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Piston-operated volumetric apparatus —

Part 5: Dispensers

Appareils volumétriques à piston —

Partie 5: Distributeurs

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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 8655-5:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 8655-5:2002/Cor.1:2008.

The main changes compared to the previous edition are as follows:

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

— metrological performance requirements for dispenser tips have been further specified;

— 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 5:
Dispensers

1 Scope

This document specifies

— metrological requirements,

— maximum permissible errors,

— requirements for marking and

— information to be provided for users,

for dispensers. It is applicable to dispensers with nominal volumes from 1 µl up to 200 ml, designed to deliver their 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 terminological 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

Dispensers are used for the accurate repetitive delivery (dispensing) of preset liquid volumes. They are of two types:

— single-stroke dispensers providing a single delivery from each filling stroke;

— multiple delivery dispensers or ratchet-based systems providing multiple deliveries from each filling stroke.

The piston can be operated manually, electrically, pneumatically or hydraulically. Drive mechanism, piston and cylinder can be a single unit or can be separable by simple hand actions, so that different pistons and cylinders (change-over units) can be used with the same drive mechanism.

During operation, the aspiration tube dips into the reservoir containing the fluid to be dispensed. After the system has been primed with fluid, assuring that it is free of any air, the piston aspirates fluid by moving in one direction and delivers the fluid to be measured by moving in the opposite direction.

Dispensers can be constructed with or without valves, see Figure 1. The metrological characteristics of dispensers are dependent on, among other things, the material and workmanship of the aspiration and delivery tubing used. The dispenser shall therefore be provided together with the necessary tubing or suggestion or statement about the characteristics the tubing shall have in order to meet the metrological demands placed on the system.

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

Key

↔ piston movement direction

↑ liquid uptake direction

→ liquid delivery direction for dispensers with valves

Figure 1 — Schematic drawing of dispensers with and without valves

5 Adjustment

5.1 Basis of adjustment

A dispenser 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 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 dispenser shall be provided with an initial adjustment.

5.3 Subsequent adjustment

Some dispensers have provision for adjustment when, for example, it is found in routine check that the volume delivered is not within the 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 dispenser 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 dispenser 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 method 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) including aspiration and delivery tubing and shall be included in 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 errors 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 Single-stroke dispenser with a nominal volume of 10 ml and a usable volume range of 1–10 ml. Calculation of maximum permissible systematic error at a selected volume of 2 ml:

e_{Vnom} = 0,60 %

V_{nom} = 10 ml

Vs = 2 ml

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

$$e_{Vs(2\ ml)} = \frac{10\ ml}{2\ ml} \text{ x } 0{,}6\ \%$$

$$e_{Vs(2\ ml)} = 5 \text{ x } 0{,}6\ \%$$

$$e_{Vs(2\ ml))} = 3\ \%$$

Table 1 — Maximum permissible errors for single-stroke dispensers

Dispensing volume		Maximum permissible systematic error[a]	Maximum permissible random error[a]
Nominal volumes ml	Setting as a proportion of the nominal volume %	±%	%[b]
0,01	100	2,0	1,0
	50	4,0	2,0
	10	20	10
> 0,01 - 0,02	100	2,0	0,50
	50	4,0	1,0
	10	20	5,0
> 0,02 - 0,05	100	1,5	0,40
	50	3,0	0,80
	10	15	4,0
> 0,05 - 0,1	100	1,5	0,30
	50	3,0	0,60
	10	15	3,0
> 0,1 - 0,2	100	1,0	0,30
	50	2,0	0,60
	10	10	3,0
> 0,2 - 0,5	100	1,0	0,20
	50	2,0	0,40
	10	10	2,0
> 0,5 - 200	100	0,60	0,20
	50	1,2	0,40
	10	6,0	2,0

[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.