Determining the Performance of Hamilton Syringes

I. Summary

This general procedure is based on determining the weighing result of water samples delivered by the syringe. True volume is calculated based on the density of water at specific temperatures.

II. Limitations

The method is not recommended for volumes below 20 uL. There is no upper limit, except the testing of volumes greater the 80% of full scale of the syringe are not recommended.

III. Equipment, Materials, Environment

A. Laboratory balances required for the test method should meet or exceed the following performance specifications, be calibrated regularly with the appropriate traceable weights, and be regularly maintained.

Test Volume, uL	Balance sensitivity, mg
1-10 uL	0.001 mg
10-100 uL	0.01 mg
100-1000 uL	0.1 mg

B. Use a balance table, or suitable equivalent to minimize vibration. Cover the working surface directly in front of the balance with a dark, smooth, non-glare material. Keep the balance area reasonably free of draft currents and the ambient area free of excessive dust.

C. Use a calibrated thermometer readable to 0.1°C to measure the temperature of the water.

D. Use a weighing vessel that has a total volume of about 10 times the test volume, or 500uL, whichever is larger. This is for evaporation control. If possible, also use a cover that fits over the outside of the vessel top (do NOT allow the cover to come into contact with the test liquid). The vessel should be plastic, glass, metal, or some other non-porous material. The cross-sectional area of the opening should be as small as possible to further control evaporation.

E. Handle the vessel with forceps or tweezers.

F. Use distilled water.

IV. Procedure for determining the performance of Hamilton Syringes

A. Introduction: Deliver a total of n samples into a weighing vessel, and weigh each sample after delivery. Replicate all motions and time intervals in each sampling cycle as precisely as possible.

B. Preparation: Select the analytical equipment and materials. Select the syringe to be evaluated, including removable and disposable parts. Make sure the syringe is clean. Ensure the room, equipment and materials, including the prepared water, are thermally equilibrated. Ensure the electronic balances have had sufficient warm-up time to stabilize.

C. Place a small amount of water in the weighing vessel (between 2 and 30 sample amounts or a minimum of 500 uL).

D. Fill a water reservoir. Aspirate water into the syringe. Remove any bubbles by slowly aspirating and quickly dispensing water several times.

E. Open door of balance chamber, place the weighing vessel on the balance pan and close the door of the balance chamber.

F. Tare the balance. Aspirate one sample. Retrieve the weighing vessel from the balance chamber, deliver complete sample, and return the vessel to the balance pan, closing the door to the chamber. Observe and record balance readout.

G. Repeat step F until 10 samples have been weighed. Note: Perform the weighing cycles as quickly as possible, but without compromising the integrity of the liquid delivery or the precision of the technique of the operator.

H. Measure and record the water temperature.

V. Calculations

A. Calculate the volume of each dispense (Vi) by dividing each mass value by the density of water at the measured temperature.

B. Single dispense (in)accuracies can be calculated from the volume dispensed (Vi) and the expected volume (V o): Accuracy (%) = 100 x (Vi – Vo) / Vo

C. Calculate the average dispensed volume from the individual dispensed volumes, Vi (where I is 1 to10): V avg = V1 + V2 + V3 + … + V10) / 10

D. Calculate the syringe accuracy: Accuracy (%) = 100 x (Vavg – Vo) / Vo

E. Calculate the standard deviation (SDEV) of the calculated volumes, then determine the coefficient of variation: CV (%) = 100 x SDEV / V avg

HAMILTON
THE MEASURE OF EXCELLENCE™

Hamilton Company
4970 Energy Way
Reno, Nevada 89502 USA
Toll-Free: 800-648-5950
Telephone: +1-775-858-3000
Fax: +1-775-856-7259
e-mail: sales@hamiltoncompany.com

Hamilton Bonaduz AG
Via Crusch 8
CH-7402
Bonaduz/Switzerland
Telephone: +1-775-858-3000
Fax: +1-775-856-7259
e-mail: marketing@hamilton.ch

www.hamiltoncompany.com