
Volumetrične naprave, delujoče na bat - 6. del: Gravimetrični referenčni postopek merjenja za določanje prostornine (ISO/DIS 8655-6:2020)

Piston-operated volumetric apparatus - Part 6: Gravimetric reference measurement procedure for the determination of volume (ISO/DIS 8655-6:2020)

Volumenmessgeräte mit Hubkolben - Teil 6: Gravimetrisches Referenzprüfverfahren zur Bestimmung des Volumens (ISO/DIS 8655-6:2020)

Appareils volumétriques à piston - Partie 6: Procédure de mesure de référence gravimétrique pour la détermination du volume (ISO/DIS 8655-6:2020)

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Part 6: Gravimetric reference measurement procedure for the determination of volume

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ISO/DIS 8655-6:2020(E)**Foreword**

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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).

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This second edition cancels and replaces the first edition (ISO 8655-5:2002 and ISO 8655-5:2002/Cor 1:2008), which has been technically revised.

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

- Expanded uncertainty of measurements in [Table 1](#) and [2](#) has been revised in conjunction with ISO/TR 20461;
- Annex B was deleted;
- new [Clause 4](#) “General requirements” is added;
- a new volume formula was added based on ISO 4787.

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

ISO 8655 addresses the needs of:

- manufacturers, as a basis for quality control including, where appropriate, the issuance of manufacturers' declarations;
- calibration laboratories, test houses, users of the equipment and other bodies as a basis for independent calibration, verification and routine checking.

The tests specified in the ISO 8655 series are intended to be carried out by trained personnel.

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Piston-operated volumetric apparatus —

Part 6: Gravimetric reference measurement procedure for the determination of volume

1 Scope

This part of ISO 8655 specifies a gravimetric reference measurement procedure for the determination of volume of piston-operated volumetric apparatus (POVA). The tests are applicable to complete systems comprising the basic apparatus and all parts selected for use with the apparatus, disposable or reusable, involved in the measurement by delivery (Ex) or contained (In).

NOTE General requirements and definitions of terms for piston-operated volumetric apparatus are given in ISO 8655-1. For the 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 pipettes, see ISO 8655-3 for burettes, see ISO 8655-4 for dilutors, see ISO 8655-5 for dispensers, and see ISO 8655-9 for manually operated precision laboratory syringes. The photometric reference measurement procedure for the determination of volume of piston operated volumetric apparatus is given in ISO 8655-8. Alternative measurement procedures or the determination of volume are described in ISO 8655-7.

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/DIS 8655-1:2020, *Piston-operated volumetric apparatus — Part 1: Terminology, general requirements and user recommendation*

ISO/DIS 8655-2:2020, *Piston-operated volumetric apparatus — Part 2: Pipettes*

ISO/DIS 8655-3:2020, *Piston-operated volumetric apparatus — Part 3: Burettes*

ISO/DIS 8655-4:2020, *Piston-operated volumetric apparatus — Part 4: Dilutors*

ISO/DIS 8655-5:2020, *Piston-operated volumetric apparatus — Part 5: Dispensers*

ISO/DIS 8655-7:2020, *Piston-operated volumetric apparatus — Part 7: Alternative measurement procedures for the determination of volume*

ISO/DIS 8655-9:2020, *Piston-operated volumetric apparatus — Part 9: Manually operated precision laboratory syringes*

ISO/TR 20461, *Determination of uncertainty for volume measurements made using the gravimetric method*

ISO/IEC Guide 2:2004, *Standardization and related activities — General vocabulary*

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

ISO/IEC Guide 98:2008, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

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ISO/IEC Guide 98:2012, *Uncertainty of measurement — Part 4: Role of measurement uncertainty in conformity assessment (JCGM 106:2012)*

ISO 4787:2010, *Laboratory glassware — Volumetric instruments — Methods for testing of capacity and for use*

3 Terms and definitions

For the purposes of this part of ISO 8655, the terms and definitions given in ISO/DIS 8655-1:2020, ISO/IEC Guide 2 and ISO/IEC Guide 99 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 <http://www.electropedia.org/>

4 General requirements

When performing calibrations according to the reference measurement procedure described in this standard, all provisions and requirements of this standard shall be followed. If one or more of those requirements are not followed, conformity to ISO 8655-6 shall not be claimed.

5 Test equipment

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Measurements by the following equipment (balance, thermometers, hygrometer, barometer) shall be traceable to the International System of Units (SI), as shown through careful evaluation according to ISO/TR 20461.

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5.1 Analytical balance or equivalent weighing device. The balance used for testing shall be chosen according to the specified minimum requirements of [Table 1](#), depending on the nominal volume of the apparatus under test. The balance parameters are defined so that the expanded uncertainty in use is less than one-fourth of the maximum permissible systematic error of the apparatus.

Table 1 — Minimum requirements for balances

Nominal volume of apparatus under test (V)	Readability (d) mg	Repeatability (s) ^a mg	Expanded uncertainty in use $U (k = 2)^{a, b}$ mg
$0,5 \mu\text{l} \leq V < 20 \mu\text{l}$	0,001 ^c 0,01 ^d	0,006 0,03	0,012 0,06
$20 \mu\text{l} \leq V < 200 \mu\text{l}$	0,01	0,025	0,05
$200 \mu\text{l} \leq V \leq 10 \text{ ml}$	0,1	0,2	0,4
$10 \text{ ml} < V \leq 1\ 000 \text{ ml}$	1	2	4

^a The repeatability and expanded uncertainty in use value, in this table, apply when testing single channel apparatus. When a balance is used exclusively for testing multichannel pipettes the repeatability and expanded uncertainty in use values are double the values of this table.

^b Expanded uncertainty in use can be estimated according to EURAMET CG-18 [2] at the value of the nominal volume. Expanded uncertainty in use shall include non-corrected errors as well as possible drift and environmental effects to balance sensitivity. Regular sensitivity adjustments (e.g. daily) are recommended to improve balance sensitivity. Expanded uncertainty in use may be taken from the balance calibration certificate or calculated separately (see example in ISO/TR 20461). If expanded uncertainty in use is not available, then the expanded uncertainty of calibration may be used.

^c Single-channel balance

^d Multi-channel balance, only valid for multi-channel pipettes. Multi-channel balances of 0,01 mg readability may be used to test multi-channel pipettes with nominal volumes below 20 μl only if the expanded uncertainty in use is less than one-fourth of the maximum permissible systematic error of the apparatus.

Table 1 (continued)

Nominal volume of apparatus under test (V)	Readability (d) mg	Repeatability (s) ^a mg	Expanded uncertainty in use $U (k = 2)^{a, b}$ mg
1 000 ml < V ≤ 2 000 ml	10	10	40

^a The repeatability and expanded uncertainty in use value, in this table, apply when testing single channel apparatus. When a balance is used exclusively for testing multichannel pipettes the repeatability and expanded uncertainty in use values are double the values of this table.

^b Expanded uncertainty in use can be estimated according to EURAMET CG-18 [2] at the value of the nominal volume. Expanded uncertainty in use shall include non-corrected errors as well as possible drift and environmental effects to balance sensitivity. Regular sensitivity adjustments (e.g. daily) are recommended to improve balance sensitivity. Expanded uncertainty in use may be taken from the balance calibration certificate or calculated separately (see example in ISO/TR 20461). If expanded uncertainty in use is not available, then the expanded uncertainty of calibration may be used.

^c Single-channel balance

^d Multi-channel balance, only valid for multi-channel pipettes. Multi-channel balances of 0,01 mg readability may be used to test multi-channel pipettes with nominal volumes below 20 µl only if the expanded uncertainty in use is less than one-fourth of the maximum permissible systematic error of the apparatus.

5.2 Liquid reservoir, with sufficient capacity for all the test liquid likely to be required for the complete series of tests.

The liquid reservoir should minimize temperature difference between the test liquid and room temperature.

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5.3 Weighing vessel, for the selected test procedure according to [Clause 8](#). Care shall be taken regarding the evaporation loss of water during delivering and weighing procedure.

5.4 Measurement devices [oSIST prEN ISO 8655-6:2020](https://standards.iteh.ai/catalog/standards/sist/004284ae-57b0-41ea-9322-1caeb37e1e1e/iso-8655-6-2020)

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The minimum requirements for each relevant measurement device are described in [Table 2](#).

Table 2 — Minimum requirements for the measurement devices

Parameter	Readability	Expanded uncertainty of measurement ($k = 2$)
Thermometer for liquids	0,1 °C	0,2 °C
Thermometer for room air	0,1 °C	0,2 °C
Hygrometer	1 % rel. humidity	5 % rel. humidity
Barometer	0,1 kPa	1 kPa
Timing device	1 s	not applicable

6 Test liquid

Use distilled or deionized water conforming to grade 3 as specified in ISO 3696, degassed or air equilibrated. The water temperature shall be within $\pm 0,5$ °C of ambient air temperature (see [7.2](#)).

7 Test Conditions

7.1 General

All equipment used to test the POVA shall be operated as specified in the supplier's operation manual.