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Standard Guide for Worldwide Published Standards Relating to Particle and Spray Characterization¹

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1. Scope

1.1 This guide covers the awareness and use of available standard methods for characterizing solid and liquid particles, and provides information for subsequent evaluation and standardization.

1.2 The principal purpose of this guide is the identification of particle characterization standard methods that have been developed and published by various standards organizations worldwide. Although this is an extensive list of methods, it is not all inclusive. These standards have been divided into the following twelve sections related to particle characterization.

Section 1	— Representation and Treatment of Data
Section 2	— Sedimentation, Classification, Gravity and Centrifugal Methods
Section 3	— Surface Area and Porosity Measurement Methods
Section 4	— Sieving Methods
Section 5	— Electrical Sensing Methods
Section 6	— Laser Diffraction Methods
Section 7	— Photon Correlation Spectroscopy Methods
Section 8	— Image Analysis Methods
Section 9	— Single Particle Light Interaction Methods
Section 10	— Small Angle X-Ray Scattering Method
Section 11	— Sampling Methods
Section 12	— General Methods, Vocabulary, and Information

2. Terminology

2.1 Abbreviations: Abbreviations:

ASME—American Society of Mechanical Engineers
ASTM—American Society for Testing and Materials
BSI—British Standard Specification
DIN—Deutsches Institut für Normung; German Standard Institution
DIN and VDI—German Standards
ISO—International Organization for Standardization
ISO/DIS—Draft International Standards
JSA/JIS—Japanese Standards Association/Japanese Industrial Standard
MPIF—Metal Powders Industry Federation
NF X—Normalisation Française (AFNOR) French Standards (E) - English Translation
TAPPI—Technical Association of Pulp and Paper Industry

VDI—Verein Deutscher Ingenieure; Society of German Engineers

3. Significance and Use

3.1 Reported particle size measurement is a function of both the actual dimension and/or shape factor as well as the particular physical or chemical properties of the particle being measured. Caution is required when comparing data from instruments operating on different physical or chemical parameters or with different particle size measurement ranges. Sample acquisition, handling and preparation can also affect reported particle size results.

4. Referenced Documents

SECTION 1—REPRESENTATION AND TREATMENT OF DATA

4.1 Related Standards:

4.1.1 ASTM Standards:

ASTM E 177	Practice for Use of the Terms Precision and Bias in ASTM Test Methods ²
ASTM E 799	Practice for Determining Data Criteria and Processing for Liquid Drop Size Analysis ²
ASTM E 1617	Practice for Reporting Particle Size Characterization Data ²
ASTM F 658	Practice for Defining Size Calibration, Resolution, and Counting Accuracy of a Liquid-Borne Particle Counter Using Near-Monodisperse Spherical Particulate Material ²

4.1.2 British Standard:

BS 3406	Test Method for the Determination of Particle Size Distribution ³
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4.1.3 German Standards:

DIN 66 141	Representation of (grain) Particle Size Distributions, Basic Standard ⁴
DIN 66 142 T 1	Representation and Identification of Separated Fractions of Dispersed Matter; Fundamentals ⁴
DIN 66 142 T 2	Representation and Identification of Separated Fractions of Dispersed Matter, Application to Analytical Separations ⁴
DIN 66 142 T 3	Representation and Identification of Separated Fractions to Dispersed Matter, Selection and Determination of Parameters of ⁴

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² Available from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-22959.

³ Available from British Standard Specification, 389 Chiswick High Road, London W4 4AL.



DIN 66 143	Representation of (Grain) Particle Size Distributions, Power Function Grid ⁴
DIN 66 144	Representation of (Grain) Particle Size Distributions, Logarithmic Gaussian Grid ⁴
DIN 66 145	Representation of (Grain) Particle Size Distributions; RRSB Grid ⁴

4.1.4 ISO Standards:

ISO 9276-1	Representation of Results of Particle Size Analysis - Part 1 - Graphical Representation ⁵
ISO/DIS 9276-2	Representation of Results of Particle Size Analysis—Part 2: Calculation of Average Particle Sizes/Diameters and Moments from Particle Size Distributions ⁵
ISO/CD 9276-3	Representation of Results of Particle Size Analysis—Part 3: Fitting of an Experimental Cumulative Curve to a Reference Model ⁵
ISO/DIS 9276-4	Representation of Results of Particle Size Analysis—Part 4: Characterization of a Classification Process Used for Particle Size Analysis ⁵
ISO/D 9276-5	Representation of Results of Particle Size Analysis—Part 5: Validation of Calculations Relating to Particle Size Analyses Using the Logarithmic Normal Probability Distribution ⁵

4.1.5 French Standards:

NF X 11-632	Particle Size Analysis—Expression of Experimental Results of Particle Size Analysis (E) ⁶
NF X 11-634	Particle Size Analysis—Characterization of the Size and Form of the Elements of a Granular Population ⁶
NF X 11-635	Particle Size Analysis—Representation of Particle Size Distributions - Reference Models ⁶
NF X 11-636	Particle Size Analysis—Representation of Particle Size Distributions - Adjustment of an Experimental Cumulative Curve to a Reference Model—Case of Sieving ⁶

DIN 66 111	Particle Size Analysis; Sedimentation Analysis; Principles ⁴
DIN 66 111 Bbl.1	Particle Size Analysis; Sedimentation Analysis; Principles; Evaluation Equations for Determination of Quantities in the Field of Centrifugal Force ⁴
DIN 66 115	Test Method for Particle Size Analysis, Sedimentation Analysis in the Gravitational Field ⁴
DIN 66 116	Grain (particle) Size Analysis; Sedimentation Analysis in the Gravitational Field, Sedimentation Balance ⁴
DIN 66 118	Particle Size Analysis, Size Analysis by Air Classification, Fundamentals ⁴
DIN 66 119	Particle Size Analysis, Size Analysis by Air Classification with Gravitation Counterflow ⁴
DIN 66 120	Particle Size Analysis, Size Analysis by Air Classification with Centrifugal Counterflow Classifier ⁴

4.2.4 ISO Standard:

ISO 10076	Metallic Powders - Determination of Particle Size Distribution by Gravitational Sedimentation in a Liquid and Attenuation Measurement ⁵
ISO/DIS 13317-1	Determination of Particle Size Distribution by Gravitational Liquid Sedimentation Methods Part 1: General Principles and Guidelines ⁵
ISO/CD 13317-2	Determination of Particle Size Distribution by Gravitational Liquid Sedimentation Methods Part 2: Pipette Methods (Fixed and Variable Positions) ⁵
ISO/CD 13317-3	Determination of Particle Size Distribution by Gravitational Liquid Sedimentation Methods Part 3: X-Ray Method ⁵
ISO/CD 13318-1	Determination of Particle Size Distribution by Centrifugal Liquid Sedimentation Methods Part 1: General Principles and Guidelines ⁵
ISO/CD 13318-2	Determination of Particle Size Distribution by Centrifugal Liquid Sedimentation Methods Part 4: Photocentrifugal Method ⁵
ISO/CD 13318-3	Determination of Particle Size Distribution by Centrifugal Liquid Sedimentation Methods Part 3: Centrifugal X-Ray Method ⁵
ISO/WD 13318-4	Determination of Particle Size Distribution by Centrifugal Liquid Sedimentation Methods Part 2: Centrifugal Pipette Method ⁵

4.2.5 Japanese Standards:

JIS Z8820	General Rules for the Determination of Particle Size Distribution by Sedimentation in Liquid ⁷
JIS Z8821	Determination of Particle Size Distribution by the Sedimentation in Liquid Using the Pipette Apparatus ⁷
JIS Z8822	Determination of Particle Size Distribution by the Weight of Sedimentation in Liquid ⁷

4.2.6 French Standards:

NF X 11-680	Test Method for Particle Size Analysis—Separation by Fluids - Particle Size Analysis by Gravity Sedimentation in a Liquid Medium (E) ⁶
NF X 11-681	Test Method for Particle Size Analysis—Particle Size Analysis by Gravity Sedimentation in a Liquid Medium (E) ⁶
NF X 11-682	Test Method for Particle Size Analysis—Particle Size Analysis by Gravitational Liquid Sedimentation - Photosedimentation Technique (E) ⁶
NF X 11-683	Test Method for Particle Size Analysis—Particle Size Analysis of a Powder by Variable Height Gravity Sedimentation in a Liquid - Method Using X-ray Absorption Measurement (E) ⁶
NF X 11-684	Test Method for Particle Size Analysis—Particle Size Analysis by Cumulative Sedimentation in a Static Liquid - Sedimentation Balance Method ⁶
NF X 11-685	Test Method for Particle Size Analysis by Centrifugal Sedimentation in a Liquid Which is at Rest in Relation to the Axis of Centrifugation (E) ⁶
NF X 11-690	Test Method for Particle Size Analysis by Gravity in a Moving Fluid (Levigation-Elutriation) (E) ⁶

SECTION 2—SEDIMENTATION, CLASSIFICATION, GRAVITY AND CENTRIFUGAL METHODS

4.2 Related Standards:

4.2.1 ASTM Standards:

ASTM B 330	Test Method for Average Particle Size of Powders of Refractory Metals and Their Compounds by the Fisher Sub-Sieve Sizer ²
ASTM B 430	Test Method for Particle Size Distribution of Refractory Metal Powders and Related Compounds by Turbidimetry ²
ASTM B 761	Test Method for Particle Size Distribution of Metal Powders Related Compounds by X-Ray Monitoring of Gravity Sedimentation ²
ASTM C 721	Test Method for Average Particle Size of Alumina and Silica Powders by Air Permeability ²
ASTM C 775	Test Method for Particle-Size Analysis of Whiteware Clays ²
ASTM C 958	Test Method for Particle Size Distribution of Alumina or Quartz by X-Ray Monitoring of Gravity Sedimentation ²
ASTM C 1282	Test Method for Determining the Particle Size Distribution of Advanced Ceramics by Centrifugal Photosedimentation ²

4.2.2 British Standards:

BS 3406: Part 2	Recommendations for Gravitational Liquid Sedimentation Methods for Powders and Suspensions ³
BS 3406: Part 3	Air Elutriation Methods ³
BS 3406: Part 6	Recommendations for Centrifugal Liquid Sedimentation Methods for Powders and Suspensions ³

4.2.3 German Standards:

⁴ Available from Deutsches Institut für Normung; German Standard Institution, Burggrafenstraße 6, 10787 Berlin.

⁵ Available from International Organization for Standardization, 1 rue de Varembe, Case Postale 56, CH-1211 Geneva 20, Switzerland.

⁶ Available from Normalization Française (AFNOR) French Standards, Tour Europe; Cedex 7; 92049 Paris-La Defense; France.

⁷ Available from Japanese Standards Association/Japanese Industrial Standard, 4-1-24, Akosaka; Minato-Ku, Tokyo 107.