ISO 13319-1:2021 (E)

Determination of particle size distribution — Electrical sensing zone method — Part 1: Aperture/orifice tube method

Contents

Foreword

1 Scope

2 Normative references

3 Terms and definitions

4 Symbols

5 Principle

6 General operation

6.1 Response
6.2 Size limits
6.3 Effect of coincident particle passage
6.4 Dead time
6.5 Analysis volume

7 Repeatability and reproducibility of counts

7.1 Instrument repeatability
7.2 Method reproducibility/intermediate precision

8 Operational procedures

8.1 General
8.2 Instrument location
8.3 Linearity of the aperture/amplifier system
8.4 Linearity of the counting system
8.5 Choice of electrolyte solution
8.5.1 General
8.5.2 Special considerations for small apertures (D < 50 µm)
8.5.3 Special considerations for large apertures (D > 400 µm)
8.6 Preparation of electrolyte solution
8.7 Recommended sampling, sample splitting, sample preparation and dispersion
8.7.1 General
8.7.2 Method 1: Using a paste
8.7.3 Method 2: Alternative method applicable to low-density particles of less than 50 µm
8.7.4 Suspensions and emulsions
8.7.5 Verification of the dispersion
8.8 Choice of aperture(s) and analysis volume(s)
8.9 Clearing an aperture blockage
8.10 Stability of dispersion
8.11 Calibration
8.11.1 General
8.11.2 Calibration procedure — microsphere calibration

9 Analysis

10 Calculation of results

11 Instrument qualification

11.1 General
11.2 Report

Annex A (informative) Derivation of maximum count number to limit coincidence

Annex B (informative) Fishbone diagram for method development

Annex C (informative) Calibration and control of frequently used apertures

Annex D (informative) Mass integration method for calibration and mass balance

- **D.1 General**
- **D.2 Calibration procedure**
- **D.2.1 General**
- **D.2.2 Volume Vm of analysed suspension**
- **D.2.3 Effective density of particles**
- **D.2.4 Sample preparation**
- **D.2.5 Determination of the calibration factor**
- **D.2.6 Secondary calibration**
- **D.2.7 Example of calibration by mass integration**
- **D.3 Mass balance**
- **D.3.1 General**
- **D.3.2 Sample preparation**
- **D.3.3 Procedure**
- **D.3.4 Calculations**
- **D.3.5 Results**
- **D.3.6 Report**
- **D.3.7 Theoretical example of mass balance**

Annex E (informative) Calibration for the measurement of porous and conductive particles

- **E.1 General**
- **E.2 Particles of conductive materials**
- **E.3 Porous particles**
- **E.3.1 General**
- **E.3.2 Sample preparation**
- **E.3.3 Microscopy and ESZ measurements**
- **E.4 Calculations for microscopy**
- **E.4.1 General**
- **E.4.2 Calculations**

Annex F (informative) Technique using two (or more) apertures

- **F.1 General**
- **F.2 Separation**
- **F.3 Calibration**
- **F.4 Analysis**

Annex G (informative) Chi-squared test of the correctness of instrument operation or sample preparation

- **G.1 General**
- **G.2 Theory**
- **G.2.1 General**
- **G.3 Worked examples**

Page count: 34