Minimizing Flow Oscillations for Continuous Extrusion

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The extruder or melt pump will always have some flow oscillation that it delivers. The amount of flow oscillation that reaches the product will be less than that which leaves the extruder. The amount of dampening of the oscillations will depend on the delivery system characteristics. Some simple design rules can be used to maximize the dampening and minimize flow oscillation that reaches the product in the form of thickness non uniformity.

First, the amplitude of the flow oscillation must be minimized. This will be a function of the geometry of the pump. Gear pumps with few large teeth have a greater amplitude than will a similar pump with greater, smaller teeth for the same total flow rate. The condition of the pump is important. Worn or misaligned thrust bearings in extruders can be a major source of flow oscillation. Drive misalignment, for extruder or pump, is another factor which can produce flow oscillation.

The frequency of the oscillation is a primary factor in the dampening. Higher frequencies are more greatly dampened. The frequency is typically a function of extruder or pump speed. Therefore, a higher speed machine will have a greater dampening of its flow oscillations than will a slower machine.

The volume of the delivery system is important, and a larger volume is desirable. The larger volume serves to absorb the oscillation of the flow by virtue of the compressibility of the resin and the elasticity of the delivery system. The compressibility of the resin is normally fixed, but the elasticity of the delivery system can be increased to alleviate flow surging. Large diameter pipes with thin walls will provide the greatest elastic strain (and dampening). However, the obvious limiting factor is the static pressure rating, which must be maintained.

Greater die pressure helps the dampening of flow surges. Also, the presence of additional pressure drops, such as a filter, will lower flow surge transmission. Locating additional pres sure loss near the end of the delivery system will help provide more flow dampening. For example, a filter should be located as close as possible to the die.

For more details on flow surge dampening, see "Calculating Surge Dampening in Melt Delivery Systems," by Stephen J. Derezinski, Conference Proceedings, ANTEC ‘97, Volume I, pp. 341-346.

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See also:

- Gear pumps - answers to questions
- More on gear pumps
- Thrust bearings

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