SLOVENSKI STANDARD
SIST EN 17077:2018

01-julij-2018

Ugotavljanje obnašanja pri gorenju prahu v plasteh

Determination of burning behaviour of dust layers

Brandverhalten von Staubschichten durch Klassifizierung in Brennklassen

Détermination du comportement lors de la combustion des couches de poussières

Ta slovenski standard je istoveten z: **EN 17077:2018**

ICS:

13.220.40	Sposobnost vžiga in obnašanje materialov in proizvodov pri gorenju	Ignitability and burning behaviour of materials and products

SIST EN 17077:2018 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 17077

May 2018

ICS 13.220.40

English Version

Determination of burning behaviour of dust layers

Détermination du comportement lors de la combustion des couches de poussières

Bestimmung des Brandverhaltens von Staubschichten

This European Standard was approved by CEN on 9 March 2018.

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

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Ref. No. EN 17077:2018 E

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European foreword

This document (EN 17077:2018) has been prepared by Technical Committee CEN/TC 305 “Potentially explosive atmospheres – Explosion prevention and protection”, 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of an identical text or by endorsement, at the latest by November 2018, and conflicting national standards shall be withdrawn at the latest by November 2018.

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This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive 2014/34/EU.

For relationship with EU Directive, see informative Annex ZA, which is an integral part of this document.

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

Introduction

This document specifies a method for experimental determination of the burning behaviour of dust layers.

The determination of burning behaviour of a dust layer is a screening test required to assess the type and magnitude of the fire risk associated with the dust.

The determination of the burning behaviour enables assessment of whether a material layer, when in contact with an external ignition source shows a reaction (e.g. ignition, smouldering). It also measures the ability of the locally induced reaction to propagate through the material in bulk or layer form. The behaviour in the test is characterized as a class number (burning class).

The burning class allows qualitative estimations on the burning behaviour of a dust layer as well as on the probability of transfer of glowing particles and glowing nests from upstream connected parts of a plant. It is therefore in certain cases a basis for explosion prevention and protection measures. In addition to that the burning class is used as basis to decide whether fire prevention and protection measures are necessary.

Therefore this document gives added values to the following clauses of the EU directives:

Directive 2014/34/EU of the European Parliament and the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to equipment and protective systems intended for use in potentially explosive atmospheres.

The burning behaviour can be markedly affected by physical characteristics (e.g. particle size, packing density) and external factors (e.g. temperature, air movement across the surface of the dust). To obtain comparable and reliable results, it is necessary to standardize the conditions under which the burning behaviour is measured. Further testing may be required for those substances which melt or for which rapid propagation of the combustion reaction is observed in the initial test.

If additional information is requested for labelling of the substances according to Regulation (EC) No 1272/2008 (i.e. whether labelling as H228: flammable solid is appropriate) and if testing according to this standard leads to a determination of burning class 4 or 5, then further testing according to the UN (United Nations) Manual of Tests and criteria test N.1 [3] is required.

1 Scope

This European Standard describes a test method for the determination of the burning behaviour of dust layers under defined initial conditions of air flow, temperature and ignition.

A test result of "burning class 1" with the described method does not mean that a dust cannot be ignited when dispersed in a cloud.

This method is not suitable for use with recognized explosives, like gunpowder and dynamite, explosives which do not require atmospheric oxygen for combustion, pyrophoric substances, or substances or mixtures of substances which may under some circumstances behave in a similar manner. Expert advice should be called in, when any doubt exists about the existence of hazard due to explosive properties.

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 1127-1:2011, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 13237:2012, *Potentially explosive atmospheres — Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13237, EN 1127-1 and the following apply.

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
air flow velocity
volume of air [m^3] which flows through a defined surface [m^2] per unit time [s]

3.2
combustion
exothermic reaction with either flames, glowing or smouldering when ignited

Note to entry: For the purpose of this standard "combustion" includes decomposition

3.3
ignition
initiation of combustion

3.4
initial temperature
temperature of the dust train at the moment of ignition

3.5
propagation
movement of the combustion front along the train

3.6
glowing
combustion with light emission without visible flame

3.7
smouldering
combustion without light emission

4 Principle of the test method

A representative sample of the test substance is placed at ambient temperature on a heat insulating surface and ignition is attempted. The air flow moving along the length of the dust train is kept constant during the test.

Since the test result may depend on the temperature of the dust sample tests at elevated temperatures could be necessary (see Annex A).

For melting substances the sample preparation or test equipment shall be modified (see 7.5).

5 Test equipment

5.1 General

The test apparatus is placed in a laboratory fume cupboard which creates an air flow of approximately 0,2 m/s to 0,4 m/s in the propagation direction of the reaction next to the surface of the dust. The slight overflow with air is necessary, since the sample may produce inert gas after contact with the ignition source. The inert gas can influence the burning behaviour of the dust.

NOTE The higher air velocities and/or temperatures present in filter systems or dryers can change the burning behaviour when compared to that determined by the standard test procedure. Varying test conditions can simulate technical process conditions.

If modified test conditions lead to a different burning class then this should be mentioned in the test report along with a description of how test conditions have deviated from the standard.

5.2 Test apparatus

5.2.1 Board method

The tests are performed on a clean, non-combustible thermal isolating board, or tile, with a plane surface placed in a laboratory fume cupboard. A mould [(20 ± 2) mm width, (10 ± 1) mm height and min. 40 mm length] is used to form a triangular powder train (see Figure 1).

Dimensions in millimetres

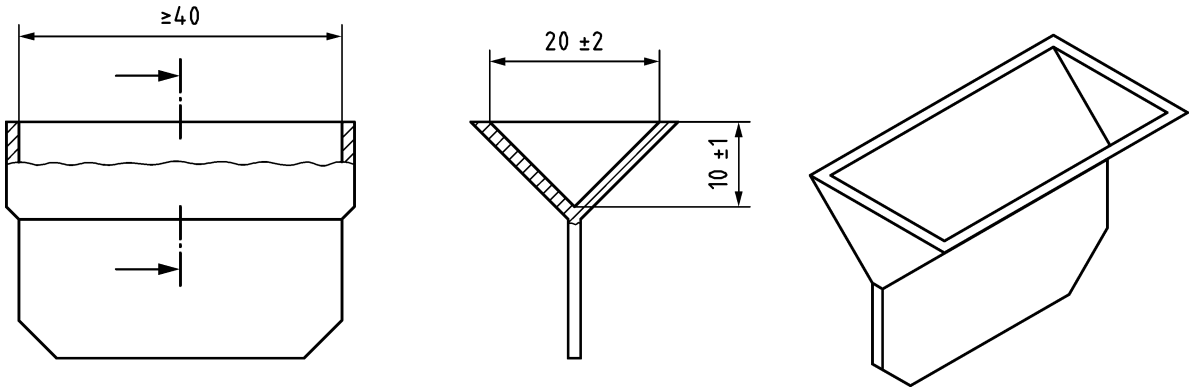


Figure 1 — Mould for forming powder train

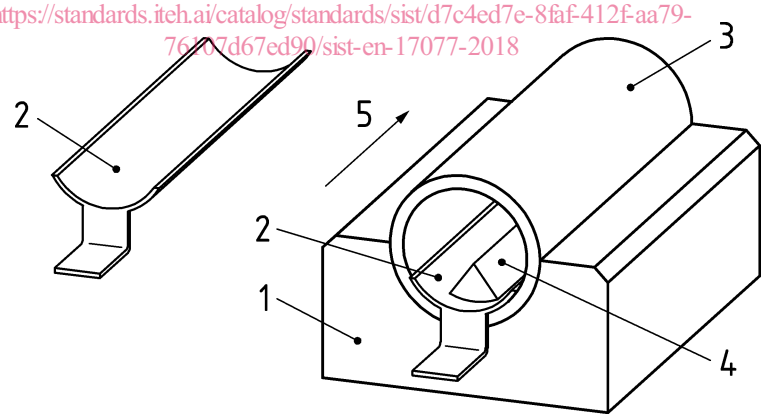
NOTE 1 Different plate materials are possible (e.g. ceramic, marble, fibre insulation board).

NOTE 2 Boards with a textile structure yield in a higher burning classes for melting dust samples (see 7.4 and Annex B).

NOTE 3 The size of the mould, apart from the length, corresponds to the UN-Test N.1 [3] concerning readily combustible solids.

5.2.2 Lütolf apparatus

The Lütolf Apparatus consists of a glass tube, a sample holder made out of stainless steel, a thermally insulating heat-proof support and a mould to form a powder train, see Figure 2.



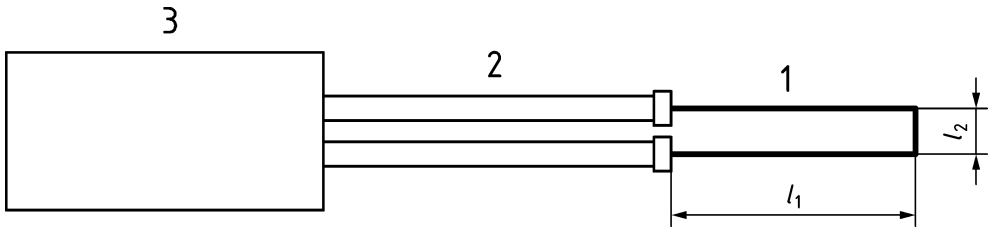
Key

1 support
2 sample holder (l = 80 mm ± 1 mm)
3 glass tube (⌀ = 43 mm ± 1 mm, l = 121 ± 1 mm)
4 dust sample
5 air flow (0,2 m/s to 0,4 m/s)

Figure 2 — Lütolf apparatus for burning class

5.3 Ignition source

The ignition source is an electrically heated glowing platinum wire with a temperature of approximately 1 000 °C (e.g. diameter 1 mm, length 86 mm ± 1 mm, I = 30 A ± 0,5 A). This is illustrated in Figure 3. Alternatively, an open flame of a burner (operating with e.g. butane, propane, natural gas) can be used. The oxygen concentration should be regulated to achieve a blue coloured triangular flame with a length of approximately 10 mm to 20 mm and a diameter of 2 mm to 3 mm in the middle of the flame. See Figure 4. The temperature at the tip of the inner blue flame should be approximately 1 000 °C.



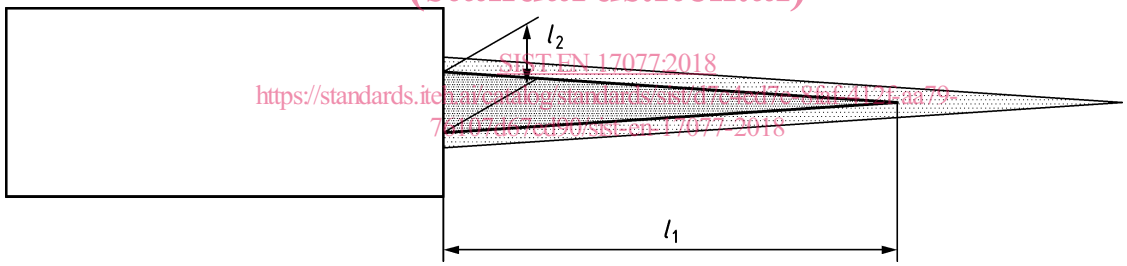
Key

1 platinum wire: total length 86 mm ± 1 mm l_1 35 mm ± 1 mm, l_2 16 mm ± 1 mm

2 electrical connectors

3 handle/holder

Figure 3 — Platinum wire ignition source



Key

l_1 length of blue zone of flame 10 mm to 20 mm l_2 2 mm to 3 mm

Figure 4 — Open flame ignition source

6 Characterization of dust sample

The person who wants the dust tested shall be responsible for ensuring that the sample is representative of the material as it appears in the process operated. The sample shall be characterized by:

— particle size distribution by either an optical method or sieving;

— moisture content.

Many unit operations, such as extract systems, will separate dust into finer fractions than seen in the main processing equipment. Samples should be representative of the process, or the worst case.

If the person who wants the dust tested cannot ensure that the sample is representative then sample preparation shall be carried out to apply worst case conditions. Therefore the dust fraction which has

passed through a sieve of 250 µm is dried to a constant weight (e.g. at 50 °C, in a vacuum drying chamber) before testing. If a dust is tested at other conditions these conditions shall be specified in the test report.

Grinding and sieving may be carried out to achieve a defined particle size. All preparation procedures shall be documented in the test report, especially when altering the grain size.

NOTE Sample preparation such as grinding and sieving, or drying can alter the material characteristics. For mixtures sample preparation can result in changes to the sample composition, which in turn can result in changes to the experimentally determined parameters.

7 Test procedure

7.1 General

Tests on burning behaviour with defined dusts shall be carried out according to the following procedure.

If this procedure does not give a clear result, the test shall be repeated at least once.

For melting samples further tests could be necessary which are described in 7.5.

7.2 Sample preparation

7.2.1 Board method

A sample prepared as described in paragraph 6 is placed on a board or tile as an unbroken powder train as described in 5.2.1.

7.2.2 Lütolf apparatus method

A sample prepared as described in paragraph 6 is placed in the middle of the sample holder as an unbroken powder train as described in 5.2.2. Afterwards the sample holder is inserted into the glass tube which is placed on the support

7.3 Ignition procedure

For the ignition attempt the ignition source shall be applied to the top of one end of the powder train, and for melting samples also at the bottom of one end of the powder train, for approximately 5 s to 10 s, depending which ignition procedure is most effective. If ignition does not occur the ignition attempt shall be repeated on the same sample at least 5 to 10 times.

NOTE The UN test N.1 [3] requires a longer ignition time of 2 min to 4 min. Non propagating burning behaviour according to this standard can still be classified under UN testing.

7.4 Evaluation

It shall be visually observed how the dust reacts (e.g. ignition, burning, smouldering, propagation of flame or propagation of smouldering) and/or if the dust melts.