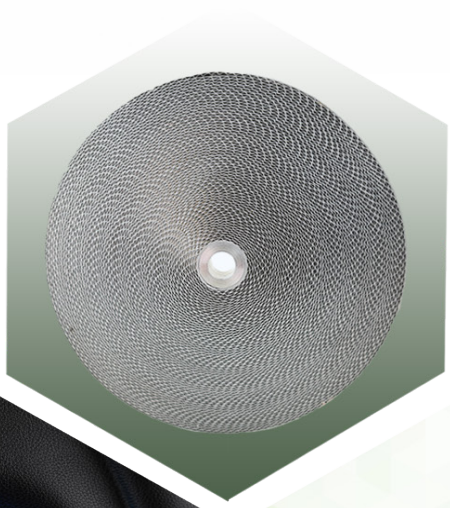
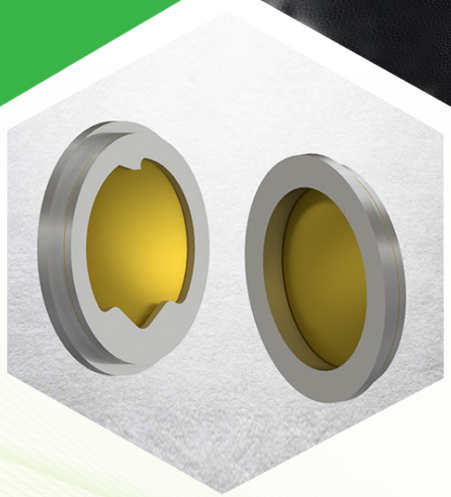
Catalog #77-7011

Pressure Safety Management for e-mobility Systems

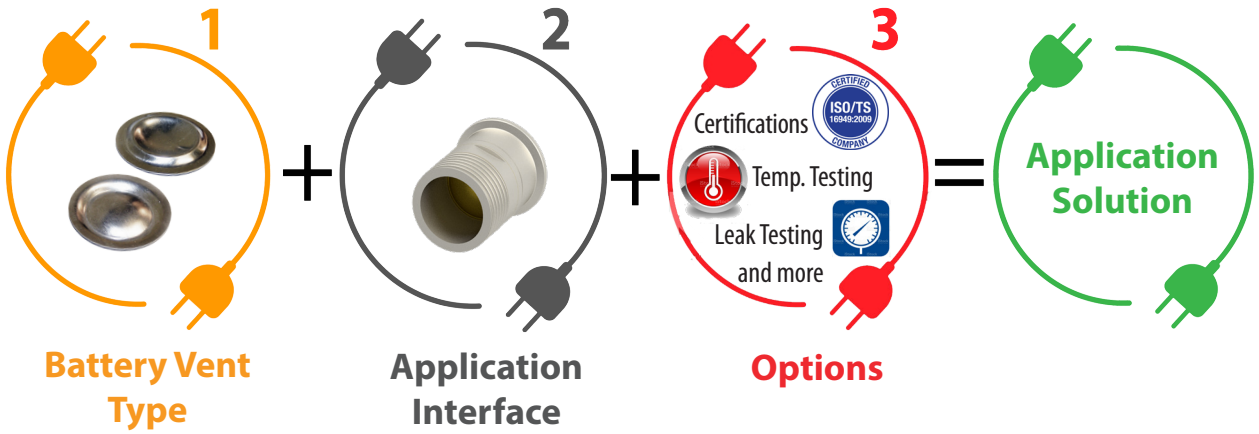




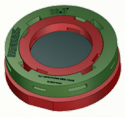
www.bsbsystems.com | www.bsb.ie

BS&B manufactures battery pack and cell pressure relief eVents used for the battery mobility market. We offer a personalized approach for each project to ensure flexibility in design and burst pressures. Many BS&B customer projects require customized solutions. We take great pride in "solving the impossible". Our custom engineered products team rallies around decades of machining experience, most recently 3-D printing, to offer inexpensive tooling solutions for new pressure relief products.

Custom Engineered Products: Application Solutions



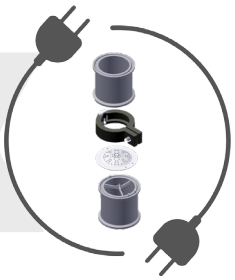
1 Battery Vent Type

Rupture Disk Type		Pressure Range	Size Range
eVent® Series FRB™		from 10 psig to 900 psig (from 0.69 barg to 62.05 barg)	from 1/8" to 1" (from 3mm to 25mm)
eVent® Series LPS™		from 3 psig to 70 psig (from 0.2 to 4.83 barg)	from 1" to 4" (from 25mm to 100mm)
eVent® Series HL™		from 0.73 psig to 16 psig (from 0.05 barg to 1.1 barg) *breathable and non-breathable*	from 3/4" to 3" (from 19mm to 80mm)
eVent® Series G™		from 1.5 to 29 psig (from 0.1 to 2.0 barg)	from 1/4" to 3" (from 6mm to 80mm)

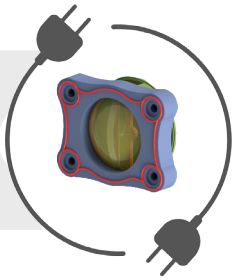
2 Application Interface

Threaded

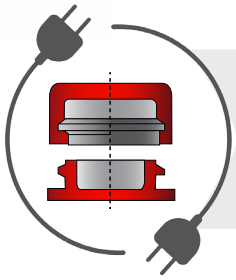
Clamped



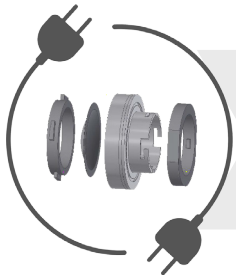
Bolted



Snap-fit



Quarter-turn



Adhesive Bonding

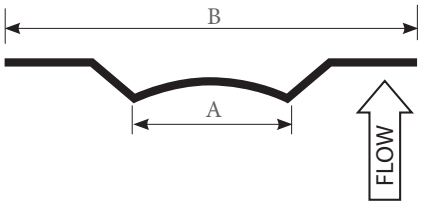
3 Options

PACKAGING	INVENTORY MANAGEMENT	MARKING	ON DEMAND ACTIVATION
CLEANING	LEAK TESTING	FAST PROTOTYPING	FLAME ARRESTERS
CERTIFICATIONS	VALIDATION TESTING	TEMPERATURE TESTING	BURST ALERT SENSORS

eVent™ Series FRB™

Features

- Standard sizes: 1/8, 1/4, 3/8, 1/2, 3/4 and 1 inch (3, 6, 9, 12, 19 and 25 mm)
- Pressure ratings from 10 to 900 psig (0.7 to 62 barg)
- Full opening along circular score
- Solid metal, reverse buckling technology
- Standard materials: stainless steel, nickel 200, Inconel® 600, and aluminum
- Standard and custom holder designs are available
- Low volume, starting at one unit
- High volume, automated manufacturing



Battery manufacturers rely on the eVent FRB™ lithium cell for overpressure protection due to its small size, low-pressure capabilities, and fast response time (milliseconds). From 1/8" (3mm) to 1"(25mm) Nominal flow diameters, and 10 psig (0.7 barg) to 900 psig (62 barg) activation pressures, the FRB is the perfect solution for your lithium cell design requirements.

BS&B also offers the added advantage of integrating the FRB disk with laser welding expertise, and with the Prototype Introduction Track "PIT" program, BS&B supports your lithium cell and pack development program with fast completion of your initial welded cell prototypes.

Nominal Size		A		B	
		Flow Diameter		Outside Diameter Options	
in	mm	in	mm	in	mm
1/8	3	0.125	3.175	0.312	7.925
1/4	6	0.215	5.461	0.500, 0.550	12.700, 13.970
3/8	9	0.350	8.890	0.670, 0.750, 0.935, 1.000	17.018, 19.05, 23.749 , 25.400
1/2	12	0.525	13.335	0.935, 1.000	23.749, 25.400
3/4	19	0.787	19.990	1.181	29.997
1	25	0.95	24.130	1.425, 1.500	36.195

These dimensions are for information only, exact FRB disk installation design shall be determined by BS&B for each application.

FRB Battery eVent Burst Pressure Capabilities Rated at 72°F (22°C)

Disk Size		Disk Material*															
		Nickel 200				Inconel® 600				316ss				Aluminum			
		min		max		min		max		min		max		min		max	
in	mm	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg	psig	barg
1/8	3	200	13.79	500	34.47	250	17.24	850	58.61	300	20.68	900	62.05	125	8.62	400	27.58
1/4	6	100	6.89	450	31.03	150	10.34	800	55.16	150	10.34	850	58.61	60	4.14	300	20.68
3/8	9	50	3.45	400	27.58	60	4.14	750	51.71	60	4.14	800	55.16	35	2.41	250	17.24
1/2	13	35	2.41	200	13.79	45	3.10	650	44.82	45	3.10	675	46.54	25	1.72	200	13.79
3/4	19	20	1.39	100	6.89	25	1.72	325	22.40	25	1.72	360	24.82	15	1.03	100	6.89
1	25	10	0.69	65	4.48	15	1.03	160	11.03	15	1.03	190	13.10	10	0.69	50	3.45

eVent™ Series LPS™

The eVent LPS™ provides low burst pressures starting at 3 psig (0.2 barg). The LPS is a reverse buckling metal rupture disk using SAF™ technology, which enables low burst pressures to be achieved while maintaining excellent opening characteristics.

BS&B offers a variety of choices for application interface designs using LPS rupture disk technology including: plastic body; metal body; cassette; snap fit; quarter-turn; and adhesive bonding.

BS&B partners with you to solve overpressure requirements for pressurized systems. Solutions may include off-the-shelf assemblies or customized designs requiring unique sealing and interface options to meet the constraints placed by the assembly and production of your products. You can count on BS&B as your team member to help guide you through the pressure relief selection process. It's what we do.

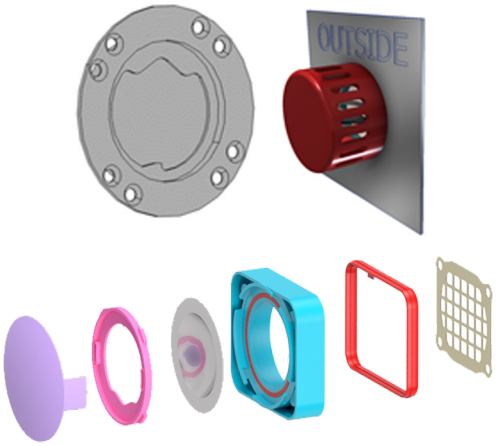
LPS technology is validated for many conditions including:

- Burst Pressure Performance
- Effective Sealing
- Advanced Life Pressure Cycle Testing
- Mechanical Shock Drop Testing
- Random Vibration Endurance Test
- Salt Spray with Humidity Functional Endurance Test
- Fluid Corrosion
- Tested for many types of automotive related fluid
- Climatic Sequence Testing
- Thermal Life Test

LPS technology has been used for battery industry applications for over 10-years.

Features

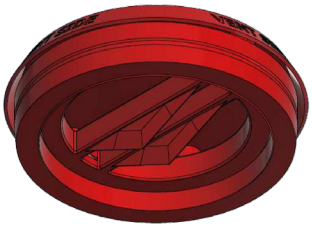
- Solid metal design provides leak tight performance
- Low burst pressure capability from 3 psig (0.2 barg)
- Fail safe: Damage Safety Ratio ≤ 1
- Designed for non-fragmentation
- High operating ratio: 90% of minimum burst pressure
- High backpressure resistance
- Defined vent area
- Custom designs available (examples below)
- Stainless steel and aluminum construction



LPS Battery eVent Burst Pressure Capabilities Rated at 72°F (22°C)

Disk Size		Nickel Alloy 200				316ss				Monel® Alloy 400, Inconel® Alloy 600 and Tantalum				Hastelloy® Alloy C-276				Aluminum			
in	mm	psig		barg		psig		barg		psig		barg		psig		barg		psig		barg	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
1	25	15	70	1.03	4.83	15	70	1.03	4.83	20	70	1.38	4.83	15	70	1.03	4.83	-	-	-	-
1.5	40	6	55	0.41	3.79	6	55	0.41	3.79	10	55	0.69	3.79	7	55	0.48	3.79	-	-	-	-
2	50	5	40	0.34	2.76	5	40	0.34	2.76	8	40	0.55	2.76	6	40	0.41	2.76	3	0.20	0.55	2.76
3	80	5	35	0.34	2.41	5	35	0.34	2.41	7	35	0.48	2.41	5	35	0.34	2.41	2.5	35	0.17	2.41
4	100	5	30	0.34	2.06	5	30	0.34	2.06	7	30	0.48	2.06	5	30	0.34	2.06	2.5	30	0.17	2.06

eVent™ Series HL™

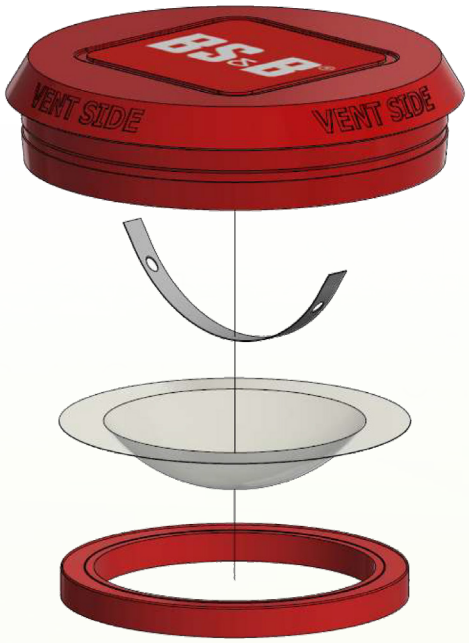


The eVent HL is a reverse buckling plastic rupture disk that combines optional air breathing capability with accurate pressure relief. Burst pressure is controlled by a calibrated metal support arch which retains the plastic domed rupture disk under normal operating conditions. The assembly is typically injection moulded engineered plastic. The general design and method of assembly is customizable to meet specific customer needs. eVent HL provides an immediate high flow rate under overpressure relief conditions. There are two options available in relation to the plastic domed rupture disk – breathable and non-breathable PTFE. The patented control arch is typically stainless steel.

The eVent HL has an integrated cutting member, precision engineered metal arch, and PTFE seal. During an overpressure event, the arch reverses, allowing the seal to be pierced. Burst pressure is controlled by arch design and material thickness.

The eVent HL breathable vent is intended for battery packs with weak flexible containers that must be stabilized close to atmospheric pressure (e.g. +/- 20 mbar) while also performing as an emergency venting device in case of fire or other overpressure generating event. A sintered PTFE seal provides a water tight barrier while allowing air to pass through the rupture disk dome.

The eVent HL non-breathable vent can be used alone or in combination with independent breather vents.



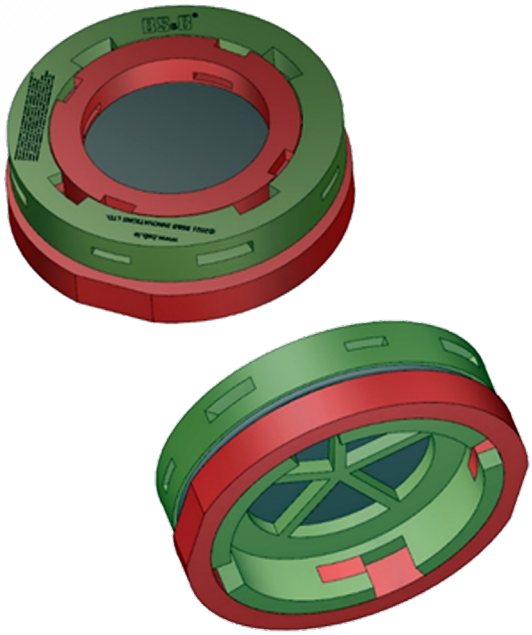
Features

- Reverse buckling plastic rupture disk with metal arch provides accurate pressure relief
- Instant flow area provides fast pressure relief
- Low burst pressure from 0.73 Psig (0.05bar)
- Temperature stable
- Breathable and non-breathable options available
- Size range: 3/4"- 3"(19 mm – 80 mm)
- Water entry pressure $\geq$ 500 mbar
- Withstands up to 1m water backpressure
- Defined vent area
- Custom designs available
- Plastic or metal housing
- Environmental performance compliance:
  - IP6KX, avoid dust ingress
  - IPX6K, avoids pressure wash water ingress
  - IPX69K, resits steam cleaning

US & International Patent Pending.

eVent™ Series G™
graphite rupture disks

The eVent G is manufactured from high quality graphite blended with an environmentally friendly resin to achieve a leak tight material structure. With its low tensile strength, eVent G material achieves a very low burst pressure capability. The eVent G can provide a very compact battery vent design as the material remains almost flat until the moment of overpressure activation. The eVent G is customizable and available in a variety of designs to meet different nominal sizes and overpressure relief requirements.



The eVent G assembly can be produced with either metal or plastic housing components, or even a combination of metal and housing. The leak tightness of the rupture disk and control of its burst pressure is achieved through proper engagement with its housing.

Features

- High quality graphite design
- Low burst pressure capability from 1.5 psig (0.1 bar)
- Thermally stable burst pressure
- Nominal sizes from ½" to 4" (12mm to 100mm)
- Full Opening upon activation
- Compact assembly design
- Custom designs available

PIT™ PROGRAM

(Prototype Introduction Track)

Similar to a Race Car Pit Team, the BS&B Prototype Introduction Track combines special skill sets to work in unison with the common goal of giving the customer an excellent prototype order experience.

- Rapid response Prototype Introduction Track
- Schedule management to assure on time performance
- Focus on your needs, not a 'cookie cutter' approach
- Engineering engagement throughout
- Plan For Success™ approach
- Access to Engineering and Quality from design to delivery

BS&B®

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