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Piston-operated volumetric apparatus —

Part 3: **Burettes**

Appareils volumétriques à piston —

Partie 3: Burettes

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 48, *Laboratory equipment*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 332, *Laboratory equipment*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 8655-3:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 8655-3:2002/Cor.1:2008.

The main changes are as follows:

— ISO 8655-7 and ISO 8655-8 have been added as normative references;

— Tables 1 and 2 have been revised.

A list of all parts in the ISO 8655 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 8655 series addresses the needs of:

— manufacturers, as a basis for quality control including, where appropriate, the issuance of manufacturer's declarations;

— calibration laboratories, test houses, users of the equipment and other bodies as a basis for independent calibration, testing, verification and routine tests.

The tests specified in the ISO 8655 series are intended to be carried out by trained personnel.

Piston-operated volumetric apparatus —

Part 3:
Burettes

1 Scope

This document specifies

— metrological requirements,

— maximum permissible errors,

— requirements for marking and

— information to be provided for users,

for burettes. This document is applicable to burettes with nominal volumes up to 100 ml, designed to deliver their specified volume (Ex).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3696:1987, *Water for analytical laboratory use — Specification and test methods*

ISO 8655-1, *Piston-operated volumetric apparatus — Part 1: Terminology, general requirements and user recommendations*

ISO 8655-6, *Piston-operated volumetric apparatus — Part 6: Gravimetric reference measurement procedure for the determination of volume*

ISO 8655-7, *Piston-operated volumetric apparatus — Part 7: Alternative measurement procedures for the determination of volume*

ISO 8655-8, *Piston-operated volumetric apparatus — Part 8: Photometric reference measurement procedure for the determination of volume*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 8655-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Principle of operation

Burettes are used for the accurate delivery of liquids. In contrast with pipettes, dispensers and dilutors, which are designed to dispense accurately preselected volumes, burettes are required to dispense

volumes of liquids until external criteria such as pH or conductivity are met, at which point it is necessary to know the accurate volume dispensed.

The piston can be operated manually, electrically, pneumatically or hydraulically. The volume delivered can be indicated mechanically or by electronic means. The drive, the piston and the cylinder can be one unit, or modular to permit the use of different pistons and cylinders (change-over units) with the same drive.

Prior to delivery, the piston system is charged by aspiration of liquid from a reservoir. After air-bubble-free filling of the system, movement of the piston in one direction dispenses the liquid whose volume is to be measured; movement in the other direction recharges the system from the reservoir (see Figure 1).

Burettes may or may not be equipped with valves or may have several piston/cylinder systems which dispense continuously.

Manufacturers' instruction manuals should contain detailed and specific information about the proper operation of burettes.

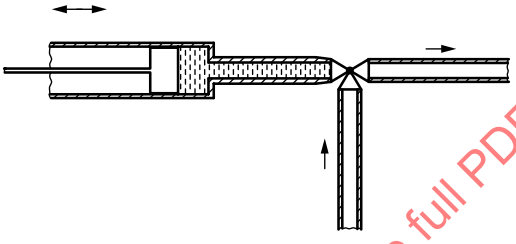

Figure 1 — Schematic drawing of a piston burette

5 Adjustment

5.1 Basis of adjustment

A burette shall be adjusted for the delivery (Ex) of its nominal volume (or selected volume, in the case of a variable-volume model).

For countries that have adopted the standard reference temperature of 20 °C, the adjustment shall be for the temperature of 20 °C, a relative air humidity of 50 % and a barometric pressure of 101,3 kPa, when handling grade 3 water as specified in ISO 3696:1987.

For those countries that have adopted a standard reference temperature of 27 °C, the adjustment shall be for the temperature 27 °C, a relative air humidity of 50 % and a barometric pressure of 101,3 kPa, when handling grade 3 water as specified in ISO 3696:1987.

5.2 Initial adjustment

A burette shall be provided with an initial adjustment.

5.3 Subsequent adjustment

Some burettes have provision for adjustment when, for example, it is found upon routine checking that the volume delivered is not within specification. Such adjustment shall be made according to the manufacturer's instructions and by reference to a measurement procedure in accordance with ISO 8655-6, ISO 8655-7 or ISO 8655-8.

Any burette so adjusted shall have clear, visible evidence that the initial adjustment has been modified. This information shall also be recorded.

6 Metrological performance requirements

6.1 General

In order to state the metrological trueness and precision of the total system of the POVA and thus determine its systematic and random errors, a reference measurement procedure as specified in ISO 8655-6 and ISO 8655-8 or a measurement procedure in accordance with ISO 8655-7 shall be used. The total system consists of the drive and, if applicable, the change-over unit (see Clause 4) and shall be included with the measurements. The maximum permissible errors given in Tables 1 and 2 shall apply.

If metrological performance data are issued for change-over units by the manufacturer, the manufacturer shall specify the combination of drive and change-over unit to which the metrological performance data applies.

6.2 Calculation of maximum permissible errors not given in Tables 1 and 2

The calculation of maximum permissible systematic and random error in the usable volume range, not included in Tables 1 and 2, shall be made by dividing the nominal volume by the selected volume and multiplying the result by the maximum permissible error at nominal volume. This calculation does not apply to volumes below 10 % of the nominal volume.

Formula (1) shall be applied for the calculation:

$$e_{Vs} = \frac{V_{nom}}{V_s} \text{ x } e_{Vnom} \quad (1)$$

where

V_{nom} is the nominal volume;

V_s is the selected volume;

e_{Vnom} is the maximum permissible error (either systematic or random) at nominal volume;

e_{Vs} is the maximum permissible error (either systematic or random) at the selected volume.

If the calculated value exceeds 25 %, then the value of 25 % shall be applied as the maximum permissible error.

EXAMPLE Hand-driven piston burette with a nominal volume of 5 ml and a usable volume range of 0,5 ml to 5 ml.

Calculation of maximum permissible systematic error at a selected volume of 1 ml:

e_{Vnom} = 0,5 %

V_{nom} = 5 ml

V_s = 1 ml

$$e_{V_s} = \frac{V_{nom}}{V_s} \text{ x } e_{Vnom}$$

$$e_{V_s\,(1\text{ ml})} = \frac{5\text{ ml}}{1\text{ ml}} \text{ x } 0{,}5\ \%$$

$$e_{V_s\,(1\text{ ml})} = 5 \text{ x } 0{,}5\ \%$$

$$e_{V_s\,(1\text{ ml})} = 2{,}5\ \%$$

Table 1 — Maximum permissible errors for motor-driven piston burettes

Dispensing volume		Maximum permissible systematic error[a]	Maximum permissible random error[a]
Nominal volumes ml	Setting as a proportion of the nominal volume %	±%	%[b]
≤ 1	100	0,60	0,10
	50	1,2	0,20
	10	6,0	1,0
> 1 to 2	100	0,50	0,10
	50	1,0	0,20
	10	5,0	1,0
> 2 to 5	100	0,30	0,10
	50	0,60	0,20
	10	3,0	1,0
> 5 to 25	100	0,20	0,070
	50	0,40	0,14
	10	2,0	0,70
> 25 to 50	100	0,20	0,050
	50	0,40	0,10
	10	2,0	0,50
> 50 to 100	100	0,20	0,030
	50	0,40	0,060
	10	2,0	0,30

[a] To calculate errors in units of millilitres, multiply the maximum permissible errors by the selected volume.

[b] Expressed as the coefficient of variation according to ISO 8655-6, ISO 8655-7, or ISO 8655-8.

Table 2 — Maximum permissible errors for hand-driven piston burettes

Dispensing volume		Maximum permissible systematic error[a]	Maximum permissible random error[a]
Nominal volumes ml	Setting as a proportion of the nominal volume %	±%	%[b]
≤ 1	100	0,60	0,10
	50	1,2	0,20
	10	6,0	1,0
> 1 to 2	100	0,50	0,10
	50	1,0	0,20
	10	5,0	1,0
> 2 to 10	100	0,30	0,10
	50	0,60	0,20
	10	3,0	1,0
> 10 to 100	100	0,20	0,10
	50	0,40	0,20
	10	2,0	1,0

[a] To calculate errors in units of millilitres, multiply the maximum permissible errors by the selected volume.

[b] Expressed as the coefficient of variation according to ISO 8655-6, ISO 8655-7, or ISO 8655-8.

7 User information

Information essential to the proper use of the burette and its accessories (see ISO 8655-1) shall be provided when making a burette available on the market and shall be as follows.

a) the basis of adjustment (Ex) at reference conditions according to ISO 8655-1,

b) nominal volume or usable volume range of the burette; where this is not practicable [see 8.1 a)], information shall be provided to enable the nominal volume to be correctly identified from markings on the appropriate unit or module,

c) smallest volume which can be delivered observing the maximum permissible errors in accordance with Clause 6,

d) the correct method of use, including a reference to this document, i.e. ISO 8655-3,

e) the error limits of the systematic and random error of measurement at the nominal volume, at 50 % of the nominal volume and either at 10 % of the nominal volume or the smallest selectable volume whichever is greater,

f) information regarding the care, cleaning and maintenance of the burette,

g) advice about air bubble-free filling,

h) suggestions as to the basis on which a minimum routine testing protocol can be established including a reference to this document, i.e. ISO 8655-3,

i) upon request, information regarding the interaction of the materials of the burette with organic and inorganic solutions, solvents and caustic chemicals,

j) recommendations for the proper storage of the burette.