SLOVENSKI STANDARD
SIST EN 14034-4:2005+A1:2011

01-maj-2011

Ugotavljanje eksplozijskih značilnosti oblakov prahu - 4. del: Ugotavljanje mejne koncentracije kisika LOC oblakov prahu

Determination of explosion characteristics of dust clouds - Part 4: Determination of the limiting oxygen concentration LOC of dust clouds

Bestimmung der Explosionskenngrößen von Staub/Luft-Gemischen - Teil 4: Bestimmung der Sauerstoffgrenzkonzentration SGK von Staub/Luft-Gemischen

Détermination des caractéristiques d'explosion des nuages de poussière - Partie 4: Détermination de la concentration limite en oxygène CLO des nuages de poussière

Ta slovenski standard je istoveten z: **EN 14034-4:2004+A1:2011**

ICS:

13.230	Varstvo pred eksplozijo	Explosion protection

SIST EN 14034-4:2005+A1:2011 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14034-4:2004+A1

January 2011

ICS 13.230

Supersedes EN 14034-4:2004

English Version

Determination of explosion characteristics of dust clouds - Part 4: Determination of the limiting oxygen concentration LOC of dust clouds

Détermination des caractéristiques d'explosion des nuages de poussière - Partie 4: Détermination de la concentration limite en oxygène CLO des nuages de poussière

Bestimmung der Explosionskenngrößen von Staub/Luft-Gemischen - Teil 4: Bestimmung der Sauerstoffgrenzkonzentration SGK von Staub/Luft-Gemischen

This European Standard was approved by CEN on 9 July 2004 and includes Amendment 1 approved by CEN on 13 November 2010.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of 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, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

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

Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

page

Foreword

This document (EN 14034-4:2004+A1:2011) 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 July 2011, and conflicting national standards shall be withdrawn at the latest by July 2011.

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 includes Amendment 1, approved by CEN on 2010-11-13.

This document supersedes EN 14034-4:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟨A1⟩ ⟨A1⟩.

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(s).

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

This document includes a Bibliography.

This document is one of a series of standards as listed below:

— EN 14034-1,Determination of explosion characteristics of dust clouds - Part 1: Determination of the maximum explosion pressure p_{max} of dust clouds;

— ⟨A1⟩ EN 14034-2 ⟨A1⟩, Determination of explosion characteristics of dust clouds - Part 2: Determination of the maximum rate of explosion pressure rise $(dp/dt)_{max}$ of dust clouds;

— ⟨A1⟩ EN 14034-3 ⟨A1⟩, Determination of explosion characteristics of dust clouds – Part 3: Determination of the lower explosion limit LEL of dust clouds;

— EN 14034-4, Determination of explosion characteristics of dust clouds – Part 4: Determination of the limiting oxygen concentration LOC of dust clouds.

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, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This document specifies a method for experimental determination of the limiting oxygen concentration of dust/air/inert gas mixtures. The limiting oxygen concentration is the maximum concentration of oxygen of a dust/air/inert gas mixture at which dust explosions cannot occur. The measurement of the limiting oxygen concentration forms the basis for explosion protection by ”Inerting“.

This limiting oxygen concentration is a safety characteristic used for hazard identification and designing safety measures. This is done by avoidance or reduction of the amount of explosive atmosphere.

〚A1〉 *deleted text* 〈A1〛

1 Scope

This document describes a test method for the determination of the limiting oxygen concentration of dust clouds in a closed vessel under defined initial conditions of pressure and temperature.

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

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.

〚A1〛 EN 14034-1:2004+A1:2011 〚A1〛; *Determination of explosion characteristics of dust clouds — Part 1: Determination of the maximum explosion pressure p_{max} of dust clouds*

〚A1〛 EN 14034-2:2006+A1:2011; *Determination of explosion characteristics of dust clouds — Part 2: Determination of the maximum rate of explosion pressure rise $(dp/dt)_{max}$ of dust clouds* 〚A1〛

〚A1〛 EN 14460 〚A1〛, *Explosion resistant equipment*

3 Terms and definitions

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

3.1
dust
small solid particles in the atmosphere which settle out under their own weight, but which may remain suspended in air for some time (includes dust and grit, as defined in ISO 4225).

NOTE Generally maximum particle size will not exceed 500 µm.

3.2
combustible dust
dust able to undergo an exothermic reaction with air when ignited

NOTE The terms “flammable” and “combustible” are used synonymously.

3.3
ignition delay
t_v
time between the initiation of the dust dispersion and the activation of the ignition source

3.4
inert gas
non-flammable gas which will not support combustion and does not react to produce a flammable gas

3.5
initial pressure
p_i
the pressure in the explosion vessel at the moment of ignition

3.6
initial temperature
T_i
the temperature in the explosion vessel at the moment of ignition

3.7
limiting oxygen concentration of dust clouds (LOC)
maximum oxygen concentration in mixture of a combustible dust and air and an inert gas, in which an explosion will not occur, determined under test conditions specified by this document

3.8
maximum explosion pressure
p_{max}
maximum overpressure occurring in a closed vessel during the explosion of an explosive atmosphere determined under specified test conditions and standard atmospheric conditions

3.9
maximum rate of explosion pressure rise
$(dp/dt)_{max}$
maximum value of the pressure rise per unit time during explosions of all explosive atmospheres in the explosion range of a combustible substance in a closed vessel under specified test conditions and standard atmospheric conditions

NOTE This parameter when determined in the 1 m^3 vessel is numerically identical with the parameters K_{max} (ISO 6184-1) and K_{St} (VDI 2263-1) but the units of the latter are bar · m · s^{-1} whereas the unit of the $(dp/dt)_{max}$ is bar · s^{-1}.

4 Test apparatus

4.1 General

The standard test apparatus to determine limiting oxygen concentrations is an explosion pressure resistant vessel of 1 m³, as used for the determination of the maximum explosion pressure, the maximum rate of explosion pressure rise (K_{St}-value) and the lower explosion limit of dust clouds.

The main components of the test apparatus are

— the explosion vessel;

— the dust dispersion system;

— the ignition source;

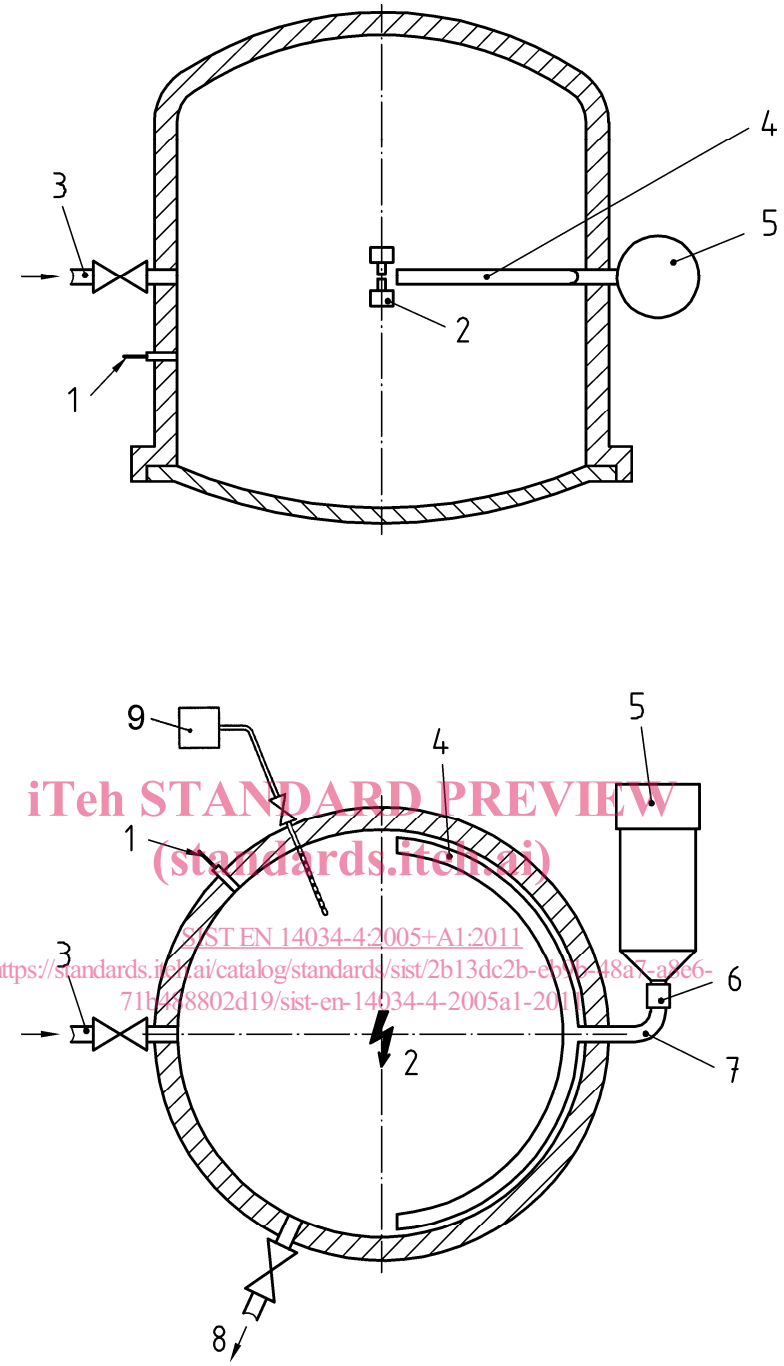
— the control unit;

— the pressure measuring system;

— the oxygen measuring system;

— the system to create the inert gas/air-mixture.

NOTE The 20 l sphere apparatus is an alternative explosion vessel for these determinations (see annex C).



Key

1 Pressure sensor
2 Chemical igniters
3 Inlet for purge air / inert gas
4 Dust disperser
5 Dust container
6 Fast acting valve
7 Connecting tube
8 Outlet for exhaust gas
9 Oxygen analyser

Figure 1 — 1 m³ vessel (schematic)

4.2 Explosion vessel

The standard explosion vessel is an explosion pressure resistant, spherical or cylindrical vessel having a volume of 1 m³ in accordance with ⟦A1⟩ EN 14460 ⟨A1⟧. The aspect ratio of the cylindrical vessel shall be 1:1 ± 10 % (see Figure 1).

NOTE It is recommended that the explosion vessel be designed to withstand an overpressure of at least 20 bar.

The apparatus shall be fitted with electrical and/or mechanical cut-offs as far as possible to ensure that any openings in the vessel (e.g. main door, instrument ports, inlet or outlet) are properly closed before a test procedure can start.

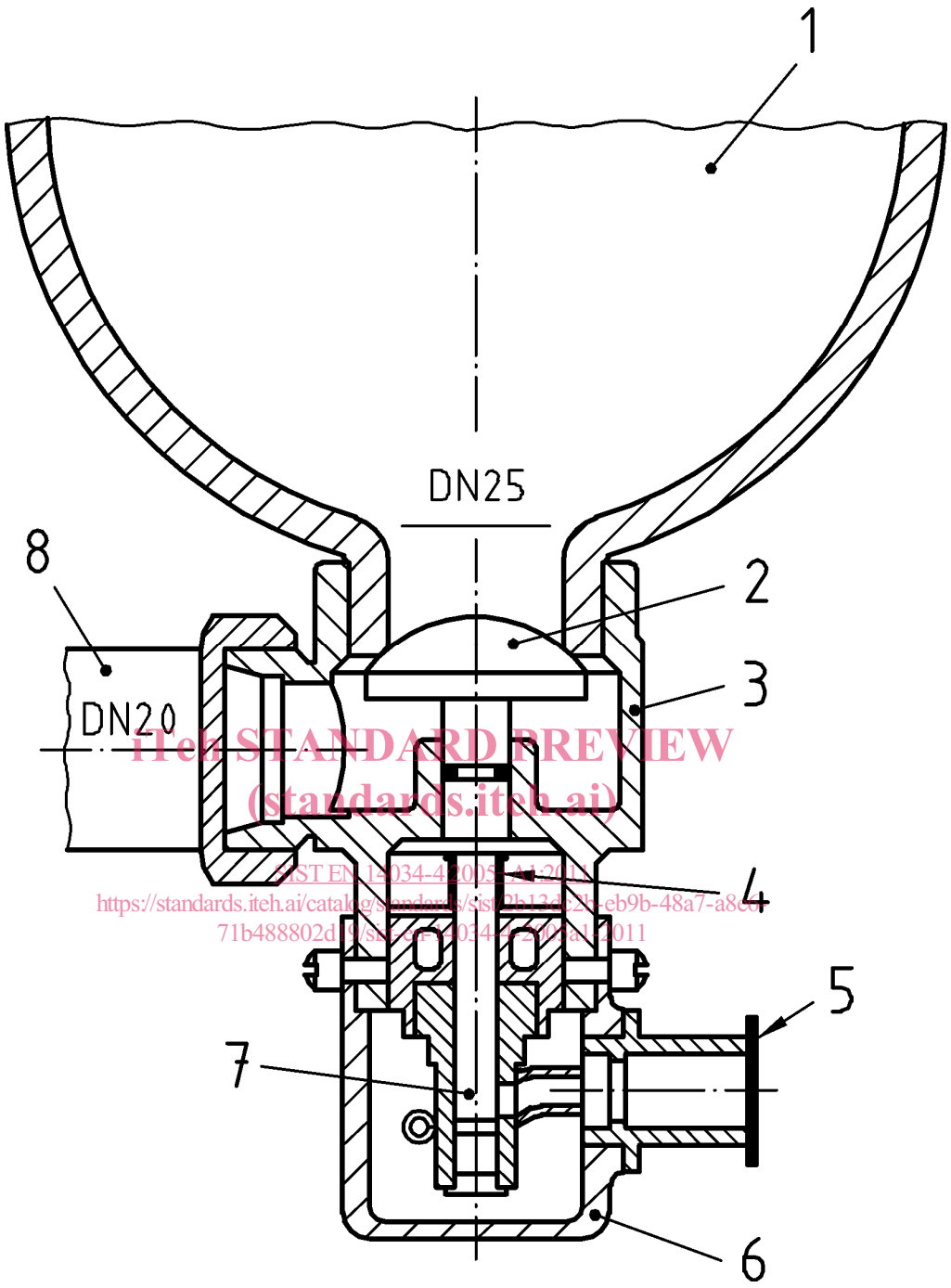
The apparatus shall also be equipped as far as possible to ensure that any residual pressure inside the vessel is vented before the vessel can be opened.

4.3 Dust dispersion system (dust container, fast acting valve, connecting tube, dust disperser)

The dust to be dispersed is charged into a dust container having a volume of 5,4 dm³. Its aspect ratio is 3:1. It is designed to withstand an overpressure of at least 20 bar (see Figure 2).

The dust container has an outlet at the base through which the dust leaves the container. This outlet is closed by a fast acting valve activated by a blasting cap. The valve has a mushroom-shaped seal. The seal is held in position against the pressure in the dust container by a small ring. The ring is destroyed by firing a blasting cap and the valve opens due to the pressure inside the dust container (see Figure 2). The valve shall be designed so that it opens in less than 10 ms. For alternative valves see annex A.

The fast acting valve is connected to the side of the explosion vessel. The connecting tube between the fast acting valve and the dust disperser shall be not longer than 350 mm (see Figure 1).



Key

1 Dust container
2 Mushroom shaped seal
3 Seal housing
4 Support ring
5 Protective hood
6 Protective hood
7 Blasting cap
8 Connecting tube

Figure 2 — Dust container with blasting cap activated valve as commonly used for explosion suppression (schematic; it is commercially available)

For dispersing the dust, a perforated semicircular spray pipe (dust disperser) is mounted inside the explosion vessel, concentric with its wall. The spray pipe, with an internal diameter of 21,7 mm[1)] is fitted with 13 holes of a diameter of 6 mm (incl. one hole in each end cap) which are located as shown in Figure 3 (see also Figure 1).

For coarse, voluminous, fibrous or poorly flowing dust samples, it may not be possible to properly discharge the dust through the dust dispersers detailed in Figures 3 and B.1. It may, therefore, be necessary to use special dust dispersers, examples of which are given in Figures B.2 and B.3. In such cases, the dust disperser used shall be described in the test report.

NOTE If other dust dispersing systems than those described in this standard are used, a propagation of the explosion from the explosion vessel into the dust container, cannot be excluded. For these cases, additional safety measures should be employed, e.g. higher pressure resistance of the dust container.

1) (e.g. EN ISO 1127, DN 20, 3/4")