



BSI Standards Publication

Workplace exposure — Measurement of the dustiness of bulk materials

Part 1: Requirements and choice of test methods

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National foreword

This British Standard is the UK implementation of EN 15051-1:2025. It supersedes BS EN 15051-1:2013, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EH/2/2, Work place atmospheres.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Workplace exposure - Measurement of the dustiness of bulk materials - Part 1: Requirements and choice of test methods

Exposition sur les lieux de travail - Mesurage du pouvoir de resuspension des matériaux en vrac - Partie 1 : Exigences et choix des méthodes d'essai

Exposition am Arbeitsplatz - Messung des Staubungsverhaltens von Schüttgütern - Teil 1: Anforderungen und Auswahl der Prüfverfahren

This European Standard was approved by CEN on 15 September 2025.

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European foreword

This document (EN 15051-1:2025) 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 European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2026, and conflicting national standards shall be withdrawn at the latest by May 2026.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 15051-1:2013.

EN 15051-1:2025 includes the following significant technical changes with respect to EN 15051-1:2013:

- the introduction was revised to better explain the purpose of dustiness testing;
- 5.1: a schematic overview of the test procedure has been added;
- 5.8: information about an in-house / test powder has been added;
- Annex C: an example of a suitable powder for quality purposes (Spheriglass 5000 CP00) has been added.

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.

EN 15051-2 and EN 15051-3 give details of two test apparatus and test methods for the reproducible production of dust from a bulk material under standard conditions, and the measurement of the inhalable, thoracic and respirable fractions of this dust, with reference to the existing European standards, where relevant (see Clause 6).

Any feedback and questions on this document should be directed to the users’ national standards body. A complete listing of these bodies can be found on the CEN website.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Türkiye and the United Kingdom.

Introduction

The control of dust emissions during the handling and transportation of bulk materials is an important consideration in the design and operation of many industrial processes. Excessive airborne dust levels in workplaces are undesirable for several reasons:

- they can cause adverse health effects to the workers;
- their control can involve the use of costly ventilation and filtration systems;
- they can contaminate machinery and products;
- they can be costly in terms of product losses.

It is therefore advantageous for occupational hygienists and process engineers to have relevant information about the propensity of bulk materials to release airborne particles (i.e. dust) (the “dustiness” of the bulk material) so that risks can be evaluated, controlled and minimized.

Dustiness testing measures the propensity of a bulk materials e.g. powder to become airborne in response to a mechanical stimulus. Dustiness is a relative term and the measurement obtained will depend on specified method parameters including: the test apparatus used (design and volume), the mechanical stimulus and energy level applied, the condition and properties of the tested bulk material, the amount of bulk material tested (volume or mass), the sampling duration or volume of air sampled and various environmental variables (e.g. relative humidity, temperature and electrostatic effects). If one changes the extent of one or more method parameters then the outcome (e.g. dustiness values) can change significantly. The test and the variables therefore need to be closely specified to ensure reproducibility.

A single method of dustiness testing is unlikely to represent and reproduce the many types of processing and handling used in industry. This has meant that a number of bespoke methods have been developed and used in some industry sectors but are limited in their scope and application and were not designed to measure and express results in terms of the health-related fractions: i.e. inhalable, thoracic and respirable, as defined in EN 481. Therefore, a clear need for a European Standard was presented, leading to the initial publication of EN 15051 as a single document in 2006. In 2013, the standard was restructured into three separate parts: EN 15051-1, which outlines general requirements, and two test methods. EN 15051-2 (rotating drum test) and EN 15051-3 (continuous drop test) were designed to simulate two of the main handling methods: small-scale repeated discreet handling (e.g. shovelling, dispensing, batch preparation and weighing etc.) and larger scale conveyancing of bulk dust into silos and hoppers. EN 15051-2 separates the airborne dust into the three health related fractions using porous foams and EN 15051-3 measures the respirable fraction using a well-characterized cyclone sampler.

The EN 15051 standard was originally developed in 2006 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. In 2013, the standard was revised based on 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.

The level of the dustiness generally depends on material-specific and process-specific parameters. The most important material-specific parameters are:

- the particle size distribution of the bulk material;
- its bulk density;
- its moisture content (“bulk material moisture content”);

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- its chemical composition;
- physical characteristics like electrostatic charge distribution.

Process-specific parameters are mainly determined by the type of handling and are essentially determined by:

- the type and level of energy that leads to dust release;
- the duration of the energy effect.

For a specific chemical substance in a powder form, it is important to understand that its particle size distribution cannot predict its dustiness behaviour and respectively its dustiness values cannot predict the size distribution of this substance.

The results of the dustiness test are expressed in terms of the ratio of the mass of dust released of specific health-related fractions (mg) / mass of material tested (kg) for specified method parameters. They are relative values, so a specific scale for dustiness has been derived for each method, which enables a categorization of the powder into: very low, low, medium and high dustiness categories, for the applicable health-related fraction/s measured. The scale is specific to the dustiness method selected and for the specified method parameters.

The dustiness values of a specific method can be used for comparing and ranking powders and assess whether the current controls are adequate. The information also supports risk and safe by design assessments. The results 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. They provide the manufacturers of bulk materials with information that can help to improve their products. They allow 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 emission source and does not consider the transportation of the airborne particles within a workplace environment to the breathing zone of a worker. Concentrations of respirable, thoracic 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.

The test methods produce 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 (rotating drum) or by the respirable and inhalable samplers (continuous drop). A bulk material is expected to be made of solid particles and granular materials. For a mixture, the size distribution of each substance is likely to be different and furthermore, during disturbance and attrition of the bulk material in the dustiness testers, it is very likely that the airborne particle size distribution of each substance is different from each other and from its original size distribution in the bulk material. This document does not discuss the sample preparation for further chemical analysis of dust released from bulk materials (except in terms of health-related fractions).

For the measurement of dustiness of bulk materials that possibly contain or release nano-objects and their agglomerates and aggregates (NOAA), the EN 17199 series [4, 5, 6, 7, 8] apply.

1 Scope

This document specifies the environmental conditions, the sample handling and analytical procedures and the method of calculating and presenting the results. Reasons are given for the need for more than one method and advice is given on the choice of method to be used.

This document establishes a categorization scheme for dustiness to provide a standardized way to express and communicate the results to users of the bulk materials. Details of the scheme for each method are given in EN 15051-2:2025 and EN 15051-3:2025.

This document is applicable to powdered, granular or pelletized bulk materials.

This document does not apply to test the dust released during mechanical reduction of solid bulk materials (e.g. cut, crushed) or to test application procedures for the bulk materials.

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*

EN 15051-2:2025, *Workplace exposure — Measurement of the dustiness of bulk materials — Part 2: Rotating drum method*

EN 15051-3:2025, *Workplace exposure — Measurement of the dustiness of bulk materials — Part 3: Continuous drop method*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in EN 1540 and the following apply.

NOTE In particular, the following terms of EN 1540 are used in this document: airborne dust, dustiness, dustiness mass fraction, inhalable fraction, 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

inhalable dustiness mass fraction

$w_{I,t}$

ratio of the inhalable dust mass produced by the dustiness test procedure, to the test mass for the respective test method t

Note 1 to entry: The different test methods are specified in EN 15051-2:2025 and EN 15051-3:2025, and t has the value A and B for the two methods respectively.

3.2

respirable dustiness mass fraction

$w_{R,t}$

ratio of the respirable dust mass produced by the dustiness test procedure to the test mass for the respective test method t