

# SVENSK STANDARD

## SS-EN 14034-4:2004+A1:2011



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### **Explosiv atmosfär – Bestämning av explosionsegenskaper hos dammoln –**

#### **Del 4: Bestämning av den begränsande syrekonzentrationen, LOC**

#### **Determination of the explosion characteristics of dust clouds – Part 4: Determination of the limiting oxygen concentration LOC of dust clouds**

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Denna standard ersätter SS-EN 14034-4:2004, utgåva 1.

The European Standard EN 14034-4:2004+A1:2011 has the status of a Swedish Standard. This document contains the official version of EN 14034-4:2004+A1:2011.

This standard supersedes the Swedish Standard SS-EN 14034-4:2004, edition 1.

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EUROPEAN STANDARD

**EN 14034-4:2004+A1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

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.

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COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## Contents

page

Foreword.....	3
1 Scope .....	5
2 Normative references .....	5
3 Terms and definitions .....	5
4 Test apparatus .....	6
4.1 General.....	6
4.2 Explosion vessel.....	8
4.3 Dust dispersion system (dust container, fast acting valve, connecting tube, dust disperser).....	8
4.4 Ignition source .....	12
4.5 Control unit.....	12
4.6 Pressure measuring system.....	12
4.7 Oxygen measuring system .....	12
4.8 System to create the inert gas/air-mixture .....	12
5 Dust sample.....	12
6 Test procedure .....	12
7 Calibration and verification .....	15
7.1 Calibration .....	15
7.2 Verification .....	15
8 Safety precautions / instructions for use.....	15
9 Alternative test equipment / procedures.....	16
10 Test report .....	16
Annex A (normative) Electro pneumatic valve .....	17
Annex B (normative) Dust disperser with 5 mm holes .....	20
Annex C (normative) 20 l sphere.....	24
C.1 General.....	24
C.2 Test apparatus .....	24
C.3 Test conditions .....	25
C.4 System to create the inert gas/air-mixture .....	26
C.5 Test procedure .....	26
Annex D (informative) Examples of procedures to determine the LOC.....	27
Annex ZA (informative) <b>[A1]</b> Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC <b>[A1]</b> .....	29
Bibliography .....	30

## 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** and **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.

EN 14034-1:2004+A1:2011 <sup>A1</sup>; *Determination of explosion characteristics of dust clouds — Part 1: Determination of the maximum explosion pressure  $p_{max}$  of dust clouds*

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* <sup>A1</sup>

EN 14460 <sup>A1</sup>, *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  $\mu\text{m}$ .

### 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<sup>3</sup> 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<sup>-1</sup> whereas the unit of the  $(dp/dt)_{max}$  is bar · s<sup>-1</sup>.

## 4 Test apparatus

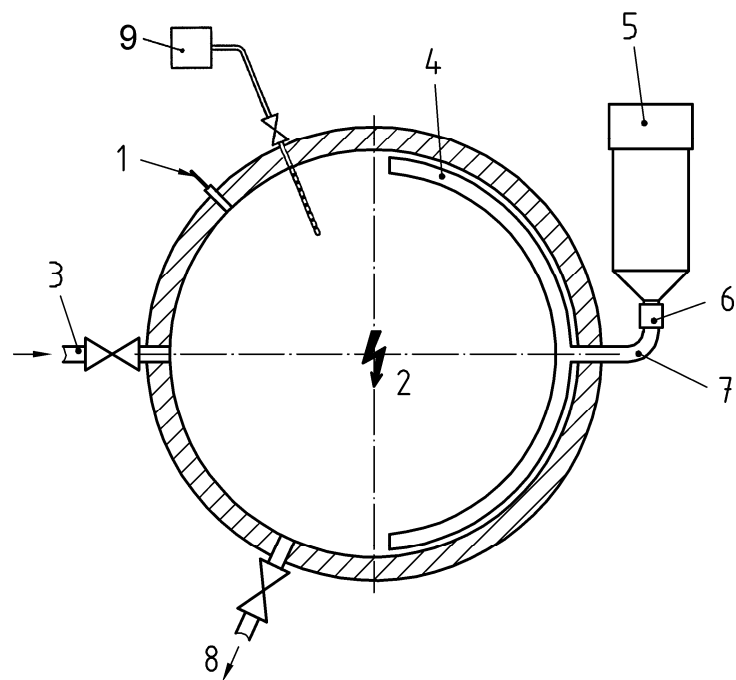
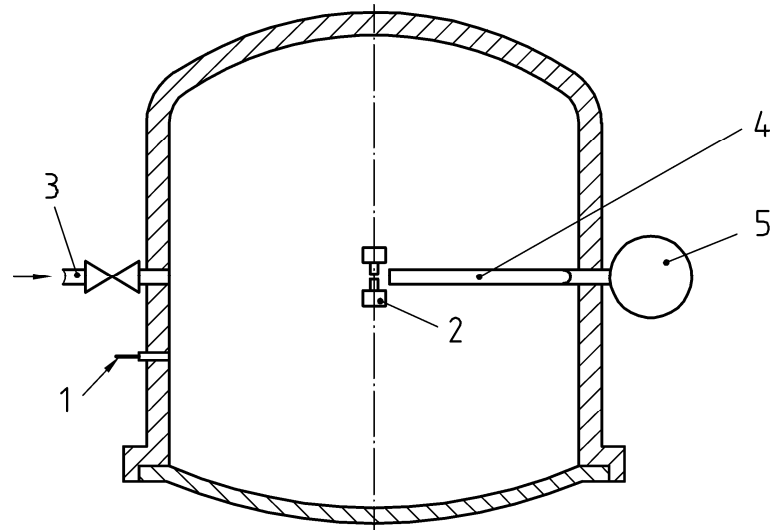
### 4.1 General

The standard test apparatus to determine limiting oxygen concentrations is an explosion pressure resistant vessel of 1 m<sup>3</sup>, 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                 | 4 Dust disperser    | 7 Connecting tube        |
| 2 Chemical igniters               | 5 Dust container    | 8 Outlet for exhaust gas |
| 3 Inlet for purge air / inert gas | 6 Fast acting valve | 9 Oxygen analyser        |

**Figure 1 — 1 m<sup>3</sup> vessel (schematic)**