
**Piston-operated volumetric
instruments — Determination of
uncertainty for volume measurements
made using the photometric method**

*Instruments volumétriques actionnés par piston — Détermination de
l'incertitude de mesure pour les mesurages volumétriques au moyen de
la méthode photométrique*



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Foreword

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Piston-operated volumetric instruments — Determination of uncertainty for volume measurements made using the photometric method

1 Scope

This Technical Report gives the detailed evaluation of uncertainty for volume measurements according to the *Guide to the expression of uncertainty in measurements* (GUM). ISO 8655-7 covers non-gravimetric methods of volume measurement. ISO 8655-7:—, Annex A, presents the details of a method that employs removable cells (vials) in a UV/VIS photometer. ISO 8655-7:—, Annex B, presents the details of a method that employs a flow cell fixed in place in a UV/VIS photometer. This Technical Report covers the uncertainty of measurement of both methods.

2 Uncertainty analysis for the replaceable cell photometric method as described in ISO 8655-7:—, Annex A

2.1 Uncertainties of each measurand

For purposes of creating an uncertainty budget, the uncertainty for each device used in the determination of unknown volume has been taken from manufacturer's literature. The uncertainty for the system linearity was measured using a reference UV/VIS photometer. UV/VIS photometric uncertainties are based on ISO 8655-7:—, Table A.1.

Table 1 — Uncertainties of the analytical devices used

Item	Laboratory grade UV/VIS-photometer	Reference grade UV/VIS-photometer	Type of uncertainty
Flask, Class A volumetric, 1 000 ml	0,4 ml		B
Pipette, Class A volumetric, 100 ml	0,08 ml		B
Pipette, Class A volumetric, 10 ml	0,02 ml		B
Pipette, Class A volumetric, 5 ml	0,015 ml		B
Pipette, Class A volumetric, 2 ml	0,010 ml		B
Photometric measurement at $A = 0$	0,001 0	0,000 3	A
Photometric measurement at $A = 0,5$	0,001 5	0,000 5	A
Photometric measurement at $A = 1,0$	0,001 5	0,000 5	A
Photometric measurement at $A = 1,5$	0,002 0	0,000 7	A
Temperature of sample	0,2 °C		B
Reproducibility of UV/VIS photometer wavelength	0,5 nm	0,2 nm	B
Non-linearity of photometric response with 2:1 dynamic range	—	0,14 %	A
Non-linearity of photometric response with 8:1 dynamic range	—	0,63 %	A