INTERNATIONAL STANDARD

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Safety devices for protection against excessive pressure —

Part 2: Bursting disc safety devices

Dispositifs de sécurité pour protection contre les pressions excessives —

Partie 2: Dispositifs de sûreté à disque de rupture

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 4126-2 was prepared by the European Committee for Standardization (CEN) in collaboration with Technical Committee ISO/TC 185, *Safety devices for protection against excessive pressure*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This first edition of ISO 4126-2, together with that of ISO 4126-6, cancels and replaces ISO 6718:1991.

Throughout the text of this document, read "...this European Standard..." to mean "...this International Standard...".

ISO 4126 consists of the following parts, under the general title, *Safety devices for protection against excessive pressure*:

— *Part 1: Safety valves*

— *Part 2: Bursting disc safety devices*

— *Part 3: Safety valves and bursting disc safety devices in combination*

— *Part 4: Pilot-operated safety valves*

— *Part 5: Controlled safety pressure relief systems (CSPRS)*

— *Part 6: Application, selection and installation of bursting disc safety devices*

— *Part 7: Common data*

For the purposes of this part of ISO 4126, the CEN annex regarding fulfilment of European Council Directives has been removed.

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Foreword

This document (EN ISO 4126-2:2003) has been prepared by Technical Committee CEN/TC 69 "Industrial valves", the secretariat of which is held by AFNOR, in collaboration with ISO/TC 185 "Safety devices for protection against excessive pressure".

This European Standard EN ISO 4126-2:2003 shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by July 2003, and conflicting national standards shall be withdrawn at the latest by July 2003.

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).

This standard for safety devices for protection against excessive pressure consists of seven parts of which this is Part 2. The various parts are:

— *Part 1: Safety valves.*

— *Part 2: Bursting disc safety devices.*

— *Part 3: Safety valves and bursting disc safety devices in combination.*

— *Part 4: Pilot operated safety valves.*

— *Part 5: Controlled safety pressure relief systems (CSPRS).*

— *Part 6: Application, selection and installation of bursting disc safety devices.*

— *Part 7: Common data.*

Part 7 contains data that is common to more than one of the parts of this standard to avoid unnecessary repetition.

Annex A is normative. Annex B is informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

A bursting disc safety device is a non-reclosing pressure relief device used to protect pressure equipment such as pressure vessels, piping, gas cylinders or other enclosures from excessive pressure and/or excessive vacuum.

A bursting disc safety device typically comprises an assembly of components including a bursting disc, a bursting disc holder and, where necessary, other components such as back pressure supports, stiffening rings etc.

The bursting disc is a pressure-containing and pressure-sensitive part of the bursting disc safety device and is designed to open by bursting at a pre-determined pressure. There are many different types of bursting disc safety devices manufactured in corrosion resistant materials, both metallic and non-metallic, to cover a wide range of nominal sizes, burst pressures and temperatures.

1 Scope

This part of this European Standard specifies the requirements for bursting disc safety devices.

It includes the requirements for the design, manufacture, inspection, testing, certification, marking, and packaging.

The requirements for the application, selection and installation of bursting disc safety devices are given in Part 6 of this European Standard.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 485-1, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 1: Technical conditions for inspection and delivery*.

EN 485-2, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 2: Mechanical Properties*.

EN 485-3, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 3: Tolerances on shape and dimensions for hot-rolled products*.

EN 485-4, *Aluminium and aluminium alloys – Sheet, strip and plate – Part 4: Tolerances on shape and dimensions for cold-rolled products.*

EN 573-3, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 3: Chemical composition.*

EN 573-4, *Aluminium and aluminium alloys – Chemical composition and form of wrought products – Part 4: Forms of products*.

EN 1092-1*, Flanges and their joints - Circular flanges for pipes, valves, fittings and accessories, PN designated – Part 1: Steel flanges.*

EN 1333, *Pipework components - Definition and selection of PN.*

EN 1652, *Copper and copper alloys – Plate, sheet, strip and circles for general purposes*.

EN 1653, *Copper and copper alloys – Plate, sheet and circles for boilers, pressure vessels and hot water storage units.*

EN 10028-1, *Flat products made of steels for pressure purposes – Part 1: General requirements.*

EN 10028-7, *Flat products made of steels for pressure purposes – Part 7: Stainless steels.*

EN 10088-1, *Stainless steels – Part 1: List of stainless steels.*

EN 10095, *Heat resisting steels and nickel alloys*.

EN 10222-1, *Steel forgings for pressure purposes – Part 1: General requirements for open die forgings.*

EN ISO 6708, *Pipework components - Definition and selection of DN (nominal size) (ISO 6708:1995).*

DIN 17740, *Wrought nickel – Chemical composition.*

DIN 17742, *Wrought nickel alloy with chromium – Chemical composition*.

DIN 17743, *Wrought nickel alloys with copper – Chemical composition.*

DIN 17744, *Wrought nickel alloys with molybdenum and chromium – Chemical composition.*

DIN 17850, *Titanium – Chemical composition*.

SEW 400, *Rolled and forged stainless steels*.

BS 3072, *Specification for nickel and nickel alloys – Sheet and plate*.

BS 3073, *Specification for nickel and nickel alloys – Strip*.

ASTM A240/A240M, *Standard specification for chromium and chromium-nickel stainless steel plate, sheet and strip for pressure vessels and for general applications.*

ASTM B127, *Standard specification for nickel-copper alloy (UNS N04400) plate, sheet, and strip*.

ASTM B162, *Standard specification for nickel plate, sheet and strip*.

ASTM B168, *Standard specification for nickel-chromium-iron alloys (UNS N06600, N06601, N06603, N06690, N06025, and N06045) and nickel-chromium-cobalt-molybdenum alloy (UNS N06617) plate, sheet and strip.*

ASTM B209, *Standard specification for aluminium and aluminium-alloy sheet and plate*.

ASTM B265, *Standard specification for titanium and titanium alloy strip, sheet and plate*.

ASTM B333, *Standard specification for nickel-molybdenum alloy plate, sheet and strip*.

ASTM B424, *Standard specification for Ni-Fe-Cr-Mo-Cu alloy (UNS N08825 and UNS N08221), plate, sheet and strip.*

ASTM B443, *Standard specification for nickel-chromium-molybdenum-columbium alloy (UNS N06625) and nickel-chromium-molybdenum-silicon alloy (UNS N06219), plate, sheet and strip*.

ASTM B569, *Standard specification for brass strip in narrow widths and light gauge for heat-exchanger tubing.*

ASTM B575, S*pecification for low-carbon nickel-molybdenum-chromium, low-carbon nickel-chromium-molybdenum, low-carbon nickel-chromium-molybdenum-copper, low-carbon nickel-chromium-molybdenum-tantalum, low-carbon nickel-chromium-molybdenum-tungsten alloy plate, sheet and strip.*

ASTM B708, *Standard specification for tantalum and tantalum alloy, plate, sheet and strip.*

3 Terms and definitions

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

3.1
bursting disc safety device
non-reclosing pressure relief device actuated by differential pressure and designed to function by the bursting of the bursting disc(s), and which is the complete assembly of installed components including, where appropriate, the bursting disc holder

3.2
bursting disc assembly
complete assembly of components which are installed in the bursting disc holder to perform the desired function

3.3
bursting disc
pressure-containing and pressure-sensitive component of a bursting disc safety device

3.4
bursting disc holder
part of a bursting disc safety device which retains the bursting disc assembly in position

3.5
conventional domed bursting disc (also referred to as: forward-acting)
bursting disc which is domed in the direction of the bursting pressure (i.e. where the bursting pressure is applied to the concave side of the bursting disc, see Figure 1)

3.6
slotted lined bursting disc
bursting disc made up of two or more layers, at least one of which is slit or slotted to control the bursting pressure of the bursting disc

3.7
reverse domed bursting disc (also referred to as: reverse-acting)
bursting disc which is domed against the direction of the bursting pressure (i.e. where the bursting pressure is applied to the convex side of the bursting disc, see Figure 2)

3.8
flat bursting disc
bursting disc having one or more layers which is flat when installed. It may be made of a ductile or brittle material

3.9
graphite bursting disc
bursting disc manufactured from graphite, impregnated graphite, flexible graphite or graphite composite and designed to burst due to bending or shearing forces

NOTE The following definitions apply:

a) **graphite.** A crystalline form of the element carbon;

b) **impregnated graphite.** Graphite in which the open porosity is impregnated with a filler material;

c) **flexible graphite.** A graphite structure formed by the compression of thermally exfoliated graphite intercalation compounds;

d) **graphite composite.** Made up of two or more distinct materials and having different properties to those of the separate materials and in which the proportion of graphite is over 50 per cent by weight.

3.10
bursting pressure
value of the differential pressure between the upstream side and the downstream side of the bursting disc when it bursts

3.11
specified bursting pressure
bursting pressure quoted with a coincident temperature when defining the bursting disc requirements (used in conjunction with a performance tolerance, see 3.15)

3.12
specified maximum bursting pressure
maximum bursting pressure quoted with a coincident temperature when defining the bursting disc requirements (used in conjunction with specified minimum bursting pressure, see 3.13)

3.13
specified minimum bursting pressure
minimum bursting pressure quoted with a coincident temperature when defining the bursting disc requirements (used in conjunction with specified maximum bursting pressure, see 3.12)

3.14
coincident temperature
temperature of the bursting disc associated with a burst pressure (see 3.11, 3.12 and 3.13) and which is the expected temperature of the bursting disc when it is required to burst

3.15
performance tolerance
range of pressure between the specified minimum bursting pressure and the specified maximum bursting pressure, or the range of pressure in positive and negative percentages or quantities which is related to the specified bursting pressure (see Figure 9)

3.16
operating pressure
pressure existing at normal operating conditions within the system being protected

3.17
differential back pressure
differential pressure across a bursting disc in the opposite direction to the direction of the bursting pressure, which is the result of pressure in the discharge system from other sources and/or a result of vacuum on the upstream side of the bursting disc

3.18
vent area
cross-section area available for discharge of fluid

3.19
batch
quantity of bursting discs or bursting disc safety devices made as a single group of the same type, size, materials and specified bursting pressure requirements where the bursting discs are manufactured from the same lot of material (see 3.20)

3.20
lot of material
a) **metal**. Material of the same specification coming from the same heat number, heat treatment batch and specified thickness with tolerances to an appropriate standard;

b) **graphite and flexible graphite**. Material of the same specification grade and quality coming from the same graphite manufacturer and the same manufacturing process;

c) **impregnated graphite**. Graphite of the same lot impregnated with a specific grade of filler material by the same manufacturing process;

d) **graphite composite**. Graphite and specific grades of other constituents coming from the same mix

3.21
back pressure support
component of a bursting disc safety device which prevents damage to the bursting disc due to differential back pressure

NOTE A back pressure support which is intended to prevent damage to the bursting disc when the system pressure falls below atmospheric pressure is sometimes referred to as a vacuum support.

3.22
stiffening ring
component of a bursting disc assembly used primarily for reinforcing fragile bursting discs, so as to prevent damage

3.23
coating
layer of metallic or non-metallic material applied to components of a bursting disc safety device by a coating process

3.24
lining
additional sheet or sheets of metallic or non-metallic material forming part of a bursting disc assembly or bursting disc holder

3.25
plating
metal layer applied to a bursting disc or bursting disc holder by a plating process

3.26
muffled outlet
component of a bursting disc safety device which disperses the discharge

3.27
temperature shield
device which protects a bursting disc from excessive temperature

4 Materials

4.1 Selection of materials

The selection of materials used for the components of bursting disc safety devices shall take into account:

a) suitability with regard to manufacture;

b) compatibility with the process fluid, the adjoining components and the chemical and physical conditions to which the bursting disc safety device will be subjected when in service.

NOTE The use of corrosion-resistant materials for the downstream side of the bursting disc device is recommended because corrosion of these parts can cause damage which can impair the performance of the bursting disc safety device.

4.2 Material specifications

The material specification for the bursting disc safety devices shall be according to annex A (normative) and annex B (informative).

They shall have uniform chemical and physical properties and shall be free from defects, which would cause the bursting disc safety device to malfunction.

4.3 Protection from corrosion

Bursting disc safety devices are frequently required to operate in corrosive environments and, therefore, components manufactured from materials affected by corrosion shall, where appropriate, be protected by coating, plating or lining.

Coatings and plating shall be applied to give an even and homogeneous coating to the surfaces to be protected.

Linings shall be seamless and supplied with the bursting disc safety device so as to preserve them as a set or integral unit.

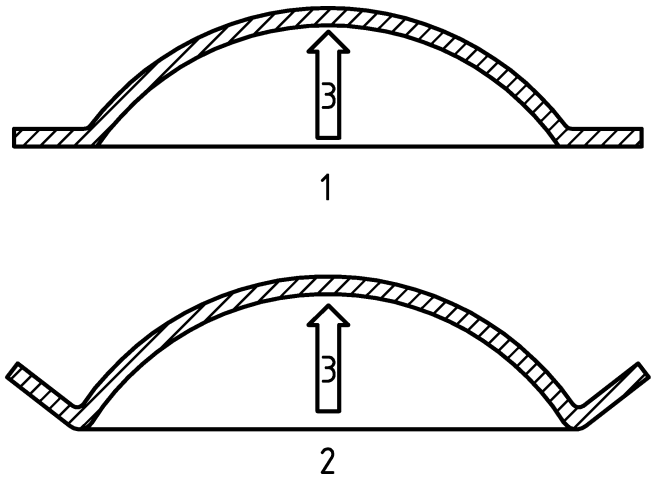
The corrosion protection shall be supplied only by the manufacturer.

The corrosion protection shall not impair the performance of the bursting disc safety device.

5 Types of bursting discs

5.1 Conventional domed bursting discs (forward acting)

Conventional domed bursting discs shall be designed so that they burst due to tensile stresses when the bursting pressure is applied to the concave side of the bursting disc (see Figure 1).



Key

1 Flat seat
2 Angle seat
3 Flow

Figure 1 — Conventional domed bursting disc (forward acting)

They shall be domed by a means sufficient to cause a permanent set such that no further plastic flow will occur initially when the bursting disc is subjected to its intended operating condition.

Conventional domed bursting discs include the following types:

a) **conventional simple domed**. This type of bursting disc shall have one or more layers, the bursting pressure of which is controlled by the ultimate tensile strength of the material(s);

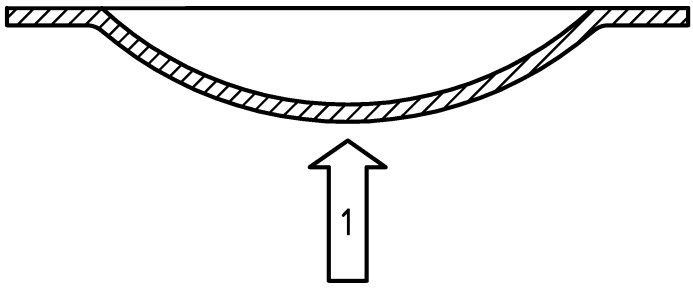
b) **conventional slotted domed**. This type of bursting disc shall have two or more layers at least one of which shall have slits or slots so as to reduce its strength and to control the bursting pressure;

c) **conventional scored simple domed**. This type of bursting disc shall be scored such that when the bursting pressure is reached, the bursting disc opens along the score;

d) **conventional simple domed with knife blades**. This type of bursting disc shall open by being cut by the knife blades when the bursting pressure is reached.

5.2 Reverse domed bursting discs (reverse acting)

Reverse domed bursting discs shall be designed to function due to buckling, bending or shearing stresses when the bursting pressure is applied to the convex side of the bursting disc (see Figure 2).



Key

1 Flow

Figure 2 — Reverse domed bursting disc (reverse acting)

Reverse domed bursting discs include the following types:

a) **reverse domed scored**. This type of bursting disc shall be scored such that, when the dome reverses at the bursting pressure, the bursting disc opens along the score. The bursting disc may also have areas of weakness which determine the pressure at which the bursting disc reverses;

b) **reverse domed having slip or tear-away design**. This type of bursting disc shall function by being expelled downstream from the bursting disc holder;

NOTE A catching device can be provided for this type of bursting disc.

c) **reverse domed with knife blades**. This type of bursting disc shall open by being cut by knife blades during reversal of the dome;

d) **reverse domed that function by shearing**. This type of bursting disc shall have one or more layers which upon reversal opens due to shearing forces;

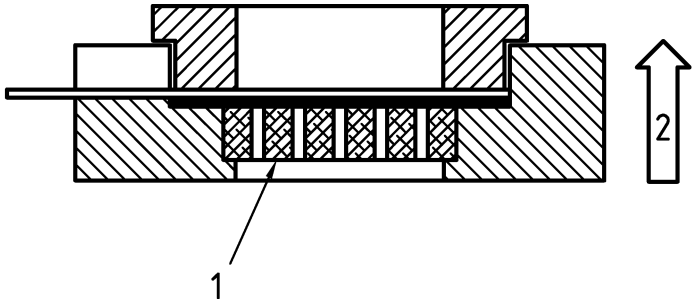
e) **reverse domed composite or multi-layered**. This type of bursting disc shall have two or more layers at least one of which shall contain areas of weakness of such a configuration as to determine the pressure at which the bursting disc reverses.

5.3 Flat bursting discs

Flat bursting discs shall have one or more layers. According to the type, they may require a bursting disc holder, or be fitted directly between installation flanges.

Flat bursting discs include the following types:

a) **graphite replaceable element**. This type of bursting disc shall be plane or recessed and used in conjunction with a bursting disc holder. They shall be designed to burst due to bending or shearing forces, (see Figure 3);

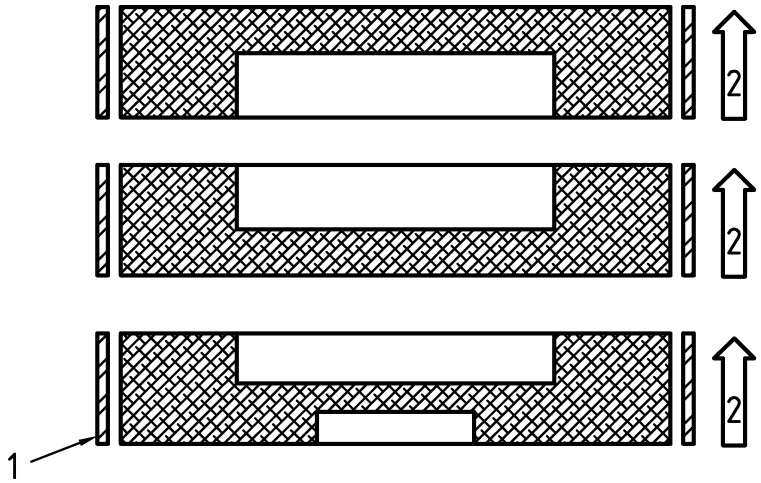


Key

1 Back pressure support (where required)
2 Flow

Figure 3 — Typical replaceable element graphite bursting disc and holder

b) **graphite monobloc**. This type of bursting disc shall be designed so as to fit directly between the installation flanges. They may be recessed on one or both sides according to the bursting pressure and the direction in which it is to be applied (see Figure 4). Graphite monobloc bursting discs may be reinforced with an external armour ring. This design may be provided with a lining on the pressure side;



Key

1 Armour ring (optional)
2 Flow

Figure 4 — Monobloc graphite bursting discs - different configurations

The pressure containing capability of graphite monobloc bursting discs, after bursting, shall be determined by one of the methods given in 6.1.1.

NOTE For this design of graphite monobloc bursting disc, the diameter of the downstream piping adjacent to the bursting disc should follow the manufacturer's instructions. Normally this diameter will be greater than the inside diameter of the recess.

c) **flat slotted lined**. This type of bursting disc shall have two or more layers. At least one of the layers shall have for example, slits or slots so as to reduce its strength and to control the bursting pressure. According to the design it may be necessary for the bursting disc to be used in conjunction with a bursting disc holder.

5.4 Other types and designs

Other types and other designs of bursting discs are permitted providing that they meet the requirements of this standard.

6 Bursting disc holders

6.1 Design

6.1.1 Pressure containing capability

The pressure containing capability of bursting disc holders shall be determined by either:

a) calculation generally according to design rules for flanged connections such as EN 1092-1; or

b) other established design methods of the manufacturer; or

c) experimental design procedure(s) developed by the manufacturer, carried out on prototypes, or on representative production samples.

6.1.2 Other design requirements

The design of the bursting disc holder shall ensure:

a) the accurate positioning of the bursting disc assembly;

b) the bursting disc assembly, where applicable, can only be fitted the correct way round;

c) the ability to apply or transmit a clamping load appropriate to the particular bursting disc assembly;

d) where appropriate, the correct fitting of a back pressure support (see clause 8);

e) that, when installed in accordance with the manufacturer's installation instructions, it provides adequate pressure containment under the specified service conditions;

f) the position of any holes for pre-assembly screws is compatible with the specified gaskets used between the bursting disc holder and the installation flanges;

g) the accurate positioning within the pressure system connection including direction of flow;

h) its suitability for the specified service conditions;

i) correct functioning of the bursting disc assembly.

NOTE It is recommended that the bursting disc holder is so designed as to protect the bursting disc assembly during installation and removal. With domed bursting discs this can be achieved by ensuring that the dome does not protrude beyond the bursting disc holder. Other methods may be used subject to agreement between the purchaser and the manufacturer.

6.2 Types

The type of bursting disc holder shall be appropriate to the particular type of bursting disc and suitable for its intended use.

Bursting disc holders include the following types:

a) **insert/capsule**. Insert/capsule bursting disc holders shall have an inlet and outlet member, with or without fasteners and shall fit within the installation flange bolting (see Figure 5);

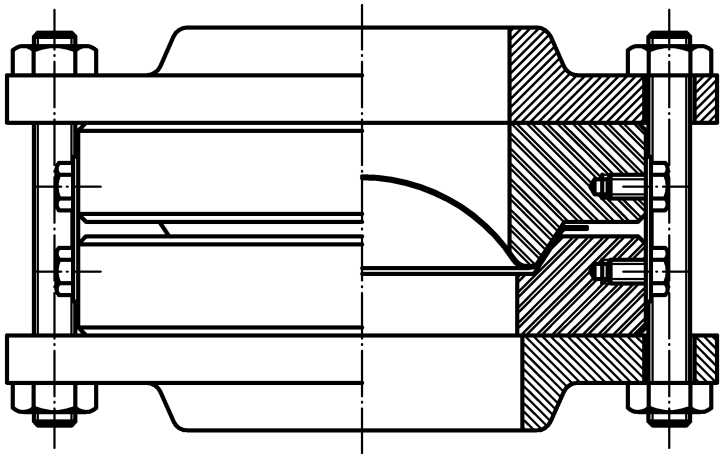


Figure 5 — Typical insert / capsule bursting disc holder

b) **full face flange**. Full face flange bursting disc holders shall have an inlet and outlet member, with or without fasteners and shall have holes/slots to suit the installation flange bolting (see Figure 6).

NOTE The outside diameter is normally the same as the outside diameter of the installation flanges.

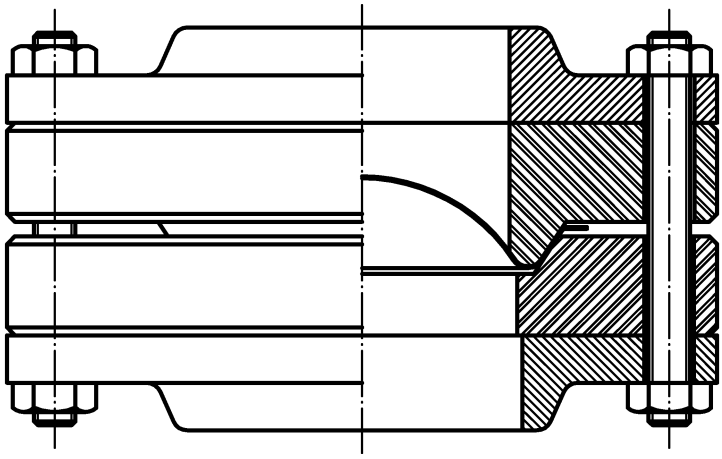
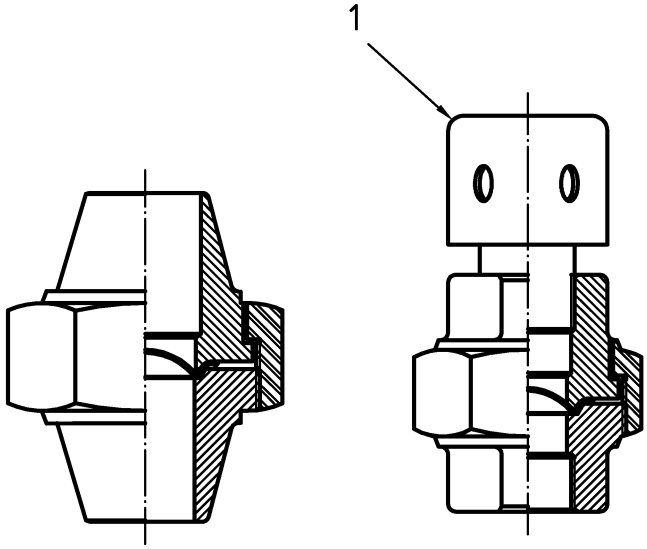


Figure 6 — Typical full face flange bursting disc holder

c) **union**. Union bursting disc holders shall have an inlet and outlet member connected by a union nut (see Figure 7);



Key

1 Muffled outlet (optional)

Figure 7 — Typical union bursting disc holders

d) **plug/screw**. Plug/screw bursting disc holders shall have an inlet and outlet member which are screwed together. The outlet member may be a muffled outlet design (see Figure 8);

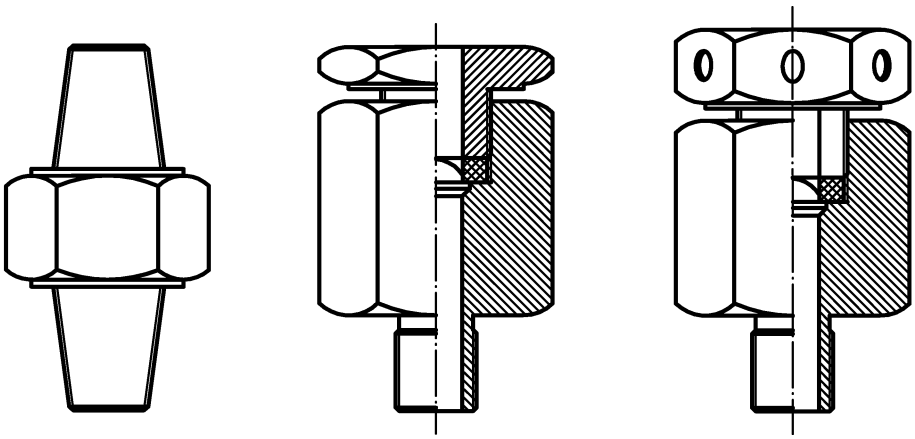


Figure 8 — Typical plug / screw bursting disc holders

e) **other**. Other types of bursting disc holders are permitted providing that they meet the requirements of this standard.

6.3 Connections

Where bursting disc holders fit between installation flanges, for example, insert/capsule and full face flange types, the facing and surface finish of the bursting disc holder shall be compatible with that of the purchaser's piping specifications.

For other types (see 6.2) the connections to the installation may be threaded, welded, proprietary etc., according to the purchaser's requirements.

7 Back pressure supports

7.1 General

Where a bursting disc is to be subjected in service to a differential back pressure it shall be supported by a back pressure support unless the bursting disc is capable of withstanding the back pressure.

The back pressure support shall be supplied by the manufacturer either permanently attached to the bursting disc, or it shall form part of a bursting disc safety device that ensures the back pressure support can only be assembled to the correct side of the bursting disc.

The back pressure support shall be free from all burrs or similar imperfections which would cause a bursting disc to function incorrectly.

7.2 Opening back pressure supports

The opening back pressure support shall fit closely against and give adequate support to the bursting disc. The support shall be of a design such that the pressure in the system is transmitted to the bursting disc.

When the bursting disc has burst, the back pressure support shall open when subjected to a pressure not exceeding the specified minimum bursting pressure or the specified bursting pressure minus the negative tolerance at the coincident temperature of the associated bursting disc.

7.3 Non-opening back pressure supports

The non-opening back pressure support shall fit closely against and give adequate support to the bursting disc. The support shall have openings to allow the discharge of fluid.

8 Temperature shields

The temperature shields shall be designed and manufactured so as to reduce the temperature at the bursting disc in order to avoid incorrect functioning of the bursting disc. They shall be used when specified, and shall be supplied by the manufacturer.

9 Stiffening rings

Stiffening rings shall provide reinforcement to, and protection of, the seating area of the bursting disc without interfering with the correct functioning of the bursting disc. They shall be permanently attached to the bursting disc.

10 Gaskets/seals

Gaskets/seals forming part of the bursting disc safety device shall be compatible with the chemical, thermal and mechanical demands of the application (see 4.1)

The use, type, material (see 4.2) and dimensions shall be as specified by the manufacturer.

11 Assembly of bursting disc safety devices

11.1 General

Instructions for the assembly, installation, use and maintenance of the bursting disc safety device shall be provided by the manufacturer.

The requirements for the assembly of bursting disc safety devices are dependent upon whether:

a) the bursting disc assembly is retained in the bursting disc holder in such a way that the bursting disc assembly can readily be replaced (see 11.2);

or

b) the bursting disc assembly is permanently retained in the bursting disc holder as an integral assembly (see 11.3).

11.2 Bursting disc safety devices with replaceable bursting disc assemblies

The bursting disc safety device shall be such that following initial assembly of the bursting disc assembly in the bursting disc holder, it can readily be dis-assembled, a replacement bursting disc assembly fitted and then re-assembled.

The components of the bursting disc safety device may be assembled either by the manufacturer or the purchaser.

The bursting disc holders and the bursting disc assemblies shall be subjected to testing before assembly in accordance with clause 14.

Prior to assembly, the manufacturer's model/type reference for the bursting disc holder, marked on the bursting disc assembly, shall be checked to ensure that it coincides with that marked on the bursting disc holder (see clause 17).

The performance of the bursting disc safety device is determined by the interaction of its components and shall be assembled in accordance with the manufacturer's instructions.

11.3 Bursting disc safety devices with non-replaceable bursting disc assemblies

The components of the bursting disc safety devices shall be assembled by the manufacturer.

They shall be permanently joined together using welding, crimping, adhesion or other permanent joining process. Joining materials such as welding materials, brazing materials, solders, adhesives and cements shall be compatible with the materials of the components being joined and be suitable for the duty. The joining shall be carried out by suitably experienced/qualified personnel using approved written procedures. The completed joint shall form an effective seal and pressure containment when installed.

Bursting disc safety devices with non-replaceable bursting disc assemblies shall be manufactured as a batch with the bursting discs being manufactured from the same lot of material.

The testing and marking shall comply with clauses 14 and 17.

12 Specified bursting pressure requirements

The specified bursting pressure shall be expressed as follows, (see Figure 9):

a) by using specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature (see Figure 9a);

or

b) by using specified bursting pressure and performance tolerance with a coincident temperature (see Figure 9b).

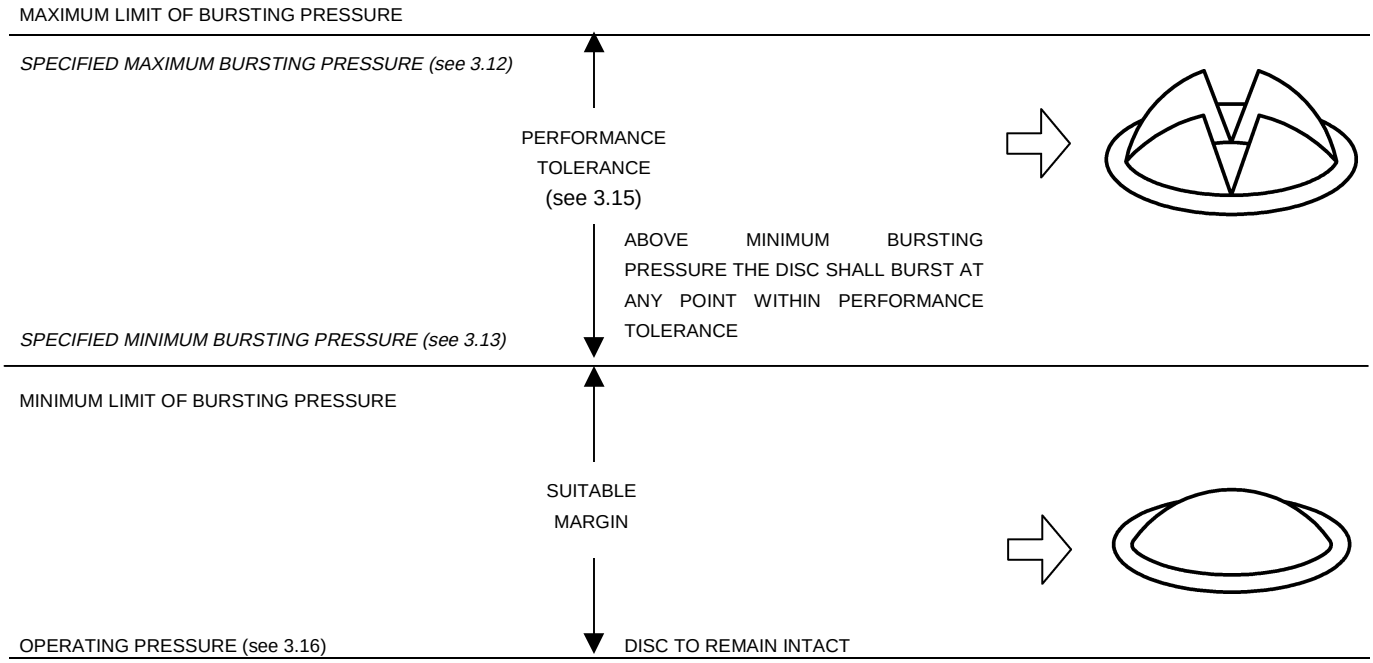


Figure 9 a — Specified maximum bursting pressure and specified minimum bursting pressure with coincident temperature

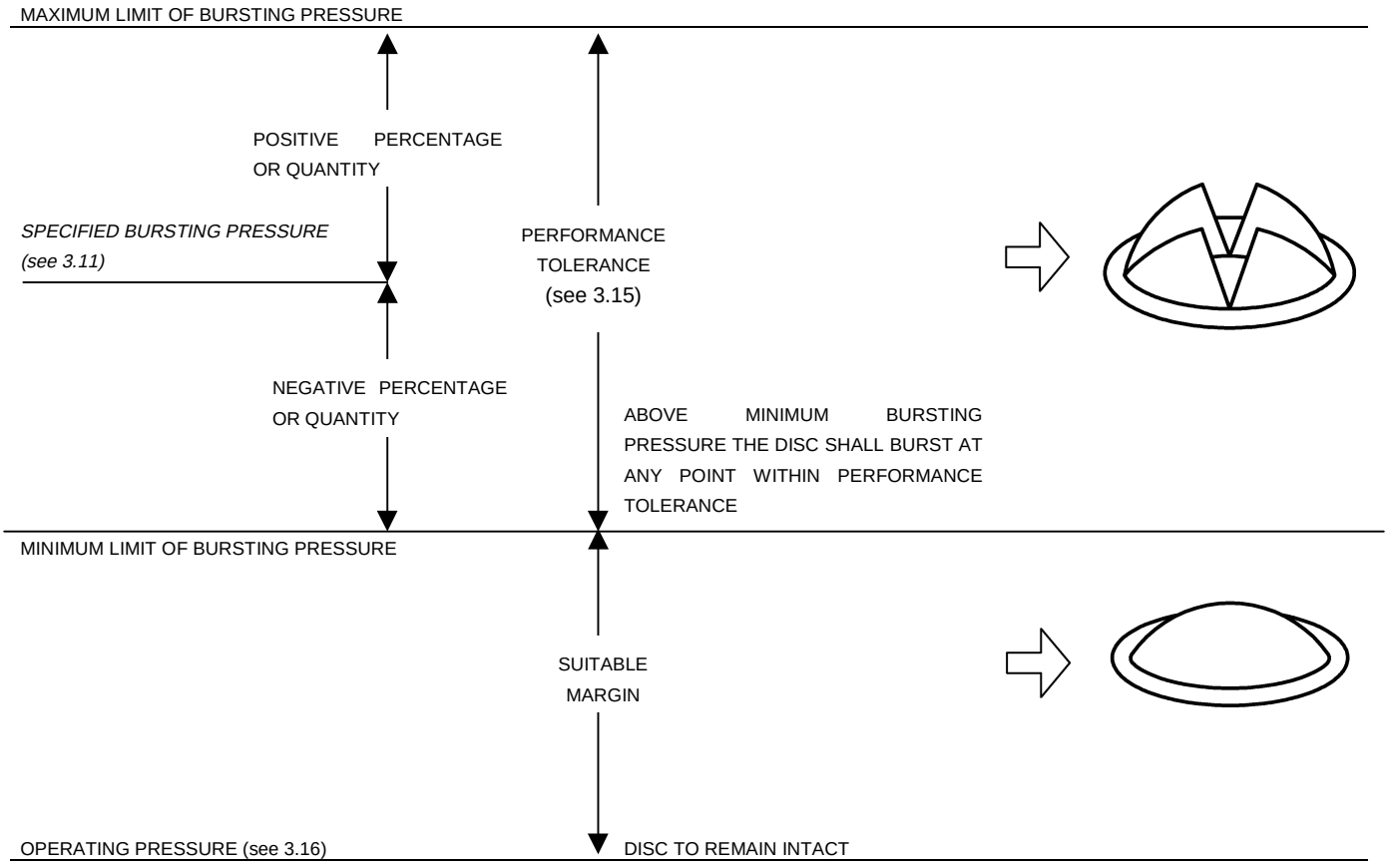


Figure 9 b — Specified bursting pressure and performance tolerance with coincident temperature

Figure 9 — Methods for specifying bursting pressure

13 Inspection by the manufacturer

Inspection of components during manufacture shall be carried out in accordance with the manufacturer's requirements.

On completion of manufacture, all components shall be visually inspected for defects. Any components having defects, which would cause incorrect functioning, shall be discarded or rectified.

14 Test procedures

14.1 General

The verification of the pressure integrity of bursting disc holders, when required is described in 14.2. The verification of the specified bursting pressure requirements of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies shall be carried out in accordance with 14.3.

NOTE Additional testing requirements necessitated by a particular application should, where required, be specified by the purchaser (see 14.4 and 14.5).

14.2 Pressure testing

14.2.1 Bursting disc safety devices with replaceable bursting disc assemblies

When required the manufacturer shall subject each bursting disc holder to an hydrostatic test. The test fluid shall normally be water. Other fluids may be used providing the appropriate safety precautions are observed.

In order to carry out the pressure test, the bursting disc holder shall be assembled using an appropriate sealing device in place of a bursting disc and a clamping load sufficient to sustain the test pressure shall be applied.

The test pressure (see 6.1.1.b) shall be maintained at the required value for a sufficient period of time to permit a visual examination to be made. Any bursting disc holder showing visible signs of leakage or permanent deformation shall be rejected.

14.2.2 Bursting disc safety devices with non-replaceable bursting disc assemblies

The test pressure for bursting disc safety devices with non-replaceable bursting disc assemblies shall be the specified bursting pressure.

14.3 Burst testing

14.3.1 General

A number of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies shall be selected at random from each batch (see Table 1) and be subjected to burst testing in accordance with 14.3.2 to 14.3.4 in order to verify that the bursting pressure(s) is (are) in accordance with the specified requirements.

Bursting tests carried out during the manufacture of the batch of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies, i.e. discarded and trial bursts, shall not be considered as part of the batch.

14.3.2 Coincident temperature in the range 15 °C to 30 °C

The number of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies in accordance with Table 1, shall be tested at any temperature in the range 15 °C to 30 °C.

14.3.3 Coincident temperature above or below the range 15 °C to 30 °C

14.3.3.1 The number of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies in accordance with Table 1, shall be tested at the coincident temperature.

14.3.3.2 Alternatively, subject to specific agreement, testing may be carried out at a test temperature in the range 15 °C to 30 °C inclusive providing that both the following as satisfied:

a) the relationship between the bursting pressure at the test temperature and the bursting pressure at the coincident temperature is determined from the manufacturer's certified bursting test data;

and

b) the relationship (used to establish the bursting pressure in the temperature range 15 °C to 30 °C) is specific for the type of bursting disc and the lot of material and is appropriate to the nominal size.

The number to be tested shall be in accordance with Table 1.

The reference of the manufacturer's certified bursting test data used to establish the bursting pressure shall be recorded on the certificate (see clause 15).

Table 1 — Number of bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies to be tested

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 6
251 to 999	3 % but not less than 10
1 000 and greater	Minimum 30

14.3.4 Procedure for burst testing

14.3.4.1 Bursting discs shall be tested in a bursting disc holder or test die identical in orifice size and orifice configuration with the bursting disc holder in which the bursting disc is to be installed.

14.3.4.2 In the case of reverse domed bursting discs the test system shall have sufficient capacity to ensure reversal and bursting of the bursting disc (see also 14.3.4.7).

14.3.4.3 A clamping load shall be applied in accordance with the manufacturer's installation instructions for the bursting disc to be tested.

14.3.4.4 The test installation shall be equipped with calibrated measuring and indicating instruments that meet the requirements for the testing and certification specified for the bursting disc or bursting disc safety device with non-replaceable bursting disc.

14.3.4.5 The pressure sensing device shall be located as near as practicable to the bursting disc holder or test die inlet and connected to it in such a way as to minimise pressure drop.

14.3.4.6 In the case of tests to be carried out at specified coincident temperature(s) the bursting disc and bursting disc holder or test die shall be maintained at the coincident temperature for sufficient time to allow the

temperature to stabilise before carrying out the test. The coincident temperature shall be maintained throughout the test.

14.3.4.7 With one of the bursting discs/bursting disc safety devices with non-replaceable bursting disc assemblies installed the pressure at the inlet shall be increased to 90 per cent of the expected minimum bursting pressure in a time not less than 5 seconds. Thereafter the pressure at the inlet shall be increased at a linear rate, which allows accurate reading of the smallest graduation of the pressure gauge, but in not more than 120 seconds, until the bursting disc bursts.

NOTE Some applications can require testing procedures which deviate from the above. These should be specified by the manufacturer in consultation with the purchaser.

The bursting pressure and any other pertinent characteristics shall be recorded.

14.3.4.8 Where a bursting pressure is not in accordance with the specified bursting pressure requirements, (see clause 12), the batch shall be rejected.

14.3.4.9 The appropriate safety precautions shall be observed when carrying out the tests.

14.4 Leak testing

14.4.1 General

When required, the manufacturer shall subject the bursting disc safety device to a leak test in order to detect any leakage through the bursting disc and/or the leakage through the bursting disc safety device to the surrounding environment.

The method of carrying out the leak test, the number of bursting disc safety devices to be tested and any acceptance criteria shall be specified and testing shall be carried out in accordance with a written procedure.

14.4.2 Selection of acceptable leakage rate

The acceptable leakage rate is dependent on the application. The maximum leakage rate shall be specified by the purchaser and shall not exceed that permitted by the appropriate regulations or standards covering the pressure system.

14.5 Non-destructive examination

Components required to be subject to non-destructive examination shall be tested by the manufacturer in accordance with the specified method, the number of components to be examined and the acceptance criteria.

15 Certification

The manufacturer shall issue a certificate for each batch or part batch of bursting discs or bursting disc safety devices with non-replaceable bursting disc assemblies, stating that they have been manufactured and tested in accordance with the requirements of this standard. The certificate shall include the following information:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) nominal size designation, as appropriate, for example DN or NPS;

d) the specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature, stating units;

or

the specified bursting pressure and performance tolerance with a coincident temperature, stating units;

e) when testing in accordance with 14.3.3.2 information as in d) correlated to the conditions of the test;

f) reference of the manufacturer's certified bursting test data used to establish the bursting pressure, (see 14.3.3.2);

g) actual bursting pressure and the actual temperatures recorded during the tests;

h) materials(s) of the bursting disc and components supplied (in the case of impregnated graphite, the type of impregnant shall be stated);

i) manufacturer's identification mark;

j) batch identity;

k) number of this standard, i.e. EN ISO 4126-2;

l) results of leakage tests, non-destructive examination etc., where appropriate;

m) where applicable, information in accordance with 17.6.

16 Product designation

The following minimum data shall be provided to the manufacturer:

a) manufacturer's model/type reference;

b) nominal size DN or NPS (according to EN ISO 6708);

c) PN or Class (according to EN 1333);

d) material specification for components of the device;

e) the specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature, stating units;

or

the specified bursting pressure and performance tolerance with a coincident temperature, stating units;

f) quantity of bursting disc assemblies to be delivered to the purchaser;

g) specific requirements in addition to those specified in this standard e.g. testing, marking, packaging, certification, etc.

17 Marking

17.1 General

Marking of bursting disc safety devices shall be in accordance with 17.2, 17.3, 17.4 and 17.5 except as permitted in 17.6. Where practicable, the marking shall be permanent and such that it can be visible after installation.

17.2 Bursting discs/bursting disc assemblies

Each bursting disc/bursting disc assembly shall be marked preferably on an identification plate (tag) fixed to the bursting disc/bursting disc assembly.

The marking shall include the following:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) nominal size designation, as appropriate, for example DN or NPS;

d) material identification;

e) the specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature, stating units;

or

the specified bursting pressure and performance tolerance with a coincident temperature stating units;

f) indication of direction of flow;

g) number of this standard, i.e. EN ISO 4126-2;

h) batch identity;

i) manufacturer's reference of the bursting disc holder into which the bursting disc/bursting disc assembly is to be installed (except where separate holders are not required);

j) vent area of any restriction permanently attached to the bursting disc, for example non-opening back pressure support;

k) year of manufacture.

17.3 Bursting disc holders

Each bursting disc holder shall be marked on the outer rim or on an identification plate firmly fixed to the outer rim.

The marking shall include the following:

a) manufacturer's name or trade mark;

b) manufacturer's bursting disc holder reference;

c) nominal size designation, as appropriate, for example DN or NPS;

d) PN or Class;

e) material identification;

f) indication of direction of flow;

g) number of this standard, i.e. EN ISO 4126-2;

h) vent area of any fixed or loose restriction, for example non-opening back pressure support, knife blades, etc., provided with the bursting disc holder;

i) year of manufacture.

17.4 Bursting disc safety devices with non-replaceable bursting disc assemblies

Each bursting disc safety device with non-replaceable bursting disc assembly shall be marked externally with the following information:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) nominal size designation, for example DN or NPS thread designation etc.;

d) PN or Class;

e) material identification of the bursting disc and the bursting disc holder;

f) the specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature, stating units;

or

specified bursting pressure and performance tolerance with a coincident temperature, stating units;

g) indication of direction of flow;

h) number of this standard, i.e. EN ISO 4126-2;

i) batch identity;

j) vent area of any restriction permanently attached to the bursting disc/bursting disc assembly, for example, non-opening back pressure support.

k) year of manufacture.

17.5 Ancillary components

Ancillary components, for example loose back pressure supports, temperature shields, etc., which may be supplied separately from a bursting disc safety device shall be marked with the following information:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) material identification;

d) indication of direction of flow, where appropriate;

e) number of this standard, i.e. EN ISO 4126-2;

f) vent area, where the component causes a restriction to the bursting disc safety device with which it is to be assembled or installed;

g) year of manufacture.

17.6 Omission of markings

Where the size and shape does not allow inclusion of all the required markings, as many of the marking requirements, as is practicable shall be met.

The marking shall always include a reference number which relates the item to the certificate, (see 15 m)) or document that contains the information omitted from the marking requirements.

The provision of loose identification plates, labels etc., shall be agreed between the manufacturer and the purchaser.

18 Preparation for storage and transportation

18.1 General

Bursting disc safety devices or their components shall be packed to prevent any damage and to ensure that their function is not impaired.

18.2 Marking of packages

Each bursting disc container shall be permanently marked with the following information:

a) manufacturer's name or trade mark;

b) manufacturer's model/type reference;

c) nominal size designation, as appropriate, for example DN or NPS;

d) material identity of contents;

e) where appropriate:

— the specified maximum bursting pressure and specified minimum bursting pressure with a coincident temperature, stating units;

or

— specified bursting pressure and performance tolerance with a coincident temperature, stating units;

f) manufacturer's reference of the bursting disc holder where appropriate;

g) batch identity, where appropriate;

h) reference number, where appropriate;

Where components of a bursting disc safety device, for example back pressure support, temperature shield etc., are supplied separately, the packages shall be marked with the appropriate references.

18.3 Provision of assembly and installation instructions

Assembly and installation instructions shall be included by the manufacturer in each package unless otherwise specified.

18.4 Provision of documents, loose identification plates etc.

Packages shall include:

a) the documentation according to clause 15 as applicable;

b) any loose identification plates, labels etc., as agreed between the manufacturer and purchaser.

Annex A
(normative)

Materials

The materials of bursting discs and bursting disc assemblies, with the exception of non-metallic components, shall be selected from Table A.1.

Table A.1 — Materials for use in bursting disc safety devices

MATERIAL GROUP: STAINLESS STEELS							
European Standard	Grade (see EN 10088-1)	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 10028-7	1.4301 X5CrNi18 10 1.4306 X2CrNi 19 11 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo17 122 1.4404 X2CrNiMo17 122 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4439 X2CrNiMoN17 135 1.4462 X2CrNiMoN22 53 1.4539 X1NiCrMoCu25 205 1.4541 X6 CrNiTi18 10 1.4571 X6CrNiMoTi17 122			SEW 400	1.4505	ASTM A240	304: S30400 304H: S30409 304L: S30403 304LN: S30453 304N: S30451 316: S31600 316H: S31609 316L: S31603 316LN: S31653 316N: S31651 317: S31700 321: S32100 321H: S32109 347: S34700 347H: S34709 348: S34800 348H: S34809 309S: S30908 310S: S31008
EN 10095	1.4301 X5CrNi 18 10 1.4306 X2CrNi 19 11 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo 17 12 2 1.4404 X2CrNiMo 17 12 2 1.4541 X6CrNiTi 18 10						
MATERIAL GROUP: NICKEL & RELATED ALLOYS							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
		BS 3072	Nickel 200/201 NA11 Monel 400 NA13 Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602	DIN 17740	2.4060 2.4066 2.4068	ASTM B127	NO4400
				DIN 17742	2.4816	ASTM B162	NO2200 NO2201
				DIN 17743	2.4360	ASTM B168	NO6600 NO6690
		BS 3073	Nickel 200/201 NA11 Monel 400 NA13 Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602	DIN 17744	2.4602 2.4605 2.4610 2.4617 2.4816 2.4819 2.4856 2.4858	ASTM B424	NO8825
						ASTM B443	NO6625-1 NO6625-2
						ASTM B333	NI0001 NI0665
						ASTM B575	NO6022 NO6059 NO6455 NI0276
MATERIAL GROUP: TANTALUM							
				VDTUV	382/507	ASTM B708	RO5200 RO5400

Table A.1 *(continued)*

MATERIAL GROUP: TITANIUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
				DIN 17850	3.7024 3.7025 3.7034 3.7035 3.7055	ASTM B265	R50250 R50400 R50550 R52252 R52260 R52400 R52402 R53400 E56320
MATERIAL GROUP: COPPER, BRASS AND BRONZE							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 1652 EN 1653						ASTM B569	C23000 C26000 C261300
MATERIAL GROUP: ALUMINIUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 485 EN 573-3 EN 573-4	 3.0285 3.0285					ASTM B209	Alclad 6061

NOTE 1 The above materials can also be used as corrosion-resistant lining for bursting disc holders.

NOTE 2 General requirements for products in stainless steels are given in EN 10028-1 and EN 10222-1.

Annex B
(informative)

Materials

The materials of bursting disc holders, with the exception of non-metallic components, should be selected from Table B.1.

Table B.1 — Materials for use in bursting disc safety devices

MATERIAL GROUP: CARBON & LOW ALLOY STEELS							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 10025	1.0037 S235JR [a] 1.0038 S235JRG [a] 1.0570	BS 3146-1				ASTM A36	KO2600
						ASTM A105	KO3504 [a]
						ASTM A106	A KO2501 B KO3006 [a] C KO3501 [a]
EN 10028-2	1.0345 P235GH 1.0425 P265GH [a] 1.0481 P295GH [a] 1.5415 16Mo3 [a]					ASTM A210	A-1 KO2707 C KO3501
						ASTM A216	WCA JO2502 [a] WCB JO3002 [a] WCC JO2503 [a]
EN 10028-4	1.5637 12Ni14 [a] 1.5680 12Ni19					ASTM A350	LF KO3011 [a]
EN 10087	1.0718 11SMnPb30					ASTM A516	55 KO1800 60 KO2100 [a] 65 KO2403 [a] 70 KO2700 [a]
EN 10216-2	P235GH P250GH 1.5415 16Mo3 1.5637 12Ni14					ASTM A519	1025
EN 10222-2	1.0402 P235GH 1.0460 /P250GH 1.5414 16Mo3					ASTM A576	
						ASTM A696	B KO3200 C KO3200
EN 10222-3	1.5637 12Ni14 [a] 1.5680 X12Ni5 [a]						
EN 10273	1.0345 P235GH 1.0460 P250GH 1.0425 P265GH 1.0481 P295GH 1.5415 16Mo3						

Table B.1 *(continued)*

MATERIAL GROUP: STAINLESS STEELS							
European Standard	Grade (see EN 10088-1)	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 10028-7	1.4301 X5CrNi18 10 [a] 1.4306 X2CrNi 19 11 [a] 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo17 122 [a] 1.4404 X2CrNiMo17 122 [a] 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4439 X2CrNiMoN17 135 1.4462 X2CrNiMoN22 53 1.4539 X1NiCrMoCu25 205 1.4541 X6 CrNiTi18 10 [a] 1.4571 X6CrNiMoTi17 122 [a]			SEW 400	1.4505	ASTM A182	F1: K12822 [a] F2: K12122 [a] F5: K41545 [a] F5A: K42544 [a] F9: K90941 [a] F11: K11572 [a] F11: K11597 [a] F12: K11564 [a] F12: K11582 [a] F22: K21590 F304: S30400 [a] F304H: S30409 [a] F304L: S30403 [a] F304LN: S30453 F304N: S30451 F310: S31000 [a] F316: S31600 [a] F316H: S31609 [a] F316L: S31603 [a] F316LN: S31653 F316N: S31651 F321: S32100 [a] F321H: S32109 [a] F347: S34700 F347H: S34709 [a] F348: S34800 [a] F348H: S34809 [a] F44:S31254 [a]
EN 10088-2	1.4301 X5CrNi18 10 1.4306 X2CrNi 19 11 1.4307 X2CrNi 18 9 1.4439 X2CrNiMoN17 135 1.4541 X6 CrNiTi18 10	BS 3146-2	ANC4				
EN 10088-3	1.4301 X5CrNi18 10 1.4306 X2CrNi 19 11 1.4307 X2CrNi 18 9 1.4439 X2CrNiMoN17 135 1.4541 X6 CrNiTi18 10					ASTM A240	304: S30400 [a] 304H: S30409 [a] 304L: S30403 [a] 304LN: S30453 304N: S30451 316: S31600 [a] 316H: S31609 [a] 316L: S31603 [a] 316LN: S31653 316N: S31651 317: S31700 [a] 321: S32100 [a] 321H: S32109 [a] 347: S34700 347H: S34709 [a] 348: S34800 [a] 348H: S34809 [a] 309S: S30908 [a] 310S: S31008 [a]
EN 10095	1.4301 X5CrNi 18 10 1.4306 X2CrNi 19 11 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo 17 12 2 1.4404 X2CrNiMo 17 12 2 1.4541 X6CrNiTi 18 10 1.4841 X15 CrNiSi 25 21						
EN 10216-5	1.4301 X5CrNi18 10 1.4306 X2CrNi19 11 1.4401 X5CrNiMo17 122 1.4404 X2CrNiMo17 122 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4541 X6CrNiTi18 10 1.4571 X6CrNiMoTi17 122						
EN 10222-5	1.4301 X5CrNi18 10 [a] 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo17 122 [a] 1.4404 X2CrNiMo17 122 [a] 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4462 X2CrNiMoN22 53 1.4541 X6CrNiTi18 10 [a] 1.4571 X6CrNiMoTi17 122 [a]					ASTM A312	TP316: S31600 TP304: S30400 TP304L: S30403 TP316L: S31603 TP321: S32100
						ASTM A351	CF3 J92500 [a] CF3M J92800 [a] CF8 J92600 [a] CF8M J92900 [a]

Table B.1 *(continued)*

MATERIAL GROUP: STAINLESS STEELS							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 10272	1.4301 X5CrNi18 10 1.4306 X2CrNi19 11 1.4307 X2CrNi 18 9 1.4401 X5CrNiMo17 122 1.4404 X2CrNiMo17 122 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4439 X2CrNiMoN17 135 1.4462 X2CrNiMoN22 53 1.4541 X6CrNiTi18 10 1.4571 X6CrNiMoTi17 122					ASTM A479	304: S30400 304H: S30409 304L: S30403 304LN: S30453 304N: S30451 316: S31600 316H: S31609 316L: S31603 316LN: S31653 316N: S31651
EN 10273	1.4301 X5CrNi18 10 1.4306 X2CrNi19 11 1.4401 X5CrNiMo17 122 1.4404 X2CrNiMo17 122 1.4435 X2CrNiMo18 143 1.4436 X3CrNiMo17 133 1.4462 X2CrNiMoN22 53 1.4541 X6CrNiTi18 10 1.4571 X6CrNiMoTi17 122					ASTM A789	S31260 S31500 S31803 S32304 S32550 S32750 S32900 S32950
						ASTM A790	S31280 S31500 S31803 S32304 S32550 S32750 S32900 S32960

Table B.1 *(continued)*

MATERIAL GROUP: NICKEL & RELATED ALLOYS							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
		BS 3146-2	Nickel 200/201 NA11 Monel 400 NA13 Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602	DIN 17740	2.4060 2.4066 2.4068	ASTM A494	CW-12MW/C N30002 M35-2
				DIN 17742	2.4816	ASTM B127	NO4400
				DIN 17743	2.4360	ASTM B160	NO2200 NO2201
						ASTM B161	NO2200 NO2201
						ASTM B164	NO4400 NO4405
						ASTM B165	NO4400
		BS 3072	Nickel 200/201 NA11 Monel 400 NA13 Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602	DIN 17744	2.4602 2.4605 2.4610 2.4617 2.4816 2.4819 2.4856 2.4858	ASTM B166	NO6600 NO6690
						ASTM B167	NO6600 NO6690
						ASTM B423	NO8825
						ASTM B424	NO8825
						ASTM B425	NO8825
						ASTM B444	NO6625-1 NO6625-2
						ASTM B446	NO6625-1 NO6625-2
		BS 3074	Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602			ASTM B473	NO8020
						ASTM B564	NO4400 NO6022 NO6059 NO6800 NO6625 NO8367 NO8800 NO8810 NO8811 N10276
		BS 3076	Nickel 200 2.4060 Nickel 201 2.4066 Monel 400 2.4360 Inconel 600 2.4816 Inconel 625 2.4856 Incoloy 825 2.4858 Hastelloy B 2/3 2.4617 Hastelloy C4 2.4610 Hastelloy C22 2.4602 Hastelloy C276 2.4602			ASTM B335	NI0001 NI0665
						ASTM B574	NO6022 NO6059 NO6455 NI0276
MATERIAL GROUP: TANTALUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
				VDTUV	382/507	ASTM B364	RO5240 RO5252 RO5255 RO5400
						ASTM B708	RO5200 RO5252 RO5255 RO5400

Table B.1 *(continued)*

MATERIAL GROUP: TITANIUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
				DIN 17850	3.7024 3.7025 3.7034 3.7035 3.7055	ASTM B265	R50250 R50400 R50550 R52252 R52260 R52400 R52402 R53400 E56320
				DIN 17851	3.7024 3.7025 3.7034 3.7035 3.7055	ASTM B348	R50250 R50400 R50550 R52400 R524402 R53400 R56320
				DIN 17860	3.7024 3.7025 3.7034 3.7035 3.7055	ASTM B367	C-2 R50440 C-3 R50550
				DIN 17861	3.7024 3.7025 3.7034 3.7035 3.7055	ASTM B381	F1 R50250 F2 R50400 F3 R50550 F7 R52400 F16 R52402 F12 R53400 F9 R56320
				DIN 17869	3.7035		
				DIN 17862	3.7025 3.7035 3.7055		
				DIN 17864	3.7025 3.7035 3.7055		
MATERIAL GROUP: CARPENTER							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
						ASTM B473	N08020
MATERIAL GROUP: COPPER, BRASS AND BRONZE							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 1652						ASTM B584	C92200 C93700 C97600
EN 1653							
MATERIAL GROUP: ZIRCONIUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
						ASTM B493	R60702 R60705
						ASTM B550	R60702 R60705
MATERIAL GROUP: ALUMINIUM							
European Standard	Grade	British Standard	Grade	German Standard	Grade	US Standard	Grade
EN 485						ASTM B209	Alclad 6061
EN 573-3	3.0285						
EN 573-4	3.0285						

[a] Also given in EN 1092-1, prEN 12516-1, prEN 1759-1.

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EN 10028-2, *Flat products made of steels for pressure purposes – Part 2: Non-alloy and alloy steels with specified elevated temperature properties.*

EN 10028-4, *Flat products made of steels for pressure purposes – Part 4: Nickel alloy steels with specified low temperature properties.*

EN 10087, *Free-cutting steels – Technical delivery conditions for semi-finished products, hot-rolled bars and rods.*

EN 10088-2, *Stainless steels – Part 2: Technical delivery conditions for sheet, plate and strip for general purposes.*

EN 10088-3, *Stainless steels – Part 3: Technical delivery conditions for semi-finished products, bars, rods and sections for general purposes.*

EN 10216-2, *Seamless steel tubes for pressure purposes – Technical delivery conditions – Part 2: Non-alloy and alloy steel tubes with specified elevated temperature properties.*

EN 10222-2, *Steel forgings for pressure purposes – Part 2: Ferritic and martensitic steels with specified elevated temperature properties.*

EN 10222-3, *Steel forgings for pressure purposes – Part 3: Nickel steels with specified low-temperature properties.*

EN 10222-5, *Steel forgings for pressure purposes – Part 5: Martensitic, austenitic and austenitic-ferritic stainless steels.*

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