SLOVENSKI STANDARD
oSIST prEN 14373:2019

01-april-2019

Sistemi za dušenje eksplozij

Explosion suppression systems

Explosions-Unterdrückungssysteme

Systèmes de suppression d'explosion

Ta slovenski standard je istoveten z: **prEN 14373**

ICS:

13.230	Varstvo pred eksplozijo	Explosion protection

oSIST prEN 14373:2019 **en,fr,de**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 14373

January 2019

ICS 13.230

Will supersede EN 14373:2005

English Version

Explosion suppression systems

Systèmes de suppression d'explosion

Explosions-Unterdrückungssysteme

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 305.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 14373:2019) 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 document is currently submitted to the CEN Enquiry.

This document will supersede EN 14373:2005.

This document has been prepared under a standardization request 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.

1 Scope

This document describes the basic requirements for the design and application of explosion suppression systems. This document also specifies test methods for evaluating the effectiveness and the scale up of explosion suppression systems against defined explosions. This document covers:

— general requirements for explosion suppression system components;

— evaluating the effectiveness of an explosion suppression system;

— evaluating the scale up of an explosion suppression system;

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

— installation, operation and maintenance instructions for an explosion suppression system.

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

This document 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.

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.

prEN 1127-1:2018, *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*

EN 15233:2007, *Methodology for functional safety assessment of protective systems for potentially explosive atmospheres*

EN 15967:2011, *Determination of the maximum explosion pressure and the maximum rate of pressure rise of gases and vapours*

EN 14034-1:2004+A1:2011, *Determination of explosion characteristics of dust clouds — Part 1: Determination of the maximum explosion pressure pmax 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*

EN 61508-1:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 1: General requirements*

EN 61508-2:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 2: Requirements for electrical/electronic/programmable electronic safety-related systems*

EN 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 3: Software requirements*

EN 61508-4:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 4: Definitions and abbreviations*

EN 61508-5:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 5: Examples of methods for the determination of safety integrity levels*

EN 61508-6:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 6: Guidelines on the application of IEC 61508-2 and IEC 61508-3*

EN 61508-7:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems — Part 7: Overview of techniques and measures*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in prEN 1127-1:2018, EN 13237:2012 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
HRD-suppressor
vessel with opening mechanism, which upon activation discharges an explosion suppressant at a high rate

Note 1 to entry: HRD is the abbreviation of High Rate Discharge.

3.2
suppressant
substance contained in the HRD-suppressor which, when dispersed into an enclosure to be protected, can arrest and mitigate a developing explosion in that enclosure

Note 1 to entry: Two categories of suppressants are in general use, separately or in combination:

— powder suppressant;

— liquid 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 1 to entry: Such suppressants can contain additives to improve their flow properties and their effectiveness

3.2.2
liquid suppressant
substance stored as a liquid with recognised flame extinguishing properties such as water and halogenated alkanes, cold or hot

Note 1 to entry: Additives can be included to provide frost protection, and/or to improve the suppressant effectiveness.

3.3
dispersion pressure
p_S
pressure in HRD-suppressor to disperse the suppressant, which is provided by gas, chemical reaction or the application of heat

3.4
suppressant charge
M_S
mass of the suppressant contained within the suppressor

3.5
explosion detector
device that responds to an explosion (e.g. developing pressure and/or radiation) and provides a signal to the control and indicating equipment

Note 1 to entry: See 3.10.

3.6
activation pressure
p_a
pressure at which the CIE activates the HRD-suppressor(s)

3.7
maximum reduced (suppressed) explosion pressure
$p_{red,max}$
maximum explosion overpressure generated by an explosion of an explosive atmosphere in an enclosure at optimum fuel concentration, after effective explosion venting or explosion suppression

3.8
explosion suppression
technique limiting and/or avoiding the destructive effect of an explosion by the deployment of suppressant

3.9
explosion suppression system
arrangement comprising one or more explosion detectors, CIE and one or more HRD-suppressors aiming at achieving explosion suppression

3.10
control and indicating equipment
CIE
electronic system which controls, records and monitors the status of the explosion protection system and initiates the explosion protection devices upon detection

Note 1 to entry: On detection of an incipient explosion, the CIE activates the explosion protection devices and initiates alarm systems and process shutdown.

3.11
dispersion nozzle
device fitted on a HRD-suppressor and designed to distribute the suppressant throughout the enclosure to be protected

3.12
compact enclosure/cubic enclosure
enclosures having a length (height) to diameter ratio of less than 2

3.13
elongated enclosures
enclosures with a length (height) to diameter ratio of 2 to 10

3.14
pipe
construction with a length (height) to diameter ratio greater than 10

3.15
hazard sector
three-dimensional space for which the explosion suppression system is designed to be active

3.16
LOAEL
lowest concentration of the suppressant at which an adverse toxicological or physiological effect has been observed

Note 1 to entry: LOAEL is the abbreviation of Lowest Observable Adverse Effect Level.

3.17
suppression 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

3.18
maximum throw
maximum distance from a suppressor at which the concentration of the expelled suppressant is still sufficiently high to extinguish an explosion flame

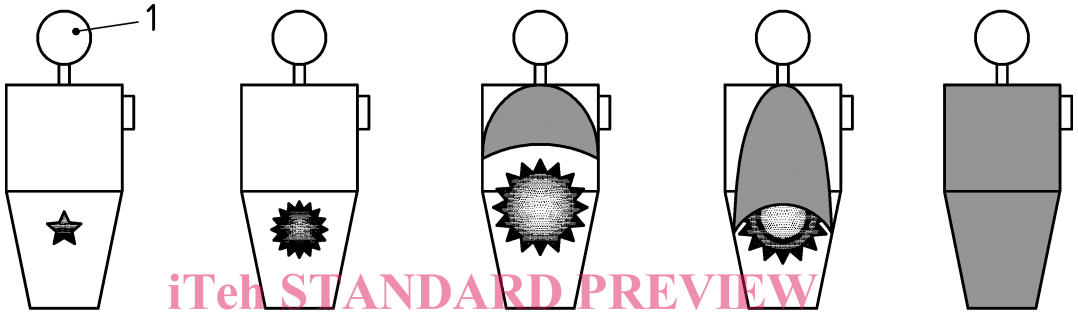
4 Explosion suppression

4.1 Objectives

Explosion suppression systems shall be designed to extinguish propagating flames and to reduce the maximum explosion pressure, $P_{max,}$ to a reduced explosion pressure (P_{red}), following an ignition in the protected enclosure. In general, successful explosion suppression implies that the P_{red} will not exceed the strength of the protected equipment. Explosion suppression systems can be applied to flammable gases, mists, dusts or hybrid mixtures.

4.2 General function

Explosion suppression is a protective measure for enclosures, where a gas, mist, dust or hybrid mixture explosion is detected and arrested during incipient stages (see Figure 1).



Key

1 supressor

a The explosive atmosphere in an enclosure is ignited. The enclosure is provided with one (or more) explosion detectors (D) and one (or more) suppressors (1).

b The explosion is detected by the explosion detector(s).

c The control and indicating equipment CIE (not shown) has received the signal from the explosion detector(s) and activated the suppressor(s). The suppressor(s) have started to inject suppressant into the enclosure.

d The suppressant cloud reaches the explosion flame.

e The flame is extinguished: the explosion is suppressed.

Figure 1 — Stages in explosion suppression of an enclosure

The performance of an explosion suppression system depends on:

— the response time of the system: time until explosion is detected + response time of the various components + time required to inject sufficient suppressant into the enclosure;

— the suppressant dispersion: spatial distribution, as a function of time;

— the effectiveness of the suppressant.

4.3 Essential requirements

An explosion suppression system consists of at least one: explosion detector, HRD suppressor, complete with suppressant / dispersion nozzle and connected to control and indicating equipment (CIE).

Essential requirements are:

— the overall requirement of the explosion suppression system is to detect an explosion in the incipient stage and to have a fast response to allow for the dispersion of suppressant and extinguishment of the flame in order to limit the maximum reduced explosion pressure below the admissible pressure of the protected equipment - Experimental validation shall be performed as described in Clause 6;

— the system as installed or any of its components shall not introduce ignition hazards, such as electrostatic discharge, mechanical friction, electrical sparks, hot surfaces;

— the activation of the suppression system shall not result in dangerous ejected parts;

— the explosion suppression system shall have a defined reliability for safety-functions according to the intended use (see 4.3 d);

— if discharging the suppressant during maintenance or inspection can result in injury, the explosion suppression system shall have provisions in place to prevent an unintended suppressor discharge prior to performing such operations;

— the suppression system shall be configured to prevent unintended arming;

— the supplier shall provide instructions which ensure safe operation of the explosion suppression system and the system is always activated when explosible atmospheres are present and is disarmed before access to be inside protected equipment is granted (see 7.6);

— the explosion suppression system shall avoid operation of the protected process by provision of a safe signal interface through the CIE so that operation cannot be resumed until the suppression system is armed and fault free.

Other essential requirements are:

a) Explosion Detector

An explosion detector shall detect the onset of the explosion in time to allow for achieving successful suppression.

b) Control and Indication Equipment (CIE)

The components and software used in the Control and Indication Equipment (CIE) shall ensure explosion suppression system functionality by undertaking the following:

— process detection signals;

— initiate the suppressors;

— initiate interlocks/alarms;

— enable safe isolation;

— enable an automatic and orderly safe-mode of the protected process upon activation, fault/trouble condition.

c) Emergency power

Emergency power shall be specified and facilitated such that full uninterrupted unchanged explosion protection functionality is ensured at least 4 h after a mains power failure.

d) Explosion Suppressors

Explosion suppressors shall inject sufficient suppressant into the protected enclosure in the required time. Either monitored mechanical blocking or other monitored provisions to prevent unintended activation shall be present.

NOTE 1 The performance of suppressors depends upon at least:

— volume, shape and outlet diameter of the suppressor;

— filling ratio and pressure inside the suppressor;

— opening time of the suppressor;

— characteristics of the dispersion nozzle and the suppressant.

e) Dispersion nozzle

The dispersion nozzle shall spread the suppressant into the protected enclosure to achieve both required throw and spatial distribution / concentration.

NOTE 2 The performance of a dispersion nozzle depends upon at least:

— design of the nozzle;

— characteristics of the suppressor and the suppressant.

Depending on the intended use specific dispersion nozzles can be applied, with special performances, for example to obtain strong directional effects.

f) Suppressant

The suppressant shall have dispersion characteristics and extinguishing properties allowing for extinguishing an explosion flame for a given fuel type.

NOTE 3 The properties influencing these characteristics include:

— the particle/droplet size distribution;

— chemical and thermal properties.

Apart from the effectiveness in explosion suppression of the suppressant applied, also the compatibility of the suppressant with the process shall be considered:

— temperature stability;

— any adverse reaction with the process products;

— toxicity levels of the suppressant.

g) Installation, commissioning, service and maintenance