



the corrosion expert

FluoroFlow High Performance PTFE Bellows



www.crp.co.uk
www.ptfebellows.com

Corrosion Resistant Products

CRP has been designing, processing and manufacturing top quality paste extruded PTFE and PFA lined products for more than 30 years. All of our products originate from our manufacturing site near Manchester, UK. Using qualified materials, robust and repeatable manufacturing process technologies and a depth of experience CRP are able to deliver product for the most exacting applications.

Introduction

The FluoroFlow Bellows (FFB) range has been engineered over 40 years to compensate for thermal expansion in pipelines; for the protection of fragile process equipment such as graphite, plastic or glass and the isolation of vibration hazards. PTFE bellows come into their own for corrosive, high purity or hot applications.

CRP has some unique manufacturing processes based upon the use of paste extruded PTFE, and a proprietary convolution process. These have been independently tested by the internationally recognised safety and quality group TÜV, undertaking innovative long term pressure increase testing.

The Product Family

The bellows product range covers 20 sizes from DN25/1in to DN900/36in. They are manufactured in two materials—virgin PTFE and static dissipating PTFE. FluoroFlow Bellows in sizes DN25/1in to DN200/8in are available in extra heavy duty only. For larger diameters there is a choice of two wall thicknesses—a heavy duty (HD) and extra heavy duty (XHD). The bellows can be manufactured with 2 to 10 convolutions. However, this is just the standard product. The flexibility of the manufacturing method is such that many special configurations can be produced to meet specific customer requirements.

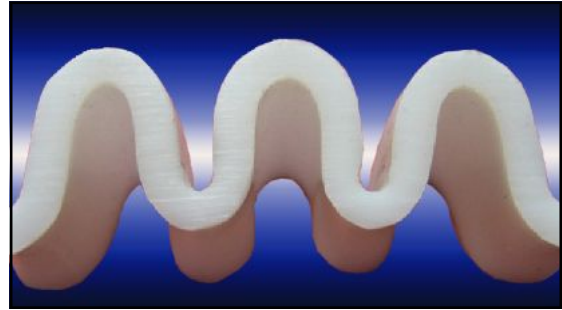
For products requiring a higher pressure rating than is possible with PTFE alone, we have our range of armoured bellows (FFAB) where the PTFE is surrounded by a high pressure stainless steel shell.

HiPerFlon®

HiPerFlon® is a second generation paste extruded High Performance PTFE. HiPerFlon® has the greatest mechanical properties and lowest permeation rates of PTFE materials and as such provides high pressure ratings, long lifetime, low maintenance costs and consequently the lowest cost of ownership.

The Manufacturing Process

CRP uses virgin paste extruded or virgin multi-ply PTFE tubes of their own manufacture to guarantee the highest quality from the beginning of the production process. A unique convolution process undertaken at very high temperatures, combined with additional material to compensate for the extra length from straight to convoluted, provides a uniform PTFE wall thickness and a stress-free material in a thermally locked bellows shape. This process has a significant influence on product lifetime performance.



Bellows Design and Type Testing

A key consideration in bellows performance is the temperature and pressure that the bellows will withstand for extended periods of time.

There is no ASME, DIN or other global standard for bellows design. Most of CRP's competitors just use a simple burst pressure test at ambient temperature to create the comprehensive pressure/temperature curves in their catalogues, sometimes with a safety factor of less than 3.

A safety factor is defined as the ratio of burst pressure to allowable operating pressure. Bursting pressure tests, although a key indicator, cannot fully define a bellows performance as a burst pressure test has a duration of 10 to 20 seconds and is unable to replicate the effect of deformation of the bellows through creep.

Therefore CRP has developed a much more comprehensive approach to testing as below:

Bursting Pressure Test

Bursting pressure tests are used only for the determination of pressure rating at ambient (20°C) temperature. At this temperature CRP has adopted a safety factor of 6 for bellows up to DN200 and a safety factor of 4 for the larger diameters.

Pressure Increase Test

In addition to the bursting pressure tests, innovative pressure increase tests have been undertaken successfully at 100°C, 150°C and 200°C by TÜV. These unforgiving tests slowly increase the delivered pressure to the bellows at high temperatures, encouraging the PTFE material to flow and creep as in service. The pressure increase test results confirm the outstanding creep resistance of the FluoroFlow Bellows provided by the unique convolution process.

Internal Pressure Long Term Creep Test

FluoroFlow Bellows have passed successfully an Internal Pressure Creep Test (similar to EN ISO 9080) by TÜV at 150°C. 14 Bellows have been tested in total and two bellows remained under pressure at 150°C in the oven for one year. This confirms the long term creep resistance even at high temperatures and pressures.

Lifetime Assurance

Based on the pressure/temperature limits from these tests, CRP has determined the pressure/temperature curves for the FluoroFlow Bellows to have a residual safety factor of 2 after more than 10 years in operation.

International Standards

All bellows, comply with the Pressure Equipment Regulations 1999/Pressure Equipment Directive 97/23/EC and are provided with a CE declaration of conformity. PTFE armoured bellows for high pressure performance are designed according to the EJMA international standard. The business is third party accredited to ISO9001:2015.

Product Testing

Bellows materials are fully traceable. Bellows tubes undergo mechanical and dimensional tests following manufacture. PTFE sintering and convolution are undertaken using calibrated ovens with precise temperature control. Independent process checks are undertaken using infra-red thermometry. In-process visual inspection of the PTFE tubes is undertaken and this combined with a hydrostatic test and further visual inspection of the finished product completes the product verification. Certification is available if required to reassure the customer on materials of construction, process control and product testing.

Operating Temperatures

The standard operating envelope for the product is 0°C to 200°C, but bellows can be supplied for temperatures outside this envelope.

Special Bellows

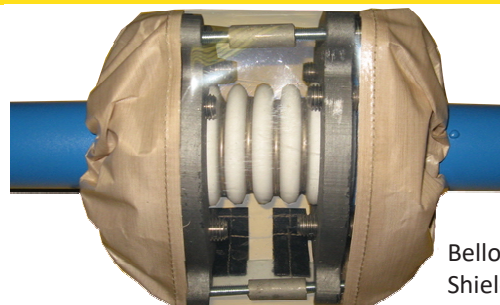
Many customized bellows are available, including bellows with extended flares, reducing bellows (different flange sizes), different flange types, hinged bellows, lateral bellows, dual containment bellows, bellows with special neutral lengths and bellows with special PTFE wall thicknesses. Internal vacuum support rings can be provided in exotic metals or PTFE lined and the bellows flanges can be manufactured in other metals. Bellows with electrically isolating tie rods are also available.



Stainless Steel Flanged Bellows

Safety Shields

Following guidance from the European Pressure Equipment Directive 97/23/EC and international insurers, we strongly recommend the use of Safety Shields around each bellows. Because of its nature, the bellows is the weakest part of a piping system and safety shields can assist in mitigating risk to operators and the environment.



Bellows Safety Shield

Smoothbore Sleeves

If handling media at high velocities or with entrained solids we suggest you consider using smoothbore sleeves. These are manufactured from PTFE and provide additional protection to the bellows for abrasive duties as well as minimising the potential build up of solids in the convolutions. As standard these are supplied as a loose fit to avoid the sleeve constraining the bellows movement. However a tight fit is also available. As standard the sleeve is sized to protrude just beyond the end of the bellows when it is at maximum axial length, but this can be specified at the time of order.



Design and Piping Layout

Prior to specifying the bellows it is necessary to produce a piping layout with correct pipe supports and an exact specification of the expected movements, irrespective of whether they are to be used for thermal compensation or the protection of fragile equipment made of glass or graphite. Bellows cannot support forces either from the weight of the piping components or from the liquid inside the pipes.

Effective Area and Spring Rates

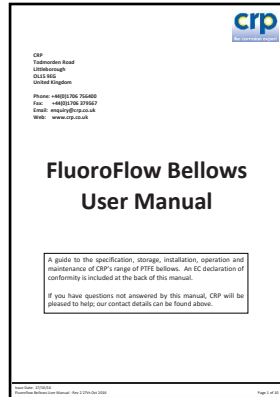
The effective area and the spring rates have a significant influence upon the stress calculations for the piping system. Please find the relevant data on the following pages for each bellows size. For the influence of temperature upon spring rates please use the conversion table below.

Temperature Correction Factors (TCF)	
Temperature	TCF
20 / 68	1.0
80 / 176	0.65
120 / 248	0.5
150 / 302	0.4
200 / 404	0.32

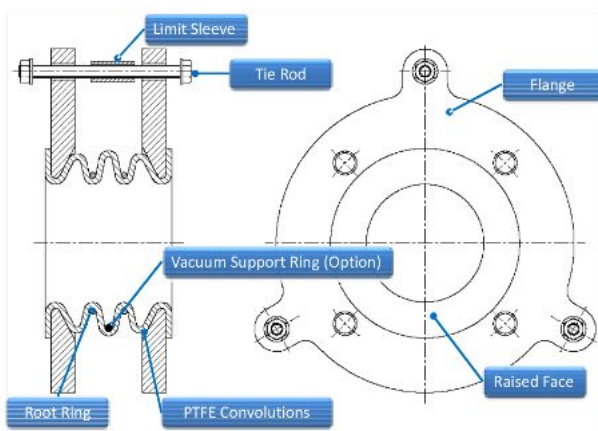
For example: To calculate the spring rate @ 120°C take the spring rate at 20°C x 0.5.

Operating and Installation Instructions

A comprehensive user manual is packed with the bellows shipment. These instructions can also be downloaded from our web site (www.crp.co.uk) or can be sent out by email (enquiry@crp.co.uk). It is critical that these are referred to for the correct installation of bellows.



Key Product Features



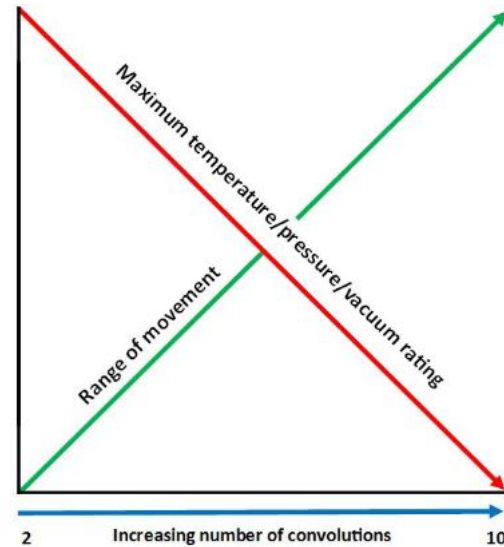
Flanges

Bellows flanges are available to all of the international flange standards including ASME Class 150 and 300 and DIN PN 10 and 16. As standard the flange connection drillings are drilled either UNC for ASME or Metric for DIN. Flanges are painted in an ultra high temperature paint in a silver finish. It is worth noting the internal flange profiling that assists the first convolution in minimising any stress generated by the flange.

PTFE Convolutions

The number of convolutions is key to the range of movement provided by the bellows—the more convolutions the greater the range of movement. However the compromise is that both pressure and vacuum performance are reduced as the number of convolutions increases. (See next diagram.)

In sizes above 8in (DN200) there is the option of Heavy Duty (HD) or Extra Heavy Duty (XHD) Bellows. The additional wall thickness of the XHD product provides an improved temperature and pressure range. Up to 8in (DN200) XHD is the standard product.



Root Rings

Root rings serve to provide support for the PTFE which is a mechanically weak material especially when hot. These sit at the base of each convolution. These are supplied in stainless steel as standard, but can be manufactured in exotic metals where required—for example to avoid the potential for stress corrosion cracking in hydrochloric acid service.

Tie Rods

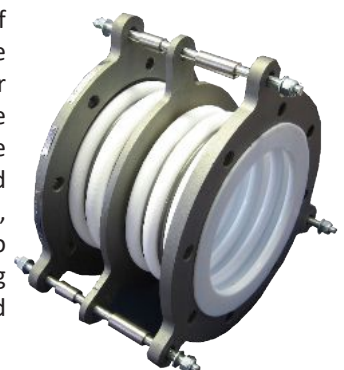
These prevent the bellows from exceeding their maximum allowed movements. They arrive factory set at the maximum allowable extension as detailed on the data label. The tie rods have been sized to cope with the maximum pressure thrust that can result from internal pressure in the bellows, both in operation and during test. However, tie rods are not designed to cope with external loads applied to the bellows by the adjacent pipe work due to circumstances such as pipe work misalignment, failure of anchors etc.

Limit Sleeves

These prevent damage to the convolutions by preventing the bellows from being compressed below the minimum allowable axial length.

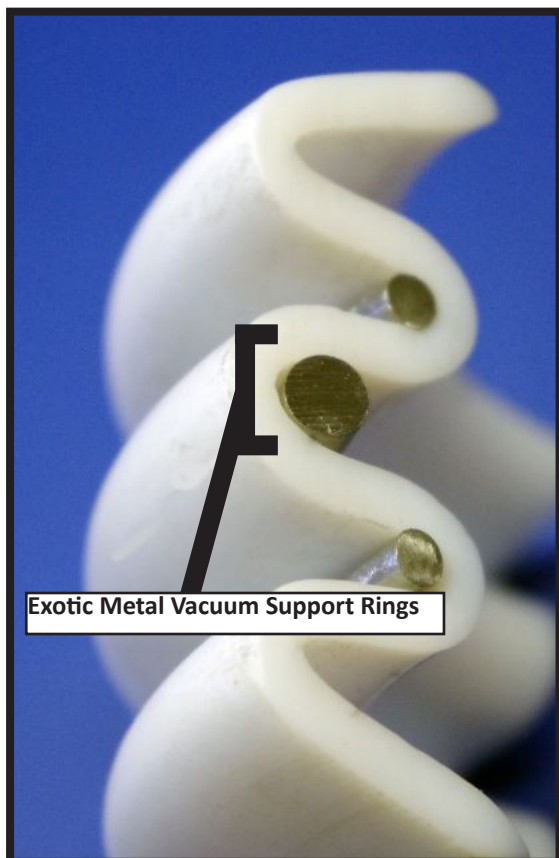
Anti-Snake Rings

When the number of convolutions exceeds five we would recommend one or more Anti-snake rings. These are mounted on the outside of the bellows, replacing and serving the role of the root ring, but also tying into the tie rod to prevent the bellows squirming under high temperatures and pressures.



Vacuum Support Rings

Internal vacuum support rings are available for larger bellows where they have a low or no vacuum performance. They will enable the bellows to work under full vacuum. These rings fit inside the bellows convolutions, so are exposed to the process. They are available either PTFE lined on the outside, or in various exotic metals. They may reduce bellows movements, so please consult with us.



Exotic Metal Vacuum Support Rings

Data Labels

There are three or four data labels present on the bellows flanges to carry as much information about the bellows as practical. However, more information is available in this catalogue, or by reference to CRP, quoting the part number and serial number references.



1. The product family is referred to as FluoroFlow Bellows or "FFB".

2. The CRP part number.

3. The number of convolutions.

4. The material used for the root rings.

5. Our CE mark and notified body number for compliance with the PED (Pressure Equipment Directive).

1. The flange type.

2. The size and thread type for the drillings.

3. The bellows nominal size or in the case of reducing bellows, the flange size at each end.

1. The month and year of manufacture.

2. Two rows of temperature and pressure information. In this example showing the performance at -10°C to 25°C and 200°C . There is not always enough room to show the maximum temperature which can cope with full vacuum, nor provide intermediate data. Reference to the data sheets in this catalogue can provide more information.

3. The minimum, neutral and maximum lengths for axial travel.

4. A unique serial number for the item.

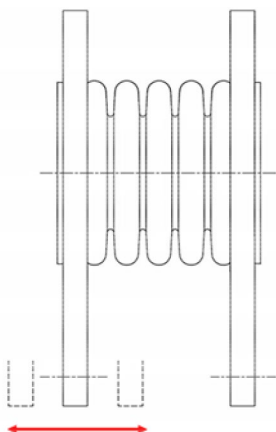
Explanation of Movements

A key attribute of bellows is their ability to move in response to stresses placed upon them by the equipment to which they are mounted, whether such stresses are generated by expansion and contraction or plant vibration.

There are three directions of movement for which a bellows is designed; axial, lateral and angular. Bellows are not designed for rotational movement around the principal axis.

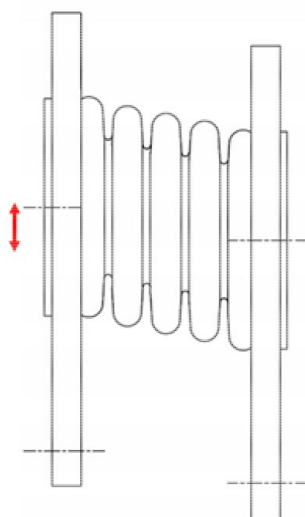
Axial

This is the most frequently required type of movement and is specified in terms of the bellows minimum and maximum extension and its neutral length. The neutral length is the mid-range position of the bellows. Bellows can be installed at lengths between the minimum and maximum length, but this of course will restrict the amount of allowable movement. CRP Bellows are not designed to hold their neutral length and are delivered with the flanges sitting at their neutral length with the tie rods set to their maximum extension.



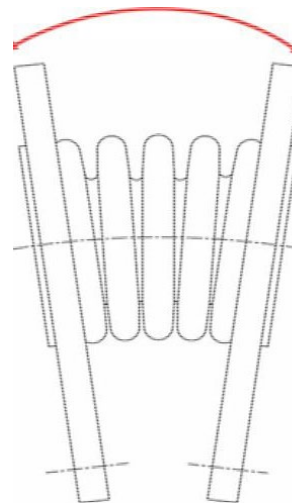
Lateral

Lateral movement is movement at right angles to the principal axis.



Angular

Angular movement is the movement of the flanges out of parallel.



The allowable movements are dependent upon nominal bore and number of convolutions and is provided on the following individual product nominal bore pages. It is important to understand that these movements are not independent. For combined movement calculations consider the total allowable in all three directions as comprising 100%. This 100% can be apportioned across the three movement types. Alternatively you can use the Bellows Configurator on our website www.ptfellow.com which can make sizing much simpler. The configurator enables one to choose the size and temperature and pressure performance required and the range of movements required. It will then recommend a choice of bellows and provide a print out of the chosen specification.

Step 1

Project Name: Sulphuric Acid Expansion
 Bellows Item No.: 7
 Bellows Diameter: 6"
 Max. Operating Press: 4 barg
 Max. Operating Temp: 130 °C
 PTFE: Virgin W

Step 2

Required Maximum Movements:
 Assuming only one is occurring

Step 3

Required Maximum Movements:
 Assuming they occur together

Selected number of convolutions:
 Choose your preferred number of convolutions:

Units
 metric English units

Project name: Sulphuric Acid Expansion **Bellows Item no.:** 7

The program has selected a
5 convoluted FFB PTFE Bellows DN 150, NB 6" diameter

This Bellows has the following characteristics:

Step	Required	Actual
Step 1		
Max. Operating Pressure:	4 barg	4.20 barg
at Temperature:	130 °C	130 °C
Neutral Length:		159.00 mm
Step 2		
Maximum Movements: (Assuming only one is occurring)		
axial:	0 mm	35.00 mm
lateral:	0 mm	21.00 mm
angular:	0 °	14 °
Step 3		
Maximum Movements: (Assuming they occur together)		
axial:	25 mm	
lateral:	4 mm	
angular:	0 °	

Flange standard: ASME 150b.
 PTFE: Virgin White

Would you like us to email this data to you only?

Would you like to enquire Price & Delivery and get this data sheet send to your email address?

Modified Movement Bellows

The mechanical design of the flanges, tie rods and limit sleeves are to restrict bellows movement within their safe range. However, it may be necessary to change movement still further, such as preventing movement in one or more planes, focus all movement in one plane or create additional movement. Special bellows are available for these purposes.

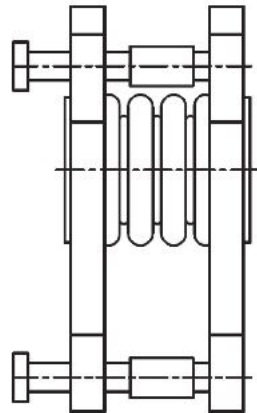


Axial Bellows

Axial Only Bellows [Axial Bellows]

By providing an external frame with guide rods, the bellows can be restricted to axial movement only.

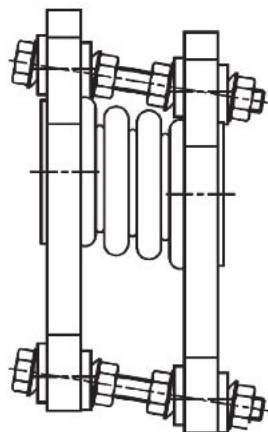
Movement	Allowed
Axial	✓
Lateral	✗
Angular	✗



Lateral Only Bellows [Lateral Bellows]

Tie rods with special spherical washers capturing the flange face allow movement in any lateral plane.

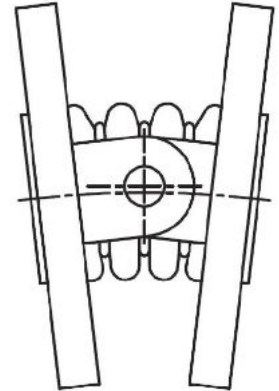
Movement	Allowed
Axial	✗
Lateral (any plane)	✓
Angular	✗



One Plane Angular Bellows [Hinged Bellows]

Hinged bellows allow angular movement only in one plane, thereby maximising the angular range.

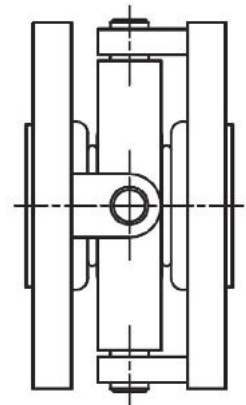
Movement	Allowed
Axial	✗
Lateral	✗
Angular (one plane)	✓



All Planes Angular Bellows [Gimballed Bellows]

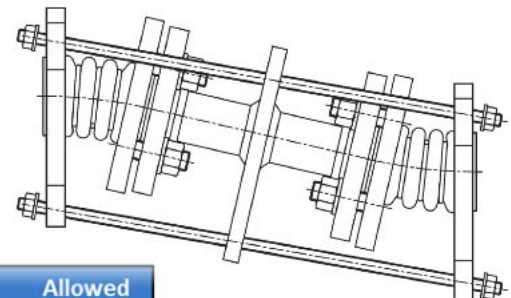
As with the hinged bellows they allow only angular movements, but with the addition of gimbals enables angular movement in any plane.

Movement	Allowed
Axial	✗
Lateral	✗
Angular (any plane)	✓



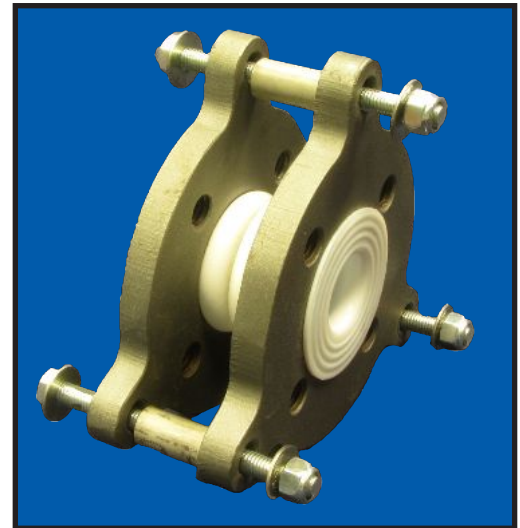
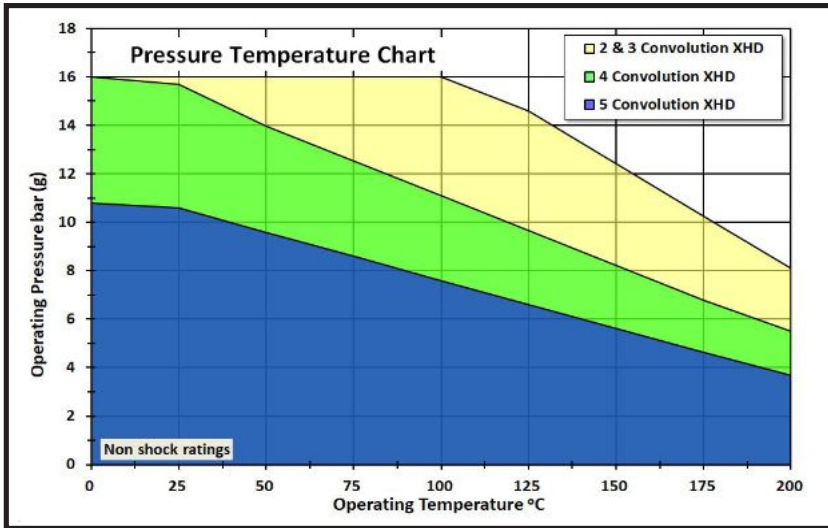
Large Movement Lateral Bellows [Universal Bellows]

An arrangement of two bellows incorporating a short PTFE lined pipe spool provides a large amount of lateral movement by effectively converting each bellows into an angular bellows. This still provides for axial and angular movement.



Movement	Allowed
Axial	✓
Large Lateral	✓
Angular	✓

FluroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	43	36	50	4	6	2
FFB 3	54	43	65	6	10	2
FFB 4	65	50	80	8	13	2
FFB 5	76	57	95	10	17	2

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
90	54	108	1.5
60	36	72	1.0
46	28	54	0.7
36	22	43	0.6

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	51	68
Bolt Circle Ø [mm]	79	85
Flange Max Ø [mm]	167	
Holes ³ [No. x Thread]	4 x ½" UNC	4 x M12
Thickness [mm]	12	
Effective Area [mm ²]	1,000	

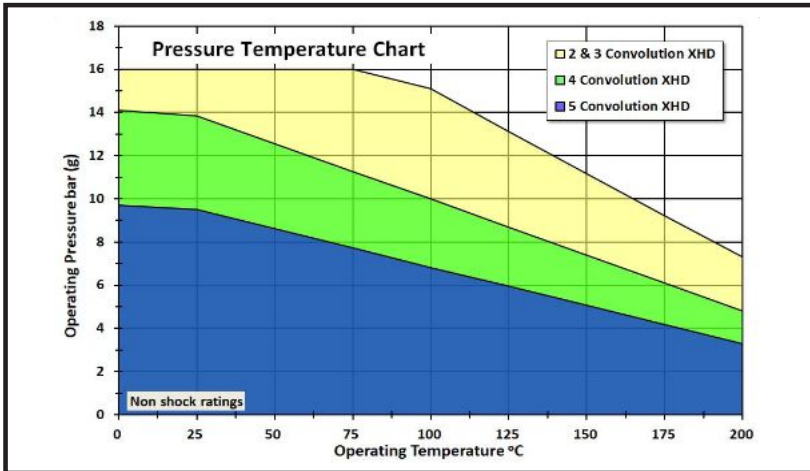
Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

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Dimensions and Movements ²						
Convolutions ⁵	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral [mm]	Angular [degrees]	Weight [kg]
FFB 2	54	46	62	4	6	4
FFB 3	69	56	82	6	10	4
FFB 4	84	66	102	8	13	4
FFB 5	99	76	122	12	17	4

Spring Rate ³ @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
144	90	191	3.3
96	60	128	2.2
72	46	96	1.6
58	36	77	1.3

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges	
	DIN PN10/16
Raised Face ø [mm]	84
Bolt Circle ø [mm]	100
Flange Max ø [mm]	204
Holes [No. x Thread]	4 x M16
Thickness [mm]	16
Effective Area [mm ²]	2200

Options	
Bellows ⁷	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

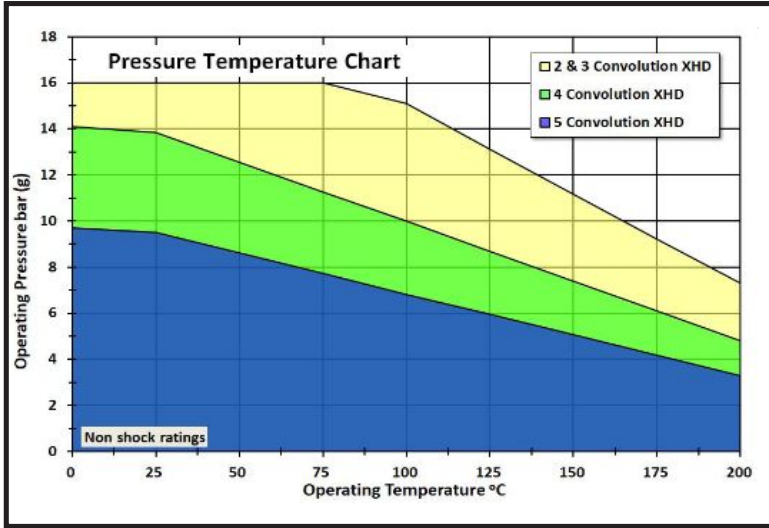
Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Size 1.1/4" FFAB bellows are also available with flange bolt holes to suit ASME 150 flanged piping systems.
- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flanges are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows DN 40-1.1/2in

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	54	46	62	4	6	5
FFB 3	69	56	82	6	10	5
FFB 4	84	66	102	8	13	5
FFB 5	99	76	122	12	17	5

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
144	90	191	3.3
96	60	128	2.2
72	46	96	1.6
58	36	77	1.3

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Options	
Component	Options
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

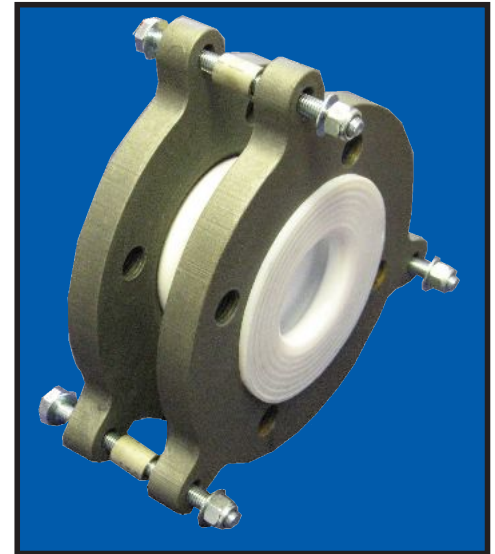
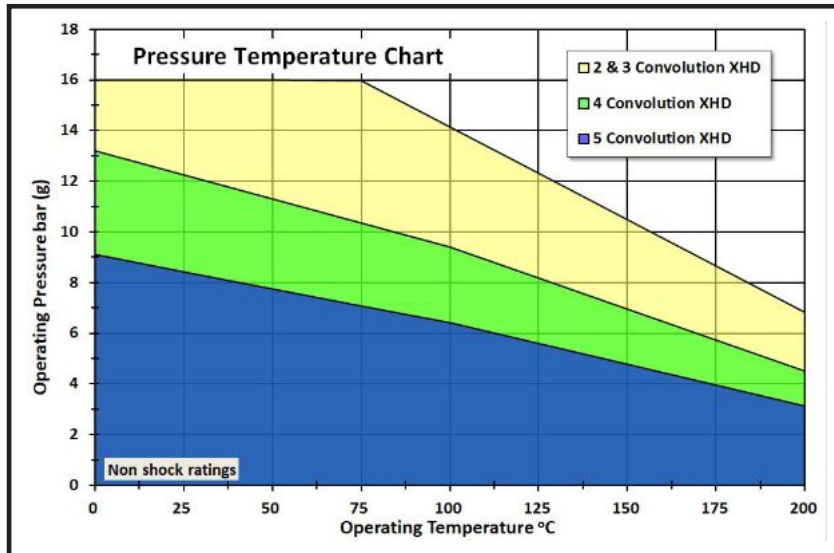
Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	73	88
Bolt Circle Ø [mm]	98	110
Flange Max Ø [mm]	204	
Holes ³ [No. x Thread]	4 x ½" UNC	4 x M16
Thickness [mm]	16	
Effective Area [mm ²]	2,200	

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	55	44	66	6	7	5
FFB 3	70	54	86	9	11	5
FFB 4	85	64	106	12	14	5
FFB 5	100	74	126	15	18	6

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
154	104	225	4.1
102	70	150	2.7
76	52	113	2.0
62	42	90	1.6

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	92	102
Bolt Circle Ø [mm]	121	125
Flange Max Ø [mm]	220	
Holes ³ [No. x Thread]	4 x ½" UNC	4 x M16
Thickness [mm]	16	
Effective Area [mm ²]	3,200	

Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

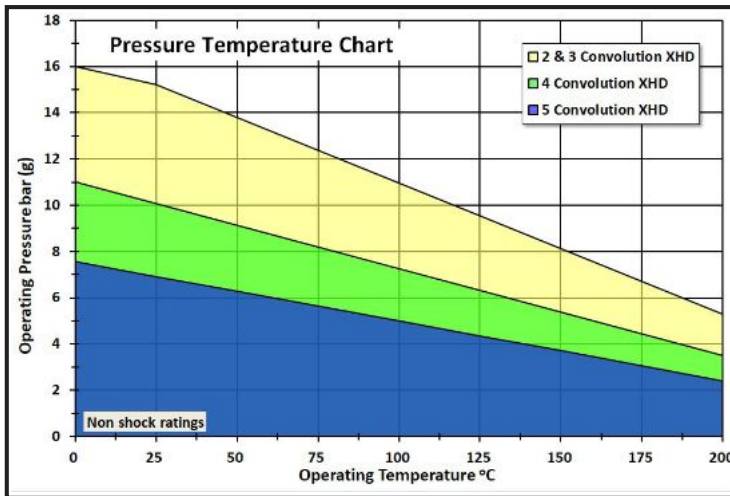
Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluroFlow FFB PTFE Bellows DN 65-2.1/2in

FluroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	65	54	76	6	7	6
FFB 3	85	69	101	9	10	6
FFB 4	105	84	126	12	13	7
FFB 5	125	99	151	15	16	7

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
190	144	293	5.9
126	96	195	3.9
94	72	146	2.9
76	58	117	2.3

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L
Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

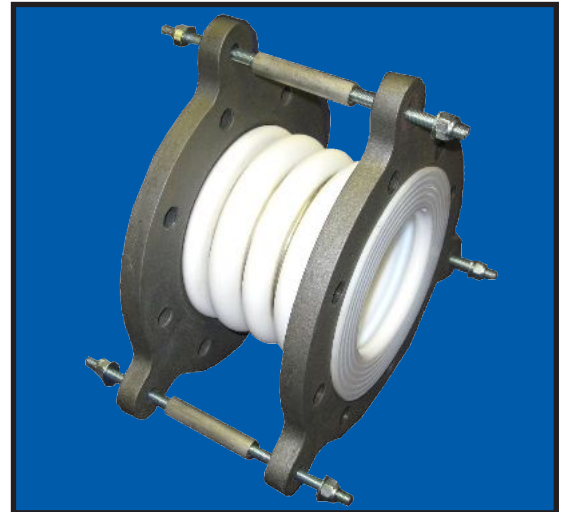
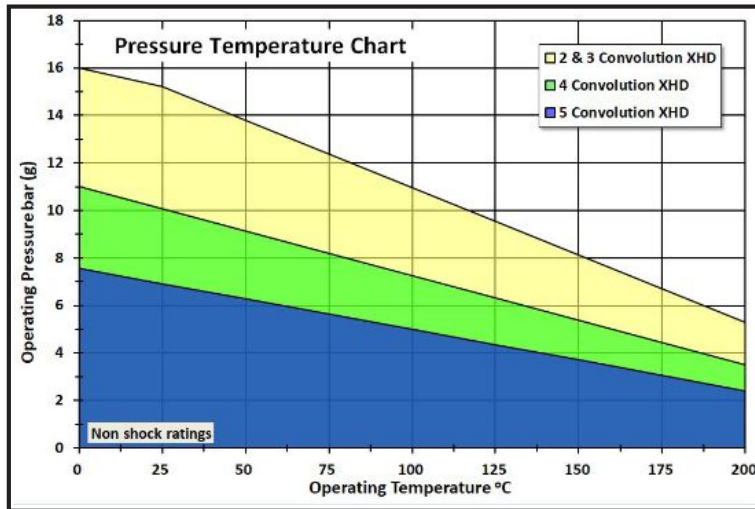
Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	105	122
Bolt Circle Ø [mm]	140	145
Flange Max Ø [mm]	240	
Holes ³ [No. x Thread]	4 x ½" UNC	8 x M16
Thickness [mm]	16	
Effective Area [mm ²]	5,200	

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	65	52	78	7	7	7
FFB 3	85	66	104	11	11	8
FFB 4	105	81	129	15	14	8
FFB 5	125	95	155	19	18	8

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
256	166	360	7.3
172	112	240	4.9
128	84	180	3.7
102	66	144	2.9

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	127	138
Bolt Circle Ø [mm]	152	160
Flange Max Ø [mm]	260	
Holes ³ [No. x Thread]	4 x ½" UNC	8 x M16
Thickness [mm]	16	
Effective Area [mm ²]	7,300	

Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

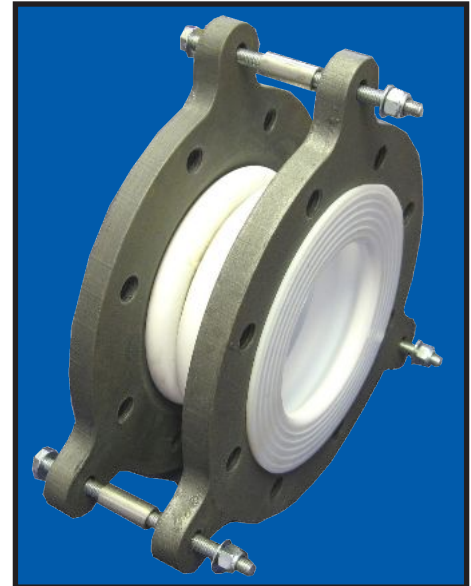
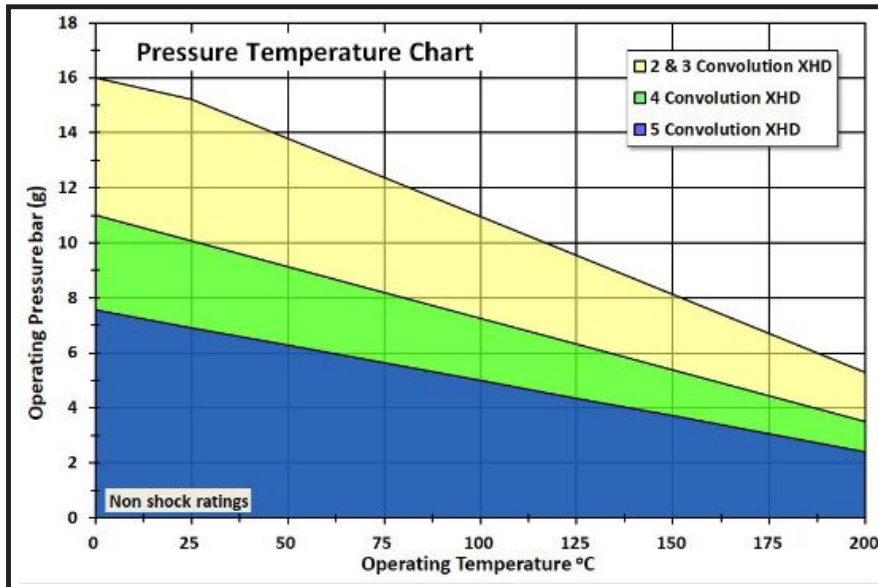
Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.

Notes



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	67	52	82	8	7	10
FFB 3	91	70	112	12	10	10
FFB 4	115	88	142	16	13	10
FFB 5	139	106	172	20	17	10

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Options	
Bellows ⁵	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
400	248	450	9.9
268	166	300	6.6
200	124	225	5.0
160	100	180	4.0

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	157	158
Bolt Circle Ø [mm]	191	180
Flange Max Ø [mm]	308	
Holes ³ [No. x Thread]	8 x ½" UNC	8 x M16
Thickness [mm]	16	
Effective Area [mm ²]	10,200	

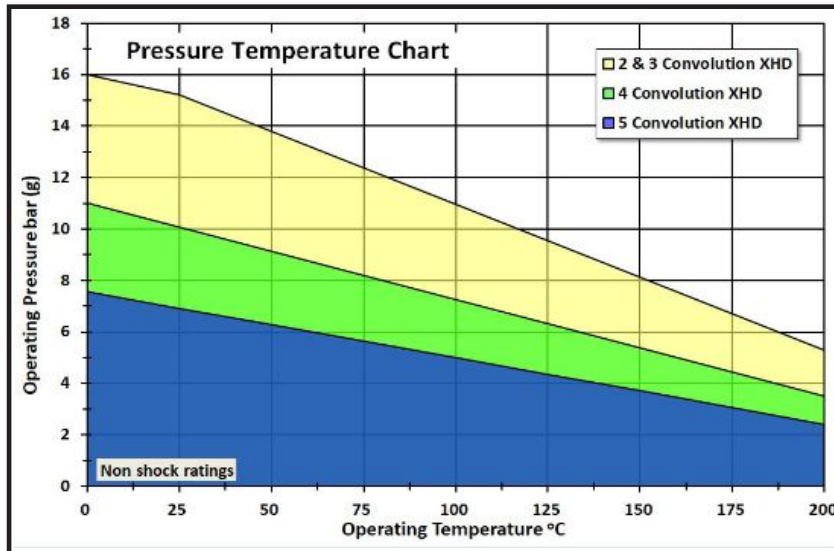
Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows DN 125-5in

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	75	60	90	8	6	12
FFB 3	103	82	124	12	9	13
FFB 4	131	103	159	16	12	13
FFB 5	159	125	193	20	15	13

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
442	288	563	13.5
294	192	375	9.0
220	144	281	6.8
176	116	225	5.4

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	186	188
Bolt Circle Ø [mm]	216	210
Flange Max Ø [mm]	333	
Holes ³ [No. x Thread]	8 x ¾" UNC	8 x M16
Thickness [mm]	20	
Effective Area [mm ²]	17,300	

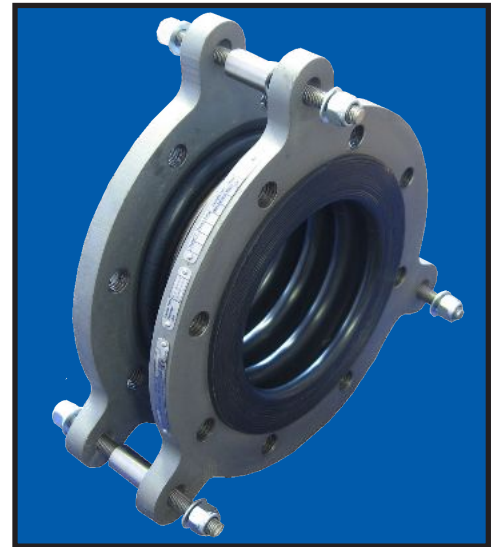
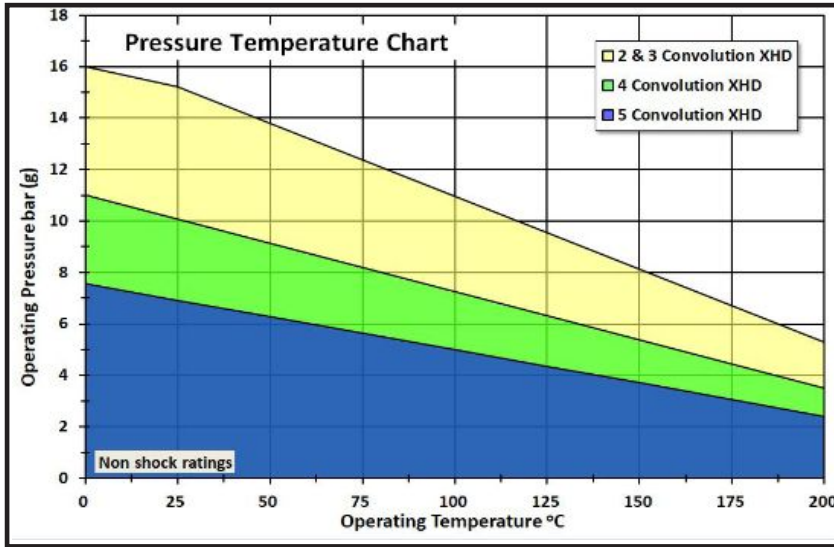
Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	75	59	91	8	6	15
FFB 3	103	81	125	12	8	15
FFB 4	131	102	160	17	11	16
FFB 5	159	124	194	21	14	16

Spring Rate ² @ 20°C +/- 50%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
496	306	675	16.4
330	204	450	11.0
248	154	338	8.2
198	122	270	6.6

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150	DIN PN10/16
Raised Face Ø [mm]	216	212
Bolt Circle Ø [mm]	241	240
Flange Max Ø [mm]	378	
Holes ³ [No. x Thread]	8 x ½" UNC	8 x M16
Thickness [mm]	20	
Effective Area [mm ²]	20,900	

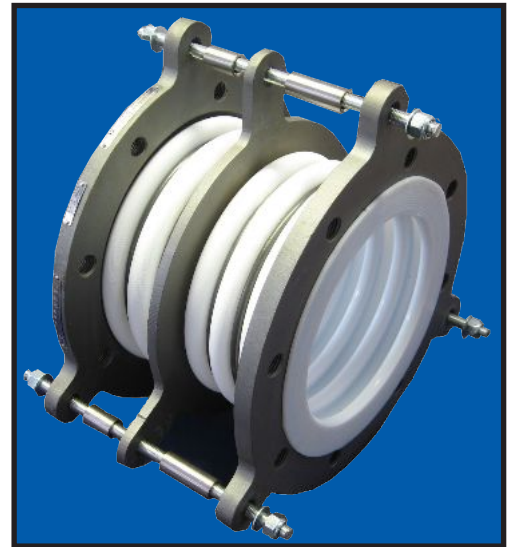
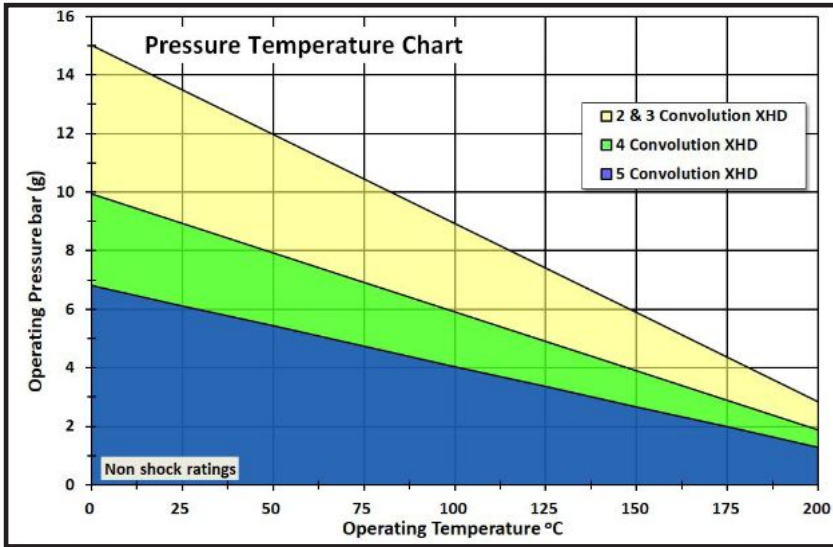
Options	
Bellows ⁶	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD	-1.0	-1.0	-1.0	-1.0
FFB 5 XHD	-1.0	-1.0	-1.0	-1.0

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us. please contact us.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin paste extruded HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available with an Extra Heavy Duty “XHD” liner.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	75	58	92	8	5	20
FFB 3	103	79	127	12	8	20
FFB 4	131	100	162	17	10	21
FFB 5	159	121	197	21	12	21

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
390	300	885	18.3
260	200	590	12.2
195	150	443	9.1
156	100	354	7.3

Materials	
Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	270	268	
Bolt Circle Ø [mm]	298	295	335
Flange Max Ø [mm]	440		
Holes ³ [No. x Thread]	8 x ¾" UNC	8 x M20	12 x M20
Thickness [mm]	20		
Effective Area [mm ²]	35,300		

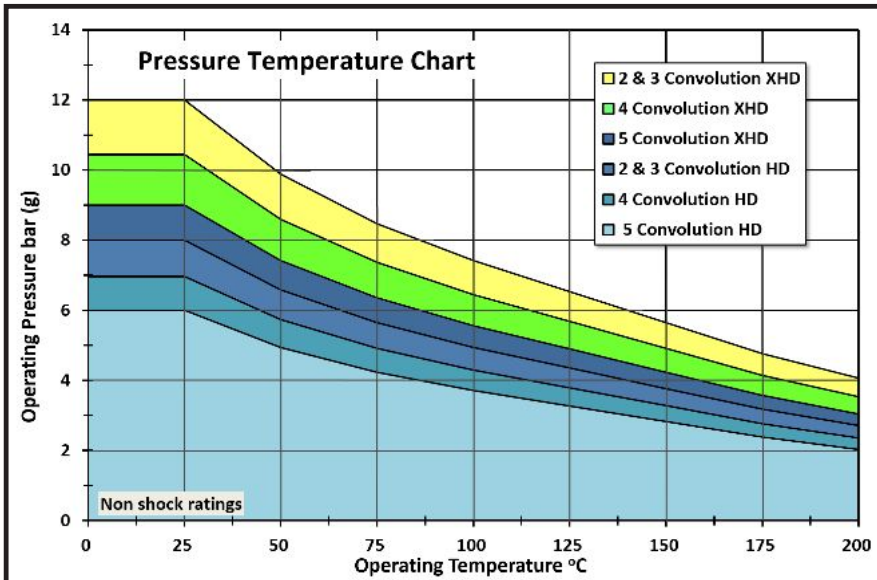
Options	
Bellows ⁷	Paste Extruded Static-Dissipating PTFE to ASTM D4895
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

Vacuum				
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)	200°C bar (g)
FFB 2 XHD	-1.0	-1.0	-1.0	-1.0
FFB 3 XHD	-1.0	-1.0	-1.0	-1.0
FFB 4 XHD ⁵	-1.0	-0.9	-0.8	-0.7
FFB 5 XHD	-0.9	-0.8	-0.7	-0.6

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	78	59	97	8	5	25
FFB 3	107	81	133	12	7	26
FFB 4	135	103	167	17	9	26
FFB 5	164	125	203	21	11	27

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
420	330	840	25.9
280	220	560	17.3
210	165	420	12.9
168	132	336	10.4

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JR2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	324	320	
Bolt Circle Ø [mm]	362	350	355
Flange Max Ø [mm]	514		
Holes ³ [No. x Thread]	12 x ¾" UNC	12 x M20	12 x M24
Thickness [mm]	20		
Effective Area [mm ²]	56,600		

Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

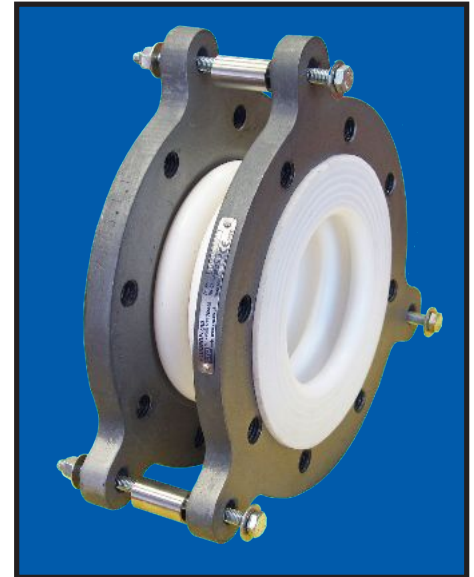
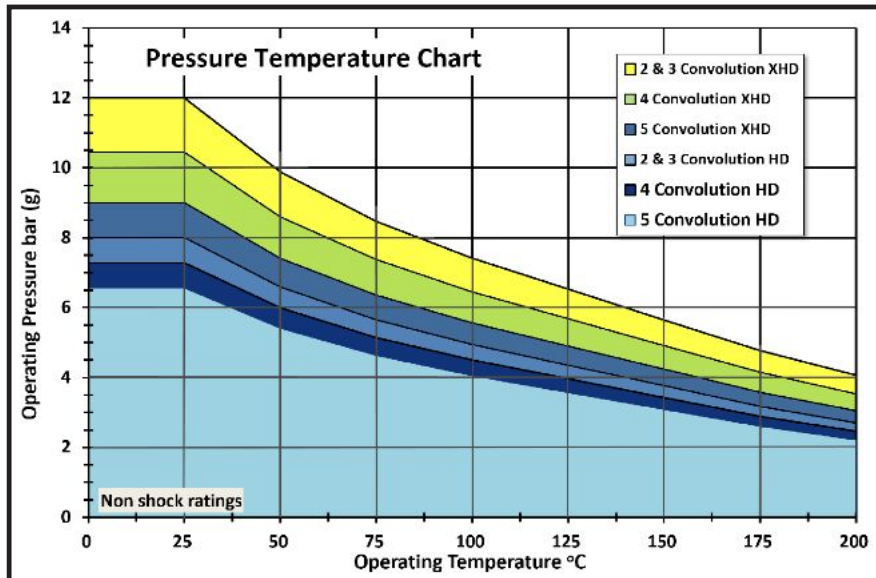
Vacuum			
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)
FFB 2 HD	-1.0	-1.0	0.0
FFB 3 HD	-1.0	-1.0	0.0
FFB 2 XHD	-1.0	-1.0	-1.0
FFB 3 XHD ⁵	-1.0	-1.0	-0.75

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For vacuum performance above 3 convolutions please consult us. Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows DN 300-12in

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	95	76	114	9	4	36
FFB 3	132	106	158	13	6	36
FFB 4	169	136	202	18	8	37
FFB 5 ⁴	206	166	246	22	9	37

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
510	375	1020	38.0
340	250	680	25.3
255	188	510	19.0
204	150	408	15.2

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	381	370	378
Bolt Circle Ø [mm]	432	400	410
Flange Max Ø [mm]	590		
Holes ³ [No. x Thread]	12 x ¾" UNC	12 x M20	12 x M24
Thickness [mm]	20		
Effective Area [mm ²]	77,700		

Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

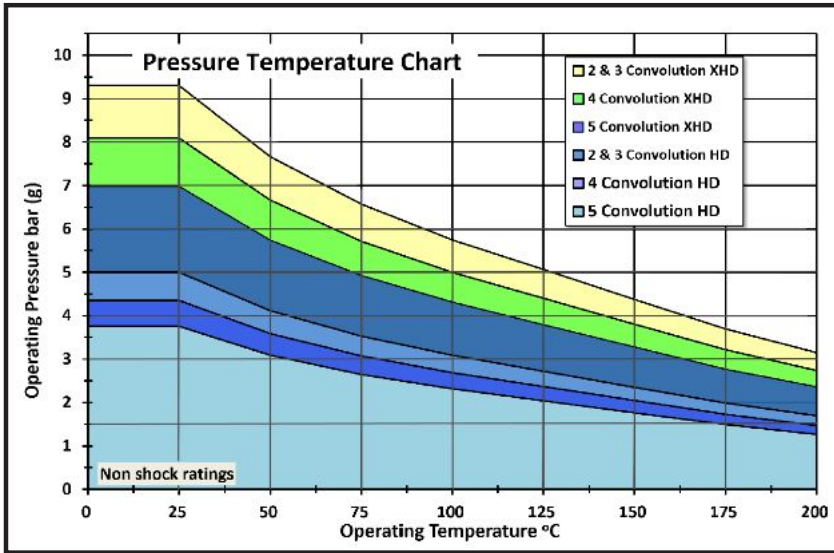
Vacuum			
Convolutions	20°C bar (g)	100°C bar (g)	150°C bar (g)
FFB 2 HD	-1.0	-1.0	0.0
FFB 3 HD	-1.0	-1.0	0.0
FFB 2 XHD	-1.0	-1.0	-1.0
FFB 3 XHD ⁵	-1.0	-1.0	-0.75

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 10.
- For vacuum performance above 3 convolutions please consult us. Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows DN 350-14in

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	98	78	118	8	3	65
FFB 3	137	110	164	12	5	66
FFB 4	176	142	210	17	6	67
FFB 5	215	174	256	21	7	68

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
900	510	1208	47.4
600	340	805	31.6
450	255	604	23.7
360	204	483	19.0

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	413	430	438
Bolt Circle Ø [mm]	476	460	470
Flange Max Ø [mm]	640		
Holes ³ [No. x Thread]	12 x 1" UNC	16 x M20	16 x M24
Thickness [mm]	22		
Effective Area [m ²]	0.1074		

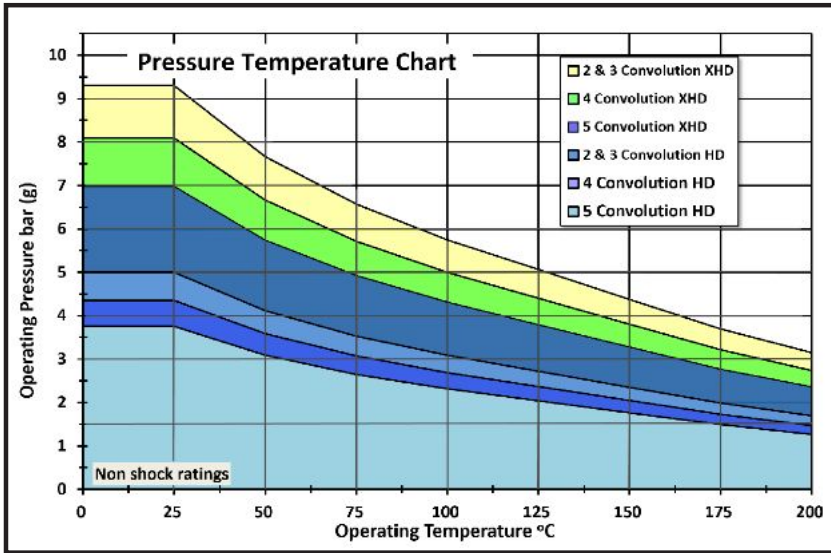
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

Vacuum	
Please consult ⁵	

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 7.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	117	97	137	10	3	79
FFB 3	162	134	190	15	4	80
FFB 4	207	171	243	20	6	81
FFB 5	252	208	296	25	7	83

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
1455	870	1380	56.9
970	580	920	38.0
728	435	690	28.5
582	348	552	22.8

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

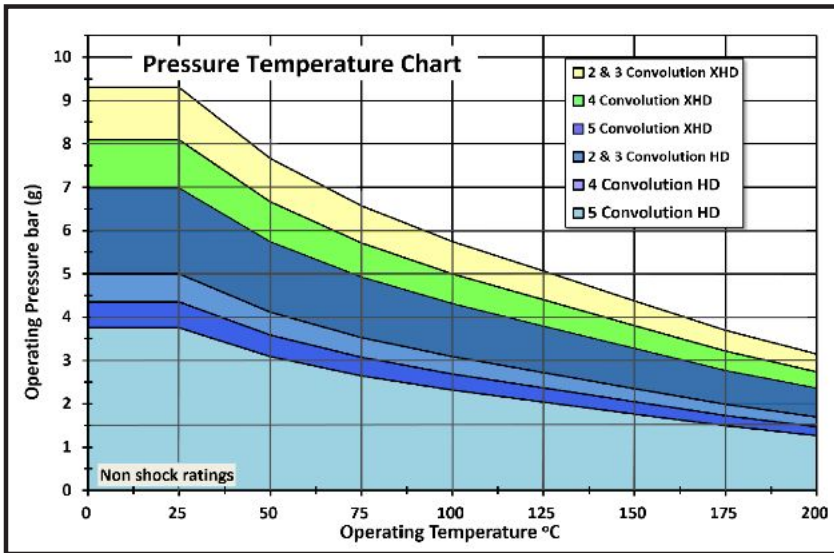
	ASME Class 150	DIN PN10	DIN PN16
	Raised Face Ø [mm]	470	482
Bolt Circle Ø [mm]	540	515	525
Flange Max Ø [mm]	700		
Holes ³ [No. x Thread]	16 x 1" UNC	16 x M24	16 x M27
Thickness [mm]	20		
Effective Area [m ²]	0.1411		

Vacuum
Please consult ⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 7.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements¹

Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	118	98	138	11	3	82
FFB 3	163	135	191	15	4	84
FFB 4	208	172	244	20	5	85
FFB 5	253	209	297	24	7	86

Spring Rate² @ 20°C +/- 30%

Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
2325	1290	1553	65.6
1550	860	1035	43.7
1163	645	776	32.8
930	516	621	26.2

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Options

Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

Flanges

	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	533	532	550
Bolt Circle Ø [mm]	578	565	585
Flange Max Ø [mm]	740		
Holes ³ [No. x Thread]	16 x 1.1/4" UNC	20 x M24	20 x M27
Thickness [mm]	22		
Effective Area [m ²]	0.18		

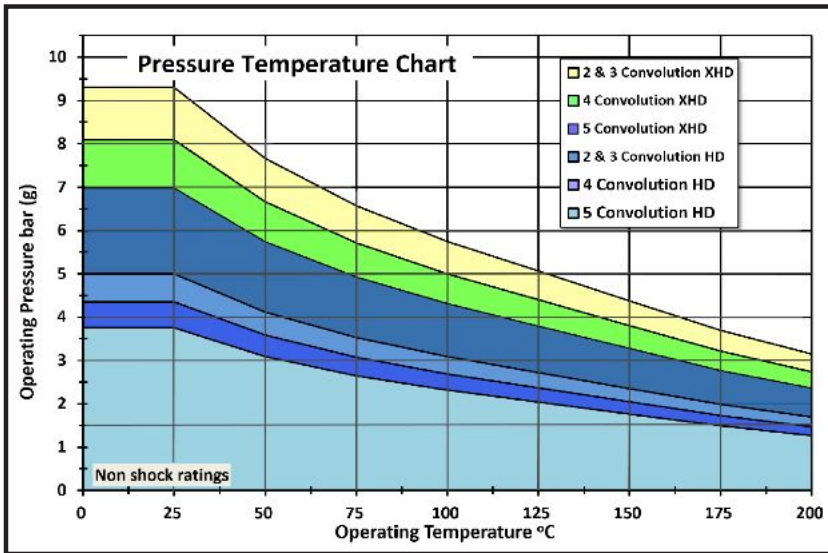
Vacuum

Please consult⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 7.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	125	105	145	11	2	104
FFB 3	170	142	198	15	4	106
FFB 4	215	179	251	20	5	108
FFB 5	260	216	304	24	6	109

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
2865	1605	1725	74.2
1910	1070	1150	49.5
1433	803	863	37.1
1146	642	690	29.7

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

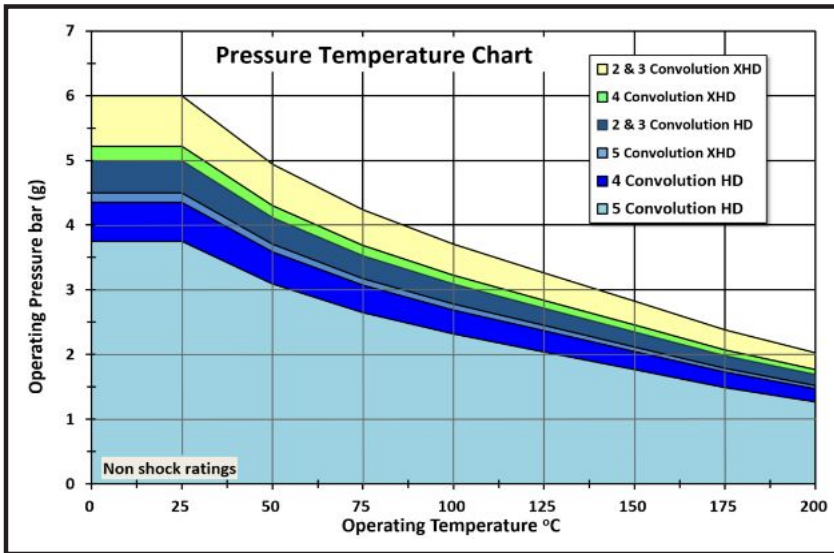
Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	584	585	610
Bolt Circle Ø [mm]	635	620	650
Flange Max Ø [mm]	830		
Holes ³ [No. x Thread]	20 x 1.½" UNC	20 x M24	20 x M30
Thickness [mm]	25		
Effective Area [m ²]	0.2164		

Vacuum	
Please consult ⁵	

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 7.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	130	110	150	11	2	140
FFB 3	175	147	203	15	3	142
FFB 4	220	183	257	20	4	145
FFB 5	265	220	310	24	5	147

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
2865	1605	1725	74.2
1910	1070	1150	49.5
1433	803	863	37.1
1146	642	690	29.7

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320531 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

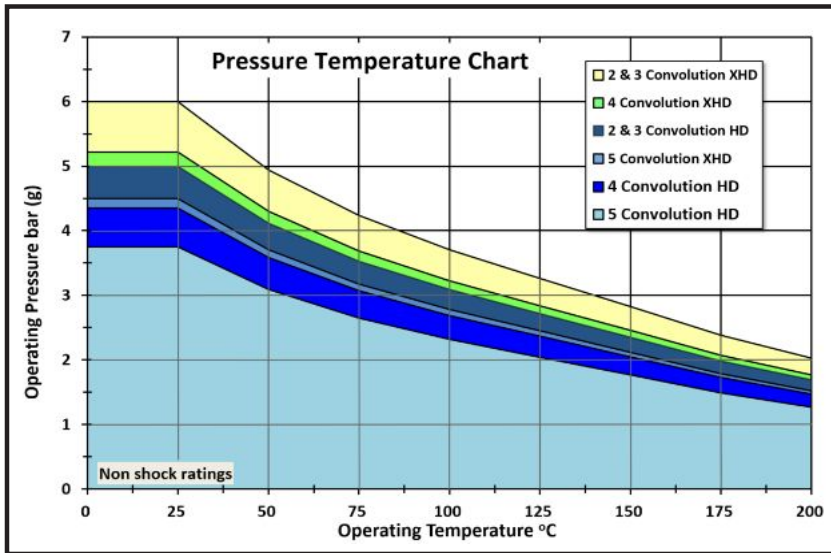
Flanges			
	ASME Class 150	DIN PN10	DIN PN16
Raised Face Ø [mm]	692	685	725
Bolt Circle Ø [mm]	749	725	770
Flange Max Ø [mm]	935	900	960
Holes ³ [No. x Thread]	20 x 1.¼" UNC	20 x M27	20 x M33
Thickness [mm]	25		
Effective Area [m ²]	0.3077		

Vacuum
Please consult ⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 6.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	146	121	171	12	2	154
FFB 3	207	175	239	16	3	157
FFB 4	268	229	307	20	3	160
FFB 5	329	283	375	24	4	163

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
3120	2415	5745	134.6
2080	1610	3830	89.7
1561	1208	2873	67
1248	966	2298	54

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

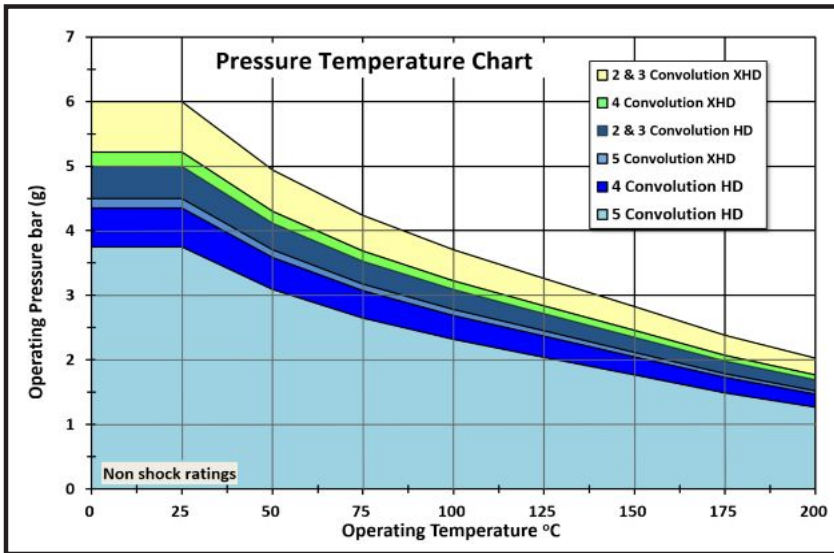
Flanges				
	ASME Class 150 Series A	ASME Class 150 Series B	DIN PN10	DIN PN16
Raised Face Ø [mm]	800	762	800	795
Bolt Circle Ø [mm]	864	795	840	
Flange Max Ø [mm]	1060	970	1028	1043
Holes ³ [No. x Thread]	28 x 1.¼" UNC	40 x ¼" UNC	24 x M27	24 x M33
Thickness [mm]	27			
Effective Area [m ²]	0.4228			

Vacuum
Please consult ⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 5.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	160	135	185	11	2	178
FFB 3	221	189	251	15	3	181
FFB 4	282	243	321	19	3	184
FFB 5	343	297	389	23	4	187

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
3340	2590	6145	145
2225	1725	4100	100
1670	1294	3076	73
1336	1035	2460	58

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges		
	ASME Class 150 Series A	ASME Class 150 Series B
Raised Face Ø [mm]	857	813
Bolt Circle Ø [mm]	914	846
Flange Max Ø [mm]	1117	1020
Holes ³ [No. x Thread]	28 x 1.¼" UNC	44 x ¾" UNC
Thickness [mm]	27	
Effective Area [m ²]	0.4717	

Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

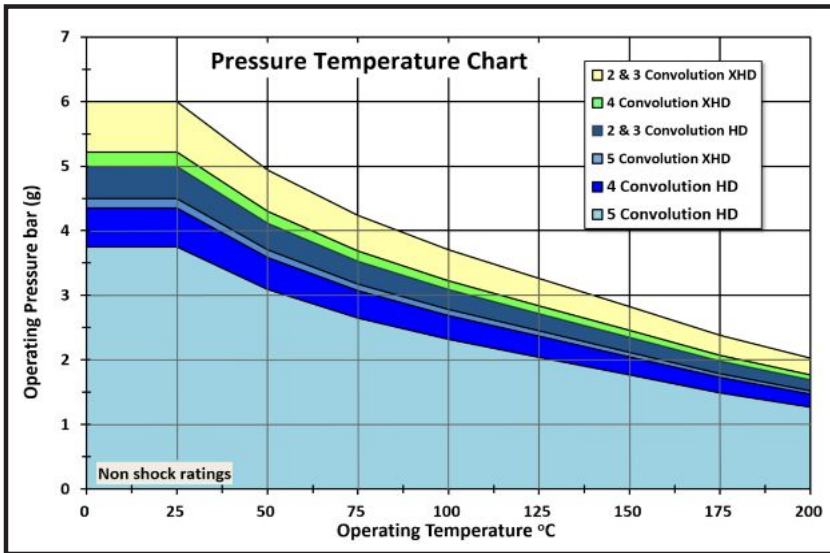
Vacuum
Please consult ⁵

Please note that there is no DN750 DIN equivalent in EN1092-1

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 5.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	160	135	185	11	2	202
FFB 3	221	189	251	15	3	206
FFB 4	282	243	321	19	3	210
FFB 5	343	297	389	23	4	214

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
3560	2750	6550	153
2373	1833	4367	102
1780	1375	3275	77
1424	1100	2620	61

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges				
	ASME Class 150 Series A	ASME Class 150 Series B	DIN PN10	DIN PN16
Raised Face Ø [mm]	914	864	905	900
Bolt Circle Ø [mm]	978	900	950	
Flange Max Ø [mm]	1170	1070	1125	1135
Holes ³ [No. x Thread]	28 x 1.1/2" UNC	48 x 3/4 UNC	24 x M30	24 x M36
Thickness [mm]	30			
Effective Area [m ²]	0.5509			

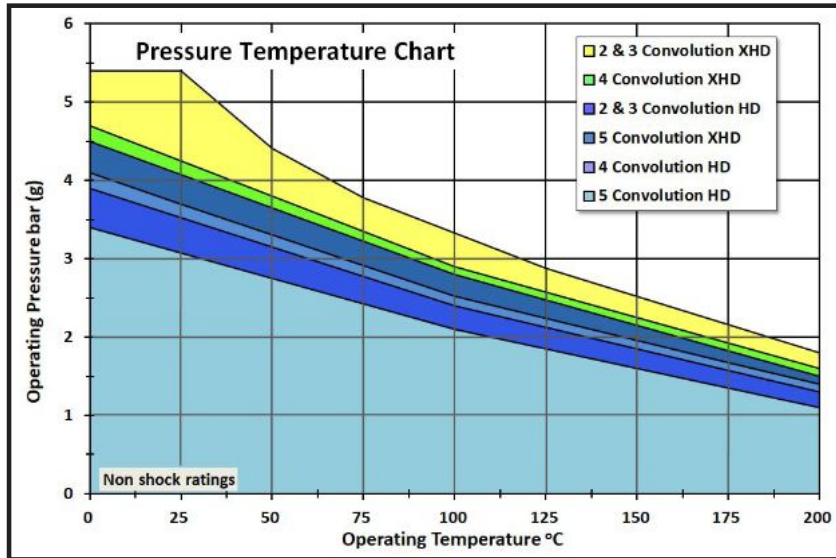
Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

Vacuum
Please consult ⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes are possible for certain sizes please contact us.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

FluoroFlow FFB PTFE Bellows are manufactured from virgin multi-ply HiPerFlon® PTFE. FluoroFlow Bellows are manufactured using a unique process which ensures a uniform PTFE wall thickness and eliminates stress in the PTFE from the convolution process. This product is available in two liner thicknesses, our standard Heavy Duty “HD” and an Extra Heavy Duty “XHD”.



Dimensions and Movements ¹						
Convolutions ⁴	Neutral Length [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral +/- [mm]	Angular +/- [degrees]	Weight [kg]
FFB 2	240	215	265	11	2	310
FFB 3	307	275	339	15	3	318
FFB 4	374	335	413	19	3	326
FFB 5	441	395	847	23	4	334

Spring Rate ² @ 20°C +/- 30%			
Axial Compression [N/mm]	Axial Extension [N/mm]	Lateral [N/mm]	Angular [Nm/°]
4110	3100	7370	172
2740	2067	4914	114
2055	1550	3685	86
1644	1240	2948	68

Materials	
Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to BS1501-161-430A / S235JRG2 (RSt 37.2)
Paint	Ultra-High Temperature in Silver
Root Rings	Stainless Steel to 320S31 (316Ti)
Tie Rods	Carbon Steel Grade 8.8 Zinc Plated
Nuts	Carbon Steel Grade 8.8 Zinc Plated
Limit Sleeves	Stainless Steel to ASTM A312 Gr. 304/304L

Flanges				
	ASME Class 150 Series A	ASME Class 150 Series B	DIN PN10	DIN PN16
Raised Face Ø [mm]	1022	972	1005	1000
Bolt Circle Ø [mm]	1086	1010	1050	
Flange Max Ø [mm]	1278	1167	1225	1235
Holes ³ [No. x Thread]	32 x 1.½" UNC	44 x ¾" UNC	28 x M30	28 x M36
Thickness [mm]	30			
Effective Area [m ²]	0.672			

Options	
Bellows ⁷	Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Root Rings	Hastelloy, Monel etc.
Tie Rods	Stainless Steel, Hastelloy, Monel etc.
Anti-Snake Rings	Stainless Steel
Vacuum Support Rings	Hastelloy, Titanium, Tantalum, PTFE Encapsulated etc.

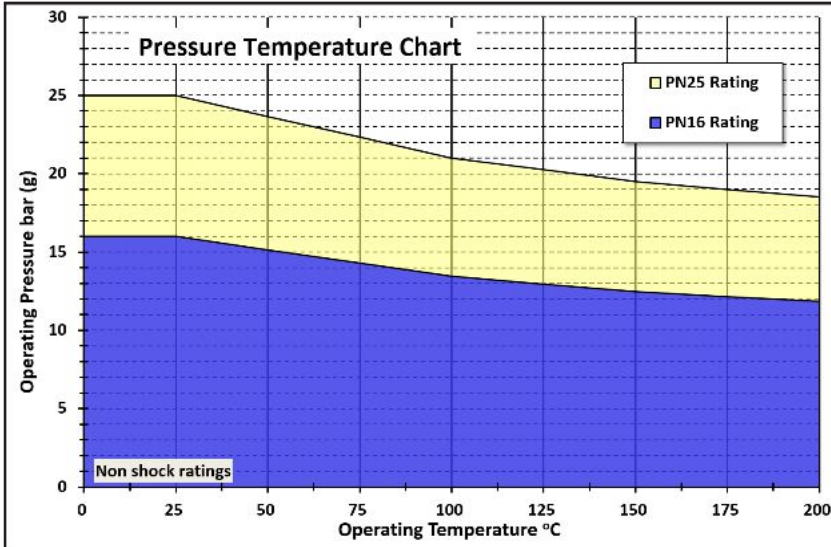
Vacuum
Please consult ⁵

Notes:

- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes and alternative threads are possible for certain sizes please contact us.
- The maximum number of convolutions for this size is 5.
- Vacuum performance can increase to full vacuum with the use of vacuum support rings.
- For operating temperature and pressure for more than 3 convolutions please contact us.
- Static-Dissipating Bellows have the same working pressure / temperature range as Virgin PTFE Bellows.

Armoured FluoroFlow FFAB PTFE Bellows are manufactured from virgin HiPerFlon® PTFE and combined with a multi-layered austenitic stainless steel shell to provide high pressure performance outside the range of conventional PTFE bellows. This range is designed to the EJMA international standard.

The manufacturing technique is such that the PTFE and the steel shell are convoluted simultaneously to provide a uniform PTFE wall thickness throughout the product.



Materials	
Component	Materials
Bellows Liner	Paste Extruded Virgin PTFE to ASTM D4895 or Multi-ply Virgin PTFE to ASTM D4894 Type IV
Bellows Shell	Stainless Steel to 321S31 / 321 / 1.4541
Flanges	Carbon Steel to S235JRG2 / RSt 37.2
Paint—on CS Flanges	Zinc Epoxy Primer in Grey
Options	
Bellows Liner	Paste Extruded Static-Dissipating PTFE to ASTM D4895 or Multi-ply Static-Dissipating PTFE to ASTM D4894 Type IV
Bellows Shell ¹	Hastelloy and other Exotic Materials
Flanges	Stainless Steel, Hastelloy, Low Temperature Steels etc.
Flanges	Threaded holes
Tie Rods ²	Available as an option—not supplied as standard product



Notes:

1. Please note that hastelloy is available for areas subject to stainless steel stress corrosion cracking such as HCl service.
2. Tie rods are not provided with the standard product, but these are available as an option.

FluoroFlow FFAB PTFE Bellows

Note that as standard flanges are rotating. Also tie rods are not supplied as part of the standard product, they are an option.

Dimensions, Movements and Vacuum Performance																
NB	DN	Ambient Rating bar (g)	Flange Type		Neutral Length ¹ [mm]	Minimum Length [mm]	Maximum Length [mm]	Lateral ² [mm]	Angular [degrees]	Weight DIN [kg]	Weight ASME [kg]	Spring Rate [N/mm] ± 30%	Effective Area [m ²]	Vacuum		
			ASME Class	DIN PN										20°C bar (g)	100°C bar (g)	180°C bar (g)
1.1/2 in	40	16	150	16	130	121	139	1	3	5	3	183	0.00278	-1.0	-1.0	-1.0
					225	210	240									
		25	300	25	260	246	274									
2 in	50	16	150	16	125	116	134									
					215	200	230									
25	300	25	240	225	255	8	8									
									2.1/2 in	65	16	150	16			
215	197	233														
25	300	25	230	214	246	7	7		200	0.00590						
											3 in	80	16			
220	201	239														
25	300	25	225	209	241	9	10		202	0.00840						
								4 in			100	16	150	16	160	150
260	239	281														
25	300	25	220	203	237	10	12	300	0.01383							
										5 in	125	16	150	16	175	164
270	247	293														
25	300	25	300	280	32	12	14	390	0.02008							
										6 in	150	16	150	16	165	154
300	274	326														
25	300	25	295	275	315	12	16	237	0.01990							
										8 in	200	16	150	16	180	168
325	292	358														
25	300	25	230	217	243	28	35	356	0.01963							
										10 in	250	16	150	16	16	17
300	274	326														
25	300	25	295	275	315	16	17	216	0.02800							
										12 in	300	16	150	16	180	168
325	292	358														
25	300	25	230	217	243	32	43	407	0.02746							
										14 in	350	16	150	16	200	186
330	296	364														
25	300	25	330	303	357	23	27	707	0.04480							
										16 in	400	16	150	16	180	168
325	292	358														
25	300	25	230	217	243	25	30	303	0.04455							
										18 in	450	16	150	16	200	186
330	303	357														
25	300	25	330	303	357	40	61	750	0.04434							
										20 in	500	16	150	16	195	1783
350	310	390														
25	300	25	345	312	378	34	38	896	0.06770							
										14 in	350	16	150	16	195	1783
350	310	390														
25	300	25	345	312	378	35	40	376	0.06770							
										16 in	400	25	n/a	25	315	280
335	300	370														
25	300	25	335	300	370	44	59	792	0.09390							
										14 in	350	16	150	16	175	157
315	271	359														
25	300	25	345	312	378	65	78	1026	0.11080							
										16 in	400	25	n/a	25	315	280
335	300	370														
25	300	25	335	300	370	68	80	484	0.11080							
										16 in	400	16	150	16	175	157
315	271	359														
25	300	25	345	312	378	68	n/a	661	0.10970							
										16 in	400	25	n/a	25	315	280
335	300	370														
25	300	25	335	300	370	96	114	445	0.14370							
										16 in	400	16	150	16	175	157
315	271	359														
25	300	25	345	312	378	158	n/a	859	0.14320							
										16 in	400	25	n/a	25	315	280
335	300	370														
25	300	25	335	300	370	n/a	209	859	0.14320							
										16 in	400	16	150	16	175	157
315	271	359														
25	300	25	345	312	378	149	144	1067	0.21590							
										16 in	400	25	n/a	25	315	280
335	300	370														
25	300	25	335	300	370	219	290	1095	0.21750							
										20 in	500	16	150	16	220	195
25	300	25	300	268	332											

Notes:

1. Longer and shorter lengths are available providing more or less axial travel.
2. More lateral and angular movement are possible, please consult us.

PTFE Bellows need to be specified accurately to perform safely and have a long life. Beyond the basics of nominal bore size, media, temperature and pressure, the movements required by the bellows are critical. The individual data sheets for each bellows size provide this data for our standard products. If this does not suit your need then please contact us with the information below. Fields in solid blue indicate the standard product.

Customer Name Media

Operational Information

Min. Operating Temperature	<input type="text"/> °C	Max. Operating Temperature	<input type="text"/> °C
Min. Operating Pressure	<input type="text"/> bar (g)	Max. Operating Pressure	<input type="text"/> bar (g)
Vacuum	<input type="text"/> bar (g)	Bellows Nominal Bore	<input type="text"/> mm

Mechanical Requirements

Nominal Length	<input type="text"/> mm	Axial Movement	<input type="text"/> mm
		Lateral Movement	<input type="text"/> mm
		Angular Movement	<input type="text"/> °

Are these movements ever combined at the same time? If so please identify the maximum combined movements.

Axial Movement	<input type="text"/> mm
Lateral Movement	<input type="text"/> mm
Angular Movement	<input type="text"/> °

Bellows Type

Standard 3 Convolutions Bellows	<input checked="" type="checkbox"/>	Number of Convolutions	<input type="text"/>
Armoured PTFE Bellows	<input type="checkbox"/>		

HiPerFlon® PTFE

HiPerFlon® Virgin PTFE	<input checked="" type="checkbox"/>	HiPerFlon® Static-Dissipating PTFE	<input type="checkbox"/>
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Flange Material

Carbon Steel, High Temp. Paint	<input checked="" type="checkbox"/>	Stainless Steel	<input type="checkbox"/>	Other	<input type="text"/>
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Flange Drilling

ASME B16.5 Class 150	<input type="checkbox"/>	DIN PN10	<input type="checkbox"/>	Other	<input type="text"/>
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Tie Rods

Carbon Steel, Zinc Plated	<input checked="" type="checkbox"/>	Stainless Steel	<input type="checkbox"/>	Other	<input type="text"/>
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Root Rings

Stainless Steel	<input checked="" type="checkbox"/>	Hastelloy	<input type="checkbox"/>	Other	<input type="text"/>
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Vacuum Support Rings

Stainless Steel & PTFE Lined	<input type="checkbox"/>	Hastelloy	<input type="checkbox"/>	Other	<input type="text"/>
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Options

Axial Bellows	<input type="checkbox"/>	Other Special Movement Bellows	<input type="checkbox"/>	Smoothbore Sleeve	<input type="checkbox"/>	Safety Shield	<input checked="" type="checkbox"/>
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Other Remarks

Certification

Certification EN10204 Type 2.2	<input checked="" type="checkbox"/>	Certification EN10204 Type 3.1	<input type="checkbox"/>
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Europe Bellows Iss.14

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