

<31> VOLUMETRIC APPARATUS

Most of the volumetric apparatus available in the United States is calibrated at 20°, although the temperatures generally prevailing in laboratories more nearly approach 25°. To minimize volumetric error, the temperature should be the same for the volumetric apparatus, the material being prepared, the solvents being used to prepare the volumetric solutions, the area in which they are prepared, and the final volume adjustment.

USE

To attain the degree of precision required in many Pharmacopeial assays involving volumetric measurements and directing that a quantity be “accurately measured”, the apparatus must be chosen and used with care. A buret should be of such size that the titrant volume represents not less than 30% of the nominal volume. Where less than 10 mL of titrant is to be measured, a 10-mL buret or a microburet generally is required.

STANDARDS OF ACCURACY

The capacity tolerances for volumetric flasks, transfer pipets, and burets are those accepted by the National Institute of Standards and Technology (Class A),¹ as indicated in *Table 1*, *Table 2*, and *Table 3*, respectively. [NOTE—The tables in this chapter list the tolerances for the most commonly used sizes. See the referenced ASTM standards for a complete list of tolerances and other applicable criteria.] Use Class A volumetric apparatus unless otherwise specified in the individual monograph. When plastic volumetric apparatus is specified, the accepted capacity tolerances are equal to Class B glass.²

The capacity tolerances for measuring (i.e., “graduated”) pipets of up to and including 10-mL capacity are somewhat larger than those for the corresponding sizes of transfer pipets, namely, 10, 20, and 30 µL for the 2-, 5-, and 10-mL sizes, respectively.

Transfer and measuring pipets calibrated “to deliver” should be drained in a vertical position and then touched against the wall of the receiving vessel to drain the tips. Volume readings on burets should be estimated to the nearest 0.01 mL for 25- and 50-mL burets and to the nearest 0.005 mL for 5- and 10-mL burets. Pipets calibrated “to contain” are called for in special cases, generally for measuring viscous fluids such as syrups; however, a volumetric flask may be substituted for a “to contain” pipet. In such cases, the pipet or flask should be washed clean after draining, and the washings should be added to the measured portion.

Table 1. Volumetric Flasks

Designated volume, mL	10	25	50	100	250	500	1000
Limit of error, mL	0.02	0.03	0.05	0.08	0.12	0.20	0.30
Limit of error, %	0.20	0.12	0.10	0.08	0.05	0.04	0.03

Table 2. Transfer Pipets

Designated volume, mL	1	2	5	10	25	50	100
Limit of error, mL	0.006	0.006	0.01	0.02	0.03	0.05	0.08
Limit of error, %	0.60	0.30	0.20	0.20	0.12	0.10	0.08

Table 3. Burets

Designated volume, mL	10 (“micro” type)	25	50
Subdivisions, mL	0.02	0.1	0.1
Limit of error, mL	0.02	0.03	0.05

¹ See ASTM 288-06, ASTM E287-02, ASTM E1189-00, and ASTM E969-02.

² See ASTM E288 and ISO Standard 384.