BS EN 14797:2006

Explosion venting devices

The European Standard EN 14797:2006 has the status of a British Standard

ICS 13.230

British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 14797:2006.

The UK participation in its preparation was entrusted to Technical Committee FSH/23, Fire precautions in industrial and chemical plant.

A list of organizations represented on FSH/23 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 28 February 2007

ISBN 978 0 580 50186 9

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14797

December 2006

ICS 13.230

English Version

Explosion venting devices

Dispositifs de décharge d'explosion

Einrichtungen zur Explosionsdruckentlastung

This European Standard was approved by CEN on 4 November 2006.

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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, 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: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 14797:2006: E

Contents

Page

Foreword....4
1 Scope 5
2 Normative references 5
3 Terms and definitions 6
4 Design requirements 8
4.1 General....8
4.2 Potential sources of ignition 9
5 Types of explosion venting devices 9
5.1 Explosion venting devices with reusable elements....9
5.2 Explosion venting devices with non reusable elements 9
6 Back pressure supports....9
6.1 General....9
6.2 Opening back pressure supports 10
6.3 Non-opening back pressure supports....10
7 Testing of explosion venting devices....10
7.1 General....10
7.2 Static activation pressure 10
7.3 Explosion testing....12
8 Information for use 16
9 Assembly, replacements or reusability....17
10 Marking 17
10.1 General....17
10.2 Explosion venting devices with reusable retaining elements 17
10.3 Explosion venting devices with non-reusable retaining elements....18
10.4 Omission of markings 18
11 Packaging 19
11.1 General....19
11.2 Marking 19
Annex A (informative) Examples for explosion venting devices 20
A.1 Re-closing explosion venting devices 20
A.2 Devices which require manual repositioning or replacement of the retaining element 21
A.3 Devices with non reusable elements....23
Annex B (informative) Service and maintenance....26
B.1 General....26
B.2 Servicing....26
Annex ZA (informative) Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC 27
Bibliography 29

Figures

Figure 1 — Direct comparison method.... 14
Figure 2 — Example for direct comparison method 15

Figure A.1 — Example for an explosion door 21
Figure A.2 — Example for a buckling-rod device 22
Figure A.3 — Example for a bursting panel device 23
Figure A.4 — Example for a restrained pop-out panel device 24
Figure A.5 — Example for a back pressure support 25

Tables

Table 1 — Symbols and their descriptions 8
Table 2 — Number of tests of explosion venting devices with non-reusable elements 12
Table ZA.1 — Correspondence between this European Standard and Directive 94/9/EC 27

Foreword

This document (EN 14797:2006) 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 June 2007, and conflicting national standards shall be withdrawn at the latest by June 2007.

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, 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.

1 Scope

This European Standard specifies the requirements for venting devices used to protect enclosures against the major effects of internal explosions arising from the rapid burning of suspended dust, vapour or gas contained within. It includes the requirements for the design, inspection, testing, marking, documentation and packaging. This European Standard specifies explosion venting devices which are put on the market as autonomous protective systems.

Explosion venting devices are safety devices comprised of a pressure sensitive membrane fixed to and forming part of the structure that it protects, designed to intervene in the event of an explosion at a predetermined low pressure, to immediately open a vent area sufficient to ensure that the maximum pressure attained by the explosion within the enclosure does not exceed its designed resistance to pressure.

The application and specification of explosion venting devices is outlined for dust explosion protection in EN 14491 and for gas explosion protection in prEN 14994. The use of venting devices according to this European Standard on pipelines and on applications other than described in EN 14491 or prEN 14994 needs to be carefully evaluated and where appropriate their suitability needs to be confirmed by tests.

Flameless explosion venting devices avoid the breakthrough of flames into the surroundings. They are used to allow explosion venting in situations where the hazards of flames resulting from the venting action are not acceptable. Flameless explosion venting devices are treated in a separate standard.

This European Standard does not cover details for the avoidance of ignition sources from detection devices or other parts of the venting devices.

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

EN 13463-1, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*

EN 14491, *Dust explosion venting protective systems*

prEN 14994:2005, *Gas explosion venting protective systems*

EN 60079-0, *Electrical apparatus for explosive gas atmospheres — Part 0: General requirements (IEC 60079-0:2004)*

prEN 61241-0, *IEC 61241-0, Ed. 1: Electrical apparatus for use in the presence of combustible dust — Part 0: General requirements*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13237:2003 and the following apply.

3.1
batch
quantity of non-reusable retaining elements made as a single group of the same type, size, materials and specified static activation pressure requirements when the non-reusable retaining elements are manufactured from the same lot of material

3.2
effective vent area
A_E
product of the geometric vent area A_d and the venting efficiency E_f for the venting device

NOTE It is the effective vent area that should be used in making up the vent area for explosion venting.

3.3
explosion venting
protective measure which will prevent the explosion pressure in a vessel or other closed volume from exceeding the vessel design strength by exhausting the explosion through an explosion venting device in the vessel walls

3.4
explosion venting device
device which protects a vessel or other closed volume by explosion venting

3.5
gas explosion constant
K_G
maximum value of the pressure rise per unit time $(\mathrm{d}p/\mathrm{d}t)_{max}$ during the explosion of a specific explosive atmosphere in a closed vessel under specific test conditions normalized to a vessel volume of 1 m^3 multiplied by $V^{1/3}$

[prEN 14994:2005, 3.8]

3.6
dust explosion constant
K_{st}
maximum value of explosion pressure rise per unit of time $(\mathrm{d}p/\mathrm{d}t)_{max}$ in a volume of 1 m^3 multiplied by $V^{1/3}$

3.7
retaining element
part or parts of the explosion venting device that determines the activation pressure

NOTE It may or may not be re-useable.

3.8
reduced explosion pressure
p_{red}
overpressure generated by an explosion of an explosive atmosphere in an enclosure protected by explosion venting

3.9
restraining element
parts of some explosion venting devices that prevent components or objects from becoming dangerous missiles

NOTE They may or may not be reusable.

3.10
specific mass
total mass per unit area (A_d) of the venting element. The specific mass is used in determining the effect of inertia

3.11
static activation pressure
p_{stat}
differential pressure at which the retaining element activates such that the venting element is able to open

3.12
static activation pressure tolerance range
range of differential pressure between the specified maximum static activation pressure and the specified minimum static activation pressure or the range of differential pressure in positive and negative percentages or quantities which is related to the specified static activation pressure

3.13
vent area
A_d
geometric vent area of an explosion venting device.

NOTE The vent area is the minimum cross-sectional flow area of the explosion venting device taking into consideration the possible reduction of the cross section, e.g. by back pressure support, restraining devices and parts of the explosion venting device which remain after venting

3.14
venting efficiency
E_f
dimensionless number used to define the efficiency of the explosion venting device as determined in 7.3.4

3.15
venting element
part of the explosion venting device that covers the vent area and opens under explosion conditions

NOTE It may or may not incorporate the retaining element - it may or may not be reusable.

Table 1 — Symbols and their descriptions

Symbol	Description	Units
A	Required vent area	m^2
A_E	Effective vent area	m^2
A_d	Geometric vent area	m^2
E_f	Venting efficiency	-
p_{stat}	Static activation pressure	bar
p_{red}	Reduced explosion pressure	bar
$p_{red, baseline}$	Reduced explosion pressure measured using an explosion venting device with a specific mass < 0,5 kg m^{-2}	bar
$p_{red, test device}$	Reduced explosion pressure measured using an explosion venting device under investigation	bar
K_G	Gas explosion constant	bar m s^{-1}
K_{st}	Dust explosion constant	bar m s^{-1}
V	Volume of vessel to be protected by explosion venting	m^3

4 Design requirements

4.1 General

Explosion venting devices shall be designed so that they open when subjected to pressure exceeding their static activation pressure (within a stated static activation pressure tolerance range). Any part not designed to rupture shall not rupture. Venting elements shall be designed so that they shall not fragment to produce dangerous missiles. These requirements may be proved by explosion testing, but other methods e.g. calculation, may be used if their validity has been verified from representative explosion tests.

Explosion venting devices shall employ re-usable elements or non re-usable elements (see Clause 5). Explosion venting devices may be provided with back pressure supports (see Clause 6).

The performance capability of an explosion venting device is defined by the following parameters:

— the static activation pressure p_{stat} and its tolerance;

— the maximum K_G/K_{st} values specified by the manufacturer;

— the maximum reduced pressure p_{red} specified by the manufacturer;

— the minimum venting efficiency E_f of the device.

Tests to determine or prove these parameters are given in Clause 7.

Explosion venting devices shall be designed to maintain their specified performance taking into account environmental and process conditions. Build-up or addition of any substance on external surfaces of the device (e.g. snow and ice) and the build-up of product on the internal surfaces of the device may affect the correct operation of the device, so particular attention shall be given to preventing such effects.

Material used for the parts of explosion venting devices shall be selected on the basis of their suitability with regard to the chemical and physical conditions to which they will be subjected in service.

It is common practice to use electrical detection devices to sense vent function, to operate an alarm or shut plant down. Such detection devices shall meet the requirements of EN 13463-1, EN 60079-0 and prEN 61241-0.

Explosion venting devices can incorporate thermal insulation on the internal or external or both sides to prevent heat loss and/or condensation.

Gaskets or seals forming part of an explosion venting device, shall be as specified by the manufacturer and shall be compatible with the chemical, thermal, mechanical and environmental demands of the application.

4.2 Potential sources of ignition

Due consideration shall be given to potential sources of ignition in the design and material specification of venting devices, e.g. static electricity, heating and detection devices. Requirements for potential sources of ignition in electrical and non-electrical equipment apply, as stated in EN 13463-1.

5 Types of explosion venting devices

5.1 Explosion venting devices with reusable elements

Explosion venting devices with re-usable elements shall be distinguished as follows:

a) normally automatically re-closing devices;

b) devices which require manual re-positioning of the retaining elements.

For examples see Annex A.

5.2 Explosion venting devices with non reusable elements

Explosion venting devices with non reusable elements describe all devices which after having functioned can not be reused without the replacement of an individual element or a number of elements.

For examples see Annex A.

NOTE Flameless explosion venting devices are treated in a separate standard.

6 Back pressure supports

6.1 General

When the pressure external to the explosion venting device is greater than the pressure inside the protected vessel, unless the device is capable of withstanding this pressure difference, a back pressure support shall be fitted which prevents damage to the venting element.

The back pressure support shall be either permanently attached to the venting element or it shall form part of the explosion venting device that ensures it is fitted to the correct side of the venting element.

The back pressure support shall not cause the explosion venting device to perform incorrectly. When back pressure supports are used consideration shall be given to the effects of the back pressure support on the vent area and venting efficiency.

6.2 Opening back pressure supports

The opening back pressure support shall give adequate support to the venting element. The support shall be of a design such that the pressure in the system is transmitted to the venting element.

When the explosion venting device is activated, the back pressure support shall open simultaneously with the venting element.

The effect of the specific mass of the opening back pressure supports shall be considered in the determination of the efficiency of an explosion venting device.

6.3 Non-opening back pressure supports

The non-opening back pressure support shall give adequate support to the venting element. The support shall be of a design such that the pressure in the system is transmitted to the venting element.

The effect of non-opening back pressure supports shall be considered when determining the effective vent area.

7 Testing of explosion venting devices

7.1 General

Each design of explosion venting device shall be subject to type tests and design assessments to assure:

a) function and mechanical integrity (type testing only);

b) efficiency, where required (type testing only);

c) static activation pressure.

The static activation pressure and the mechanical strength of the explosion venting device shall be proven.

7.2 Static activation pressure

7.2.1 General

All explosion venting devices shall be tested for static activation pressure. The number of tests required shall be in accordance with 7.2.5.

Depending on the explosion venting device type, the static activation pressure can be measured using either a pressure test method or a mechanical test method. The observed static activation pressure shall be recorded.

The static activation pressure test shall have starting conditions where inside and outside pressure conditions are equal.

The static activation pressure is observed:

— when discharge begins;

— when the venting element releases from the retaining element.

7.2.2 Pressure test method

The retaining elements and where applicable the venting elements shall be tested in an appropriate arrangement where they are assembled and mounted according to the manufacturer's instructions.

The test arrangement shall be equipped with calibrated measuring instruments suitable for the testing of the explosion venting device.

The pressure measuring device shall be located as near as practicable to the explosion venting device and connected in such a way as to minimize pressure drop.

The pressure shall be increased to 90 % of the expected minimum static activation pressure in a time not less than 5 s and thereafter the pressure shall be increased at a linear rate which allows accurate reading or recording of the pressure measurement system but in not more than 120 s.

Appropriate safety measures shall be observed when carrying out the tests.

7.2.3 Mechanical test method

The retaining element and where applicable the venting element shall be tested in an appropriate arrangement where they are assembled and mounted according to the manufacturer's instructions.

The test arrangement shall be equipped with calibrated measuring instruments suitable for the test.

By applying continuously increasing mechanical forces on the venting element, the activation of an explosion venting device is effected. The direction of the force shall be normal to the venting element. The point of application of the force shall depend on the design of the explosion venting device. Mechanical forces shall be applied almost statically (10 kN m^{-2} min^{-1}).

Appropriate safety measures shall be observed when carrying out the tests.

7.2.4 Influence of temperature

The static activation pressure shall normally be determined at a temperature in the range of 15 °C to 25 °C. If there is a temperature dependence of the static activation pressure, this dependence shall be determined for the temperature range in which the device will be used.

7.2.5 Number of tests

7.2.5.1 Devices with non reusable elements

A number of explosion venting devices with non-reusable elements shall be selected at random from each batch (see Table 2) and be tested in accordance with 7.2.1 in order to verify that the static activation pressure meets the specified requirements. Static activation tests carried out during the manufacture of the batch of explosion venting devices i.e. discarded or trial tests shall not be considered part of the batch testing procedure.

Table 2 — Number of tests of explosion venting devices with non-reusable elements

Total number in a batch	Number to be tested
Less than 10	2
10 to 15	3
16 to 30	4
31 to 100	6
101 to 250	4 % but not less than 8
251 to 1 000	3 % but not less than 10

All the test results shall fall in the tolerance range for the static activation pressure specified by the manufacturer. Otherwise the batch shall be deemed to have failed the test.

7.2.5.2 Devices with reusable elements

The static activation pressure of explosion venting devices with reusable elements shall be determined in at least three tests per device.

All the test results shall fall in the tolerance range for the static activation pressure specified by the manufacturer. Otherwise the device shall be deemed to have failed the test.

7.3 Explosion testing

7.3.1 General

Mechanical strength and venting efficiency of explosion venting devices shall be determined.

The manufacturer shall specify the range of nominal sizes of the venting device, p_{stat}-value of the venting device, the maximum K_{st}/K_G and p_{max}-value at which the device can be used, and the maximum p_{red}-value for which the device is designed.

For type testing of a range of explosion venting devices of an identical design, but a defined range of nominal sizes, testing shall be carried out on a representative selection of nominal sizes from this range. Tests shall be performed on the smallest and largest sizes in this range and if there are more than five different sizes also tests shall be performed with at least one intermediate size.

The explosion venting devices shall be mounted on the test apparatus either directly or with an appropriate adapter. The area of the explosion venting device shall not be greater than the opening in the test apparatus.

7.3.2 Explosion testing for function and mechanical integrity

The mechanical integrity of the venting device shall be assessed by an explosion test using an explosion with a K_{st} or K_G-value not less than that provided by the manufacturer as the maximum value for which the device is designed (see 7.3.1) and a reduced explosion pressure not less than 1,1 × the maximum value that the device is designed to withstand (see 7.3.1). The volume of the test vessel shall satisfy the testing requirement of 7.3.1.

A minimum of at least 2 explosion tests shall be carried out.

The mechanical integrity shall be such that any part not designed to fail shall not fail and that no dangerous missiles are produced.

All tests shall be documented.

7.3.3 Effect of specific mass on venting efficiency

7.3.3.1 Specific mass smaller or equal to 0,5 kg m^{-2}

Explosion venting devices which are almost inertia-free (with a specific mass less than 0,5 kg m^{-2}) do not impede the venting process to any great extent. For the determination of the venting efficiency of such explosion venting devices explosion testing is therefore not required and the venting efficiency shall be 1.

7.3.3.2 Specific mass greater than 0,5 kg m^{-2} and smaller or equal to 10 kg m^{-2}

Explosion venting devices with venting elements with a mass per unit area greater than 0,5 kg m^{-2} can influence the venting process by their opening and release behavior.

Experiments have shown that explosion venting devices with an inertia greater than 0,5 kg m^{-2} and smaller or equal to 10 kg m^{-2} can have a venting efficiency < 1,0 depending on application.

NOTE According to EN 14491 where: $A / V^{0,753} < 0{,}07$. The venting efficiency $E_f = 1{,}0$. This is valid for $p_{stat} \leq 0{,}1$ bar and 0,1 bar < p_{red} < 2 bar. For all other conditions the efficiency has to be determined by tests (see 7.3.4.1).

7.3.3.3 Specific mass greater than 10 kg m^{-2}

This influence shall be determined by comparing the venting efficiency to that of an explosion venting device (with a specific mass less than 0,5 kg m^{-2} e.g. a bursting foil) regarded as being inertia-free as described in 7.3.4.

7.3.4 Determination of venting efficiency by direct comparison method

The venting efficiency shall be determined by explosion tests. The complete venting device, including all added elements, shall be compared to a venting device with a specific mass < 0,5 kg m^{-2} (e.g. bursting foil) of same size, static activation pressure p_{stat} and geometry without any obstructions.

In addition to the tests at the maximum K_G, K_{st} values specified by the manufacturer, tests shall also be done at lower K_G, K_{st} values. Three to five K_G, K_{st} values are sufficient, as evenly distributed as is practicable between K_G, K_{st} = 50 bar m s^{-1} and the maximum values specified by the manufacturer. More tests shall be performed if no single relationship is found between K_G, K_{st} value and p_{red}.

In the case of temperature dependence on performance of the venting device, the test shall be carried out with the test conditions resulting in the highest p_{red}.

The effective venting efficiency shall be calculated by the following equation:

$$E_f = A_E \times 100 \times A_d^{-1}\ \%$$

The effective vent area (see Figure 1 and Figure 2) is determined by direct comparison of the test results between the explosion venting devices and the test results with the explosion venting devices with a specific mass < 0,5 kg m^{-2} (e.g. bursting foils).

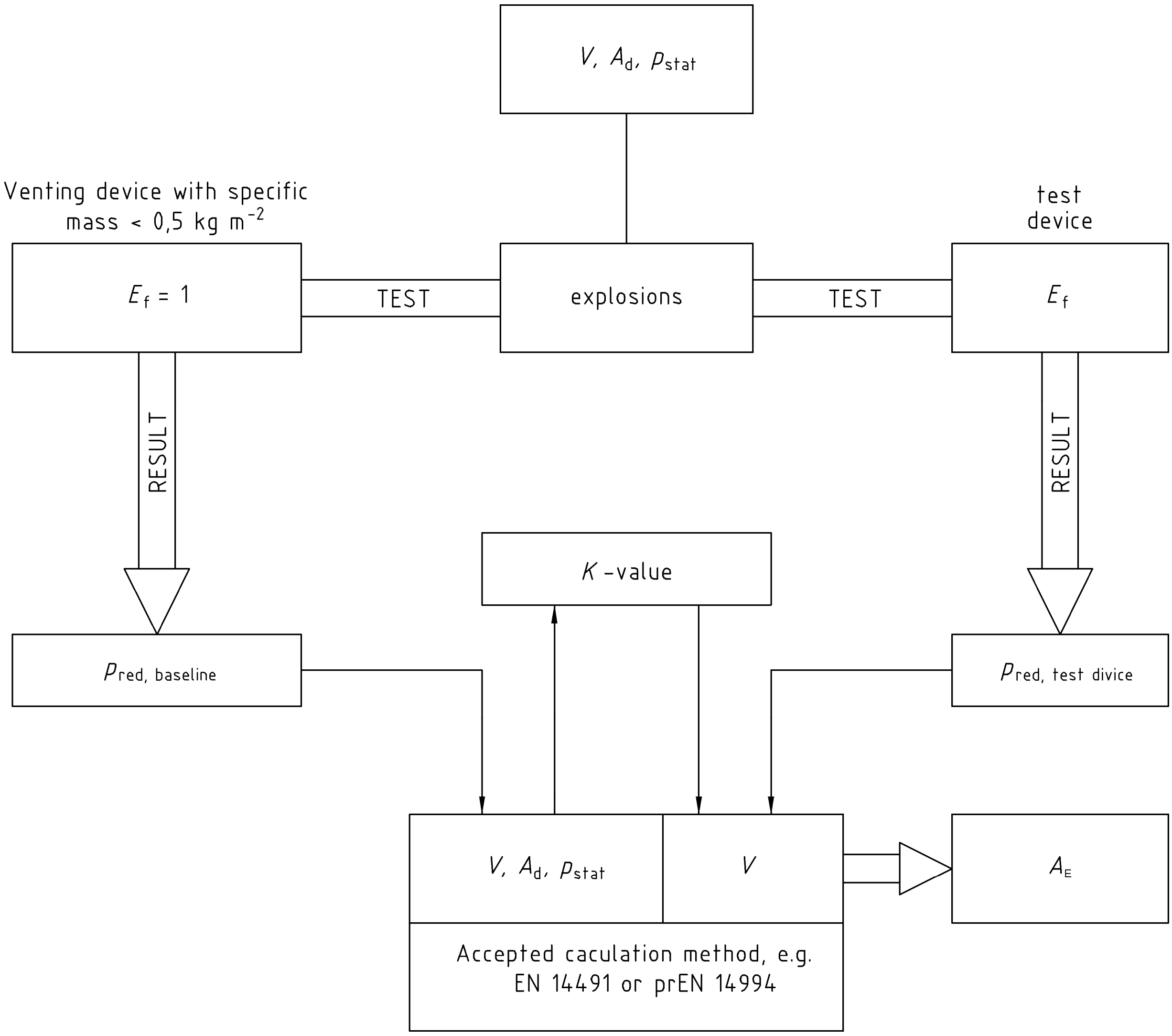
To this aim the following steps shall be performed:

At the test conditions of vessel volume, vent area and p_{stat}, the reduced explosion pressure $p_{red,\ baseline}$, is measured using an explosion venting device that has a specific mass < 0,5 kg m^{-2}.

Using the test conditions and the measured $p_{red,\ baseline}$, a K-value for the explosion shall be calculated using an accepted vent sizing method according to EN 14491 and prEN 14994.

The test is repeated using the venting device that is under test, and the reduced explosion pressure, $p_{red,\ test\ device}$, is measured.

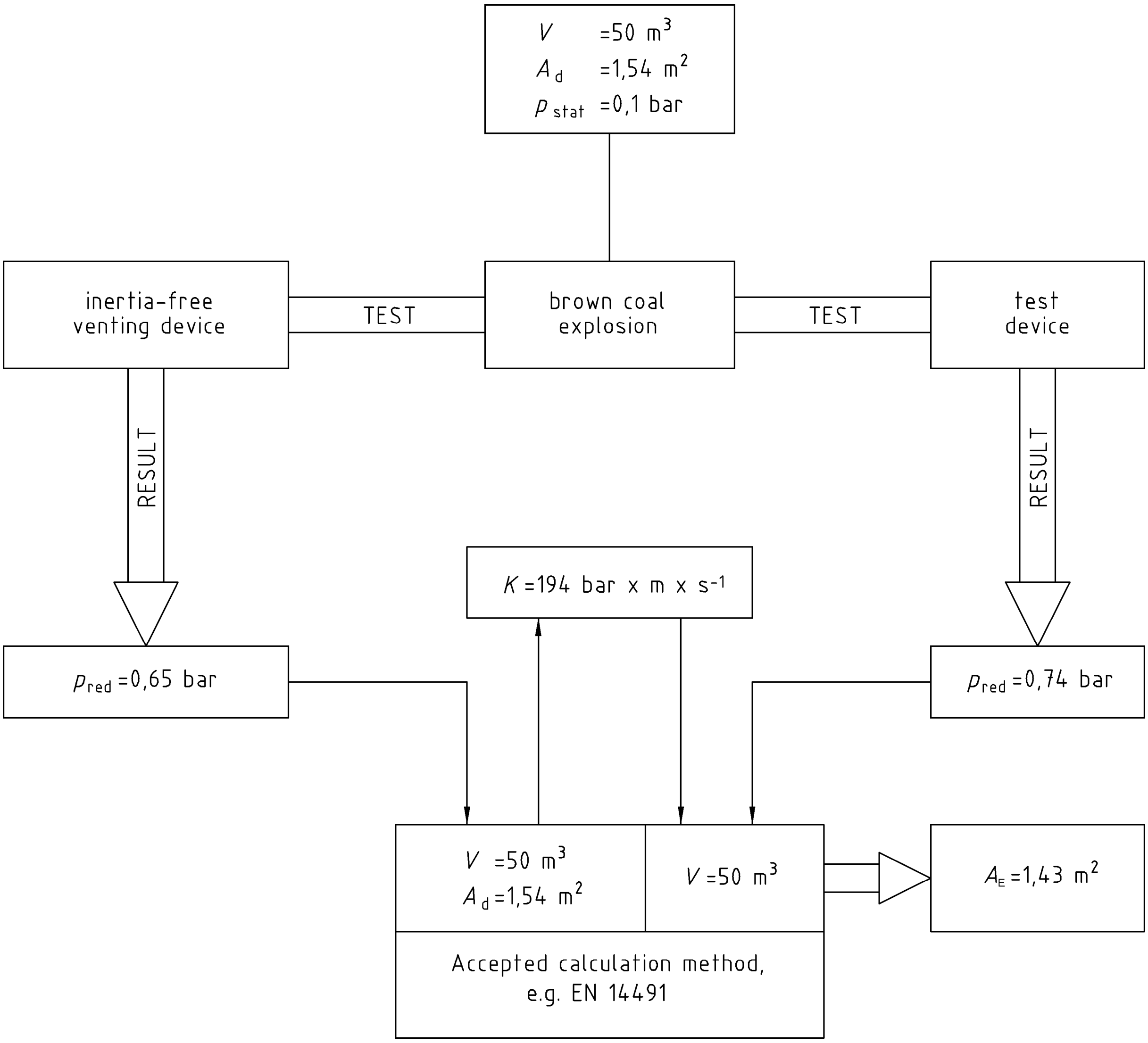
Using the test conditions of vessel volume and p_{stat}, the measured $p_{red, test device}$ and the K_{st}, K_G-value previously calculated, an effective vent area for the device under test is calculated using the same vent sizing method. The resulting venting efficiency or venting efficiency relationship is only valid for the range of K_{st}, K_G-values and $p_{red, max}$ tested.



Key

V	volume of the test apparatus
A_d	area of the explosion venting device
E_f	venting efficiency of the explosion venting device
p_{red}	reduced explosion pressure
$p_{red, baseline}$	reduced explosion pressure measured using an explosion venting device with a specific mass < 0,5 kg m^{-2}
$p_{red, test device}$	reduced explosion pressure measured using the explosion venting device under investigation
p_{stat}	static activation pressure
A_E	effective vent area

Figure 1 — Direct comparison method



Key

V	volume of the test apparatus
A_d	area of the explosion venting device
p_{red}	reduced explosion pressure
p_{stat}	static activation pressure
A_E	effective vent area

Figure 2 — Example for direct comparison method

8 Information for use

Information for use for installation, use and maintenance of explosion venting devices shall be issued by the manufacturer.

The information for use shall include as a minimum:

- the information found on the device, including:

  1) name and address of the manufacturer, together with any appropriate additional information to facilitate assembly and installation;

  2) CE marking;

  3) designation of series or type of device the instructions apply to;

  4) year of construction;

  5) specific marking of explosion protection 'Ex' followed by the symbol of the equipment group and category;

  6) any warning or information essential to the device's safe use.

- the detailed requirements necessary to ensure:

  1) use of the correct components, inclusive reuse of explosion venting device elements;

  2) correct assembly of the explosion venting device;

  3) correct installation of the explosion venting device into the plant/equipment;

  4) correct use;

  5) necessary service and maintenance (see informative Annex B);

  6) methods of adjustment;

  7) methods of dismantling;

  8) process compatibility of materials.

- if required:

  1) a caution on the danger areas in front of the explosion relief device;

  2) special conditions of use, including particulars of possible misuse which experience has shown might occur;

  3) training instructions;

  4) identification of any special tools required;

  5) explosion relief device operating limits;

  6) IP-code according to EN 60529.

The instructions shall be written so that no requirement is likely to be misunderstood. They shall give clear step by step instructions with diagrams, where necessary, to give a better understanding.

9 Assembly, replacements or reusability

All parts which together make up a venting device shall be assembled in accordance with the manufacturers' instructions.

Devices which have re-usable parts shall be cleaned, checked and reset as required, by qualified personnel in accordance with the manufacturers instructions.

10 Marking

10.1 General

Each explosion venting device shall be marked in accordance with 10.2, 10.3 accordingly (except when the conditions described in 10.4 apply).

The markings shall be permanent and shall not impair the performance of the explosion venting device and, where practicable, shall be such that they are visible after installation.

10.2 Explosion venting devices with reusable retaining elements

Each explosion venting device shall be marked, preferably on an identification plate, securely attached to the venting device.

The marking shall include the following:

a) name and address of the manufacturer;

b) designation of series or type;

c) nominal size of explosion venting device;

d) batch identity;

e) year of construction;

f) specific mass;

g) maximum and minimum static activation pressure or a specified static activation pressure with associated tolerances and where appropriate, the coincident temperature stating units;

h) indication of direction of flow where applicable;

i) the specific marking of explosion protection followed by the symbol of the equipment group and category;

j) for equipment-group II, the letter 'G' (concerning explosive atmospheres caused by gases, vapours or mists) and/or the letter 'D' (concerning explosive atmospheres caused by dust);

k) the maximum values of K_{st}/K_G, p_{max} and $p_{red, max}$ for which the device is designed;

l) number of this European Standard, i.e. EN 14797.

10.3 Explosion venting devices with non-reusable retaining elements

10.3.1 General

Explosion venting devices with non-reusable retaining elements shall be marked in accordance with 10.2. The non-reusable retaining elements shall be marked in accordance with 10.3.2.

10.3.2 Non-reusable retaining element

Each non-reusable retaining element shall be marked with at least the following information:

a) name and address of the manufacturer;

b) designation of series or type;

c) manufacturer reference to the explosion venting device into which the non reusable retaining element is to be installed;

d) batch identity;

e) year of construction;

f) maximum and minimum static activation pressure or a specified static activation pressure with associated tolerances and where appropriate the coincident temperature stating units;

g) the specific marking of explosion protection by the symbol of the equipment group and category;

h) for equipment-group II, the letter 'G' (concerning explosive atmospheres caused by gases, vapours or mists) and/or the letter 'D' (concerning explosive atmospheres caused by dust);

i) the maximum values of K_{st}/K_{G}, p_{max} and $p_{red, max}$ for which the device is designed;

j) Ex-marking;

k) number of this European Standard, i.e. EN 14797;

l) reference to explosion venting device.

10.4 Omission of markings

Where the size and shape does not allow inclusion of all the required markings or when marking may affect the performance, as many of the marking requirements, as is practical shall be met.

The markings shall always include a unique reference which relates the item to the document that contains the relevant information omitted from the marking requirements.

11 Packaging

11.1 General

Explosion venting devices or their parts shall be packed to prevent any damage which may impair their performance.

11.2 Marking

If the marking of the device or component is not visible whilst packed the package shall be permanently marked. The markings shall include at least:

a) name and address of the manufacturer;

b) designation of series or type;

c) nominal size of the explosion venting device;

d) batch identity;

e) maximum and minimum static activation pressure or a specified static activation pressure with associated tolerances and where appropriate, the coincident temperature stating units;

f) customers reference where appropriate;

g) special requirements for handling and storage of packed items.

Annex A
(informative)

Examples for explosion venting devices

A.1 Re-closing explosion venting devices

A.1.1 Weight loaded explosion doors

Weight loaded explosion doors employ as venting elements a hinged cover which under normal process conditions covers the venting area and generally re-closes the venting area by falling back into its original position after the venting, aided by gravity. The cover should be fitted in or on a frame in a way to avoid leakage. The frame is used to fix the weight loaded explosion door to the venting area of the protected enclosure.

The cover can be held in place by one or more restraining elements and is designed to open at a predetermined pressure in order to provide a specified vent area when open.

Explosion doors are designed to be reused after an explosion. The disintegration or deformation of restraining elements negatively affects the sealing capacity of the re-closing venting elements. Some types of restraining element may be reused, others may have to be replaced.

The orientation of a weight loaded explosion door is critical to its correct operation.

A.1.2 Spring loaded explosion doors

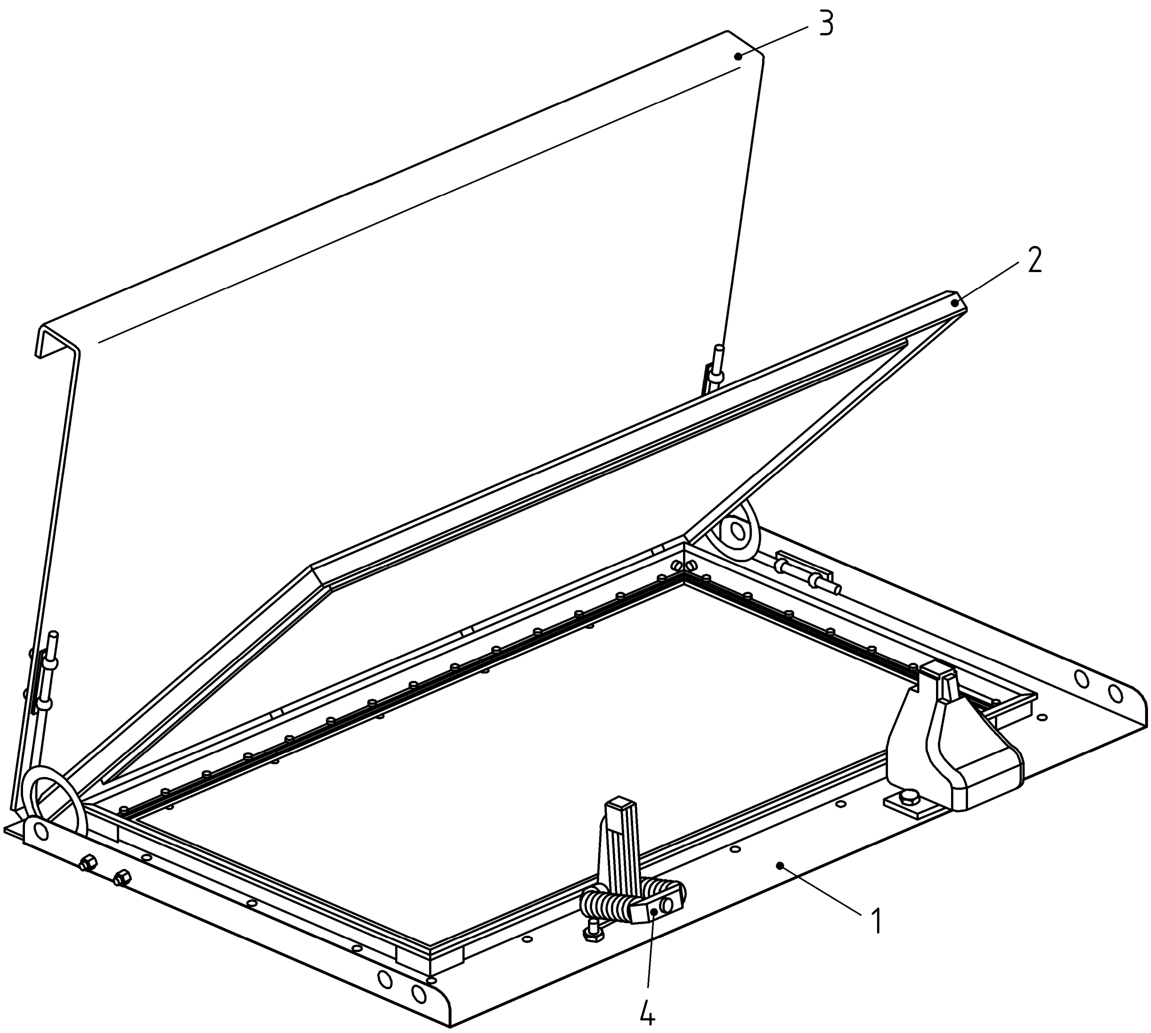
Spring loaded explosion doors are devices that allow venting of explosion pressure and re-close automatically after the explosion event (see Figure A.1).

The pressure rise due to the explosion lifts the lid of the venting device into a position where it no longer obstructs the venting process.

The lid closes after the explosion under the action of a spring assembly.

The spring assembly, designed to re-close the lid automatically after the venting, is at the same time designed to keep the lid in its closed position under quiescent process conditions. At the same time it keeps the vent closed under pressure fluctuations as long as the pre-set static response pressure is not exceeded.

Spring loaded explosion doors can be mounted in any orientation.



Key

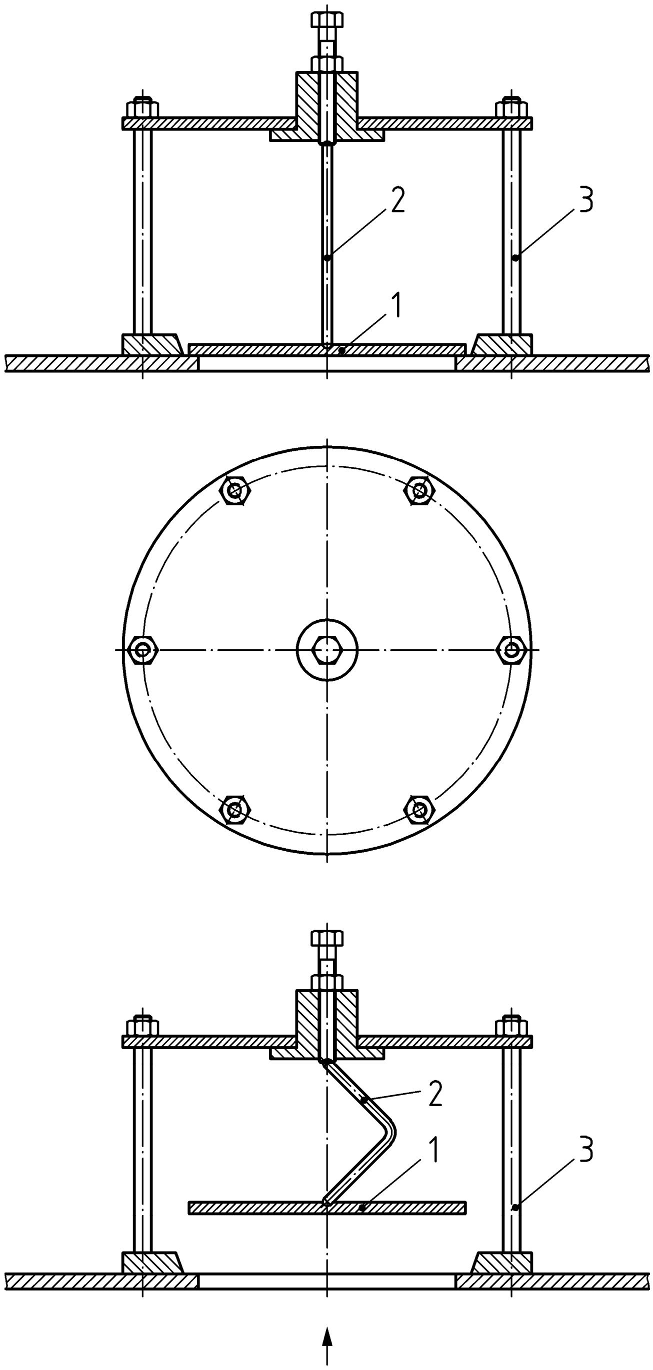
1	supporting frame	3	baffle
2	venting element	4	retaining elements

Figure A.1 — Example for an explosion door

A.2 Devices which require manual repositioning or replacement of the retaining element

A.2.1 Buckling-rod devices

Buckling-rod devices typically consist of three main elements; supporting structure, venting element and buckling-rod. The supporting structure retains the other two elements, ensuring effective sealing of the venting element and acting as a stop for the buckling-rod. The venting element is usually free to move in one axes when not fixed by a buckling-rod, being retained in the other two axes by the supporting element. The buckling-rod fixes the venting element in place until the prescribed pressure is reached at which point the venting element moves opening the vent port in the supporting structure. The buckling-rod which is typically slender (high length to diameter ratio) is the 'stressed' element which is designed to buckle at a prescribed force. The force is transmitted from the process pressure through the venting element into the buckling-rod. Once buckled the buckling-rod has to be removed, the venting element reset and the buckling-rod replaced (non reusable element). The opening pressure of the buckling-rod device is therefore dependent on the venting element area and the buckling-rod geometry and material properties.



Key

1 venting element

2 retaining element (buckling-rod)

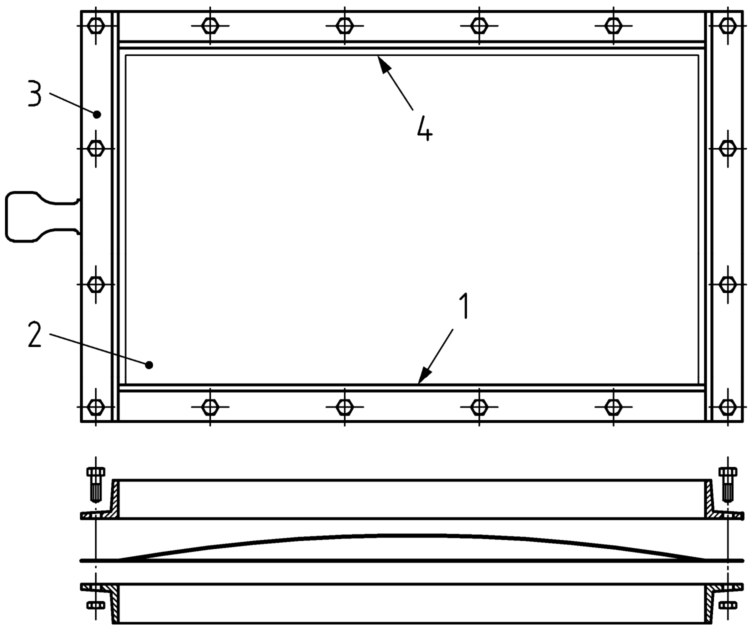
3 supporting structure

Figure A.2 — Example for a buckling-rod device

A.3 Devices with non-reusable elements

A.3.1 Bursting panel devices

Panel devices used for explosion venting have venting elements which are generally constructed from one or more complete or partial layers to form a sealed panel (see Figure A.3). The panel is fitted directly, or by means of support frame, to the enclosure to be protected. The panel is designed to open at a predetermined pressure to provide a specified vent area when open. Commonly the panel is flat, curved or pre-formed with a rim formed as to enable fitting and to yield the required vent area. Once open the panel can not reseal and is therefore the non-reusable element of the device.



Key

1 fixed side

2 area of the explosion venting device

3 supporting frame

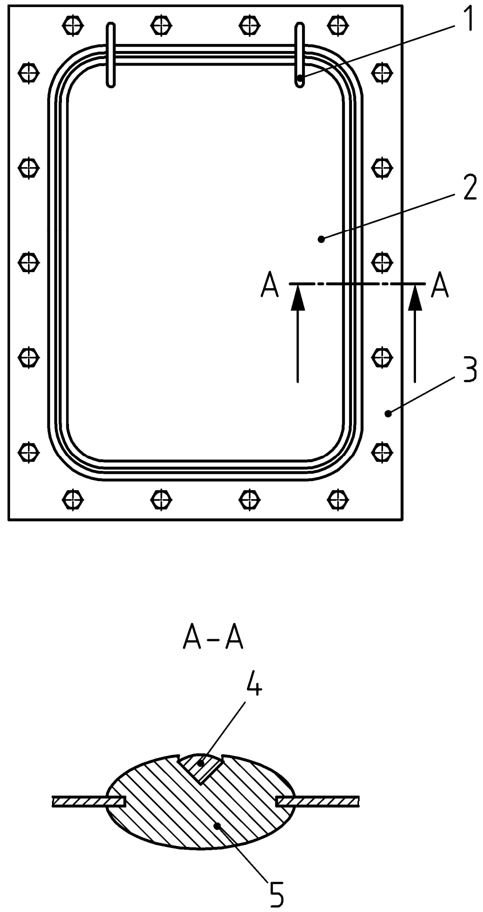
4 sides yielding during venting process

Figure A.3 — Example for a bursting panel device

A.3.2 Pop-out panel devices

Pop-out panel devices comprise semi rigid venting panels secured at the edges (Figure A.4). They are designed to bend when subjected to pressure on the inside of the plant, and become detached from the retaining seal. If a flexible plastic or rubber seal is used the opening pressure will depend on the panel size and properties of the seal. An alternative design uses a rigid metal frame to clamp the edges of the panel, usually in combination with a flexible sealing strip. The clamping pressure and the width of the panel edge held by the clamp will influence the opening pressure.

Pop-out panel devices will be supplemented by a restraining system. Once open the venting element normally can reseal and is therefore the reusable element of the device.



Key

1 restraining element

2 venting element

3 supporting frame

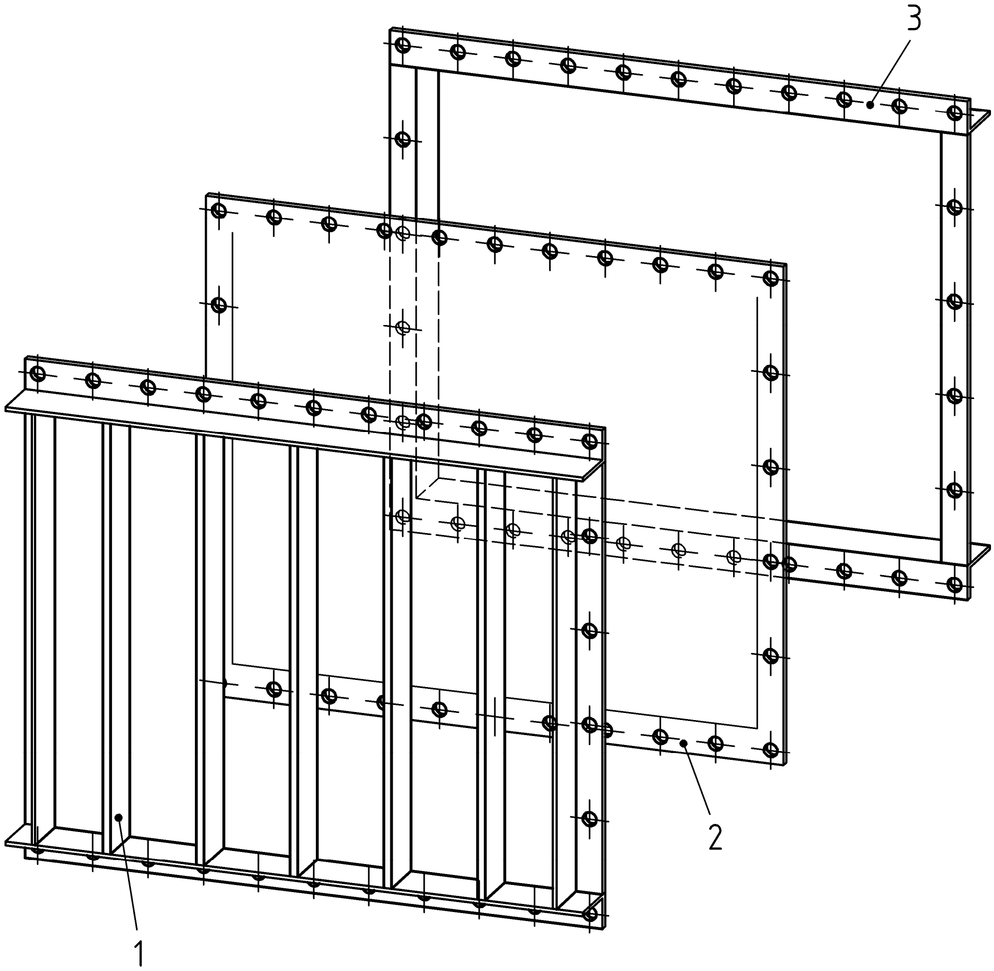
4 clamped device

5 plastic or rubber seal

Figure A.4 — Example for a restrained pop-out panel device

A.3.3 Back pressure support

Back pressure support screens prevent membrane rupture during reverse pressure surges (see Figure A.5). There are two different types of back pressure supports: opening and non-opening back pressure supports. When the explosion venting device is activated an opening back pressure support shall open simultaneously with the venting element. Non-opening back pressure supports remain in place after activation of the venting element. Their presence shall be considered in determining the venting efficiency of the device.



Key

1 back pressure support

2 vent panel

3 supporting frame

Figure A.5 — Example for a back pressure support

Annex B
(informative)

Service and maintenance

B.1 General

Explosion venting systems should be inspected by a competent person at least once a year. More frequent inspections may be necessary, depending on the process and/or environmental conditions.

B.2 Servicing

Servicing comprises care of the system, exchange of components having a limited service life and adjustments.

All incidents that occur, with indications as to their origins and, if possible, the reasons as well as all necessary measures concerning maintenance and modifications, should be continuously reported in an Operation Logbook, permanently at the disposal of personnel at the installation. This report should be written by the user or by the user’s instructed persons in charge of the operation.

Annex ZA
(informative)

Relationship between this European Standard and the Essential Requirements of EU Directive 94/9/EC

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 of 23rd March 1994 concerning equipment and protective systems intended for use in potentially explosive atmospheres.

Once this standard is cited in the Official Journal of the European Communities 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.1 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.1 — Correspondence between this European Standard and Directive 94/9/EC

Essential Requirements (ERs) of EU Directive 94/9/EC		**Clauses of this EN**	**Reference in other standards**
1.0	**General requirements**	**whole document**	
1.0.1	Principles of integrated explosion safety	whole document	
1.0.3	Special checking and maintenance conditions	7.1, 8, 9, Annex B	
1.0.4	Surrounding area conditions	4.1	
1.0.5	Marking	10, 11.2	
1.0.6	Instructions	8	
1.1	Selection of materials	4.1	
1.1.1	Trigger of an explosion	4.1	
1.1.2	Limits of operating	4.1	
1.2	Design and construction	whole document	EN 14491, prEN 14994
1.2.1	Technological knowledge of explosion protection for safe	whole document	EN 14491, prEN 14994
1.2.2	Safe functioning of replacement components	whole document	
1.2.3	Enclosed structures and prevention of leaks	4.1, A1.1	
1.2.4	Dust deposits	4.1	
1.2.6	Safe opening	4.1	
1.2.7	Protection against other hazards	4.1, 7.3.2	
d)	Overload conditions	7.3.2	

Table ZA.1 (*concluded*)

Essential Requirements (ERs) of EU Directive 94/9/EC		**Clauses of this EN**	**Reference in other standards**
1.3	Potential ignition sources	4.2	
1.3.1	Hazards arising from	4.2	
1.3.2	Hazards arising from static electricity	4.2	
1.3.3	Hazards arising from stray electric and leakage currents	4.2	
1.4	Hazards rising from external effects	4.1, 4.2, 7.3.1	
1.4.1	Safe functioning	4.1	
1.4.2	Mechanical and thermal stresses and withstanding attack by existing or on foreseeable aggressive substances	4.1, 7.3.2	
3	**Supplementary requirements in respect of protective systems**		
3.0	General requirements	whole document	EN 14491, prEN 14994
3.0.1	Dimension of protective systems safety level	7	EN 14491, prEN 14994
3.0.4	Failure of protective systems due to outside interference	4.1, 4.2, 6	
3.1	Planning and design	4.1, 7	
3.1.1	Characteristics of materials		EN 14491, prEN 14994
3.1.2	Withstanding shock wave effects of explosions	7.3.2	EN 14491, prEN 14994
3.1.3	Accessories to withstand maximum pressure of explosions	4.1, 7.3	EN 14491, prEN 14994
3.1.4	Planning protective systems to take account of pressures on pipework etc.		EN 14491, prEN 14994
3.1.5	Pressure relief systems	whole document	EN 14491, prEN 14994
3.1.6	Explosion suppression systems		EN 14491, prEN 14994
3.1.7	Explosion decoupling systems		EN 14491, prEN 14994
3.1.8	Protective systems integrated into a circuit with an alarm	4.1	EN 14491, prEN 14994

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

Bibliography

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

[2] EN 13980, *Potentially explosive atmospheres — Application of quality systems*

[3] EN ISO 4126-2, *Safety devices for protection against excessive pressure — Part 2: Bursting disc safety devices (ISO 4126-2:2003)*

[4] EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL