PTFE Bellows

PTFE bellows are used as balancing elements between engineering parts. They are machined parts. Due to the different geometries of the folds highly flexible or pressure-resistant versions can be designed and manufactured.

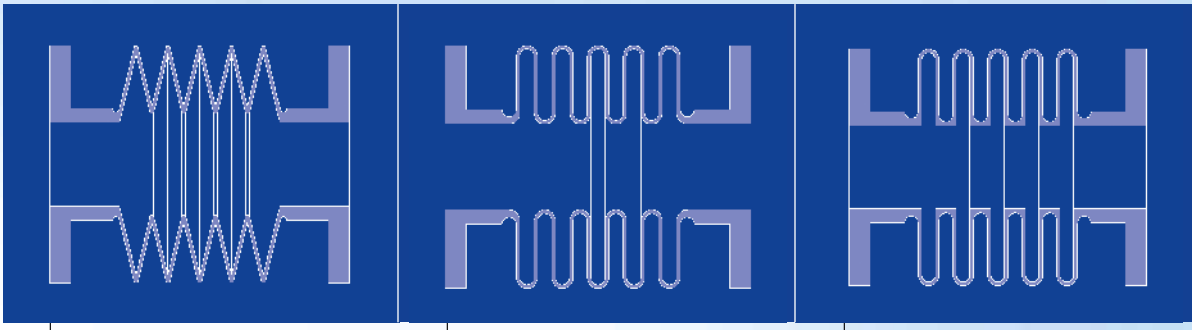
PTFE's outstanding material properties allow bellows to be used increasingly in medical, food and general industrial applications.

Benefits

- Nearly universal chemical resistance
- FDA-conformable materials for food and pharmaceutical products
- Very good suitability for sterilization
- Anti-adhesive
- Wide temperature range from –60°C to +200°C
- Cost effective series production from in-house production of semi-finished goods to the final product
- High reverse bending strength
- Good dimensional stability
- Low tooling costs
- Freedom of design

Applications

Versions



Pointed, Non-cut Folds
for maximum expansion and low pressures up to 3 bar.

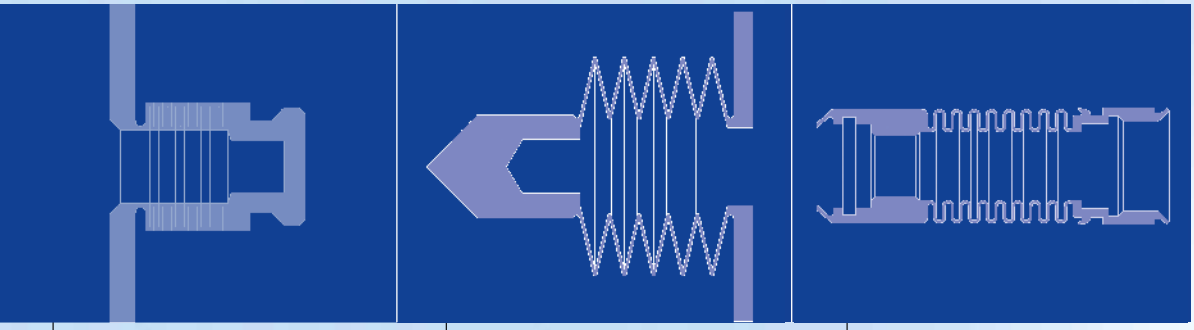
Round, Machined Folds
for improved cleaning and maximum reverse bending strength. Low to medium pressures up to 6 bar.

Solid, Machined Folds
for high pressures above 6 bar. Optimal with rectangular support on the rod or in the cylinder.

Fields of Application

- As compensation for expansion in pipe systems
- For shielding sterile areas
- For filling systems
- With aseptic valves
- With solenoid valves
- With metering deveices
- With pumps and valves

Application Examples

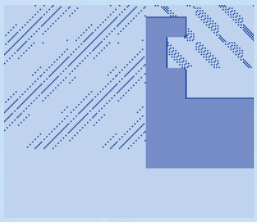


Bellows for a solenoid valve *in medical technology. High flexibility and frequency. Physiologically harmless. Resistant to aggressive cleaning agents.*

Bellows for filling valves *Hermetical separation of the medium from the actuation mechanism. The tip is the sealing cone of the valve.*

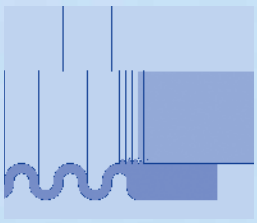
Multi-functional bellows *Separation of two areas with moving parts. Integration of sealing and guiding elements. Connections can be performed according to customer specifications.*

Various Connecting Configurations

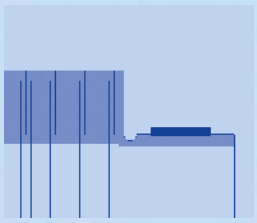


Positive flange compression fit.

Clamping flange with additional O-ring seal.



Locating connection with thread.



Clamping by means of a sleeve.

Materials

- Typically, unfilled PTFE with FDA-conformance
- Modified PTFE with higher reverse bending strength
- Special versions with electrical conductivity
- With applications as metering, shut-off and sealing element the clamping flange, the sealing cone or the slide ring may be manufactured from a PTFE compound (e.g. glass fibers or ceramics)
- For information on materials with good reverse bending strength and low permeation, please see pages 20 – 23
- For your inquiry, please complete the technical questionnaire at the end of the catalog

New Materials and their Properties

In the past, with applications requiring the utilization of modified PTFE, certain limitations regarding reverse bending properties had to be accepted. Now ElringKlinger has managed to launch a new product on the market, HS 22121, which combines all the advantages of modified PTFE.

Benefits

- **Higher permeation density**
- **Low cold flow**
- **Lower porosity**
- **Smoother surfaces**
- **Lower Stretch Void Index**
- **Weldability**
- **FDA-conformance**

In certain aspects, the new material extent even significantly surpasses the excellent reverse bending properties of non-modified standard PTFE types. The combination of these properties was not possible in the past.

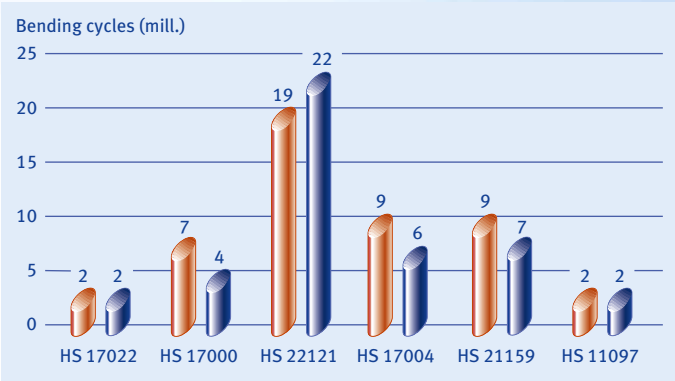
HS 22121 is equally suitable for use as a diaphragms or bellows.

In addition to the high reverse bending resistance, the material's reduced cold flow improves the retention of the diaphragm and/or bellows in the clamping area; another plus in terms of sealing performance and service life.

The results of the reverse bending test were determined by bending a test rod with a 1-mm thickness at a frequency of 4 Hz without media contact by 180° respectively.

Reverse Bending Test 180° [2]

SPI test rod, 1 mm thick, average value

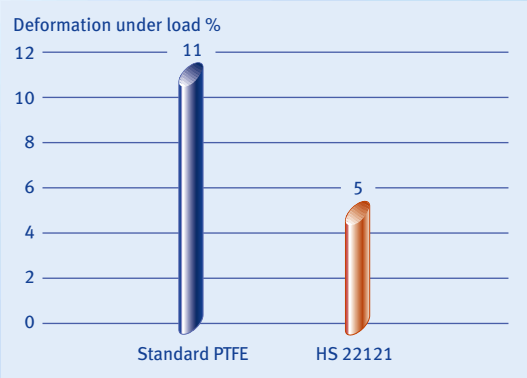


Parallel to peeling direction
Perpendicular to peeling direction

HS 22121 is also available as an anti-static version specifically for use in applications involving contact with solvents.

Cold Flow Benefits [2]

Measuring conditions: 15 N/mm², 100 hrs of pressure loading, 24 hrs of pressure relief, results in permanent deformation



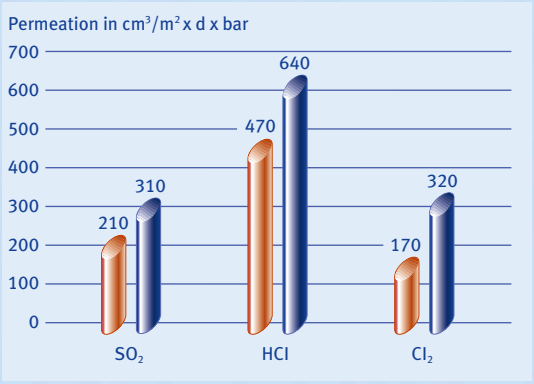
For long service life, bellows and/or diaphragms should be designed with thin walls. Consequently, it is all the more important that the material used have a high barrier effect with regard to permeation. This is the case with modified PTFE materials and applies to aggressive, gaseous chemicals such as SO_2, HCl or Cl_2 as well as to water. The latter poses a challenge for fluoropolymers particularly at high temperatures and/or in the vapor phase or in the form of aqueous, aggressive chemicals.

Further information about material you will find in our catalog “Compounds and Semi-Finished Products Made from PTFE”

Higher Barrier Effect of HS 22121

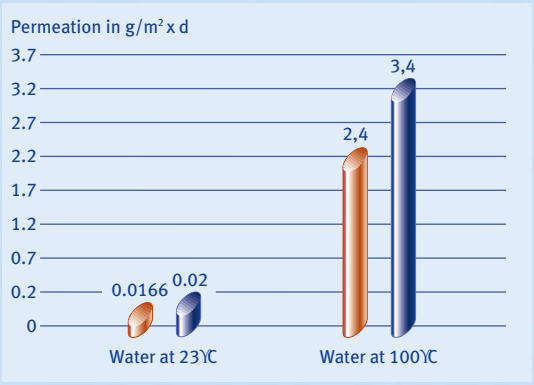
a) Aggressive Media[2]

Measuring method: According to DIN 53380, film thickness: 1 mm



b) Water and vapor [2]

Medium: Water, measuring temperature: 23°C or 100°C, film thickness: 1 mm



The Most Commonly Used Fillers and their Influences on Compound Properties

PTFE-Type	*Influence of Fillers*	*Filler Content in % of Weight*	*Limits of Use*
PTFE filled with glass fibers	• higher pressure and wear resistance as well as better thermal conductivity • very good chemical resistance • good dielectric properties	up to 40%	resistant to organic solvents, non-resistant to alkaline solutions and acids
PTFE filled with carbon fibers	• very low deformation under load • good wear resistance, even in water • higher thermal conductivity and lower thermal expansion than glass fibers • very good chemical resistance	up to 25%	carbon fibers are chemically inert
PTFE filled with carbon	• high pressure resistance and hardness • good sliding properties and wear behavior • good thermal conductivity • good chemical resistance • low volume and surface resistivity • electrically conductive	up to 35%, also in combination with graphite	compound is brittle, filler may be attacked by oxidizing media
PTFE filled with graphite	• good lubricating effect • low friction coefficient • no static charging • good thermal conductivity • very good chemical resistance	typically up to 5%, in exceptional cases up to 15%, also in combination with glass fibers or carbon	high abrasion when used with hard metals, is attacked by oxidizing media
PTFE filled with molybdenum disulfite (MoS_2)	• good sliding properties and wear behavior • good no-lube operation in combination with bronze	up to 10%, also in combination with glass fibers or bronze	not resistant when used with hot, concentrated sulfuric acid
PTFE filled with bronze	• good sliding properties and wear behavior • low cold flow • good thermal conductivity • lower chemical resistance • high pressure resistance	up to 60%, also in combination with MoS_2	may be attacked by acids and water
PTFE filled with organic fillers (high-performance thermoplastics)	• outstanding sliding properties and wear behavior • good chemical resistance • high pressure resistance in some cases • suitable for soft mating surfaces, e.g. aluminum • non-abrasive	up to 20%, may be higher in combination with different fillers	depending on the respective filler

(1) Limit Values:
Limit values have been compiled with great care based on years of experience. Values, however, will not be deemed binding and are provided without guarantee. Please note that the desired function is only assured when considering the specific conditions of a particular application. In any event, we recommend prior sampling and testing. Our development team will be happy to assist you with requisite expertise and in-house test rigs.

(2) Diagrams:
The information provided in these diagrams is based on comparative values determined by ElringKlinger. These values have been obtained under specifically defined conditions and may not be transferred exactly to other applications. The diagrams, however, allow you to draw a basic comparison between our seal designs and compounds.

Technical Questionnaire
Diaphragms/Bellows
Please complete and return by fax to:
+49 7142 583-200

elringklinger
Engineered Plastics

1.1. Pressure Conditions, Diaphragm

Pressure (bar): _____

Differential pressure (bar): _____

1.2. Pressure Conditions, Bellows

Pressure interior (bar): _____

Pressure exterior (bar): _____

2. Operating Conditions

Permanent temperature (°C): _____

Peak temperature (°C): _____

Frequency/# of strokes/lifts: _____

Medium: _____

Stroke/lift (mm): _____

Diaphragm feeding volume (cm^3): _____

Required service life: _____

Application: _____

_____

_____

3.1. Dimensions, Diaphragm

Clamping dimensions D (mm): _____

Type of retention/fixing: _____

_____

3.2. Dimensions, Bellows

Inner Ø (mm): _____

Outer Ø (mm): _____

Length min/max (mm): _____

4. Special Needs/Design

_____

_____

_____

_____

5. Requirement

Once-off (pieces): _____

Monthly (pieces): _____

Anually (pieces): _____

_____

_____

Company (Address)

_____ _____

Contact person Fax

_____ _____

Phone E-Mail

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