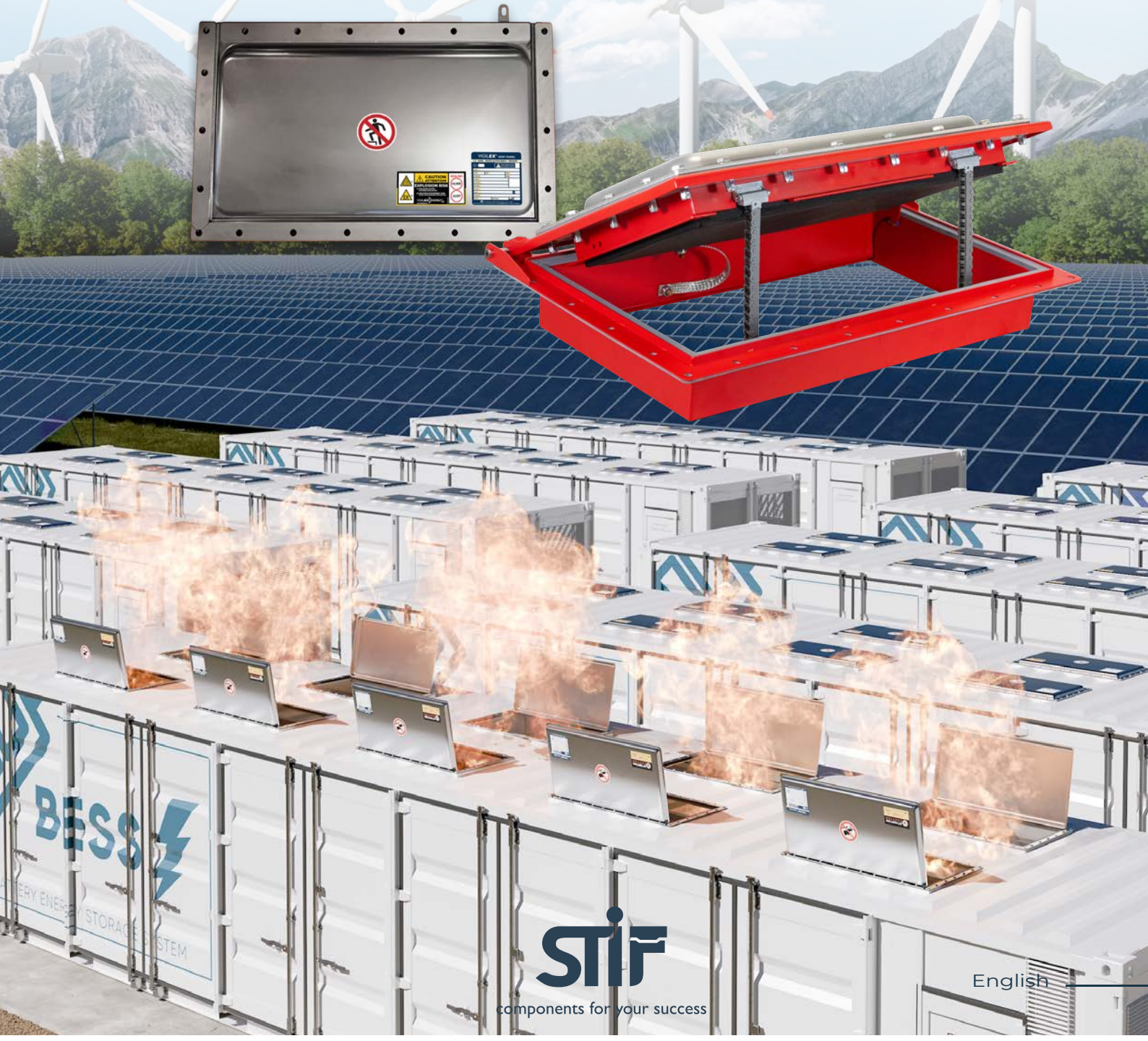
VIGILEX ENERGY®

By STIF

FIRE AND EXPLOSION PROTECTION FOR BESS

(Battery Energy Storage Systems)



STIF

components for your success

English

STIF is a global leader in manufacturing of fire and explosion protection solutions for **Battery energy Storage Systems (BESS)**, headquartered in France.

Innovation, which is a strong part of the company's DNA, has enabled the **VIGILEX** division to experience rapid growth in recent years for the **EXPLOSION PROTECTION** sector.

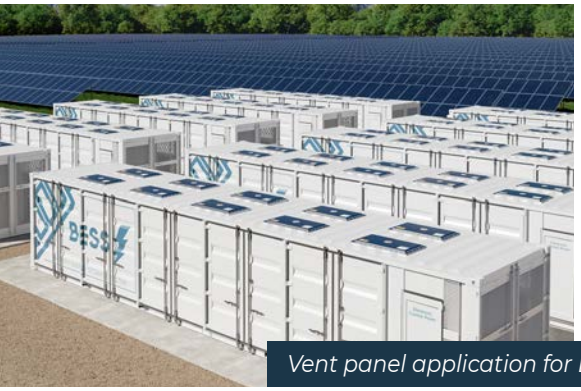
STIF constantly monitors potential new markets, which led to the conception, engineering, and design of products meant specifically to protect against fires and explosions in **BESS**.

To engage as closely as possible with **BESS** customers and provide them with a range of products designed for their unique requirements, **STIF** created a new division specifically focused on the **BESS** market called :

VIGILEX ENERGY

In this catalog you will find solutions to effectively protect **BESS** containers from the risks of explosions and fires.

We also can customize products based on your system's specific requirements.



Vent panel application for BESS

Explosion test on vent panel

BESS market :

In just a few years, **BESS** have become an unparalleled solution to the intermittency of most renewable energy sources such as wind and solar.

These battery systems (most often lithium-ion based) make it possible to supply electricity for several hours by acting as a relay even when renewable energy generation is not active.

Like any highly complex electric system, however, it is important to protect the assets and limit the risks of explosions and fires that are caused by occasional thermal runaway within the batteries.

THIS IS WHERE VIGILEX ENERGY COMES IN BY OFFERING YOU OUR EXPERTISE IN :

- The sizing and configuration of deflagration vents.
- Understanding and conforming to the relevant safety standards in effect around the world.
- Technical support, including the option of conducting joint studies, research & development, and testing to achieve the perfect solution for your system.
- A wide range of solutions for your specific system design, including fully waterproof IP67 rated products and others that respond to the requirements of both NFPA 68 and NFPA 69 – detecting and releasing gasses or opening to release the pressure during an explosion.
- We can support your local supply chain globally, with factories in France (Europe), China (Asia), and the USA (Americas).

www.vigilexenergy.com

UL 50E GASKETS APPROVED

VIGILEX ENERGY PRODUCTS

NFPA 855 v2023:

The rapid development of **BESS** installations has led to a correlating increase in the occurrence of incidents resulting in electrochemical fires, at times accompanied by a container explosion.

The **NFPA 855** standard for the Installation of Stationary Energy Storage Systems provides the minimum requirements for mitigating the hazards associated with BESS installations.

The standard was revised in 2023 to better address the risks of explosion and fire in a **BESS**. The extract from the standard (right) states very clearly that all **BESS** should include deflagration panels.

EXTRACT standard NFPA 855 v2023

9.6.5.6.3 ESS installed within a room, buiding, **ESS** cabinet, **ESS** walk-in unit, or otherwise nonoccupiable enclosure shall be provided with one of the following:

(1) Explosion prevention systems designed, installed, operated, maintained, and tested in accordance with **NFPA 69**

(2) Deflagration venting installed and maintained in accordance with **NFPA 68**

PRODUCTS RANGE

Explosion Risk in BESS : THERMAL RUNAWAY

A **thermal runaway** is a phenomenon of chain reactions that can quickly become uncontrollable, and which can lead to the explosion of a **BESS**.

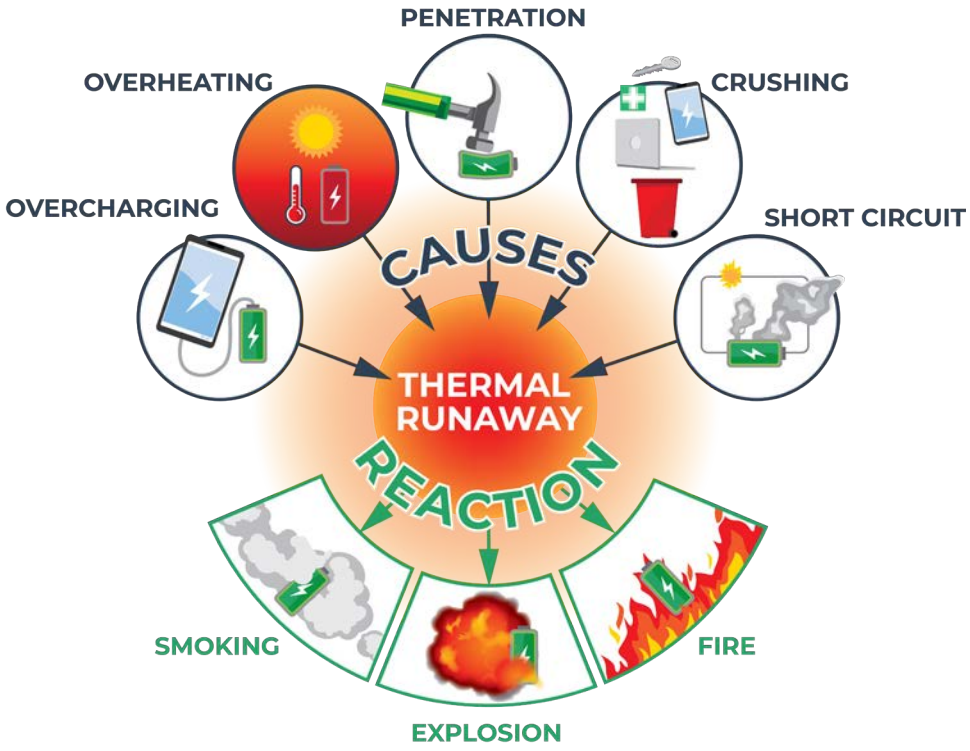
Thermal runaway triggers an exothermic reaction that generates extreme heat (exceeding 1000°C in some cases) and releases significant quantities of flammable gases, such as hydrogen, along with other toxic fumes.

The intensity of a thermal runaway depends on the battery's chemistry and its state of charge (SOC). During a thermal event, heat from faulty cells can cause adjacent cells to fail, triggering a chain reaction that may spread throughout the module, potentially destroying the entire **BESS** and nearby equipment.

THERMAL RUNAWAY CAN BE TRIGGERED BY MANY DIFFERENT FACTORS:

Manufacturing defects within the battery cel, mechanical abuse such as a crash or penetration, electrical abuse such as overcharging or short circuiting a cell, thermal abuse related to excessive temperatures. The severity of the risks associated with a thermal runaway highlight the importance of implementing measures within a **BESS** design that **mitigate the risks of explosion and fire**, such as the use of explosion-protection panels.

Detecting and releasing flammable gases from a **BESS** are two key measures outlined in **NFPA 855**.



BESS Explosion

BESS Fire

VENT PANEL
EXPLOSION
TEST

DIRECTIVE : 2014/34/UE

QUALITY CONTROL - OPENING PRESSURE

We test the vent panels in our factory according to **EN 14 797**. These panels are manufactured under the EU examination certificate type INERIS **25ATEX0004X** and the quality managment system of the company is certified by the EU quality certification Ineris **08ATEXQ406**.

Our range of products are supplied with a certificate of conformity complete with burst test results along with installation guidelines.

CERTIFICATIONS

EXPLOSION VENT PANEL STANDARD

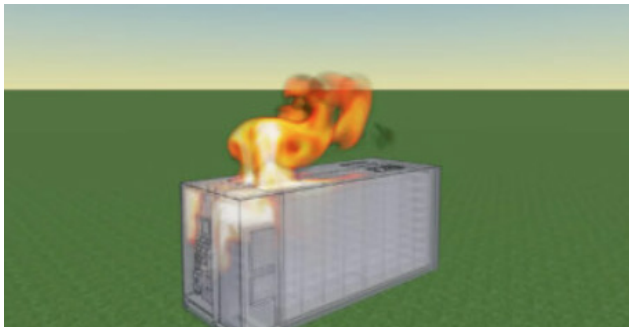
- Ex II G
- EN 14 491 / EN 14 994 / EN 14 797 / EN 1127.1
- EU Type examination certificate : INERIS 25ATEX0004X
- Production quality assurance notification : INERIS 08ATEXQ406
- UL : Silicone gasket UL 50 E - UL157

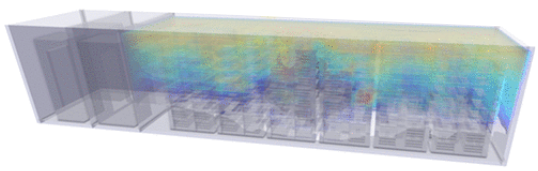
CALCULATION

EXPLOSION VENT PANEL SIZING

- Sizing according to NFPA68 chapter 7 – V2023
- Values based upon the results of UL9540A report
- Designed to match each containers' design
- FLACS- simulation

CFD Analyses by FLACS





ARC-VENT® *INS*⊕ MAX

APPLICATIONS

The new **ARC-VENT® INS⁺MAX** panel has a unique design which employs a stamped stainless-steel membrane which gives it the strongest resistance of any similar product on the market in the event of elevated external load (such as a heavy snowfall).

The stamped membrane also makes it possible to create a physical hydraulic-pressed barrier against any water intrusion within the panel insulation.

The **INS⁺MAX** is designed to integrate the insulating foam within the membrane itself, eliminating the requirement of an insulation box.

ARC-VENT® INS⁺MAX
Insulation protection integrated

STANDARD CHARACTERISTICS

- Design: one-piece pressed membrane with integrated insulating foam
- SST 304L
- Insulation foam Armaflex UL 94 VO
- Grey silicone gasket UL 50 E - UL157
- Flange + gasket included
- Fully waterproof and vibration resistant

Insulation Material: Foam UL 94-V0
Thermal Conductivity : λ=0.036 w/(m.K)

INTERNAL DIMENSION		EXTERNAL DIMENSION	AREA
(mm)	Inches	(mm)	(cm²)
305 x 610	12 x 24	386 x 690	1845
580 x 780	23 x 30	670 x 870	4495
520 x 1020	20 x 40	600 x 1000	5270
680 x 880	27 x 35	770 x 970	5950
1080 x 1080	42 x 42	1180 x 1180	11600

**other sizes available on request*

CERTIFICATIONS

ARC-VENT® *INS*⊕ MAX **IP66**

Ex II G

EN 14994
EN 14797
EN 1127.1

NF EN ISO 9227: 2012
NF EN 8993: 2010
NF EN 10289: 1999

EU Certificate: *INERIS 25ATEX0004X*

Production quality assurance notification: *INERIS 08ATEXQ406*

UL157 UL50E

According to *NFPA 68*

1440 hours Salt Fog tested

TECHNICAL INFO

Pstat @ 22 °C	EFFICIENCY RATIO	EXTERNAL WEIGHT RESISTANCE
Pstat ≤ 100 mbar (±25%)	70 % - 100 %	1000 kg/m²

OPTIONS

- Grey Silicone
- White Silicone Gasket (-55 °C +200°C)
- Black EPDM Gasket (-40°C +80°C)
- Flat Grid ARC-VENT GF (detailed page 7)
- Inductive Burst Sensor (INR)
- SST 316L

ARC-VENT®

APPLICATIONS

The new **VIGILEX ARC-VENT®** range is specifically designed and engineered for installation on **BESS** and on the external walls of electrical switch rooms to relieve the over-pressurization caused by gas or arc flash explosions.

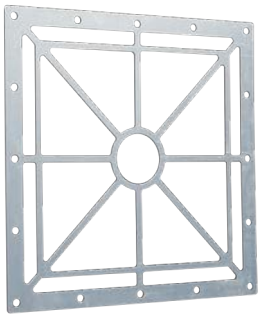
These safety elements are tested and certified to open at the required pressure. They are generally installed on the top of a **BESS** to safely direct an explosion upwards and away from surrounding equipment or people. **ARC VENT®** panels are **IP66** certified for waterproof protection, and **ATEX EN 14994** certified for the design of gas explosion venting systems.

STANDARD CHARACTERISTICS

- Design: Single layer SST 304 L
- **Grey silicone gasket UL 50 E - UL157** (-55 °C +200°C)
- Flange + gasket included
- No water retention and vibration resistant system

OPTIONS

- Grey Silicone
- White Silicone Gasket (-55 °C +200°C)
- Black EPDM Gasket (-40°C +80°C)
- Flat Grid ARC-VENT GF
- Inductive Burst Sensor (INR)
- SST 316L



Flat grid ARC-VENT GF

CERTIFICATIONS

Ex II G

EN 14 994
EN 14 797
EN 1127.1

IP66

NF EN ISO 9227: 2012
NF EN 10289: 1999

EU Certificate: *INERIS 25ATEX0004X*

Production quality assurance notification: *INERIS 08ATEXQ406*

UL157 UL50E

According to *NFPA 68*

1440 hours Salt Fog tested

TECHNICAL INFORMATION

STIF MODEL	Pstat @ 22 °C	EFFICIENCY RATIO	EXTERNAL WEIGHT RESISTANCE
ARC-VENT®	Pstat ≤ 100mbar (±20%)	80 % - 100 %	500 kg/m²

ARC-VENT® INS⁻A & ARC-VENT® INS⁻B

WITH INTERNAL THERMAL INSULATION

APPLICATIONS

To complement our product range, we offer the **ARC-VENT® INS⁻A** and **INS⁻B** panels, specifically designed to provide superior thermal performance.

To meet the internal environment control requirements of your **BESS**, we have enhanced the thermal insulation properties of our panels to ensure optimal enclosure protection. In the **INS⁻A** version, we incorporate a layer of synthetic rubber insulation foam on the internal side of the panel, significantly minimizing thermal weak points caused by use of venting panels. As an alternative, the **INS⁻B** version utilizes mineral wool encased in an aluminum box, offering comparable insulation performance without relying on synthetic rubber foam.

Both versions are available in various insulation thicknesses to suit your specific needs, all while maintaining the panel's efficiency during explosion events.

ARC-VENT® INS⁻A ***GLUED FOAM***

Insulation protection below the vent panel (Internal insulation)

Insulation Material: Foam UL 94-V0
Thermal Conductivity : λ=0.036 w/(m.K)

ARC-VENT® INS⁻B ***ALUMINUM BOX***

Insulation protection box below the vent panel (Internal insulation)

Insulation Material: Mineral wool
Includes an aluminum box
Thermal Conductivity : λ=0.037 w/(m.K)

STANDARD CHARACTERISTICS

- Design : Single layer SST 304L
- **Grey silicone gasket UL 50 E - UL157** (-55 °C +200°C)
- Flange + gasket included
- Insulation protection
- Fully waterproof and vibration resistant

OPTIONS

- Grey Silicone
- White Silicone Gasket (-55 °C +200°C)
- Black EPDM Gasket (-40°C +80°C)
- Inductive Burst Sensor (INR)
- SST 316L

TECHNICAL INFO

STIF MODEL	Pstat @ 22 °C	EFFICIENCY RATIO	EXTERNAL WEIGHT RESISTANCE
ARC-VENT® INS⁻A	Pstat ≤ 100 mbar (±20%)	70 % - 100 %	500 kg/m²
ARC-VENT® INS⁻B	Pstat ≤ 100 mbar (±25%)	70 % - 100 %	500 kg/m²

CERTIFICATIONS

Ex II G

IP66

EN 14 994
EN 14 797
EN 1127.1

NF EN ISO 9227 : 2012
NF EN 8993 : 2010
NF EN 10289 : 1999

EU Certificate : *INERIS 25ATEX0004X*

Production quality assurance notification : *INERIS 08ATEXQ406*

UL157 UL50E

According to *NFPA 68*

ARC-VENT®INS+ WITH EXTERNAL THERMAL INSULATION

APPLICATIONS

In certain cases, our **INS −** versions may not align with the design of your **BESS**, and internal insulation may not be suitable. To address this, we offer an alternative solution to ensure effective thermal control for your **BESS**.

The **ARC-VENT® INS+** delivers high insulation performance by incorporating mineral wool on the external side of the panel. This insulation is encased in anodized aluminum, providing robust protection against environmental factors and ensuring a long service life. With this external insulation setup, there is no interference with your piping or electrical wiring networks.

This alternative preserves the primary function of our panels during an explosion, and we can offer varying insulation thicknesses to meet your specific thermal efficiency requirements.

ARC-VENT® INS+

Insulation protection above the vent panel (External insulation)

STANDARD CHARACTERISTICS

- Design: Single layer SST 304L
- **Grey silicone gasket UL 50 E - UL157** (-55 °C +200°C)
- Flange with gasket included
- Insulation protection (above position) **INS+**
- Fully waterproof and vibration resistant

OPTIONS

- Grey Silicone
- White Silicone Gasket (-55 °C +200°C)
- Black EPDM Gasket (-40°C +80°C)
- Flat Grid ARC-VENT GF (detailed page 7)
- Inductive Burst Sensor (INR)
- SST 316L

Insulation Material: Glass wool
Thermal Conductivity : λ=0.037 w/(m.K)

CERTIFICATIONS

Ex II G

IP66

EN 14 994
EN 14 797
EN 1127.1

NF EN ISO 9227: 2012
NF EN 8993: 2010
NF EN 10289: 1999

EU Certificate: *INERIS 25ATEX0004X*

Production quality assurance notification: *INERIS 08ATEXQ406*

UL157 UL50E

According to *NFPA 68*

1440 hours Salt Fog tested

TECHNICAL INFORMATIONS

STIF MODEL	Pstat @ 22 °C	EFFICIENCY RATIO	EXTERNAL WEIGHT RESISTANCE
ARC-VENT® INS+	Pstat ≤ 100 mbar (±25%)	70 % - 100 %	1000 kg/m²
ARC-VENT® INS+ / INS-	Pstat ≤ 100 mbar (±25%)	70 % - 100 %	1000 kg/m²

EXPLESS® IP67

APPLICATIONS

The first and only explosion vent on the market with to be IP67 certified. Its special design incorporates a seal over the entirte surface of the panel, enabling the **EXPLESS®** (patent pending) to meet the demanding requirements for an **IP67** rating, specifically demonstrating complete **resistance to water intrusion while under 1 meter of water for over 30 minutes**.

The **EXPLESS®** provides perfect sealing for your **BESS**.

STANDARD CHARACTERISTICS

- Design: Single flat SST 304 L
- **Grey silicone gasket UL 50 E - UL157** (-55 °C +200°C)
- Flange with gasket included
- IP67 waterproof
- Vibration resistant

OPTIONS

- Grey Silicone
- White Silicone Gasket (-55 °C +200°C)
- ARC-VENT GF(detailed page 7)
- Inductive Burst Sensor (INR)
- SST 316L

CERTIFICATIONS

Ex II G
EN 14 994
EN 14 797
EN 1127.1

IP67

NF EN ISO 9227: 2012
NF EN 10289: 1999

EU Certificate: *INERIS 25ATEX0004X*

Production quality assurance notification: *INERIS 08ATEXQ406*

UL157 UL50E

According to *NFPA 68*

TECHNICAL INFORMATION

STIF MODEL	Pstat @ 22 °C	EFFICIENCY RATIO	EXTERNAL WEIGHT RESISTANCE
EXPLESS©	Pstat ≤ 100 mbar (±20%)	70 % - 100 %	500 kg/m²
EXPLESS® INS + MAX	Pstat ≤ 100 mbar (±25%)	70 % - 100 %	1000 kg/m²

GAS-VENT®

NEW

APPLICATIONS

The **GAS-VENT®** was designed and engineered to meet the needs for degassing or smoke extraction in a **BESS**. This active ventilation system creates natural ventilation when it detects gas or smoke and automatically opens.

Its design mirrors the **DUAL-VENT®**, but it does not include an explosion protection panel. The system can be paired with various sensors or detection mechanisms for smoke, gas, heat, etc.

A (NFPA69)

GAS VENTING

During thermal runaway, a single defective battery cell can generate a large amount of dangerous gases. This can result in a severe uncontrolled fire or an explosion.

Combined with a monitoring system and detection system, the **GAS-VENT®** quickly extracts hazardous gases from the enclosure, considerably reducing the risk of fire and explosion.

Once the monitoring system deems the enclosure safe, the **GAS-VENT®** automatically closes and seals the container.

CONNECTION BOX
included for easy wiring

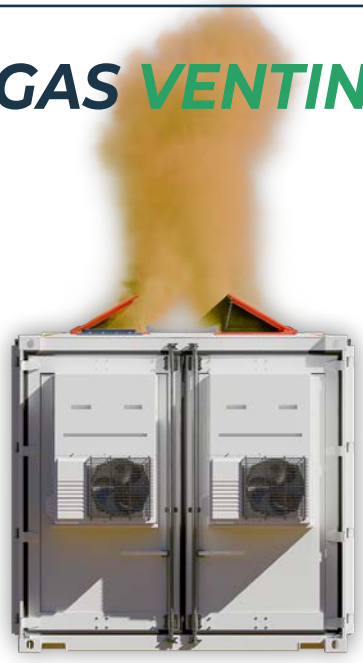
OPENING SETTINGS : 30°

- **Easy to connect** with the included connection box.
- **Easy to install** on your BESS.
- **Easy to control** via low voltage monitoring systems.

GAS VENTING

NFPA® 69

Door triggered by gas detector



AUTOMATIC RECLOSING AFTER VENTING

DUAL-VENT®

PATENTED No. FR2301551

DOUBLE ACTION Product

APPLICATIONS

Fire protection systems installed within a **BESS** enclosure are insufficient on their own to prevent a thermal runaway. This has been extensively demonstrated through studies, tests, and reports.

It is imperative to both discharge the **BESS** of flammable gases when they are detected and to protect the enclosure and surrounding environment during an explosion.

The **DUAL-VENT®** is designed and engineered to meet both of these requirements in one system and is the only product on the market to address the requirements for NFPA 68 and NFPA 69.

OPENING SETTINGS : 30°

A (NFPA69)

GAS VENTING

During thermal runaway, a single defective battery cell can generate a large amount of dangerous gases. This can result in a severe uncontrolled fire or an explosion.

Combined with a monitoring system and detection system, the **DUAL-VENT®** quickly extracts hazardous gases from the enclosure, considerably reducing the risk of fire and explosion.

Once the monitoring system deems the enclosure safe, the **DUAL-VENT®** automatically closes and seals the container.

B (NFPA68)

EXPLOSION VENTING

In the event of an explosion within an enclosure, the deflagration panel opens to release the overpressurization generated by the explosion and directs flames upwards and away from surrounding equipment and people when installed on the top of your **BESS**.

CONNECTION BOX
included for easy wiring

All panels in the Arc-vent range are compatible with DUAL-VENT®.

- **Easy to connect** with the included connection box.
- **Easy to install** on your BESS.
- **Easy to control** via low voltage monitoring systems.

It is possible to combine ARC-VENT® and DUAL-VENT® on your BESS

A GAS VENTING

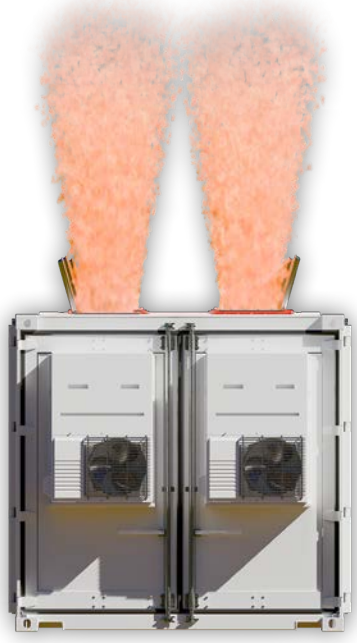
NFPA® 69

Door **triggered** by **gas detector**

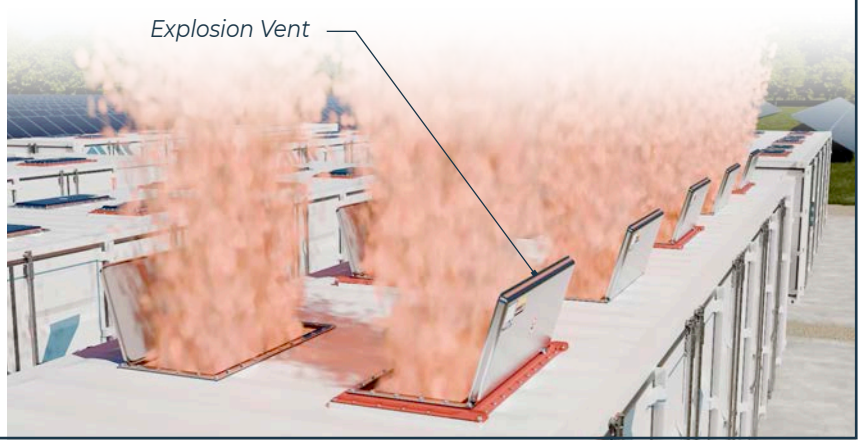
AUTOMATIC RECLOSING AFTER VENTING

B EXPLOSION VENTING

NFPA® 68



Integrated vent panel **activated** by **explosion pressure**



The **DUAL-VENT®** is an efficient solution to mitigate the risks and the fallout of thermal runaway with a **BESS**. It is the only product on the market that helps address both **NFPA 68** and **69** requirements. It is a competitive and cost-effective solution compared to less efficient and costlier alternatives.

DEFLECTOR VIGI*SPACE*®

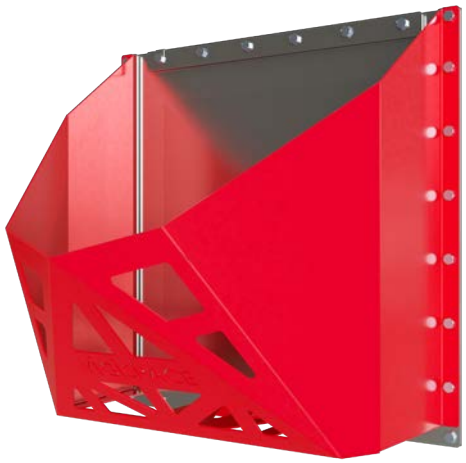
APPLICATIONS

If it is not possible to position the explosion vents on the top of the **BESS**, the ideal solution is to use **VIGISPACE®** as a deflector that can be placed on the sides of the enclosure and protect against damage to the surrounding environment in the event of an explosion.

The vent panel is installed first, then the deflector is mounted. In the event of an explosion, the vent will only open as far as the deflector, and flames will be directed upwards.

It is important to note that there is a lower efficiency when positioning vent panels on the sides of an enclosure rather than the top, and additional or larger panels may be required.

VIGISPACE® is tested and certified for explosion protection.



CERTIFICATIONS

Ex II D

EN 14 994
EN 14 797
EN14 491

EU Certificate: *INERIS 22ATEX0004X*

Production quality assurance notification: *INERIS 08ATEXQ406*

VIGISPACE® for BESS

Explosion without VIGISPACE®

Explosion with VIGISPACE®

DUAL-VENT® +VIGISPACE®

The **innovative combination** of our **DUAL-VENT® solution** (opening with gas detection + blast panel) **with** our **VIGISPACE®** certified deflector.

APPLICATIONS

When fitted the gas detection and the opening of the **DUAL-VENT®** will be done in the lateral opening, with minimal rainentering inside the container.

In the event of an explosion, the vent incorporated in the **DUAL-VENT®** will burst open normally and the flame will be deflected upwards by our **VIGISPACE®** deflector.

DUAL-VENT® with VIGISPACE®

VIGILEX ENERGY® By STIF

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To reduce our CO_2 emissions and to meet our global customers' demand, **STIF** manufactures on

3 continents

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2025 02 — Document non contractuel — Conception/réalisation : AVANTI