Determining the Performance of Hamilton Syringes

May 2012

Greyhound CHROMATOGRAPHY AND ALLIED CHEMICALS

HAMILTON

Table of Contents

Summary

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

Limitations

This method is not recommended for volumes below 2 µL. There is no upper volume limit.

Equipment, Materials, Environment

1. Laboratory balances required for the test method should meet or exceed the following performance specifications. They must be regularly maintained and calibrated with the appropriate N.I.S.T. traceable weights.

Test Volume, µL	Balance Sensitivity, mg
1–10 µL	0.001 mg
10–100 µL	0.01 mg
100–1,000 µL	0.1 mg

2. 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.
3. Use a weighing vessel that has a total volume 12 to 40 times the test volume, or 500 µL, whichever is larger (this is for evaporation control). If possible, 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.
4. Handle the vessel with forceps or tweezers.
5. Use deionized water that has equilibrated to room temperature.
6. Use a calibrated thermometer to measure the temperature of the water.

Test Procedure

1. Allow all test materials to equilibrate to room temperature.
2. Place a small amount of deionized water in the weighing vessel (between 2 and 30 test volumes).
3. Fill a reservoir with deionized water and aspirate water into the syringe. Remove any bubbles by slowly aspirating and quickly dispensing water several times.
4. Open the door of the balance chamber, place the weighing vessel on the balance pan, and close the door of the balance chamber.
5. Aspirate the sample to be measured. Traditionally 80% of the nominal volume is used at Hamilton Company for calibration.
6. Tare the balance. Retrieve the weighing vessel from the balance chamber, deliver the sample, and return the vessel to the balance pan, closing the door to the chamber. Observe and record the mass of the deionized water.
7. Deliver a total of *n* samples (*n*=10 is recommended) into the weighing vessel, and record each sample mass after delivery. Replicate all motions and time intervals in each sampling cycle as precisely as possible. Keep the distance between the balance and the syringe to a minimum.
8. Measure and record the water temperature.

   Note: For best results, this procedure should be performed at 22–26 °C.

Calculations

1. Calculate the volume of each dispense (Vi) by dividing each mass value by the density of water at the measured temperature. Refer to the table below for density values.

Density of Water at Various Temperatures

C°	g/mL	C°	g/mL
17	0.998774	24	0.997296
18	0.998595	25	0.997044
19	0.998405	26	0.996783
20	0.998203	27	0.996512
21	0.997992	28	0.996232
22	0.997770	29	0.995944
23	0.997538	30	0.995646

Taken from CRC Handbook of Chemistry and Physics, 50th Edition, 1969, page F–4

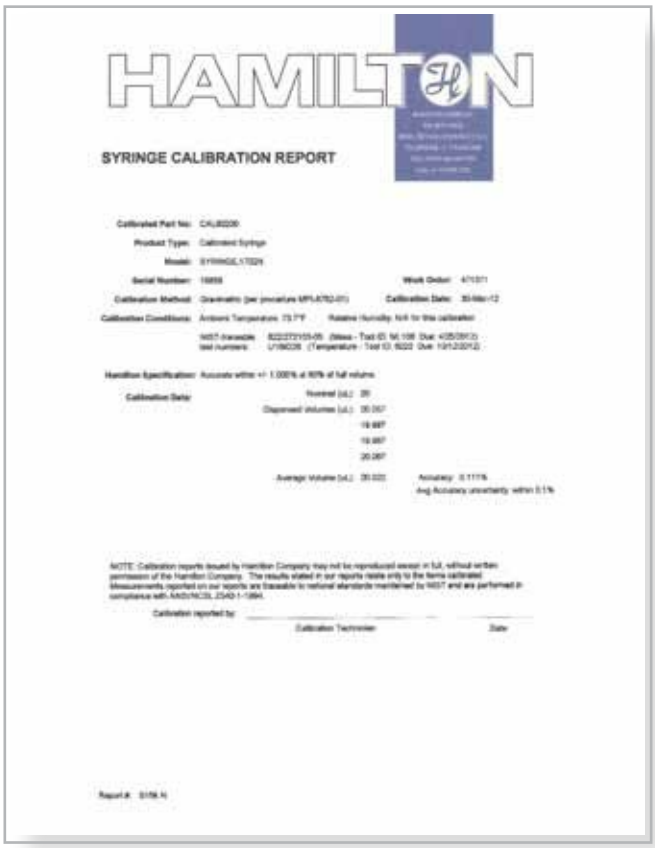
2. Calculate the average dispensed volume from the individual dispensed volumes, Vi (where i is 1 to 10): V avg = (V1 + V2 + V3 + … + V10) / 10
3. Calculate the syringe accuracy: Accuracy (%) = $\frac{(Vavg - Vo)}{Vo}$ x 100%

   Note: Vo is equal to the expected dispense volume
4. Calculate the standard deviation (STDEV) of the calculated volumes, then determine the coefficient of variation: CV (%) = 100 x STDEV / V avg

Calibrated Syringes

Calibrated syringes may be ordered directly from Hamilton. To order a calibrated syringe, simply place “CAL” at the beginning of the syringe part number. For example, if you required 80300 to be calibrated, you would order CAL80300. These syringes will come with a N.I.S.T. traceable certificate of calibration.

Note: Digital syringes are always calibrated.



HAMILTON

SYRINGE CALIBRATION REPORT

Lit. No. L20080

HAMILTON