Catalog # 77-4017

GLP-S™ Low Pressure Sanitary Reverse Buckling Rupture Disk

BS&B SAFETY SYSTEMS

Introduction

The GLP-S offers the lowest pressure, solid metal, reverse buckling disk that is resistant to vacuum. Designed for installation into sanitary / aseptic piping using the LP-C safety head, the GLP-S adds a new capability for the designer of pharmaceutical, biotechnology, food industry and other clean service pressure relief systems.

- Low burst pressures from 5 psi (0.34bar)
- Solid metal design
- Designed for gas, liquid or two-phase service
- Stainless steel, nickel alloy and tantalum materials available
- "Fail-safe" design – damage safety ratio <1
- Designed for non-fragmentation
- Vacuum / back pressure resistant
- High operating ratio; up to 90% of minimum burst pressure
- Sizes $1^{1/2}$ to 4 inch (38-102mm) tri-clamp connections
- Ideal for CIP / SIP (clean in place / steam in place) service
- Available SAS burst disk sensor option
- Utilizes SAF™ technology (structural apex forming) for enhanced performance

The type LP-C™ safety head holder with tri-clamp inlet and outlet connections provides quick and easy installation of the GLP-S™ reverse buckling disk into sanitary / aseptic piping.

Burst Pressure Capability

See the table below for the minimum and maximum burst pressures available. For higher burst pressures, please check the availability of the GCR-S type disk (catalog 77-4014). For disks with a coincident temperature exceeding 300°F (149°C), 176°F (80°C) for Hastelloy®, add 2 psi (0.14bar) to the minimum burst pressure.

Design

The GLP-S is a reverse buckling rupture disk designed with a circular score located on the outlet side of the disk dome. At the burst pressure, the disk's dome reverses and opens by shearing the circular score line leaving a single petal which is held captive by the "hinge ring" integral to the vent side of the disk. The GLP-S uses SAF technology enabling very low burst pressures to be achieved with excellent performance characteristics.

The GLP-S disk is designed for use in the LP-C safety head. The nominal size of the GLP-S rupture disk is the same as the inlet and outlet tri-clamp connections. The two halves of the LP-C safety head, with the GLP-S rupture disk installed, are held together using a larger tri-clamp connector supplied with the LP-C holder. The second table below identifies the three tri-clamp connections for each GLP-S disk size; it is the mid-clamp that is supplied with the LP-C holder. The table also identifies the area to be used for GLP-S pressure relief system sizing calculations (MNFA in square inches is provided for calculations in line with ASME practices / NRA in square centimeters is provided for calculations in line with ISO and EN practices).

Minimum / Maximum Burst Pressure @ 72°F (22°C)

Refer to catalog #77-1002 for safety head information

Size		Nickel				316ss / 316L ss				Inconel®				Monel®				Hastelloy®			
		min		max		min		max		min		max		min		max		min		max	
in	mm	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar	psig	bar
1.5	40	15	1.03	15	4.82	15	1.03	70	4.82	20	1.38	70	4.82	20	1.38	70	4.82	15	1.03	70	4.82
2	50	6	0.41	6	3.79	6	0.41	55	3.79	10	0.69	55	3.79	10	0.69	55	3.79	7	0.48	55	3.79
3	80	5	0.34	5	2.76	5	0.34	40	2.76	8	0.55	40	2.76	8	0.55	40	2.76	6	0.41	40	2.76
4	100	5	0.34	5	2.41	5	0.34	35	2.41	7	0.48	35	2.41	7	0.48	35	2.41	5	0.34	35	2.41

Size		Tantalum			
		min		max	
in	mm	psig	bar	psig	bar
1.5	40	20	1.38	70	4.82
2	50	10	0.69	55	3.79
3	80	8	0.55	40	2.76
4	100	7	0.48	35	2.41

Viton® is a registered trademark of DuPont Dow Elastomers LLC.; Inconel® and Monel® are registered trademarks of Inco Alloys International; Hastelloy® is a registered trademark of Haynes International, Inc.

Rupture Disk and Safety Head Sizes and Connections

Disk size		Inlet*		Mid-clamp connection		Outlet*		Overall height		MNFA	NRA
in	mm	in	mm	in	mm	in	mm	in	mm	in^2	cm^2
1.5	40	1.5	40	2	50	1.5	40	3.25	83	0.86	4.9
2	50	2	50	2.5	65	2	50	3	76	1.93	11.3
3	80	3	80	4	100	3	80	4	102	3.36	19.7
4	100	4	100	6	150	4	100	5.5	140	7.39	40.8

These dimensions correspond to the size of tri-clamp fitting to which the LP-C holder is connected. The connection is the same at the inlet and outlet in all cases and also the same as the disk nominal size. The LP-C safety head nominal size is determined by the inlet and outlet connection size. Example: a $1^{1/2}$ LP-C safety head has inlet and outlet tri-clamp connections size $1^{1/2}$ and is designed for use with a size $1^{1/2}$ inch GLP-S rupture disk.

Sensors

Optional Sanitary Alert Sensors (SAS) are available for use between standard sanitary / aseptic fittings to provide warning of a burst rupture disk.

Vacuum Resistance / Back Pressure Resistance

The GLP-S disk will resist vacuum without any additional vacuum support. Back pressure resistance is limited to 15 psi (1.03bar) for disks rated to burst at 15 psi (1.03bar) or less. For higher burst pressures, back pressure resistance is limited to the minimum burst pressure of the ordered GLP-S disk.

GLP-S Material Options

Standard materials for the GLP-S disk are stainless steel (grades 316 and 316L), nickel alloy 200, Inconel®, Monel®, Hastelloy® C-276, and tantalum. Typically it will be the users selected tri-clamp gasket (not supplied) that determines the operating temperature limitation of an application. The GLP-S disk includes an outlet side hinge to control fragmentation when the disk bursts. Standard disk hinge material is stainless steel 316 with alternates available upon request.

Operating Temperature Limits

Material	°F	°C
Nickel (alloy 200)	Up to 750°	Up to 399°
Monel® (alloy 400)	Up to 900°	Up to 482°
Inconel® (alloy 600)	Up to 1100°	Up to 593°
Stainless steel 316 or 316L	Up to 900°	Up to 482°
Hastelloy® (alloy C-276)	Up to 900°	Up to 482°
Tantalum	Up to 500°	Up to 260°
Silicone	-67° to 450°	-55° to 232°
Viton®	-40° to 400°	-40° to 204°
EPDM	-67° to 300°	-55° to 149°
Stainless Steel and PTFE	-20° to 450°	-29° to 232°

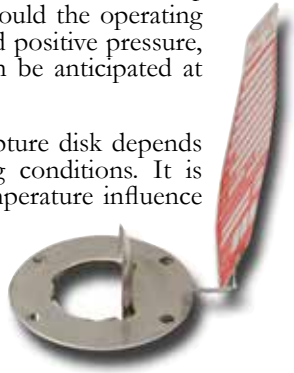
The user must take care to respect local code or piping supplier temperature / pressure limitations prescribed for the use of tri-clamp design fittings

Cycle Resistance / Temperature Influence / Service Life

The cycle resistance of the GLP-S disk is a function of the applicable operating conditions. If the operating pressure is static (without pressure cycles), then, as for all types of rupture disk devices, the service life shall be maximized. If the operating pressure is mildly cyclic, such as the conditions of a sealed atmospheric tank under ambient temperature fluctuations, the GLP-S disk may resist in excess of 1000 cycles.

Under highly cyclic operating pressure conditions, the cycle life of the GLP-S disk is determined by the frequency and magnitude of pressure change from positive to negative differential. When all of the pressure cycling takes place within the operating pressure ratio of the GLP-S disk and at a positive differential pressure, the service life shall be maximized. Should the operating pressure cycle between full vacuum and positive pressure, the service life of the GLP-S disk can be anticipated at several hundred cycles.

Cycle life and service life for every rupture disk depends upon its unique application operating conditions. It is particularly important to allow for temperature influence on burst pressure; if the rated burst temperature of the disk is selected too low, a higher actual temperature may reduce the disk burst pressure. Seek advice from BS&B Safety Systems regarding rated burst temperature.



US Patents 5,996,605, 6,178,983 apply; Other international patents pending

Burst Pressure Tolerance Options

The approach to GLP-S disk burst tolerance depends upon which International Code is being followed.

- For disks to comply with the ASME Code, please select a "manufacturing design range" and the "burst tolerance" applicable to the required burst pressure (use tables below)
- For disks to comply with EN or ISO standards, please select either a "performance tolerance" or a "minimum / aximum burst pressure" (use tables below)

Burst Tolerance (ASME Code)

This is the +/- range of pressure over which a rupture disk can be expected to burst. Burst tolerance is a function of GLP-S burst pressure.

Burst pressure		Burst tolerance
psig	barg	
28 and higher	1.93 and higher	+/-5%
20 < 28	1.38 < 1.93	+/-7%
10 < 20	0.69 < 1.38	+/-10%
<10	<0.69	+/-15%
Alternate < 40	Alternate < 2.76	+/- 2psi (+/- 0.138bar)

Manufacturing Design Range (MDR) (ASME code)

This is a range of pressure, always applied to the minus side of the user requested burst pressure for the GLP-S disk. The standard GLP-S MDR values are 0%, -5%, and -10% except for tantalum which is offered with -5% and -10%.

Performance Tolerance (EN / ISO Codes)

Introduced with EN 4126-2 and ISO 4126-2 in 2003, this tolerance is applied to the specified burst pressure as a percentage or a pressure quantity and includes all tolerances (both burst tolerance and MDR).

Specified burst pressure		Performance tolerance		
psig	barg	(three standard options indicated below)		
28 and higher	1.93 and higher	+/-5%	+/-5%, -10%	+/-5%, -15%
20 < 28	1.38 < 1.93	+/-7%	+/-7%, -12%	+/-7%, -17%
10 < 20	0.69 < 1.38	+/-10%	+/-10%, -15%	+/-10%, -20%
<10	<0.69	+/-5%, -10%	+/-10%, -25%	+/-10%, -30%
(alternate)		(alternate option indicated below)		
20 < 40	1.38 < 2.76	+/-10%	+/-10%, -15%	+/-10%, -20%

Minimum / Maximum Burst Pressure (EN / ISO Codes)

Performance tolerance can be expressed as a min / max.

Specified burst pressure	Performance tolerance	Minimum burst pressure	Maximum burst pressure
X	+y%/-z%	X - (z% converted to a pressure value)	X + (y% converted to a pressure value)
Ex: 3barg	-0.5	3 - (3 x 0.1) = 2.7bar	3 + (3 x 0.05) = 3.15 bar

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. All sales are subject to the BS&B companies' standard terms and conditions of sale. Nothing herein should be construed as a warranty of merchantability or fitness for a particular purpose.

Tulsa, OK USA
T +1 918 622 5950
F +1 918 665 3904
E sales@bsbsystems.com
BSBSystems.com

Limerick, Ireland
T +353 61 484700
F +353 61 227987
E sales@bsb.ie
BSB.ie