FINAL DRAFT

INTERNATIONAL STANDARD

ISO/FDIS 8655-4

ISO/TC **48**

Secretariat: **DIN**

Voting begins on:
2021-11-17

Voting terminates on:
2022-01-12

Piston-operated volumetric apparatus —

Part 4: Dilutors

Appareils volumétriques à piston —

Partie 4: Diluteurs

ISO/CEN PARALLEL PROCESSING

Reference number
ISO/FDIS 8655-4:2021(E)

Contents

Page

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 8655-4:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 8655-4:2002/Cor.1:2008.

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

— ISO 8655-7 has been added as normative reference;

— 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 4:
Dilutors

1 Scope

This document specifies

— metrological requirements,

— maximum permissible errors,

— requirements for marking and

— information to be provided for users,

for dilutors with a sample uptake capacity (In) from 5 µl to 10 ml and a diluent capacity (Ex) from 50 µl to 100 ml. They are designed to deliver the sample and diluent together in measured proportion and measured volume.

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:—[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*

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

A dilutor is designed to aspirate accurately a measured volume of a sample liquid and to deliver it together with an accurately measured volume of diluent. Dilutors can be operated manually, electrically,

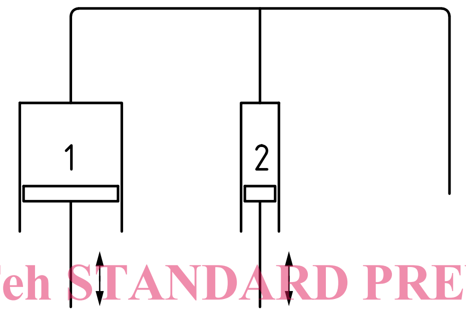
1) Under preparation. Stage at the time of publication: ISO/FDIS 8655-1:2021.

pneumatically or hydraulically and can be hand-held, bottle-top mounting or free-standing bench-top apparatus. They can also be automated analyser's components. The drive components can be integral with, or manually separable from the volumetric measuring components (change-over units).

Prior to delivery of diluent, the diluent piston system is charged by aspiration of diluent from a reservoir. After air-bubble-free filling of the system, diluent is drawn into the volume measuring cylinder by the diluent piston, either directly, via the uptake and delivery probe, or indirectly, from a reservoir until a volume controlling limit is reached. A measured volume of sample is then aspirated into the uptake and delivery probe.

The uptake of sample can be controlled by a second limit to the movement of the diluent piston, or it can involve a second, dedicated, cylinder and piston with valves (see Figure 1). During delivery, the sample volume in the uptake and delivery probe is expelled, followed by the measured quantity of diluent.

Manufacturers' instruction manuals shall contain detailed and specific information about the proper operation of dilutor.



Key

1 volume of diluent

2 piston for sample uptake

Figure 1 — Schematic drawing of a dilutor

5 Adjustment

5.1 Basis of adjustment

A dilutor shall be adjusted for the delivery (Ex) of its nominal volume (or selected volume, in the case of a variable-volume model) and if applicable also for its sample uptake (In).

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 dilutor shall be provided with an initial adjustment.

5.3 Subsequent adjustment

Some dilutors 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 in accordance with the manufacturer's instructions and by reference to a gravimetric measurement procedure in accordance with ISO 8655-6 or ISO 8655-7.

Any dilutor 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 dilutor and thus determine its systematic and random errors, a gravimetric measurement procedure in accordance with ISO 8655-6 or ISO 8655-7 shall be used. The total system consists of the piston units and valves, drive, uptake and delivery probe and tubes and, if applicable, the change-over unit (see Clause 4) 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 by the manufacturer, it shall be stated precisely which specific components have been tested.

NOTE Using substitute tubing can alter the metrological performance of the dilutor system.

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

The calculation of maximum permissible systematic and random errors 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:

$$e_{V_s} = \frac{V_{nom}}{V_s} \text{ x } e_{V_{nom}} \qquad (1)$$

where

V_{nom} is the nominal volume;

V_s is the selected volume;

$e_{V nom}$ 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 Dilutor sample uptake 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:

$e_{V nom}$= 0,8 %

V_{nom} = 5 ml

V_s = 1 ml

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

$$e_{Vs(1\ \text{ml})} = \frac{5\ \text{ml}}{1\ \text{ml}} \times 0{,}8\ \%$$

$$e_{Vs(1\ \text{ml})} = 5 \times 0{,}8\ \%$$

$$e_{Vs(1\ \text{ml})} = 4\ \%$$

Table 1 — Maximum permissible errors of sample uptake

Sample uptake volume		Maximum permissible systematic error[a]	Maximum permissible random error[a]
Nominal volumes µl	**Setting as a proportion of the nominal volume** %	±%	%[b]
5	100	3,0	2,0
	50	6,0	4,0
	10	25	20
> 5 – 20	100	2,0	0,80
	50	4,0	1,6
	10	20	8,0
> 20 – 50	100	1,8	0,40
	50	3,6	0,80
	10	18	4,0
> 50 – 100	100	1,5	0,20
	50	3,0	0,40
	10	15	2,0
> 100 - 200	100	1,0	0,20
	50	2,0	0,40
	10	10	2,0
> 200 – 500	100	0,80	0,20
	50	1,6	0,40
	10	8	2,0
> 500 –1 000	100	0,60	0,15
	50	1,2	0,30
	10	6,0	1,5

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

[b] Expressed as the coefficient of variation of a tenfold measurement according to the gravimetric measurement procedures described in ISO 8655-6 and ISO 8655-7.