ISO/TR 20461:2023-02 (E)

Determination of uncertainty for volume measure ments of a piston-operated volumetric apparatus using a gravimetric method

Contents

Page

Foreword ... **iv**

Introduction ... **v**

1 Scope ... **1**

2 Normative references ... **1**

3 Terms and definitions ... **1**

4 Modelling the measurement ... **1**

5 General procedure for the uncertainty calculation ... **3**

6 Standard uncertainty components associated with the measuring system (gravimetric measurement procedure) ... **4**
6.1 General information on standard uncertainty components estimation ... 4
6.2 Standard uncertainty of weighing (balance indication) ... 5
6.3 Standard uncertainty of temperature ... 5
6.4 Standard uncertainty of water density ... 6
6.5 Standard uncertainty of air density ... 6
6.6 Standard uncertainty of weights density ... 7
6.7 Standard uncertainty related to air cushion effects ... 7

7 Standard uncertainty components associated with the POVA ... **7**
7.1 Standard uncertainty of cubic expansion coefficient ... 7
7.2 Standard uncertainty of resolution ... 8
7.3 Standard uncertainty of setting ... 8

8 Standard uncertainty components associated with the liquid delivery process ... **8**
8.1 Repeatability (experimental standard deviation) ... 8
8.2 Reproducibility ... 8

9 Combined standard uncertainty of measurement associated with the volume V_{ref} ... **9**

10 Sensitivity coefficients ... **9**

11 Choice of an appropriate coverage factor (k) ... **10**

12 Expanded uncertainty of measurement associated with the volume V_{ref} ... **10**

13 Example for determining the uncertainty of the volume measurement of POVA ... **10**
13.1 Measurement conditions ... 10
13.2 Results ... 13
13.2.1 Calculations ... 13
13.2.2 Uncertainty in use and corrections for pressure changes ... 13
13.2.3 General remarks ... 13
13.2.4 Note on the conformity of the ISO 8655 series with ISO/IEC Guide 98-3 ... 13

Annex A (informative) **Approaches for the estimation of uncertainty in use of a single delivered volume** ... **14**

Annex B (informative) **Volume correction due to pressure changes** ... **17**

Bibliography ... **18**