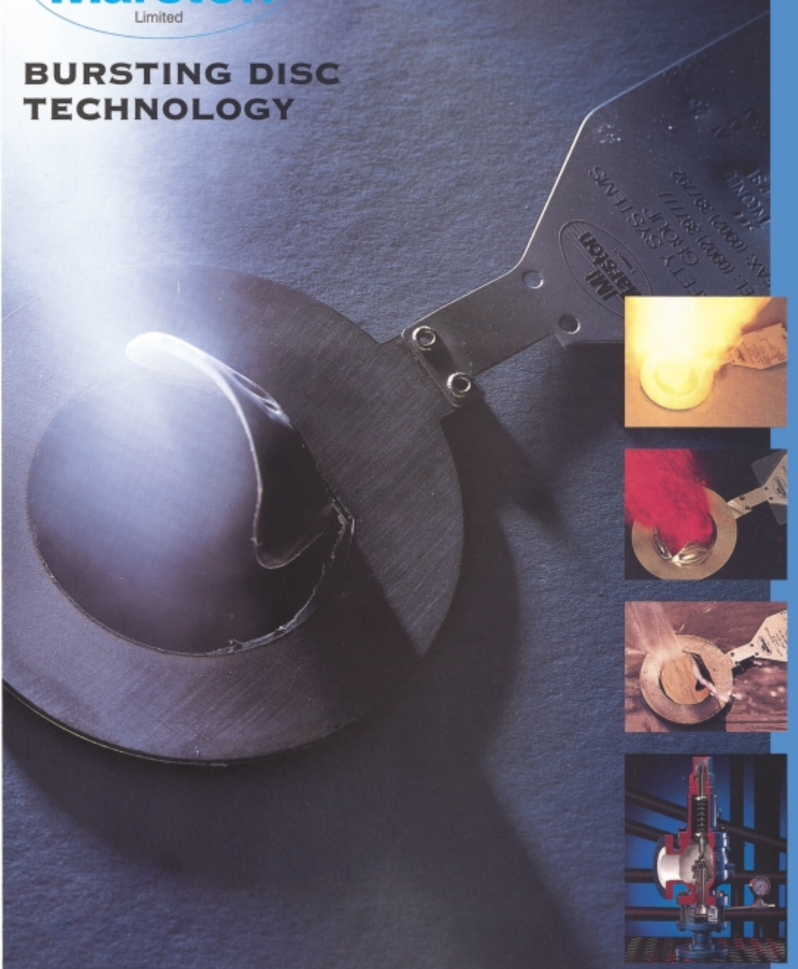
IMI Marston Limited

BURSTING DISC TECHNOLOGY



The Secret of your Success

IMI Marston Ltd
Wobaston Road, Fordhouses
Wolverhampton, WV10 6QJ, UK.

Tel +44 (0)1902 397777
Fax +44 (0)1902 397788
Email info@imimarston.co.uk

Simply photocopy and fax to us for more information on...

- ☐ Conventional discs
- ☐ Reverse buckling discs
- ☐ Graphite discs
- ☐ Explosion vent discs
- ☐ Computer disk for bursting disc sizing

	Yes	No
Do you currently use discs and/or explosion panels?	☐	☐
Do you currently have an application for which you would like our assistance?	☐	☐
Would you like one of our engineers to contact you?	☐	☐

Name:

Position:

Company:

Nature of business:

Address:

Post Code:

Country:

Tel No:

Fax No:

E-mail:

Worldwide Regional Offices

As part of IMI Marston's commitment to serving its customers, several regional offices have been established across the world. Local representatives are also available for consultation throughout the world. Contact details can be supplied on request.

IMI Marston Deutschland
Wiesenweg 6, 21524 Brunstorf, Germany.
Tel: +49 04151 7377 Fax: +49 0451 7327

IMI Safety Systems, Singapore
203A Goldhill Centre, Thomson Road, Singapore 307638.
Tel: +65 2546211 Fax: +65 2548442

IMI Safety Systems, Houston
1325 South Creek Drive, Suite 300, Houston, TX77084, USA
Tel: +1 281 4928377 Fax: +1 281 4928801

IMI Safety Systems Beijing
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Tel: +86 10 65010350 Fax: +86 10 65010286

LOCAL DISTRIBUTOR

Fax back to us on
Fax: +44 (0)1902 397788

IMI
a subsidiary of IMI plc

BS EN ISO 9001

BSI REGISTERED FIRM
Q 06285

Catalogue No. MTEC/August 98

IMI Marston Limited

BURSTING DISCS

A Technical Guide

IMI MARSTON LTD.
A HISTORY OF EXPERIENCE WITH THE TECHNOLOGY FOR THE FUTURE.

IMI Marston's Safety Systems Group has over 40 years' experience of the design, manufacture and application of bursting disc equipment.

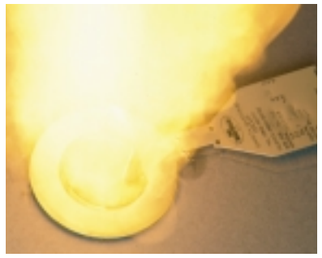
The applications for bursting discs are as diverse as the industries that use them. Chemical, oil, gas and food as well as cryogenic and transportation are typical examples. The selection of the most suitable bursting disc can be critical, however our extensive range of bursting disc designs can provide the optimum choice.

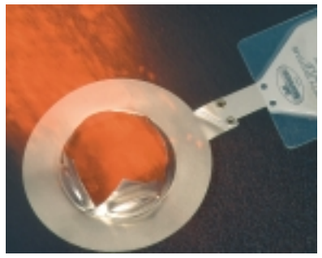
IMI Marston offers a comprehensive range of products - from simple single discs to complex multi-disc devices. A team of technical engineers is always available to discuss your application and to offer advice. Customers' requirements may be satisfied by using a standard device, but when this is not practical, IMI Marston can offer a customised design.

TECHNICAL RESOURCES

To maintain our position at the forefront of bursting disc technology, the Safety Systems Group can call upon the wide range of technical resources available within both IMI Marston and the IMI group of companies. These state-of-the-art facilities include:

- HIGH TEMPERATURE TESTING
- HELIUM LEAK TESTING
- CAD/CAM
- PRESSURE CYCLING
- RADIOGRAPHIC INSPECTION
- LASER CUTTING TECHNOLOGY
- FLOW TEST LABORATORY





QUALITY

IMI Marston is fully committed to a programme of Total Quality Management which is focused on providing customer satisfaction and confidence. The concern with quality is evident at all levels within the organisation and has become an integral part of all processes,

IMI Marston maintains stringent control of design, development, testing and production to ensure that the highest quality standards are achieved in accordance with BS EN ISO 9001.

IMI Marston's products carry a wide range of approvals and comply with the highest International standards and customer specifications including:-

BS 2915
A. D. Merkblatt A 1
I.S.P.E.S.L.
ASME Section VIII
ISO 6718
Stoomwezen
Chinese Safety Quality Licence

Other Accreditations include:-
TUeV - A.D. Merkblatt H.P.O.
Urzad Dozoru Technicznego
BASEEFA (British Approvals Service for Electrical Equipment in Flammable Atmospheres)

TESTING AND CERTIFICATION

IMI Marston bursting discs are batch tested in accordance with relevant British or other National standards and a test certificate is supplied for each batch of discs.

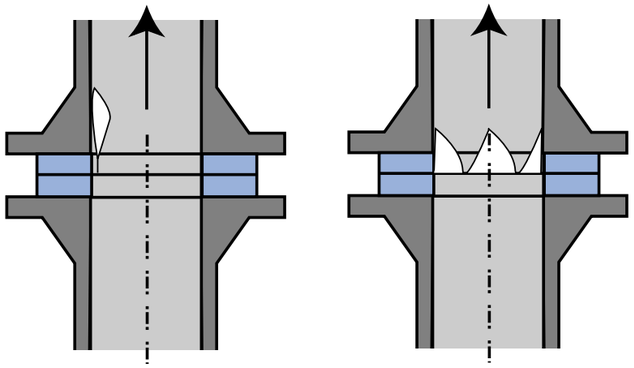
If required by the customer, arrangements can be made for the batch test procedures to be witnessed by accredited external inspection authorities.

The performance of a bursting disc is dependant on its mounting arrangements. The use of discs in holders or mounting arrangements not approved by IMI Marston will invalidate certification.

Profile

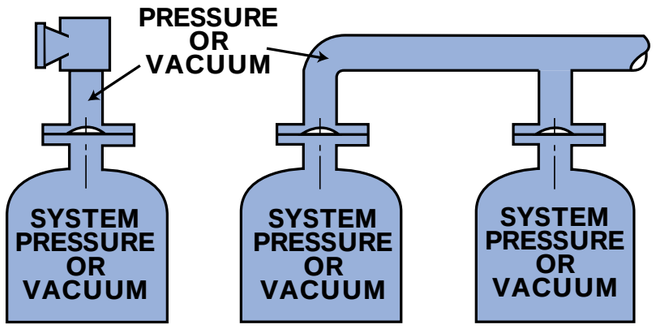
Quality Assured

All pressurised systems, conforming to the appropriate National and International standards, are limited to a maximum overpressure during pressure relief. In accordance with the E.C. Pressure Equipment Directive (P. E. D.), all pressure equipment defined therein must have a pressure relief or control system that limits the maximum overpressure to 1.1 x the maximum allowable design pressure of the equipment. A bursting disc safety device is a recommended means for pressure relief, and in some cases the preferred device. It is also used as the ultimate safety device should other pressure limiting equipment fail to function correctly. IMI Marston bursting discs fulfil these requirements to protect the pressurised equipment.



A bursting disc, often referred to as a rupture disc or a safety disc, is a non-reclosing pressure relief device. The resultant release of the contents from the protected system must be controlled in accordance with local, National and applicable E. C./International rules and may necessitate the need for a fully contained relief system.

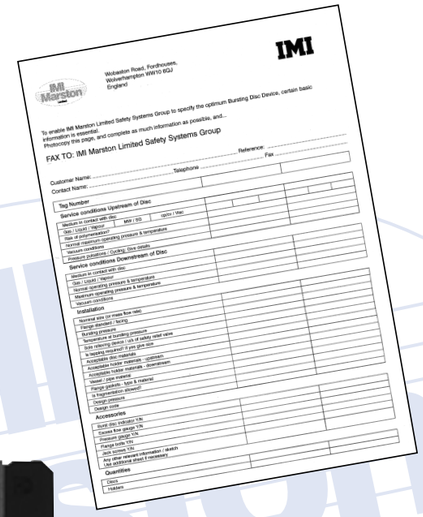
The use of a correctly designed bursting disc device, its assembly and fitting is essential. Bursting disc devices are often fragile and need to be handled with care. They normally require a dedicated holder assembly.

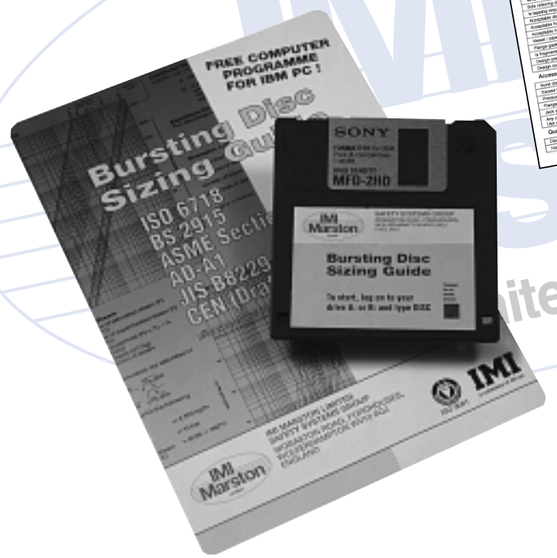


Bursting disc devices function due to the differential pressure applied across the disc. All pressures acting on the disc, including those induced by vent-side pressure, vacuum, system draining or cleaning, must be considered during specification.

Choosing the most appropriate bursting disc device for a particular application depends on a number of key factors. This guide has been designed to assist the disc selection process.

A Bursting Disc Application Form is included which details the technical information necessary for IMI Marston to offer the best solution.





Please note - the choice of a bursting disc is just the beginning of the process. By working together with IMI Marston and using our technical expertise and experience, a cost effective solution, using standard or specially designed equipment, will be assured.

This guide briefly describes the various bursting discs and the advantages of each design. Individual product brochures contain more specific information.

A policy of continuous improvement and product development ensures that IMI Marston is able to meet the demand for increased safety protection.

INDEX

Identification

PRODUCT IDENTIFICATION

Identification and traceability of the thousands of bursting discs and holders in use across the world today is critical.
At IMI Marston, every item carries a marking that can be traced back to its original manufacture.

Each bursting disc device supplied by IMI Marston is allocated a unique equipment number that provides exact identification. All details of manufacture including material identity for each item supplied are recorded and archived. Details can be tracked back over 40 years.

HOLDER LABEL

DISC TAG

The equipment number is shown on the holder label, disc assembly tag and also on the test certificate that is supplied with each batch of discs.

Following the original supply, subsequent batches of bursting discs add a suffix letter to the equipment number to provide batch identification.

Example:
Original supply :
Holder 'E' No. NT 1234
Bursting disc 'E' No. NT 1234
(including reverse pressure support if required)
First re-order
of bursting discs 'E' No. NT 1234 / A
Second re-order
of bursting discs 'E' No. NT 1234 / B

Note:
The equipment number together with an adequate description including bursting pressure and temperature should be quoted for all replacement orders.

Foolproofing

FOOLPROOFING FEATURES OF IMI MARSTON TAGGED BURSTING DISC ASSEMBLIES.

A wrongly installed bursting disc can be disastrous. For this reason, where possible, IMI Marston bursting disc assemblies are fitted with a foolproofing feature which is incorporated within the disc tag and holder identity label.

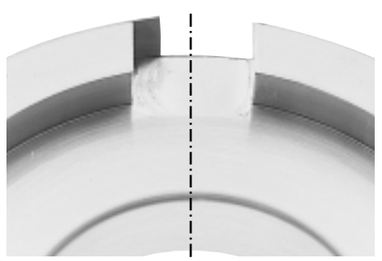
IMI Marston holders have a permanently attached stainless steel identity label. This uniquely identifies the holder type and equipment number. It also indicates the correct holder orientation relative to flow.

The disc is fitted with a notched stainless steel tag as shown below. This uniquely identifies the disc type, its equipment number and batch, the rated bursting pressure and temperature, the design code and also indicates the vent side of the disc.

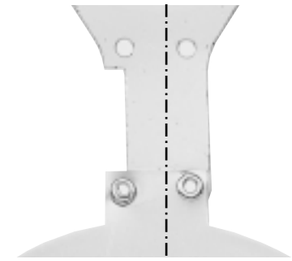
The combination of the notched tag and the offset identity label, prevents the incorrect assembly of the disc to the holder.

The holder can also be provided with installation inhibitors such as 'J' bolts. These prevent the holder from being installed incorrectly between the plant flanges. (See accessories on page 22 for details.) Other methods can be considered such as dowels, or tongue and groove flanges, to ensure correct installation.

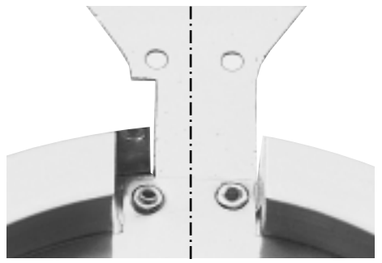
When these features are combined with IMI Marston comprehensive installation instructions, quick and simple installation is ensured.



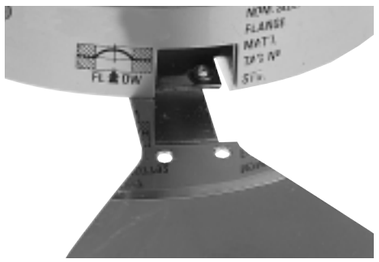
Offset label on Holder



Notched Disc Tag



Correct Assembly



Incorrect Assembly

The photographs show the offset label on the holder and the notch on one side of the neck of the disc identification tag.
These foolproofing features aid correct assembly and prevent incorrect assembly as demonstrated in the two lower photographs.

The sizing of safety discs is based on equations that are derived from general gas and liquid flow equations. They assume that flow is critical.

The discharge capacity of a discharge system should be such as to ensure that under relieving conditions the maximum allowable working pressure of the pressurised system to be protected does not exceed the limits as governed by the appropriate regulation or standard.

The equations in this section give a simplified approach neglecting pressure drops in the inlet pipe and the discharge pipe.

They should only be used when it can be safely assumed that any pressure drops are negligible.

In such cases, the flow rate is controlled by the nozzle entry configuration of the equipment and the bursting disc device.

Where the system cannot be safely assumed to be suitable for the simplified approach or the flow is sub-critical, the user should refer to the appropriate standard.

These equations are only to be used with single phase flow. Should the state at flowing conditions be two-phase then specialist advice should be sought.

NOMENCLATURE AND GENERAL GAS PROPERTIES

Nomenclature

A = required flow area (mm^2)
d = required nominal bore (mm)
F = constant for gas factor which is a function of the Isentropic coefficient and the ratio of absolute reverse pressure to absolute inlet pressure and also contains the numeric constants arising as a result of the system of units used.
$f\mu$ = viscosity correction factor. See relevant standard. For liquids with a viscosity equal to or less than water $f\mu = 1$.
k = the Isentropic coefficient at the inlet conditions (the ratio of the specific heats at standard temperature and pressure may be used).
M = molecular mass (kg/kmol)
Pb = absolute bursting pressure (bar)
Pr = absolute reverse pressure (bar)
Q = discharge mass flow (kg/hr)
T = inlet temperature (K)
v = volumetric mass (m^3/kg)
Z = compressibility factor (see relevant standard). In many cases Z approximates to unity and may be ignored.
α = coefficient of discharge
ΔP = pressure drop (bar). (Pb -Pr)
ρ = density (kg/m^3)

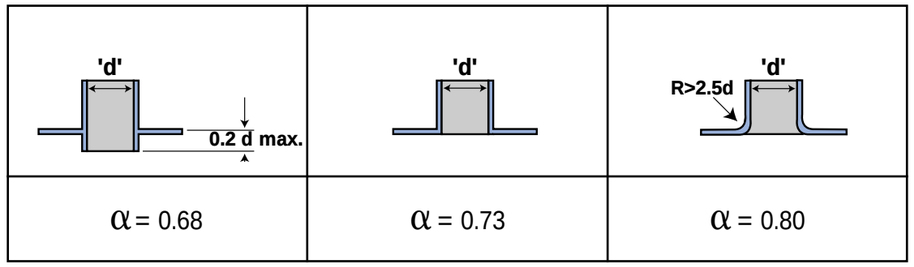
Gas	Symbol	Molecular Mass M	Isentropic coefficient k	Constant F
Acetylene	C_2H_2	26.02	1.25	2.58
Air		28.96	1.40	2.70
Ammonia	NH_3	17.03	1.31	2.64
Argon	Ar	39.91	1.66	2.86
Butane	C_4H_{10}	58.08	1.11	2.48
Carbon Dioxide	CO_2	44.00	1.30	2.63
Carbon Monoxide	CO	28.00	1.40	2.70
Chlorine	Cl_2	70.91	1.35	2.66
Chlorodifluoromethane (Arcton 22)	$CHClF_2$	86.47	1.18	2.55
Dichlorodifluoromethane (Arcton 12)	CCl_2F_2	120.91	1.14	2.51
Dichlorotetrafluoroethane (Arcton 114)	$(CClF_2)_2$	170.90	1.09	2.47
Ethane	C_2H_6	30.05	1.22	2.57
Ethylene	C_2H_4	28.03	1.25	2.60
Helium	He	4.00	1.63	2.85
Hydrogen	H_2	2.02	1.41	2.71
Hydrogen Chloride	HCl	36.46	1.41	2.71
Hydrogen Sulphide	H_2S	24.08	1.32	2.65
Isobutane	$CH(CH_3)_3$	58.08	1.11	2.48
Methane	CH_4	16.03	1.31	2.64
Methyl Chloride	CH_3Cl	50.48	1.28	2.62
Nitrogen	N_2	28.02	1.40	2.70
Nitrous Oxide	N_2O	44.02	1.30	2.63
Oxygen	O_2	32.00	1.40	2.70
Propane	C_3H_8	44.06	1.13	2.51
Propylene	C_3H_6	42.05	1.15	2.52
Sulphur Dioxide	SO_2	64.07	1.29	2.62
Trichlorofluoromethane (Arcton 11)	CCl_3F	137.37	1.14	2.51

COMPRESSIBLE FLUIDS

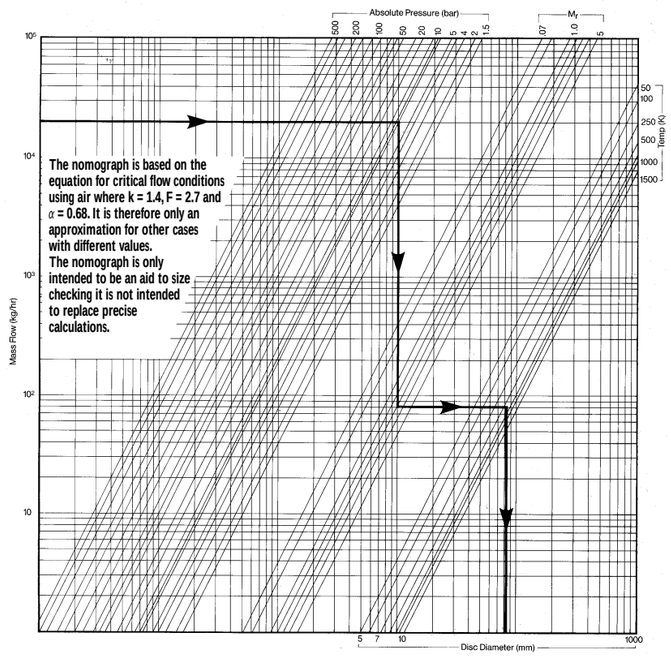
The equations and nomographs shown here are limited to those systems where: -

- The bursting disc device is installed within eight inlet pipe diameters from the entry to the equipment branch / nozzle.
- The bursting disc device discharge area is not less than 50% of the inlet pipe area.
- The length of the discharge pipe following the bursting disc device does not exceed five pipe diameters.
- The branch nozzle configurations are as given here.

The discharge coefficients for gases/vapours are:



Nomograph for Gases



Equation for gases & vapours

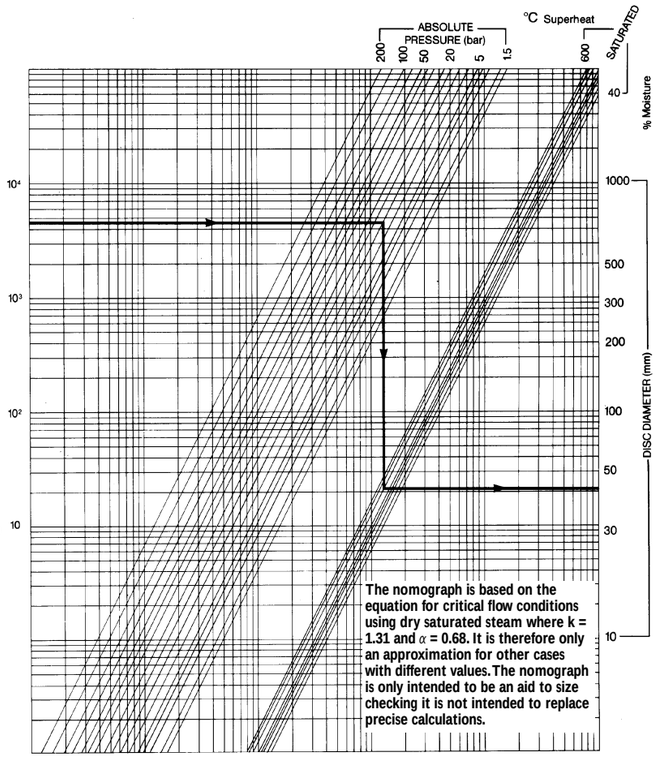
The mass flow rate or the capacity of a bursting disc (Q), is calculated from the equation.

$$Q = A \,.\, Pb \,.\, F \,.\, \alpha \,.\, \sqrt{M / T \,.\, Z}$$

Therefore the area required to discharge a given mass flow is given by the equation

$$A = \frac{Q}{F \,.\, \alpha \,.\, Pb} \sqrt{\frac{T \,.\, Z}{M}}$$

Nomograph for Steam



Equation for saturated or superheated steam

The mass flow rate or the capacity of a bursting disc (Q), is calculated from the equation.

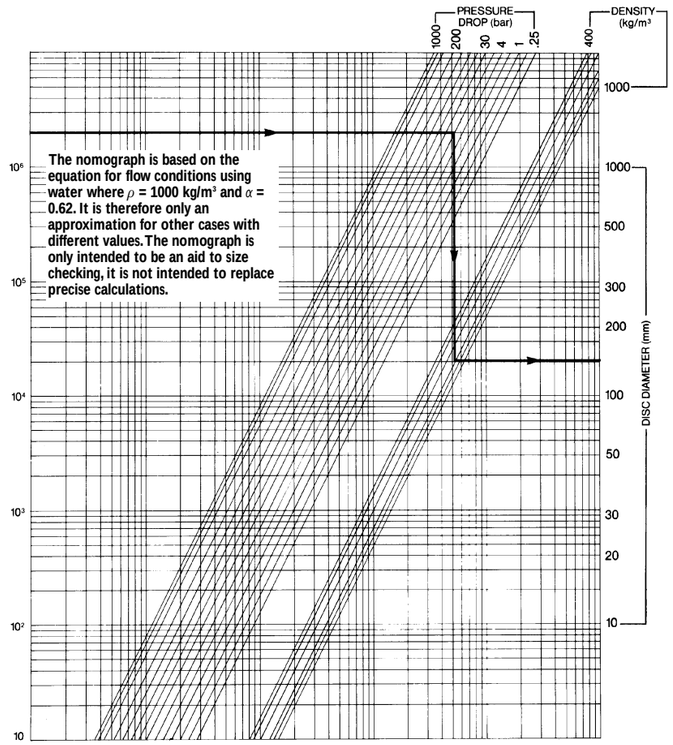
$$Q = 0.2883 \cdot A \cdot F \cdot \alpha \sqrt{Pb \cdot v}$$

Therefore the area required to discharge a given mass flow is given by the equation:

$$A = \frac{Q}{0.2883 \cdot F \cdot \alpha \sqrt{\frac{v}{Pb}}}$$

INCOMPRESSIBLE FLUIDS

Nomograph for Liquid



Equation for liquid

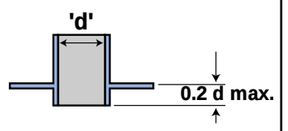
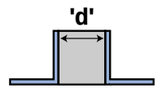
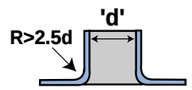
For incompressible fluids as single phase flow at the inlet, and not flashing to vapour neither partly, nor completely on venting.
The mass flow rate or the capacity of a bursting disc (Q), is calculated from the equation.

$$Q = 1.61 \cdot A \cdot f\mu \cdot \alpha \sqrt{\Delta P \cdot \rho}$$

Therefore the area required to discharge a given mass flow is given by the equation:

$$A = \frac{Q}{1.61 \cdot A \cdot f\mu \cdot \alpha \sqrt{\Delta P \cdot \rho}}$$

The discharge coefficients for liquids are:

		
α = 0.5	α = 0.62	α = 0.80

MARSTON'S SIZING PROGRAMME

IMI Marston provides a computer programme which aids the engineer when calculating the required size or capacity of a disc, within the limitations given in this section and within the programme.

Wrongly sized venting can be dangerous. It is imperative that the user complies with the requirements of the relevant codes for the sizing and use of bursting discs, in particular, that the effect of any associated pipework or restriction is taken into account.

Restrictions within the disc assembly, such as vacuum supports, should also be considered.

Correct sizing for relief venting of a system is the responsiblity of the end user

ASSISTANCE

For assistance with sizing and selection please photocopy the form overleaf. Complete and return to IMI Marston.

Enquiry Form

IMI Marston Limited

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Wolverhampton WW10 6QJ, England
Telephone +44 (0)1902 623550
Facsimile +44 (0)1902 623555
Web www.imimarston.co.uk

IMI

To enable IMI Marston Limited Safety Systems Group to specify the optimum Bursting Disc Device, certain basic information is essential. Photocopy this page, and complete as much information as possible, and...

FAX TO: IMI Marston Limited Safety Systems Group
Fax Number: +44 (0)1902 623555

Customer Name: ..... Reference: .....

Contact Name: ..... Telephone ..... Fax .....

Tag Number		

Service conditions Upstream of Disc

Medium in contact with disc									
Gas / Liquid / Vapour	MW / SG	cp/cv / Visc							
Risk of polymerisation?									
Normal maximum operating pressure & temperature									
Vacuum conditions									
Pressure pulsations / Cycling: Give details									

Service conditions Downstream of Disc

Medium in contact with disc		
Gas / Liquid / Vapour		
Normal operating pressure & temperature		
Maximum operating pressure & temperature		
Vacuum conditions		

Installation

Nominal size (or mass flow rate)		
Flange standard / facing		
Bursting pressure		
Temperature at bursting pressure		
Sole relieving device / u/s of safety relief valve		
Is tapping required? If yes give size		
Acceptable disc materials		
Acceptable holder materials - upstream		
Acceptable holder materials - downstream		
Vessel / pipe material		
Flange gaskets - type & material		
Is fragmentation allowed?		
Design pressure		
Design code		

Accessories

Burst disc indicator Y/N		
Excess flow gauge Y/N		
Pressure gauge Y/N		
Flange bolts Y/N		
Jack screws Y/N		
Any other relevant information / sketch Use additional sheet if necessary		

Quantities

Discs		
Holders		

Material Selection

MATERIAL SELECTION

Materials will normally conform to those listed below. *denotes standard materials.
Other specifications may be available.

DISC / VACUUM SUPPORT MATERIAL

Material	Short Form	B.S.	Werkstoffe	ASME / ASTM	UNS
*St.St.316 S31	X5CrNiMo 18 10 X5CrNiMo 17 12 2	BS 1501 316S	1.4401	SA-240	S31600
St.St.316 S33	X5CrNiMo 18 12 X5CrNiMo 17 13 3	BS 1501 316S	1.4436	SA-240	S31600
St.St.321 S31	X10CrNiTi 18 9 X6CrNiTi 18 10	BS 1501 321S	1.4541	SA-240	S32100
St.St.321 S33	X10CrNiMoTi 18 10 X6CRNiMoTi 17 12 2	BS 1501 321S	1.4571	SA-240	S32100
*Nickel 200	Ni	BS 3072 & 3	2.4066	SB-162	N02200
Nickel 201	Ni LC-Ni 99	BS 3072 & 3	2.4068	SB-162	N02201
*Monel 400	NiCu30Fe	BS 3072 & 3	2.4360	SB-127	N04400
*Inconel 600	NiCr15Fe	BS 3072 & 3	2.4816	SB-168	N06600
Inconel 625	NiCr22Mo9Nb	BS 3072 & 3	2.485	SB-443	N06625
Hastelloy B2	NiMo28		2.4617	SB-333	N10665
Hastelloy C4	NiMo16Cr16Ti		2.4610	SB-575	N06455
Hastelloy C22	NiCr21Mo14W		2.4602	SB-575	N06022
*Hastelloy C276	NiMo16Cr15W		2.4819	SB-575	N10276
*Aluminium	Al	BS 1470		SB-209	A91060
Copper	Cu	BS 2870		SB-152	C10200
*Tantalum	Ta Ta2.5W			SB-364 R05200 SB-364 R05252	005200 005252
Titanium	Ti Gr1 Ti Gr2 Ti Gr7		3.7025 3.7035	SB-265 Gr1 SB-265 Gr2 SB-265 Gr7	
*Graphite	C				
*FEP	FEP			D-3368	
*PFA	PFA				
*PTFE	PTFE	BS 6564			

HOLDER MATERIAL

*Carbon Steel		BS 970	1.0037	SA-105	
*St.St. 316 S31	X5CRNiMo 18 10 X5CrNiMo 17 12 2	BS 1501 316S	1.4401	SA-182	S31600
Nickel 200	Ni	BS 3072 & 6	2.4066	SB-162	N02200
Monel400	NiCu30Fe	BS 3072 & 6	2.4360	SB-127	N04400
Super Austenitic	254 SMO		1.4547		S31254
Duplex	22Cr5NiMON		1.4462		S31803
Hastelloy B2	NiMo28		2.4617	SB-333	N10665
Hastelloy C4	NiMo16Cr16Ti		2.4610	SB-575	N06455
Hastelloy C22	NiCr21Mo14W		2.4602	SB-575	N06022
Hastelloy C276	NiMo16Cr15W		2.4602	SB-575	N10276
Tantalum	Ta			SB-364 R05200	C05200

GASKET MATERIAL

The table lists the common jointing materials as shown on page 24, detailing the maximum pressures and temperatures at which they can be used.

TYPE	Material	Maximum Pressure (@20 C)	Maximum Temperature
FLAT GASKET	AFM 34	100 Bar	250 C
	AFM 30	100 Bar	200 C
	Garfite	138 Bar	550 C
	Gylon Blue	55 Bar	250 C
	PTFE	55 Bar	250 C
'O' RING	Viton	250 Bar	150 C
	PTFE	350 Bar	250 C
	Silver Plated St.St.	1000 Bar	600 C

Pressure

GUIDE TO BURSTING PRESSURES

Bursting pressure capabilities for each type of bursting disc vary depending on the design, size, material and temperature.

Please consult one of our sales engineers for bursting pressures outside the ranges quoted in the table.

MINIMUM / MAXIMUM BURSTING PRESSURES : Barg @ 20°C

Disc Types

BORE SIZE mm	NT NR *	CS *	NTG NRG *	MAXI VENT	RBH RBF	LRBH	SRBH	GR	MONO BLOC	GRB
25	0.8	1.5	4.0	12.4	1.8	3.0	1.2	1.0	1.0	0.4
	125	125	125	450	380	100	100	17.2	56	15
40	0.6	1.0	2.6	7.0	1.2	2.5	0.9	0.52	0.5	—
	83	83	83	315	380	75	65	17.2	42	—
50	0.4	0.75	2.0	5.5	0.9	2.0	0.6	0.275	0.4	0.14
	72	72	72	255	380	50	50	17.2	28	10
65	0.35	0.65	3.4	4.8	0.8	1.75	0.5	0.24	0.4	—
	50	50	50	210	175	40	40	16.5	24	—
80	0.3	0.5	2.5	3.4	0.7	1.5	0.4	0.21	0.3	0.1
	41	41	41	170	120	40	35	15.5	20	4.5
100	0.2	0.35	1.9	3.0	0.6	1.4	0.3	0.14	0.2	0.04
	36	36	36	100	90	30	25	10.3	14	2.5
150	0.14	0.3	1.4	2.0	0.5	1.25	0.25	0.07	0.2	0.04
	20	20	20	100	60	20	20	5.5	10.5	1.5
200	0.1	0.25	1.4	1.7	0.5	1.25	0.2	0.07	0.1	
	18	18	18	30	50	17.5	12.5	3.45	5.5	
250	0.1	0.2	1.4	1.7	0.5	1.25	0.2	0.07	0.1	
	12.5	12.5	12.5	25	40	12	10	2.15	4.5	
300	0.07	0.2	1.4	1.7	0.5	1.25	0.2			
	10	10	10	18	35	10	10			
350	0.07	0.15	1.4	1.7	0.5	1.25	0.2			
	9.5	9.5	9.5	18	27.5	8.5	8.5			
400	0.07	0.12	1.4	1.4	0.5	1.25	0.2			
	9	9	9	18	20	7.5	7.5			
450	0.07	0.10	1.4	1.0	1.25	1.25	0.2			
	7	7	7	16	17	7	6.5			
500	0.07	0.07	1.4	1.0	0.5	1.25	0.2			
	6	6	6	14	14	6.0	6.0			
550	0.07	0.07	-	1.0						
	5.5	5.5	-	12						
600	0.07	0.10	-	0.8						
	5	5	-	10						
750	0.07	0.10								
	4	4								

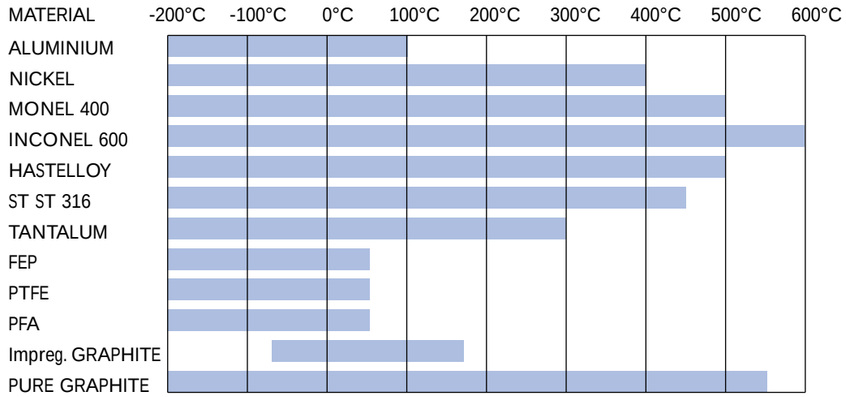
*Maximum pressures are for standard designs, for higher pressures a welded construction is also available see page 17.

Temperature

TEMPERATURE RANGES

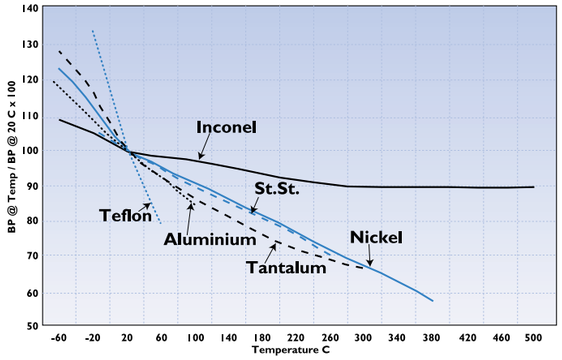
Materials for bursting discs have a limited allowable working temperature range. The table indicates the normal limits for commonly used bursting disc materials.

The limitations of joint sealing materials must be considered as well as possible corrosion from the process or environmental conditions that prevail.



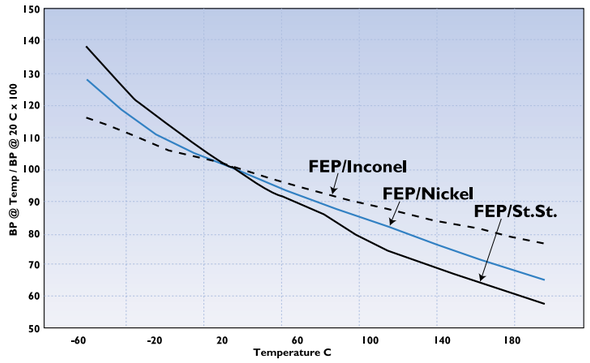
INFLUENCE OF TEMPERATURE

Bursting disc materials are affected by changes to temperature. In general, higher temperatures induce a reduction of strength and consequently bursting pressure.
The following graphs show the typical effect of temperature on various bursting disc materials for forward-acting discs :-



Temperature Effect for Conventional Type Discs

Temperature Effect for Composite Slotted Type Discs



Reverse buckling discs are generally less affected by temperature changes than equivalent forward acting discs. Each batch of reverse buckling discs will be affected differently, by factors other than just the material. A 'typical' temperature effect graph is therefore not considered to be helpful.

A **heat shield** can be fitted between the disc material and the process to provide a thermal barrier where operating conditions dictate its use. This may be to preserve the disc integrity or to reduce heat losses.

VACUUM / REVERSE PRESSURE SUPPORTS

Many simple conventional discs and most composite slotted bursting discs are unable to withstand vacuum conditions without assistance.

To allow them to be used for duties where vacuum is a possibility, even if only whilst equipment is being cleaned, a vacuum support can be fitted. Usually this takes the form of a multi-petal design Opening Type support, which when the disc bursts, opens up to provide a large flow area.

Opening Type Vacuum Supports

The vacuum support is permanently fixed to the bursting disc to ensure correct fitting. A new support does therefore have to be supplied and fitted with each bursting disc.

When calculating the disc size required, the Free Area through the support must always be considered.

In some applications, reverse pressures may exist greater than atmospheric pressure. Often an opening type support alone will be sufficient. However sometimes an additional Auxiliary support is required. This is designed to aid the opening support whilst still maintaining a large free flow area. This type of support is often used in double disc assemblies, where a secondary disc is used to prevent an often variable reverse pressure from affecting the performance of the primary disc. This is common when several bursting discs vent into a common line or flare stack. This type of support is generally re-useable, with only the opening support needing to be replaced.

Auxiliary Support

Some discs, particularly graphite, use a permanent or Non-Opening type vacuum support. These supports are not usually attached to the disc, but fit immediately upstream of the bursting disc, sometimes in a recess provided within the holder.

Non-Opening Supports

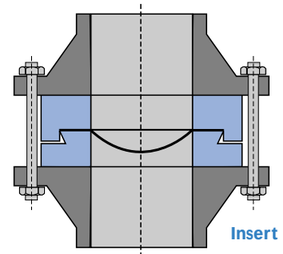
These supports follow the form of the disc, whether it be flat or domed, and have holes through which the product flows when the disc bursts. These supports are considered to be re-useable and therefore only one is required for each position.

More consideration must be given to the flow area for these supports as a typical free area through a permanent support is around 60%. See the relevant disc brochure for more details.

Generally, reverse buckling discs do not require any additional support to withstand vacuum or reverse pressure.

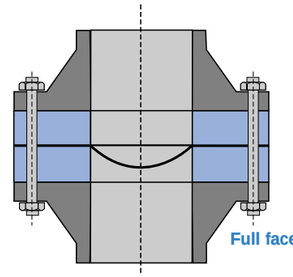
HOLDERS

The bursting disc holder can have a significant effect on the performance of a bursting disc. The holder provides an accurate location, sealing face, vent bore size and form. Generally, holders will be manufactured from stainless steel, though other materials can be supplied when required. Holders are normally non-torque sensitive.



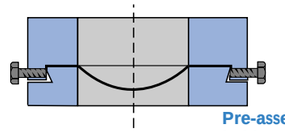
Insert type

IMI Marston provide holders specifically designed for each disc type, and to fit the particular application. Usually the holder will be an insert type; one that fits within the flange bolt circle. This provides an easier method of fitting replacement bursting discs since fewer flange bolts need to be removed. Full face holders with flange bolt holes can be supplied if required.

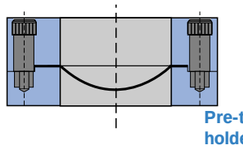


Full face type

Holders usually consists of two annular rings that provide a flat sealing flange for the bursting disc. Consequently, the performance of the disc should be unaffected by excessive flange bolt loading. (Certain graphite assemblies require close control of the flange bolt torque.) Most holders are supplied with assembly screws. These can be simply to hold the assembly together whilst fitting onto the plant, or, for pre-torque type holders, they are tightened to pre-set values to ensure an adequate joint is achieved between the disc and holder before installing onto the plant. More details of both types of holders can be found in the individual product brochures.

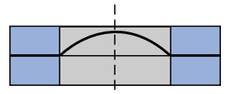


Pre-assembled holder

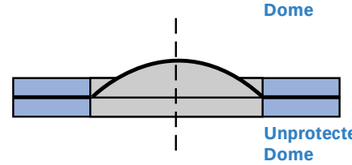


Pre-torqued holder

For sizes up to 250mm bore, the holder will usually provide dome protection. Larger sizes are often supplied without dome protection and where conditions allow, simple clamp rings may be acceptable. Where the bursting disc dome is not protected extreme care must be taken when fitting to prevent damage.

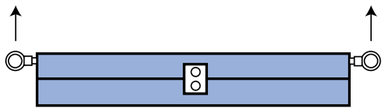


Protected Dome



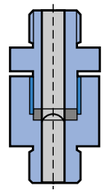
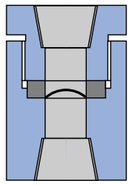
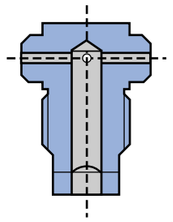
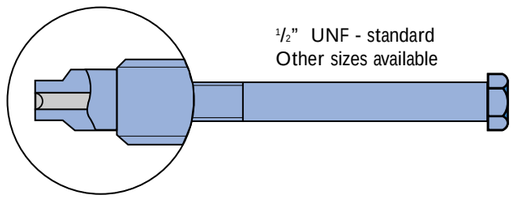
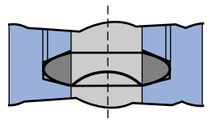
Unprotected Dome

For large assemblies, where the holder weight exceeds 25kg, or where it is considered beneficial for handling purposes, IMI Marston will make provision for suitable lifting attachments.



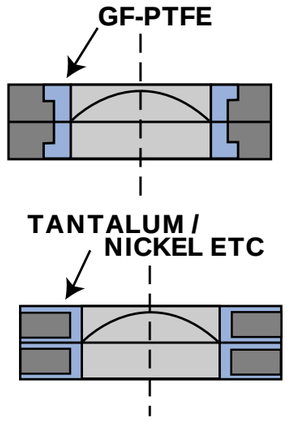
SCREWED, WELDED AND ADAPTOR TYPE ASSEMBLIES

Where simple flanged joints are not practical, alternative designs are available. IMI Marston have the experience and expertise to supply a wide variety of screwed assemblies and fully welded units, to satisfy the most arduous of requirements. These allow for screwing a disc holder unit into the main body of the pressurised vessel or for fitting directly into pipelines. Where it is practical, the discs may be scored so that they petal open. Various types are illustrated, with special designs prepared as required.

TYPE	TYPICAL CONNECTION	
AM A screwed adaptor as illustrated with male connection threads. Special designs are often manufactured to customer's requirements. The standard pressure range is up to 700 barg but higher pressures can be made to special order.		¼" to 1¼" NPT / BSP
AF A screwed adaptor as illustrated with female connection threads. Special designs are often manufactured to customer's requirements. The standard pressure range is up to 700 barg but higher pressures can be made to special order.		¼" to 1¼" NPT / BSP
WA A flanged type assembly suitable for applications up to 100 barg.		Up to 6"/150mm NB. A flanged design for installing the disc close to the process.
WA A plug type assembly suitable for applications up to 100 barg.		¼" to 1" BSP ¼" to 1" NPT
WA A stem type welded assembly for applications such as the protection of rubber or plastic extrusion presses. The disc is brazed or welded to the screwed stem		½" UNF - standard Other sizes available
LR A lens ring style bursting disc. This is another method of mounting a disc in high pressure pipework. It provides a leaktight seal at pressures up to 700 barg.		⅜" to 2" NB 8 to 50mm NB

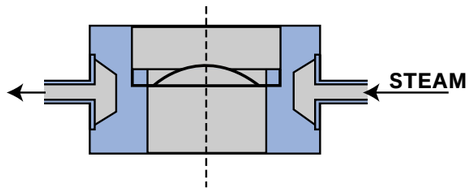
OPTIONAL FEATURES

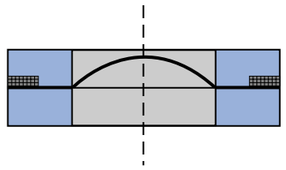
Pressure Tappings
Tappings for monitoring equipment can be incorporated in the vent-side of the holder, or in the pressure-side if required. Any thread form and size is usually possible but this may in some cases require an increase in holder dimensions.



Corrosion Protection
For corrosive environments, holders manufactured from resistant materials may prove costly. One possible alternative offered by IMI Marston is the Glass Filled-PTFE insert that also provides a non-stick surface. For extreme conditions a resistant metal liner such as nickel or tantalum may be suitable.

Steam Heating
Where the duty may be prone to polymerisation the holder can be heated. This can be achieved by introducing a chamber around the holder body and passing either hot water or steam through to prevent the product from cooling and solidifying.

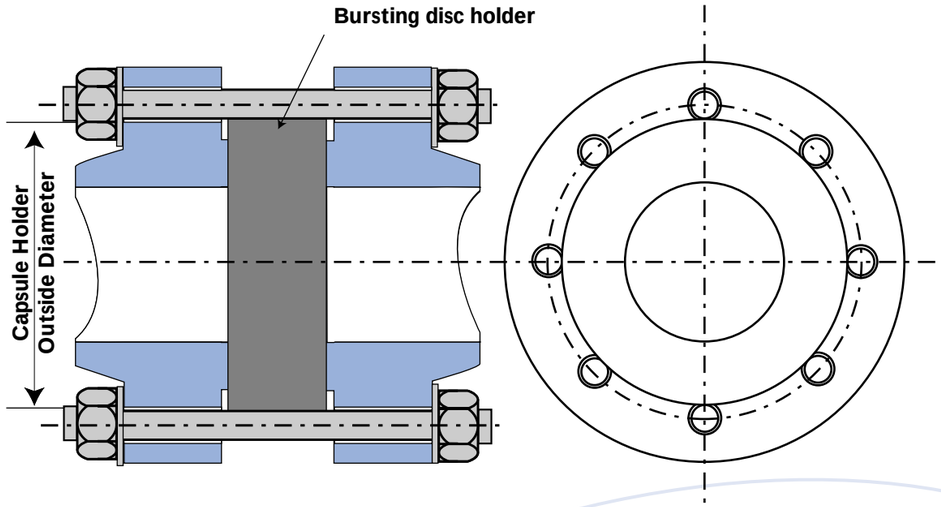




High Pressure
When the bursting pressures exceed the limits for standard holder designs to retain the disc satisfactorily, alternative designs are available. Wedge type holders can be supplied on request but their performance can be affected by possible misalignment or incorrect torque of the plant flange bolts. For this reason, IMI Marston would recommend the use of discs with welded edge rings for high pressures that fit into a simple recessed holder.

LOCATION OF HOLDER BETWEEN FLANGES

To ensure that the bursting disc holder is installed concentrically, each IMI Marston bursting disc holder has an outside diameter manufactured specifically to suit its corresponding flange.



Holder heights are available on request.

TABLE OF OUTSIDE DIAMETERS

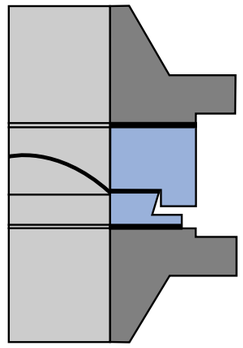
Capsule Holders, to fit within the ring of flange bolts as shown above.

Flange Rating		Holder Outside Diameter for Nominal Bores (mm)														
ANSI	PN	25	40	50	65	80	100	150	200	250	300	350	400	450	500	600
150		66	85	104	123	136	174	222	279	339	409	450	514	549	606	717
	10	73	94	109	129	144	164	220	275	330	380	440	491	-	596	698
300		73	95	111	130	149	181	251	308	362	422					
	16	73	94	109	129	144	164	220	275	331						
	25	73	94	109	129	144	170	226	266	343						
600		73	95	111	130	149	197	266								
	40	73	94	109	129	144	170	226								
900		79	98	143	165	168	205									
	64	84	105	115	140	150	176									
1500		79	98	143	165	174										
	100-164	84	105	121	146	156										
2500		85	117	146												
	250	85	111	126												

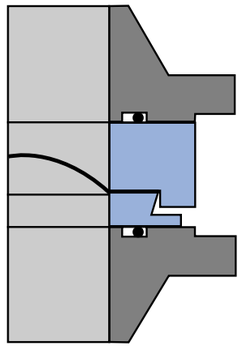
FLANGE SEALING

Bursting disc holders can usually be provided to satisfy the requirements of any type of flange sealing arrangement. The diagrams below illustrate typical examples. Flange joints (i.e. those between the holder and the mating flanges) will normally be provided by the customer. IMI Marston will supply gaskets for bursting discs that are designed to be fitted directly between flanges, such as the Monobloc graphite disc.

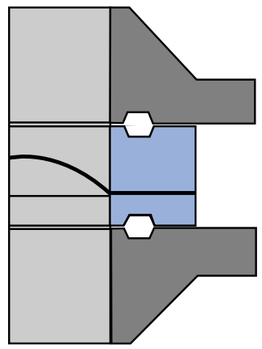
Flat gasket joint



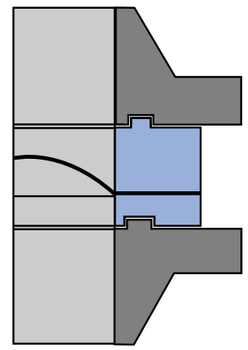
'O' ring joint for minimum leakage



Ring type joint for high pressure/temperature

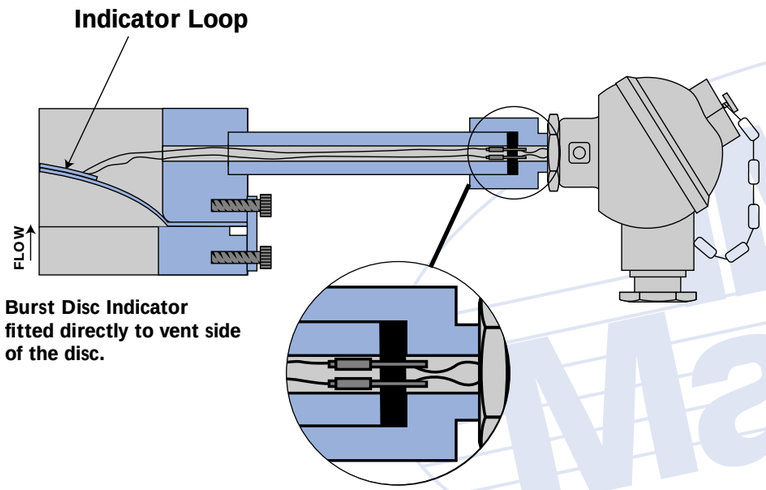


Tongue and groove



BURST DISC INDICATORS

Once a bursting disc has ruptured, it is often beneficial to shut down relevant plant equipment as quickly as possible. One common method of achieving this is to fit a Burst Disc Indicator. A Burst Disc Indicator is a simple circuit, fitted usually downstream of the bursting disc, which upon disc rupture, is broken. The signal is usually received in the plant control room. This then instigates the shutdown of the relevant equipment.



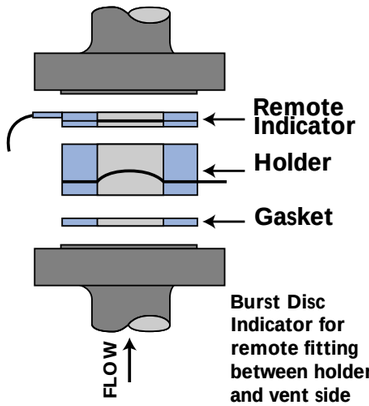
Burst Disc Indicator fitted directly to vent side of the disc.

IMI Marston manufacture two basic types of Burst Disc Indicator, one which is fitted directly to the disc, and one which is fitted between the holder and the downstream pipe flange. This can be fitted to existing disc assemblies or safety relief valves.

All of IMI Marston Burst Disc Indicators have been approved by BASEEFA to EEx ia IIC T6 (T_{amb} = 75°C); i.e. they do not induce or release sufficient electrical energy when they function to cause an explosion even in the most hazardous environment, Zone 0.

The system requires a 100mA maximum supply feed from an appropriate isolator barrier.
Note: when a Zener barrier is used, the holder must be earthed to inhibit high circulating currents.

When the indicator is fitted directly to the bursting disc, it is normal to run the electrical lead wires through a suitable connection head. For the remote indicator, the lead wires are routed through the gasket to an armoured, shielded, supply lead.

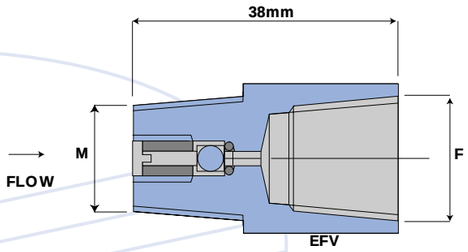


Burst Disc Indicator for remote fitting between holder and vent side flange.

Burst Disc Indicators are components which have been considered NOT to require EMC testing on their own. It is the users responsibility to ensure compliance with the EMC Directive in relation to their particular system.

EXCESS FLOW VALVES

Excess flow valves (EFV) may be fitted to prevent back pressure developing between a bursting disc and, for example, a safety relief valve during normal plant operation. The excess flow valves should be fitted in a horizontal mode. In the event of the disc rupturing, the excess flow valve will seal the vent system under the influence of the pressure pulse.

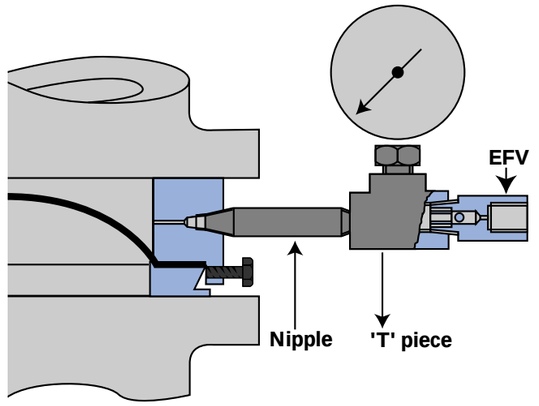


Standard Dimensions (BSP or NPT)

M	1/4”	3/4”	1/2”
F	1/8”	1/4”	3/8”

Pressure Gauges

Pressure gauges are normally supplied by the user, although IMI Marston is able to supply them on request.

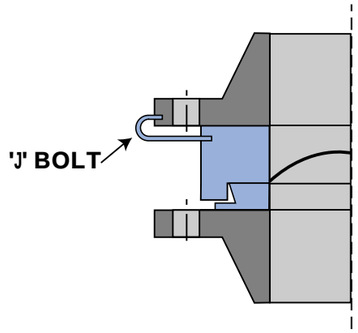


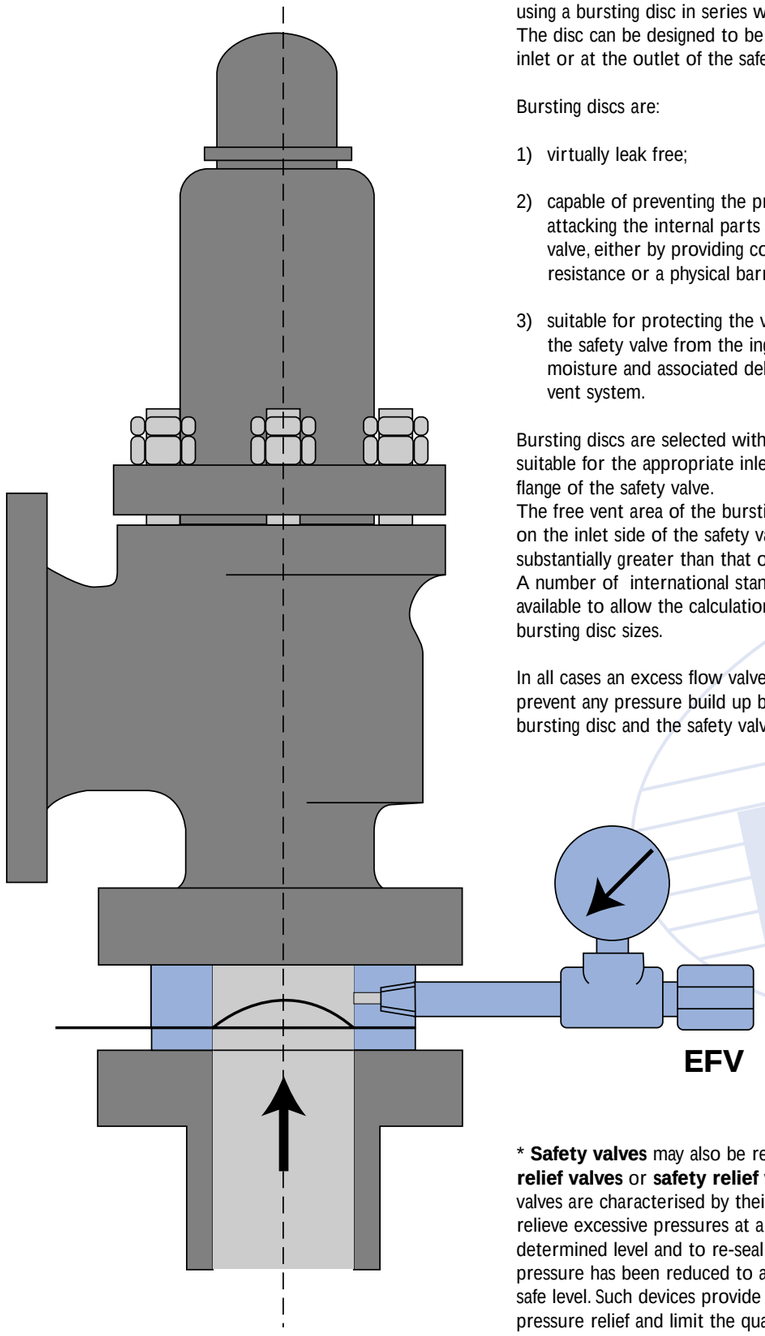
Jack Screws

To help users to separate the bursting disc holder from the system flanges during overhaul, or following an incident, jack-screws may be required. These are normally incorporated into pipe-flange drillings, although IMI Marston can supply suitable screws if requested.

‘J’ Bolt

It is important that bursting disc assemblies are mounted in the correct orientation relative to the flow direction. Although the holder is stamped with a flow arrow, and the vent-side is also shown on the holder and disc labels, it is often a requirement that the installation is ‘foolproofed’. One such example is a ‘J’ bolt as shown which is welded to the holder and locates in a corresponding hole in one of the flanges. Other methods are available.





THE PROTECTION OF SAFETY VALVES*

Safety valve service life can be prolonged by using a bursting disc in series with the valve. The disc can be designed to be fitted at the inlet or at the outlet of the safety valve.

Bursting discs are:

1) virtually leak free;

2) capable of preventing the process media attacking the internal parts of the safety valve, either by providing corrosion resistance or a physical barrier;

3) suitable for protecting the vent side of the safety valve from the ingress of moisture and associated debris from the vent system.

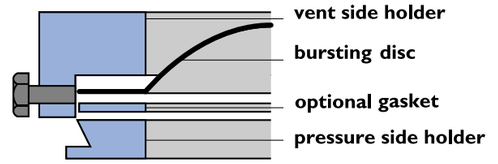
Bursting discs are selected with a bore size suitable for the appropriate inlet or vent flange of the safety valve.
The free vent area of the bursting disc used on the inlet side of the safety valve is always substantially greater than that of the valve.
A number of international standards are available to allow the calculation of suitable bursting disc sizes.

In all cases an excess flow valve is advised to prevent any pressure build up between the bursting disc and the safety valve.

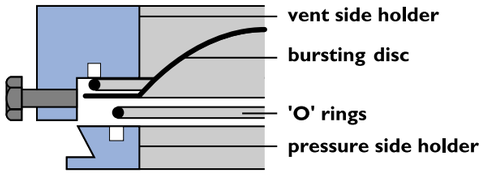
* **Safety valves** may also be referred to as **relief valves** or **safety relief valves.** Such valves are characterised by their ability to relieve excessive pressures at a pre-determined level and to re-seal once that pressure has been reduced to an acceptable, safe level. Such devices provide re-closing pressure relief and limit the quantity of product actually released.

FUGITIVE EMISSIONS : LEAK TIGHTNESS ACROSS DISC SEALING FLANGE

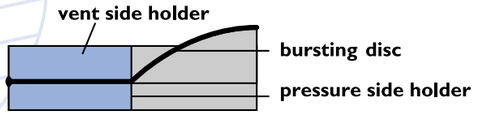
FEATURES	LEAK TIGHTNESS mbar.l/s
Metal to metal joint	1×10^{-4}
Gasket fitted to process side :	
GARFITE (Graphite-based)	1×10^{-4}
AFM 34 (Asbestos free)	1×10^{-4}
AFM 30 (Asbestos free)	1×10^{-4}
PTFE	1×10^{-4}
GYLON BLUE (PTFE)	1×10^{-5}



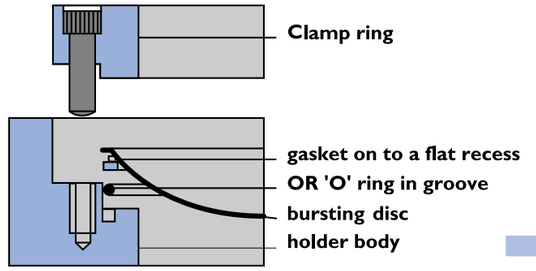
'O' rings incorporated :	
PTFE	1×10^{-6}
VITON	1×10^{-6}
Silver-coated metal	1×10^{-8}



Disc welded to holder	ZERO



Type MN : flat gasket :	
Garfite (Graphite based)	1×10^{-3}
AFM 34 (Asbestos free)	1×10^{-3}
PTFE / GYLON	1×10^{-4}
Type MO :'O' rings :	
PTFE	1×10^{-4}
VITON	1×10^{-6}
Silver coated metal	1×10^{-8}



APPLICATIONS

1
Simple Application where a disc is the primary safety device on a pressurised system

2
Simple application where a disc is the primary safety device. Negative pressure may require a reverse pressure support.

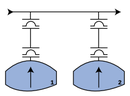
3
Two discs mounted in parallel with interlocked valves enabling rapid changeover from a ruptured disc to a second disc.

4
Two discs mounted in series. Used where process media is likely to attack a disc material..

5
A disc used as a secondary safety device. In the event of safety valve failure to vent, the disc provides the ultimate protection.

6
A disc used to protect a safety valve. Essential in some corrosive or viscous applications.

7
Where corrosion could attack the ventside of a safety valve discs may be employed as a protection.

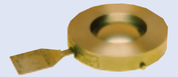
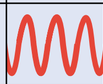
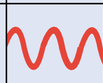
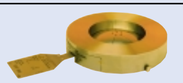
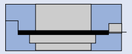
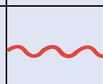
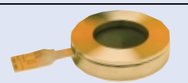
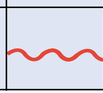
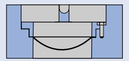


8
Two discs mounted in series. Used where multiple relief streams vent into a common manifold.

GUIDE TO BURSTING DISC SELECTION

The following information is presented as an aid to bursting disc selection. It will guide the user through certain criteria to give a general assessment of the choice of bursting disc for a particular application. It will help to eliminate those which are unsuitable for specific reasons.

Remember - check your choice of bursting disc with IMI Marston Ltd. Safety Systems Group. We can offer advice regarding particular recommendations and sizing assistance. Simply complete the application form and fax it to us.
For further information and guidance refer to the specific brochures for chosen disc.

		Applications	Pressure Range Bar g	Size Range NB mm	Relief Phase Gas/Liquid	S R V Isolation	Support Required for Vacuum Duty (i)	Leak Tightness mbar. l/s @ 20°C	Operating Pressure Ratio @ 20°C (ii)	Fragmentation (iii)	Pulsating Pressure Capability (iv)		
FORWARD ACTING BURSTING DISCS													**FORWARD ACTING BURSTING DISCS**
NT/NR		1 2 3 4 5 7 8	0.3 to 1030	3 to 1200			Generally Required	1 x 10 -6	0.75				**NT / NR Conventional Simple Domed Assemblies.** The simplest of all discs, usually a single domed metallic foil which will probably fragment upon disc rupture.
NTG/NRG		1 2 3 4 5 6 7 8	0.3 to 1030	25 to 800			NOT Required	1 x 10 -6	0.80				**NTG / NRG Conventional Grooved Disc Assemblies.** A single metallic foil which has grooved lines of weakness and is designed to be non-fragmenting. It will normally withstand vacuum conditions without the aid of a vacuum support.
CS		1 2 3 4 5 6 7 8	0.07 to 125	25 to 1100			Required	1 x 10 -3	0.80				**CS Composite Slotted Disc Assemblies** A forward acting disc which has two membranes. A load-bearing slotted metallic outer membrane and a weaker, usually fluoropolymer seal membrane giving a non-fragmenting design. This disc is widely used for lower bursting pressures.
GR		1 2 3 4 5 7	0.07 to 17.2	25 to 250			Required where Pb<1.5barg	1 x 10 -2	0.80				**GR Graphite Discs** A flat graphite disc, impregnated with a high quality resin, giving good corrosion resistance and low bursting pressures. The unique GR arrangement is designed to protect the disc from the effects of flange bolt loading. This disc fragments on rupture.
MONO BLOC		1 2 3 4 5 7	0.1 to 56	25 to 350			Required where Pb<1.5barg	1 x 10 -2	0.80				**Monobloc Graphite Discs** A flat graphite disc, impregnated with a high quality resin, giving good corrosion resistance and low bursting pressures. This disc does not require a dedicated holder, and fragments on rupture.
REVERSE BUCKLING BURSTING DISCS													**REVERSE BUCKLING BURSTING DISCS**
MN/MO		1 2 3 4 5 6 7 8	0.1 to 450	25 to 1200	(v)		Generally NOT Required	1 x 10 -4	0.95				**MN / MO Maxivent Assemblies** Usually a single foil disc which has the pressure applied to its convex side. The dome inverts and is completely expelled from its holder and stopped by an arrestor.
RBH/ RBF		1 2 3 4 5 6 7 8	0.5 to 380	25 to 500	(v)		Generally NOT Required	1 x 10 -4	0.95				**RBH Assemblies** Usually a single foil disc which has the pressure applied to its convex side. The dome inverts and opens along a peripheral groove. It is designed to be retained by its hinge portion.
LRBH		1 2 3 4 5 6 7 8	3.0 to 100	25 to 500			Generally NOT Required	1 x 10 -4	0.95				**LRBH Assemblies** Usually a single foil disc which is designed specifically for liquid duties. The pressure is applied to its convex side. The dome inverts and opens along a peripheral groove. It is designed to be retained by its hinge portion.
SRBH		1 2 3 4 5 6 7 8	0.2 to 100	25 to 500			Generally Required	1 x 10 -3	0.90				**SRBH Assemblies** This disc has two membranes. A load-bearing slotted metallic membrane and a weaker, usually fluoropolymer, seal membrane giving a non-fragmenting design suitable for low bursting pressures.
GRB		1 2 3 4 5 7	0.04 to 15	25 to 150			Required where Pb<1.2barg	1 x 10 -3	0.90				**GRB Graphite Disc Assemblies** A unique disc manufactured from pure graphite powder. It is suitable for high temperatures and extremely low bursting pressures. This disc will fragment on rupture.

(i) Under certain conditions a Vacuum or Reverse pressure Support may be required. This depends on the disc size, material and rating. Refer to the individual Product Brochure for more detailed information.

(ii) The Operating or Working Ratio is the ratio of the Working Pressure to the minimum tolerance Burst Pressure. Reverse Buckling discs can offer a higher capability than Conventional Tensile-loaded discs. This ratio can be affected by disc material and operating temperature.

(iii) Fragmentation of the Disc during bursting may be unacceptable. Certain discs are designed to eliminate the likelihood of fragmentation.

(iv) The effects of pulsating or cyclic pressures on discs need to be considered. Reverse buckling discs generally offer greater resistance to cyclic conditions than conventional discs.

(v) A gas/vapour space, or energising volume, is required if these discs are to be used on liquid applications.

Selection