Standard Pumps
Accuracy and Precision

Precision is defined as **shot-to-shot** repeatability. This is typically quantified as **"imprecision"** and expressed as *Coefficient of Variation (C.V.).*

The precision of the pump is mechanically controlled through a consistent interface between the stepper motor/leadscrew, and is inherently precise.

TriContinent assures precision by measuring the repeated movements of the pump mechanism with a cutom-designed fixture.

Accuracy is defined as the agreement of desired volume to actual volume. The difference between the two is quantified as **"inaccuracy"** and expressed as a percentage.

The accuracy of the pump is mechanically controlled through proper leadscrew pitch and step angle of the motor. Correct syringe barrel I.D. also assures accuracy. Consistency of the I.D. over the entire barrel length is necessary. TriContinent assures accuracy by mechanically measuring syringe barrel for proper I.D. using air bore gauges. The pump mechanism is verified by use of manufacturing test fixtures.

Several places within this website you will find references to specific Accuracy and Precision figures. This data is based on results from Gravimetric testing with fluids, the test setups and environmental conditions have been optimized. Tubing sizes, probe configurations, protocols and speeds have been selected to provide optimum results. The liquid measured is DI water. Whenever any of these factors are changed you can expect deviations from published performance data.

You can use the BP/BPV and AP/APV specification as a benchmark to measure how close to optimum your instrument's fluid path is.

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Standard Pumps Accuracy and Precision *(cont.)*

Performance of a liquid handling system will be dependent upon many factors. As a rule, empirical testing will be required to resolve all pertinent issues. Below are some typical variables to be considered when developing an application-specific liquid-handling system. All these items must reach a balance before optimization is achieved.

- **Syringe Size**, while important is not as critical as you might imagine. In most applications, a significant shift of volume (up or down) must be made before any measurable difference in A & P will be noted. *See "Selecting Syringes" page for more details.*

- **Pump speed** needs to be adjusted to deliver liquids at rates agreeable with desired throughput, but not so fast as to stall the motor when pumping through restrictive tubing. It is used for "fine tuning."

- **Tubing Selection** can have a major impact on liquid handling performance. Keep tubes as stiff and as short as possible. I.D's should be as large as possible without causing the smallest sample/air gap to break up. *See "Optimizing Tubing Performance" page for more details.*

- **Orifices** of all valves, connectors, fittings, etc. must be an appropriate size. Transistions must be smooth and free from "dead" volume. *See "Optimizing Tubing Performance" page for more details.*

- **Priming and preloading** to remove air and "charge" fluid paths is critical to liquid-handling system performance. *See "Optimizing Tubing Performance" page for more details.*

- **Probes** for aspirating and dispensing are often the most critical in a liquid-handling system. Good probe design should follow the same general guidelines as tubing and orifices (see above).

Additional criteria for good probe designs are:

- **Contour** - make all transitions to I.D. smooth and "step" free.

- **Surface Area** - the end of the probe should have as little surface area as possible. Keep probe end perpendicular to probe, and wall thickness minimized to avoid "drops" from clinging.

- **Finish** - both inside and outside surfaces should be free.

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