1.0 Purpose

This SOP will address the basic procedure, and frequency for the calibration of the bottle-top burette used for USP analysis.

2.0 Scope

This procedure applies to the USP bottle-top burette. Calibration will be performed on the bottle-top burette by QA Lab personnel on a quarterly basis.

3.0 Responsibility

QA Lab personnel are responsible for performing this procedure.

4.0 Safety Considerations

Safety is a condition of employment. Employees are not authorized to work in an unsafe manner and are prohibited from harming the environment of the facility or community.

5.0 Materials/Equipment

- Brand Titrette® bottle-top burette
- Bottle (at least 500 ml) filled with deionized water
- Balance-Mettler Toledo X5105Du, B13929Z316
- Receiving vessel (e.g., Erlenmeyer flask) with bottom of vessel covered with deionized water
- Thermometer (room temperature range in °C)
- 50-ml Beaker
- Nitrile gloves
- Laboratory tissue wipers

6.0 Procedure

1. Place water bottle near area where the calibration will take place, and place thermometer into it.
2. Allow the water and thermometer to come to thermal equilibrium with the surround area by letting them set for a few minutes.
3. Enter the temperature of the water in the bottle onto the *USP Bottle-Top Burette Calibration Log (L14-PR-100-F062).*

4. Enter the air pressure onto the *USP Bottle-Top Burette Calibration Log (L14-PR-100-F062)*. The air pressure in Waynesville (in inches of Hg) can be found at http://waynesvilleweather.com/Current+Conditions/Waynesville.
5. Put on nitrile gloves to prevent error from transfer of oil from fingers.
6. Place burette onto the bottle of DI water.
7. Fill the burette to the upper stop („Fill“).
8. Dispense 5 drops into the 50-ml beaker, and wipe off the titrating tube.
9. Set display to zero („Clear“).
10. Place the receiving vessel onto the balance and tare the balance.
11. Place receiving vessel under the titrating tube. Dispense the test volume without interruption (the titrating tube should not touch the inner wall of the receiving vessel). Dispense with both hands to facilitate smooth dispensing.
12. Wipe titrating tube at the receiving vessel.
13. Place receiving vessel back onto balance, and close the balance door.
14. Write down the value that appears on the balance display after it has stabilized onto the *USP Bottle-Top Burette Calibration Log (L14-PR-100-F062)*.
15. If necessary, empty the receiving vessel to make room for the next test volume.
16. Repeat steps 7 – 15 nine more times for a total of ten replicates.
17. Repeat steps 7 – 16 for each of the volumes remaining to be tested.
18. Use a Microsoft Excel worksheet to calculate the systematic error and the random error for each volume and evaluate each error against the error limits in accordance with ISO 8655-3.
19. Enter the results onto the appropriate page of the *USP Bottle-Top Burette Calibration Log (L14-PR-100-F062)*.
20. If any of the tests fail, repeat the tests, paying close attention to the troubleshooting section below. If it fails again, adjustments need to be made to the burette. Follow the manufacturer’s instructions for adjustment.
21. If the burette failed and was adjusted make a note on the worksheet and perform the calibration procedure again after adjustment.

Troubleshooting:

Fault	Possible Causes	Measures
Volume too large	▪ Drop remaining on the titrating tube ▪ Dispensed too fast or unevenly	➢ Before weighing, wipe off any drop into the receiving vessel. Tare the balance. ➢ Repeat the test and dispense more slowly.
Volume too small	▪ Dispensing with media which form deposits in the piston ▪ Filling valve/titrating tube leaking	➢ Clean the instrument with a suitable agent according to the medium used. ➢ Tighten the filling valve/titrating tube (see Operating Manual) or clean it. Replace if necessary.
Other causes	▪ Instrument calibrated wrongly (<CAL> appears on the display) ▪ Jerky titration ▪ Temperature adjustment between instrument, room and water temperature not completed	➢ Revert to original calibration (see Operating Manual). ➢ Turn wheels evenly and without exerting any pressure. ➢ Carry out temperature adjustment.

For further information, consult your operator's manual.

7.0 Calculations

To calculate the absolute atmospheric pressure at the elevation of Giles Laboratory in kPa ($\mathbf{P_{ABS}}$), from the mean sea level pressure in inches of Hg ($\mathbf{P_{MSL}}$) (as reported at http://waynesvilleweather.com/Current+Conditions/Waynesville), use the following equation:

$$\mathbf{P_{ABS}} = (687.407894148557 * ((\mathbf{P_{MSL}} * 25.4) / 760 - 1) + 687.407894148557) * 0.133322368$$

To calculate **Factor Z (µl/mg)** in accordance with EN ISO 8655 as a function of the temperature and air pressure for distilled water use this table:

Temp.	Air Pressure (kPa)						
(°C)	80.0	85.0	90.0	95.0	100.0	101.3	105.0
15.0	1.0017	1.0018	1.0019	1.0019	1.0020	1.0020	1.0020
15.5	1.0018	1.0019	1.0019	1.0020	1.0020	1.0020	1.0021
16.0	1.0019	1.0020	1.0020	1.0021	1.0021	1.0021	1.0022
16.5	1.0020	1.0020	1.0021	1.0021	1.0022	1.0022	1.0022
17.0	1.0021	1.0021	1.0022	1.0022	1.0023	1.0023	1.0023
17.5	1.0022	1.0022	1.0023	1.0023	1.0024	1.0024	1.0024
18.0	1.0022	1.0023	1.0023	1.0024	1.0025	1.0025	1.0025
18.5	1.0023	1.0024	1.0024	1.0025	1.0025	1.0026	1.0026
19.0	1.0024	1.0025	1.0025	1.0026	1.0026	1.0027	1.0027
19.5	1.0025	1.0026	1.0026	1.0027	1.0027	1.0028	1.0028
20.0	1.0026	1.0027	1.0027	1.0028	1.0028	1.0029	1.0029
20.5	1.0027	1.0028	1.0028	1.0029	1.0029	1.0030	1.0030
21.0	1.0028	1.0029	1.0029	1.0030	1.0031	1.0031	1.0031
21.5	1.0030	1.0030	1.0031	1.0031	1.0032	1.0032	1.0032
22.0	1.0031	1.0031	1.0032	1.0032	1.0033	1.0033	1.0033
22.5	1.0032	1.0032	1.0033	1.0033	1.0034	1.0034	1.0034
23.0	1.0033	1.0033	1.0034	1.0034	1.0035	1.0035	1.0036
23.5	1.0034	1.0035	1.0035	1.0036	1.0036	1.0036	1.0037
24.0	1.0035	1.0036	1.0036	1.0037	1.0037	1.0038	1.0038
24.5	1.0037	1.0037	1.0038	1.0038	1.0039	1.0039	1.0039
25.0	1.0038	1.0038	1.0039	1.0039	1.0040	1.0040	1.0040
25.5	1.0039	1.0040	1.0040	1.0041	1.0041	1.0041	1.0042
26.0	1.0040	1.0041	1.0041	1.0042	1.0042	1.0043	1.0043
26.5	1.0042	1.0042	1.0043	1.0043	1.0044	1.0044	1.0044
27.0	1.0043	1.0044	1.0044	1.0045	1.0045	1.0045	1.0046
27.5	1.0045	1.0045	1.0046	1.0046	1.0047	1.0047	1.0047
28.0	1.0046	1.0046	1.0047	1.0047	1.0048	1.0048	1.0048
28.5	1.0047	1.0048	1.0048	1.0049	1.0049	1.0050	1.0050
29.0	1.0049	1.0049	1.0050	1.0050	1.0051	1.0051	1.0051
29.5	1.0050	1.0051	1.0051	1.0052	1.0052	1.0052	1.0053
30.0	1.0052	1.0052	1.0053	1.0053	1.0054	1.0054	1.0054

To calculate each volume dispensed, multiply each mass that appeared on the balance display by the appropriate **Factor Z**.

To calculate the systematic and random errors for each target volume ($\mathbf{V_T}$), take the mean of calculated volumes ($\mathbf{V_M}$), and use the following equations (with all volumes in milliliters):

Systematic Error (± µL) = $|\mathbf{V_M} * 1000 - \mathbf{V_T} * 1000|$
Systematic Error (± %) = 100 * (**Systematic Error (± µL)** / ($\mathbf{V_T} * 1000$))
Random Error (± µL) = 1000 * Standard Deviation of All Calculated Volumes
Random Error (± %) = (**Random Error (± µL)** / ($\mathbf{V_M} * 1000$)

Error limits in accordance with ISO 8655-3 – Piston burettes				
Testing Volume	Error Limits			
	Error			
	Systematic		Random	
	± %	± µL	± %	± µL
50 mL	± 0.2	± 100	± 0.1	± 50
25 mL	± 0.4	± 100	± 0.2	± 50
5 mL	± 2	± 100	± 1	± 50

8.0 Reference Documents

USP Calibration Log (L14-PR-100-F062)

9.0 Change Information

New Document.