Designation: E934 – 94 (Reapproved 2021)

Standard Specification for Serological Pipet, Disposable Plastic[1]

This standard is issued under the fixed designation E934; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This specification covers disposable plastic serological pipets, calibrated "to deliver" when measuring volumes of liquids.

1.1.1 *Any institution or individual who reuses a disposable pipet must bear full responsibility for its safety and effectiveness.*

1.2 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D703 Specification for Polystyrene Molding and Extrusion Materials (Withdrawn 1987)[3]

E542 Practice for Calibration of Laboratory Volumetric Apparatus

E920 Specification for Commercially Packaged Laboratory Apparatus

E921 Specification for Export Packaged Laboratory Apparatus

E1133 Practice for Performance Testing of Packaged Laboratory Apparatus for United States Government Procurements

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *accuracy*—the expected distribution of mean volumes around the stated volume.

3.1.2 *coefficient of variation*—the expected distribution of individual volumes around the mean volume.

3.1.3 *disposable pipet*—such pipets will only be expected to provide their specified performance during their original use or operation.

4. Material and Manufacturer

4.1 The pipets made to this specification shall be fabricated from crystal grade, uncolored polystyrene, or regrind of same, in accordance with Specification D703.

5. Design

5.1 *Shape*—0.5, 1.0, and 2.0-cm^3 pipets shall be straight and of one-piece construction. Any cross section of a pipet taken in a plane perpendicular to the longitudinal axis shall be circular.

5.1.1 Pipets of 5.0, 10.0, 25.0, and 50.0 cm^3 shall be straight and may consist of one, two, or three components, the extruded pipet barrel, the pulled or injection molded tip, and the plain, pulled, or injection molded top end. Any cross section of a pipet taken in a plane perpendicular to the longitudinal axis shall be circular.

5.2 *Delivery Tips*—Delivery tips shall be made with a gradual taper of 10 to 40 mm. The tip end shall be reasonably perpendicular to the longitudinal axis of the pipet, and shall be free of internal flash.

5.3 *Top End*—The 5, 10, 25.0, and 50.0-cm^3 sizes shall have a top end with an inside diameter of 2 to 6.5 mm for a minimum distance of 20 mm from the open end, and shall have an overall length of 24 to 28 mm. On all sizes, the top end shall be suitable for plugging with filtering material. The top may be flat or chamfered and must be without sharp outer edges. All top ends shall be reasonably perpendicular to the longitudinal axis of the pipet. The O.D. of top end should range from 7 to 9 mm.

5.4 *Dimensions and Outflow Times*—The limiting dimensions and outflow times shall be as shown in Table 1. Outflow times shall be determined by means of a stopwatch on unplugged pipets when using distilled water at 25 ± 5 °C.

[1] This specification is under the jurisdiction of ASTM Committee E41 on Laboratory Apparatus and is the direct responsibility of Subcommittee E41.01 on Laboratory Ware and Supplies.

Current edition approved Jan. 1, 2021. Published February 2021. Originally approved in 1983. Last previous edition approved in 2015 as E934 – 94(2015). DOI: 10.1520/E0934-94R21.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

TABLE 1 Dimensions and Outflow Times

Capacity, cm^3	Least Value	Graduation cm^3 (mL)		Outside Diameter Graduated Portion, mm	Outflow, s		Wall Thickness, min, mm
		Main No.	Graduation 0 to		min	max	
0.5	0.01	0.1	0.4	4.5 to 4.8	0.5	3.0	0.8
1.0	0.01	0.1	0.9	4.5 to 4.8	0.5	3.0	0.8
1.0	0.10	0.1	0.9	4.5 to 4.8	0.5	3.0	0.8
2.0	0.01	0.1	1.8	5.5 to 6.7	0.5	4.0	0.9
2.0	0.10	0.2	1.8	5.5 to 6.7	0.5	4.0	0.9
5.0	0.10	1	4.0	7.6 to 8.4	0.5	7.0	0.9
10.0	0.10	1	9.0	9.5 to 11.7	0.5	8.0	0.9
25.0	0.20 or 0.25	1 or 2	23.0	13.0 to 15.0	1.0	10.0	0.7
50.0	0.25	1 or 2	47.0	17.0 to 19.0	2.0	12.0	0.8

6. Markings

6.1 *Graduation Markings*—Graduation lines shall be between 0.2 mm and 0.5 mm in width, and in a plane perpendicular to the longitudinal axis of the pipet parallel to each other. A main graduation line shall extend at least ⅗ of the way around the pipet. The values of all main graduation lines shall be in Arabic numbers directly above the lines referenced. Intermediate graduation lines shall extend at least ⅕ of the way around the pipet, and least graduation lines shall extend at least ⅛ of the way around the pipet. The zero graduation line shall be at least 90 mm below the top of the pipet on all sides.

6.2 *Identification Markings*—Each pipet shall be marked with the manufacturer's or vendor's name or trademark, its capacity and subdivision, the symbols "TD" ("to deliver") and "20 °C", and either a wide band or two narrow bands on the top end to signify that the last drop must be blown out to achieve full delivery.

7. Capacity

7.1 The pipet capacity, expressed as cm^3 (or mL), and the expected deviation from the stated capacity, shall be stated on the product package or published data. The expected deviation from stated capacity is expressed as accuracy and coefficient of variation. Pipets shall be calibrated for delivery at 20 °C.

7.1.1 The accuracy shall be determined as specified in 7.2 and shall be within the limits given in Table 2.

7.1.2 The coefficient of variation shall be determined as specified in 7.2 and shall be within the limits given in Table 2.

TABLE 2 Accuracy and Coefficient of Variation of Stated Capacity

Capacity cm^3	Accuracy + %[A]	Coefficient of Variation Equal to or less than 1.5 %
0.5	3	1.5
1.0	3	1.5
2.0	3	1.5
5.0	3	1.5
10.0	3	1.5
25.0	3	1.5
50.0	3	1.5

[A] Accuracy and coefficient of variation are expressed as a percentage of the stated capacity.

7.2 *Determination of Accuracy and Coefficient of Variation*—A minimum number of 30 pipets in accordance with Practice E542, taken at random, shall be tested gravimetrically, using distilled water. Distilled water at 20 ± 1 °C is drawn into the pipet and the volume adjusted as in the case of normal use. This is discharged into a tared weighing bottle and the mass, *m*, is determined using a balance capable of weighing to ±0.0001 g. The volume, v_x, is computed from the relation:

$$v_x = \frac{m}{0.998} \quad (1)$$

7.2.1 *Accuracy* (*A*)

A = $(\bar{x} - v_1)/v_1 \times 100$, in percent,
$\bar{x}$ = mean of sample measurements, and
v_1 = stated capacity or stated volume of pipet.

7.2.2 *Coefficient of Variation* (*cv*)

cv = $100S/\bar{x}$, in percent
S = standard deviation

$$= \sqrt{\frac{\sum (x - x)^2}{n - 1}}$$

x = individual sample measurements,
$\bar{x}$ = mean of sample measurements, and
n = number of pipets measured.

7.2.3 The use of volumetric standards developed from and traceable to gravimetric standards is permissible if said volumetric standards were calibrated using weighings and corrections as recommended in Practice E542.

8. Workmanship, Finish, and Appearance

8.1 Pipets shall be free from defects that may impair their serviceability, such as foreign matter or chips that affect the bore.

9. Packaging

9.1 For packaging, select from Specifications E920, E921, or Practice E1157.

10. Keywords

10.1 disposable; pipet; plastic; serological