SLOVENSKI STANDARD
SIST EN 14373:2006

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Sistemi za dušenje eksplozij

Explosion suppression systems

Explosions-Unterdrückungssysteme

Systemes de suppression d'explosion

Ta slovenski standard je istoveten z: **EN 14373:2005**

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13.230 Varstvo pred eksplozijo Explosion protection

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Explosion suppression systems

Systèmes de suppression d'explosion

Explosionsunterdrückungs-Systeme

This European Standard was approved by CEN on 16 August 2005.

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Foreword

This European Standard (EN 14373:2005) 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of an identical text or by endorsement, at the latest by April 2006, and conflicting national standards shall be withdrawn at the latest by April 2006.

This European Standard 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 European Standard.

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1 Scope

This European Standard describes the basic requirements for the design and application of explosion suppression systems. This European Standard also specifies a method for evaluating the effectiveness and the scale up of explosion suppression systems against defined explosions. It gives the criteria for alternative test apparatus used to undertake explosion suppression efficacy tests and criteria to be applied in defining the safe operating regime of an explosion suppression system.

It covers:

— general requirements for explosion suppression components;

— evaluating the effectiveness of an explosion suppression system;

— evaluating the scale up of an explosion suppression system;

— evaluation and development of design tools for explosion suppression systems;

— instructions for installation of an explosion suppression system;

— maintenance instructions for an explosion suppression system.

This European Standard is applicable only to explosion suppression systems intended for the protection of closed, or essentially closed, enclosures in which an explosion may result as a consequence of ignition of an explosible mixtures, e.g. dust-air mixtures, gas(vapour)-air mixtures, dust-gas(vapour)-air mixtures and mists.

This European Standard is not applicable for explosions of materials listed below, or for mixtures containing some of those materials:

— unstable materials that are liable to dissociate;

— explosive materials;

— pyrotechnic materials;

— pyrophoric materials.

NOTE For the listed materials expert advice is required.

2 Normative references

The following referenced documents are indispensable for the application of this European Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including amendments) applies.

EN 1127-1:1997, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 13237:2003, *Potentially explosive atmospheres — Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres*

EN 13673-1, *Determination of the maximum explosion pressure and the maximum rate of pressure rise of gases and vapours — Part 1: Determination of the maximum explosion pressure*

EN 13673-2, *Determination of maximum explosion pressure and the maximum rate of pressure rise of gases and vapours — Part 2: Determination of the maximum explosion pressure rise*

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

prEN 14034-2, *Determination of explosion characteristics of dust clouds — Part 2: Determination of the minimum rate of explosion pressure rise $(dp/dt)_{max}$ of dust clouds*

prEN 14034-3, *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*

prEN 14491, *Dust explosion venting protective systems*

prEN 14994, *Gas explosion venting protective systems*

EN 26184-3, *Explosion protection systems — Part 3: Determination of explosion indices of fuel/air mixtures other than dust/air and gas/air mixtures (ISO 6184-3:1985)*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1127-1:1997, EN 13237:2003 and the following apply.

3.1
HRD-suppressor
appliance containing an explosion suppressant, which can be expelled by the action of internal pressure

NOTE 1 This pressure may be stored pressure, or may be obtained by a chemical reaction such as the activation of an explosive or pyrotechnic device.

NOTE 2 HRD is the abbreviation of High Rate Discharge.

3.2
suppressant
substance contained in the HRD-suppressor which, when dispersed into a volume to be protected, can arrest or prevent a developing explosion in that volume

NOTE Three categories of suppressants are in general use, separately or in combination:

- powder suppressant;
- water suppressant;
- chemical suppressant.

3.2.1
powder suppressant
powder with recognised flame extinguishing properties such as products based on monoammonium phosphate, potassium bicarbonate or sodium bicarbonate

NOTE Such suppressants may contain additives to improve their flow properties and their effectiveness.

3.2.2
water suppressant
water, cold or hot, used as an explosion suppressant

NOTE Additives may be included to provide frost protection, and/or to improve the suppressant effectiveness.

3.2.3
chemical suppressants
chemical suppressants with recognised flame-extinguishing properties

3.3
dispersion agent pressure
p_s
maintained pressure in a stored pressure-type suppressor at which the suppressant is dispersed, e.g. dry gas, chemical reaction or the application of heat

3.4
suppressant charge
M_s
mass or volume of the suppressant contained within the suppressor

3.5
explosion sensor
device which is responsive to the changes, caused by a developing explosion, in one or more of the parameters such as pressure, temperature and/or radiation

3.6
explosion detector
device or arrangement of apparatus, containing one or more explosion sensors, that responds to a developing explosion by providing an explosion detection signal

3.7
activation pressure
p_a
pressure threshold, above the pressure at ignition of the reactants (p_i), at which a detection of the explosion is deemed to have occurred

3.8
reduced (suppressed) explosion pressure
p_{red}
explosion overpressure, above the pressure at ignition of the reactants (p_i), recorded in a suppressed explosion event

3.9
maximum reduced (suppressed) explosion pressure
$p_{red,max}$
maximum explosion overpressure, above the pressure at ignition of the reactants (p_i), recorded in a suppressed explosion event at optimum fuel concentration

3.10
explosion suppression
technique by which burning in an explosive atmosphere is detected and arrested during incipient stages, restricting development of pressure

3.11
explosion suppression system
composite arrangement of devices to detect automatically the onset of an explosion and initiate the deployment of suppressant so as to limit the destructive effects of the explosion

3.12
control and indicating equipment
CIE
explosion protection equipment which controls, records and monitors the explosion sensors/detectors and the explosion protection devices

NOTE On detection of an incipient explosion, the CIE activates the explosion protection devices and initiates alarm systems.

3.13
dispersion device
device fitted on a HRD-Suppressor and designed to spread the suppressant throughout the volume to be protected

3.14
enclosure

3.14.1
compact enclosure
cubic enclosure
enclosures having a length (height) to diameter ratio of less than 2

3.14.2
elongated enclosures
enclosures with length (height) to diameter ratio of 2 to 10

3.14.3
pipe
construction with a ratio length (height) to diameter greater than 10

3.15
combination systems

3.15.1
suppression combined with venting
system combining the technology of explosion suppression with explosion venting

3.15.2
venting combined with suppression
system designed to minimise flame ejection out of an explosion vent

3.15.3
reduced oxygen concentration combined with suppression
system where a reduced oxygen concentration is used to minimise the explosion intensity and suppression is used to suppress the reduced explosion intensity

3.16
design strength of enclosure *p* (plant strength)

3.16.1
explosion resistant enclosures
enclosures and equipment, inclusive of attached pipelines, which are designed in accordance with CEN-regulation, such that the expected explosion pressure can be withstood without permanent deformation

3.16.2
explosion shock resistant enclosures
enclosures and equipment, inclusive of attached pipelines, which are designed in accordance with CEN-regulation such that they will resist the anticipated overpressure of an explosion. Unlike the criteria for explosion resistant enclosures, with explosion shock resistant enclosures some plastic deformation is allowable. In designing these enclosures, a higher utilisation of the strength of the material of construction is assumed

3.17
hazard sector
three dimensional space for which the explosion suppression system is designed to be active

3.18
LOAEL
lowest concentration at which an adverse toxicological or physiological effect has been observed

NOTE LOAEL is the abbreviation of Lowest Observable Adverse Effect Level.

3.19
model
mathematical calculation which predicts the course of an explosion, the action of the suppression system and its interaction with the explosion, in order to enable an accurate design of explosion suppression systems

3.20
NOAEL
highest concentration at which no adverse toxicological or physiological effects have been observed

NOTE NOAEL is the abbreviation of No Observable Adverse Effect Limit.

3.21
obstructed volume
volume element containing internal obstructions

3.22
occupied space
three dimensional expanse in which personnel may be or are present

3.23
segregated volumes
three dimensional space that is set apart from others or from the main volume

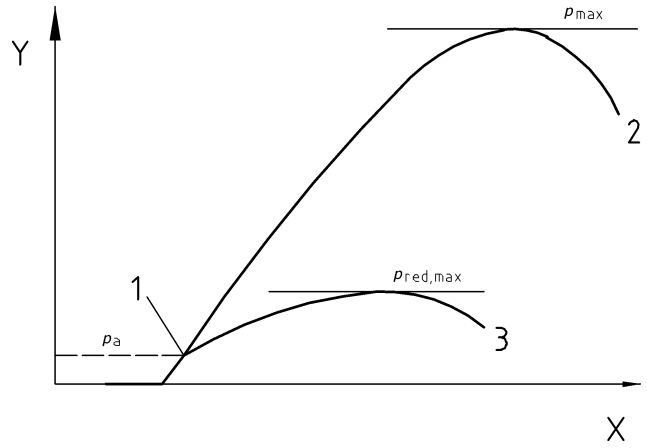
3.24
threshold dose
dose level below which no adverse toxicological or physiological effects have been observed

4 Explosion suppression

4.1 General

Explosion suppression is a technique by which combustion of an explosive atmosphere in a closed or essentially closed volume is detected and arrested during incipient stages, restricting development of damaging pressures.

A control and indicating equipment, CIE initiates the discharge of the HRD-Suppressor and the suppressant is dispersed into the volume to be protected in as short a time as possible. An explosion is regarded as suppressed when it is possible either to restrict the maximum explosion pressure to a suppressed (reduced) explosion pressure, which is lower than the protected volume design strength, or to limit fireball propagation to a specified maximum size in unconfined spaces. The maximum explosion overpressure, p_{max} will therefore be lowered to a maximum reduced (suppressed) explosion overpressure $p_{red, max}$ of typically between 0,2 bar and 1 bar (Figure 1).



Key

1 Activation of the suppression system
2 Closed enclosure explosion
3 Suppressed explosion
Y Explosion overpressure p, in bar
X Time t, in s

Figure 1 — Pressure behaviour versus time for a normal and suppressed explosion

For most practical applications of explosion suppression the worst case maximum suppressed explosion pressure, $p_{red,\,max}$ that can result is determined. Provided that this suppressed explosion pressure is lower than the process equipment design strength and provided further that suppression is achieved with a sufficient margin of safety, effective explosion suppression can be assured.

4.2 Influencing factors

4.2.1 General

The effectiveness of an explosion suppression system depends on the parameters listed in 4.2.2 to 4.2.4.

4.2.2 The explosion hazard

a) Volume of enclosure (free volume, V);

b) shape of enclosure (surface area and length (height) to diameter ratio);

c) explosible material (gas, dust, flammable liquids, mixtures thereof);

d) homogeneity and intrinsic turbulence of the explosive atmosphere;

e) induced turbulence caused by interaction of the combustion wave with internal obstacles and reflected pressure waves;

f) initial pressure;

g) temperature condition;

h) explosibility parameters of explosible materials:

1) maximum explosion overpressure, p_{max};