Overview

The following procedure is recommended for establishing the optimal jetting parameters for various fluids used in MicroFab jetting devices.

Jet Setup steps

- Verify that the tip of the jetting device is visible in the camera window of the User Interface.

- Verify that the device and fluid line are full of fluid by purging under positive pressure. This is accomplished by turning the knob on the front panel from *Control* to *+ Purge*. After a few seconds, turn the knob back to *Control*. With a clean device and fluid line, the purge should look like Figure 1. If the ink stream coming out is twisted and/or deviates from the axis of symmetry most of the time it means that there is contamination in the orifice. Follow the cleaning procedure on MicroFab website at www.microfab.com.

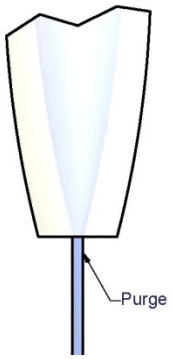

Figure 1 – Dispensing Device Purge

- Adjust the back pressure until the fluid meniscus is flush with the face of the orifice (See Figure 2). If the back pressure is too low, the fluid will be pulled in the reservoir and bubbles will be observed in the reservoir as air is drawn into the device. If the pressure is too high, the fluid will wet the face of the orifice and form a bead or drip (See Figure 3).

- The back pressure is adjusted by turning Fairchild Pressure Controller knob clockwise if fluid is not observed on the face of the orifice or counter clock wise if fluid is observed on the face of the orifice. Because the backpressure contributes to balancing the hydrostatic pressure, its' value will be between -4 to -12 mm of Hg vacuum for most of MicroFab's printheads. For fluids that wet the glass very well, the backpressure might need to be set to a slight negative value as well.

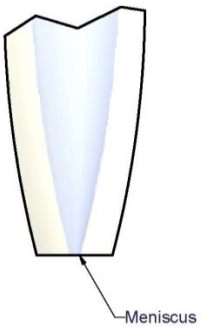

Figure 2 - Meniscus location

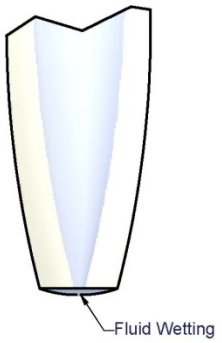

Figure 3 - Fluid wetting the tip

- Initialize the pulse to the jetting device. Set the signal frequency at 240 Hz. Set Dwell voltage (V_1 for Jetserver program) to 20 V and Dwell time (t_1) between 25 and 30µs. The rise and fall times are adjustable and should be set to 3-5 µs. If an echo pulse is used, set Dwell Voltage (V_1) to 15 V and Echo Voltage (V_2) to –15 V and Echo time (t_2) to 50 µs (twice t_1). The echo pulse is used to optimize the drop break-off, so for initial studies, using a unipolar pulse is recommended.

- When the *Start Jetting* button is clicked, drops should be observed exiting the jetting device. The strobe delay slider bar should be adjusted to locate the drop in flight; drops should be visible close to the orifice for delay values in the 150-200µs range. To generate drops continuously make sure that the *Trigger mode* is set to *Continuous* on *Jet Setup* tab of Jetlab4 and Jetserver software program.

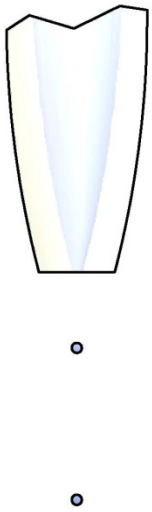

Figure 4 - Drops in flight

- If drops are not observed, turn the pneumatics knob on the front panel to *+ Purge*, and you should observe radial perturbations on the cylindrical fluid column exiting the device. The perturbations will move along the column when changing the delay. This demonstrates that the fluid is seeing a voltage pulse that disturbs the fluid column. Turn the knob back to *Control*. Adjusting the actuation waveform is the next step.

- If the meniscus is moving at the device orifice but no drop is formed, adjust the strobe delay slider bar so you can see the meniscus at the maximum position outside the glass. Increase the applied voltage in 2 V increments. This should produce an increase of the meniscus excursion and, at a certain voltage level, should produce a drop.

- Adjust (change Dwell time up and down from the previous set value) the Dwell time keeping constant voltage for the maximum velocity. If satellites (smaller drops) are formed, the voltage should be decreased.

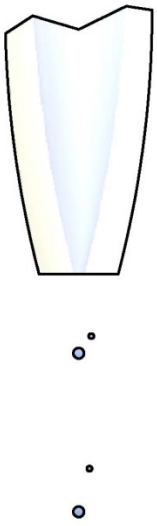

Figure 5 – Drop Generation with satellites

- Perform fine-tuning (for stable drop formation and no satellite operation) by adjusting the timings and voltage around the values determined above.

Notes

- An increase of the voltage produces an increase in velocity. Beyond a certain voltage level satellites start forming. Also, high voltage could cause air ingestion.
- Drops are formed at a certain range for Dwell time. Increasing Dwell time past a certain point will result in no drops. Increasing Dwell time further will again produce drops (of larger volume).
- There is no need to use the negative side of the voltage. It is recommended to evaluate first just the unipolar waveform. If good drop formation is achieved, use the unipolar.
- Changing the operating frequency to values above 500Hz might require additional tuning.
- When using high frequency values use the strobe divider (*Options Menu, Settings dialog, Jetting Tab*) to reduce the amount of light captured by the camera. For default 1, every main pulse is accompanied by a strobe pulse, for larger numbers, it is every 2nd for 2, every 3rd for 3, and so on. Otherwise the drops will not be observable on the screen. As an alternative, the camera gain and exposure can be changed in the camera software (StCamSWare).

Basic Drop Formation Troubleshooting

No drops formed

- Set the delay to zero then set it to 150-200µs to make sure no drops are ejected.
- Inspect the tip. Purge to recover the meniscus or to eliminate any large air bubbles observed in the nozzle area.
- Pressurize the reservoir. If no fluid is purged, the device is clogged. Several possible techniques exist for removing a clog from the orifice.

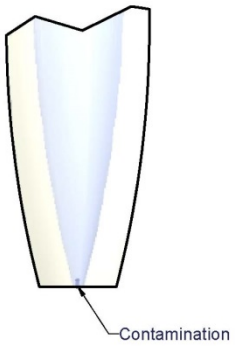

Figure 6 - Clogged tip

- Repeat steps 3 to 9 in the setup procedure

No drops are formed with a fluid puddle formed on the device tip

- Readjust the reservoir back pressure if necessary.

- Air may have been ingested through the orifice – Purge the device, or decrease the voltage to the device

- Satellites are formed in addition to the main drop – Decrease the voltage to the device or adjust the dwell time.

Drop trajectory is not straight

- Could be produced by a low velocity drop. In this case increase the velocity (increase the voltage or adjust the the Dwell time)

- Could be produced by non-uniform wetting. Wipe off the device face until dry and readjust the backpressure (pressure controller).

- Could be a foreign particle at, or in the orifice, follow the cleaning procedure on MicroFab website at www.microfab.com.

Drop is Unstable

- Could be caused by contamination or big particles. This kind of debris or particle agglomerate eventually travels to nozzle taper area and create instability. Purge at high pressure with device pulsed at high frequency (6-8KHz), and high negative voltage in addition to +50V voltage.

- Could be caused by bubbles in the ink/fluid. The bubble in the ink or feeding tube eventually travels to orifice area and gets trapped there. It bounces around in the nozzle taper area until ink is purged under high pressure and forces the bubble to collapse.

- Check the ink. Subject the ink to high vacuum for a few minutes to collapse all air bubbles before loading it in reservoir. Be careful loading the ink with surfactant using a pipette so as not to generate bubbles in the ink.