Standard Pumps
Optimizing Pump Performance

There are two types of movements in a syringe pump, **MEASURED** and **PRELIMINARY**. Both are equally important in achieving optimum pump performance.

Measured movements provide accurate and precise fluid volumes to a specified location.

Preliminary movement prepare the liquid path for the measured movements.

While most pump users are only concerned with the results of their **measured** movements, it is imperative to understand and fully utilize **preliminary** movements if optimum pump performance is to be achieved. One way to visualize the effect of **preliminary** movement in the liquid path is to imagine trying to push or pull two bricks with an inflated toy balloon between them. In order to get equal movement between the bricks you must either expand or compress the balloon to its fullest point through **preliminary** movements. Once you have accomplished this, you have a **charged** liquid path and **measured** movements will be optimized.

AIR GAPS are useful in minimizing mixing of aspirated and primed fluids but must be handled carefully. Their introduction into a positive displacement system can severely degrade Accuracy and Precision unless countered with appropriate **preliminary** movements. **Air gaps** must be kept as small as possible.

Even with **air gaps** between sample and priming fluids, some mixing will take place in probes and tubes. In one-step sample dilutions, this has no effect, but in multiple aliquoting and sample transfers some dilution of the **measured** sample closest to the **air gap** will occur. Make **preliminary** allowances for some waste if absolute sample integrity is required. Aspirate an additional amount of the sample to act as a buffer. Discard this amount as part of the probe cleaning process. Typically 10% can be used as a guideline but variables such as speed, types of fluids, volumes and allowable error will determine final adjustments. Optimum waste allowances can only be determined through testing.

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Standard Pumps
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Repetitive functions, such as multiple dispenses and aliquoting are best done when all **measured** movements are done in a like manner and speed. **Preliminary** movements to ensure a **charged** liquid path are critical to achieving optimum precision. The best method for accomplishing this task is to make a **preliminary** dispense of the aspirated liquid, roughly equal to the desired **measured** movement, into a waste cup, or if possible, into the same receptacle from which it is aspirated.

Backstepping or anti-backlash routines built into most commercial syringe drive software typically eliminate only the inherent looseness of the drive mechanism itself. They do not **charge** the liquid path.

Priming, the most common **preliminary** movement, is important. All air should be expelled from the syringe, valves, tubes and other wetted surfaces to achieve optimum performance. Bubbles and air pockets MAY cause inconsistencies. Small bubbles located directly on the surface of the syringe seal often do not cause problems, however should they break free and enter the liquid path, a **measured** movement could be affected. It is best to try to remove these through adequate priming. Surfactants in priming fluids make priming easier and more effective. If the priming liquid is outgassing during fill, evidenced by recurring bubbles in the syringe, either slow down the fill stroke of increase the diameter of tubing.

The guidelines and tips offered here are generally effective in optimizing performance of syringe pumps. They are not, by any means, an all-inclusive list of methods and procedures. Every application requires specific techniques, tailored to that application, to achieve optimum performance. Please contact a TriContinent engineer by using the Engineers quick link located from any page on this website, for further information or assistance.

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