EESTI STANDARD

EVS-EN 15188:2007

Ladestunud tolmu iseenesliku süttmiskäitumise määramine

Determination of the spontaneous ignition behaviour of dust accumulations

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EESTI STANDARDIKESKUS

EESTI STANDARDI EESSÕNA	NATIONAL FOREWORD
Käesolev Eesti standard EVS-EN 15188:2007 sisaldab Euroopa standardi EN 15188:2007 ingliskeelset teksti. Käesolev dokument on jõustatud 30.10.2007 ja selle kohta on avaldatud teade Eesti standardiorganisatsiooni ametlikus väljaandes. Standard on kättesaadav Eesti standardiorganisatsioonist.	This Estonian standard EVS-EN 15188:2007 consists of the English text of the European standard EN 15188:2007. This document is endorsed on 30.10.2007 with the notification being published in the official publication of the Estonian national standardisation organisation. The standard is available from Estonian standardisation organisation.

Käsitlusala: This European Standard specifies analysis and evaluation procedures for determining self-ignition temperatures (TSI) of combustible dusts or granular materials as a function of volume by hot storage experiments in ovens of constant temperature. The specified test method is applicable to any solid material for which the linear correlation of lg (V/A) versus the reciprocal self-ignition temperature 1/TSI (with TSI in K) holds (i.e. not limited to only oxidatively unstable materials).	**Scope:** This European Standard specifies analysis and evaluation procedures for determining self-ignition temperatures (TSI) of combustible dusts or granular materials as a function of volume by hot storage experiments in ovens of constant temperature. The specified test method is applicable to any solid material for which the linear correlation of lg (V/A) versus the reciprocal self-ignition temperature 1/TSI (with TSI in K) holds (i.e. not limited to only oxidatively unstable materials).

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English Version

Determination of the spontaneous ignition behaviour of dust accumulations

Détermination de l'aptitude à l'auto-inflammation des accumulations de poussières

Bestimmung des Selbstentzündungsverhaltens von Staubschüttungen

This European Standard was approved by CEN on 13 July 2007.

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Management Centre: rue de Stassart, 36 B-1050 Brussels

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Foreword

This document (EN 15188:2007) 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 February 2008, and conflicting national standards shall be withdrawn at the latest by February 2008.

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

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 94/9/EC.

For relationship with EU Directive 94/9/EC, 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, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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Introduction

The self-ignition behaviour of combustible dusts depends on their chemical composition as well as on related substance properties. It also depends on the size and geometry of the body of material, and, last but not least on the ambient temperature.

The reason behind self-heating (or possibly self-ignition) is that the surface molecules of combustible dust particles undergo exothermic reactions with the oxygen in air transported into the void volume between the particles even at normal temperatures. Any heat then released will cause the temperature of the reactive dust-air system to rise, thus accelerating the reaction of additional dust molecules with oxygen, etc. A heat balance involving the heat produced inside the bulk (quantity and surface of reactive surface molecules, specific heat producing rate) and the heat loss to the surroundings (heat conductivity and dimension of the bulk, heat transfer coefficient on the outside surface of the bulk and the size of the latter) is decisive as to whether a steady state temperature is reached at a slightly higher temperature level (the heat loss terms are larger than the heat production term), or whether temperatures in the bulk will continue to rise up to self-ignition of the dust, if heat transport away from the system is insufficient (in this case the heat production term is larger than all heat losses).

The experimental basis for describing the self-ignition behaviour of a given dust is the determination of the self-ignition temperatures (T_{SI}) of differently-sized bulk volumes of the dust by isoperibol hot storage experiments (storage at constant oven temperatures) in commercially available ovens. The results thus measured reflect the dependence of self-ignition temperatures upon dust volume.

Plotting the logarithms of the volume/surface ratios [lg (V/A)] of differently sized dust deposits versus the reciprocal values of the respective self-ignition temperatures [$1/T_{SI}$ in K^{-1}] or following other evaluation procedures – described in Annex A – one produces straight lines, allowing interpolation, to characterise the self-ignition behaviour of dust deposits of a different scale and of a different bulk geometric shapes (see 5.1). Experience has shown that the spread of slopes of such straight lines determined by different laboratories using differently constructed ovens is fairly large. This is the reason why scale up of those results to industrial scale will lead to non-negligible errors in T_{SI}.

Experience has shown, that it seems necessary to prescribe the installation of a unique inner chamber into the oven, surrounding the dust samples and the thermocouples, with an also prescribed air flow through this chamber. In this way the spread of results should be minimised. Decisions on the design of this inner chamber and on the amount of air flow respectively other test setups leading to comparable results have to be carried out later on.

If it is possible based on suitable thermo analytic test procedures (adiabatic, isothermal or dynamic tests) to derive a reliable formal kinetic model, which describes the heat production of the substance as a function of temperature, then the volume dependency of the self-ignition temperature may be calculated according to the methods described in Annex A.

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1 Scope

This European Standard specifies analysis and evaluation procedures for determining self-ignition temperatures (T_{SI}) of combustible dusts or granular materials as a function of volume by hot storage experiments in ovens of constant temperature. The specified test method is applicable to any solid material for which the linear correlation of lg (V/A) versus the reciprocal self-ignition temperature $1/T_{SI}$ (with T_{SI} in K) holds (i.e. not limited to only oxidatively unstable materials).

This European Standard is not applicable to the ignition of dust layers or bulk solids under aerated conditions (e.g. as in fluid bed dryer).

This European Standard should not be applied to dusts like recognised explosives that do not require atmospheric oxygen for combustion, nor to pyrophoric materials.

NOTE Because of regulatory and safety reasons “recognised explosives” are not in the scope of this European Standard. In spite of that, substances which undergo thermal decomposition reactions and which are not “recognised explosives” but behave very similarly to self-ignition processes when they decompose are in the scope. If there are any doubts as to whether the dust is an explosive or not, experts should be consulted.

2 Terms and definitions

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

2.1
self-ignition temperature
T_{SI}
highest temperature at which a given volume of dust just does not ignite

NOTE Self-ignition temperature is expressed in °C.

2.2
oven temperature
arithmetic mean of the measured values of two thermocouples, both freely installed in an oven at half the distance between the wall and the surface of the dust sample

NOTE Oven temperature is expressed in °C.

2.3
sample temperature
temperature measured at the centre of the dust sample using a thermocouple

NOTE Sample temperature is expressed in °C.

2.4
induction time
interval of time between reaching the storage temperature and an ignition

NOTE Induction time is expressed in h.

2.5
ignition
initiation of combustion

[EN 13478:2001, 3.20]

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