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

*Appareils volumétriques à piston —
Partie 1: Définitions, exigences générales et recommandations pour
l'utilisateur*

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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 8655-1 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

Annex A forms a normative part of this part of ISO 8655.

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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.

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Piston-operated volumetric apparatus —

Part 1:

Terminology, general requirements and user recommendations

1 Scope

This part of ISO 8655 specifies the general requirements for piston-operated volumetric apparatus. It is applicable to piston pipettes, piston burettes, dilutors and dispensers. It furthermore defines terms for the use of piston-operated volumetric apparatus and gives user recommendations.

ISO 8655 is not applicable to medical products intended for use on human beings, e.g. for medical syringes.

NOTE For metrological requirements, maximum permissible errors, requirements for marking and information to be provided for users for piston-operated volumetric apparatus, see ISO 8655-2 for piston pipettes, see ISO 8655-3 for piston burettes, see ISO 8655-4 for dilutors and see ISO 8655-5 for dispensers. Conformity testing (type evaluation) of piston-operated volumetric apparatus is given in ISO 8655-3. 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.

2 Normative references

ISO 8655-1:2002

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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 8655-2:2002, *Piston-operated volumetric apparatus — Part 2: Piston pipettes*

ISO 8655-3:2002, *Piston-operated volumetric apparatus — Part 3: Piston burettes*

ISO 8655-4:2002, *Piston-operated volumetric apparatus — Part 4: Dilutors*

ISO 8655-5:2002, *Piston-operated volumetric apparatus — Part 5: Dispensers*

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

IEC 60073, *Basic and safety principles for man-machine interface, marking and identification — Coding principles for indication devices and actuators*

IEC 61010-1, *Safety requirements for electrical equipment for measurement, control and laboratory use — Part 1: General requirements*

IEC 61326-1, *Electrical equipment for measurement, control and laboratory use — EMC requirements*

3 Terms and definitions

For the purposes of this part of ISO 8655, the following terms and definitions apply.

3.1 Metrological terms

3.1.1

maximum permissible error

upper or lower permitted extreme value for the deviation of the dispensed volume from the nominal volume (3.1.5) or selected volume (3.1.6) of a piston-operated volumetric apparatus

NOTE 1 A general definition for maximum permissible error is given in the VIM.

NOTE 2 The maximum permissible errors of piston-operated volumetric apparatus are specified in ISO 8655-2 to ISO 8655-5. Conformity testing for observance of maximum permissible errors is performed gravimetrically in accordance with ISO 8655-6.

3.1.2

systematic error

(piston-operated volumetric apparatus) difference between the dispensed volume and the nominal volume or selected volume of the piston-operated volumetric apparatus

NOTE 1 General definitions for systematic error are given in the VIM and ISO 3534-1.

NOTE 2 For conformity testing in accordance with ISO 8655-6, the systematic error is ascertained by taking the mean of 10 measurements.

3.1.3

random error

(piston-operated volumetric apparatus) scatter of the dispensed volumes around the mean of the dispensed volumes

NOTE 1 General definitions for random error are given in the VIM and ISO 3534-1.

NOTE 2 For conformity testing in accordance with ISO 8655-6, the random error is ascertained by taking the repeatability standard deviation of 10 measurements.

3.1.4

uncertainty of measurement

(volume dispensed by a piston-operated apparatus) parameter, associated with the dispensed volume, that characterizes the dispersion of the volumes that could reasonably be attributed to the dispensed volume

NOTE 1 Adapted from the VIM.

NOTE 2 The uncertainty of measurement comprises portions of the systematic and random error of measurement. The calculation of the uncertainty of measurement can be performed with the equation given in annex B of ISO 8655-6:2002.

3.1.5

nominal volume

(piston-operated volumetric apparatus) volume specified by the manufacturer and used for identification and for indication of the measuring range

NOTE For specific piston-operated volumetric apparatus such as variable-volume piston pipettes and multi-channel piston pipettes, this definition is further qualified in the applicable parts of ISO 8655.

3.1.6

selected volume

(variable-volume volumetric apparatus) volume set by the user, in order to dispense a volume chosen from the useful volume range (3.1.7) of a variable-volume piston-operated volumetric apparatus

NOTE For a fixed-volume piston-operated volumetric apparatus, the selected volume is equal to the nominal volume.

3.1.7**useful volume range**

that part of the nominal volume which allows dispensing under observance of the maximum permissible errors as specified in the applicable part of ISO 8655

NOTE 1 The upper limit of the useful volume range is always the nominal volume. The lower limit is 10 % of the nominal volume if not otherwise specified by the supplier.

NOTE 2 For piston-operated burettes, provision may be made in the design for the burette to be recharged automatically (involving more than one stroke of the piston) before the required volume has been dispensed.

3.1.8**dead air volume**

(piston-operated pipettes with air interface) air volume between the lower part of the piston and the surface of the liquid

3.1.9**dead liquid volume**

(positive displacement pipettes, burettes, dilutors and dispensers) amount of liquid which does not belong to the dispensed volume and which is contained during operation in aspiration or expelling tubes, valves and within the cylinder

3.1.10**adjustment**

(piston-operated volumetric apparatus) manufacture of an apparatus within appropriate tolerances, or the supplier's setting of the apparatus, ensuring the metrological performance, as specified in the applicable part of ISO 8655, for a reference temperature of 20 °C

3.1.11**user adjustment**

(piston-operated pipette) adjustment employing only the means at the disposal of the user

NOTE 1 Adapted from the VIM.

NOTE 2 Adjustment requires operations which modify the apparatus for subsequent measurements.

3.1.12**calibration**

(piston-operated volumetric apparatus) set of operations that establish the relationship between the dispensed volume and the corresponding nominal or selected volume of the apparatus

NOTE 1 Adapted from the VIM.

NOTE 2 The result of a calibration permits the determination of correction values of the dispensed volume and its associated expanded uncertainty, e.g. following an adjustment or user adjustment.

NOTE 3 The result of a calibration may be recorded in a document called a calibration certificate or a calibration report.

NOTE 4 Calibration requires no operation which permanently modifies the apparatus.

3.2 Terms related to testing**3.2.1****conformity testing**

(piston-operated volumetric apparatus) systematic examination to determine whether the requirements specified in this International Standard, especially in a metrological sense, are fulfilled

NOTE 1 Adapted from ISO/IEC Guide 2.

NOTE 2 The corresponding test methods are specified in the applicable part of ISO 8655.