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Interested committees:

Title: Draft BS ISO 9276-1 Representation of results of particle size analysis. Part 1: Graphical representation.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/ Figure/Table/Note	Type of comment	Comment (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



DRAFT International Standard

ISO/DIS 9276-1

Representation of results of particle size analysis —

Part 1: Graphical representation

*Représentation de données obtenues par analyse
granulométrique —*

Partie 1: Représentation graphique

ICS: 19.120

ISO/TC 24/SC 4

Secretariat: **BSI**

Voting begins on:
2024-11-04

Voting terminates on:
2025-01-27

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 24 *Particle characterization including sieving*, Subcommittee SC 4 *Particle characterization*.

This third edition cancels and replaces the second edition (ISO 9276-1:1998), which has been technically revised.

The main changes are as follows:

- Clause “3 Terms and Definitions” has been added;
- In [subclause 7.2](#), [equations \(9\)](#) and [\(10\)](#) have been added for further explanation;
- [Clause 8](#) on ‘Graphical representation of non-normalized distributions’ has been added;
- [Clause 9](#) on ‘Graphical representation of two-dimensional distribution’ has been added;
- [Annex B](#) and [Annex C](#), giving examples of graphical representation of non-normalized and two dimensional distributions have been added.

A list of all parts in the ISO 9276 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

The characterisation of a dispersed phase with respect to its particle size distribution (PSD) is a major task, whenever the generation, emission, transport, application or consumption of particulate matter is monitored or investigated. The spectrum of relevant materials is very broad and 'particle' can refer e.g. to grains, flakes, fibres, droplets, bubbles, micelles or pores. Within a particulate material, particles typically vary with regard to their size. The distribution of this measurand is characterised by the relative quantity of particles belonging to a specific size class.

Nowadays, there is wide range of methods for the size analysis of particulate matter. Due to many reasons the results will, in general, not be the same. One of the main problems still encountered with most methods in use is their unknown absolute accuracy. Apart from this, there are two principal origins of the differences among measured particle size distributions.

Firstly, the measurand 'particle size' is an ambiguous property being specified by the measurement principle of the instrumentation and the way of signal analysis. They define the type of particles, which is measured - for instance to agglomerates or their constituent particles, to pickering emulsion droplets or the nanoparticles at their surface, to complete core-shell particles or the core of the particles only. Therefore, 'size' can refer to a variety of physical and geometric properties.

Secondly, the distribution of size can be measured and expressed by different types (and measures) of quantity^[1].

Hence, a disperse system can be described by different types of particle size distribution, which supplement each other in providing a comprehensive view on the granulometric state of the particulate material. Moreover, each type of PSD can be represented in various manners.

Beside numerical and mathematical representations, graphical ones are particularly popular and useful because they allow for a quick comprehension of the main PSD features or a fast evaluation of differences among product lots. There are various ways of plotting a PSD, which emphasize different details though communicating the same information. This requires explanation - especially when a PSD is described by discrete data.

A harmonised view on terms and a common understanding of how to graphically plot and interpret PSDs support the communication between suppliers and clients and improve the comparability of measurement data from different instruments.

Representation of results of particle size analysis —

Part 1: Graphical representation

1 Scope

This part of ISO 9276 specifies guidelines and instructions for the graphical representation of particle size analysis data in histograms, distribution densities and cumulative distributions. It also establishes a standard nomenclature to be followed to obtain the distributions mentioned above from measured particle size data.

This part of ISO 9276 applies to the graphical representation of particle size distributions of solid particles, droplets or gas bubbles covering all size ranges.

2 Normative references

The following referenced documents are indispensable for the application 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 26824:2022

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 particle

minute piece of matter with defined physical boundaries

Note 1 to entry: A physical boundary can also be described as an interface.

Note 2 to entry: A particle can move as a unit.

Note 3 to entry: This general particle definition applies to nano-objects.

[SOURCE: ISO 26824:2022 3.1.1]

3.2 particle size

x

d

linear dimension of a particle determined by a specified measurement method and under specified measurement conditions

Note 1 to entry: Different methods of analysis are based on the measurement of different physical properties. Independent of the particle property actually measured, the particle size is reported as a linear dimension, e.g. as the equivalent spherical diameter.

Note 2 to entry: Possible types of particle size values are equivalent spherical diameters from physical measurement or equivalent circular diameters from image analysis as well as linear dimensions, e.g. sieve size of a particle, the smallest aperture size through which a particle will pass if presented in the most favourable attitude.

Note 3 to entry: In ISO 9276 the symbol 'x' is used to denote the particle size. However, it is recognised that the symbol 'd' is also used to designate these values. Therefore the symbol 'x' may be replaced by 'd'

3.3 equivalent diameter equivalent spherical diameter

x_j
 d_j

diameter of a sphere that produces a response by a given particle-sizing method, that is equivalent to the response produced by the particle being measured

Note 1 to entry: The physical property to which the equivalent diameter refers is indicated using a suitable subscript [ISO 9276-1:1998].

Note 2 to entry: For discrete-particle-counting in light-scattering instruments, a scattering intensity equivalent diameter is used, in extinction measurement a light extinction equivalent diameter is used.

Note 3 to entry: Other material constants like density of the particle are used for the calculation of the equivalent diameter like Stokes diameter or sedimentation equivalent diameter. The material constants, used for the calculation, should be reported additionally. In some instances refractive index and the spectral function should be reported as well.

Note 4 to entry: For inertial instruments, the aerodynamic diameter is used. Aerodynamic diameter is the diameter of a sphere of density 1 000 kg m⁻³ that has the same settling velocity as the irregular particle.

[SOURCE: ISO 26824:2022 3.1.10, Note 2 and 3 have been modified]

3.4 type of quantity r

specification of the quantity of a distribution, a cumulative or a density measure.

Note 1 to entry: The type is indicated by the general subscript, r , or by the appropriate value of r as follows:

number: $r = 0$

length: $r = 1$

area: $r = 2$

volume or mass: $r = 3$

Note 2 to entry: To include frequently used non-geometrical quantities, the specification of the quantity has been extended to the following subscripts, replacing r :

— light extinction: subscript "ext"

— light intensity: subscript "int"

3.5 particle size distribution

distribution of *particles* (3.1) as a function of *particle size* (3.2).

Note 1 to entry: Particle size distribution may be expressed as cumulative distribution (3.5) or a distribution density (3.6) (distribution of the fraction of material in a size class, divided by the width of that class).

[SOURCE: ISO/TS 80004-6:2021, 4.1.2]