INTERNATIONAL STANDARD

ISO 8655-4

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Piston-operated volumetric apparatus —

Part 4: Dilutors

Appareils volumétriques à piston —

Partie 4: Diluteurs

Reference number
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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 8655 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 8655-4 was prepared by Technical Committee ISO/TC 48, *Laboratory glassware and related apparatus*, Subcommittee SC 1, *Volumetric instruments*.

ISO 8655 consists of the following parts, under the general title *Piston-operated volumetric apparatus*:

- *Part 1: Terminology, general requirements and user recommendations*
- *Part 2: Piston pipettes*
- *Part 3: Piston burettes*
- *Part 4: Dilutors*
- *Part 5: Dispensers*
- *Part 6: Gravimetric methods for the determination of measurement error*

The following part is under preparation:

- *Part 7: Non-gravimetric methods for the determination of measurement error*

Introduction

ISO 8655 addresses the needs of:

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

— test houses and other bodies, as a basis for independent certification;

— users of the equipment, to enable routine checking of accuracy.

The tests specified should be carried out by trained personnel.

Piston-operated volumetric apparatus —

Part 4:
Dilutors

1 Scope

This part of ISO 8655 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.

NOTE General requirements and definitions of terms for piston-operated volumetric apparatus are given in ISO 8655-1. Conformity testing (type evaluation) of piston-operated volumetric apparatus is given in ISO 8655-6. Alternative test methods such as photometric and titrimetric methods will be the subject of a future Part 7 to ISO 8655. For all other tests (e.g. quality assurance by the supplier, analytical and measuring equipment quality assurance by the user) see ISO 8655-6 or alternative test methods. For safety requirements of electrically powered piston dilutors, see IEC 61010-1.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 8655. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 8655 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

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

ISO 8655-1:2002, *Piston-operated volumetric apparatus — Part 1: Terminology, general requirements and user recommendations*

ISO 8655-6:2002, *Piston-operated volumetric apparatus — Part 6: Gravimetric methods for the determination of measurement error*

3 Terms and definitions

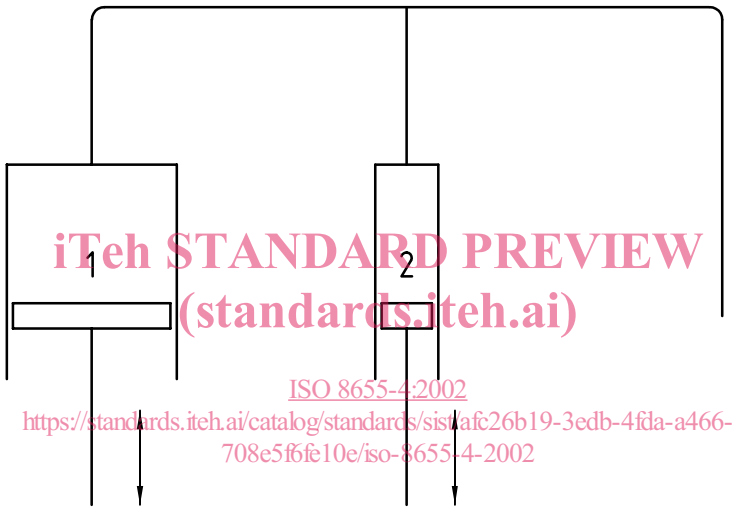
For the purposes of this part of ISO 8655, the terms and definitions given in ISO 8655-1 apply.

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 may be operated manually, electrically, pneumatically or hydraulically and may be hand-held, bottle-top mounting or free-standing bench-top apparatus. They can also be automated analyser's components. The drive components may 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 may be controlled by a second limit to the movement of the diluent piston, or it may involve a second, dedicated, cylinder and piston with valves. During delivery, the sample volume in the uptake and delivery probe is expelled, followed by the measured quantity of diluent.



Key

1 Volume of diluent

2 Piston for sample uptake

Figure 1 — Schematic drawing of a dilutor

5 Adjustment

5.1 A dilutor shall be adjusted by its supplier for the uptake and delivery of its stated volumes and for the standard reference temperature of 20 °C, using grade 3 water as specified in ISO 3696.

5.2 If the dilutor is designed to have its factory preset adjustment altered by the user, the design shall prevent unintentional readjustment. If the user readjusts the dilutor, it shall be clearly and unequivocally indicated on the outside of the dilutor that readjustment has been effected, for example by means of a mark, a broken seal, or a label affixed by the user.

5.3 Type testing of the adjustment shall satisfy the performance requirements specified in clause 6 when the dilutor is tested in accordance with ISO 8655-6.

6 Metrological performance requirements

The conformity test (type evaluation) specified in ISO 8655-6 evaluates the total system of the dilutor, comprising the piston units and valves, drive, uptake and delivery probe and tubes and, if applicable, the change-over unit (see clause 4).

The conformity test shall be carried out in accordance with ISO 8655-6 by

— the supplier, prior to the issuance of a supplier's declaration of conformity, or

— a test house or other authorized body, prior to the issuance of a certificate of conformity.

For conformity tests, the maximum permissible errors of Tables 1 and 2 shall apply. If a supplier's declaration or a certificate of conformity is issued, it shall be stated precisely which specific components have been tested. The use of substitute tubing involves alteration of the system type-tested and this may invalidate the supplier's or third party certified volumetric performance.

Table 1 — Maximum permissible errors of sample uptake

Nominal volume	Maximum permissible systematic error		Maximum permissible random error	
µl	± %	± µl [a]	± % [b]	± µl [c]
5	3,0	0,15	2	0,1
10	2,0	0,2	0,8	0,08
20	2,0	0,4	0,8	0,16
50	1,8	0,9	0,4	0,2
100	1,5	1,5	0,2	0,2
200	1,0	2,0	0,2	0,4
500	0,8	4,0	0,2	1,0
1 000	0,6	6,0	0,15	1,5

[a] Expressed as the deviation of the mean of a tenfold measurement from the nominal volume or from the selected volume (see ISO 8655-6:2002, 8.4).

[b] Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 8.5)

[c] Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

Table 2 — Maximum permissible errors of diluent

Nominal volume	Maximum permissible systematic error		Maximum permissible random error	
ml	± %	± µl [a]	± % [b]	± µl [c]
0,05	1,8	0,9	0,6	0,3
0,1	1,5	1,5	0,5	0,5
0,2	1,0	2,0	0,4	0,8
0,5	0,8	4,0	0,2	1,0
1	0,6	6,0	0,2	2,0
2	0,6	12,0	0,2	4,0
5	0,6	30	0,15	7,5
10	0,6	60	0,15	15
25	0,6	150	0,15	37,5
50	0,6	300	0,15	75
100	0,6	600	0,15	150

[a] Expressed as the deviation of the mean of a tenfold measurement from the nominal volume or from the selected volume (see ISO 8655-6:2002, 8.4).

[b] Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

[c] Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

