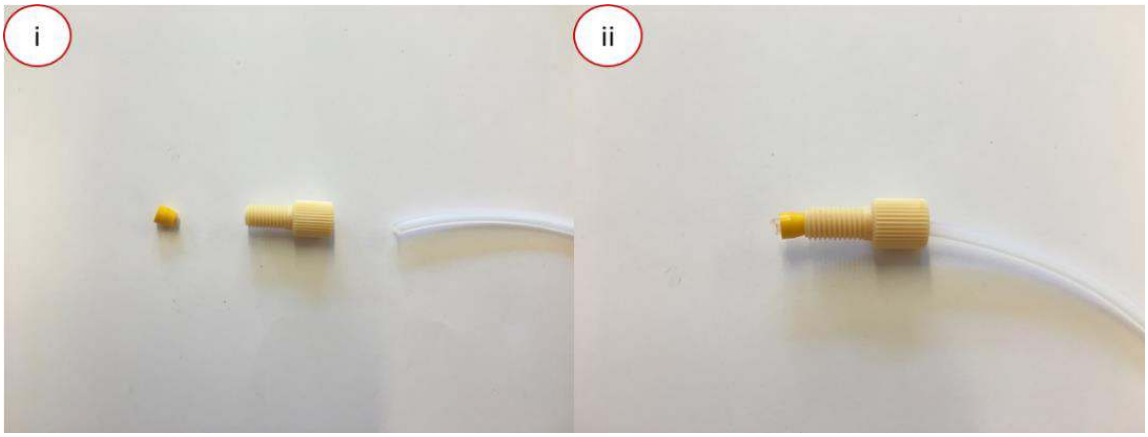

Figure 2.5. The provided tubing and fittings for connecting the slot die head to the sample syringe (i) disassembled, (ii) assembled.

Next, proceed to attached the provided Luer lock adapter to the desired sample syringe, as shown below. Please note that the desired syringe must have a Luer lock fitting at the outlet in order to be compatible with the provided Luer lock adapter.

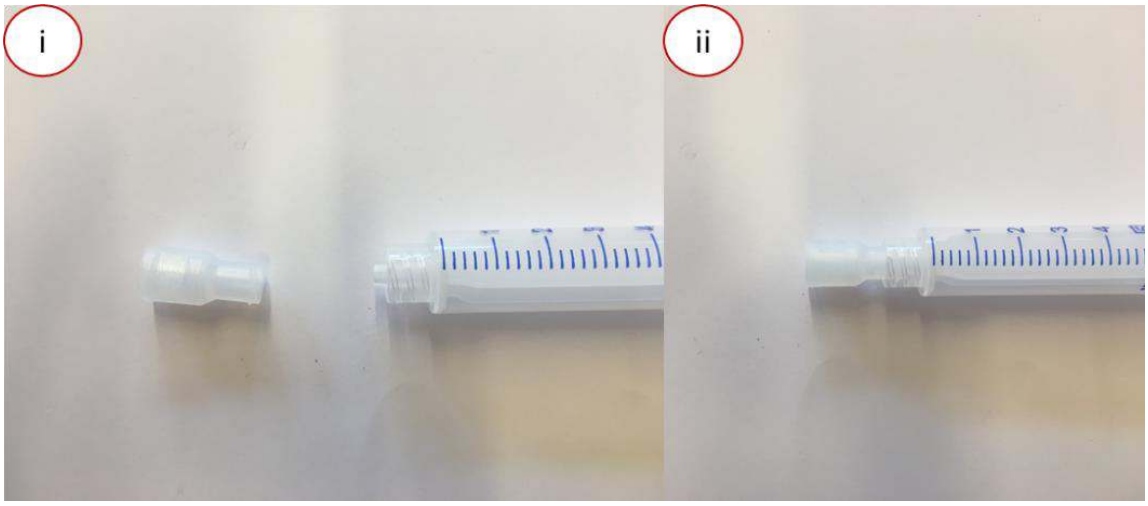

Figure 2.6. The provided Luer lock adapter and sample syringe (i) disassembled, (ii) assembled.

Both ends of the assembled tubing can then be easily screwed into the sample syringe and the inlet port in the front plate of the slot die head until they are secure, as shown below:

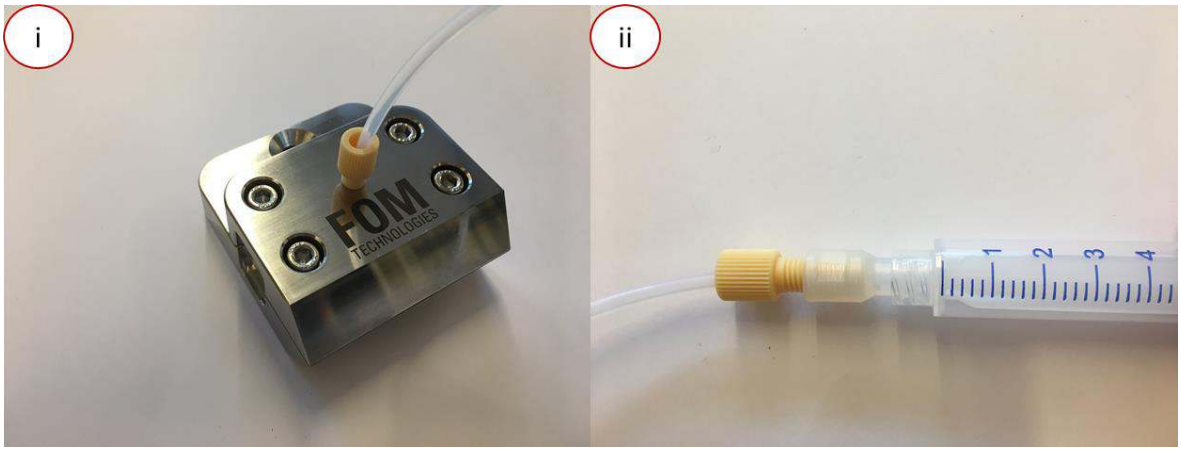

Figure 2.7. Both ends of the fully assembled tubing are shown to connect easily to (i) the slot die head inlet, (ii) the sample syringe.

The sample syringe should now be securely connected to the inlet port of the fully assembled slot die head via the provided tubing and fittings.

Please note that users should generally connect and disconnect the sample syringe from the tubing via the Luer lock fitting rather than the cream-colored screw connection for their own convenience. This makes it easy to quickly connect and disconnect the tubing from a syringe that is already mounted on a syringe pump.

3. Service & maintenance

The following section describes the procedure for safe and effective maintenance FOM Technologies slot die head products. If the need arises for more complex servicing of your unit, please contact FOM Technologies directly for further instructions.

3.1. Standard maintenance

FOM slot die head products are designed to be easy to use, with little need to complex maintenance. However, the observing the following standard maintenance steps during daily use will result in the most ideal performance and longevity of your unit.

Before operation, it is recommended that users should check for the following issues:

- Leaks
- Loose screws/bolts
- Crystallized ink obscuring the outlet of the slot die head coating lip

Leaks and loose screws/bolts can be easily remedied by adjusting any screws/bolts that have not been tightened enough to provide a suitable seal in the slot die head. If leaks persist, ensure that the internal components of the slot die head are flush with each other, and that the space between the front and back plates of the slot die head remains free of any fine debris that may be preventing a full seal between the internal components. Additionally ensure that the shim and meniscus guide have been inserted in the correct order to allow ink to flow from the inlet to the coating lip of the slot die head rather than building up against the meniscus guide.

To reiterate, the correct order of assembly is as follow: (i) apply alignment pins to the back plate, (ii) apply meniscus guide on top of the back plate (iii) apply shim on top of the meniscus guide (iv) apply the front plate on top of the shim (v) insert and secure all securing bolts into the front plate.

After operation, it is recommended that users should observe the following clean up procedures:

- Cleaning of the slot die head
- Cleaning of the shim and meniscus guide

To clean the slot die head, users should disconnect the head from the syringe tubing and dismount the head from its respective coating equipment. The head should be disassembled by reversing the previously described assembly procedure. The front plate, back plate, shim and meniscus guide should then be individually cleaned with the same or similar solvent to what was used in the most recently used coating fluid. It is recommended to wipe down slot die head components individually rather than sonicating for extended periods, as this can reduce the chemical resistance of the slot die components. Ensure that all parts are thoroughly dry before safely storing the slot die in the provided Peli case.