Flame Arresters, Detonation Arresters, Breather Vents
About BS&B FlameSaf
BS&B FlameSaf Limited is a safety company dedicated to protecting industrial plants and personnel from the dangers of explosion and fire propagation. The company’s rich history spans more than 80 years with the BS&B name being well known for its innovative solutions for personal protection against dangerous over pressurizations and explosions within industrial settings.

BS&B offers a comprehensive portfolio of products and services that meet and exceed rigorous industry standards for quality and reliability. Our integrated solutions have been time-tested and fine-tuned to deliver maximum value and greater efficiencies to individual engineering processes.

BS&B is a certified manufacturer of flame arresters, detonation arresters and pressure / vacuum vents both with and without flame arrester function. Our flame arresters and Breather Vents (pressure/vacuum vents, P/V vents) incorporate impressive design and performance features that include compact and light weight construction, with low pressure loss in flowing conditions. The easy to assemble design enables quick installation of replacement parts when required.

Certification
All products have been certified through an independent certification body as per the EC Directive 94/9/EC and awarded the CE mark of conformity.

Our state of the art flow and dimensional measurement techniques ensure the user receives high quality safety devices compliant with Industry Standards. Product performance features are controlled according to EN 10204 and in line with customer special requirements.

The BS&B FlameSaf quality assurance system is monitored by Det Norske Veritas (DNV), who issue certification according to ISO 9001 to BS&B.

Flame Arresters
Flame arresters are used as protection against explosions by preventing the transmission of flame and explosion transfer in machines, equipment and plant, containing inflammable gas or steam-air mixtures of inflammable liquids. These autonomous safety systems limit the effects of the explosions, rendering them harmless, they are intended to allow flow but prevent flame transmission.

BS&B FlameSaf arrester products use the technical principle of a ‘quenching gap’. Precision coiled arrester elements are manufactured to allow normal flow to occur and to present a barrier to flame propagation. The quenching gap selected for the combustion condition of each application is too small for flame to pass and burning is ‘arrested’. Precision coiled arrester elements offer superior safety as compared to mesh type arresters which offer less stability of quenching gap.

The BS&B FlameSaf product line includes arrester technology suited to safe management of deflagration and detonation risks in piping systems and equipment. End-of-line and in-line devices are available along with P/V vents that offer integral arresters.
Deflagration
A deflagration is an explosive combustion process in which the flames propagate at subsonic velocity. There are end-of-line and in-line deflagration flame arresters. It is imperative to adhere to the maximum distance (L) from the ignition source when installing in-line flame arresters.

(Refer to page 11 of this document for combustion reference data.)

Detonation
A detonation is an explosion propagating at supersonic velocity characterized by a shock wave. Detonations occur in pipelines with long distances to the ignition source (L > 50 x DN being an example for explosion group IIA).

The flame arresting capability and mechanical strength of an in-line detonation flame arrester is much greater than an in-line deflagration flame arrester. Devices designed for detonation conditions will provide deflagration protection as well.

Stabilized Burning
Stabilized burning is the steady burning of a flame at or on a flame arrester element. Survival of such conditions requires the selection of an arrester model designed for endurance conditions.

BS&B FlameSaf short time burning flame arresters have an integral temperature sensor for the user to monitor temperature. If a predetermined limit is exceeded, the user must initiate a process shut down to end the combustion event within a defined time period specific to the application.

Flame Arrester Reference Guide:
Flame arresters are suitable for a variety of explosive atmospheres within industrial applications. The next several pages showcases the benefits of the BS&B lineup of flame arresters. Please reference these pages for solutions to protect your application. For detailed information, please visit our website at www.BSBflamearrester.ie.

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- End-of-Line Breather Vents ....................... Pages 8 - 9
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<th>Model 931-A</th>
<th>Model 931-B</th>
<th>Model 931-T</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
</tbody>
</table>

### Purpose
- Deflagration, stable and unstable detonation endurance burning
- Deflagration, stable and unstable detonation endurance burning
- Deflagration, stable and unstable detonation
- Deflagration, short-time burning

### Application
- Gas / air- or vapor / air- mixtures of the explosion groups: IIA, I (methane)
- Gas / air or vapor / air mixtures of the explosion groups: IIA, I (methane)
- Gas / air or vapor / air mixtures of the explosion groups: IIC, IIB, IIA, I (methane)
- Gas / air or vapor / air mixtures of the explosion groups: IIA, I (methane)

### Nominal Diameter
- Metric: 8, 10, 15, 20 and 25 and 32mm
- Imperial: 1/4, 3/8, 1/2, 3/4, 1 and 1 1/4 inch
- Metric: 15, 20, 25 and 32mm
- Imperial: 1/2, 3/4, 1 and 1 1/4 inch
- Metric: 6, 8, 10 and 15mm
- Imperial: 1/8, 1/4, 3/8 and 1/2 inch
- Metric: 40mm
- Imperial: 1 1/2 inch

### Connection
- Rp to ISO 7-1 (DIN 2999)
- BSP to BS 21
- NPTF to ANSI B1.20.3
- DIN 2501 PN10
- ANSI B16.5 - 150 RF
- Rp to ISO 7-1 (DIN 2999)
- BSP to BS 21
- NPTF to ANSI B1.20.3
- DIN 2501 PN10
- ANSI B16.5 - 150 RF

### Approval
- EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852
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- EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852

### Metal Foil Element
- Stainless Steel
- Stainless Steel
- Stainless Steel, Special Alloy
- Stainless Steel

### Housing of Metal Foil Element
- -
- -
- -
- -

### Body / Cover
- Carbon Steel, Stainless Steel
- Carbon Steel, Stainless Steel
- Stainless Steel, Special Alloy
- Carbon Steel, Stainless Steel

### Coating
- Optional
- Optional
- -
- -

### Temperature Sensor
- -
- -
- -
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure resistant enclosure (E Ex d)
# Reference Guide

## In-Line Flame Arrester

<table>
<thead>
<tr>
<th>Model</th>
<th>Model</th>
<th>Model</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>931-A-T</td>
<td>933-A</td>
<td>933-G</td>
<td>933-S</td>
</tr>
</tbody>
</table>

### Deflagration, short-time burning
- Model 931-A-T
- Model 933-A
- Model 933-G
- Model 933-S

### Deflagration, stable and unstable detonation, short-time burning
- Model 931-A-T
- Model 933-A
- Model 933-G
- Model 933-S

### Deflagration, stable and unstable detonation short time burning
- Model 931-A-T
- Model 933-A
- Model 933-G
- Model 933-S

### Purpose
- Gas / air- or vapor / air- mixtures of the explosion groups: IIA, I (methane)
- Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)
- Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)
- Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)

### Application
- Metric: 40mm
- Imperial: 1 1/2 inch
- Metric: 25, 32, 40, 50, 65 and 80mm
- Imperial: 1, 1 1/4, 1 1/2, 2, 2 1/2 and 3 inch
- Metric: 25, 32, 40, 50, 65 and 80mm
- Imperial: 1, 1 1/4, 1 1/2, 2, 2 1/2 and 3 inch
- Metric: 50, 65, 80, 100, 125, 150, 200, 250, 300, 350, 400 and 500mm
- Imperial: 2, 2 1/2, 3, 4, 5, 6, 8, 10, 12, 14, 16 and 20 inch

### Nominal Diameter
- Rp to ISO 7-1 (DIN 2999)
- BSP to BS 21
- NPTF to ANSI B1.20.3
- DIN 2501 PN10
- ANSI B16.5 - 150 RF
- ISO 7005 PN10
- ANSI B16.5 - 150 RF
- DIN 2501 PN10
- ANSI B16.5 - 150 RF
- ISO 7005 PN10
- ANSI B16.5 - 150 RF

### Connection
- Rp to ISO 7-1 (DIN 2999)
- BSP to BS 21
- NPTF to ANSI B1.20.3
- DIN 2501 PN10
- ANSI B16.5 - 150 RF
- ISO 7005 PN10
- ANSI B16.5 - 150 RF
- DIN 2501 PN10
- ANSI B16.5 - 150 RF
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- ANSI B16.5 - 150 RF

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- EC-type-examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852

### Metal Foil Element
- Stainless Steel, Special Alloy
- Stainless Steel, Special Alloy
- Stainless Steel, Special Alloy
- Stainless Steel, Special Alloy

### Body / Cover
- Carbon Steel, Stainless Steel
- Body: Carbon Steel, Stainless Steel, Special Alloy
- Body: Carbon Steel, Stainless Steel, Special Alloy
- Body: Ductile Iron, Carbon Steel, Stainless Steel, Special Alloy

### Optional
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure-resistant enclosure (E Ex d)
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure-resistant enclosure (E Ex d)
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure-resistant enclosure (E Ex d)
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure-resistant enclosure (E Ex d)

### Coating
- Optional
- Optional
- Optional
- Optional

### Temperature Sensor
- Resistance thermometer with ignition protection type:
  - Inherently safe (E Ex i)
  - Pressure-resistant enclosure (E Ex d)

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### Model 933-SE

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Deflagration, stable detonation short time burning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIA, IIB1, I (methane)</td>
</tr>
</tbody>
</table>
| Nominal Diameter | Metric: 50, 80, 100, 125, 150, 200 and 250mm  
Imperial: 2, 3, 4, 5, 6, 8 and 10 inch |
| Connection | ISO 7005 PN10  
ANSI B16.5 - 150 RF |
| Approval | EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852 |
| Metal Foil Element | Stainless Steel, Special Alloy |
| Housing of Metal Foil Element | Stainless Steel, Special Alloy |
| Body / Cover | Ductile Iron, Carbon Steel, Stainless Steel |
| Coating | Optional |
| Temperature Sensor | Resistance thermometer with ignition protection type  
– Inherently safe (E Ex i)  
– Pressure-resistant enclosure (E Ex d) |

### Model 934-BM

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Deflagration, endurance burning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Gas / air or vapor / air mixtures of the explosion groups: IIA, IIB, IIB3, I (methane)</td>
</tr>
</tbody>
</table>
| Nominal Diameter | Metric: 40, 50, 65 and 80mm  
Imperial: 1½, 2, 2½ and 3 inch |
| Connection | ISO 7005 PN10  
ANSI B16.5 - 150RF  
Rp to ISO 7-1 (DIN 2999)  
BSP to BS 21  
NPTF to ANSI B1.20.3 |
| Approval | EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852 |
| Metal Foil Element | Carbon Steel, Stainless Steel |
| Housing of Metal Foil Element | Stainless Steel, Special Alloy |
| Body / Cover | Body: Carbon Steel, Stainless Steel  
Hood: Stainless Steel |
| Coating | Optional |
| Temperature Sensor | - |

### Model 934-BP

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Deflagration, endurance burning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application</td>
<td>Gas / air or vapor / air mixtures of the explosion groups: IIA, IIB, IIB3, I (methane)</td>
</tr>
</tbody>
</table>
| Nominal Diameter | Metric: 25, 32, 40 and 50mm  
Imperial: 1, 1¼, 1½ and 2 inch |
| Connection | ISO 7005 PN10  
ANSI B16.5 - 150RF  
Rp to ISO 7-1 (DIN 2999)  
BSP to BS 21  
NPTF to ANSI B1.20.3 |
| Approval | EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852 |
| Metal Foil Element | Carbon Steel, Stainless Steel |
| Housing of Metal Foil Element | Stainless Steel, Special Alloy |
| Body / Cover | Body: Carbon Steel, Stainless Steel  
Hood: Plexiglass |
<p>| Coating | Optional |
| Temperature Sensor | - |</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>Deflagration</th>
<th>Deflagration, short-time burning</th>
<th>Deflagration</th>
<th>Deflagration, Short Time Burning</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 934-B-E</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIC, IIB3, IIA, I (methane)</td>
<td>Purpose</td>
</tr>
<tr>
<td>Model 934-B-T</td>
<td>Metric: 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350 and 400mm Imperial: 1, 1(1/4), 1(1/2), 2, 2(1/4), 3, 4, 5, 6, 8, 10, 12, 14 and 16 inch</td>
<td>Metric: 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, 300, 350 and 400mm Imperial: 1, 1(1/4), 1(1/2), 2, 2(1/4), 3, 4, 5, 6, 8, 10, 12, 14 and 16 inch</td>
<td>Metric: 25, 32, 40, 50, 65, 80mm Imperial: 1, 1(1/4), 1(1/2), 2, 2(1/4), 3, 4, 5, 6, 8, 10, 12, 14 and 16 inch</td>
<td>Metric: 50, 65, 80, 100, 125, 150, 200, 250, 300, 350 and 400mm Imperial: 2, 2(1/4), 3, 4, 5, 6, 8, 10, 12, 14 and 16 inch</td>
<td>Purpose</td>
</tr>
<tr>
<td>Model 934-BP-E</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150RF Rp to ISO 7-1 (DIN 2999) BSP to BS 21 NPTF to ANSI B1.20.3</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150RF Rp to ISO 7-1 (DIN 2999) BSP to BS 21 NPTF to ANSI B1.20.3</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150RF Rp to ISO 7-1 (DIN 2999) BSP to BS 21 NPTF to ANSI B1.20.3</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150RF Rp to ISO 7-1 (DIN 2999) BSP to BS 21 NPTF to ANSI B1.20.3</td>
<td>Purpose</td>
</tr>
<tr>
<td>Model 934-BP-T</td>
<td>EC-type examination certificate based on Directive 94/9/EC, according to ATEX 95 and ISO 16852</td>
<td>EC-type examination certificate based upon Directive 94/9/EC, according to ATEX 95 and ISO 16852</td>
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<td>EC-type examination certificate based upon Directive 94/9/EC, according to ATEX 95 and ISO 16852</td>
<td>Purpose</td>
</tr>
<tr>
<td>Model 934-B-E</td>
<td>Carbon Steel, Stainless Steel, Special Alloy</td>
<td>Carbon Steel, Stainless Steel, Special Alloy</td>
<td>Carbon Steel, Stainless Steel, Special Alloy</td>
<td>Carbon Steel, Stainless Steel, Special Alloy</td>
<td>Metal Foil Element</td>
</tr>
<tr>
<td>Model 934-B-T</td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
<td>Metal Foil Element</td>
</tr>
<tr>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>-</td>
<td>Resistance thermometer with ignition protection type – Inherently safe (E Ex i) – Pressure-resistant enclosure (E Ex d)</td>
<td>-</td>
<td>Resistance thermometer with ignition protection type – Inherently safe (E Ex i) – Pressure-resistant enclosure (E Ex d)</td>
<td>-</td>
<td>Temperature Sensor</td>
</tr>
</tbody>
</table>
Flame Arrester
End-Of-Line Breather Vent, with Integrated Flame Arrester

<table>
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<th>Model 935</th>
<th>Model 935-E</th>
<th>Model 936-E</th>
<th>Model 937-E</th>
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</thead>
<tbody>
<tr>
<td><strong>Purpose</strong></td>
<td>Pressure vent: deflagration and endurance burning</td>
<td>Pressure vent: deflagration</td>
<td>Vacuum vent: deflagration</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIA, I (methane)</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIB3, IIA, I (methane)</td>
<td>Gas / air- or vapor / air- mixtures of the explosion groups: IIB3, IIA, I (methane)</td>
</tr>
<tr>
<td><strong>Nominal Diameter</strong></td>
<td>Metric: 50 and 80mm Imperial: 2 and 3 inch</td>
<td>Metric: 50 and 80mm Imperial: 2 and 3 inch</td>
<td>Metric: 50, 80, 100, 125, 150 and 200mm Imperial: 2, 3, 4, 5, 6 and 8 inch</td>
</tr>
<tr>
<td><strong>Connection</strong></td>
<td>ISO 7005 PN10 ANSI B16.5 - 150 RF</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150 RF</td>
<td>ISO 7005 PN10 ANSI B16.5 - 150 RF</td>
</tr>
<tr>
<td><strong>Approval</strong></td>
<td>EC-type examination certificate based upon Directive 94/9/EC, according to ATEX 95 and ISO 16852, EN 13463-1 and EN 13463-5</td>
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<td>EC-type examination certificate based upon Directive 94/9/EC, according to ATEX 95 and ISO 16852, EN 13463-1 and EN 13463-5</td>
</tr>
<tr>
<td><strong>Metal Foil Element</strong></td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
</tr>
<tr>
<td><strong>Housing of Metal Foil Element</strong></td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
<td>Stainless Steel, Special Alloys</td>
</tr>
<tr>
<td><strong>Body / Cover</strong></td>
<td>Ductile Iron, Stainless Steel</td>
<td>Stainless Steel, Special Alloys</td>
<td>Ductile Iron, Stainless Steel</td>
</tr>
<tr>
<td><strong>Coating</strong></td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td><strong>Temperature Sensor</strong></td>
<td>-</td>
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</tbody>
</table>
## Reference Guide

### End-Of-Line Breather Vent

<table>
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<tr>
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<th>Model</th>
<th>Model</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>937-P</strong></td>
<td><strong>942-EV</strong></td>
<td><strong>943</strong></td>
<td><strong>944</strong></td>
</tr>
</tbody>
</table>

- **Including Flame Arrester**
- **Pressure and vacuum vent:** deflagration and endurance burning
  - (Emergency vent) pressure vent (no arrester element)
  - Vacuum vent (no arrester element)
  - Pressure and vacuum vent (no arrester element)

### Purpose

**Application**

- Gas / air- or vapor / air- mixtures of the explosion groups: IIA, I (methane)
- Gas / air- or vapor / air- mixtures: II 1/2 G c IIB T X
- Gas / air- or vapor / air- mixtures: II 1/2 G c IIB T X

### Nominal Diameter

<table>
<thead>
<tr>
<th>Metric: 50mm</th>
<th>Imperial: 2 inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metric: 50, 80, 100, 125, 150, 200 and 250mm</td>
<td>Imperial: 2, 3, 4, 5, 6, 8 and 10 inch</td>
</tr>
</tbody>
</table>

### Connection

<table>
<thead>
<tr>
<th>ISO 7005 PN10</th>
<th>ANSI B16.5 - 150 RF</th>
</tr>
</thead>
<tbody>
<tr>
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<td>ANSI B16.5 - 150 RF</td>
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</tbody>
</table>

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### Metal Foil Element

- Stainless Steel, Special Alloys
- Stainless Steel, Special Alloys
- Stainless Steel, Special Alloys
- Stainless Steel, Special Alloys

### Housing of Metal Foil Element

- Ductile Iron, Stainless Steel
- Carbon Steel, Stainless Steel
- Ductile Iron, Stainless Steel
- Ductile Iron, Stainless Steel

### Body / Cover

- Optional
- Optional
- Optional
- Optional

### Coating

- Optional
- Optional
- Optional
- Optional

### Temperature Sensor

- -
- -
**Vents Without Flame Arrester Element**

Vents are used for independent ventilation of vessels and storage tanks therefore offering safety for both normal and emergency venting situations, as detailed in API 2000/ISO 28300.

BS&B FlameSaf vents have weight loaded valve discs which attain their full valve lift as soon as pressures exceed 10% above the set pressure. This enables us to offer the customer maximum performance with lowest product losses.

Standard valve seats, discs and spindles are manufactured from corrosion-resistant material. For minimizing the leak rate, the sealing between valve disc and seat is made of a sealing foil and an air cushion over it. The sealing is made of metal if set pressures are high.

The suitability of all vents used in explosive atmospheres has been proved in an ignition hazard assessment. As devices of Device Group II Category 1G, they are approved for use in vessels and equipment with inflammable mixtures.

**Vents Including Flame Arrester Element**

The weight loaded pressure and vacuum vents are additionally equipped with flame arrester elements. In addition to the test as device for inflammable mixtures, the vents have also been tested and certified as safety systems in accordance with the EC Directive 94/9/EC.

The combination of vent and flame arrester element combines the merits of the two systems in a single compact device.
### Selection of Explosion Group IIA (D) (*Substances in the explosion group I*)

<table>
<thead>
<tr>
<th>Gases</th>
<th>Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biogas</td>
<td>Acetaldehyde (C₅H₇O)</td>
</tr>
<tr>
<td>Butane (C₂H₆)</td>
<td>Acetone (C₅H₈O)</td>
</tr>
<tr>
<td>Butene (C₄H₈)</td>
<td>Acetonitrile (C₅H₈N)</td>
</tr>
<tr>
<td>Land-fill gas*</td>
<td>Formic acid (CH₂O₂)</td>
</tr>
<tr>
<td>Natural gas</td>
<td>Ammonia (NH₃)</td>
</tr>
<tr>
<td>Liquefied gas</td>
<td>Aniline (C₆H₆N)</td>
</tr>
<tr>
<td>Power gas (suction gas)</td>
<td>Benzol (C₆H₅)</td>
</tr>
<tr>
<td>Furnace gas</td>
<td>Cumene (C₈H₁₀)</td>
</tr>
<tr>
<td>Carbon oxsulphide (COS)</td>
<td>Dichloromethane (CH₂Cl₂)</td>
</tr>
<tr>
<td>Digester gas*</td>
<td>Diesel fuel</td>
</tr>
<tr>
<td>Methane (CH₄)*</td>
<td>Jet petrol</td>
</tr>
<tr>
<td>Methyl nitrite (CH₃NO₂)</td>
<td>Petroleum (crude oils)</td>
</tr>
<tr>
<td>Monochlor difluorethane (C₂H₅ClF₂)</td>
<td>Acetic acid (C₄H₈O₂)</td>
</tr>
<tr>
<td>Propane (C₃H₈)</td>
<td></td>
</tr>
<tr>
<td>Propene (C₃H₆)</td>
<td></td>
</tr>
<tr>
<td>Trimethylamine (C₆H₁₂N)</td>
<td></td>
</tr>
<tr>
<td>Vinyl chloride (C₂H₃Cl)</td>
<td></td>
</tr>
<tr>
<td>1,1,1-Trifluorothane (C₂H₃F₃)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Selection of Explosion Group IIB1-IIB (C)

<table>
<thead>
<tr>
<th>Gases</th>
<th>Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butadiene -1,3 (C₄H₆)</td>
<td>Oxobutanoic acid (C₅H₈O₃)</td>
</tr>
<tr>
<td>Dimethyl ether (C₉H₁₈O)</td>
<td>Acrylonitrile (C₅H₈N)</td>
</tr>
<tr>
<td>Ethylene (C₂H₄)</td>
<td>Cyclohexadiene -1,3 (C₆H₆)</td>
</tr>
<tr>
<td>Ethylenoxide (C₄H₈O)</td>
<td>Diethyl carbonate (C₁₀H₁₈O₃)</td>
</tr>
<tr>
<td>Formaldehyde (CH₂O)</td>
<td>Divinyl ether (C₆H₁₀O)</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>Ethanol (C₂H₅OH)</td>
</tr>
<tr>
<td>Coke oven gas</td>
<td>Ethyl benzol (C₆H₁₀O)</td>
</tr>
<tr>
<td>Hydrogen sulphide (H₂S)</td>
<td>Furan (C₅H₈O)</td>
</tr>
<tr>
<td></td>
<td>Isoprene (C₅H₈)</td>
</tr>
<tr>
<td></td>
<td>Methacrylate (C₅H₈O₃)</td>
</tr>
<tr>
<td></td>
<td>Nitrobenzol (C₆H₆NO₂)</td>
</tr>
<tr>
<td></td>
<td>Propylenoxide (C₅H₈O)</td>
</tr>
</tbody>
</table>

### Selection of Explosion Group IIC (B)

<table>
<thead>
<tr>
<th>Gases</th>
<th>Liquids</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen (H₂)</td>
<td>Carbon disulfide (CS₂)</td>
</tr>
</tbody>
</table>
Service Station Products

Safety Components at Service Stations: Biofuels (E85)

There are various technical solutions for the worldwide increased safety requirements for explosion protection. One of these challenges in particular; securing service stations, is met by BS&B FlameSaf Limited with a newly developed range of compact flame arresters and vents.

The vents serve to recirculate the petrol fumes safely, as well as secure ventilation. The development of various solutions became necessary, as the mineral oil companies worldwide all have their own safety philosophies. The new range is conceived in such a way that they are also in line with the increased technical requirements, which arose from the use of alternative fuels. In particular the continuing worldwide introduction of bioalcohol mixtures (E85) was taken into account. Therefore a sustainably fire resistant over and under pressure valve is a worldwide novelty for E85, which was matched to the particular technical requirements, has an interesting design and is produced in line with excellent quality standards.

The compact design allows cost effective production which is reflected in a customer friendly price. With the new range, of which a large number of various valves has already been installed in Sweden, we hope to increase the popularity of BS&B FlameSaf outside of the natural gas provision sector.

Safety Equipment for Vapor Recovery and Venting Systems of Service Stations

Gasoline vapors are released to the atmosphere every time a fuel tank is filled with gasoline. This includes filling a large underground storage tank as well as the fuel tank of a motor vehicle.

Stage 1: Vapor recovery refers to the capture of gasoline vapors generated when a tank truck delivers gasoline to a storage tank at a gasoline station. As the storage tank is filled, the vapors are transferred to the tank truck, which then carries the vapors to the gasoline distribution terminal. During loading of the truck, the vapors are returned to the terminal and then condensed into liquid gasoline or are incinerated.

Stage 2: Vapor recovery refers to the capture of gasoline vapors generated when a motor vehicle fuel tank is filled at a gasoline station. Using a specially designed nozzle, the vapors are transferred from the fuel tank in the vehicle to the storage tank at the station as the vehicle fuel tank is filled.
Service Station Products Specifications

**Item:** 934-ES 2 inch  
**Description:** End of line flame arrester deflagration and endurance burning  
**Explosion group:** IIA and / or E85  
**Dimension:** DN50

**Item:** 933-G 2 inch  
**Description:** In-line detonation flame arrester  
**Explosion group:** IIA and / or IIB3  
**Dimension:** DN50

**Item:** 944-ES 2 inch  
**Description:** End of line pressure / vacuum vent  
**Dimension:** DN50

**Item:** 933-A 3 inch  
**Description:** In-line detonation flame arrester  
**Explosion group:** IIA and / or IIB3  
**Dimension:** DN80

**Item:** 937-ES 2 inch  
**Description:** End of line flame arrester endurance burning proof with pressure / vacuum vent  
**Explosion group:** IIA and / or E85  
**Dimension:** DN50

**Item:** 931-ES 1 inch  
**Description:** In-line deflagration flame arrester  
**Explosion group:** IIA  
**Dimension:** DN25

**Item:** 931-ES 2 inch  
**Description:** In-line pressure / vacuum vent  
**Explosion group:** IIB  
**Dimension:** DN50

**Item:** 931-ES 3 inch  
**Description:** In-line deflagration flame arrester  
**Explosion group:** IIA  
**Dimension:** DN50

**Item:** 931-ES 2 inch  
**Description:** In-line deflagration flame arrester  
**Explosion group:** IIA  
**Dimension:** DN50

**Item:** 931-ES 2 inch  
**Description:** In-line detonation flame arrester  
**Explosion group:** IIA  
**Dimension:** DN50
Rupture disks (bursting disks) are non-reclosing, pressure relief devices that activate at a specified pressure and temperature. They may be used as stand-alone pressure relief devices, or in parallel or in series with safety / pressure relief valves.

Graphite disks are made from impregnated graphite offering low burst pressure and excellent corrosion resistance. BS&B graphite disks are supplied with integral gaskets for direct installation between international pipe flanges. The replaceable element range is installed in graphite or stainless steel safety heads before installation between pipe flanges.

<table>
<thead>
<tr>
<th>Rupture Disk Devices</th>
<th>Saf-T-Graf® Monobloc and replaceable element Graphite Disks</th>
<th>Custom Engineered Products</th>
</tr>
</thead>
</table>
| Rupture disks (bursting disks) are non-reclosing, pressure relief devices that activate at a specified pressure and temperature. They may be used as stand-alone pressure relief devices, or in parallel or in series with safety / pressure relief valves. | Graphite disks are made from impregnated graphite offering low burst pressure and excellent corrosion resistance. BS&B graphite disks are supplied with integral gaskets for direct installation between international pipe flanges. The replaceable element range is installed in graphite or stainless steel safety heads before installation between pipe flanges. | • A wide range of standard and custom-designed rupture disk assemblies are available for your specific application  
• Assemblies are designed to be discarded after disk rupture; other designs permit the replacement of the ruptured disk  
• Customized designs are available for customer applications which cannot be met using standard assembly designs  
• 3-150mm (1/8-6 inches)  
• Burst pressures from 0.02-69barg (0.25-1,000 psig)  
• Temperatures to 205°C (400°F) - higher operating temperatures to 427°C (800°F) are achieved using a 'high temperature assembly'  
• Disk assemblies include soldered, welded, crimped and threaded designs |
| Pressure relief solution for burst pressures ranging from a few inches of water column / a few millibar to over 4,800bar (70,000 psig) | • 15-600mm (0.5-24 inches)  
• Burst pressures 0.02-69barg (0.25-1,000 psig)  
• Temperatures to 205°C (400°F) - higher operating temperatures to 427°C (800°F) are achieved using a 'high temperature assembly' | |
<p>| Disk designs for industrial process, sanitary / aseptic pharmaceutical and biotech and highly viscous process media applications. | A steel armoring ring around the disk for added safety and easier installation is recommended. | |</p>
<table>
<thead>
<tr>
<th>Industrial Explosion Protection</th>
<th>Vent-Saf® and Vent-Saf® Plus</th>
<th>Specialty Valves</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="77-8024" alt="Image" /></td>
<td>![Image](77-8003 77-8015)</td>
<td><img src="77-1015" alt="Image" /></td>
</tr>
</tbody>
</table>

**Type IPD system** - explosion suppression and isolation systems detect the earliest stage of a deflagration by sensing the pressure wave that comes ahead of the flameball and uses the signal to activate delivery of an extinguishing agent.

A typical system consists of the following:
- Sensor
- Power supply module
- System monitor
- Several explosion suppression ‘cannons’

**BS&B** utilizes NFPA 68 and VDI-3673 venting guidelines, which are recognized worldwide.

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**Buckling pin pressure relief technology (BPRV™)**
- Fast acting, quick opening buckling pin activate pressure relief devices designed to protect personnel, equipment and the environment from danger of overpressure
- Ability to ‘field-reset’ while remaining installed after an over pressure event

**BS&B** offers a complete line of explosion vents including types VSPTM, VSSTM, VSETM, VSBTM, EXPTM, EXP-DVTM, LCVTM and HTVTM.

**BPRV™** - offers the highest flow capacity and convenient inline installation
- 50-1,500mm (2-60 inches)
- ASME “UD” stamped
- European Pressure Equipment Directive “CE” marked

**BPAV™** - controlled by a precision buckling pin that is calibrated to respond to the forces generated by inlet pressure acting on the valve plug

The BS&B companies have proven to be the fastest growing manufacturers of industrial explosion protection technology with products designed to meet the requirements of the United States OSHA Combustible Dust National Emphasis program, NFPA standards and European ATEX Directive.