Marston

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Worldwide Regional Offices

As part of 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. For contact details please visit the Marston website at: www.imimarston.co.uk.

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☐ **Technical guide for bursting discs**

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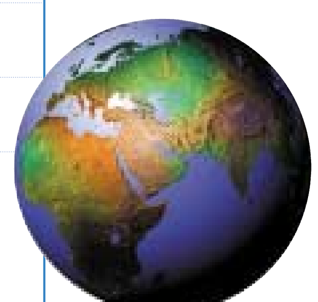


BS EN ISO 9001

BSI REGISTERED FIRM

Q 06285

Catalogue No. MAVP0801

Marston

Explosion Vent Panels

Technical Catalogue

Introduction

Marston

MARSTON - A HISTORY OF EXPERIENCE WITH THE TECHNOLOGY FOR THE FUTURE.

Marston has over 20 years of experience in the design, manufacture and application of explosion vent panels.

Applications for explosion vent panels are as diverse as the industries that use them.
The Pharmaceutical, Food and Plastic industries are typical examples of industries that regularly use explosion vent panels.

The sizing and selection of the most suitable explosion vent panel can often be critical to the safety of plant and personnel. Marston's team of Application Engineers possess both expertise and experience, enabling them to assess each customer's individual specifications and design a high quality, cost effective solution. This ensures that every explosion vent panel offered is the best technical solution for the required duty.

Marston offer a comprehensive range of products - from single panels to complex multi-unit devices. A team of Technical Engineers is always available to discuss your application and to offer advice. Enquiries can often be easily satisfied by using a standard device, but when this is not practical Marston can offer a customised design.

TECHNICAL RESOURCES

To maintain our position at the forefront of explosion vent panel technology we can call upon the wide range of technical resources available within Marston. These state-of-the-art facilities include:

- TEMPERATURE TESTING
- CAD/CAM
- PRESSURE CYCLING
- RADIOGRAPHIC INSPECTION
- LASER CUTTING TECHNOLOGY

Marston

Quality

QUALITY

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

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.

INDEX

DUST AND GAS EXPLOSIONS

What is an explosion?

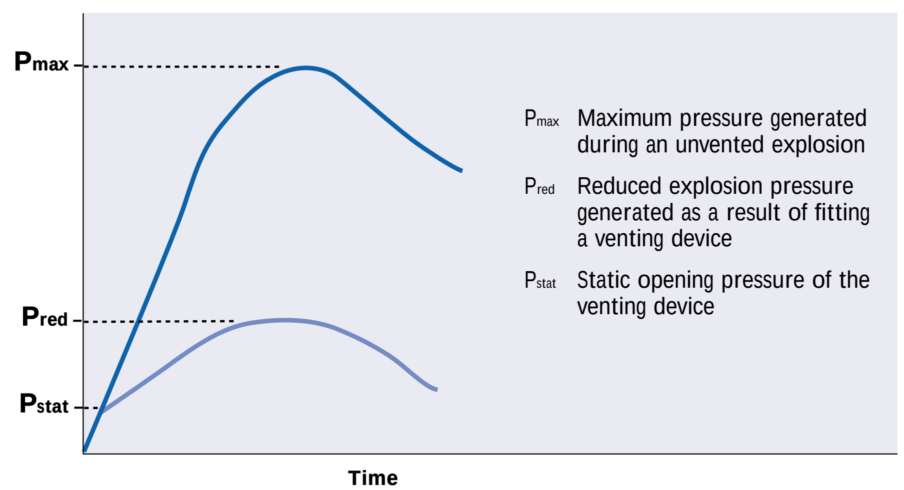
The occurrence normally called an explosion is more accurately referred to as a deflagration. This is the rapid burning of a mixture of dust or gas within an oxygen-rich atmosphere (typically air) leading to a very rapid pressure rise inside the vessel or system. Unless this pressure is relieved the vessel or system can be ruptured, causing the products of the rapid combustion to be released uncontrollably. This results in the devastating effect referred to as an explosion, causing widespread damage to plant and personnel.

Operators of plant handling flammable gases are well aware of the dangers of explosions and the need for continual care and attention to prevent ignition. Perhaps less well known is that there is a similar risk when handling materials that produce dusty conditions, such as foodstuffs, grain, sugar, coal and some plastics and metals. Where dusts can be present and suspended in the atmosphere, then an equally disastrous explosion can occur if the mixture is ignited.

The severity of an explosion can be affected by a number of factors, which are often inter-related. The damage that an explosion can cause is directly related to the pressure that can be generated. This pressure is affected by the individual characteristics of the dust or gas, the volume and geometry of the vessel being operated and the strength or 'rupture pressure' of the weakest section of the vessel. Dusts and gases burning uncontrollably within a vessel can rapidly generate pressures up to 10 Barg (145 Psig) or higher. Unless the vessel is sufficiently strong this high pressure will cause the vessel to deform or even rupture at its weakest point. Where such vessels are long and relatively narrow the weak point could be the end-cap. The resultant explosion could induce a fierce jet effect.

A correctly sized and fitted explosion vent panel, or group of panels, will help to reduce the likelihood of major damage to the vessel and anything nearby. The vent panel will open at a low pressure and allow the pressure to be released.

The vent area is dependent on the geometry of the equipment being protected. Elongated equipment can develop very high pressure as a result of 'pressure piling', resulting in detonations if the explosion is incorrectly vented.



Care must be exercised when considering venting, in particular the safe siting of the vent panel. In the event of an explosion, flame, product (both burnt and unburnt) and pressure waves will result. The equipment being protected will also need to be capable of withstanding the internal pressure and any resulting reaction forces due to the venting process.

Often, protected equipment will be located indoors, in areas where it is impractical or unsafe to vent. In these instances it may be possible to vent the explosion through an outside wall, via a duct. The duct should be as short and straight as possible to minimise its effects on the venting process. A vent may need to be considerably larger if a duct is used.

Who is at Risk?

Many industries are at risk of an explosion. The more common ones are:

- **Paper**
- **Food**
- **Aggregates**
- **Metal fines**
- **Pharmaceutical**
- **Wood**
- **Plastics**

In addition, bulk-handling systems in any industry may be at risk. Equipment such as Blenders, Dryers Cyclones and Mills are the source of many explosions, not forgetting Filters and Silos, which together account for almost half of reported explosions. Consideration must also be given to connecting equipment. Conveyors, Ducts and Elevators are common sources of explosions. Interconnected equipment must be given special attention as an explosion propagating from one piece of equipment to another can cause even more devastation than one in isolation.

The ignition can originate from many sources, such as sparks, friction, mechanical failures, flames or even static.

It is very often impossible to eliminate every ignition source, or prevent completely the risk of an explosion. Therefore venting is probably the most economical form of protection for your plant.

Explosion Vent Panels

Explosion vent panels provide an economical method of minimising the effects of an explosion.

When equipment is unvented, high pressure can quickly be generated. In many cases this pressure is sufficient to cause permanent and sometimes catastrophic damage.

Marston explosion vent panels are a recognised and effective solution. These panels are of a lightweight construction and are designed to open and vent, providing almost instantaneous relief at low pressures, typically 0.1 Bar (1.5 Psig). Care must be exercised when siting the vent to ensure that the products of any resulting explosion are directed to a safe location, minimising the risk of damage or injury.

Marston explosion vent panels provide a fully certified, reliable, maintenance free solution to the problem of explosion venting. They are designed to be non-fragmenting and are simple to install on both new and existing equipment.

Using the empirical formulae in one of the approved guides, it is possible to calculate a vent area based on the characteristics of the gas or dust and the size and geometry of the vessel.

Some common dusts and gases have been analysed by test laboratories, which have established and published various data. It must be remembered though that the data is only typical, as values for K_G, K_{St} and P_{max} are dependent on particle size and concentration in the oxygenated atmosphere. Whilst this data is useful, the only way to be entirely sure of the characteristics of a product is to have it tested by a test establishment.

Explosions

Vent sizing

Marston generally work to one of two recognised guides:

VDI 3673	Pressure relief of dust explosions	VDI - Verlag Dusseldorf Germany
NFPA - 68	Guide for Venting of Deflagrations	National Fire Protection Association, USA

VDI 3673 addresses only dust explosions whereas NFPA-68 provides guidance on both dust and gas explosions.

Marston Engineers are always available for advice. Providing sufficient information is available, vent areas can be established in accordance with the agreed guide such that in the event of an explosion, the fully opened panel will release the products of the combustion and relieve the pressure.

The calculated vent area is dependent on various design and operating criteria. The vessel will dictate the volume, geometry and the maximum allowable pressure. The operating conditions of the system, along with the maximum allowable pressure, will help to determine the opening pressure of the panel. Generally this is 0.1 Barg (1.5 Psig). The product (dust or gas) will define specific characteristics related to explosivity, such as the maximum unvented pressure capability and the rate of pressure rise that can be generated.

This data can be used to establish the required vent area by using either nomographs or, more accurately, by calculation.

VDI 3673 Simple System - Dust

The basic formula for a homogeneously dispersed dust is:

$$A = [3.264 \times 10^{-5} \times P_{max} \times K_{St} \times P_{red.max}^{-0.569} + 0.27 \times (P_{stat} - 0.1)\, P_{red.max}^{-0.5}] \times V^{0.753}$$

Where: A = free vent area, m².

P_{max} = maximum pressure reached during an explosion in a closed vessel, Barg.

K_{St} = dust characteristic, equivalent to the maximum rate of pressure rise in a 1m³ vessel, bar.m/s.

P_{red} = reduced explosion pressure, generated by an explosion in a vented vessel, Barg. (Often referred to as the maximum allowable pressure).

V = volume of the vessel, m³.

P_{stat} = static activation pressure of the venting device, Barg.

Where the enclosure is elongated (i.e. Length/Diameter > 2), the required vent area may be greater. In elongated enclosures, the flame front of an explosion acts like a piston, increasing the pressure ahead of itself. This can cause pressure piling which can lead to a detonation if the pressure is not relieved quickly enough.

To determine the additional area required, the following formula is applied:

$$\Delta A = A \times [-4.305 \times \log P_{red.max} + 0.758] \times \log H/D$$

Where: H = length of enclosure, m

D = hydraulic diameter of enclosure, m

The vent area for an elongated vessel, 'A_L', is therefore:

$$A_L = A + \Delta A.$$

Sizing

NFPA - 68 Simple System - Dust

The basic formula for a homogeneously dispersed dust is:

$$A = (a) \times [V^{2/3}] \times [K_{St}]^b \times [P_{red}]^c$$

Where: a = $0.000571\, e^{(2 P_{stat})}$

b = $0.978\, e^{(-0.105 P_{stat})}$

c = $-0.687\, e^{(0.226 P_{stat})}$

A = free vent area, m²

K_{St} = dust characteristic, equivalent to the maximum rate of pressure rise in a 1m³ vessel, bar.m/s.

P_{red} = reduced explosion pressure, generated by an explosion in a vented vessel, barg. (Often referred to as the maximum allowable pressure).

V = volume of the vessel, m³.

P_{stat} = static activation pressure of the venting device, barg.

NFPA - 68 Simple System - Gas

Two methods are possible depending on the enclosure strength. For low strength equipment capable of withstanding no more than 0.1 Barg (1.5 Psig), the venting equation is:

$$A = \frac{C\,(A_s)}{(P_{red})^{0.5}}$$

Where: A = free vent area, m²

C = venting equation constant

P_{red} = reduced explosion pressure, generated by an explosion in a vented vessel, barg. (Not to exceed 0.1 Barg [1.5 Psig]). (Often referred to as the maximum allowable pressure).

A_s = internal surface area of vessel, m²

For higher strength equipment, capable of withstanding pressures greater than 0.1 Bar (1.5 Psig), the venting equation is:

$$A = a(V)^b \times e^{c(P_{stat})} \times (P_{red})^d$$

Where: A = free vent area, m².

P_{red} = reduced explosion pressure, generated by an explosion in a vented vessel, barg. (Often referred to as the maximum allowable pressure).

V = volume of the vessel, m³.

P_{stat} = static activation pressure of the venting device, barg.

e = 2.718 (base for natural logarithms)

The factors a, b, c and d are derived for each gas. Some values are listed in NFPA - 68

These formulae are valid for L/D of up to 5. Above this, reference must be taken from the guide.

Ducts

The addition of a vent duct can seriously hinder the venting process. If a vent duct must be employed consideration must be given to its effect. Typically ducts should be as short and straight as possible. The effect on the resulting P_{red} can be huge if the vent area is not increased to counteract it. The duct should be of similar size to the vent opening, to prevent choking if too small, or unwanted turbulence if too large. Each guideline addresses the effect, but each in a different manner. There are also other publications, which may be referenced. Marston can offer guidance if required.

Sizing

Characteristics of some common dusts

Name	P max Barg	(Psig)	Kst Bar m/s	Dust Classification
Adipic acid	8.0	(116.0)	97	1
Aluminium	12.4	(179.8)	415	3
Anthraquinone	10.6	(153.7)	364	3
Ascorbic acid	9.0	(130.5)	111	1
Cellulose	9.7	(140.7)	229	2
Charcoal, activated	7.7	(111.7)	44	1
Charcoal, wood	9.0	(130.5)	10	1
Coal, bituminous	9.2	(133.4)	129	1
Coke	7.6	(110.2)	47	1
Cork	9.6	(139.2)	202	2
Corn	9.4	(136.3)	75	1
Dextrin	8.8	(127.6)	106	1
Egg white	8.3	(120.4)	38	1
Epoxy resin	7.9	(114.6)	129	1
Iron carbonyl	6.1	(88.5)	111	1
Lactose	7.7	(111.7)	81	1
Lignite	10	(145.0)	151	1
Magnesium	17.5	(253.8)	508	3
(poly) Methyl acrylate	9.4	(136.3)	269	2
Milk, powdered	5.8	(84.1)	28	1
Milk, non-fat dry	8.8	(127.6)	125	1
Paraformaldehyde	9.9	(143.6)	178	1
Phenolic resin	9.3	(134.9)	129	1
Sodium stearate	8.8	(127.6)	123	1
Soy flour	9.2	(133.4)	110	1
Starch, corn	10.3	(149.4)	202	2
Starch, wheat	9.9	(143.6)	115	1
Sugar	8.5	(123.3)	138	1
Sugar, beet	8.2	(118.9)	59	1
Sugar, milk	8.3	(120.4)	82	1
Sulphur	6.8	(98.6)	151	1
Tapioca	9.4	(136.3)	62	1
(poly) Vinyl chloride	7.6	(110.2)	46	1
Whey	9.8	(142.1)	140	1
Wood flour	10.5	(152.3)	205	2
Zinc	7.3	(105.9)	176	1

Note: *These are typical values and can vary with concentration and particle size.*

Characteristics of some common gases

Name	P max Barg	(Psig)	KG Bar m/s
Butane	8.6	(124.7)	92
Ethane	7.8	(113.1)	106
Hydrogen	7.4	(107.3)	659
Methane	7.2	(104.4)	64
Pentane	8.7	(126.2)	104
Propane	8.6	(124.7)	96

Frames and Fitting

Marston explosion vent panels are usually mounted into a bolted frame to enable them to be fitted onto the equipment they are protecting. Using a frame guarantees the opening size and therefore the accuracy of the opening pressure. They also ease the installation procedure in many cases. The frame section employed by Marston is generally flat which allows the user to bolt directly to the protected equipment and allows the simple connection of downstream ducting. The frames can be supplied with either the Marston recommended hole configuration, or to suit the clients own or existing arrangement.

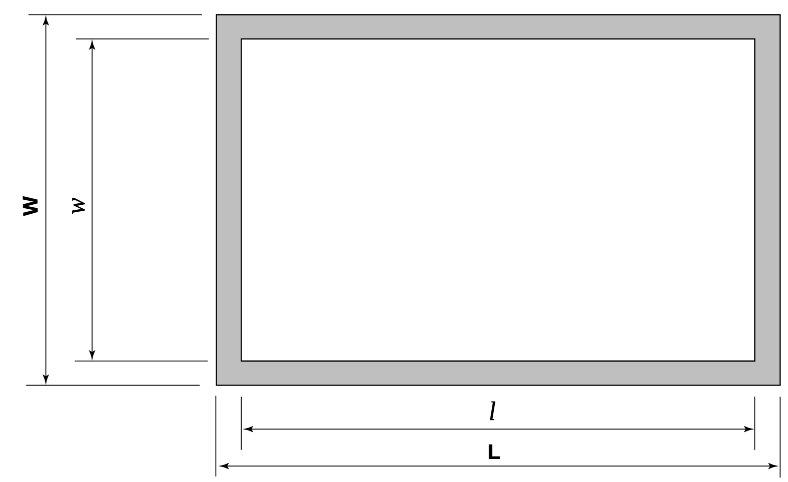
In some instances, the frames may be fitted with a support grid or mesh. This can be to prevent implosion of a membrane or to prevent injury to personnel falling through. Implosion may be as a result of a vacuum condition during normal operation or cleaning, or it could be a reverse pressure such as wind loading. Whatever the reason, any restriction must be taken into account when establishing the required vent area.

Generally frames are constructed from either Stainless Steel or Carbon Steel, although it is possible for other materials to be considered.

Marston are always ready to provide a custom designed solution to satisfy the individual needs of the customer. This can involve differing shapes and sizes, rectangular, circular, semi-circular, trapezoidal, triangular and even curved panels are just some of the shapes available.

We also appreciate the need to provide the user with a readily available, standard solution.

Marston Range of Standard Frame Sizes



Size Ref	Inside length *l* mm	(ins)	Overall Length L mm	(ins)	Inside Width *w* mm	(ins)	Overall Width W mm	(ins)	Vent Area A m³	(ft³)*
645.365	645	(25.39)	705	(27.76)	365	(14.37)	425	(16.73)	0.23	(2.53)
710.450	710	(27.95)	770	(30.31)	450	(17.72)	510	(20.08)	0.3	(3.44)
645.645	645	(25.39)	705	(27.76)	645	(25.39)	705	(27.76)	0.4	(4.48)
710.710	710	(27.95)	770	(30.31)	710	(27.95)	770	(30.31)	0.5	(5.43)
920.586	920	(36.22)	980	(38.58)	586	(23.07)	646	(25.43)	0.5	(5.80)
1000.710	1000	(39.37)	1060	(41.73)	710	(27.95)	770	(30.31)	0.7	(7.64)
920.920	920	(36.22)	980	(38.58)	920	(36.22)	980	(38.58)	0.8	(9.11)
1000.920	1000	(39.37)	1060	(41.73)	920	(36.22)	980	(38.58)	0.9	(9.90)
1000.1000	1000	(39.37)	1060	(41.73)	1000	(39.37)	1060	(41.73)	1.0	(10.7)
1130.1130**	1130	(44.49)	1190	(46.85)	1130	(44.49)	1190	(46.85)	1.25	(13.7)

Note: **Free area may be reduced as a result of fitting supports.*

***1130.1130 is not available in PTX series.*

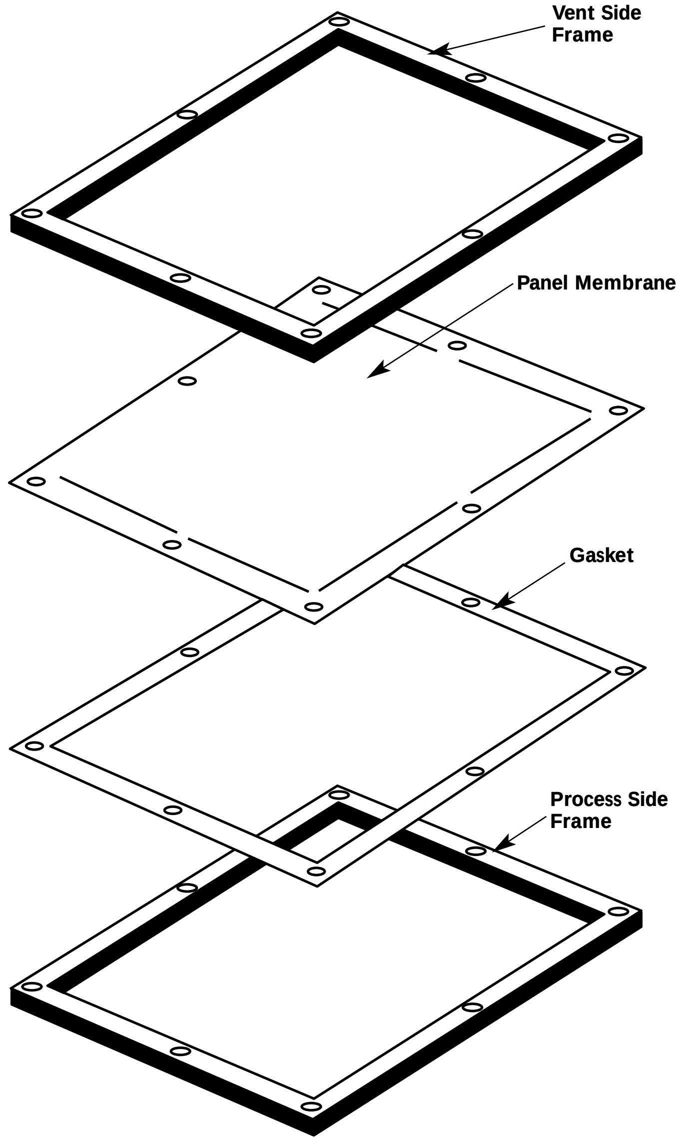
Protex

PROTEX (PTX) Explosion Vent Panel

Protex is the latest development in explosion vent panel technology from Marston, providing cost-effective solutions for venting requirements. Protex is a single skin, full metal explosion vent panel that is robust and easy to handle, yet still lightweight and accurate. The Protex explosion vent panel is also hygienic, as no slots or grooves are visible when installed.

Protex can be domed or flat and can be designed to withstand pressure in either direction, usually without the need for support, making Protex suitable for a wide range of applications.

The dome can be produced so that its convex side can either face the process - PTX-R, or face towards the vent - PTX-D. This depends upon the operating parameters of the equipment it is to protect.



The Protex explosion vent panel can operate at pressures up to 75% of its minimum activation pressure in the direction of its dome and approximately 20% in the opposite direction.

Many designs of explosion vent panel have relatively low temperature limitations due to their materials of construction. Some Protex panels can operate at temperatures up to 550ºC (1020°F), before a heat shield needs to be considered.

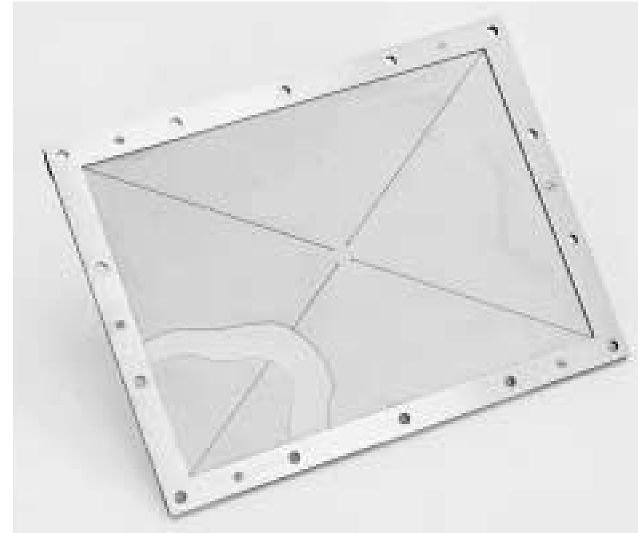
Marston's team of highly skilled Technical Engineers has developed a full metal explosion vent panel that ensures the fullest possible vent area under relief conditions. The fully patented, concealed, slot pattern ensures that the venting area and vent opening pressure are both closely controlled.

Marston utilises state of the art laser technology to cut the slots in the Protex full metal explosion vent panel. The Protex does not require an additional sealing membrane as the slots are fully protected by the frame and its gasket.

Protex is usually manufactured from a single stainless steel sheet. However, Marston can supply Protex full metal explosion panels in a wide range of materials including Nickel, Inconel 600 and Aluminium.

CSP/TSP

CSP Explosion Vent Panel



The CSP type explosion vent panel is a traditional composite slotted design.

The opening pressure is controlled by the slotted metal membrane, whilst the system integrity is provided by the seal membrane, usually manufactured from Teflon.

Primarily this type of vent is flat, but it can just as easily be domed to suit operating conditions.

Under steady conditions, flat panels may operate at up to 50% of the minimum activation pressure, whilst domed panels may operate at up to 70%. Neither is suitable for vacuum conditions, unless a support is fitted.

This design of panel provides accurate, cost effective explosion protection on equipment generally operating at, or near to atmospheric conditions.

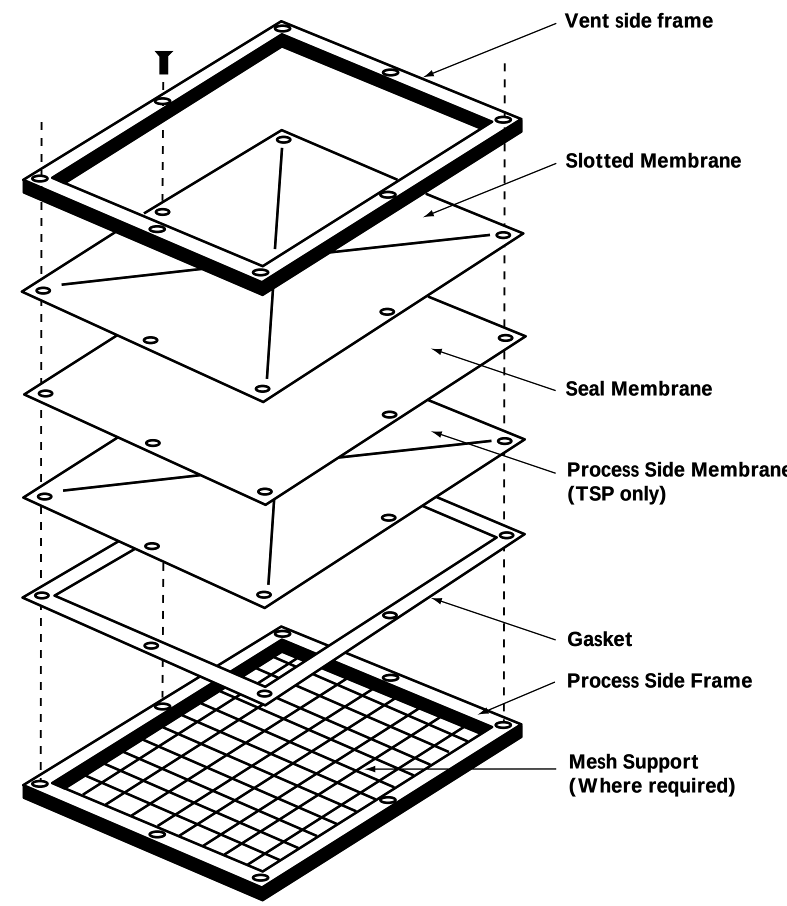
TSP Explosion Vent Panel

The TSP type explosion vent panel moves one step further from the CSP type with the addition of a second slotted membrane on the process side.

This gives the panel some resistance to vacuum without adding a support. It also protects the delicate Teflon seal membrane from abrasion.

Like the CSP membrane this too can be flat or domed and can be provided with additional support where higher vacuum conditions prevail.

A flat TSP explosion vent panel will withstand pressures of up to 25% of its minimum pressure, in both directions. Domed panels will withstand 40% of their activation pressure, but generally no vacuum. In the event of greater levels of vacuum a support can generally be fitted.



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To enable Marston to specify the optimum explosion vent panel, certain basic information is essential. Photocopy this page, and complete as much information as possible, and...

FAX TO: +44 (0)1902 623555

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

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

Tag Number		
Service conditions		
Product		
K_{st}		
P_{max}		
Normal maximum operating pressure & temperature		
Vacuum conditions - State if none		
Reverse pressures - eg. Wind load - State if none		
Pressure pulsation's/Cycling: Give Details		
Installation		
Volume of enclosure		
Enclosure dimensions (Please provide sketch if possible)		
Vent area required		
Preferred vent dimensions (if known)		
Activation Pressure (P_{stat})		
Temperature at Activation Pressure		
Acceptable membrane materials		
Acceptable frame materials - Upstream		
Acceptable frame materials - Downstream		
Enclosure material		
Gaskets - Type & material		
Design pressure		
Design code		
Accessories		
Indicator Y/N		
Thermal Insulation Y/N		
Any other relevant information/sketch - use additional sheet if necessary		
Quantities		
Vent Panels		
Frames		
Enclosures		

To enable Marston Engineers to provide the best possible solution to your application, please provide a drawing of the installation wherever possible.

Pressures

Minimum Opening Pressures

CSP

Seal Material	Units mm (ins)	250 (10)	300 (12)	350 (14)	400 (16)	500 (20)	600 (24)	750 (30)	1000 (40)	1200 (48)	Max Temp
		Nominal Diameter/Minimum Opening Length									
FEP/PFA	Barg	0.16	0.16	0.12	0.12	0.08	0.05	0.05	0.05	0.05	200°C
FEP/PFA	(Psig)	(2.4)	(2.4)	(1.8)	(1.8)	(1.2)	(0.75)	(0.75)	(0.75)	(0.75)	(390°F)
PTFE	Barg	0.2	0.2	0.15	0.15	0.1	0.07	0.07	0.07	0.07	250°C
PTFE	(Psig)	(2.9)	(2.9)	(2.2)	(2.2)	(1.5)	(1.0)	(1.0)	(1.0)	(1.0)	(480°F)
Aluminium	Barg	0.3	0.3	0.3	0.3	0.3	0.3	0.3	–	–	425°C
Aluminium	(Psig)	(4.4)	(4.4)	(4.4)	(4.4)	(4.4)	(4.4)	(4.4)	–	–	(800°F)

Note: *If a Heat Shield is used it may be possible to use at higher temperatures. See Accessories section.*

TSP

Seal Material	Units mm (ins)	250 (10)	300 (12)	350 (14)	400 (16)	500 (20)	600 (24)	750 (30)	1000 (40)	1200 (48)	Max Temp
		Nominal Diameter/Minimum Opening Length									
FEP/PFA	Barg	0.25	0.25	0.2	0.2	0.15	0.1	0.1	0.07	0.07	200°C
FEP/PFA	(Psig)	(3.6)	(3.6)	(2.9)	(2.9)	(2.2)	(1.5)	(1.5)	(1.0)	(1.0)	(390°F)
PTFE	Barg	0.3	0.3	0.25	0.25	0.18	0.1	0.1	0.08	0.08	250°C
PTFE	(Psig)	(4.4)	(4.4)	(3.6)	(3.6)	(2.6)	(1.5)	(1.5)	(1.2)	(1.2)	(480°F)
Aluminium	Barg	0.4	0.4	0.4	0.4	0.4	0.4	0.4	–	–	425°C
Aluminium	(Psig)	(5.8)	(5.8)	(5.8)	(5.8)	(5.8)	(5.8)	(5.8)	–	–	(800°F)

Note: *If a Heat Shield is used it may be possible to use at higher temperatures. See Accessories section.*

PTX

Material	Units mm (ins)	250 (10)	300 (12)	350 (14)	400 (16)	500 (20)	600 (24)	750 (30)	1000 (40)	Max Temp
		Minimum Opening Length of Panel								
Stainless Steel	Barg	0.15	0.13	0.1	0.1	0.07	0.05	0.05	0.07	300°C
Stainless Steel	(Psig)	(2.2)	(1.9)	(1.5)	(1.5)	(1.0)	(0.75)	(0.75)	(1.0)	(570°F)
Nickel	Barg	0.15	0.13	0.1	0.1	0.07	0.05	0.05	–	400°C
Nickel	(Psig)	(2.2)	(1.9)	(1.5)	(1.5)	(1.0)	(0.75)	(0.75)	–	(750°F)
Inconel	Barg	0.15	0.13	0.1	0.1	0.07	0.07	0.07	–	550°C
Inconel	(Psig)	(2.2)	(1.9)	(1.5)	(1.5)	(1.0)	(1.0)	(1.0)	–	(1020°F)
Aluminium	Barg	0.12	0.1	0.07	0.07	0.05	0.05	0.05	0.05	100°C
Aluminium	(Psig)	(1.8)	(1.5)	(1.0)	(1.0)	(0.75)	(0.75)	(0.75)	(0.75)	(212°F)

Note: *If a Heat Shield is used it may be possible to use at higher temperatures. See Accessories section.*

Marston explosion vent panels can meet or exceed the advisory limits recommended in the various codes and guides. For details or to discuss pressure requirements below the limits set out above, the engineer, contractor or user should contact the factory direct.

Tolerances

The table opposite lists tolerances for Marston explosion vent panels when used in a Marston approved frame. In some instances it may be necessary to increase tolerances where the frame is not in accordance with Marston limits.

Activation Pressure		CSP	TSP	PTX
< 0.07 Barg	(<1.0 Psig)	±50%	±50%	±40%
0.07 – 0.09 Barg	(1.0 – 1.3 Psig)	±30%	±30%	±25%
0.1 – 0.3 Barg	(1.4 – 4.3 Psig)	±25%	±25%	±20%
> 0.3 Barg	(>4.3 Psig)	±20%	±20%	±15%

Accessories

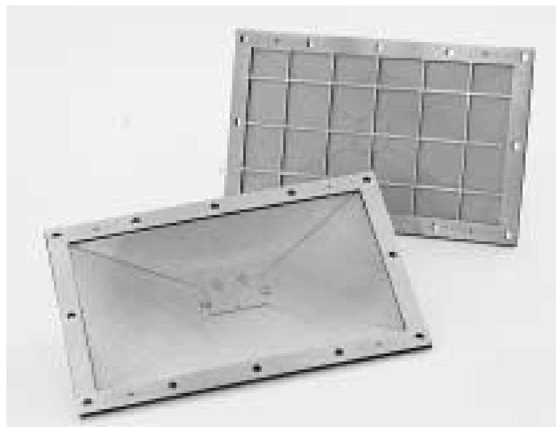
Indicators

In line with all other Marston products, explosion vent panels can be supplied with Indicators, which, when connected to the plant operating systems, can shut the plant down in the event of an explosion.

The Indicator takes the form of a simple wire loop, which, upon opening of the vent panel, breaks, interrupting the circuit. The device is certified by BASEEFA/EECS to **EEx ia IIC T6** (Tamb = 75ºC) for use in hazardous areas (Zone 0). It is also accredited by CSA (Canadian Standards Authority) to **Ex ia IIC T6**:
Class 1, Zone 0, - 20ºC ≤ Ta ≤ 40ºC (for Canada), and
Class 1, Groups A, B, C and D, T6 (for USA and Canada).

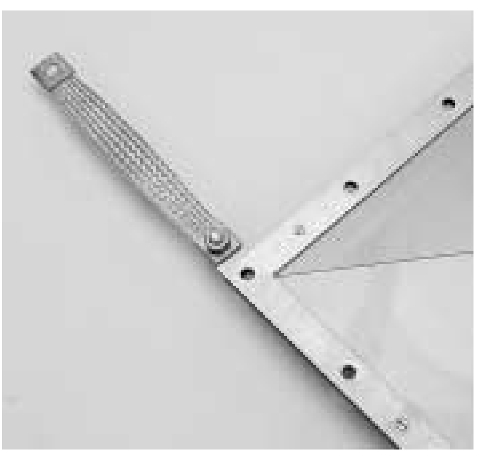
Reverse Pressure /Vacuum supports

Reverse Pressure/Vacuum supports can take different forms. Often a simple grid or mesh fitted to the inlet frame is sufficient. This support is non-opening and is generally re-useable. Alternatively, each membrane may be fitted with an opening style support. This may be flat (usually in conjunction with mesh and /or grid) or domed to closely match the profile of a domed panel.



Sometimes a domed panel, when used with a foam damper, may have a flat opening support fitted below the damper.

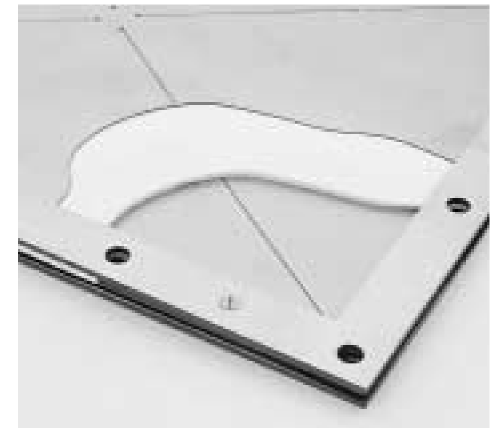
Earthing Strap



To minimise the risk of a static discharge, panels can be fitted with a braided Earth Strap. Often this is not necessary as the panel is usually earthed via the flange bolts. However in some applications where static discharge is a high risk, an Earth Strap is a valuable addition.

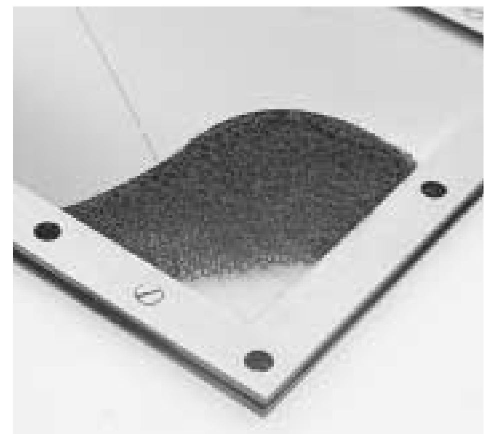
Heat Shield

A Heat Shield may be required for one of two reasons. Firstly, it may be required to insulate a panel from a very high process temperature, secondly, it may be required to prevent the accumulation of condensation on the inside face of a panel, which may affect the efficiency of the process in the equipment being protected.



Depending on the application, the heat shield may be a thin layer of ceramic paper or a thicker layer of ceramic fibres fitted to the process side of the panel. In extreme cases heat shields can protect panels from temperatures as high as 1000ºC (1832°F).

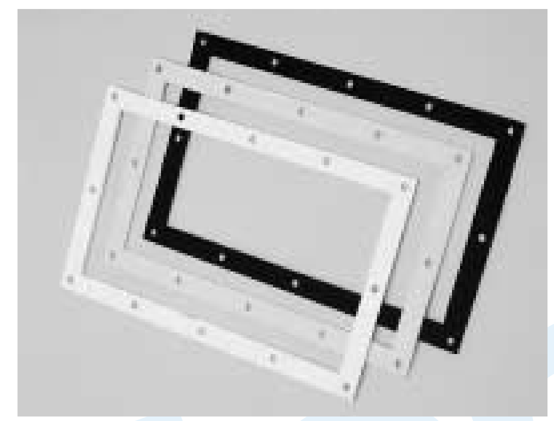
Foam Infill Damper



In many installations, particularly filters, the system is subjected to short, sharp pressure pulses. Though often small, these pressure pulses create a change in system pressure such that the membrane fluctuates. Where this fluctuation is frequent, as is the case with reverse jet filters, it can lead to fatigue of the slotted membrane ligaments. To overcome this, the vent side slotted membrane is domed and a foam 'damper' is fitted between the membranes to prevent any unwanted movement.

Gaskets

Standard Marston panels are supplied fitted with simple soft sponge rubber gaskets. To accommodate various operating conditions, alternative gasket materials are also available. In hygienic applications, particularly those involving food, a white neoprene gasket may be used. Where process temperature is too high for simple sponge rubber gaskets, a synthetic fibre gasket may be a suitable alternative. Whilst these are the most common alternative gasket materials, any other material preferred by the user may be considered.



Applications

Applications

Explosion vent panels can be used for almost any application where explosion relief is required. This could range from a simple storage silo to a complicated processing system. Each application requires individual appraisal and consideration to ensure that the correct venting device is employed.

Some of the more common equipment where venting may be required is discussed in the following paragraphs, along with some of the special considerations that need to be addressed.

Silos

A silo as an individual piece of equipment poses no real problems although any ancillary equipment associated with them may. The only real concern in many cases is the length to diameter ratio discussed in the sizing section. Often silos are long and as a result require large vent areas to protect them.

Filters/Separators

Explosion vents should always be located on the dirty side of the filter elements, and in a position that is not obstructed by the filter units. When determining the volume being protected, consideration should be given to the effect of any explosion on the filter units. Will they collapse or burn, resulting in a much larger volume than first estimated?

Cyclones

Cyclones require smooth internal surfaces to allow them to work effectively. Often, due to their relatively weak construction, it is not possible to fit sufficient vent area onto the flat, top face of the vortex. In this case, consideration should be given to a curved panel which can be designed to follow the shape of the cylinder.

Dryers

Spray dryers in particular tend to have large volumes, which in turn require large vent areas.
The explosion vent may then become a major source of heat loss, reducing the dryer's efficiency.
Panel selection should be made with this in mind, using a heat shield to reduce the heat loss where necessary.

Elevators/Conveyors

Long, small section equipment needs to be approached in a different way to that detailed on pages 5 and 6. It is common to fit vents of a size equal to the cross section of the equipment at regular intervals. Contact Marston for more assistance.

Mills/Grinders

Often mills and grinders are built strong enough so that they will withstand a deflagration. If venting is required, special attention needs to be given to vibration and its effect on a relatively weak venting device.

Interconnected Equipment

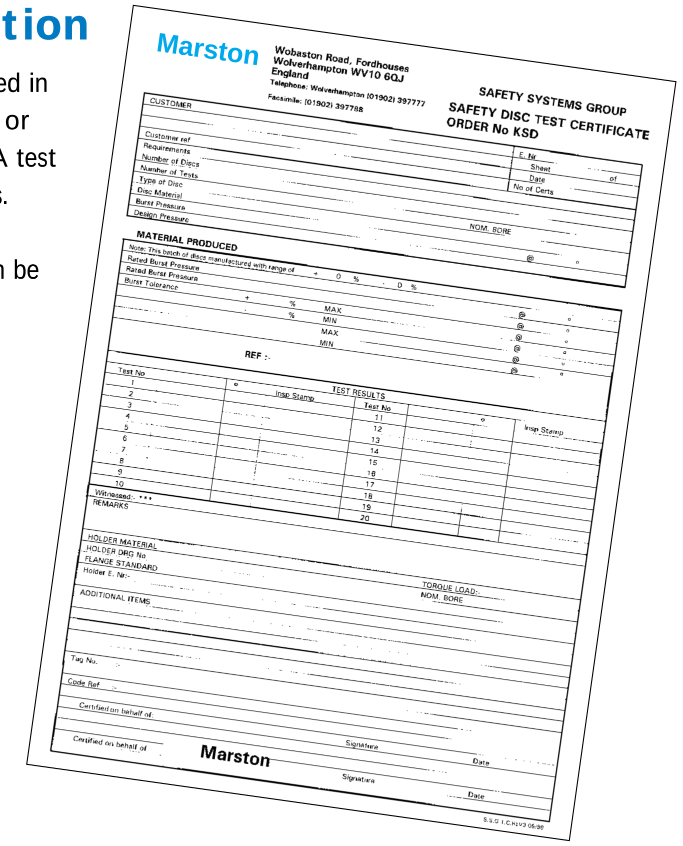
Greater care must be taken when considering explosion protection in one piece of equipment that is linked to another. The ensuing explosion, which occurs as a result of an explosion propagating from another source, can be far more violent than an isolated incident. Vent areas may need to be doubled to provide satisfactory relief. Contact Marston for further assistance.

Testing

Testing and Certification

Marston explosion vent panels are batch tested in accordance with procedures based on British or other National Standards for bursting discs. A test certificate is supplied for each batch of panels.

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


Marston
Wobaston Road, Fordhouses
Wolverhampton WV10 6QJ
England
SAFETY SYSTEMS GROUP
SAFETY DISC TEST CERTIFICATE
ORDER No KSD
CUSTOMER
MATERIAL PRODUCED
REF :-
TEST RESULTS
REMARKS
Marston

All Marston explosion vent panels have been type tested under full explosion trials to prove their strength and reliability.

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

Explosion Vent Panel Selection Guide

Applications

1. Silo/Hopper

Atmospheric pressure fill/empty effects only.

2. Filter

Atmospheric pressure steady flow only.

3. Reverse Jet Filter

Low pressure with pulsations/bag cleaning.

4. Cyclone

Low pressures, steady flow conditions.

5. Drier

Atmospheric pressures with no flow and elevated temperatures.

6. Bucket Elevator

Atmospheric pressures with vibration and abrasion.

7. Mill

Atmospheric pressures with vibration and abrasion.

****	Applications	Max Overpressure (Minimum Activation Pressure x) Barg	(Psig)	Vacuum	Hygienic *	Non Fragmenting	Max Temp °C (°F) ***	Max P_{red} Barg (Psig)	Vibration	
CSP-F	1 2 5	0.3	(4.35)	✗	✓	✓	250 (480)	2.0 (29)	✗	Flat Composite Slotted vent panel, suitable for equipment operating at or near atmospheric pressure without vacuum.
CSP-FM	1 2 4 5	0.3	(4.35)	✓	✗	✓	250 (480)	2.0 (29)	✗	Flat Composite Slotted vent panel, suitable for equipment operating at or near atmospheric pressure where vacuum may be present.
CSP-D	1 2 4 5	0.6	(8.70)	✗	✓	✓	250 (480)	2.0 (29)	✓✓	Domed Composite Slotted vent panel, suitable for equipment operating under positive pressures.
CSP-DV	1 2 3 4 5 6 7	0.6	(8.70)	✓	✗	✓	250 (480)	2.0 (29)	✓✓	Domed Composite Slotted vent panel with vacuum support, suitable for equipment operating under positive and negative pressures.
CSP-DIM	1 2 3 4 5	0.6	(8.70)	✗	✗	✓ **	100 (210)	2.0 (29)	✓✓✓	Domed Composite Slotted vent panel with foam infil, suitable for equipment operating under fluctuating pressures.
TSP-F	1 2 4 5 6 7	0.25	(3.63)	✓	✗	✓	250 (480)	2.0 (29)	✗	Flat Triple Skin vent panel, suitable for equipent operating at or near atmospheric pressure.
TSP-FI	1 2 4 5 6 7	0.25	(3.63)	✓	✗	✓ **	150 (300)	2.0 (29)	✓	Flat Triple Skin vent panel, with foam infil, suitable for equipment operating under slightly fluctuating pressures.
TSP-FM	1 2 4 5 6 7	0.25	(3.63)	✓	✗	✓	250 (480)	2.0 (29)	✗	Flat Triple Skin vent panel, suitable for equipment operating at or near atmospheric pressure, where vacuum may be present.
TSP-D	1 2 4 5 6 7	0.35	(5.08)	✓	✗	✓	250 (480)	2.0 (29)	✓✓	Domed Triple Skin vent panel, suitable for equipment operating under positive and negative pressures.
TSP-DIM	1 2 3 4 5	0.35	(5.08)	✓	✗	✓ **	100 (210)	2.0 (29)	✓✓✓	Domed Triple Skin vent panel with foam infil, suitable for equipment operating under fluctuating pressures.
PTX-F	1 2 4 5 6	0.2	(2.90)	✓	✓	✓	500 (930)	2.0 (29)	✓✓✓✓	Flat Solid Metal vent panel, suitable for high levels of cleanliness and slight pulsating pressures.
PTX-D	1 2 3 4 5 6 7	0.75	(10.88)	✗	✓	✓	500 (930)	2.0 (29)	✓✓✓✓✓	Domed Solid Metal vent panel, suitable for high levels of cleanliness and high positive pulsating pressures.
PTX-DV	1 2 3 4 5 6 7	0.75	(10.88)	✓	✗	✓	500 (930)	2.0 (29)	✓✓✓✓✓	Domed Solid Metal vent panel, with vacuum support, suitable for high positive and negative or fluctuating pressures.
PTX-R	1 2 3 5 7	0.2	(2.90)	✓	✓	✓	500 (930)	2.0 (29)	✓✓✓✓✓	Reverse Domed Solid Metal vent panel, suitable for high levels of cleanliness and high levels of vacuum.

****

Item	Descriptions
C	**Composite** Panel with Seal
S	**Slotted** Membrane
P	**Panel**
F	**Flat**
M	**Mesh** Support in Frame
D	Forward **Domed**
V	**Vacuum** Support Fitted
I	**Infill** Damper
T	**Triple** Panel with Seal
PTX	**Protex**
R	**Reverse** Domed

** Hygienic means that the vent panel has no slots or crevices where product can accumulate. Food quality materials should be used wherever necessary.*

*** Lightweight infill material will be expelled upon venting.*

**** For higher temperatures a heat shield may be used. See Accessories, page 14.*

Selection