# Leegitõkestid. Toimivusnõuded, katsemeetodid ja kasutuspiirangud

Flame arresters - Performance requirements, test methods and limits for use

## EESTI STANDARDI EESSÕNA

## NATIONAL FOREWORD

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|---|---|
| Käesolev Eesti standard EVS-EN ISO 16852:2010 sisaldab Euroopa standardi EN ISO 16852:2010 ingliskeelset teksti. | This Estonian standard EVS-EN ISO 16852:2010 consists of the English text of the European standard EN ISO 16852:2010. |
| Standard on kinnitatud Eesti Standardikeskuse 30.06.2010 käskkirjaga ja jõustub sellekohase teate avaldamisel EVS Teatajas. | This standard is ratified with the order of Estonian Centre for Standardisation dated 30.06.2010 and is endorsed with the notification published in the official bulletin of the Estonian national standardisation organisation. |
| Euroopa standardimisorganisatsioonide poolt rahvuslikele liikmetele Euroopa standardi teksti kättesaadavaks tegemise kuupäev on 28.04.2010. | Date of Availability of the European standard text 28.04.2010. |
| Standard on kättesaadav Eesti standardiorganisatsioonist. | The standard is available from Estonian standardisation organisation. |



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EUROPEAN STANDARD

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# EN ISO 16852

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English Version

## Flame arresters - Performance requirements, test methods and limits for use (ISO 16852:2008, including Cor 1:2008 and Cor 2:2009)

Arrête-flammes - Exigences de performance, méthodes d'essai et limites d'utilisation (ISO 16852:2008, Cor 1:2008 et Cor 2:2009 inclus)

Flammendurchschlagsicherungen - Leistungsanforderungen, Prüfverfahren und Einsatzgrenzen (ISO 16852:2008, einschließlich Cor 1:2008 und Cor 2:2009)

This European Standard was approved by CEN on 16 April 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 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 Management Centre has the same status as the official versions.

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Ref. No. EN ISO 16852:2010: E

# Foreword

The text of ISO 16852:2008, including Cor 1:2008 and Cor 2:2009 has been prepared by Technical Committee ISO/TC 21 “Equipment for fire protection and fire fighting” of the International Organization for Standardization (ISO) and has been taken over as EN ISO 16852:2010 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 October 2010, and conflicting national standards shall be withdrawn at the latest by October 2010.

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 supersedes EN 12874:2001.

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.

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 the United Kingdom.

**Endorsement notice**

The text of ISO 16852:2008, including Cor 1:2008 and Cor 2:2009 has been approved by CEN as a EN ISO 16852:2010 without any modification.

According to edition 2001 the following fundamental changes are given:

— explosion group IIA1, with a methane-air test mixture included;

— approval of in-line flame arrester (deflagration or detonation) limited to operational pressures less than or equal to the applied test pressure;

— maximum limit for short time burning of 30 min extended;

— procedure for calculating the critical volume flow rate for endurance burning changed from a temperature to a time based criterion;

— testing of high velocity vent valves revised;

— testing of flow controlled apertures deleted;

— types of detonation flame arresters extended to four types.

ISO 16852 has been developed from existing national and international standards on flame arresters. These include the following standards: Z343-98 (Canada), 33CFR 154 (United States Coast Guard), UL 525 (Underwriter Laboratories, USA), IMO MSC/Circ. 677 (International Maritime Organization) and EN 12874 (European Committee for Standardization).

The requirements of ISO 16852 that deviate from those of EN 12874:2001 are detailed described below:

1) According its scope ISO 16852 is not applicable to flame arresters integrated in or combined with explosion protected equipment. So, in terms of Directive 94/9/EC, ISO 16852 covers protective systems only and not explosion protected equipment.
Furthermore ISO 16852 also does not cover other protective systems, which prevent flame transmission by suppression or isolation of explosions; these different techniques find their reflection in specific CEN standards.

2) ISO 16852 defines atmospheric conditions which comply with the "Guidelines on the Application of Directive 94/9/EC, Section 4".

3) The requirements for ethylene-air test mixtures when expressed as “percent vapour in air by volume” have been adjusted slightly as a result of more precise figures from re-evaluations of safe gap data becoming available.

4) Specific requirements in EN 12874 on the strength of materials do not apply any more. The international working group took the unanimous view that strength of equipment is sufficiently and simultaneously proved by the explosion load generated by the flame transmission type tests.

5) All welded constructions are now required to undergo a routine pressure test.

6) An additional explosion group IIA1, with a methane-air test mixture, has been added to take account of the increasing importance of biogenic generated explosive mixtures.

7) ISO 16852 extends the upper limit of the design series from 400 mm to 1000 mm flange connections.

8) For end-of-line flame arresters with non-measurable elements, the safety margin is achieved by increasing the severity of the flame transmission test (higher test pressure) rather than requiring thicker flame arrester elements in the production units.

9) Flame arresters for use with directly combined separate pressure-vacuum-valves shall be tested in the same way as flame arresters that have integrated pressure-vacuum-valves.

10) For any in-line flame arrester (deflagration or detonation) the approval is limited to operational pressures less than or equal to the applied test pressure. “Atmospheric testing” and subsequent approval for operational pressures up to the limit of 1,1 bar absolute is not accepted under ISO 16852.

11) There are minor revisions of the pressure ratios characterizing unstable detonations and the range of pipe sizes has been extended to 1000 mm and above.

12) For any in-line detonation arrester additional deflagration tests with a run-up length of five pipe diameters are now required. The number of deflagration tests has also been increased from three to five for each run-up length tested.

13) The classification of detonation arresters is widened from two types to four types, to include arresters for stopping detonations in installations with pipe restrictions. Guidance on the proper use of a detonation arrester type is given in the clause “Limits for use” and in the informative Annex D.

14) The period for the short time burning test has been extended from a 1 min limit to a maximum limit of 30 min. The test period is specified by the manufacturer of the flame arrester and has to be included in the information marked on the flame arrester.

15) For endurance burn testing of static flame arresters, the procedure for calculating the critical volume flow rate has been changed from a temperature to a time based criterion. This change was necessary as a result of problems with applying the temperature criterion when testing large sizes of flame arrester. The rest of the endurance burn test procedure is unchanged.

16) The procedure for testing high velocity vent valves has been extensively revised as a result of recent test experience. The undamped oscillation testing of these devices (Annex A.4) has also been revised.

17) The testing of flow controlled apertures is not covered by ISO 16852. This is mainly because the safety of these devices largely depends on peripheral equipment and how they are installed, which would not be assessed by the type tests specified in the standard.

18) Extension of the types of detonation arrester to four (Type 1 to Type 4) and the introduction of the burn time classes (Burning Class a, b and c) were introduced to take account of the requirements of the North American market. To aid the user in selecting the correct type of arrester for their application from the many possible combinations of detonation type and burn class a warning label is now required specifying the arrester type and its application limits.

Flame arresters shall be used as an integral part of a package of explosion protection measures to fulfil the European ATEX directives. A risk assessment shall be used to develop a safety concept for the system to be protected. This can then be used for selecting the correct type of arrester, for example a deflagration flame arrester, stable detonation flame arrester or unstable detonation flame arrester, to provide the required level of protection.

If the risk of an explosion is high it may be necessary to use more than one flame arrester, of different types, to protect the system and in some cases in combination with other explosion protection measures.

# Annex ZA
(informative)

## Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC concerning equipment and protective systems for use in potentially explosive atmospheres

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide a means of conforming to Essential Requirements of the New Approach Directive 94/9/EC concerning equipment and protective systems for use in potentially explosive atmospheres

Once this standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the clauses of this standard given in table ZA confers, within the limits of the scope of this standard, a presumption of conformity with the corresponding Essential Requirements of that Directive and associated EFTA regulations.

**Table ZA — Correspondence between this European Standard and Directive 94/9/EC concerning equipment and protective systems for use in potentially explosive atmospheres**

| Clause(s)/sub-clause(s) of this EN | Essential Requirements (ERs) of Directive 94/9/EC | Qualifying remarks/Notes |
|---|---|---|
| Clause 5; 6.2; Annex D | 1.0.1 Principles of integrated explosion safety | |
| 6.2; 7.1 | 1.0.2 Design and manufacture considerations | |
| Annex C | 1.0.3 Special checking and maintenance conditions | |
| 6.2 | 1.0.4 Surrounding area conditions | |
| 11.2 | 1.0.5 Marking | |
| 7.4; 8.4; 9.4; 10.3; 11.1 | 1.0.6 Instructions | |
| 6.2; 7.1; Annex C | 1.1.1 Operational stresses on material | |
| 6.2; Annex C | 1.1.2 Reaction of material | |
| 6.2; 7.1 | 1.1.3 Wear of material | |
| 5.1; 6.2; 6.3; 6.4; 6.5; 7.1; | 1.2.1 Design and construction for safe operation | |
| 6.6 | 1.2.3 Enclosed structures and prevention of leaks | |

| | | |
|---|---|---|
| 11.1 | 1.2.5 Additional mans of protection | |
| 7.3.4; 10.1 | 1.2.8 Overloading of equipment | |
| 6.3; 6.4; 7.3.2.3 | 1.2.9 Flameproof enclosure systems | |
| 6.2 | 1.3.1 Hazards arising from different ignition sources | |
| Annex B; Annex C | 1.3.2 Hazards arising from static electricity | |
| 6.2 | 1.4.1 External effects | |
| 6.2 | 1.4.2 Mechanical, thermal and chemical stresses | |
| 6.4 | 1.6.4 Hazards arising from connections | |
| 6; 7; 8; 9; 10 | 3.0.1 Dimensioning | |
| 6; 7; 8; 9; 10 | 3.0.2 Design and position | |
| 6.5; 7.3.3 | 3.1.2 Shock waves | |

**WARNING —** Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

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# Introduction

Flame arresters are safety devices fitted to openings of enclosures or to pipe work, and are intended to allow flow but prevent flame transmission. They have widely been used for decades in the chemical and oil industry, and a variety of national standards is available. This International Standard was prepared by an international group of experts, whose aim was to establish an international basis by harmonizing and incorporating recent national developments and standards as far as reasonable.

This International Standard addresses manufacturers (performance requirements) and test institutes (test methods), as well as customers (limits for use).

Only relatively general performance requirements are specified and these are kept to a strict minimum. Experience has shown that excessively specific requirements in this field often create unjustified restrictions and prevent innovative solutions.

The hazard identification of common applications found in industry leads to the specification of the test methods. These test methods reflect standard practical situations and, as such, form the heart of this International Standard because they also allow classification of the various types of flame arresters and then determination of the limits of use.

A considerable number of test methods and test conditions had to be taken into account for two main reasons:

a) different types of flame arresters are covered with respect to the operating principle (static, hydraulic, liquid, dynamic), and each type clearly needs its specific test set-up and test procedure;

b) it is necessary to adapt flame arresters to the special conditions of application (gas, installation) because of the conflicting demands of high flame quenching capability and low pressure loss; this situation is completely different from the otherwise similar principle of protection by flameproof enclosure (of electrical equipment), where the importance of gas flow through gaps is negligible.

Consequently, in this International Standard, the testing and classification related to the gas groups and the installation conditions has been subdivided more than is usually the case. In particular,

— explosion group IIA is subdivided into sub-groups IIA1 and IIA,

— explosion group IIB is subdivided into sub-groups IIB1, IIB2, IIB3 and IIB, and

— the type “detonation arrester” is divided into four sub-types, which take into account specific installation situations.

The test conditions lead to the limits for use which are most important for the customer. This International Standard specifies this safety relevant information and its dissemination through the manufacturer's written instructions for use and the marking of the flame arresters.

The limits for use are also a link to more general (operational) safety considerations and regulations, which remain the responsibility of national or corporate authorities. Annexes B, C and D offer some guidance in this field.

# Flame arresters — Performance requirements, test methods and limits for use



## 1 Scope

This International Standard specifies the requirements for flame arresters that prevent flame transmission when explosive gas-air or vapour-air mixtures are present. It establishes uniform principles for the classification, basic construction and information for use, including the marking of flame arresters, and specifies test methods to verify the safety requirements and determine safe limits of use.

This International Standard is valid for pressures ranging from 80 kPa to 160 kPa and temperatures ranging from −20 °C to +150 °C.

NOTE 1 In designing and testing flame arresters for operation under conditions other than those specified above, this International Standard can be used as a guide. However, additional testing related specifically to the intended conditions of use is advisable. This is particularly important when high temperatures and pressures are applied. The test mixtures might need to be modified in these cases.

This International Standard is not applicable to the following:

— external safety-related measurement and control equipment that might be required to keep the operational conditions within the established safe limits;

NOTE 2 Integrated measurement and control equipment, such as integrated temperature and flame sensors as well as parts which, for example, intentionally melt (retaining pin), burn away (weather hoods) or bend (bimetallic strips), is within the scope of this International Standard.

— flame arresters used for explosive mixtures of vapours and gases, which tend to self-decompose (e.g. acetylene) or which are chemically unstable;

— flame arresters used for carbon disulphide, due to its special properties;

— flame arresters whose intended use is for mixtures other than gas-air or vapour-air mixtures (e.g. higher oxygen-nitrogen ratio, chlorine as oxidant, etc.);

— flame arrester test procedures for internal-combustion compression ignition engines;

— fast acting valves, extinguishing systems and other explosion isolating systems;

— flame arresters integrated or combined with explosion-protected equipment, such as blowers, fans, compressors and pumps.

## 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.

IEC 60079-1, *Explosive atmospheres — Part 1: Equipment protection by flameproof enclosures “d”*

IEC 60079-1-1:2002, *Electrical apparatus for explosive gas atmospheres — Part 1-1: Flameproof enclosures "d" — Method of test for ascertainment of maximum experimental safe gap*

## 3 Terms and definitions

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

**3.1**
**flame arrester**
device fitted to the opening of an enclosure, or to the connecting pipe work of a system of enclosures, and whose intended function is to allow flow but prevent the transmission of flame

**3.2**
**housing**
portion of a flame arrester whose principal function is to provide a suitable enclosure for the flame arrester element and allow mechanical connections to other systems

**3.3**
**flame arrester element**
portion of a flame arrester whose principal function is to prevent flame transmission

**3.4**
**stabilized burning**
steady burning of a flame stabilized at, or close to, the flame arrester element

**3.5**
**short time burning**
stabilized burning for a specified time

**3.6**
**endurance burning**
stabilized burning for an unlimited time

**3.7**
**explosion**
abrupt oxidation or decomposition reaction producing an increase in temperature, pressure, or in both simultaneously

**3.8**
**deflagration**
explosion propagating at subsonic velocity

**3.9**
**detonation**
explosion propagating at supersonic velocity and characterized by a shock wave

**3.10**
**stable detonation**
detonation progressing through a confined system without significant variation of velocity and pressure characteristics

NOTE For the atmospheric conditions, test mixtures and test procedures of this International Standard, typical velocities range between 1 600 m/s and 2 200 m/s.

**3.11**
**unstable detonation**
detonation during the transition of a combustion process from a deflagration into a stable detonation