

FluoroFlow High Performance PTFE Bellows



the corrosion expert



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 19 sizes from 1in to 32in. They are manufactured in two materials—virgin PTFE and static dissipating PTFE. FluoroFlow Bellows in sizes 1in to 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.

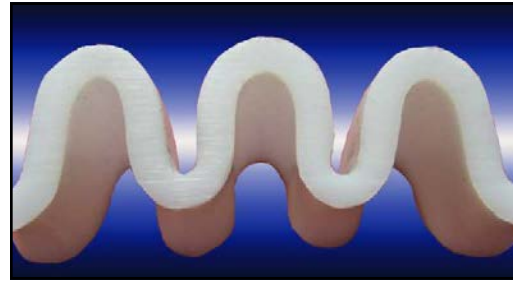
For products requiring a higher pressure rating than is possible with PTFE alone, we have our range of armoured bellows (FFAB) where the PTFE is surrounded by a high pressure stainless steel shell.

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 (68°F) temperature. At this temperature CRP has adopted a safety factor of 6 for bellows up to 8in 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 212°F, 300°F and 400°F 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 300°F. 14 Bellows have been tested in total and two bellows remained under pressure at 300°F 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 Directive 2014/68/EU 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 ISO9001:2008.

Product Testing

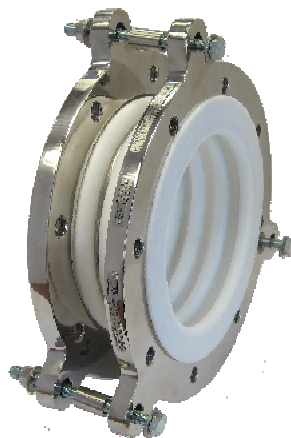
Bellows materials are fully traceable. Bellows tubes undergo mechanical and dimensional tests following manufacture. PTFE sintering and convolution are undertaken using calibrated ovens with precise temperature control. Independent process checks are undertaken using infra-red thermometry. In-process 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 32°F to 400°F, but bellows can be supplied for temperatures outside this envelope.

Special Bellows

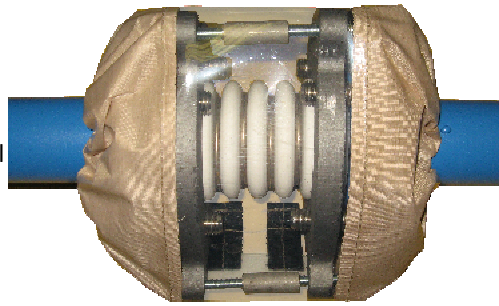
Many customized bellows are available, including bellows with extended flares, reducing bellows (different flange sizes), different flange types, hinged bellows, lateral bellows, dual containment bellows, bellows with special neutral lengths and bellows with special PTFE wall thicknesses. Internal vacuum 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

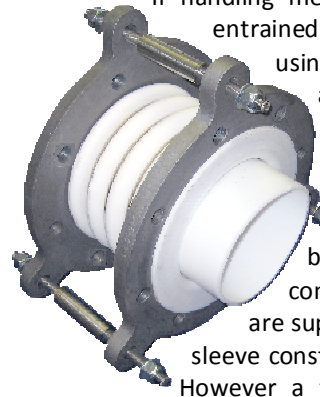
Following guidance from the Pressure Equipment Directive 2014/68/EU and international insurers, we strongly recommend the use of Safety Shields around each bellows. Because of its nature, the bellows is the weakest part of a piping system and safety shields can assist in mitigating risk to operators 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

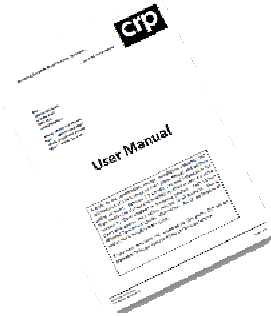
The effective area and the spring rates have a significant influence upon the stress calculations for the piping system. Please find the relevant data on the following pages for each bellows size. For the influence of temperature upon spring

Temperature Correction Factors (TCF) for Spring Rate Conversion	
Temperature (°F)	TCF
68	1.0
176	0.65
248	0.5
302	0.4
404	0.3

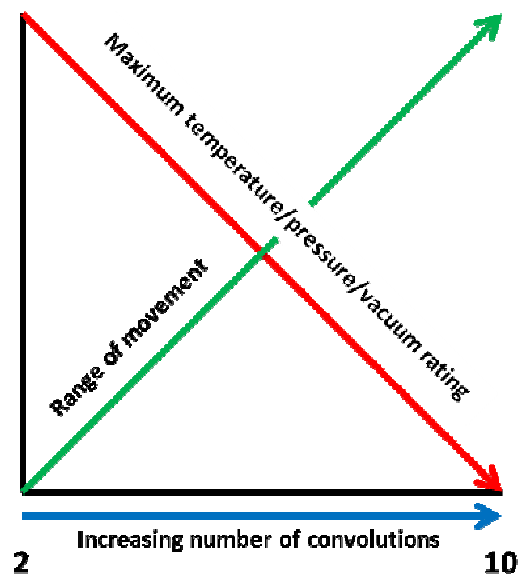
For example: To calculate the spring rate @ 248°F take the spring rate at 248°F x 0.5.

Operating and Installation Instructions

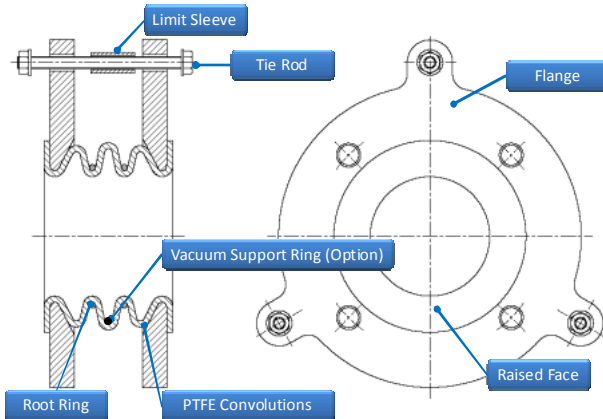
A comprehensive user manual is packed with the bellows shipment. These instructions can also be downloaded from our web site (www.crp.co.uk) or can be sent out by email (enquiry@crp.co.uk). It is critical that these are referred to for the correct installation of bellows.



Root Rings



Key Product Features



Flanges

Bellows flanges are available to all of the international flange standards including ASME Class 150 and 300. 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 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 XHD is the standard product.

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

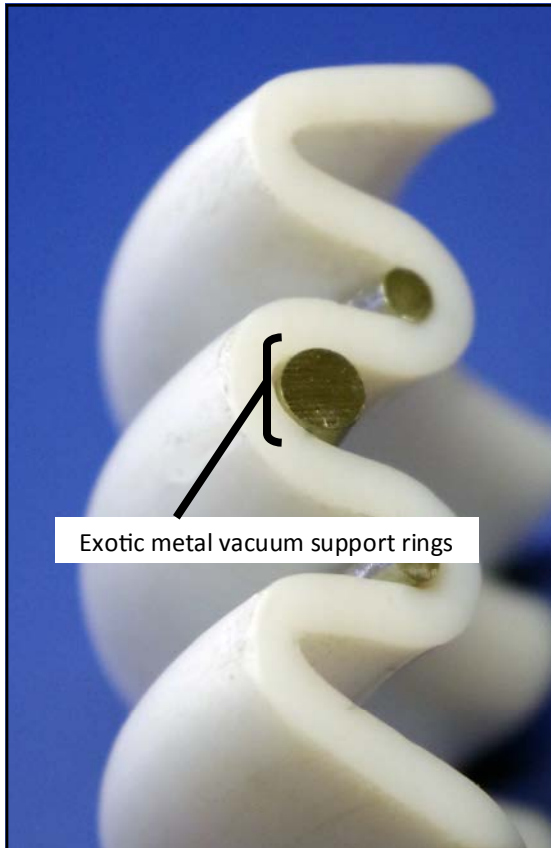
When the number of convolutions exceeds five we would recommend one or more Anti-snake rings.

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.



FLUOROFLOW crp	tel: +44 (0)1706 756400 web: www.crp.co.uk	PL No. 5723-41-010030	No. Convolutions 3	Ring Mat'l 316Ti	CE 0878
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- The product family is referred to as FluoroFlow Bellows or “FFB”.
- The CRP part number.
- The number of convolutions.
- The material used for the root rings.
- Our CE mark and notified body number for compliance with the PED (Pressure Equipment Directive.)

Flange Type	ASME150
Drillings Size	5/8" UNC
	DN80

- The flange type.
- The size and thread type for the drillings.
- The bellows nominal size or in the case of reducing bellows, the flange size at each end.

Temp °F	Pressure psi	Length in.	Date
14	77	0 130.5	09/13
392	14.5 55.1	2.72 3.35 3.98	S/N: 101623

- The month and year of manufacture.
- Two rows of temperature and pressure information. In this example showing the performance at 14°F (-10°C) to 77°F (25°C) and 392°F (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.
- The minimum, neutral and maximum lengths for axial travel.
- A unique serial number for the item.

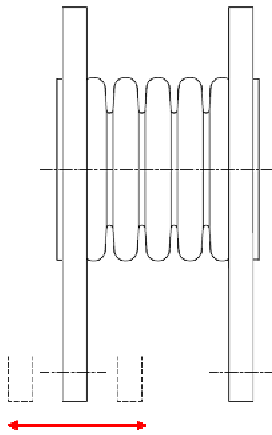
Explanation of Movements

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.

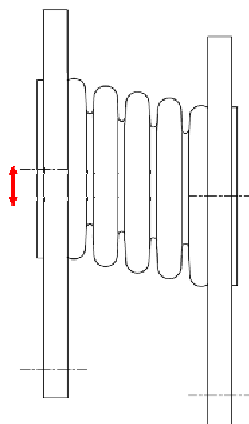
Axial

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 do not require restraining 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.



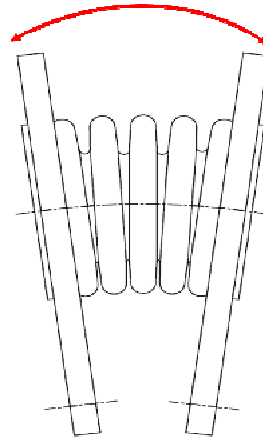
Lateral

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" (DN 150, NB 2")

Units: metric English units

Max. Operating Pressure: 4 barg

Max. Operating Temperature: 130 °C

PTFE: Virgin White

The program has selected a

5 convoluted FFB PTFE Bellows DN 150, NB 6" diameter

This Bellows has the following characteristics:

Step 1	Required	Actual
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 150lb.
PTFE: Virgin White

Selected number of convolutions: 5

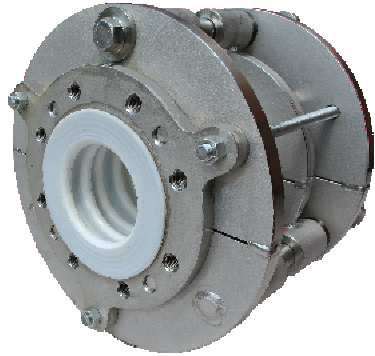
Choose your preferred number of convolutor

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.

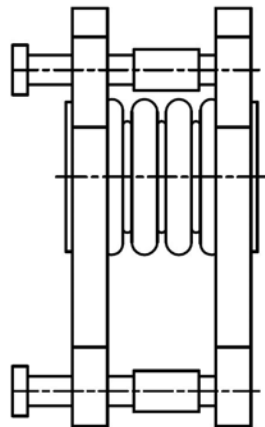


Axial Bellows

Axial Only Bellows [Axial Bellows]

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

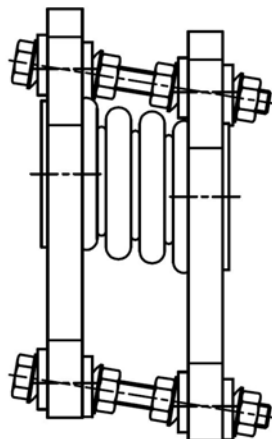
Movement	Allowed
Axial	✓
Lateral	✗
Angular	✗



Lateral Only Bellows [Lateral Bellows]

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

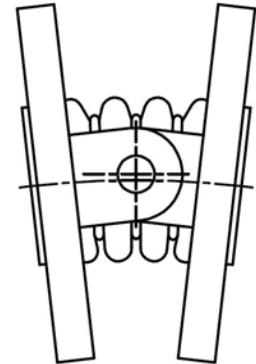
Movement	Allowed
Axial	✗
Lateral (any plane)	✓
Angular	✗



One Plane Angular Bellows [Hinged Bellows]

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

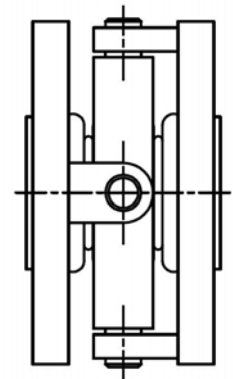
Movement	Allowed
Axial	✗
Lateral	✗
Angular (one plane)	✓



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.

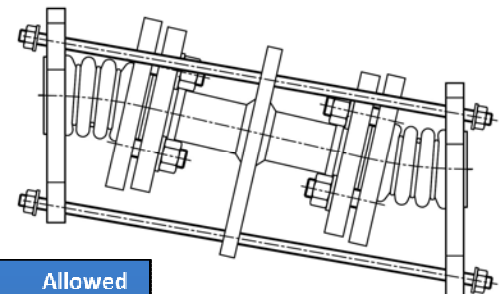
Movement	Allowed
Axial	✗
Lateral	✗
Angular (any plane)	✓



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.

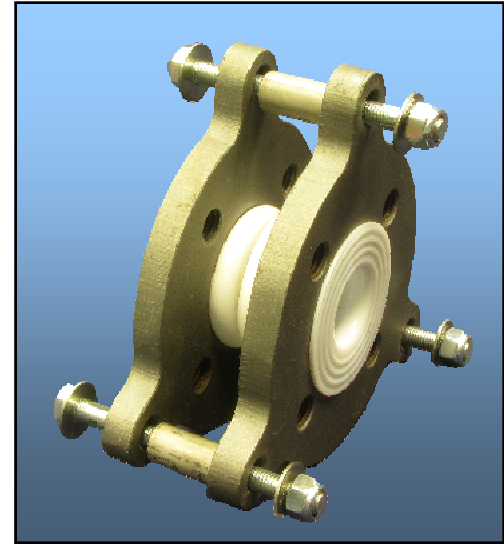
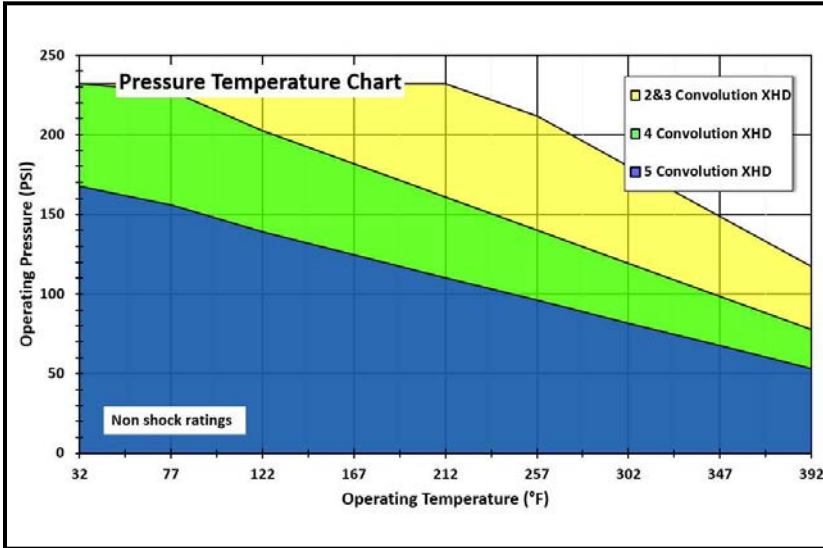
Movement	Allowed
Axial	✓
Large Lateral	✓
Angular	✓



1 in.

FluoroFlow FFB PTFE Bellows 1 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	1.69	1.42	1.97	0.16	6	4.4
FFB 3	2.13	1.69	2.56	0.24	10	4.4
FFB 4	2.56	1.97	3.15	0.31	13	4.4
FFB 5	2.99	2.24	3.74	0.39	17	4.4

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/½ in.]	Axial Extension [lb/½ in.]	Lateral [(lb/½ in.)]	Angular [in. lbf/°]
64.24	38.54	77.09	13.28
42.83	25.70	51.39	8.85
32.83	19.99	38.54	6.20
25.70	15.70	30.69	5.31

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	2.00
Bolt Circle Ø [in.]	3.12
Flange Max Ø [in.]	6.57
Holes ³ [No. x Thread]	4 x ½" UNC
Thickness [in.]	0.47
Effective Area [in. ²]	1.55

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

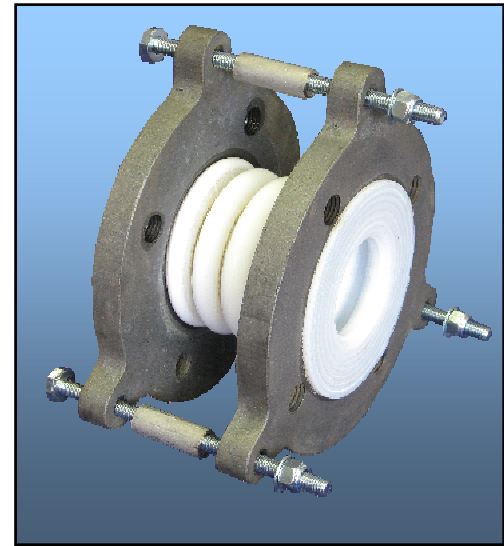
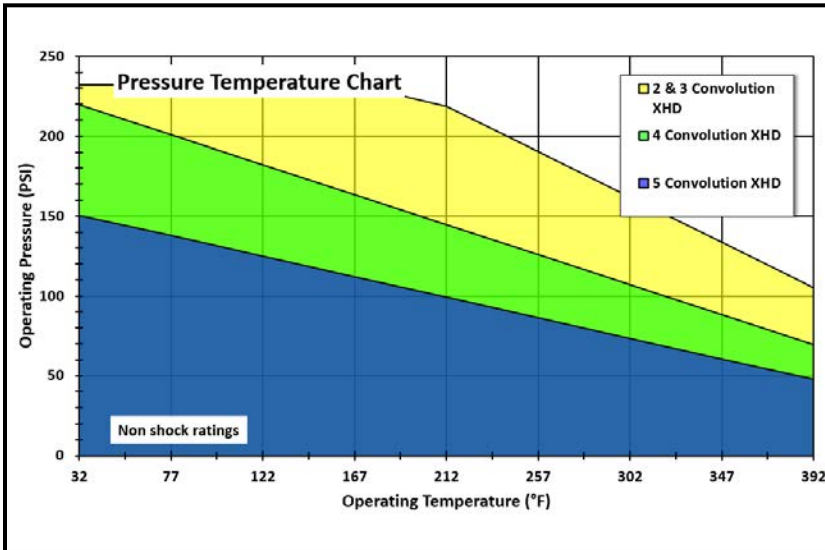
*F.V. = Full vacuum.

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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

FluoroFlow FFB PTFE Bellows 1.1/2 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.13	1.81	2.44	0.16	6	11.0
FFB 3	2.72	2.20	3.23	0.24	10	11.0
FFB 4	3.31	2.60	4.02	0.31	13	11.0
FFB 5	3.90	2.99	4.80	0.47	17	11.0

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
102.8	64.2	136.3	29.21
68.5	42.8	91.4	19.47
51.4	32.8	68.5	14.16
41.4	25.7	55.0	11.51

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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

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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.

Flanges

	ASME Class 150
Raised Face Ø [in.]	2.88
Bolt Circle Ø [in.]	3.88
Flange Max Ø [in.]	8.03
Holes ³ [No. x Thread]	4 x ½" UNC
Thickness [in.]	0.63
Effective Area [in. ²]	3.41

Vacuum

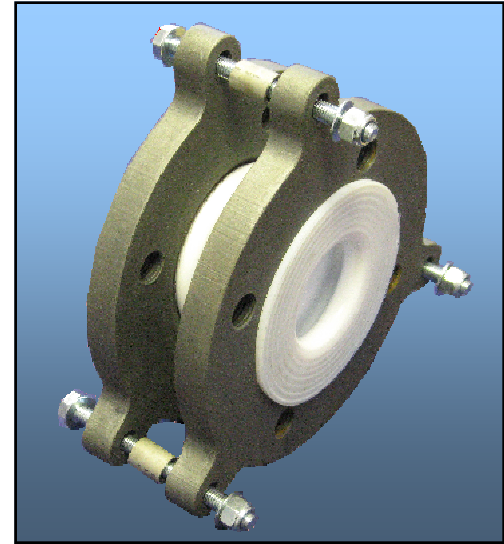
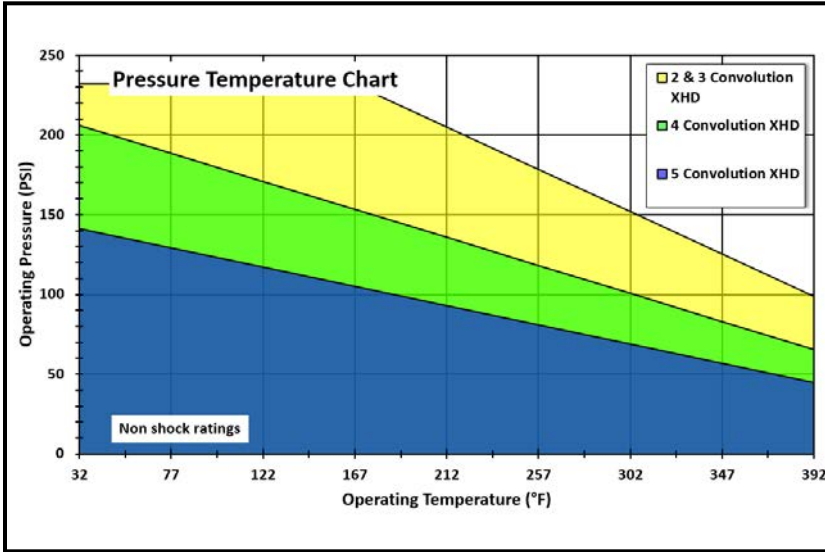
Convolutions	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

2 in.

FluoroFlow FFB PTFE Bellows 2 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.17	1.73	2.60	0.28	7	11.0
FFB 3	2.76	2.13	3.39	0.43	11	11.0
FFB 4	3.35	2.52	4.17	0.55	14	11.0
FFB 5	3.94	2.91	4.96	0.71	18	13.2

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
109.9	74.2	160.6	36.29
72.8	50.0	107.1	23.90
54.2	37.1	80.7	17.70
44.3	30.0	64.2	14.16

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	3.62
Bolt Circle Ø [in.]	4.75
Flange Max Ø [in.]	8.66
Holes ³ [No. x Thread]	4 x 3/8" UNC
Thickness [in.]	0.63
Effective Area [in. ²]	4.96

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.

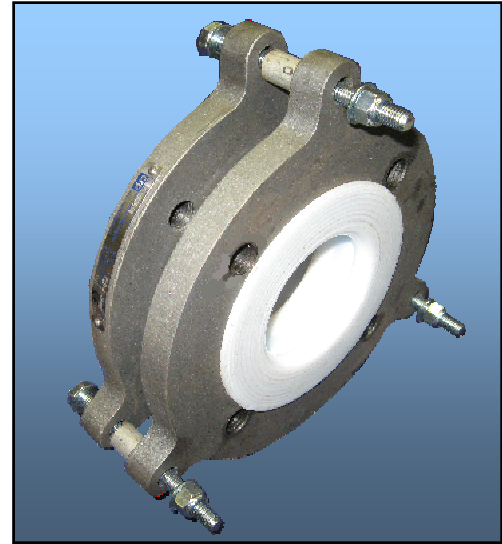
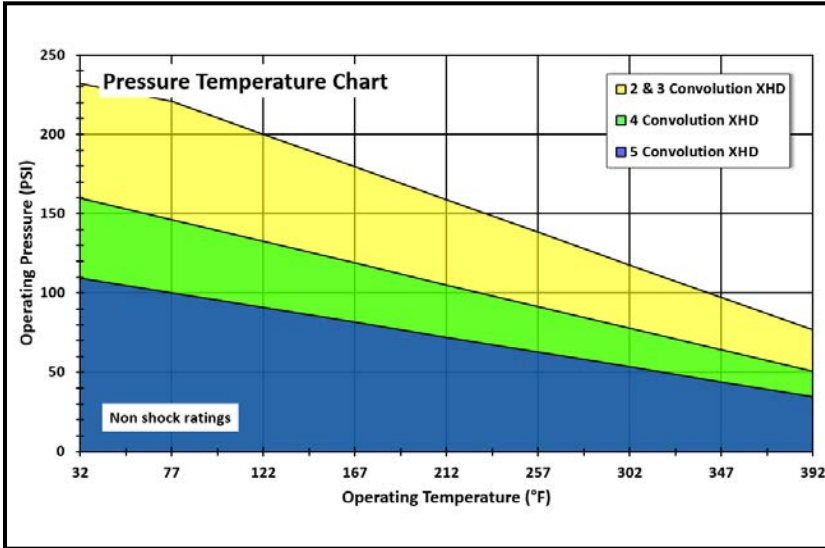
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FluoroFlow Bellows FFB/US/Iss.1



FluoroFlow FFB PTFE Bellows 2.1/2 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.56	2.13	2.99	0.24	7	13.2
FFB 3	3.35	2.72	3.98	0.35	10	13.2
FFB 4	4.13	3.31	4.96	0.47	13	15.4
FFB 5	4.92	3.90	5.94	0.59	16	15.4

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
135.6	102.8	209.1	13.2
89.9	68.5	139.2	13.2
67.1	51.4	104.2	15.4
54.2	41.4	83.5	15.4

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	4.12
Bolt Circle Ø [in.]	5.50
Flange Max Ø [in.]	9.45
Holes ³ [No. x Thread]	4 x 1/2" UNC
Thickness [in.]	0.63
Effective Area [in. ²]	8.06

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

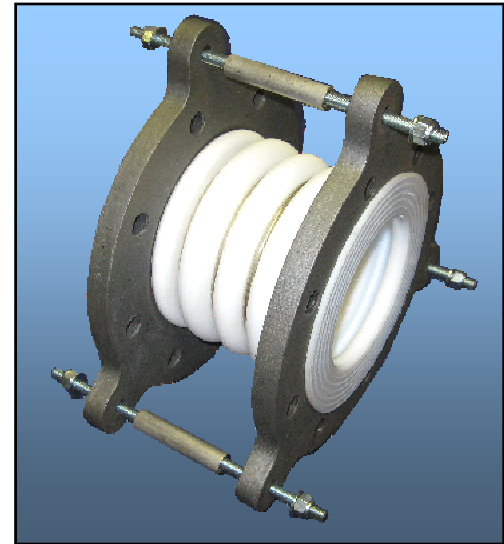
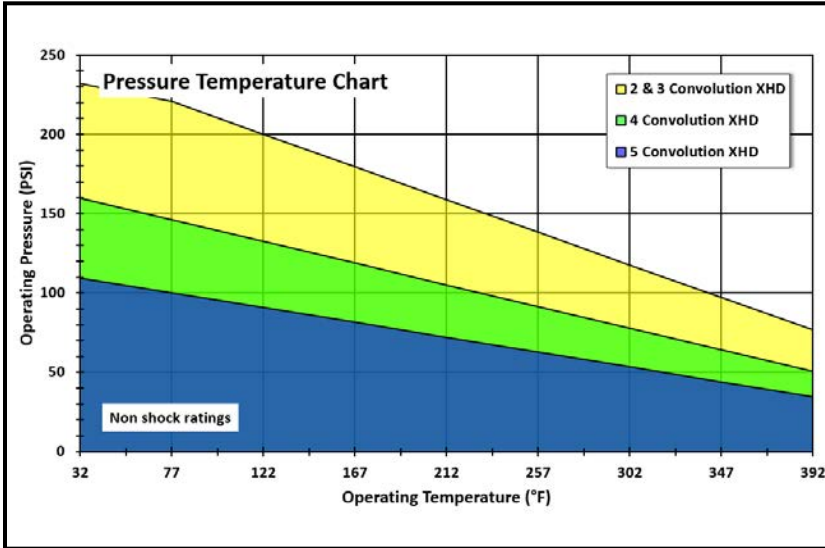
Notes:

- 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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

3 in.

FluoroFlow FFB PTFE Bellows 3 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.56	2.05	3.07	0.28	7	15.4
FFB 3	3.35	2.60	4.09	0.43	11	17.6
FFB 4	4.13	3.19	5.08	0.59	14	17.6
FFB 5	4.92	3.74	6.10	0.75	18	17.6

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
182.7	118.5	257.0	64.61
122.8	79.9	171.3	43.37
91.4	60.0	128.5	32.75
72.8	47.1	102.8	25.67

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	5.00
Bolt Circle Ø [in.]	6.00
Flange Max Ø [in.]	10.24
Holes ³ [No. x Thread]	4 x 3/8" UNC
Thickness [in.]	0.63
Effective Area [in. ²]	11.31

Vacuum

Convolutions	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.

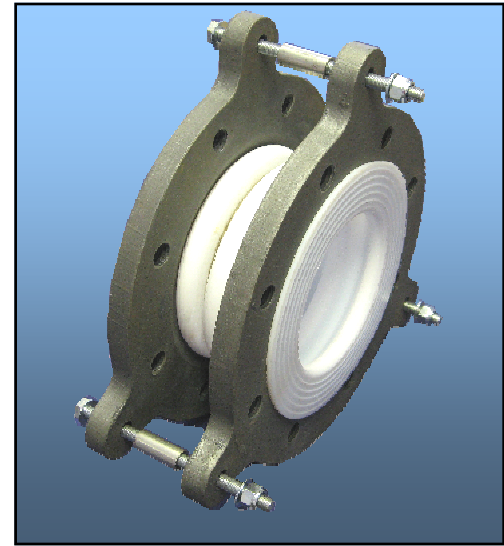
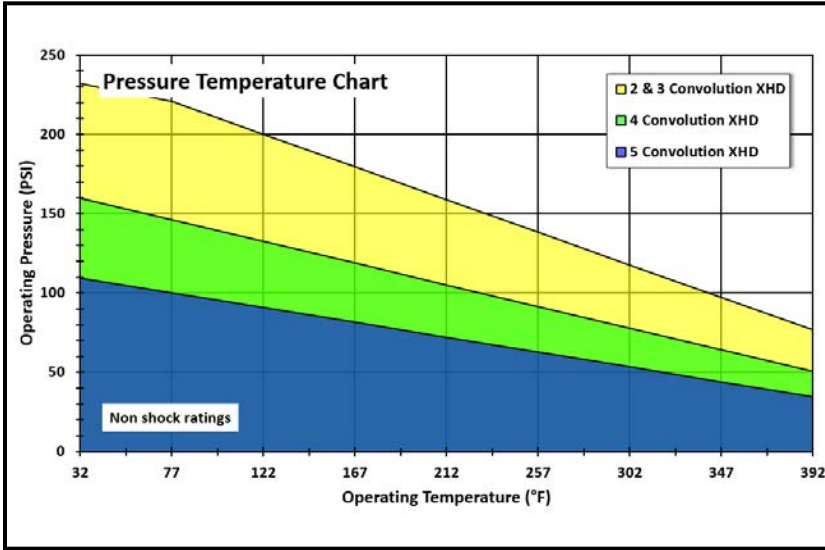
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FluoroFlow Bellows FFB/US/Iss.1



FluoroFlow PTFE Bellows 4 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.64	2.05	3.23	0.31	7	22.0
FFB 3	3.58	2.76	4.41	0.47	10	22.0
FFB 4	4.53	3.46	5.59	0.63	13	22.0
FFB 5	5.47	4.17	6.77	0.79	17	22.0

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
285.5	177.0	321.2	87.62
191.3	118.5	214.1	58.42
142.8	88.5	160.6	44.26
114.2	71.4	128.5	35.40

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	6.19
Bolt Circle Ø [in.]	7.50
Flange Max Ø [in.]	12.13
Holes ³ [No. x Thread]	8 x ½" UNC
Thickness [in.]	0.63
Effective Area [in. ²]	15.81

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

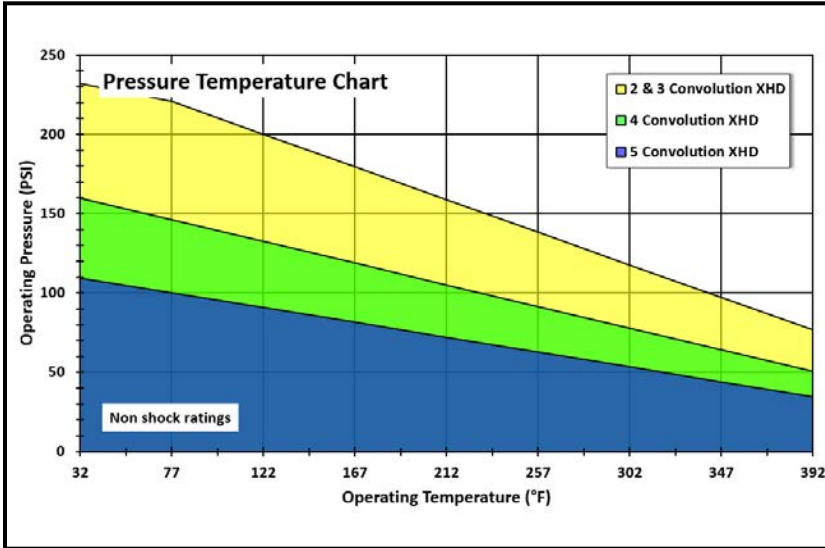
Notes:

- 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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.

5 in.

FluoroFlow FFB PTFE Bellows 5 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.95	2.36	3.54	0.31	6	26.5
FFB 3	4.06	3.23	4.88	0.47	9	28.7
FFB 4	5.16	4.06	6.26	0.63	12	28.7
FFB 5	6.26	4.92	7.60	0.79	15	28.7

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/½ in.]	Axial Extension [lb/½ in.]	Lateral [lb/½ in.]	Angular [in. lbf/°]
315.5	205.6	401.9	119.5
209.8	137.0	267.7	79.7
157.0	102.8	200.6	60.2
125.6	82.8	160.6	47.8

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	7.31
Bolt Circle Ø [in.]	8.50
Flange Max Ø [in.]	13.11
Holes ³ [No. x Thread]	8 x ¾" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	26.82

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.

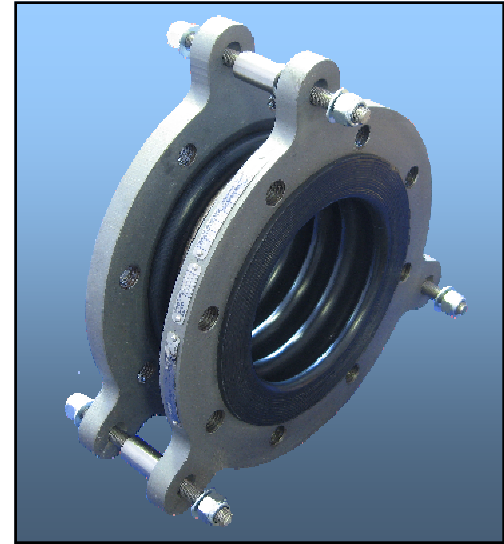
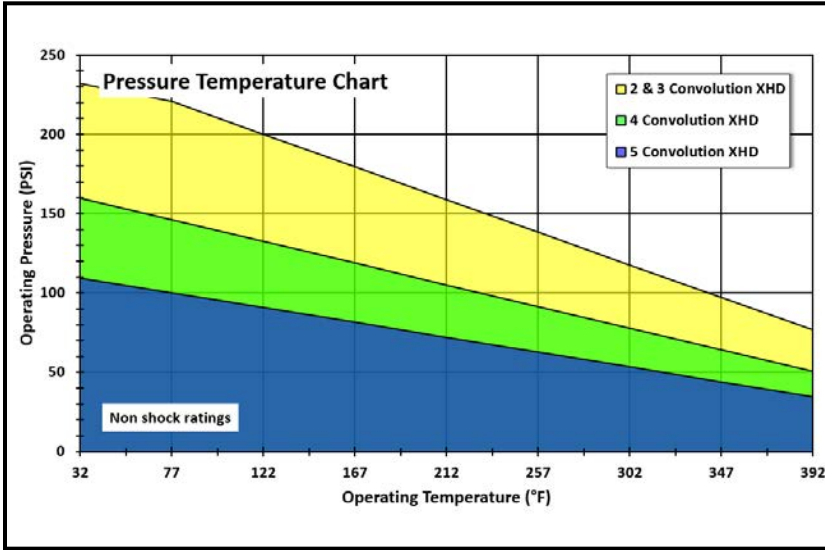
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FluoroFlow Bellows FFB/US/Iss.1



FluoroFlow FFB PTFE Bellows 6 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.95	2.32	3.58	0.31	6	33.1
FFB 3	4.06	3.19	4.92	0.47	8	33.1
FFB 4	5.16	4.02	6.30	0.67	11	35.3
FFB 5	6.26	4.88	7.64	0.83	14	35.3

Spring Rate² @ 68°F +/- 50%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
354.0	218.4	481.8	145.2
235.5	145.6	321.2	97.4
177.0	109.9	241.3	72.6
141.3	87.1	192.7	58.4

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	8.50
Bolt Circle Ø [in.]	9.50
Flange Max Ø [in.]	14.88
Holes ³ [No. x Thread]	8 x ¼" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	32.40

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	68°F	212°F	300°F	400°F
FFB 2 XHD	F.V.	F.V.	F.V.	F.V.
FFB 3 XHD	F.V.	F.V.	F.V.	F.V.
FFB 4 XHD	F.V.	F.V.	F.V.	F.V.
FFB 5 XHD	F.V.	F.V.	F.V.	F.V.

*F.V. = Full vacuum.

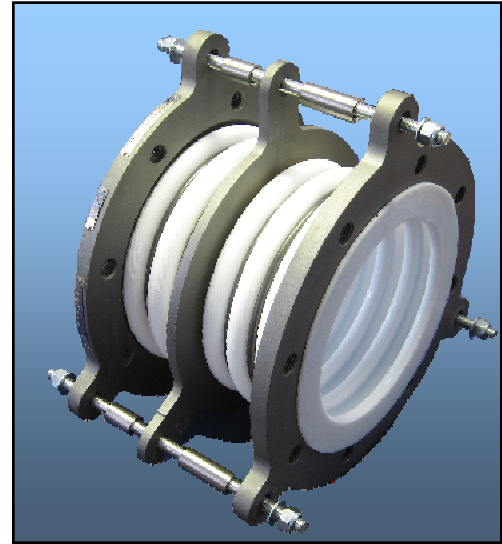
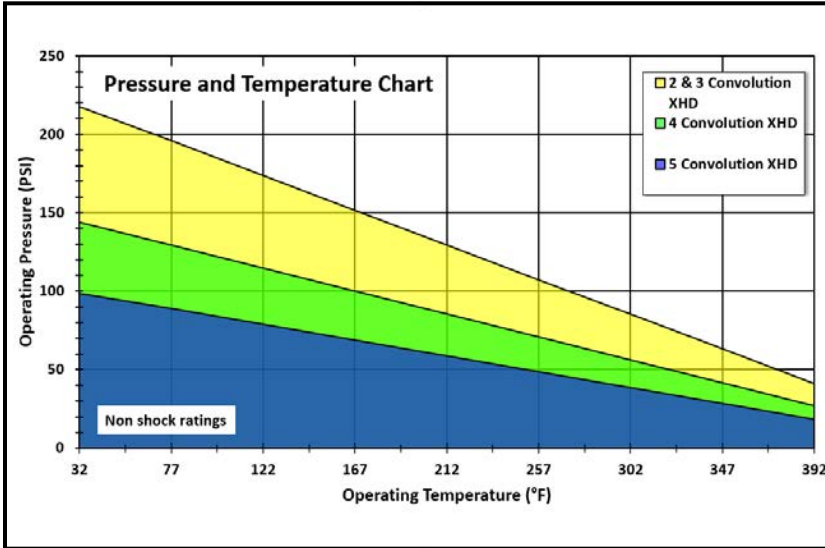
Notes:

- 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.
- The maximum number of convolutions for this size is 10.
- For operating temperature and pressure for more than 5 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

8 in.

FluoroFlow FFB PTFE Bellows 8 in.

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 Movements¹

Convolutions ⁴	Neutral Length [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	2.95	2.28	3.62	0.31	5	44.1
FFB 3	4.06	3.11	5.00	0.47	8	44.1
FFB 4	5.16	3.94	6.38	0.67	10	46.3
FFB 5	6.26	4.76	7.76	0.83	12	46.3

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
278.4	214.1	631.7	162.0
185.6	142.8	421.1	108.0
139.2	107.1	316.2	80.5
111.3	71.4	252.7	64.6

Materials

Component	Materials
Bellows	Paste Extruded Virgin PTFE to ASTM D4895
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	10.62
Bolt Circle Ø [in.]	11.75
Flange Max Ø [in.]	17.32
Holes ³ [No. x Thread]	8 x 3/4" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	54.72

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	68°F	212°F	300°F psia
FFB 2 XHD	F.V.	F.V.	F.V.
FFB 3 XHD ⁵	F.V.	F.V.	3.6

*F.V. = Full vacuum.

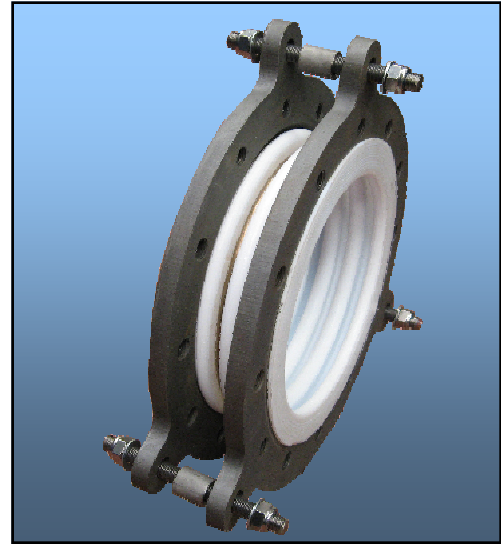
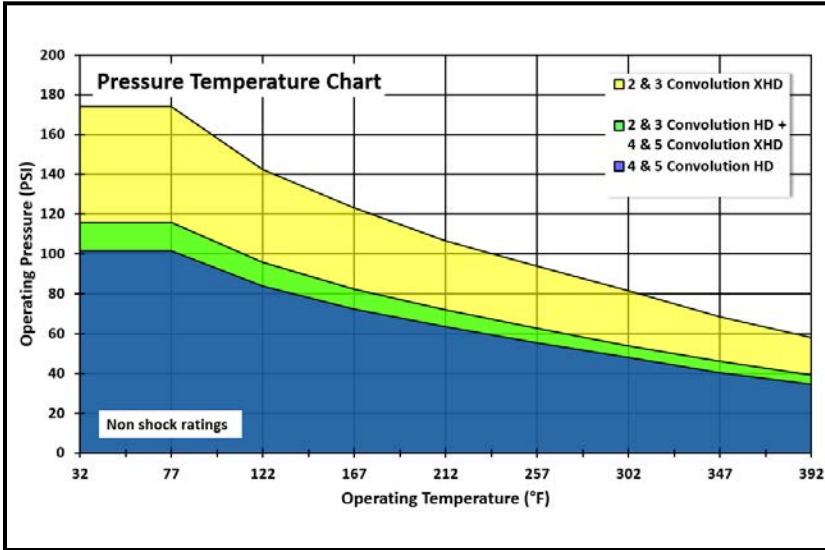
Notes:

- 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.
- The maximum number of convolutions for this size is 10.
- For vacuum performance above 3 convolutions 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.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.



FluoroFlow FFB PTFE Bellows 10 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	3.07	2.32	3.82	0.31	5	55.1
FFB 3	4.21	3.19	5.24	0.47	7	57.3
FFB 4	5.31	4.06	6.57	0.67	9	57.3
FFB 5	6.46	4.92	7.99	0.83	11	59.5

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/½ in.]	Axial Extension [lb/½ in.]	Lateral [lb/½ in.]	Angular [in. lbf/°]
299.8	235.5	599.6	229.2
199.9	157.0	399.7	153.1
149.9	117.8	299.8	114.2
119.9	94.2	239.8	92.1

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	12.75
Bolt Circle Ø [in.]	14.25
Flange Max Ø [in.]	20.24
Holes ³ [No. x Thread]	12 x ½" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	87.73

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	68°F	100°F	150°F psia
FFB 2 HD	F.V.	F.V.	14.5
FFB 3 HD	F.V.	F.V.	14.5
FFB 2 XHD	F.V.	F.V.	F.V.
FFB 3 XHD ⁵	F.V.	F.V.	3.6

*F.V. = Full vacuum.

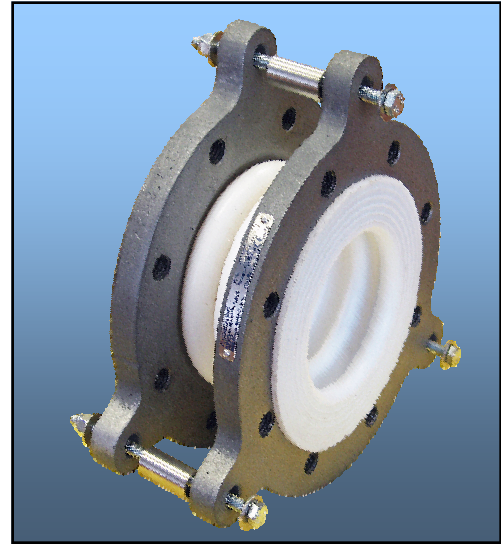
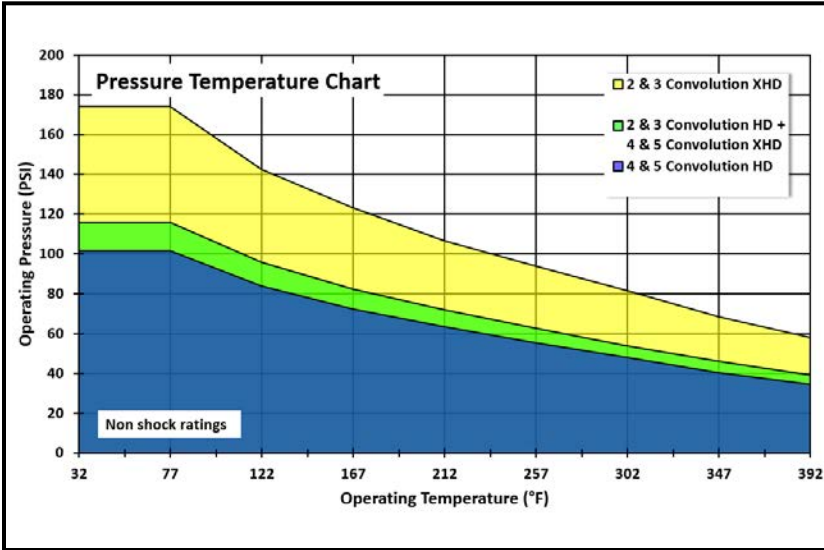
Notes:

- 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.
- 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.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

12 in.

FluoroFlow FFB PTFE Bellows 12 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	3.74	2.99	4.49	0.35	4	79.4
FFB 3	5.20	4.17	6.22	0.51	6	79.4
FFB 4	6.65	5.35	7.95	0.71	8	81.6
FFB 5 ⁴	8.11	6.54	9.69	0.87	9	81.6

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/½ in.]	Axial Extension [lb/½ in.]	Lateral [lb/½ in.]	Angular [in. lbf/°]
364.0	267.7	728.0	336.3
242.7	178.4	485.4	223.9
182.0	134.2	364.0	168.2
145.6	107.1	291.2	134.5

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	15.00
Bolt Circle Ø [in.]	17.00
Flange Max Ø [in.]	23.23
Holes ³ [No. x Thread]	12 x ¾" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	120.44

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	68°F	212°F	300°F psia
FFB 2 HD	F.V.	F.V.	14.5
FFB 3 HD	F.V.	F.V.	14.5
FFB 2 XHD	F.V.	F.V.	F.V.
FFB 3 XHD ⁵	F.V.	F.V.	3.6

Notes:

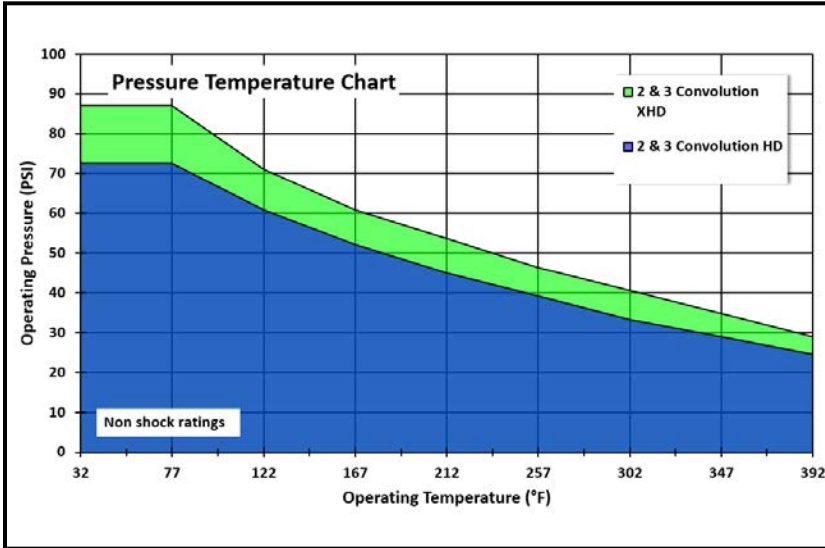
- Larger movements are available with more convolutions if required. These are not independent movements. For combined movements please consult us.
- Please see page 3 for temperature correction factors for spring rate.
- As standard flange holes are threaded. Clearance holes are possible for certain 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.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

*psia = Pounds per square inch absolute

*F.V. = Full vacuum.

FluoroFlow FFB PTFE Bellows 14 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	3.86	3.07	4.65	0.31	3	143.3
FFB 3	5.39	4.33	6.46	0.47	5	145.5
FFB 4	6.93	5.59	8.27	0.67	6	147.7
FFB 5	8.46	6.85	10.08	0.83	7	149.9

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
642.4	364.0	862.2	419.5
428.3	242.7	574.6	279.7
321.2	182.0	431.1	209.8
257.0	145.6	344.8	168.2

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	16.25
Bolt Circle Ø [in.]	18.75
Flange Max Ø [in.]	25.20
Holes ³ [No. x Thread]	12 x 1" UNC
Thickness [in.]	0.87
Effective Area [in. ²]	166.47

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

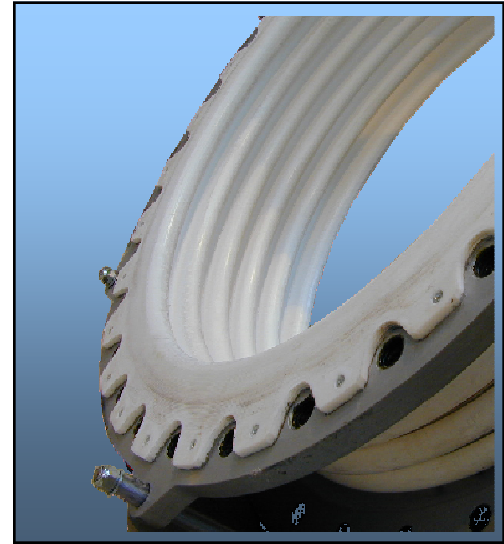
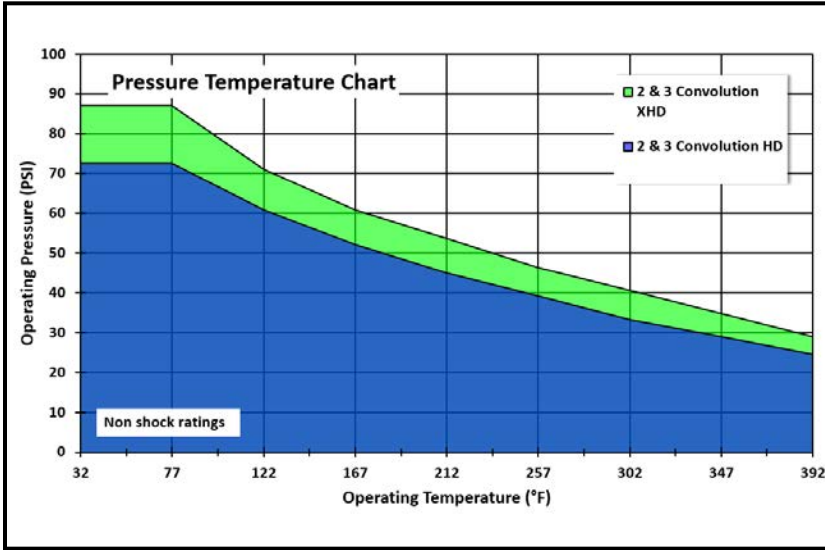
Notes:

- 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.
- 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 3 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

16 in.

FluoroFlow FFB PTFE Bellows 16 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	4.61	3.82	5.39	0.39	3	174.16
FFB 3	6.38	5.28	7.48	0.59	4	176.37
FFB 4	8.15	6.73	9.57	0.79	6	178.57
FFB 5	9.92	8.19	11.65	0.98	7	182.98

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
1038.5	621.0	985.0	174.16
692.4	414.0	656.7	176.37
519.6	310.5	492.5	178.57
415.4	248.4	394.0	182.98

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	18.50
Bolt Circle Ø [in.]	21.25
Flange Max Ø [in.]	27.56
Holes ³ [No. x Thread]	16 x 1" UNC
Thickness [in.]	0.79
Effective Area [in. ²]	218.71

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 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 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 3 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

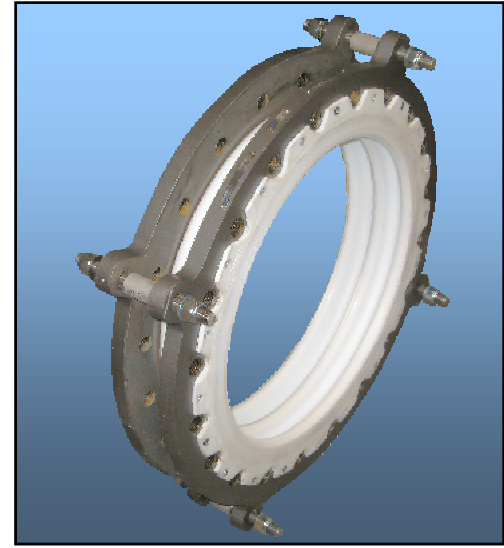
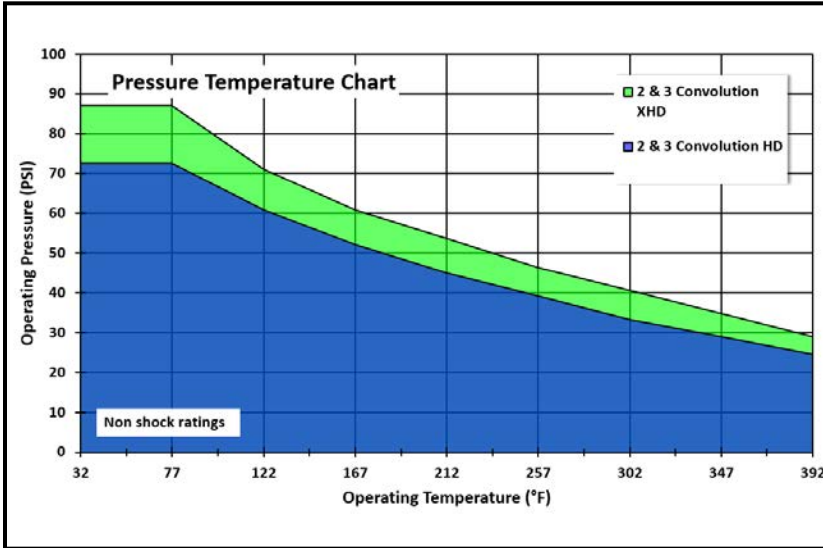
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FluoroFlow Bellows FFB/US/Iss.1



FluoroFlow FFB PTFE Bellows 18 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	4.56	3.86	5.43	0.43	3	180.8
FFB 3	6.42	5.31	7.52	0.59	4	185.2
FFB 4	8.19	6.77	9.61	0.79	5	187.4
FFB 5	9.96	8.23	11.69	0.94	7	189.6

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
1659.5	920.8	1108.5	180.8
1106.3	613.8	738.8	185.2
830.1	460.4	553.9	187.4
663.8	368.3	443.3	189.6

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	21.00
Bolt Circle Ø [in.]	22.75
Flange Max Ø [in.]	29.13
Holes ³ [No. x Thread]	16 x 1.1/2" UNC
Thickness [in.]	0.87
Effective Area [in. ²]	279.00

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

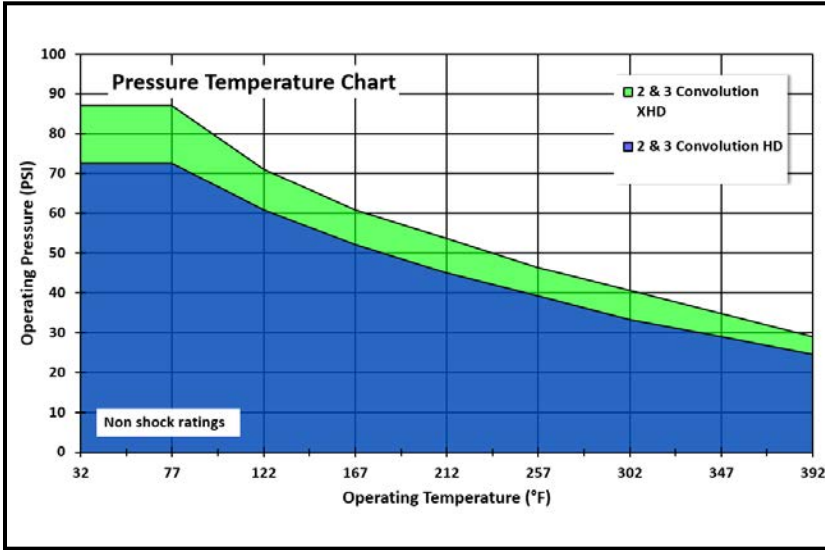
Notes:

- 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.
- 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 3 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

20 in.

FluoroFlow FFB PTFE Bellows 20 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	4.92	4.13	5.71	0.43	2	229.3
FFB 3	6.69	5.59	7.80	0.59	4	233.7
FFB 4	8.46	7.05	9.88	0.79	5	238.1
FFB 5	10.24	8.50	11.97	0.94	6	240.3

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
2044.9	1145.6	1231.3	229.3
1363.3	763.7	820.8	233.7
1022.8	573.2	616.0	238.1
818.0	458.2	492.5	240.3

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	23.00
Bolt Circle Ø [in.]	25.00
Flange Max Ø [in.]	32.68
Holes ³ [No. x Thread]	20 x 1.1/2" UNC
Thickness [in.]	0.98
Effective Area [in. ²]	335.42

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 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 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 3 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

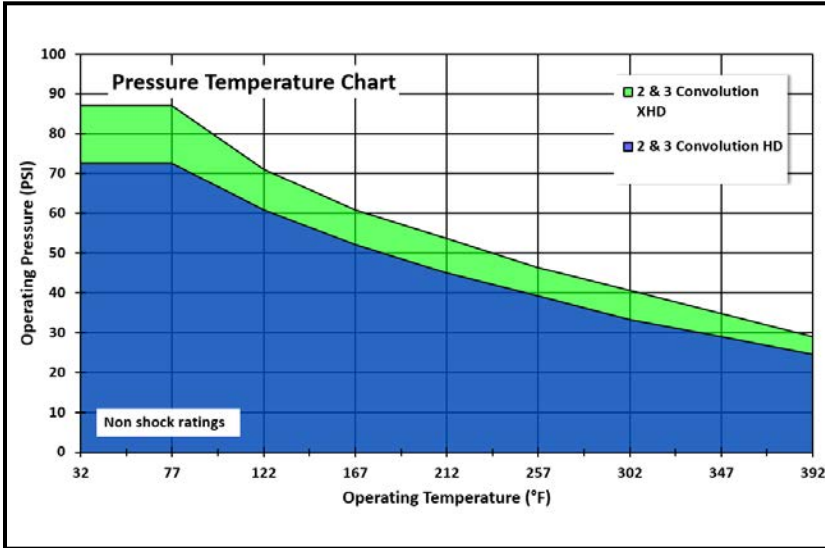
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FluoroFlow Bellows FFB/US/Iss.1



FluoroFlow FFB PTFE Bellows 24 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	5.12	4.33	5.91	0.43	2	308.6
FFB 3	6.89	5.79	7.99	0.59	3	313.1
FFB 4	8.66	7.20	10.12	0.79	4	319.7
FFB 5	10.43	8.66	12.20	0.94	5	324.1

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/½ in.]	Axial Extension [lb/½ in.]	Lateral [lb/½ in.]	Angular [in. lbf/°]
2044.9	1145.6	1231.3	308.6
1363.3	763.7	820.8	313.1
1022.8	573.2	616.0	319.7
818.0	458.2	492.5	324.1

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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
Raised Face Ø [in.]	27.25
Bolt Circle Ø [in.]	29.50
Flange Max Ø [in.]	36.81
Holes ³ [No. x Thread]	20 x 1.¼" UNC
Thickness [in.]	0.98
Effective Area [in. ²]	476.94

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 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 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 3 convolutions please contact us.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

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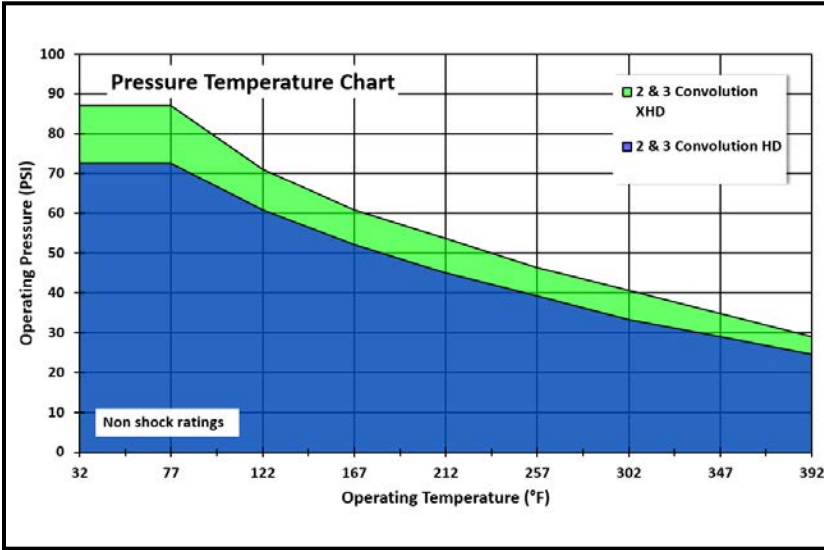
FluoroFlow Bellows FFB/US/Iss.1



28 in.

FluoroFlow FFB PTFE Bellows 28 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	5.75	4.76	6.73	0.47	2	339.5
FFB 3	8.15	6.89	9.41	0.63	3	346.1
FFB 4	Please consult					
FFB 5	Please consult					

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
2227.0	1723.8	4100.6	1191.3
1484.6	1149.2	2733.7	793.9
Please consult			
Please consult			

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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 [in.]	31.50	30.00
Bolt Circle Ø [in.]	34.00	31.31
Flange Max Ø [in.]	41.73	38.19
Holes ³ [No. x Thread]	28 x 1.¼" UNC	40 x ¾ UNC
Thickness [in.]	1.06	
Effective Area [in. ²]	655.34	

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

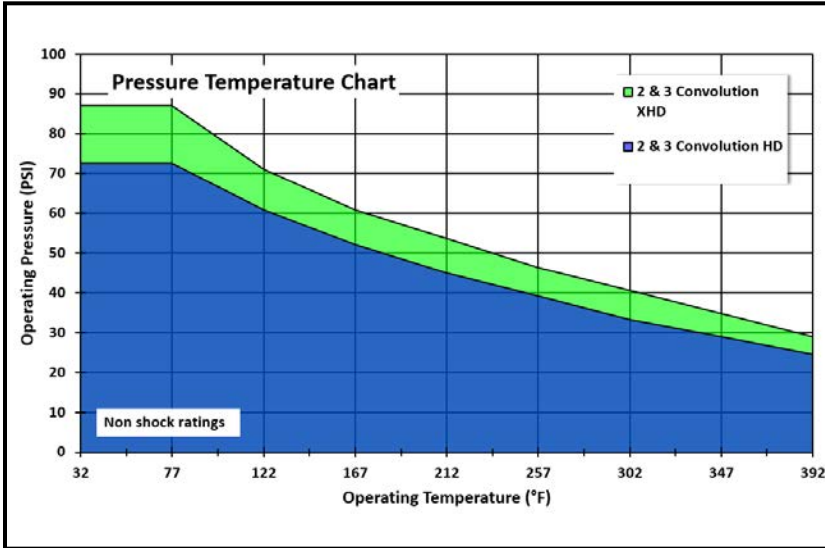
Please consult⁵

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 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.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

FluoroFlow FFB PTFE Bellows 30 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	6.30	5.31	7.28	0.43	2	392.4
FFB 3	8.70	7.44	9.88	0.59	3	346.1
FFB 4	Please consult					
FFB 5	Please consult					

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
2384.0	1848.7	4386.1	1283.4
1588.1	1231.3	2926.5	885.1
Please consult			
Please consult			

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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 [in.]	33.75	32.00
Bolt Circle Ø [in.]	36.00	33.31
Flange Max Ø [in.]	44.00	40.16
Holes ³ [No. x Thread]	28 x 1.¼" UNC	44 x ¾" UNC
Thickness [in.]	1.06	
Effective Area [in. ²]	731.14	

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

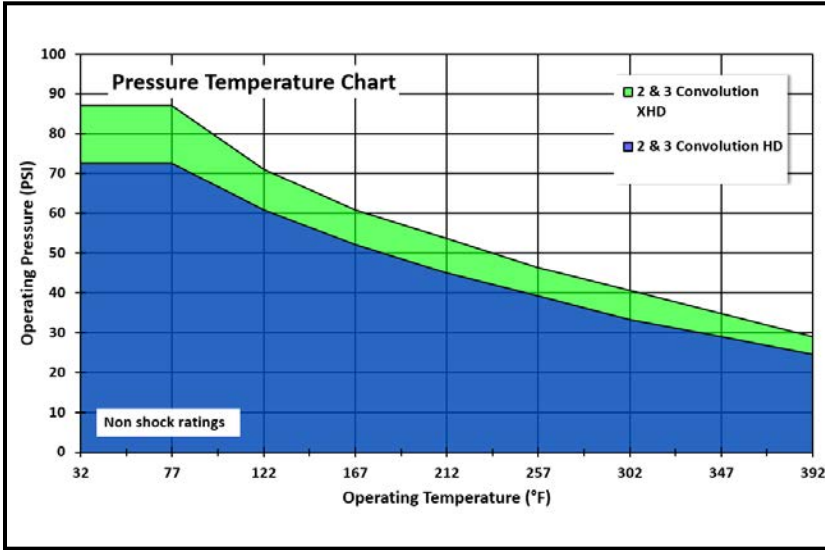
Please consult ⁵

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.
- 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.
- For Static-Dissipating Bellows maximum operating pressure is 80% of the values charted above.

FluoroFlow FFB PTFE Bellows 32 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	6.30	5.31	7.28	0.43	2	445.3
FFB 3	8.70	7.44	9.88	0.59	3	454.2
FFB 4	11.10	9.57	12.64	0.75	3	463.0
FFB 5	Please consult					

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
2541.0	1962.9	4657.2	1354.2
Please consult			
Please consult			
Please consult			

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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 [in.]	36.00	34.00
Bolt Circle Ø [in.]	38.50	35.44
Flange Max Ø [in.]	46.06	42.13
Holes ³ [No. x Thread]	28 x 1.½" UNC	48 x ¾" UNC
Thickness [in.]	1.18	
Effective Area [in. ²]	853.90	

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

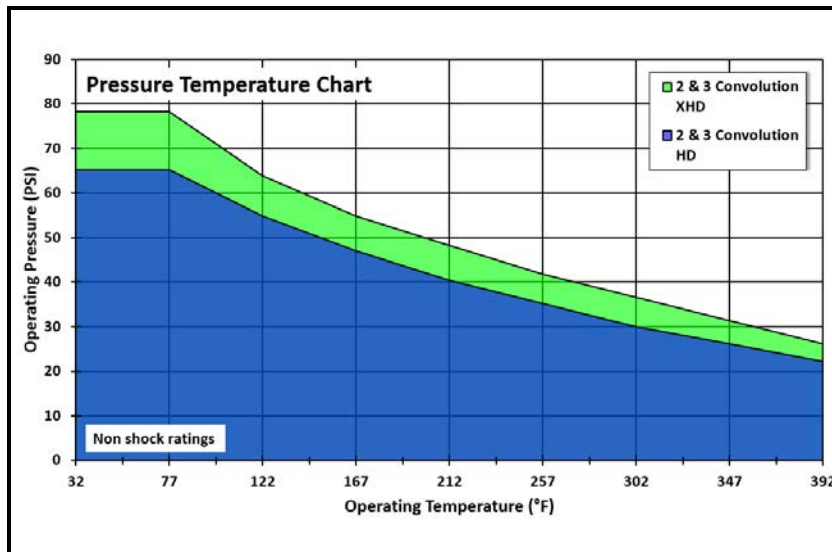
Please consult ⁵

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.
- 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.
- For Static-Dissipating Bellows maximum operating pressure they are 80% of the values charted above.

FluoroFlow FFB PTFE Bellows 36 in.

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 [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral [in.]	Angular [degrees]	Weight [lbs]
FFB 2	6.30	5.31	7.28	0.39	2	524.7
FFB 3	8.70	7.44	9.88	0.55	3	542.3
FFB 4	11.10	9.57	12.64	0.71	3	560.0
FFB 5	Please consult					

Spring Rate² @ 68°F +/- 30%

Axial Compression [lb/% in.]	Axial Extension [lb/% in.]	Lateral [lb/% in.]	Angular [in. lbf/°]
2933.6	2212.7	5260.5	1522.4
Please consult			
Please consult			
Please consult			

Materials

Component	Materials
Bellows	Multi-ply Virgin PTFE to ASTM D4894 Type IV
Flanges	Carbon Steel to ASTM A36 / BS1501-161-430A
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 [in.]	40.25	38.25
Bolt Circle Ø [in.]	42.75	39.75
Flange Max Ø [in.]	50.31	45.94
Holes ³ [No. x Thread]	32 x 1.½" UNC	44 x ¾" UNC
Thickness [in.]	1.18	
Effective Area [in. ²]	1041.60	

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

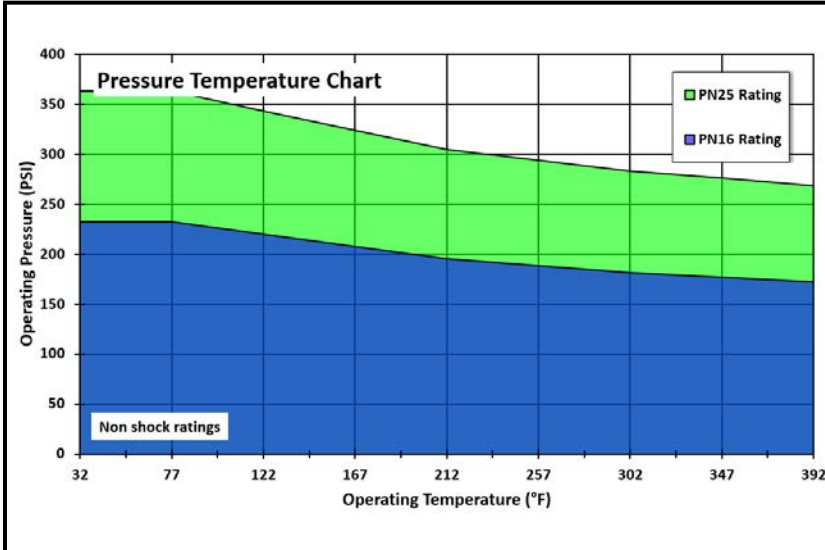
Notes:

- 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.
- The maximum number of convolutions for this size is 3.
- 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.
- For Static-Dissipating Bellows maximum operating pressure is 80% of the values charted above.

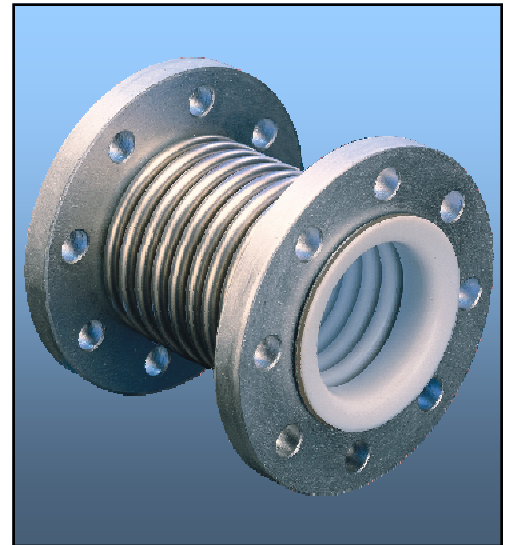
FluoroFlow FFAB PTFE Bellows

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 ASTM A36
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.

This information is for general guidance only, no warranty is given for its accuracy and CRP reserve the right to change specifications without notice © CRP

FluoroFlow Bellows FFB/US/Iss.1



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.

FFAB

Dimensions, Movements and Vacuum Performance																
NB	Ambient Rating PSI	Flange Type		Neutral Length ¹ [in.]	Minimum Length [in.]	Maximum Length [in.]	Lateral ² [in.]	Angular [degrees]	Weight ASME [lbs]	Spring Rate [lb/% in.] ± 30%	Effective Area [in. ²]	Vacuum				
		ASME Class										68°F psia	212°F psia	356°F psia		
1.1/2 in	232	150		5.12	4.76	5.47	0.04	3	6.6	130.6	4.31	F.V.	F.V.	F.V.		
				8.86	8.27	9.45			6.6	98.5	4.22					
2 in	232	150		4.92	4.57	5.28			11.0	103.5	6.43					
			363	300	9.45	8.86									10.04	
2.1/2 in	232	150		5.31	4.96	5.67			2	154.2	13.19					
				8.46	7.76	9.06									11.0	103.5
3 in	232	150		4.92	4.57	5.28		17.6							197.0	6.22
			363	300	9.45	8.86										
4 in	232	150		5.31	4.96	5.67		26.5							195.6	8.77
				8.46	7.76	9.06										
5 in	232	150		5.12	4.72	5.51		33.1	174.9	12.88						
			363	300	8.86	8.23					9.49					
6 in	232	150		6.30	5.91	6.69	26.5	214.1	21.44							
				10.24	9.41	11.06				28.7	127.8	21.24				
8 in	232	150		6.30	5.91	6.69	55.1	199.9	21.05							
				8.66	7.99	9.33				30.9	278.4	31.12				
10 in	232	150		6.89	6.46	7.32	35.3	169.2	30.85							
				10.63	9.72	11.54				77.2	254.1	30.43				
12 in	232	150		6.50	6.06	6.93	37.5	378.3	43.25							
				11.81	11.02	1.26				37.5	154.2	43.40				
14 in	232	150		6.50	6.06	6.93	94.8	290.5	42.56							
				11.61	10.83	12.40				59.5	504.6	69.44				
16 in	232	150		7.09	6.61	7.56	66.1	216.3	69.05							
				12.80	11.50	14.09				134.5	535.3	68.73				
18 in	232	150		7.09	6.61	7.56	83.8	639.5	109.94							
				12.80	11.50	14.09				88.2	268.4	104.94				
20 in	232	150		7.87	7.32	8.43	202.8	445.4	104.16							
				12.99	11.65	14.33				130.1	565.3	145.55				
22 in	232	150		7.87	7.32	8.43	134.5	241.3	145.55							
				12.99	11.93	14.06				299.8	426.1	143.58				
24 in	232	150		7.68	7.01	8.35	172.0	732.3	171.74							
				13.78	12.20	15.35				176.4	345.5	171.74				
26 in	232	150		7.68	7.01	8.35	n/a	471.8	170.04							
				13.58	12.28	14.88				374.8	170.04					
28 in	232	150		6.89	6.18	7.60	251.3	317.6	222.74							
				12.40	10.67	14.13				n/a	221.96					
30 in	232	150		6.89	6.18	7.60	460.8	613.1	221.96							
				13.19	11.30	15.08				317.5	761.6	334.65				
32 in	232	150		6.89	6.18	7.60	639.3	781.6	337.13							
				13.78	12.32	15.24				14.5	14.5	14.5				

*psia = Pounds per square inch absolute
*F.V. = Full vacuum.

- 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.

This information is for general guidance only, no warranty is given for its accuracy and CRP reserve the right to change specifications without notice © CRP

FluoroFlow Bellows FFAB/US/Iss.1



How to Specify PTFE Bellows

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"/> ° F	Max. Operating Temperature	<input type="text"/> ° F
Min. Operating Pressure	<input type="text"/> psi	Max. Operating Pressure	<input type="text"/> psi
Vacuum	<input type="text"/> psia	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

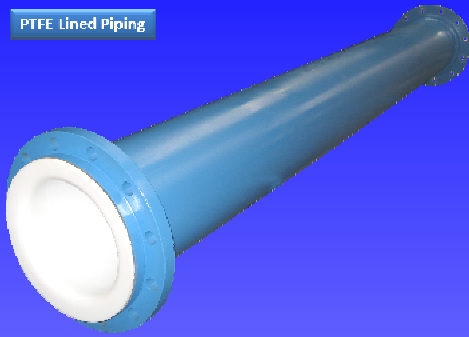
Axial Bellows	<input type="checkbox"/>	Other Special Movement Bellows	<input type="checkbox"/>	Smoothbore Sleeve	<input type="checkbox"/>	Safety Shield	<input checked="" type="checkbox"/>
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Other Remarks

Certification

Certification EN10204 Type 2.2	<input checked="" type="checkbox"/>	Certification EN10204 Type 3.1	<input type="checkbox"/>
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PTFE Lined Piping



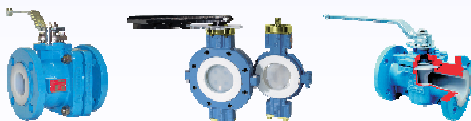
PTFE/PFA Lined Fittings



Sampling Systems



Atomac and Durco PFA Lined Ball, Plug and Butterfly Valves



FLOWSERVE
30

Experience In Motion

CRP
Todmorden Road
Littleborough
OL15 9EG
United Kingdom

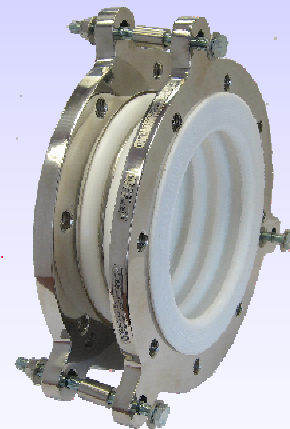
Phone: +44(0)1706 756400
Fax: +44(0)1706 379567

Email: enquiry@crp.co.uk
Web: www.crp.co.uk
www.ptfbellows.com

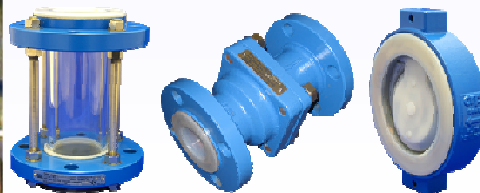
Special Pipeline Components



FluoroFlow PTFE Bellows



FluoroFlow Sight Glasses and Check valves





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