



BS&B PRESSURE SAFETY  
MANAGEMENT, L.L.C.

# EXPLOSION VENTING IQR SYSTEM™

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## FLAME, DUST and PRESSURE CONTROL

- INTERCEPTS
- QUENCHES
- RETAINS

# 4 SAFETY FUNCTIONS OF THE IQR SYSTEM™

- ♦ **Flame Arresting** – No flame escapes providing a safe operating environment for personnel. Eliminates the possibility of a 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 from pressure blast.
- ♦ **Temperature Control** – Absorbs fireball with negligible temperature rise in surrounding environment.

## HOW THE IQR SYSTEM™ WORKS

The IQR system comprises 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 of stainless steel, 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. The 3-dimensional mesh arrangement acts as a heat sink that interrupts the explosion in mid-stream as well as an absorption of the pressure wave and dust that would normally be ejected by a vented explosion.

While the flameball temperature of a dust explosion can easily reach 500°C/ 932°F, the IQR quenching module typically remains below 100°C/212°F followed by rapid cool down due to its large surface area. This results in a negligible change in temperature in the environment surrounding the IQR System.

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.

## APPLICATION OF THE IQR SYSTEM™

The IQR System is recognized as an explosion venting device by Codes and Standards such as NFPA 68, NFPA 654 and the European Atex Directive. The IQR System is a solution for the protection of process equipment installed indoors where one or more of the following conditions exist:

- Venting to outside requires ducting that is too long. Vent ducting that exceeds 20ft/6m in length is not recommended — ducts up to 10ft/ 3m in length have the least impact on the pressure developed within the protected process equipment.
- No space to install venting is available. This can arise where equipment is installed closely packed leaving no room for short and straight ducting.
- No access is available to outside for vent ducting. This can arise where equipment is installed in basement areas as where no outside wall is present.
- Release of fireball outside is unacceptable; a fireball might be ejected up to 100ft/ 30 meters and have 10 times the volume of the process equipment being protected.
- Release of dust (burned and unburned) outside is unacceptable.
- Release of explosion pressure pulse is unacceptable; adjacent building structures can be damaged by a pressure pulse that can exceed 2 or 3 psi over a large area for a short time.

Many of these application concerns apply to outdoor process equipment as well. The IQR System may be applied to outdoor process equipment where precautions are taken to avoid buildup of snow, ice and water in the quenching module.

Dust explosion without the IQR System



Dust explosion with the IQR System



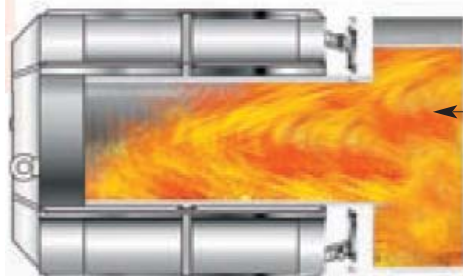
# IQR SYSTEM™ TYPICAL FAST RESPONSE TIMELINE



Zero Seconds.....Explosion ignition.

0.015 Seconds.....Pressure builds.

**0.025 Seconds**..... Vent opens at low pressure.



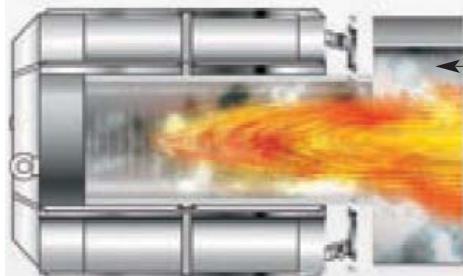
0.055 Seconds.....Fireball builds within Quench Module.

0.075 Seconds.....Fireball quenched which interrupts Combustion Process.

**0.090 Seconds**.....Peak Pressure develops within protected equipment and is absorbed by Quench Module.

0.125 Seconds

0.165 Seconds



**0.200 Seconds**.....Combustion Process ending. Dust detained by Quench Module.

0.275 Seconds

0.350 Seconds



0.425 Seconds

**0.500 Seconds**.....Combustion ends. Quench Module already cooling.

## INFORMATION REQUIRED TO SPECIFY THE IQR SYSTEM™

The IQR System is an explosion venting device. The following information is required to select and specify the correct IQR unit for your application.

- ◆ Process Dust ( $K_{st}$  and  $P_{max}$ )
- ◆ Process Equipment Description (Volume(s)); preferably drawings including inlet and outlet connections.
- ◆ Normal operating pressure and temperature
- ◆ Protection pressure for process equipment ( $P_{red}$ )

Should this information be unavailable, let BS&B's technical sales personnel review your application with you.



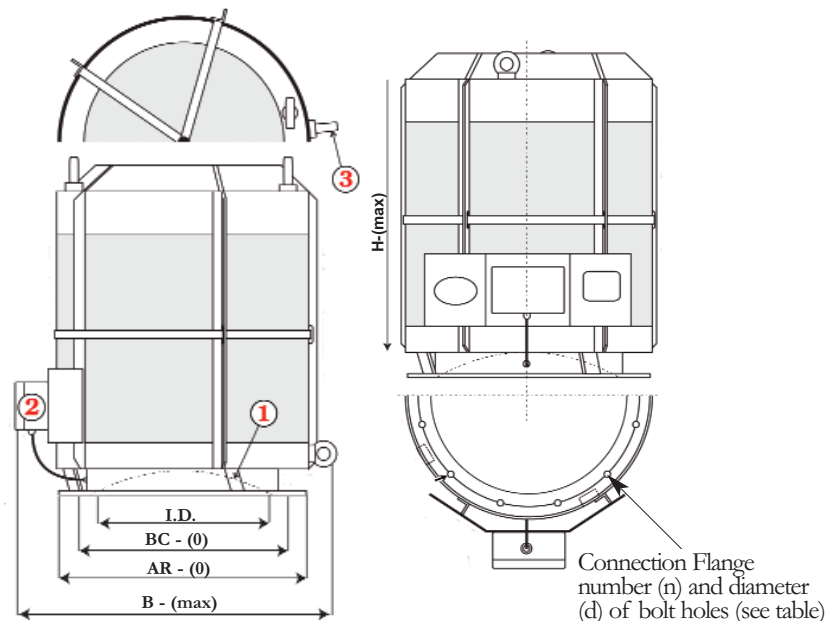
## METRIC UNITS

| Type   | I.D. mm | H mm | A mm | B mm | AR mm | BC mm | d mm | n # | wt. Kg |
|--------|---------|------|------|------|-------|-------|------|-----|--------|
| IQR-8  | 208     | 560  | 360  | 430  | 269   | 243   | 8.5  | 8   | 29     |
| IQR-12 | 310     | 560  | 460  | 530  | 391   | 355   | 11   | 12  | 34     |
| IQR-16 | 393     | 940  | 560  | 630  | 500   | 443   | 13   | 16  | 55     |
| IQR-20 | 494     | 940  | 660  | 740  | 599   | 544   | 13   | 20  | 69     |
| IQR-24 | 596     | 1400 | 770  | 860  | 701   | 646   | 13   | 20  | 144    |
| IQR-28 | 697     | 1910 | 880  | 970  | 800   | 752   | 13   | 28  | 224    |
| IQR-32 | 799     | 2210 | 980  | 1070 | 899   | 854   | 13   | 28  | 275    |

## U.S. CUSTOMARY UNITS

| Type   | I.D. in. | H in. | A in. | B in. | AR in. | BC in. | d in. | n # | wt. lbs. |
|--------|----------|-------|-------|-------|--------|--------|-------|-----|----------|
| IQR-8  | 8.2      | 22    | 14.2  | 17    | 10.6   | 9.6    | 0.33  | 8   | 64       |
| IQR-12 | 12.2     | 22    | 18.1  | 20.9  | 15.4   | 14     | 0.43  | 12  | 75       |
| IQR-16 | 15.5     | 37    | 22    | 24.8  | 19.7   | 17.4   | 0.51  | 16  | 121      |
| IQR-20 | 19.4     | 37    | 26    | 29.1  | 23.6   | 21.4   | 0.51  | 20  | 152      |
| IQR-24 | 23.5     | 55    | 30.3  | 33.9  | 27.6   | 25.4   | 0.51  | 20  | 317      |
| IQR-28 | 27.4     | 75.2  | 34.6  | 38.2  | 31.5   | 29.6   | 0.51  | 28  | 494      |
| IQR-32 | 31.5     | 87    | 38.6  | 42.1  | 35.4   | 33.7   | 0.51  | 28  | 606      |

Dimension A is the external diameter of the IQR unit.



1. Explosion vent with integral Burst Alert® Sensor
2. IQR Monitor that provides signal upon activation for process shut down.
3. Eyebolts for lifting and support after installation (if required)

## INSTALLATION, INSPECTION AND MAINTENANCE

The IQR System is simply installed by a bolted flange connection at its inlet, just as an explosion vent would be applied. Installation may be in any convenient location.

In the case of larger size IQR devices or where installed to weak equipment, additional bracing may be required by connecting to the eyebolts supplied with each IQR unit. The IQR system is always supplied with an integral Burst Alert® sensor and monitor circuit that will generate an alarm signal when the device activates. Codes require that this alarm signal be used to shut down the process to stop the feed of dust and air which are the fuel for an explosion.

Annual inspection of the IQR system is recommended by factory trained personnel. While the IQR is a passive safety device, just like an explosion vent, periodic inspection ensures optimum safety.

Factory trained personnel are available for assistance with commissioning as well as annual inspection. Forthcoming changes to codes and standards require that both passive and active safety systems be subject to periodic inspection. The IQR system has no routine maintenance requirements. Commissioning and annual inspections will identify any planned maintenance requirements unique to each application.

After system activation there is minimal external cleanup compared to an open vented dust explosion. The IQR System can typically be refurbished after activation for quick and economic process restart.



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*Products, specifications and all data in this literature are subject to change without notice. Questions regarding product selection and specifications for specific applications should be directed to BS&B Pressure Safety Management, L.L.C.*

*Contact BS&B for more information regarding Explosion Isolation, Explosion Suppression & Explosion Venting technology. BS&B Type IPD Explosion Suppression Systems are FM approved. All sales are subject to BS&B Pressure Safety Management, L.L.C. or standard terms and conditions of sale.*