SLOVENSKI STANDARD
oSIST prEN 15051-2:2024

01-julij-2024

Izpostavljenost na delovnem mestu - Meritve prašnosti razsutih materialov - 2. del: Metoda z vrtečim bobnom

Workplace exposure - Measurement of the dustiness of bulk materials - Part 2: Rotating drum method

Exposition am Arbeitsplatz - Messung des Staubungsverhaltens von Schüttgütern - Teil 2: Verfahren mit rotierender Trommel

Exposition sur les lieux de travail - Mesurage du pouvoir de resuspension des matériaux pulvérulents en vrac - Partie 2 : Méthode du tambour rotatif

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ICS:

13.040.30	Kakovost zraka na delovnem mestu	Workplace atmospheres

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English Version

Workplace exposure - Measurement of the dustiness of bulk materials - Part 2: Rotating drum method

Exposition sur les lieux de travail - Mesurage du pouvoir de resuspension des matériaux pulvérulents en vrac - Partie 2 : Méthode du tambour rotatif

Exposition am Arbeitsplatz - Messung des Staubungsverhaltens von Schüttgütern - Teil 2: Verfahren mit rotierender Trommel

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 137.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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European foreword

This document (prEN 15051-2:2024) has been prepared by Technical Committee CEN/TC 137 "Assessment of workplace exposure to chemical and biological agents", the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 15051-2:2013+A1:2016.

prEN 15051-2:2024 includes the following significant technical changes with respect to EN 15051-2:2013+A1:2016:

— The introduction was revised to better explain the purpose of dustiness testing;

— Subclause 4.2.2: Inclusion of Conditioning specifications for standard testing and inter-comparison in addition to as received testing;

— Subclause 4.3: Change in the tolerance of relative humidity (RH): Previously, RH was specified at 50 ± 10 % RH; now, it is specified at 50 ± 5 %;

— Subclause 4.8: Introduction of an in-house or test powder of relatively high dustiness for quality purpose and to ensure reproducibility in testing;

— Subclause 5.7: Change in the minimum of repeat tests to be carried out from three to five and specify procedure for reporting results based on the relative standard deviation.

— Subclause 5.10: Limit of detection (LOD) and limit of quantification (LOQ) has been added for the determination and reporting of LOD and LOQ of the weighing of the filters, and the 80ppi and 20 ppi foams;

— Clause 6: In Table 1, the respirable dustiness mass fraction (wR,A) upper limit for the very low dustiness category has been changed from < 10 mg/m3 to < 20 mg/kg. As a result, the low category has been revised from 10 to 60 mg/m3 to 20-60 mg/m3;

— Annex A: Flow rate and leak check, which is normative, has been added. It provides a procedure to check, evaluate and report the flow rate and potential leaks through the rotating drum;

— Annex B (informative) for the quality control of metal foams has been added;

— Annex C (informative) provides a test to identify outliers amongst values obtained from repeat tests;

— Annex D (informative) provides an example of a procedure to evaluate the LOD and LOQ for gravimetric filters and foams.

EN 15051 Workplace *exposure — Measurement of the dustiness of bulk materials* consists of the following parts:

— *Part 1: Requirements and choice of test methods;*

— *Part 2: Rotating drum method;*

— *Part 3: Continuous drop method.*

Introduction

This document gives details of the design and operation of the rotating drum test method that categorizes the dustiness of solid bulk materials, in terms of health-related mass fractions.

The dustiness values of a specific method can be used for comparing and ranking powders and are useful for the purpose of safety by design and risk assessment. A dustiness categorization is presented to provide users (e.g. manufacturers, producers, occupational hygienists and workers) with information on the potential for dust emissions when the bulk material is handled or processed in workplaces. It provides the manufacturers of bulk materials with information that can help to improve their products. It allows the users of the bulk materials to assess the effects of pre-treatments, and also to select less dusty products, if available. It is envisaged that different branches of industry might develop their own categorization schemes using experimentally determined dustiness values of the bulk materials of interest.

However, dustiness test methods measure dust at source emission and do not consider the transportation of the airborne particles within a workplace environment to the breathing zone of a worker. Concentrations of respirable or inhalable dust in the workplace air, resulting from the processing and handling of bulk materials, will depend on a wide variety of factors (e.g. environmental factors, quantity used, engineering controls, transport of particles from source to worker's breathing zone, type of activities). Therefore, dustiness values do not provide workplace exposure concentrations.

Although this document does not discuss in detail the analysis of dust released from bulk materials (except in terms of gravimetric analysis), the test method produces samples with the potential for chemical analysis of the contents. However, it is important to understand that for a mixture, the mass percentage of a substance in the bulk material will be different (lower or higher) to the mass percentage of the same substance in the dust collected by the foams and the filter using the rotating drum.

This document was originally developed based on the results of the European project SMT4-CT96-2074 Development of a Method for Dustiness Testing (see [1]). This project investigated the dustiness of 12 bulk materials, with the intention to test as wide a range of bulk materials as possible, i.e. magnitude of dustiness, industrial sectors, chemical composition and particle size distribution. The first revision considered important comments from industrial users of the standard (e.g. Industrial Minerals Association), a number of research papers (for example, [2] and [3]) and the potential influence of the expanding database of dustiness results. In this revised version, the performance and characteristics of the metal foams for the sampling of the respirable fraction and important comments from industrial users of the standard have been taken into account.

For the measurement of dustiness of bulk materials that possibly contain or release nano-objects and their agglomerates and aggregates (NOAA) using the rotating drum, the reader should consult the EN 17199 series [6, 7].

1 Scope

This document specifies the rotating drum test apparatus and associated test method for the reproducible production of dust from a bulk material under standard conditions, and the measurement of the inhalable, thoracic and respirable dustiness mass fractions, with reference to existing European Standards, where relevant (see Clause 6).

This method is suitable for general bulk material handling processes, including all those processes where the bulk material is dropped, or can be dropped. It differs from the continuous drop method presented in EN 15051-3 [4]. In EN 15051-2, the same bulk material is repeatedly dropped, whilst in EN 15051-3, the bulk material is dropped only once, but continuously.

Furthermore, this document specifies the environmental conditions, the sample handling and analytical procedures, and the method of calculating and presenting the results. A categorization scheme for dustiness is specified, to provide a standardized way to express and communicate the results to users of the bulk materials.

This document is applicable to powdered, granular or pelletized bulk materials. A standard sample volume is used.

This document is not applicable to test the dust released when solid bulk materials are mechanically reduced (e.g. cut, crushed).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

EN 1540, *Workplace exposure — Terminology*

prEN 15051-1:2024, *Workplace exposure — Measurement of the dustiness of bulk materials — Part 1: Requirements and choice of test methods*

ISO 15767, *Workplace atmospheres — Controlling and characterizing uncertainty in weighing collected aerosols*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 1540 and prEN 15051-1 apply.

NOTE In particular, the following terms of EN 1540 are used in this document: airborne dust, collected sample, dustiness, dustiness mass fraction, inhalable fraction, limit of detection, limit of quantification, respirable fraction, thoracic fraction and health related fractions.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp/

— IEC Electropedia: available at https://www.electropedia.org/

3.1
pore rate number of a foam
grade number of a foam
range or number of pores per linear inch in a foam

Note 1 to entry: For example: grade 1723 indicates 17 to 23 pores/inch (ppi).

3.2
relative density of a foam
mass ratio between the porous metal foam and the mass of the same volume of the basic solid material

3.3
limit of detection
LOD
three times the estimated standard deviation of the mass of blank filters, accounting for the double weighing, field blanks, filter handling and conditioning procedures

Note 1 to entry: The value of LOD, as defined here, does not take into account sources of variability beyond weighing.

3.4
limit of quantification
LOQ
ten times the estimated standard deviation of the mass of blank filters

Note 1 to entry: The value of LOQ can be used as a threshold value to ensure accurate measurement of a substance.

4 Requirements

4.1 General

The test procedures described in prEN 15051-1:2024, Clause 5 shall be applied.

4.2 Conditioning of the bulk material

4.2.1 As-received condition

For the characterization of the bulk material under workplace conditions, the bulk material shall be sent to the organization performing the dustiness test as placed on the market or as used by the downstream user, in air-tight containers. It shall be tested in the state in which it was received.

4.2.2 Conditioning specifications

For standard testing and inter-comparison, test materials shall be conditioned at a relative humidity (RH) of (50 ± 5) % before testing until they reach a stable weight. The conditioning time depends on the amount of bulk material to be conditioned and shall be at least 48 h if the weight equilibrium is unknown. Where a large amount of bulk material is required by the test method, the bulk shall be divided in smaller quantities during conditioning in order to increase the exposed surface area of the material to the conditioned air (see ISO 14488 [5]).

Additional conditioning of filters and metal foams may be required after assembly if the conditions during transfer and assembly were significantly different from the ranges stated above.

4.3 Sample and environmental control

Bulk materials that have a large specific surface area are sensitive to environmental conditions such as relative humidity, temperature and electrostatic effects, and to their own moisture content, compaction and agglomeration. Therefore, for accurate results the test atmosphere shall be within a narrow range of temperature and humidity. In all cases the environmental conditions shall be documented.

The following test conditions shall apply:

— relative humidity (RH): (50 ± 5) %;

— temperature: (21 ± 3) °C.

The test apparatus shall be electrically grounded.

NOTE In many cases, a separate determination of the particle size can be valuable.

4.4 Moisture content

The moisture content of the bulk material shall be determined and documented according to the procedure given in prEN 15051-1:2024, 5.5 and Annex A.

4.5 Bulk density

The bulk density of the test material shall be determined and documented according to the procedure given in prEN 15051-1:2024, Annex B.

4.6 Test procedure

The dustiness shall be tested according to the rotating drum test method described in Clause 5.

4.7 Replicate tests

Replicate tests shall be carried out according to 5.7.

4.8 In-house / test powder

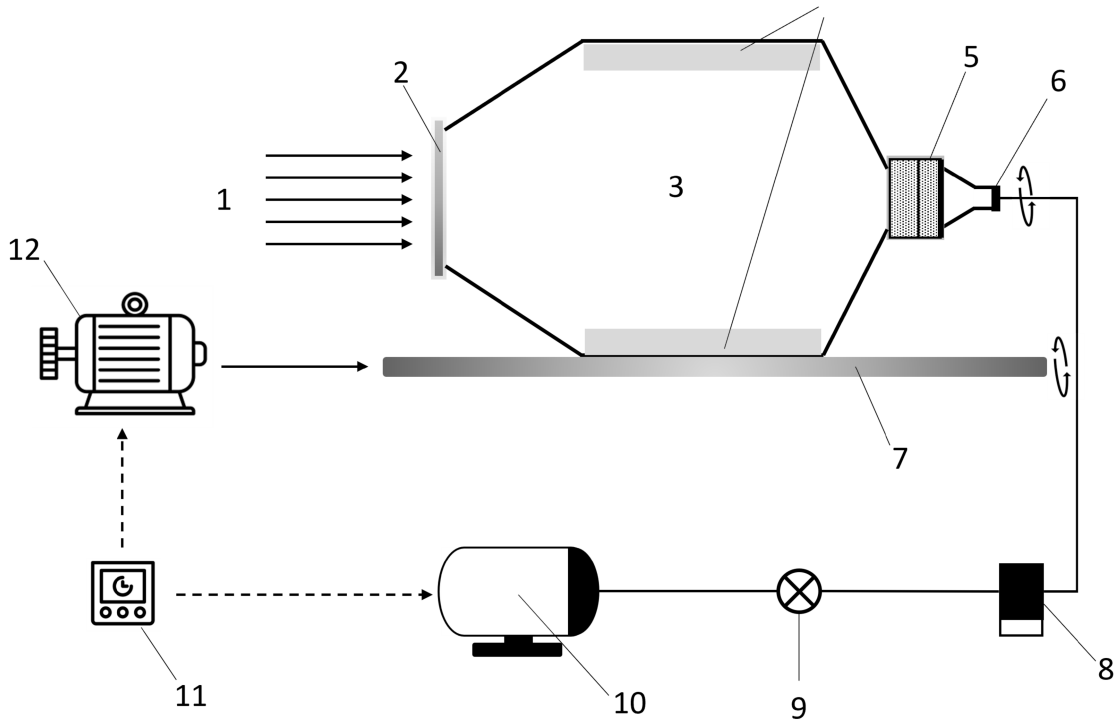
For quality purpose and to ensure reproducibility in testing, a bulk material of relatively high dustiness shall be purchased and analysed on regular basis according to the test method described in Clause 5. Sufficient amount of material shall be bought and stored appropriately in air-tight containers to become an in-house reference powder. Ballotini glass beads, such as Spheriglass® 5000 CP00[1], are an example of suitable powder of relatively high dustiness, which could be acquired for this purpose (see prEN 15051-1:2024, Annex C).

5 Rotating drum method

5.1 Description of test apparatus

The test apparatus required to determine the dustiness of bulk materials is shown in Figure 1, Figure 2 and Figure 3.

[1] Spheriglass® 5000 (CP00) is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by CEN of this product.



Key

1 air flow
2 inlet stage (protective filter)
3 dust generation section – rotating drum
4 longitudinal vanes (eight in total)
5 outlet stage / dust sampling system (two particle size selective foam stages and a back-up filter)
6 rotary coupler
7 rollers
8 in line mass-flow meter
9 control valve
10 vacuum pump
11 timer (time control circuit)
12 drive motor

Figure 1 — Outline of the rotating drum test apparatus