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**BSI Group Headquarters**

389 Chiswick High Road London W4 4AL

Tel: +44 (0)20 8996 9000

Fax: +44 (0)20 8996 7400

www.bsigroup.com

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Title: Draft BS EN 16447 BS Explosion isolation flap valves.

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Responsible Committee Secretary: Mr Christopher Brown (BSI)

Direct tel: 02089967441

E-mail: [christopher.brown@bsigroup.com](mailto:christopher.brown@bsigroup.com)

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## Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

## UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

## Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at <https://standardsdevelopment.bsigroup.com/>. You will need to register in order to comment.

## Template for comments and secretariat observations

|                  |                        |
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| Date: xx/xx/20xx | Document: ISO/DIS xxxx |
|------------------|------------------------|

| 1  | 2                                          | (3)                          | 4               | 5                                                                                                                                  | (6)                                                                      | 7                                                  |
|----|--------------------------------------------|------------------------------|-----------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------------------------------|
| MB | Clause No./ Subclause No./Annex (e.g. 3.1) | Paragraph/ Figure/Table/Note | Type of comment | Comment (justification for change) by the MB                                                                                       | Proposed change by the MB                                                | Secretariat observations on each comment submitted |
|    | 3.1                                        | Definition 1                 | ed              | Definition is ambiguous and needs clarifying.                                                                                      | Amend to read '...so that the mains connector to which no connection...' |                                                    |
|    | 6.4                                        | Paragraph 2                  | te              | The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK. | Delete reference to UV photometer.                                       |                                                    |

English Version

## Explosion isolation flap valves

Vannes à clapet d'isolation d'explosion

Rückschlagklappen zur explosionstechnischen  
Entkopplung

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.

This draft European Standard was established by CEN 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-CENELEC Management Centre has the same status as the official versions.

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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.

**Warning :** This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.



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COMITÉ EUROPÉEN DE NORMALISATION  
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## **European foreword**

This document (prEN 16447:2025) 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 16447:2014.

The significant changes between this document and EN 16447:2014 are given in Annex E.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

For the relationship with EU Legislation, see informative Annex ZA, which is an integral part of this document.

## 1 Scope

This document specifies the general requirements for flap valves used for dust explosion isolation. An explosion isolation flap valve is a protective system, which prevents a dust explosion from propagating via connecting pipes or ducts into other parts of apparatus or plant areas.

NOTE 1 An explosion isolation flap valve is also used as a process equipment (back pressure flap valve), to prevent the exposure of workers to dust cloud at workplaces when the flow is stopped in normal operation or by a process shut down. This function which is not related to explosion isolation is not in the scope of this European Standard.

An explosion isolation flap valve can only stop the propagation of a dust explosion when it propagates against the direction of the normal process flow. It does not stop explosions running in the normal process flow direction. This European Standard specifies methods for evaluating the efficacy of explosion isolation flap valves.

This document is applicable only to explosion isolation flap valves which are intended to avoid explosion propagation from a vessel, into other parts of the installation via connecting pipes or ducts. The standard covers isolation of such vessels that are protected by explosion venting (including flameless venting), explosion suppression or explosion-resistant design.

NOTE 2 This document is only applicable to cases where the explosion starts in a vessel and not in pipes or ducting.

Explosion isolation flap valves are not designed to prevent the transmission of fire or burning powder transported by the normal process flow.

Very weak explosions can still lead to an isolation failure. This residual risk is not covered by this document.

NOTE 3 It is necessary to take this into account in risk assessments.

Explosion isolation flap valves that are kept open by a retention mechanism that prevents valve closure under gravity when there is no process air flow, require a certain explosion over-pressure to overcome the forces of the retention mechanism and to start closure. Such devices do not fall under the scope of this document, but fall under the scope of EN 15089.

This document is only applicable for dust explosions.

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

- a) gases, vapours and hybrid mixtures;
- b) chemically unstable substances;
- c) explosive substances;
- d) pyrotechnic substances.

## 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.

EN 1127-1:2019, *Explosive atmospheres — Explosion prevention and protection — Part 1: Basic concepts and methodology*

EN 14460:2018, *Explosion resistant equipment*

EN 13237:2024, *Potentially explosive atmospheres — Terms and definitions for equipment and protective systems intended for use in potentially explosive atmospheres*

EN 14373:2021+A1:2025, *Explosion suppression systems*

EN 15089:2009, *Explosion isolation systems*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 13237:2024, EN 14373:2021+A1:2025 and EN 15089:2009 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

### 3.1

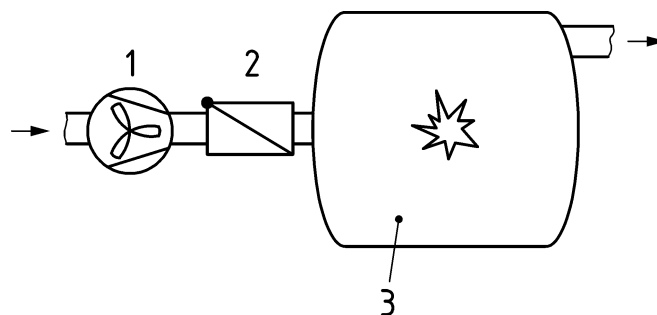
#### **explosion source**

vessel from which the explosion originates

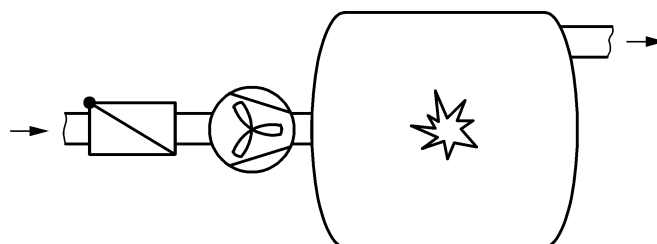
### 3.2

#### **push flow situation**

situation where the fan is located upstream (with reference to the direction of the normal process flow) of the explosion source



**a) explosion isolation flap valve positioned between fan and the explosion source**



**b) fan positioned between explosion isolation flap valve and the explosion source**

**Key**

- 1 fan
- 2 explosion isolation flap valve
- 3 vessel

**Figure 1 — Push flow situation**

### 3.3

#### **pull flow situation**

situation where the fan is located downstream (with reference to the direction of the normal process flow) of the explosion source

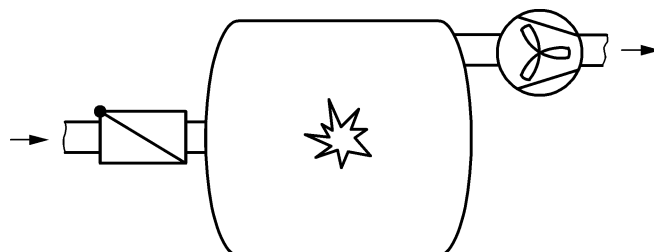


**Figure 2 — Pull flow situation**

### 3.4

#### **maximum explosion overpressure at the valve**

$p_{\text{valve,max}}$

resulting maximum overpressure measured on the pipeline close to the explosion isolation flap valve side exposed to the explosion

## **4 Explosion isolation flap valves**

### **4.1 General**

An explosion isolation flap valve is installed such that the normal process air flow passes in one direction through the valve and keeps it open. It closes when the air flow reverses due to a dust explosion event. The valve shall stay closed to avoid flames from transmitting during an explosion event (see Note 1). Explosion isolation shall also be ensured during periods without process flow.

**NOTE 1** Re-opening of the valve is possible e.g. due to pressure oscillations caused by the fan, the venting process or by flow and pressure oscillations in the pipe on the explosion isolation flap valve side which is not exposed to the explosion.

Explosion isolation flap valves shall be equipped with a locking mechanism preventing re-opening after the explosion took place. They may also be equipped with an indication that monitors if the valve is locked.

Explosion isolation flap valves may also be equipped with an indication that signals the presence of dust accumulations inside the valve that could potentially corrupt the good functioning in case of an explosion. Also, they may be equipped with provisions to connect an automated dust cleaning system.

Explosion isolation flap valves are designed to be connected to ducting. The valve housing is fitted with inlet and outlet connections to connect with the ducting.

NOTE 2   Adapters are often used to connect to an oversize valve.

NOTE 3   Sometimes the presence of a flap valve causes an increase of the maximum reduced explosion pressure in the vented vessel  $p_{red,max}$  compared to a situation where no flap valve is present in the pipe. Quantification of these effects will become part of a future revision of EN 14491 and is not part of this document.

## 4.2 Essential requirements

- Explosion isolation flap valves shall prevent an explosion flame from propagating via connecting pipes or ducts from one part of the installation into other parts or plant areas.
- The explosion isolation flap valve as installed or any of its components shall not introduce ignition hazards, such as electrostatic discharge, mechanical friction, electrical sparks, hot surfaces, or hot gases (according to EN 1127-1:2019).
- The explosion isolation flap valve shall withstand the loads imposed by any explosion that can be expected in accordance with its intended use, without losing its ability to perform its safety function. The construction can be either explosion-pressure resistant or explosion-pressure shock resistant according to EN 14460:2018.

NOTE 4: Sometimes the explosion pressure acting on the explosion isolation flap valve  $p_{valve,max}$  is higher than the (reduced) explosion pressure in the connected vessel  $p_{red,max}$  as a result of pressure piling and/or flame acceleration through the ducting.

- Installation instructions, service and maintenance requirements and intervals shall be specified in the system documentation. (See Clause 7)

## 5 Experimental testing of efficacy and mechanical integrity

### 5.1 General

The testing shall reflect the intended use.

As a minimum the following information is necessary prior to testing:

- a) a general type-description;
- b) intended use;
  - 1) ambient conditions external to the flap valve and process conditions internal to the flap valve (e.g. temperature range, flow velocity, maximum allowable dust concentrations in the process flow);
  - 2) dust combustion properties, specifically  $K_{St}$ ,  $p_{max}$ , metal dust yes/no, MIE, MIT, calculated MESG;
  - 3) explosion protection measure of the connected vessel venting (including type of explosion venting device (reclosing device / non-reclosing device), suppression, explosion pressure resistant construction;
  - 4) smallest and largest volume of the vessel in which the explosion starts;

- 5) specific product characteristics (such as sticky material, moisture content, abrasive, corrosive, toxic, tendency for product built-up);
  - 6) installation requirements (push-, pull flow situations; minimum and maximum installation distance; presence of bends/pipe restrictions; inclination);
  - 7) explosion resistance of the explosion isolation flap valve;
- c) installation and operating instructions;
- d) part list;
- e) approval drawings, system layout.

## 5.2 Test procedures

The aim of functional testing is to assess the efficacy of the flap valve as a protective system according to the intended use. The test involves testing of the ability of the valve to stop explosion pressure and flames and the verification/determination of the minimum and the maximum installation distance of the flap valve from the vessel in which the explosion originates in max flow/velocity situations and in no flow situations.

### a) Test set-up

The test rig test vessel shall reflect the specified intended use (volume range) in combination with a pipe (see Figure 4). This includes presence of restrictions and/or bends, fan, etc. in pipe, inclination of flap valve and push or pull flow situation through the test vessel. If it is the intention to use additional equipment in between protected vessel and flap valve, and this additional equipment such as a fan, valve, etc. may influence the correct functioning of the explosion isolation function, this equipment shall be inserted during explosion testing. The minimum vessel volume of the intended use shall be the volume of the test vessel and at least twice the volume of the connecting pipe up to the minimum installation distance of the flap valve.

The presence of bends at any side of the valve may influence flame velocity in the pipe, as well as the closing behaviour, the closure time and impact forces during closure due to flow disturbance. Bends between vessel and flap valve may also influence flame propagation speed and explosion pressure generation in the pipes. It is therefore important that bends are present in the test setup if the valve is intended to be used with bends in the pipeline, because they may affect the ability of the valve to isolate the explosion as well as the minimum and maximum installation distance.

Following bend parameters affect the isolation performance. When a more influencing case is tested successfully, a less influencing case may be assumed to function without additional testing:

**NOTE** If a bend is located more than 5 pipe diameters away from the valve at the flap valve side not exposed to the explosion, the influence is neglectable, and no testing is required.

- with respect to valve closure behaviour and closure time;
  - distance of bend to valve (at either side of the valve);
    - the closer to the valve, the more influence;
  - bending angle (e.g. 45°, 90°);
    - the larger the angle, the more influence;

- bend curvature ratio (radius of curvature / pipe diameter);
  - This parameter may have various effects. Largest and smallest curvature ratio of the intended use shall be tested;
- bend orientation with respect the flap orientation;
  - Figure 3 shows example different orientations that need dedicated testing if intended to be used;
- with respect to flame propagation speed and associated explosion pressure generation;
  - number of bends between vessel and valve and their location;
    - the more bends, the more influence;
    - the closer to the vessel, the more influence;
  - bending angle (e.g. 45°, 90°, ...);
    - the larger the angle, the more influence;
  - bend curvature ratio (radius of curvature / pipe diameter);
    - This parameter may have various effects. Largest and smallest curvature ratio of the intended use shall be tested.

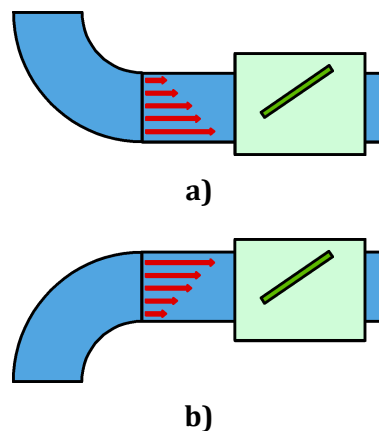


**Figure 3 — Orientation of a bend with respect to the location of the flap.**

In Figure 3a) the flap may close faster than in Figure 3b).

The inclination of the flap valve may influence the closure time, the impact forces on the flap on its seat and the allowed installation distance range, due to changing gravity forces on the flap. When a worse situation is tested successfully, a less bad case may be assumed to function without additional testing. See example in Figure 4.