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**Piston-operated volumetric apparatus —  
Part 2:  
Piston pipettes**

*Appareils volumétriques à piston —*

*Partie 2: Pipettes à piston*  
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Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
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Printed in Switzerland

**Contents**

	Page
1 Scope .....	1
2 Normative references .....	1
3 Terms and definitions .....	2
4 Principle of operation .....	2
5 Design .....	2
6 Type, designation .....	5
7 Metrological performance requirements .....	5
8 Marking .....	8

**Annexes**

A Information to be provided by the supplier for the user of piston pipettes and tips .....	9
B Possible sources of error for piston pipettes with air interface .....	10
Bibliography.....	11

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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 8655-2 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

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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. Annex B is for information only.

## 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 2: Piston pipettes

### 1 Scope

This part of ISO 8655 specifies

- metrological requirements,
- maximum permissible errors,
- requirements for marking and
- information to be provided for users,

for air-displacement (type A) and positive-displacement (type D) single-channel and multi-channel piston pipettes, complete with their selected tip(s) and any other essential, consumable parts, designed to deliver their specified nominal volume (Ex).

NOTE General requirements and definitions of terms of 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 pipettes, see IEC 61010-1.

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### 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 and the following apply.

#### 3.1

##### nominal volume

⟨variable-volume piston pipette⟩ greatest volume selectable by the user and specified by the manufacturer

NOTE This means that a variable-volume piston pipette with a useful volume range (see ISO 8655-1) of 10  $\mu\text{l}$  to 100  $\mu\text{l}$  has the nominal volume of 100  $\mu\text{l}$ .

#### 3.2

##### nominal volume

⟨multi-channel piston pipette⟩ greatest volume selectable by the user and specified by the manufacturer per channel

### 4 Principle of operation

The tip made of plastic or glass is attached to the piston pipette. With the piston at the lower aspiration limit, the tip is dipped into the liquid to be dispensed as a measured volume. When moved to the upper aspiration limit, the piston aspirates the liquid. The liquid volume to be dispensed is then expelled by depressing or sliding the piston between the volume-defining limits. Some air-displacement piston pipettes (see 5.1, type A) have an extra air volume which can be used to expel the last drop of liquid.

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See also Figure 1.

### 5 Design

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#### 5.1 Types of piston pipette

A piston pipette may be designed as follows:

- fixed volume, designed by the manufacturer to dispense only its nominal volume, for example 100  $\mu\text{l}$ ;
- variable volume, designed by the manufacturer to dispense volumes selectable by the user within its specified useful volume range, for example between 10  $\mu\text{l}$  and 100  $\mu\text{l}$ .

The piston may

- either have a body of air contained between the piston and the surface of the liquid (air displacement – type A);
- or be in direct contact with the surface of the liquid (positive or direct displacement – type D).

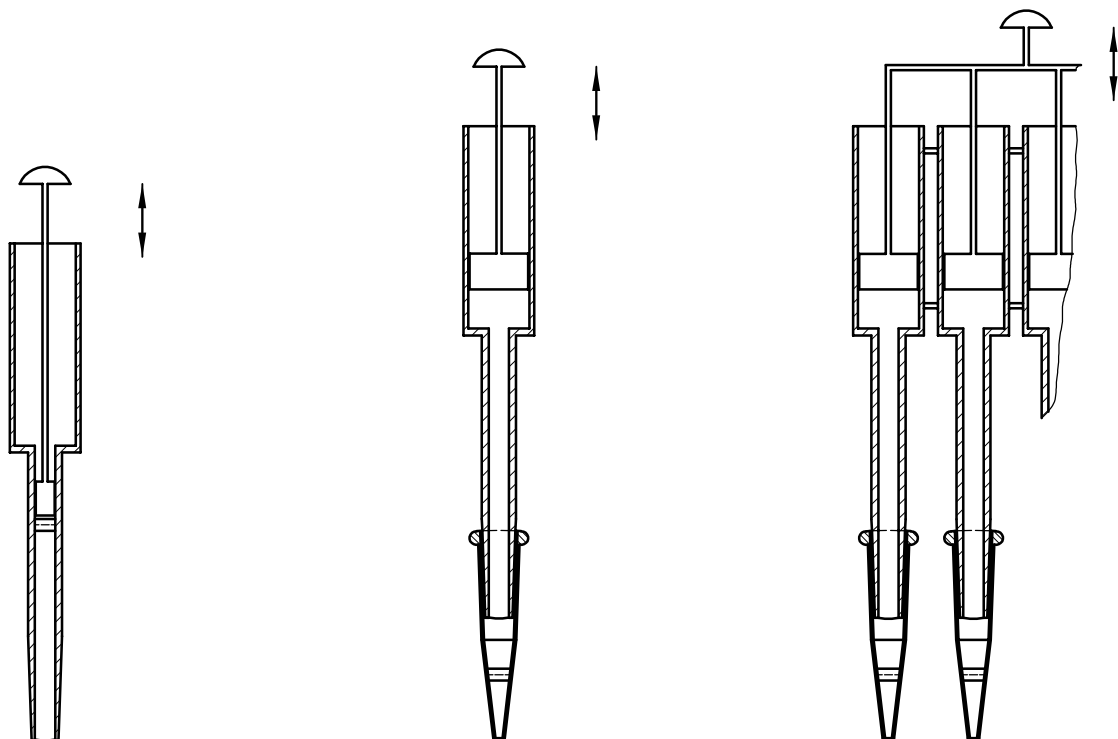
In the case of the type D piston pipette, either the plunger or the capillary, or both may be reusable (type D1) or disposable (type D2).

See Figure 1 for details.

#### 5.2 Adjustment

**5.2.1** A piston pipette shall be adjusted by its manufacturer for the delivery (Ex) of its nominal volume (or selected volume, in the case of a variable-volume model), for the standard reference temperature of 20 °C, a relative air humidity of 50 % and a barometric pressure of 101 kPa (1,01 bar), using grade 3 water as specified in ISO 3696.



**Type D**

Positive (direct) displacement

**Type A**

Air displacement

**a) Single-channel piston pipettes****b) Multi-channel piston pipette**

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**Figure 1 — Piston pipettes**

**5.2.2** Some piston pipettes have provision for adjustment by the user when, for example, it is found in routine calibration that the volume delivered is not within specification. Such user adjustment shall be made according to the manufacturer's instructions and by reference to the gravimetric test method specified in ISO 8655-6.

Any piston pipette so adjusted shall have clear, visible evidence that the initial adjustment has been modified. This information shall also be recorded on any certificate of conformity and the procedure should be included in the user's quality manual.

**5.2.3** Some piston pipettes are designed to have their factory-preset adjustment altered by the user so that they will dispense their specified volume when used with liquids with physical properties differing from those of water (see annex B for details). In such cases, the design shall prevent unintentional readjustment. Such user adjustment shall be made according to the manufacturer's instructions and by reference to the gravimetric test method specified in ISO 8655-6, but using the selected liquid instead of water.

If the user readjusts the piston pipette, it shall be clearly and unequivocally indicated on the outside of the piston pipette that readjustment has been effected. The user shall mark the outside of the piston pipette with the name of the liquid for which the nominal volume now applies. This information shall also be recorded on any certificate of conformity. The procedure should also be included in the user's quality manual.

**5.3 Transfer of hand warmth**

The constructional design of piston pipettes and the materials used for their manufacture shall be chosen in such a way that any heat transmitted from the user's hand to the apparatus during periods of use or of test in accordance with ISO 8655-6 may be ignored.

**NOTE** Transfer of hand warmth will appear as a systematic drift of results during the series of tests to ISO 8655-6.