



Designation: E 1154 – 89 (Reapproved 1997)

Standard Specification for Piston or Plunger Operated Volumetric Apparatus¹

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1. Scope

1.1 This specification covers requirements, operating conditions, and test methods for piston or plunger operated volumetric apparatus (POVA).

1.2 This specification includes specifications applicable for all types of POVA or those given by the manufacturer. The following precautionary caveat pertains only to the test method portion, Section 13, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ISO Documents:²

ISO 3534 Statistics—Vocabulary and Symbols

ISO 653 Long Solid-Stem Thermometers for Precision Use

ISO 655 Long Enclosed-Scale Thermometers for Precision Use

ISO 4787 Laboratory Glassware—Volumetric Glassware—Methods for Testing and Use

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *accuracy*³—the accuracy of an instrument is the closeness of agreement between the nominal volume and the mean volume, obtained by applying the test procedure specified in Section 13 of this specification. It is quantified by the inaccuracy of the mean.

3.1.2 *dead volume*—the dead volume is that part of the total liquid volume, held in the operational part of the device, which is not delivered.

3.1.2.1 *Discussion*—The dead volume should not be confused with the dead space of an air displacement instrument.

3.1.3 *disposable*—those parts of an instrument that are intended to be used once only and then discarded. Disposable parts are generally intended for use in applications where

sample carryover is intolerable.

3.1.4 *maximum error*—the maximum difference between the nominal volume and any single individual volume obtained by applying the test procedure specified in Section 13 of this ISO Standard.

3.1.5 *maximum expectable error*—with more than 95 % probability, the maximum expectable error is calculated as follows:

$$\pm(1E_T + 2s) \quad (1)$$

where:

E_T = inaccuracy of the mean, and

s = standard deviation from the repeatability test in Section 13.

3.1.6 *nominal volume(s)*—the stated volume(s) for which performance is specified.

3.1.7 *unit of volume*—the millilitre or the microlitre, that are accepted substitutes for the cubic centimetre or cubic millimetre.

3.1.7.1 *Discussion*—It is recommended that volumes should be specified in microlitres up to 999 µL, and in millilitres from 1 mL.

3.1.8 *piston or plunger operated volumetric apparatus (POVA)*—the volume of liquid to be measured with POVA is defined by one or more strokes of one or more pistons or plungers. POVA may be operated manually or mechanically (for example, electrically, pneumatically or by hydrostatic pressure).

3.1.8.1 *Discussion*—In the following text the word 'piston' means 'piston or plunger.'

3.1.9 *precision*³—the closeness of agreement between the individual volumes obtained by applying the test procedure specified in this specification. It is quantified by the imprecision.

3.1.9.1 *Discussion*—The test procedure specified gives only a measure of the repeatability (see ISO 3534) under controlled conditions.

3.1.10 *reusable*—those parts of an instrument that are meant to be used more than once. As the reusability of some parts can rarely be quantified, any institution or individual who reuses a reusable part must see to its safety and effectiveness. Reusable parts are generally intended for use in applications where sample carryover is tolerable, or can be adequately prevented.

3.1.11 *sample carryover*—that portion of the sample that is retained in the instrument and that may affect subsequent samples.

¹ This specification is under the jurisdiction of ASTM Committee E-41 on Laboratory Apparatus and is the direct responsibility of Subcommittee E41.06 on Weighing Devices.

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² Available from American National Standards Institute, 1430 Broadway, New York, NY 10018.

³ These definitions apply only in the cases where the distributions are Gaussian.