

Air Controllers and Air Control

Air controllers are an integral part of a medical extrusion line. They are used in free extrusion of medical tubing for two reasons: sizing and structure.

- Sizing
 - Air is one of the main inputs for free extrusion.
 - Air pressure is used to increase or decrease the diameter of the inner lumen (s) of a tubing.
 - Increasing the air pressure being supplied to a lumen will increase the diameter of that lumen. It will also make the wall of the structure surrounding the affected lumen a tad thinner (provided extruder output and linespeed stay the same.)
 - Decreasing the air pressure being supplied to a lumen will reduce the diameter of that lumen and subsequently increase the wall, around the lumen, marginally.
 - Control of air supplied to the process has a 1:1 relationship with process control.
 - Stable air pressure input helps create and maintain a stable process
 - Unstable air input is detrimental to the well-being of what could otherwise be a stable process.
- Structure
 - Air pressure helps maintain the overall structure of the extruded form until the molten material has had a chance to cool and re-solidify.

Notes for air controller use in general free extrusion:

- Strictly observe the operational and set-up guidelines in the owner's manuals.
 - Never crank up the supply air to a process beyond recommended guidelines to 'get a little more out of the controller', damage could result.
 - There are numerous ways to increase the effect of the air on the process without exposing the run, or the equipment, to excessive pressure
- Dimensional surging can result from poorly executed changes to the air being supplied to the process. Once surging starts, it compounds itself (see the Medical Extrusion 101 paper on Accumulated Dimensional Instability.)
- If having 'air problems' try removing all of the air from the process and gradually add it back into the process. This will often eliminate dimensional surging related to air supply

Air Control during taper tube (bump) extrusion:

- Taper Tube or bump extrusion is a free extrusion discipline where air and speed changes are coordinated to produce tubing with different sized cross-sections over the length of the part
- A mode of operation where cyclical changes are being made to the air being supplied to the process. These cyclical changes are typically high and low settings for air pressure. Speed changes with the puller are usually coordinated with the changes in the air pressure. Air changes during bump extrusion need to be correctly timed, accurate, 'smooth', and consistently executed from cycle to cycle over the entire run.

From the Desk of Mike Ferrandino; owner Medical Extrusion 101

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- For optimum operation in a bump mode, the step-down valve must be properly 'tuned' to insure smooth, clean, crisp changes in air supply to the process. Tuning of the air controller for use in bump extrusion is a critical element for successful operation.
- Changes in air pressure and puller speed must both be smooth to insure proper sizing and formation of the transitions from one set of dimensions to the next, cycle after cycle.
 - If changes are not accurate the target dimensions cannot be met.
 - If the changes are not 'smooth', if the 'needle' of the analog gage (even if you get a digital display, support it with an analog gage!) is 'bouncing' at the top or the bottom during each cycle change, the size (ID and OD) are bouncing with it.
 - If the changes are not timed properly, sizing will be difficult to impossible and the entire run ineffective. If inputs are not properly managed, maintaining control of the run (dimensionally) will be very difficult.

Tuning the air controller to deliver smooth response is key in quick and effective sizing as well as creating a stable base for the run. Again, if the changes are not consistent from cycle to cycle, dimensional stability for the run cannot happen

- Insure that the air controller is turned on and the recommended incoming pressure is established.
- Ensure cable connection to RDN Analog Output.
- Ensure the air controller is in the Linear mode.
- Select and run a bump program
- Set the 'ramps' associated with sizing of the minor diameter to .5V
- Set the 'ramps' associated with sizing of the major diameter to 3V
- While running, adjust the step-down valve inside the unit until needle on the analog gauge moves smoothly and crisply as voltage changes are executed.

NOTE: Generally, when properly tuned there will be a slight 'hiss' inside the box. Too much air to the process will usually make it difficult to effectively run good parts and stay in control of the process. If you are using an excess of air for sizing you may want to adjust either your process conditions or your tooling draw or draw ratio.

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