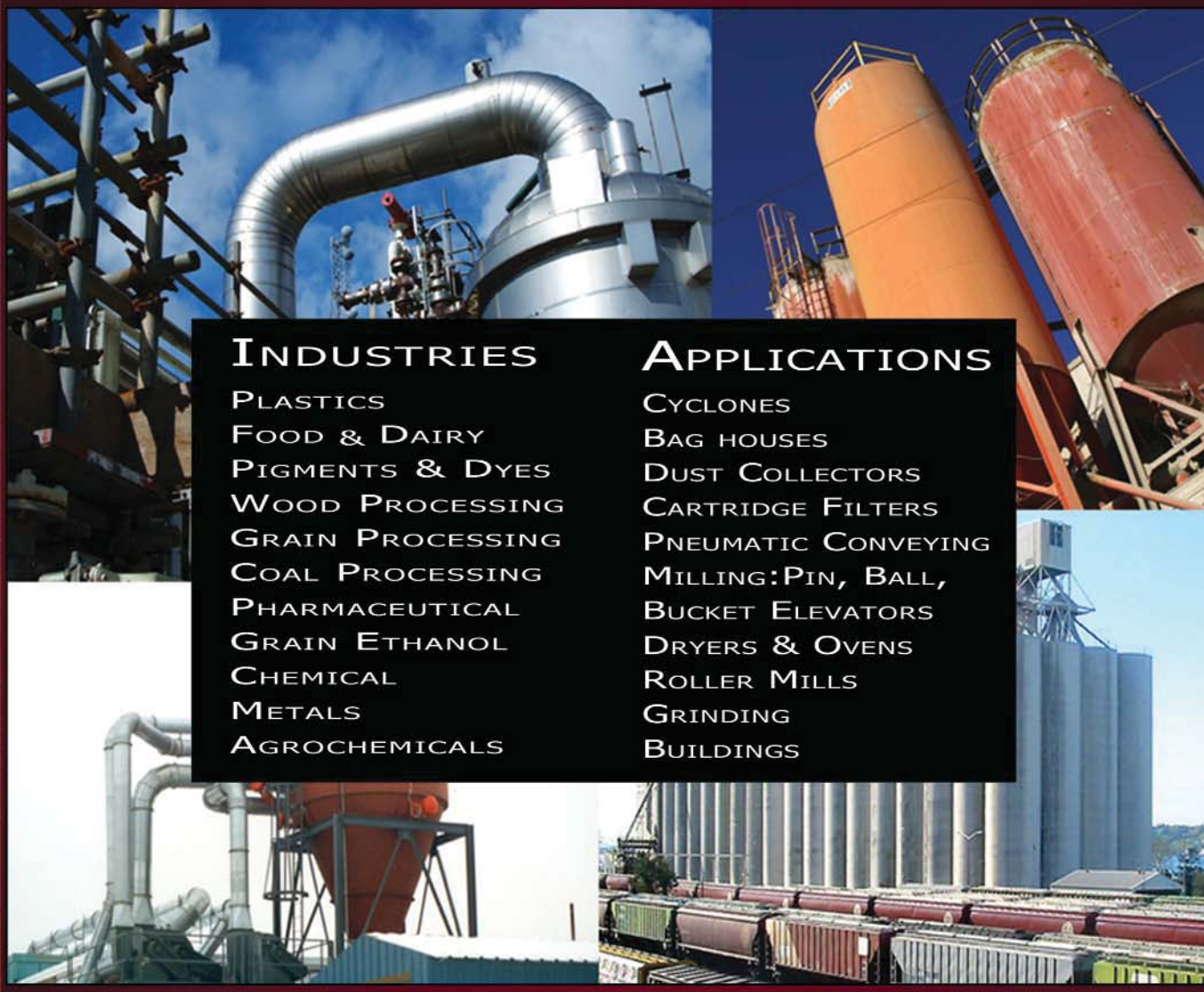
Catalog #77-8024

Industrial Explosion Protection

BS&B®

Combustible Dust Risk Management Solutions



Industries

- Plastics
- Food & Dairy
- Pigments & Dyes
- Wood Processing
- Grain Processing
- Coal Processing
- Pharmaceutical
- Grain Ethanol
- Chemical
- Metals
- Agrochemicals

Applications

- Cyclones
- Bag houses
- Dust Collectors
- Cartridge Filters
- Pneumatic Conveying
- Milling: Pin, Ball,
- Bucket Elevators
- Dryers & Ovens
- Roller Mills
- Grinding
- Buildings

Venting · Suppression
Spark Detection · Isolation · Testing

Please Visit:
www.bsbipd.com

Industrial Explosion Protection

Introduction to Industrial Explosion Protection and Prevention

There are always options in the management of explosion risks!

These measures are classified as either ***prevention*** or ***protection.***

Each application requires unique assessment that includes the following considerations:

- Quantify the risk; define the deflagration characteristics for the process material *(Testing may be required).*
- Consider whether a hybrid of prevention & protection measures should be employed.

Direct explosion venting is economically attractive, however, the full impact of a vented discharge must be assessed in order to determine the right safety measures to be implemented:

- Can the flameball developed during a deflagration be accepted?
- When protecting indoor equipment, can a vent duct to atmosphere be accepted?
- How will connected systems be isolated to prevent propagation of the explosion?
- Can the equipment accept the reaction forces generated by the vented release?
- Can buildings or equipment in the free vent path accept the shock loading of the explosion pressure pulse & accept the momentary high temperature of the fireball?

Answers to these questions will often determine that a number of protection measures should be implemented such as:

- Suppression whereby the full explosion event is prevented and no material is released to atmosphere.
- Prevention of Fire + Explosion Hazard: *(Housekeeping and process management to limit combustible load)*
- Management of electrostatic buildup, especially for low Minimum Ignition Energy (MIE) dusts
- Management of spark ignition sources (e.g. grinding, milling) by use of Spark Detection + Extinguishing technology.

What does it take to have an industrial explosion?

An explosion results from ignition of a combustible material (dust, gas or vapor) when mixed with oxygen present in the air. When this takes place inside a process or storage enclosure, the rapid rise in pressure developed will exert destructive forces within a few milliseconds that will place both personnel and equipment at risk. Most materials handling, processing and storage equipment are not designed to resist the pressure of a deflagration*. Only equipment designed to resist the maximum pressure (Pmax) developed by the combustion process will survive - such design pressures typically exceed 75 psig (5.2 bar), making design for containment of a deflagration prohibitively expensive in most cases.

* Deflagration: An expanding flameball that proceeds below the speed of sound in air, as compared to a detonation which exceeds the speed of sound in air. Typically, a process can be protected from deflagration hazards.

What does it take for prevention and protection of a dust explosion?

Often, a hybrid of technical measures is required to manage the deflagration process safety risk. The technology employed in deflagration management can be divided into passive and active. Typically passive technology functions by mechanical means, automatically, without external energy requirements. Explosion vents (also known as explosion panels) are a passive protection technology. Active systems require one or more sources of energy to function. Explosion suppression systems are an active prevention technology. Spark detection and extinguishing systems are an active prevention technology designed to detect and eliminate sources of ignition that could lead to fire or explosion. Both active and passive technology requires periodic inspection.

Assess the Risk/ Manage the Risk

Successful management of deflagration risks requires that the characteristics of the material (such as P*max* and Kst - the deflagration index of a dust) are known along with the process conditions, such as dust concentration, airflow velocity, operating pressure, temperature and humidity.

Economic considerations favor the use of explosion vent technology both in terms of cost of equipment and simple periodic inspection requirements. Consider however, the following application factors:

- Can the flameball that is ejected from an open vent be accepted? It may exceed 65 feet, 20 meters in length, and about half this in diameter. Simple free venting must be to a safe location where personnel will not be present and other equipment or buildings cannot be damaged.
- If venting equipment is installed indoors, can a vent duct to a safe outdoor location be provided? Vent ducts will always increase the required vent area and may not be practical for protecting smaller process volumes at higher Kst values.
- Can the required vent area be accommodated? As well as requiring the space for vent installation, can the reaction forces during venting be sustained and for tall equipment, can a near thrust neutral vent arrangement be achieved to prevent collapse during relief?
- If there are process inlets and outlets to the protected equipment, are these protected to prevent propagation of the deflagration to other equipment or work areas? Codes and Standards are now very clear in requiring isolation of vented equipment to prevent secondary explosions. Secondary explosion risks are typically much greater in their potential for damage and destruction.
- Can the clean up of a vented explosion be accepted? Depending upon the design basis adopted, a vented explosion may require replacement of capital equipment components that have become damaged by the pressure wave, resulting in loss of production while delivery is awaited.
- What will the neighbors think? A vented explosion is a spectacular event that will draw considerable community attention.
- What if the process material is toxic or hazardous? A vented release must simply be avoided for certain materials.

As illustrated by the above series of questions posed for a vented deflagration application, each process needs to be considered both alone and as a component of a production facility to ensure implementation of the right explosion protection and prevention technology.

Call BS&B for help!

Codes & Standards

BS&B will guide you following the practices required by the latest Codes and Standards. Visit **www.bsbipd.com** for the most up-to-date information.

OSHA COMBUSTIBLE DUST NATIONAL EMPHASIS PROGRAM

CE

FM APPROVED

AN ISO 9001 CERTIFIED COMPANY

NFPA®

BS&B Explosion Prevention and Protection Technologies Comprise Advanced Hardware Systems, Often Employed in Combinations

Prevention:

- Spark Detection & Extinguishing Systems applied to ducting.
- Explosion Suppression Systems for process equipment protection.

Trusted Service:

BS&B provides service 24/7 to support new and established installations -and to conduct advisory audits that follow NFPA standards and other best engineering practices.

Protection:

- Explosion vents for process equipment protection.
- Explosion Vents for Building Protection.
- Flameless Vents for Indoor Applications or wherever fireball release is unacceptable.
- Fast Acting Valves for Mechanical Isolation of Connecting Ductwork.
- Chemical Isolation Systems to provide a barrier to flame transmission through connecting ductwork.

Type IPD Explosion Suppression and Chemical Isolation System

From Left: the system monitor, the explosion detection unitized sensor, the explosion suppression cannon™ and the power supply. Depending upon the application, the capacity of the explosion suppression cannon™ is selected from standard modules identified as 5, 10, 20, 40, and 60lb. capacity. 5 lb module shown. Multiple cannons and sensors may be deployed.

Type IPD System: Core Technologies

The BS&B Explosion Suppression system detects the earliest stage of a deflagration by sensing the pressure wave that comes ahead of the flameball and uses this signal to activate delivery of an extinguishing agent into the developing flameball to suppress it before reaching destructive proportions. A typical system consists of a *Sensor, Power Supply Module, System Monitor* and *several Explosion Suppression "Cannons"*. The quantity, size and location of sensors and cannons are determined for each application.

Successful suppression of a deflagration results in a reduced explosion pressure; a low pressure peak within the process equipment. The developing flameball is injected with food-grade sodium bicarbonate that extinguishes from the inside; therefore showing no evidence, externally from the process, that a deflagration event occurred.

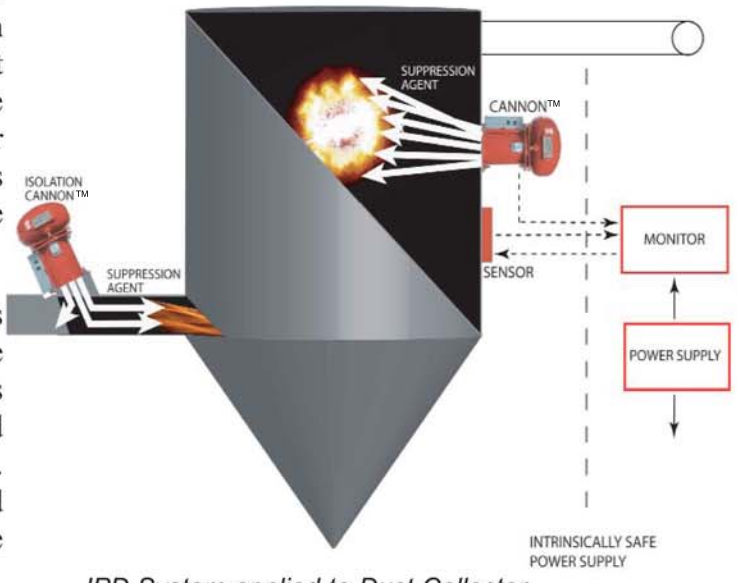
The requirement to isolate process equipment can be easily achieved using suppression system technology. When the sensor detects the early stages of the deflagration, not only are the main suppressing cannons activated but at the same time an isolation cannon is activated on each duct creating a chemical block on the duct and thus preventing the deflagration from moving upstream or downstream.

Chemical isolation systems should be deployed with vented equipment to protect both upstream process equipment and even clean air exhaust systems that return into the process.

Example: An Activated IPD System

The sensor detected pressure waves from the fireball and quickly activated the suppression cannon module to extinguish the fireball inside this dust collector. The isolation cannon™ then blocks flame from entering adjoining process equipment. Sensor relays are quickly activated to shut down the process equipment to end the supply of combustible material and to generate an alarm.

Cannons can be installed directly onto process equipment or connecting ductwork at any angle avoiding the need for heavy extension piping & nozzles for the dispersion of suppressant. The low mass and compact size of the cannons allow for easy installation. Cannons are ready-for-field mounting and shipped unpressurized, in two-parts, which reduces the weight to be manipulated by personnel.



IPD System applied to Dust Collector

BS&B Flameless Venting IQR System

Where the flameball ejected by a deflagration cannot be accepted and ducted relief is impractical, flameless venting technology provides an alternate passive protection system.

Flame, dust and pressure control:

Intercepts >>> Quenches >>> Retains

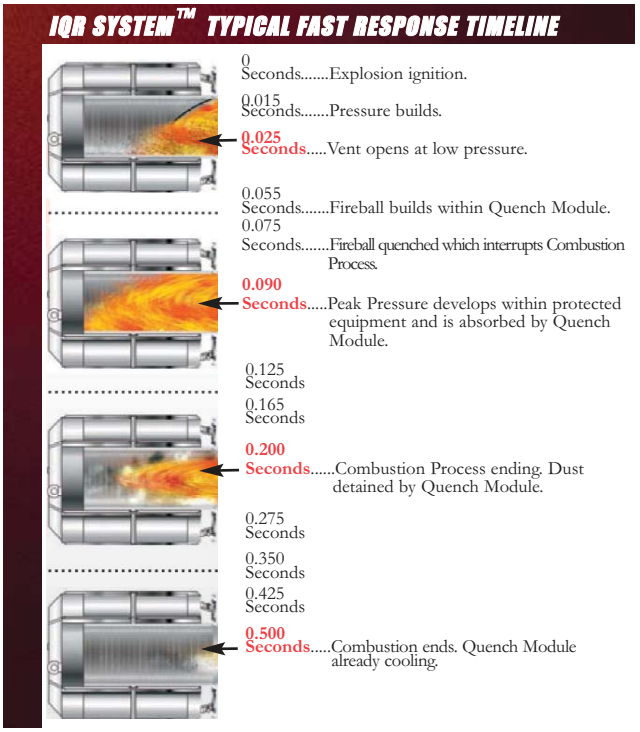
How the IQR System works

The IQR System comprises of two parts, an explosion vent and a quenching module. The explosion vent responds to the rapidly building pressure of a deflagration and opens to relieve this pressure. As the developing fireball passes through the open explosion vent, it is intercepted by the quenching module. A stainless steel precision mesh, retained by a frame, performs as a 3-dimensional flame arrestor to quench the flame. The quenching module retains the flame and hot gases of a deflagration as well as the burning and unburned dust passing through the open explosion vent.

With the quenching of flame, retention of dust and control of pressure and temperature provided by the IQR System, this safety device may be applied indoors whenever the impact of a vented explosion must be avoided.

Five Safety functions of the IQR System:

- Flame Arresting - No flame escapes providing a safe operating environment for personnel.
- Eliminates the possibility of an external secondary ignition and subsequent explosion external to the protected equipment.
- Dust Retention - Retains process product removing the possibility of potentially toxic product entering the environment.
- Pressure Retention - Absorbs explosion pressure peak, protects personnel and surrounding environment, including buildings, from pressure blast.
- Temperature Control - Absorbs fireball with negligible temperature rise in surrounding environment.



BS&B IVE Fast Acting Pinch Valve Mechanical Isolation

Ducts and Pipe may require isolation by mechanical means using a fast acting valve. BS&B provides activated 'knife gate valve' or 'pinch valve' technology in such cases.

The IVE pinch valve is designed to prevent explosion propagation from one vessel to another through interconnected piping. It can be used to prevent hot particles, glowing embers, flames and pressure from reaching a vessel and igniting a secondary deflagration or a fire.

The IVE is normally open. Upon receiving a signal from either a pressure sensor or an optical sensor, the IVE controller will signal the valve to close in milliseconds. The means of actuation is plant compressed-air stored in a tank at the pinch valve to ensure the fastest response possible. The valve closure principle is an elastomeric bladder which rapidly inflates to shut off the duct or pipe.

The IVE is designed for on-site reset by plant personnel and permits periodic functional testing.

Spark Detector Sensor SDN

External Monitoring Panel

Control Unit DCI

Automatic Extinguishing Device

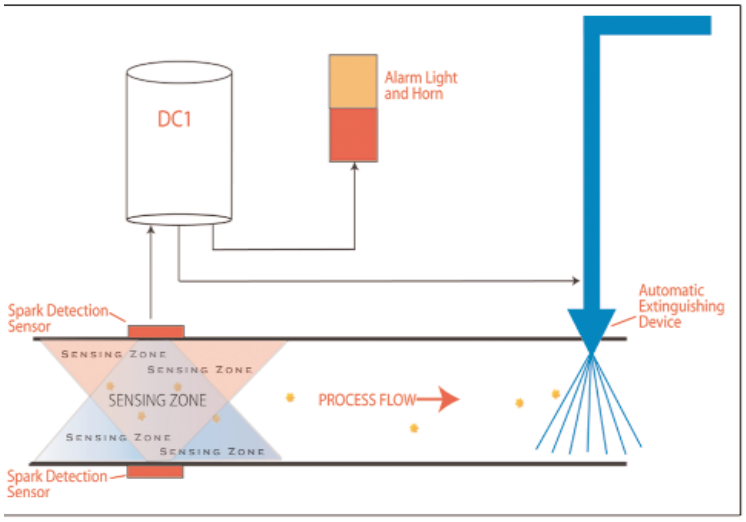
Spark Detection & Extinguishing System (SD&E)

Spark detection and extinguishing technology is employed to manage the risk of fire and explosion ignition due to sparks and burning embers that are transported through a combustible dust handling system. By detection of near infrared energy, sparks and embers are first located and then extinguished by water spray downstream of the detection point. Operation of the system is fully automatic.

Detectors located to the wall of process piping, downstream of the source of sparks or embers, continuously monitor the presence of near infrared energy. The highly responsive sensors have a wide 120-degree field of view.

Upon receipt of an alarm signal from one or more system sensors, the SD&E control unit immediately activates the electromagnetic control valve circuit for the downstream water spray nozzles.

The control unit along with the supporting sensors and nozzle units are certified for use in the dusty work area. This minimizes local wiring and allows plant personnel direct access to the status of the equipment. In the event of an alarm condition, an operator can see directly which process system is at risk. Optional external monitoring is provided that can serve multiple SD&E systems. The critical components of the SD&E system are monitored by the control unit to ensure reliable operation.



Single Duct Spark Detection and Extinguishing System

Spark Detectors Applied to an Array of Horizontal Ducting

Type VSB* Building Vent

* US and International Patents Pending. Protection of Buildings & Structures by Very Low Pressure Explosion Vents

VSB Vent Construction:

1. Translucent polycarbonate or metal sheet
2. Aluminum perimeter frame
3. Dual seal from frame to vent
4. Centrally mounted 'burst tab' to control set pressure
5. Dynamic release cord that retains vent after activation

Polycarbonate vent construction permits transmission of daylight while maintaining insulation properties similar to double panel glass (typical R value of 2.7) and an impact strength rating of over 200 times that of single panel glass.


Type VSB Building Vent

VSB Vent Sizes:

Individual Type VSB vents can be made to fit the available building apertures that achieve the required vent area for deflagration venting. Type VSB vents are available in sizes up to 56" x 120" (1.2m x 3m) and with set pressures as low as 4" Water Column / 0.14psi (10mBar).


Dynamic Testing of VSB

VSB Vent Benefits:

- Lowest available vent set pressure
- Zero maintenance of functional parts
- Low mass, simple installation
- Designed for non fragmentation
- Available translucent construction
- Excellent insulating properties
- Simple replacement

Contact BS&B with your application details.

BS&B offers a complete line of Explosion Vents including:

Types VSP™ and VSS™ - Domed single section metal explosion vents with integral gaskets. The dome resists vacuum and vacuum cycling.

Type VSE™ - A flat, single section metal explosion vent with integral gaskets designed for near static operating pressures.

Type EXP™ a flat vent with a slotted 316 SS top section and FEP/PTFE Seal. **Type EXP/V™** provides vacuum support.

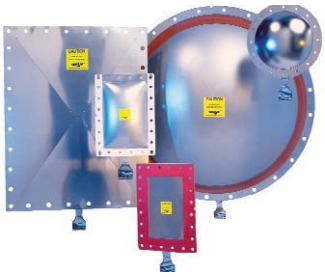
Type EXP/DV™ - a round domed explosion vent of composite construction with integral vacuum support and gaskets.

Type LCV™ - a flat explosion vent of composite construction with integral gaskets.

Type HTV™ - a lightly domed vent designed for high temperature service to 1,000°F (538°C) and above.

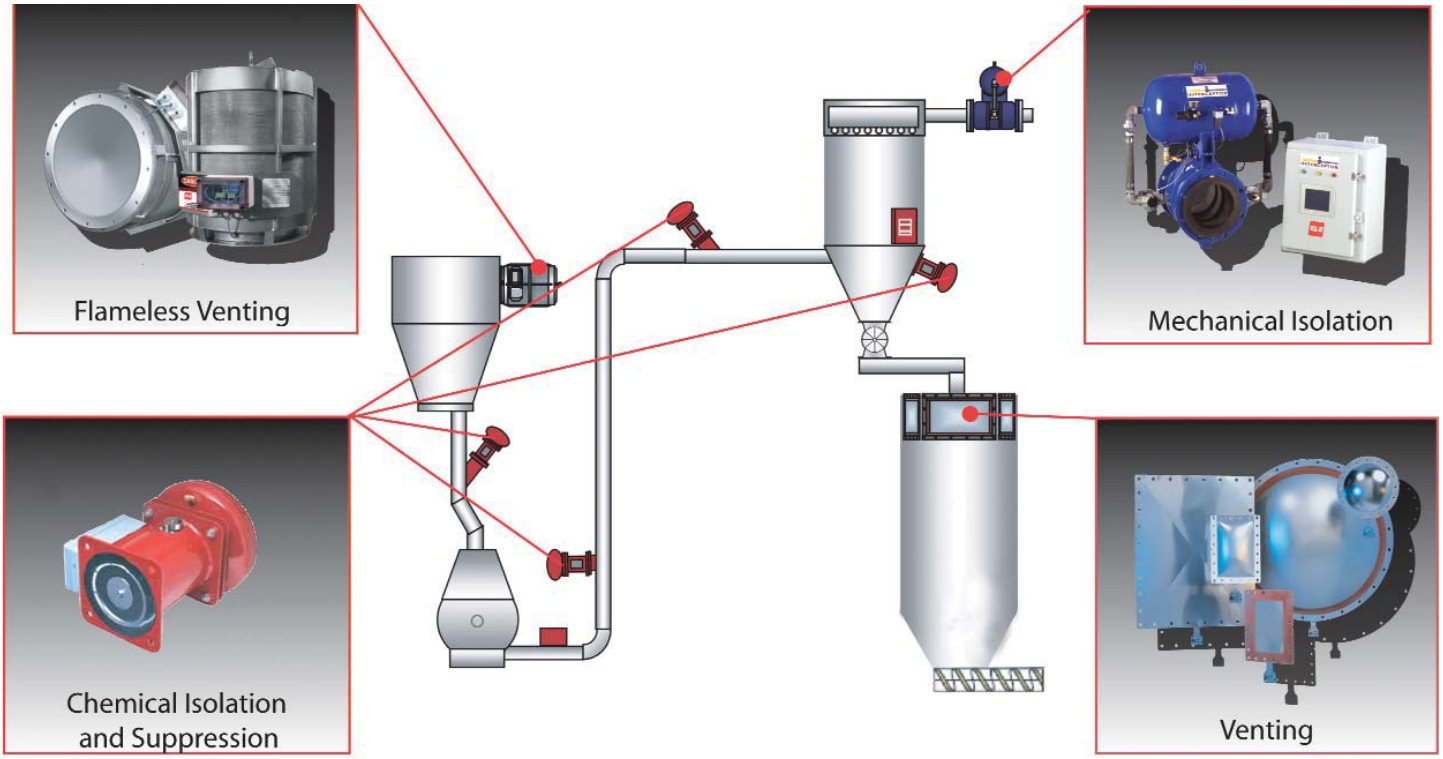
BS&B vents are available in both round or rectangle styles and designed to be mounted on the structure to be protected using a safety frame. Options include:

- Rectangular sizes from 6"x9" (152mm x 229mm) to 44.5" x 68" (1130mm x 1727mm).
- Round sizes from 8"(203mm) to 54" (1372mm).
- Material options for standard designs; sanitary aseptic designs; high temperatures above 300°F (149°C) and insulation to prevent condensation from collecting on panels.
- Manufactured to meet the requirements of NFPA 654, 68, 69 and ATEX Standards.
- Vent sensors to provide a process shutdown signal.



BS&B EXPLOSION PROTECTION SOLUTIONS

Venting · Suppression · Spark Detection · Isolation · Testing



Proven Range of Prevention and Protection Technology

Flexibility is provided by BS&B's proven range of prevention and protection technology that includes explosion venting, explosion suppression and a choice of chemical and mechanical systems for the isolation of interconnected processes. Explosion protection requires planning. Consult the experts at BS&B.

Capabilities

BS&B offers more-than 75-years of pressure safety management and a team of research & development specialists and application experts who support our clients existing and new applications.

Our Dedication includes:

- The Design and Manufacture of Explosion Prevention & Protection Technology.
- Supporting and Driving the Development of Codes and Standards.
- Providing Engineering Advice and Services to Owners, Operators, Equipment Manufacturers and engineering consultants & Contractors.
- Providing Field Service Network Support to Customers.
- Process Risk Assessment in-line with best engineering practices.
- Providing periodic inspection inline with codes and standards

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