TC 185

International Standard ISO 6718

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Bursting discs and bursting disc devices

Disques de rupture et dispositifs à disque de rupture

First edition — 1985-09-01

UDC 621.646.8 **Ref. No. ISO 6718-1985 (E)**

Descriptors : pressure equipment, safety devices, safety valves, bursting discs, components, specifications, tests, burst tests, marking, packing.

Price based on 20 pages

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 6718 was prepared by Technical Committee ISO/TC 185, *Safety devices for protection against excessive pressure*.

Printed in Switzerland

Contents

Section six : Test certificates

Annex

Tables

Figures

Bursting discs and bursting disc devices

1 Scope and field of application

This International Standard specifies requirements for bursting disc devices which may be used to protect pressure vessels, pipelines or other enclosures from excessive pressure or vacuum. They are designed to burst or vent when the pressure differential across the disc exceeds a predetermined value at a predetermined temperature.

Section one : General

2 Definitions

For the purpose of this International Standard, the following definitions apply :

2.1 bursting pressure: [1] The value of the pressure differential across the disc at which a bursting disc device functions.

2.2 specified bursting pressure: [1] The pressure, quoted with a coincident temperature, specified by the user or his agent when defining the disc requirement.

2.3 average bursting pressure: The arithmetic average value, at the coincident temperature of the test bursts carried out on a batch of discs.

2.4 coincident temperature (bursting pressure): The temperature used in conjunction with a bursting pressure.

2.5 operating temperature: The average temperature of the disc and the surrounding parts during normal operation.

2.6 bursting tolerance: The maximum variation of test results in equal positive and negative quantities or percentages related to the average bursting pressure. When a zero manufacturing range is stated, the tolerance shall be applied directly to the specified bursting pressure.

2.7 manufacturing range: A range of pressure within which the average bursting pressure of a batch of bursting discs shall fall in order to be acceptable for a particular application as agreed between the disc manufacturer and the purchaser.

2.8 performance tolerance: A range of pressure in positive and negative quantities or percentages which includes both manufacturing range and bursting tolerance at a coincident temperature, which shall be applied directly to the specified bursting pressure.

2.9 foil: The sheet or strip used for the manufacture of metallic bursting discs.

2.10 batch: A group of bursting discs of the same type, size, average bursting pressure and coincident temperature, manufactured from material of the same identity and properties made as a single group.

2.11 bursting disc device: A non-reclosing pressure relief device actuated by differential pressure and designed to function by the bursting or venting of the bursting disc.

2.12 bursting disc assembly: The complete assembly of components which are installed in the bursting disc holder to perform the desired function.

1) The words maximum and minimum may be used with these terms.

2.13 bursting disc: The pressure-containing and pressure-sensitive element of a bursting disc device.

2.14 bursting disc holder: That part of a bursting disc device which retains the bursting disc assembly in position.

2.15 back pressure: The static pressure existing at the outlet of a bursting disc device at the time the device is required to operate. It is the result of pressure in the discharge system from other sources or as a result of vacuum on the upstream side.

2.16 back pressure support: That component of a bursting disc assembly which prevents the failure of the disc due to back pressure differential. A back pressure support which is intended to prevent the failure of the disc when the system pressure falls below atmospheric pressure is sometimes referred to as a vacuum support.

2.17 baffle plate: A plate attached to vent side of a bursting disc device or system to redirect discharge and/or reduce recoil.

2.18 muffled outlet: A component of a bursting disc device which disperses the discharge.

2.19 stiffening ring: An integral component of the bursting disc assembly used primarily for the stiffening of fragile discs.

2.20 coating: A layer of metallic or non-metallic material applied by brush, spray, dipping, fluidized bed or other similar method to components of a bursting disc device.

2.21 lining: An additional sheet or sheets of material forming part of the bursting disc assembly or holder. The lining may be metallic or non-metallic.

2.22 plating: A metal layer applied to a disc or holder by a plating process.

2.23 excess flow valve: A device which permits limited flow. When this flow is exceeded the valve closes.

2.24 conventional domed bursting disc: A bursting disc which is domed in the direction of the bursting pressure and designed to fail in tension.

See figures 1 and 2.

2.25 slotted lined bursting disc: A conventional domed bursting disc made up of two or more layers, one of which is slit or slotted so as to reduce its strength and to control the bursting pressure of the bursting disc.

See figure 4.

2.26 reverse domed bursting disc: A bursting disc which is domed against the direction of the bursting pressure and designed to fail by buckling, bending or shearing forces.

See figure 5.

2.27 graphite bursting disc: A bursting disc manufactured in graphite and designed to fail by bending or shearing forces.

2.28 temperature shield: A device which protects a bursting disc from excessive temperature.

2.29 bursting disc device discharge area: The area which is the geometric minimum cross-sectional flow area of the bursting disc device which is used to calculate the theoretical flow capacity of the bursting disc device.

NOTE — Possible reduction of the cross-section, for example by back pressure supports, catching devices or parts of the bursting disc which remain after bursting, has to be considered.

2.30 bursting disc device discharge capacity: The rate at which a bursting disc device can discharge fluid after bursting or venting of the bursting disc.

2.31 independent authority: That authority which, in the country concerned, bears responsibility for all aspects of surveillance of tests, checking of calculations and certification of bursting disc discharge capacities.

2.32 service life: The time period beginning at the installation of a bursting disc assembly and ending at either replacement or burst.

2.33 operating pressure: The pressure to which the bursting disc is exposed during normal operation.

2.34 inspection authority: The independent authority or association which verifies compliance with this International Standard.

3 Selection

3.1 Bursting discs are differential pressure devices, and therefore the pressure on each side of the disc shall be taken into account.

3.2 As highly stressed components, bursting discs have a limited service life and may require replacing at regular intervals. The frequency of replacement depends upon the type and material of the disc, corrosive nature of the environment, operating temperature and operating pressure and their fluctuations, ratio of operating pressure to minimum bursting pressure, resistance to creep and fatigue and other operating conditions.

3.3 Bursting disc devices are frequently required to work in corrosive environments where corrosion may cause premature failure of the disc. Materials likely to be affected by corrosion may be protected by coating, plating, lining or other suitable means which shall be supplied only by the bursting disc device manufacturer (see clause 14).

3.4 Selection of the appropriate disc material depends upon the chemical and physical conditions that will be met on each side of the bursting disc when it is in service (see clause 8).

3.5 To function properly, bursting discs, and back pressure supports where required, shall be installed in accordance with the recommendations of the disc manufacturer.

3.6 The bursting pressure of a bursting disc according to its material and type varies with temperature. Generally a bursting disc operating at high temperatures has a lower bursting pressure than at room temperature; a bursting disc operating at below room temperatures has a higher bursting pressure than that at room temperature.

When a bursting disc is specified with a bursting pressure at a coincident temperature to protect a system, the bursting disc may not give the necessary protection at a lower temperature. The system has to be considered with regard to the bursting pressures of the disc over the temperature range of the system.

When requested by the user or his agent, data regarding the variation of bursting pressure according to the temperature for a batch of bursting discs shall be provided by the manufacturer.

Bursting discs may be protected from excessive temperature by suitable location, temperature shield or by other means. It is essential that the bursting temperature of the bursting disc shall be known when it is designed.

3.7 The manufacturer's advice should be sought when selecting a bursting disc for a particular application.

3.8 When reverse domed bursting discs are required for liquid relief the bursting disc manufacturer shall be consulted.

4 Application

4.1 Subject to the requirements of national or other regulations, bursting discs may be used either as the sole safety device or in conjunction with safety valves.

4.2 In order that bursting discs may function satisfactorily :

a) the maximum bursting pressure shall be in accordance with 4.4;

b) the bursting disc device discharge area formed when a bursting disc has burst or vented shall comply with 6.1.

4.3 The use of a bursting disc as a pressure-relieving device may be preferred in the following cases :

a) where pressure rise may be so rapid that the inertia of a safety valve would be a disadvantage;

b) where even minute leakage of the fluid cannot be tolerated under normal conditions;

c) where service conditions may involve deposition which could render a safety valve inoperative;

d) where cold service conditions could prevent a safety valve from operating.

4.4 Where a bursting disc alone is used as the relieving device, its maximum bursting pressure at the coincident temperature shall comply with the appropriate standard covering the system to be protected.

4.5 The selection of bursting discs for use on vessels which may be involved with extremely rapid and uncontrolled changes in pressure requires special consideration not covered by this International Standard.

4.6 Bursting discs may be used in combination with safety valves as permitted by the appropriate standards. The application of the discs shall not adversely affect the operation of the safety valve nor result in excess pressure to the system.

4.6.1 Bursting disc devices in combination with safety valve(s) may be used in the following cases:

a) in series to protect the safety valve against corrosion, fouling or service conditions which may affect the safety valve performance;

b) in series to prevent leakage;

c) in series to prevent total loss of contents from the pressure system following venting of the bursting disc;

d) in parallel as an additional safeguard.

4.6.2 A bursting disc device may be installed before the inlet of a safety valve if the following requirements are met:

a) The maximum bursting pressure at the coincident temperature complies with the appropriate standard for the system being protected.

b) If the discharge capacity and the operating characteristics of the particular combination of safety valve and bursting disc device have been established by test in accordance with national standards or regulations, the test results shall be used.

c) Where a combination has not been tested:

— the bursting disc device discharge area shall be such as to satisfy the safety valve inlet piping pressure drop requirements stated in the appropriate national standard,

— the bursting disc device discharge area shall be not less than 80 % of the nominal area of the safety valve inlet,

— the flow capacity of such a combination shall be assumed to be no greater than 80 % of the rated relieving capacity of the safety valve alone.

d) The space between the bursting disc and safety valve shall be provided with a means for monitoring any pressure build-up. This cavity may also be vented by means of an excess flow valve.

NOTE — Bursting discs, being pressure differential devices, will require a higher system pressure to burst the disc if pressure builds up in the space between the bursting disc and safety valve which will occur should leakage develop in the bursting disc due to corrosion or other cause.

e) In situations where fragmentation or release of bursting disc material may occur, the installation shall be designed so that parts or particles of the bursting disc cannot render the safety valve inoperative nor reduce the flow area of the safety valve.

4.6.3 A bursting disc device may be installed after the outlet of a safety valve if the following requirements are met:

a) The safety valve is so designed that its operating characteristics shall not be adversely affected by the bursting disc installed.

b) The system shall be designed so that the safety valve opens at its set pressure. The space between the safety valve disc and the bursting disc shall be vented or drained to prevent pressure build-up.

c) The maximum bursting pressure of the disc at the coincident temperature plus any pressure in the discharge piping does not exceed:

— the pressure permitted by the safety valve manufacturer,

— the design pressure of any pipe or fitting between the safety valve and bursting disc,

— the pressure permitted by the appropriate national standard.

d) In installations where fragmentation or release of bursting disc material may occur, the system shall be designed so that the performance of the safety valve is not impaired and adequate venting is provided.

e) On bursting, the bursting disc discharge area does not affect the discharge capacity and the operating characteristics of the safety valve.

f) The contents of the protected system are clean fluids, free from gumming or fouling matter, so that accumulation in the space between the safety valve inlet and the bursting disc (or in any other outlet that may be provided) does not obstruct the outlet.

NOTE — A bursting disc assembly on the discharge side of a safety valve should not be replaced while there is any possibility of the safety valve opening.

4.6.4 A bursting disc device may be installed both before and after a safety valve provided that the requirements of 4.6.2 and 4.6.3 are taken into consideration.

4.6.5 A bursting disc device fitted in parallel with a safety valve as an additional safeguard, such as to protect the system against the consequence of a rapid rise in pressure, shall be specified to burst at a pressure not exceeding that specified in the appropriate national standards or regulations.

4.6.6 A bursting disc device may be fitted in series with a second bursting disc device. In such cases the system shall be designed in accordance with the following:

a) The space between the two bursting discs shall be large enough to ensure the correct functioning of the discs.

b) The space between the bursting discs shall be provided with a means for monitoring any pressure build-up. This cavity may also be vented by means of an excess flow valve.

5 Installation

5.1 A bursting disc device should be placed as close as possible to the space it is intended to protect, taking into account pressure pulses, temperature conditions, etc. The discharge system shall be of ample size and as straight and as short as possible, terminating in such a way as to avoid dangerous or damaging conditions arising on venting.

5.2 Bursting disc devices should be mounted so that they are accessible for replacement and protected from accidental damage. Consideration should be given to the effects of weather, including freezing of the discharge pipe and possible corrosion from the atmosphere.

5.3 Adequate precautions shall be taken to prevent deposition on the pressure side of the disc and in the part leading to it of sublimates or other solids that could affect the safe operation of the bursting disc.

Casual liquid or foreign matter shall, for similar reasons, be prevented from accumulating on the vent side of the bursting disc and within the discharge pipe.

The application of an additional protective film or coating to an installed bursting disc is not allowed, except when approved by the manufacturer since this may considerably affect the bursting pressure of the disc.

5.4 The user shall ensure that provision is made to absorb the effect of reaction forces on the vessel and associated pipework which will arise when the disc bursts or vents.

5.5 If the bursting of a disc can discharge a flammable fluid, the danger of ignition in the outlet pipe shall be considered and appropriate measures taken to minimize the hazard.

5.6 Bursting discs shall be examined for defects immediately before installation and care shall be taken during assembly, particularly with thin bursting discs.

5.7 In situations where fragmentation or release of bursting disc material may occur, any piping beyond the bursting disc shall be so designed that it shall not be obstructed by fragments from the bursting disc device.

5.8 The manufacturer's installation instructions shall be followed strictly, in particular the directional arrow, bolting torque instructions and the reference to the use of gaskets. If the components are assembled incorrectly or the bursting disc device is installed incorrectly, the bursting disc may burst or vent at a system pressure higher or lower than that expected.

6 Discharge capacity

6.1 The discharge capacity of a bursting disc, used as the primary relief device, shall be sufficient to discharge the maximum quantity of fluid that can be generated or supplied to a pressure system whilst preventing the pressure from exceeding the pressures permitted by standards covering the system to be protected.

6.2 A method of calculating discharge capacities is given in the annex.

7 Information to be supplied by the user

It is recommended that the following minimum information, if known, be supplied by the user with every enquiry, to assist the manufacturer in specifying the most suitable bursting disc device for a particular application.

7.1 Application details

a) Description of the vessel, equipment or system to be protected, vessel design code where appropriate.

b) Intended application of the bursting disc device. State if the device is required to operate as the primary relief device, secondary relief device, for safety valve isolation or in some other capacity.

c) Performance specification and relative position of any safety valves or other safety devices fitted to the equipment or system.

d) The fluid which may come in contact with any part of the bursting disc device; physical properties of the fluid, for example gas, vapour, liquid or solid; wet or dry, at all stages of the process (including venting); chemical properties of the fluid which may affect bursting disc performance.

e) All conditions of temperature and pressure (including back pressure) to which the bursting disc may be subjected. Rate and frequency of pressure changes, if applicable.

7.2 Bursting disc operating details

a) Maximum specified bursting pressure and coincident temperature.

b) Minimum specified bursting pressure and coincident temperature.

c) Rate of pressure change to bursting pressure, where appropriate.

d) Bursting disc device theoretical discharge capacity, required to prevent accumulated pressure exceeding allowed maximum.

e) Minimum bursting device discharge area required through the bursting disc device discharge area.

f) Materials which the user from knowledge of the process regards as suitable for consideration in the selection of the bursting disc material.

g) Materials which may not be used for safety, corrosion or other reasons.

7.3 Installation details

a) Physical location of bursting disc device in system, preferably in the form of a sketch.

b) Method of fitting bursting disc device in system (for example between flanges, direct fitting to one flange, direct weld to outlet).

c) Inlet pipe diameter to bursting disc and outlet pipe diameter from bursting disc, including flange size, rating, type and specification or other fixing details (for example thread specification and size).

d) Type and preferred material of bursting disc holder; see clause 9.

e) Form and finish of external mating surfaces if required other than to the manufacturer's standard.

7.4 Special details

a) Inspection and certification requirements additional to those defined in this International Standard.

b) Special features required in the bursting disc device (for example excess flow valve, pressure monitoring device, jacking bolts, lifting rings).

c) Special features of application not stated elsewhere.

Section two : Components of bursting disc devices

8 Bursting discs

8.1 Materials

All materials including linings, coatings and platings used for the manufacture of bursting discs shall have uniform properties suitable for the working environment in which the bursting discs are to be used. The material in the final form shall be free from defects which may lead to premature failure.

8.2 Conventional domed bursting discs

Conventional domed bursting discs are domed in the direction of the subsequent applied bursting pressures. Bursting discs 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 conditions. They burst or vent in tension and comprise the following types :

a) conventional simple domed (see figures 1 and 2);

b) conventional slotted lined (see figure 4);

c) other types of conventional domed bursting discs are allowed providing that they meet the requirements of this International Standard.

8.3 Reverse domed bursting discs

Reverse domed bursting discs are those domed against the direction of the bursting pressure (see figure 5) and are designed to fail by buckling under pressure. They include the following types.

a) Reverse domed discs with knife blades. This type of bursting disc opens by being cut during reversal of the dome. Knife blades may be any configuration which will open the bursting disc to satisfy the requirements of clause 6.

b) Reverse domed discs having lines of weakness (without knife blades). This type of bursting disc opens by having lines of weakness, such that when the dome reverses at the bursting pressure, the disc opens along these lines.

c) Reverse domed discs having slip or tear-away design (without knife blades). This type of bursting disc vents by being expelled downstream from the holder. A catching device may be provided.

d) Others. Other types of reverse domed bursting discs may be used providing they meet the requirements of this International Standard.

8.4 Graphite bursting discs

Graphite bursting discs are designed to fail by bending or shearing forces.

Graphite bursting discs are normally flat (see figure 6) and are designed such that upon bursting a full bore opening is obtained.

8.4.1 Replaceable element bursting disc

Holders are required for use with replaceable element bursting discs. Figure 6 shows a typical replaceable element bursting disc.

8.4.2 Monobloc bursting disc

This bursting disc is installed directly between flanges, no separate holders being required. Three typical monobloc designs are illustrated.

Figure 7 shows a design in which the bursting pressure shall only be applied to the flat face of the monobloc bursting disc.

Figure 8 shows a similar bursting disc but the design is such that the bursting pressure shall only be applied into the recess.

For this type of bursting disc, the bore of the vent side mounting local to the disc shall follow the manufacturer's instructions. Normally this bore will be greater than the inside diameter of the recess.

Figure 9 is typical of designs where the bursting disc has a recess on both sides and in which the bursting pressure shall only be applied into the smaller recess.

8.4.3 Others

Other types of graphite discs may be used providing they meet the requirements of this International Standard.

8.5 Other designs

Other designs, including flat bursting discs (see figure 3), are allowed providing that they meet the requirements of this International Standard.

9 Bursting disc holder

9.1 Materials

The material(s) of the bursting disc holder shall be as agreed between the manufacturer and purchaser. The use of corrosion-resistant material(s) for the vent side is recommended because corrosion of this part of the bursting disc holder may cause damage to the disc, leading to premature failure when pressure is applied.

9.2 Design

9.2.1 The bursting disc holder has a substantial influence on the bursting pressure and the correct operation of the disc; it shall adequately secure and support the disc in operation. Each bursting disc shall be used only with its correctly designed and manufactured disc holder.

A bursting disc holder when installed shall apply, or transmit, a clamping load sufficient to ensure the correct operation of the bursting disc.

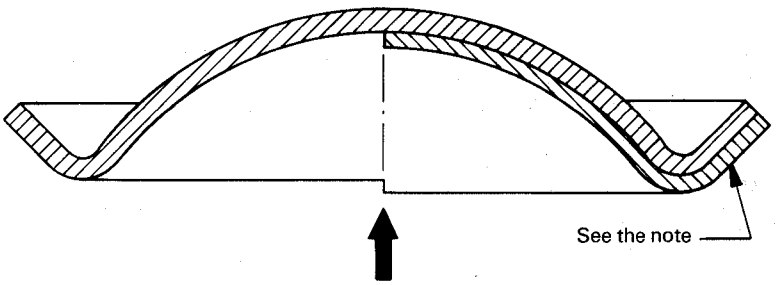

Figure 1 — Conventional domed bursting disc with angle seat

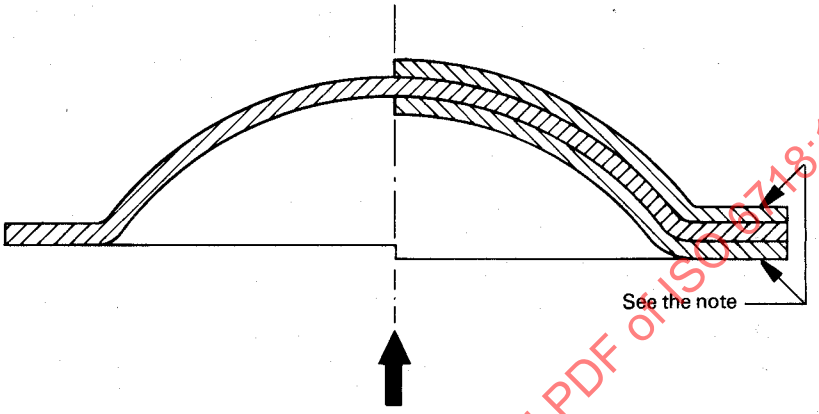

Figure 2 — Conventional domed bursting disc with flat seat

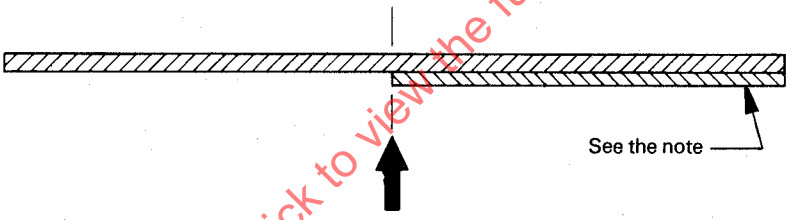

Figure 3 — Flat bursting disc

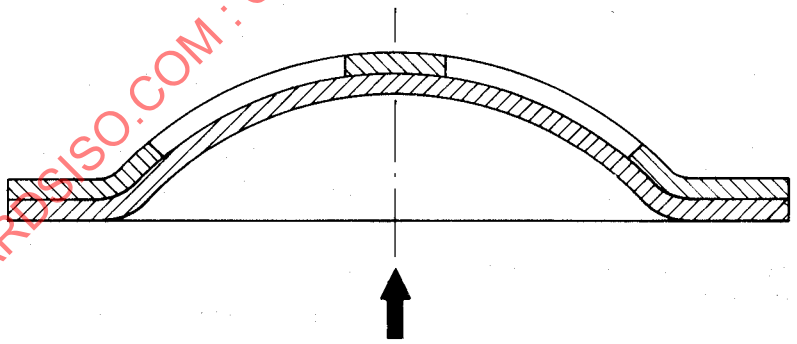

Figure 4 — Slotted lined bursting disc

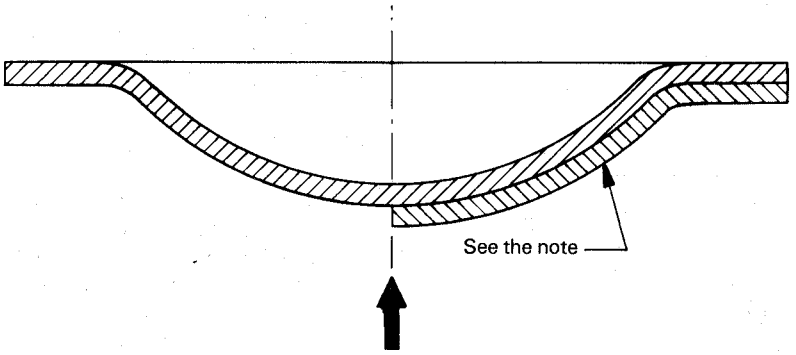

Figure 5 — Reverse domed bursting disc

NOTE — Bursting disc types may be multilayered.

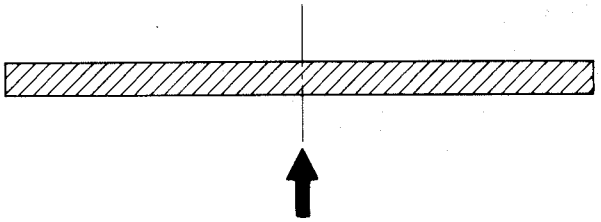

Figure 6 — Replaceable element bursting disc

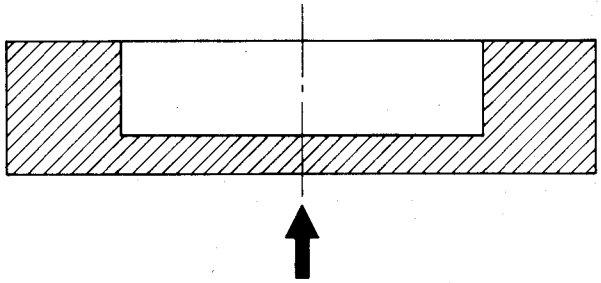

Figure 7 — Monobloc bursting disc recessed on the outlet side

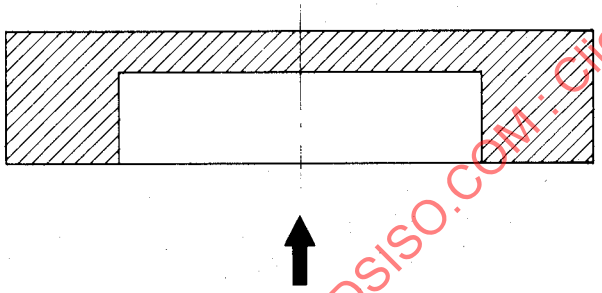

Figure 8 — Monobloc bursting disc recessed on the inlet side

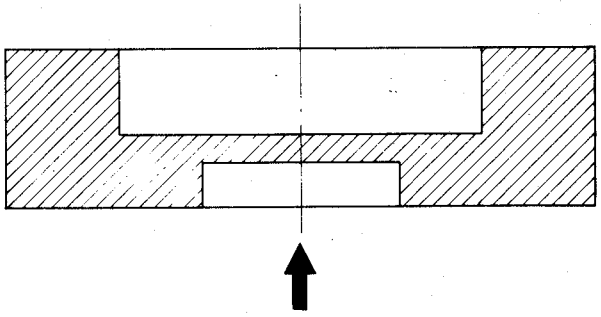

Figure 9 — Monobloc bursting disc recessed both sides

9.2.2 The design of a bursting disc holder shall be such that, for practical purposes, the bursting disc assembly is effectively sealed when correctly installed.

9.2.3 The bursting disc holder as supplied by the manufacturer shall not be modified in any way except with the approval of the manufacturer.

9.2.4 Wherever practicable, the thickness of the bursting disc holder orifice flange in which the dome of the disc protrudes shall be greater than the height of the dome of the bursting disc so as to prevent damage to it during installation. If this is not practicable, other means may be used to protect the bursting disc during installation.

9.3 Types

9.3.1 Capsule/insert bursting disc holder (see figure 10)

A capsule/insert bursting disc holder is designed to be installed centrally within the flange bolts. Accurate centralization of the bursting disc device within the supporting flanges is essential for correct bursting disc functioning and effective flange gasket sealing. Centralization may be achieved by one of the following means as agreed by manufacturer and user :

a) the outside diameter should be such that the bursting disc holder or device is accurately located within the bolts of the supporting flanges;

b) by use of locating collars;

c) by manual adjustment during fitting;

d) by other suitable means.

9.3.2 Full diameter bursting disc holder (see figures 11 and 12)

This type comprises a pair of flanges or other housing which normally has the same outside diameter as any companion flanges. The connections to the mating pipework may be threaded, welded or flat, depending on user requirements.

9.3.3 Union bursting disc holder (see figure 13)

This type consists of an inlet and outlet member connected by a union nut. The connection for the inlet may be threaded or welded. The connection for the outlet may be threaded, welded, free-vented or muffled.

9.3.4 Plug/screw bursting disc holder (see figure 14)

This type consists of two or more parts screwed together locating a replaceable bursting disc. The inlet connection may be welded or threaded. The outlet connection may be welded, threaded, free-vented or muffled.

This type of bursting disc holder is generally suited to small sizes and a wide range of pressures. If installed in pipework an additional connection may be required to facilitate installation and removal of the bursting disc.

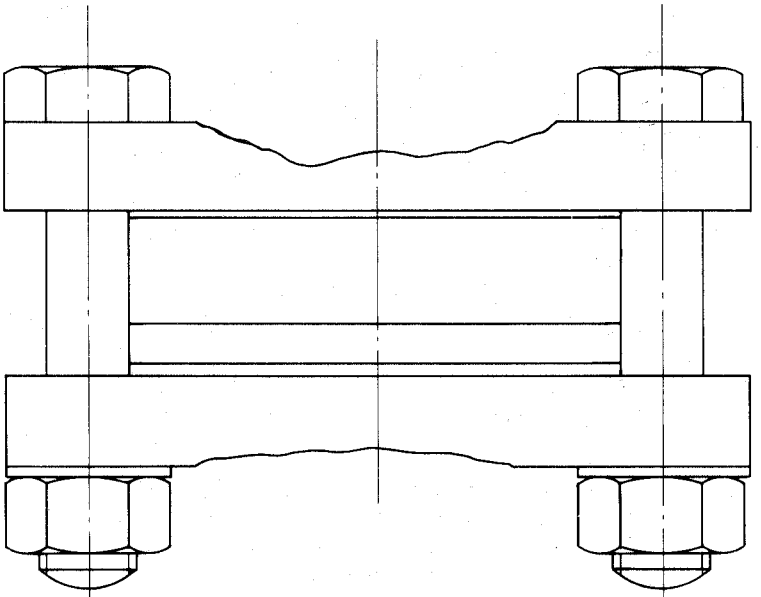

Figure 10 — Capsule/insert bursting disc holder

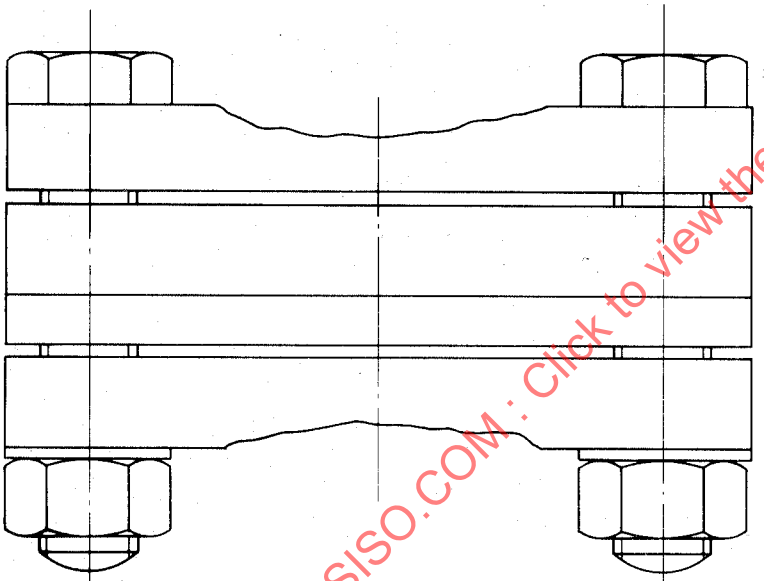

Figure 11 — Full diameter bursting disc holder

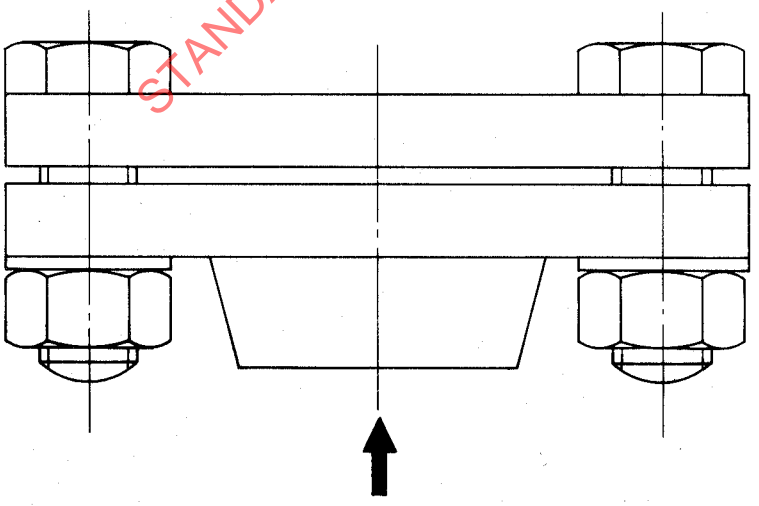

Figure 12 — Full diameter bursting disc holder

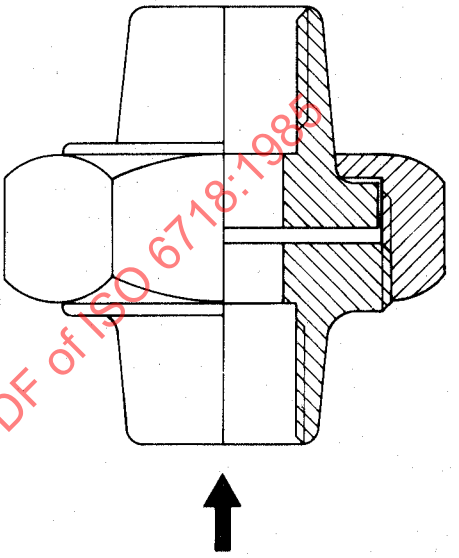

Figure 13 — Union bursting disc holder

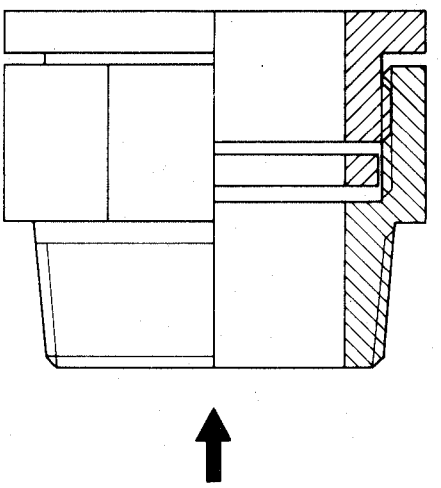

Figure 14 — Plug/screw bursting disc holder

9.3.5 Other bursting disc holders

Other types of bursting disc holder are also available meeting the requirements of this International Standard.

10 Back pressure supports

10.1 General

Where a bursting disc may be subjected in service to a back pressure differential, it shall be fitted with a back pressure support unless the bursting disc itself is strong enough to support the pressure differential. The inclusion of a back pressure support may reduce the discharge capacity and shall be taken into account when selecting bursting disc size.

The bursting disc and back pressure support shall be supplied by the manufacturer, preferably as an assembly to ensure that

a) there is a correct fit between the back pressure support and bursting disc to prevent damage to the disc;

b) the back pressure support is fitted to the correct side of the bursting disc as designed by the manufacturer.

The back pressure support shall be such that the bursting disc assembly is not deformed when subjected to the back pressure specified.

The edges of the slits and/or perforations shall be free from all burrs or similar imperfections that might cause a premature failure.

10.2 Opening back pressure supports

The opening back pressure support shall fit closely against the bursting disc so as to give support to part of its area. The support shall be slit or perforated to transmit the pressure in the system to the bursting disc.

If there is not adequate discharge capacity through the slits and/or perforations, the back pressure support shall open when submitted to a pressure not exceeding the minimum bursting pressure at the coincident temperature of the associated bursting disc. The support shall open to provide a free area sufficient to permit the discharge of the contents of the system within the requirements of clause 6 when the disc has burst.

10.3 Non-opening back pressure supports

The non-opening type of back pressure support shall fit closely against the bursting disc to give support to part of its area. The support shall be perforated with one or more holes to provide a free area sufficient to permit the discharge of the contents of the system within the requirements of clause 6.

11 Temperature shields

A temperature shield shall be used to protect a bursting disc fitted with a back pressure support only when specifically recommended by the bursting disc manufacturer.

12 Stiffening rings

Fragile bursting discs may be fitted with stiffening rings for easier handling.

13 Gaskets

Gaskets used on either or both sides of a bursting disc shall be compatible with the chemical, thermal and mechanical demands of the application. The use, type, material thickness and diameter of the gasket shall follow the bursting disc manufacturer's recommendation.

Section three: Protection from corrosion

14 General

Bursting disc devices are frequently required to work in corrosive environments. Materials likely to be affected by corrosion may be protected by coating, plating, lining or other suitable means which shall only be supplied by the bursting disc device manufacturer.

14.1 Coatings

Coating shall be applied by a suitable method to give an even and homogeneous coating to the surfaces to be protected. The continuity of coatings shall be checked by suitable means; for example, in the case of plastics coated bursting discs, a suitable method is electrostatic testing.

14.2 Plating

Plating shall be applied by a suitable method to give an even and homogeneous plating to the surface to be protected. The continuity of plating shall be checked by suitable means.

14.3 Bursting disc linings

The linings where possible should be attached to the bursting disc so as to preserve them as a set or integral unit.

Section four: Inspection and testing

15 Inspection

After manufacture all bursting discs shall be visually inspected. Any bursting disc exhibiting defects which may affect its performance shall be discarded.

Bursting discs made from foil less than 0,2 mm thick shall be examined, for example over a suitable light box using an intensity of light not less than 5 000 lm/m^2, and discarded if they appear porous.

16 Testing

A number of completed bursting discs shall be selected at random from each batch and be subjected to test as specified in 16.1. The number selected shall be in accordance with table 1. The results obtained shall be the basis for acceptance or rejection of the batch when compared to the user's specification.

The tests should normally be carried out at room temperature. Testing at coincident or other temperatures may be carried out as agreed between the bursting disc manufacturer and the user or as required by an appropriate national standard or regulation.

16.1 Burst testing of sample bursting discs

16.1.1 General requirements

16.1.1.1 The sample bursting discs shall be burst in a holder or test die identical in orifice size and orifice configuration with that in which the bursting disc will be installed.

16.1.1.2 In the case of reverse domed bursting discs, the holder shall be connected to a pressure system which has a capacity sufficient to avoid a significant pressure drop during bursting disc reversal.

16.1.1.3 A clamping load shall be applied in accordance with the manufacturer's specification.

16.1.1.4 The testing apparatus shall include pressure measuring equipment.

The error of pressure gauges used during the test shall not be more than 0,5 % of full scale reading, with the test pressure within the middle third of the instrument range. Other pressure sensing devices which provide an equivalent or higher degree of accuracy may be used.

16.1.1.5 The pressure sensing device shall be located as near as possible to the bursting disc inlet and connected to it in such a way as to minimize pressure drop.

16.1.2 Procedure

16.1.2.1 With one of the bursting disc devices installed, increase the pressure at the device inlet to 90 % of the minimum expected burst pressure in a time not less than 5 s. Thereafter increase the pressure at the device inlet at a rate not exceeding 1 % per second of the specified burst pressure until the disc bursts or vents. Record the bursting pressure and any other pertinent characteristics.

16.1.2.2 When testing with gas it is particularly important to ensure that the appropriate safety precautions are observed.

16.1.2.3 When required by the appropriate standard, an independent authority shall witness the test.

Table 1 — Number of bursting discs to be tested

Total number of bursting discs in batch	Number of bursting discs 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 1 000	3 % but not less than 10

NOTES

1 Discarded and test bursting discs do not count as part of the number of the batch.

2 For batches above 1 000 the number of test bursting discs shall be agreed between the manufacturer and user or his agent.

3 Any agreement to vary the number of bursting discs to be tested shall be based upon appropriate standards.

Section five: Marking and identification

17 Marking

17.1 Bursting discs

17.1.1 Each bursting disc shall be permanently marked where possible (see 17.1.2 to 17.1.4) with the following minimum information :

a) manufacturer's identity;

b) nominal bore, stating unit;

c) material identity;

d) maximum and minimum specified bursting pressures and coincident temperature, stating units,

or

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

NOTE — The range of pressure between the maximum and minimum specified bursting pressures will be equivalent to the performance tolerance.

e) the number of this International Standard;

f) vent side;

g) monobloc bursting discs only — direction of flow arrow on the outside diameter;

h) where appropriate, torque loading, number and size of bolts required to clamp;

j) a physical coding system such as pins and slots applied to a holder and bursting disc may be used in addition to the marking on the bursting disc — the holder for such a combination shall be permanently marked with all information plus the code reference available;

k) appropriate bursting disc holder identity.

The method of marking shall not impair performance.

17.1.2 Where possible, each bursting disc shall be marked, tagged or labelled in accordance with 17.1.1 such that the information is visible after installation.

17.1.3 Where the physical size of the bursting disc is so small that it can only bear the vent side identification mark, a suitable individual package bearing the other markings required by 17.1.1 shall be used to contain the bursting disc until it is mounted. A tag bearing the same markings should be included in the package.

17.1.4 Where identification marks cannot be seen when the bursting disc assembly is installed in the system, the user shall be responsible for attaching to the installation a suitable tag which shall be permamently marked with the information placed on the bursting disc or in the package.

17.2 Bursting disc holder

Each bursting disc holder shall be permanently marked on the outside diameter with the following minimum information :

a) manufacturer's identity;

b) bursting disc holder identity;

c) nominal size;

d) material identity;

e) direction of flow arrow;

f) the number of this International Standard.

17.3 Ancillary components

Ancillary components, such as temperature shields, which may be supplied separately from a bursting disc assembly, when appropriate, shall be marked to indicate direction of flow.

18 Packaging

Bursting disc devices or their components shall be packed to prevent any damage which may impair performance.

Each container shall be permanently marked with the following minimum information:

a) manufacturer's identity;

b) nominal bore, stating unit;

c) material identity;

d) maximum and minimum specified bursting pressures and coincident temperature, stating units,

or

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

e) the number of this International Standard;

f) the bursting disc holder identity where appropriate.

Installation and assembly instructions shall be provided if required by the user.

Where components of the bursting disc assembly, for example back pressure supports, are to be supplied separately then the containers shall be marked with the appropriate cross-reference.

Section six : Test certificates

19 Details required

If specified by the user, the bursting disc manufacturer shall provide for each batch or part of batch, a test certificate stating that the bursting discs have been manufactured and tested in accordance with the requirements of this International Standard, and giving the following minimum information :

a) nominal bore, stating unit;

b) maximum and minimum specified bursting pressures and coincident temperature as specified by the user for the application,

or

specified bursting pressure and performance tolerance and coincident temperature and positive and negative tolerances applicable;

c) information as in b) correlated to the conditions of the test;

d) any further information regarding bursting pressure/temperature, if requested by the user;

e) the actual bursting pressures and temperatures recorded when the test bursting discs were burst;

f) the material(s) of the bursting disc and components supplied;

g) name of the manufacturer;

h) manufacturer's identification mark;

j) inspection authority identification;

k) batch identification;

m) the number of this International Standard;

n) endorsement that tests reported have been carried out.

Annex

Discharge capacity

A.1 General

The following equations are given for the dimensioning of discharge area where flow through the discharge system is controlled by the bursting disc assembly and the geometry of the inlet and outlet of the vent system from the vessel.

The equations are not suitable for determining discharge areas in vent systems where the flow is controlled or "choked" by some other mechanism. In particular the equations should not be used to determine discharge where:

a) there is significant frictional pressure drop in the line before the bursting disc;

b) there is significant frictional pressure drop in the line after the bursting disc;

c) where two-phase gas-liquid flow occurs, either because it is two phase at inlet, or because some or all of the liquid flashes to gas in the vent (this commonly occurs with exothermic reactions);

d) for explosive reactions or where reactions continue in the vent line.

A.2 Gases and vapours

The general equation is:

$$Q_m = \frac{\psi \alpha A p}{0{,}179\ 1} \sqrt{\frac{M}{TZ}}$$

or

$$A = 0{,}179\ 1\ \frac{Q_m}{\psi \alpha p} \sqrt{\frac{TZ}{M}}$$

or

$$q_m = pC\alpha \sqrt{\frac{M}{TZ}}$$

where

$$q_m = \frac{Q_m}{A}$$

$$C = \frac{\psi}{0{,}179\ 1}$$

ψ is the discharge function;

α is the discharge coefficient (equal to 0,62 or as established in the appropriate standard);

Q_m is the discharge capacity, expressed in kilograms per hour;

A is the discharge area, in millimetres squared;

p is the inlet absolute pressure, in bars absolute [1];

M is the molar mass, expressed in kilograms per kilomole (some values are given in table 2);

T is the inlet absolute pressure, in kelvin;

Z is the compressibility factor (this may be assessed from figure 15; table 2 gives values of critical temperature and pressure for some gases to assist in the determination of this factor — however, if insufficient information is available, a value of 1,0 may be safely assumed).

For subcritical pressure ratios

$$\frac{p_a}{p} > \left(\frac{2}{\kappa + 1}\right)^{\frac{\kappa}{\kappa - 1}}$$

$$\psi = \sqrt{\frac{\kappa}{\kappa - 1}} \cdot \sqrt{\left(\frac{p_a}{p}\right)^{\frac{2}{\kappa}} - \left(\frac{p_a}{p}\right)^{\frac{\kappa + 1}{\kappa}}}$$

For critical pressure ratios or less

$$\frac{p_a}{p} \leqslant \left(\frac{2}{\kappa + 1}\right)^{\frac{\kappa}{\kappa - 1}}$$

$$\psi = \psi_{max} = 0{,}707\ 1 \sqrt{\kappa \left(\frac{2}{\kappa + 1}\right)^{\frac{\kappa + 1}{\kappa - 1}}}$$

Values of ψ may be obtained from figure 16.

p_a is the back pressure, in bars absolute [1];

κ is the isentropic exponent of the gas. (This will vary, for a particular gas, according to inlet temperature and pressure conditions. Table 2 gives values for κ for a number of common gases and vapours at ambient temperature and pressure.)

1) 1 bar = 10^5 Pa