



Security through technology

Flexible solutions for mechanical engineering,
plant engineering, electrical engineering,
measuring technology/optics, medical technology

The MöllerGroup

With international partners to world wide success.



The Kupferhammer in 1907 and in 2008. Headquarters and main administration of the MöllerGroup.

The Company

The MöllerGroup is a company with tradition: Family owned for seven generations, it can look back on a history of 278 years, in which period the factory has developed into an internationally successful production and service enterprise. Sectioned into two business divisions – plastics engineering and flexible structural components – the MöllerGroup today delivers peak performance products throughout the world.

The MöllerGroup world wide

As an international enterprise, the MöllerGroup thinks and acts across frontiers. With its own operative companies or joint ventures at 30 sites world wide, we produce where our customers are. Thus customers throughout the world can rely on our know-how and on our competence on site.

Data and facts

Year of foundation: 1730
Product and service areas: Flexible constructional components, plastics engineering
Operative units: 12
Möller Joint Ventures: 3
Number of employees: 1.800
Headquarters and main administration: Bielefeld/Germany
Locations: 30 world wide

Status 2008

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Flexible solutions from a single source.

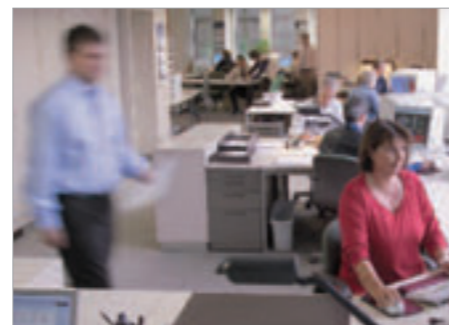


Production hall

MöllerWerke is a competent development partner for the industry. Under the brand name of möllerbalg® flexible constructional components are developed and manufactured for a wide diversity of applications. In addition to machine tool construction, special vehicles and railway engineering, the products from MöllerWerke are utilised in hydraulic systems, pneumatic systems, electrical engineering, medical technology and in many other industrial fields.

Our customers profit from the direct consultancy service on site as well as the long-term experience and the know-how of our sales engineers. The MöllerWerke offer optimally designed products, high economic efficiency, constant product quality and unrestricted service. The own materials development with corresponding released mixtures and material combinations can fulfil almost any technical requirements.

The close cooperation with our customers and the material and product development in the house of the MöllerWerke leads to new solutions and new products



Order processing centre

Materials: diversified and flexible

Our many years of material and product development experience as well as numerous special technical problem solutions constitute significant advantages for the benefit

of our customers.

The following factors are decisive for the quality of our products:

- The particular application
- The boundary conditions
- The selection of materials
- The manufacturing method

We have our own test beds and a technology centre. In addition, we can access the laboratories of the MöllerGroup.

Methods: individually planned and implemented

The MöllerWerke utilise a number of special production methods which have mostly been developed by us for industrial production of bellows. Machines, systems and production lines are special plants which have emerged in the course of numerous years of experience with bellows production. MöllerWerke owns international patents for many of these methods.



Laboratory

Coated technical fabrics:

- Polyester fabric coated with polyurethane, in various thicknesses
- Aramid fabric with and without coating
- Fabric with anti-adhesive coating
- Rubber coated fabric
- Hybrid fabric
- Tarpaulin material, Trevira high strength, coated with PVC on both sides
- Aluminium vapour deposited on fabric
- Polyester fabric

Elastomer types:

- CR chloroprene
- CSM hypalon
- NBR nitrile
- ECO epichlorhydrin
- ACM acrylate caoutchouc
- MVQ silicone
- FKM fluoro caoutchouc
- FMVQ fluoro silicone

Other materials:

- Insulating materials (e.g. textured glass)
 - Steels
 - Aluminium
 - molerit®
 - PVC
 - Polyamide
 - Polypropylene
- And numerous other materials on inquiry.

Production methods at MöllerWerke:

- Welding automatons for way covers
- HF welding automatons for bellows
- Dip moulding methods and dip automatons for molerit®
- Radiation crosslinking
- CNC mould drawing
- Manual mould drawing on special moulds
- Automated scale production
- Automated cutting on plotter, milling and water jet systems

MöllerWerke – ultra-modern production methods and production quality on the highest level.



Production of a wound hose

Research and development at MöllerWerke

The market imposes continually growing demands on us and our products. Therefore we permanently monitor the market developments and devise corresponding innovative solutions on the sector of new products, materials and methods.

Modern research facilities are available to our chemists and engineers. Important CAD systems, innovative experimental technology and continuous online data exchange between the individual work groups produce efficient application-oriented results.

You have the machine. We have the cover solution.



Measuring machine DuraMax

möllerbalg® way covers are carefully produced, quickly available for delivery, have high performance and are keenly priced. They convince with high quality materials, perfect workmanship and prevent ingress of chips, dust and liquids. The machine operates in the long run with undiminished precision, requires fewer replacement parts and suffers less downtime.

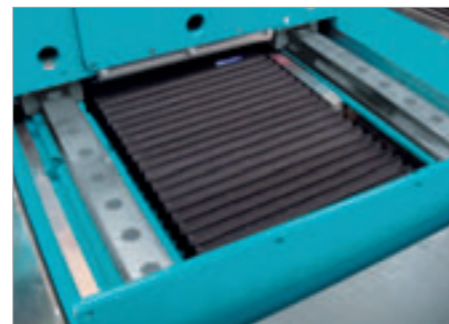
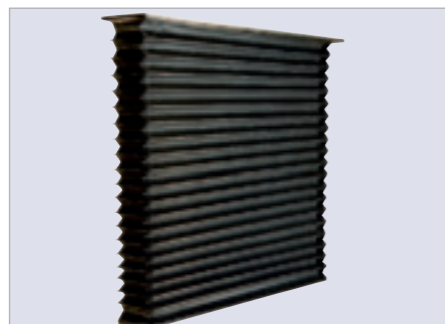
These covers afford best possible personnel protection against injury. Ultimately, they convince not only through their functionality, but also serve as visually attractive design elements.

möllerbalg® way covers

- protect employees against injury
- protect machines against wear caused by dirt
- combine design and functionality of your product



Detailed views



Structure of the möllerbalg® way covers

The product systematics developed by MöllerWerke and the production techniques based thereon permit economically efficient solutions tailored to suit the individual application.

The MöllerWerke® development department

- equipped with ultra-modern IT technology
- 2 and 3 D CAD systems
- facility for FEM-analysis

- technology centre with universal test stand and latest laboratory technology
- innovative solutions for new products and application engineering improvements of existing products

Welded-in guide frames patented by MöllerWerke

- the cover follows the guide track with high accuracy
- long flanks do not kink
- homogeneous liquid-sealed connection to outer cover

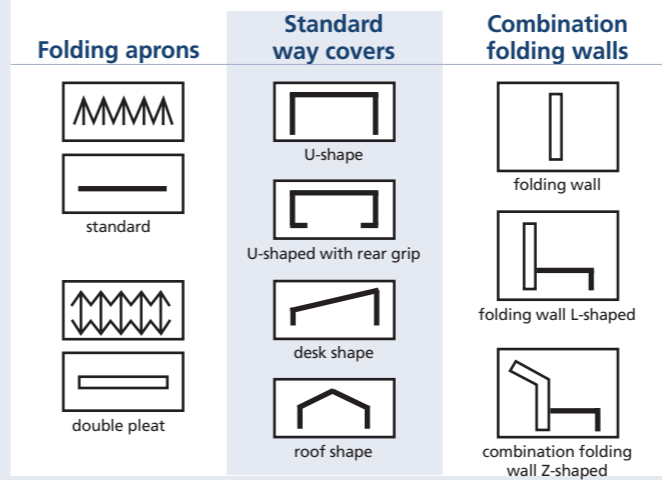
New proven materials make possible

- high speeds and accelerations of the cover
- service life of up to 10 million cycles
- resistant to aggressive coolant-lubricants

The range of materials is continually updated, tested and adapted to the customer requirements.

Design of way covers, minimised collapsed dimension per fold

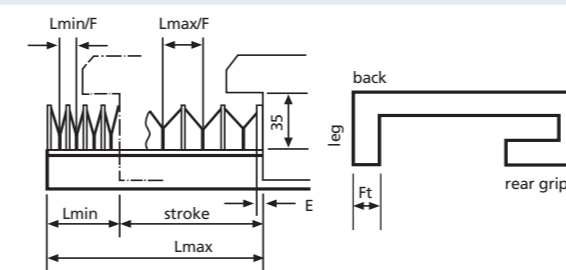
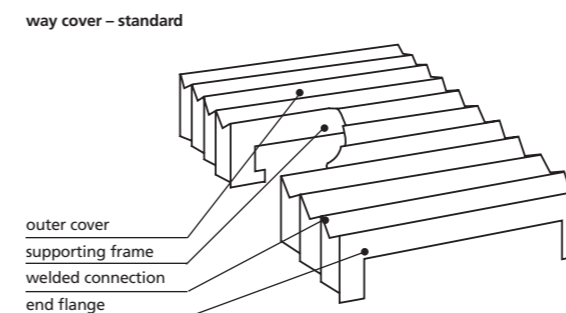
The most common geometric forms



Example of Lmin per fold in mm with a supporting frame thickness of 1 mm depending on the outer cover

	Folding aprons		Way covers standard
PUR fabric	0,20	1,8	3,0
Nomex fabric	0,40	2,2	4,5
fabric + Teflon	0,30	2,2	4,0
fabric + PUR	0,30	2,2	3,5
EM-Nomex	0,50	3,5	5,5
Pyresit-Plus	0,40	2,2	4,5

Constructional principle and designations



- Ft = depth of fold
- Fz = number of folds
- Lmax/F = maximum length per fold
- Lmin/F = minimum length per fold
- Lmax = maximum extended length
- Lmin = minimum compressed length, also block measurement
- E = thickness of the end flange

$$L_{max} = \text{stroke} + L_{min}$$

$$L_{min} = (Fz \times L_{min}/F) + (2 \times E)$$

VZ = Ratio of Lmax/F to Ft
 VZ = 1,3 at Ft ≤ 15 mm
 VZ = 1,5 at Ft = 16-39 mm
 VZ = 1,6 at Ft ≥ 40 mm

$$L_{max}/F = Ft \times VZ$$

$$Fz = \frac{L_{max}}{Ft \times VZ}$$

$$Fz = \frac{\text{stroke}}{Ft \times VZ - L_{min}/F}$$

standard depth of fold from 15 mm to 70 mm

Length calculations

These formulae are intended as help for the length calculation of möllerbalg® way covers. The results are approximations. In most cases desired deviations therefrom can be realised. Please contact our application engineers.

Material matrix

materials for way covers								properties/suitability								
No.	material type	utilisation	thick-ness	base mate-rial	bottom side coating	top side coating	colour	dust protection	imper-vious to liquids	water resistant	cooling emulsion resistant	resistant to chemicals	flame retarding	weld sputtering resistant	chip resistant	max. cont. operating temp. °C (*)
FR 1	PUR polyester fabric black RAL 9011	Standard quality with long service life with regard to cyclic flexural stress; impervious to liquids; resistant to cooling emulsions as well as oil and grease. For smaller size slide track protections or folding aprons with smaller fold depths	0,2	PES	PU	PU	black	●	●	●	●	○				-20 to +100
FR 2	PUR polyester fabric black RAL 9011	Standard quality with regard to media like position 1	0,4	PES	PU	PU	black	●	●	●	●	○				-20 to +100
FR 3	PUR polyester fabric coated with PTFE, RAL 9011	For stress with aggressive media, anti-adhesive (e.g. utilisation for grinding machines)	0,3	PES	PU	PTFE	black	●	●	●	●	●				-20 to +100
FR 4	PUR polyester fabric coated with PTFE, RAL 9011	For stress with aggressive media, anti-adhesive (e.g. utilisation for grinding machines)	0,5	PES	PU	PTFE	black	●	●	●	●	●				-20 to +100
FR 5	PUR nomex fabric, black RAL 9011 (Laserflex 2)	High flame protection. Complies with the American standard UL94 HB (utilised e.g., for laser beam guides)	0,3	nomex	PU	PU	black	●	●	●	●	○	●	○		-20 to +100
FR 6	nomex one-sided metallised silver colour	For radiant heat	0,5	nomex	-	Alu	silver	●	●	●			○			-20 to +180
FR 7	kevlar two-sided metallised silver colour	For radiant heat metallised silver colour	0,8	kevlar	Alu	Alu	silver	●	●	●			○	○		-20 to +180
FR 8	pyresit plus	Mixed fibre Kevlar/Preox with flame-protected PUR outer coating. Application: for protection against slag sputter	0,4	kevlar/preox	-	PU	black	●		●			○	●		-20 to +150
F 1	PUR polyester fabric super black RAL 9011	Material with long service life with regard to cyclic bending; utilised for linear guides	0,2	PES	PU	PU	black	●	●	●	●	○				-20 to +100
F 2	PUR polyester fabric white RAL 9002	Same as FR 2, but colour white	0,4	PES	PU	PU	white	●	●	●	●	○				-20 to +100
F 3	PUR polyester fabric one-sided HT black RAL 9011	Base fabric like position 1, but on one side open fabric structure (HAT = high temperature dyed), PUR coated. Utilisation for measuring machines (small end forces).	0,2	PES	PU	HT coloured	black	●	○	●	○					-20 to +100
F 6	PUR polyester fabric with PUR film black	Material like position 1, but coated internally with PUR film. Utilisation for grinding machines when perfect confinement is required	0,3	PES	TPU film	PU	black	●	●	●	●	○				-20 to +100
F 8	PUR 0,65 RAL 9011	F2 with coated-on TPU film (as wear protection layer in the case of severe exposure to chips). Very resistant to abrasion and wear	0,6	PES	PU	TPU film	creme white	●	●	●	●	○				-20 to +100
F 9	TopResist	Enhanced resistance to coolant-lubricants and oils. Utilised for milling machines, lathes and grinding machines.	0,4	PES	PU	NBR	black	●	●	●	●	○				-20 to +100
F 10	Laserflex 3	Flame retarding /self-extinguishing Utilised, e.g. for laser beam guides	0,27	PES	PU	PU	black	●	●	●	●	○	●	○		-20 to +100
F 11	Laserflex 4	Flame retarding /self-extinguishing Utilised, e.g. for laser beam guides	0,33	PES	PU	PU	black	●	●	●	●	○	●	○		-20 to +100

(*) = maximum temperature applies to the material. Depending on the guide frame materials used, the admissible temperature for the overall way cover can be lower.

● = well suitable ○ = conditionally suitable

Attachment/mounting

Several possibilities exist for attaching the way covers to machines or devices:

End flanges:

- steel sheet, powder-coated
- stainless steel
- plastic
- special materials

Mounting possibilities:

- standard
- front mounted
- projecting

End flanges are delivered with stipulated drilled holes pattern or without drilled holes. If absolute sealing between the cover/end flange and the machine is demanded, we deliver corresponding reliable variants.

The alternative: Quick mounting with cleat fastener.

The cleat strip is attached captive on the way cover, the opposite strip is bonded directly to the degreased machine surface.

Advantages:

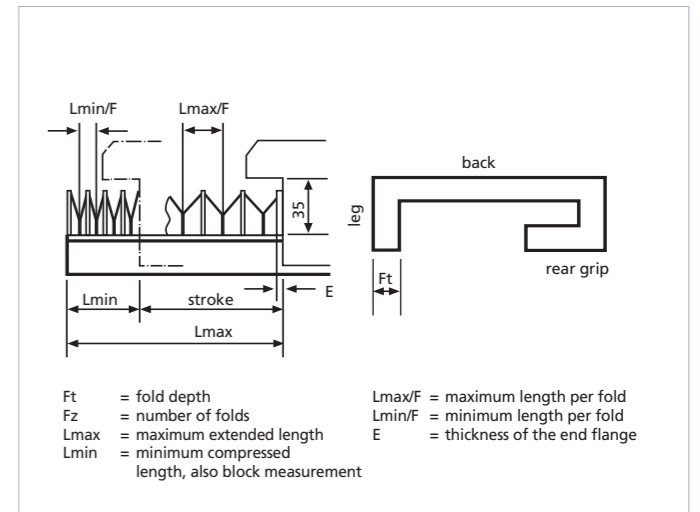
- quick mounting and dismantling
- secure attachment at temperatures in the range from -20°C to 80°C.
- many mounting and dismantling cycles without performance deterioration of the cleat strip connection



Inquiry/order	order No.	date	signature
your company			
your name			
your fax No.			
your phone No.			

Geometric form of the cover please mark the relevant items

<p>Folding aprons</p> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <p>standard</p> <p>double pleat</p>	<p>Standard way cover</p> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <p>U-shape</p> <p>U-shape with rear grip</p> <p>desk shape</p> <p>roof shape</p>	<p>Combination folding wall</p> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <p>folding wall</p> <p>combination folding wall L-shape</p> <p>combination folding wall Z-shape</p>
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Desired cover specifications please fill in measurements in mm

Dry processing

Wet processing

Back width

Leg height

Rear grip

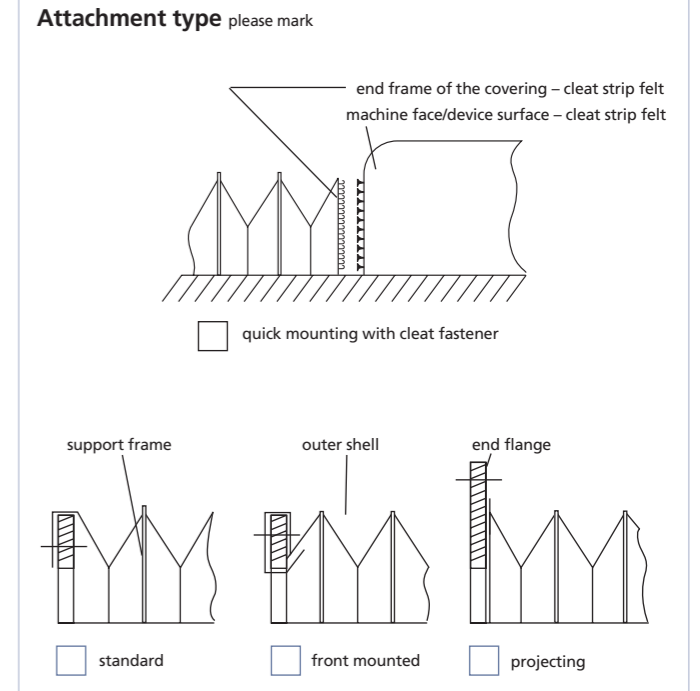
Stroke

Lmax

Lmin

Fold depth

Attachment type



Equipment with scales

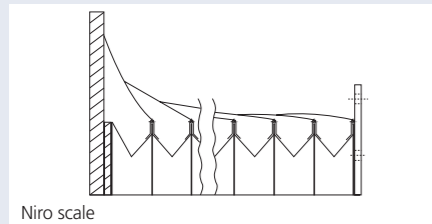
Protective shield against hot and sharp chips.

For further improvement of the resistance with respect to hot and aggressive chips, small as well as large way covers can be equipped additionally with metal scales. The scales can be mounted partially or on all sides. Even the most difficult geometries are possible with Flexecke scales developed and patented by the MöllerWerke.

For every application the right scale:

Niro scale

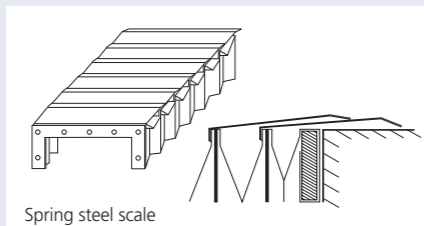
Robust, impact tolerant, acid resistant, bare or brushed surface, can be folded open.



Niro scale

Spring steel scale

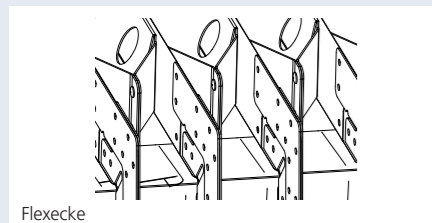
Permanent pre-tensioned surface, low weight, for high travel speeds and accelerations, low mounting height due to the flat scale geometry, particularly suitable for vertical and overhead mounting as well as for covering large areas.



Spring steel scale

Flexecke

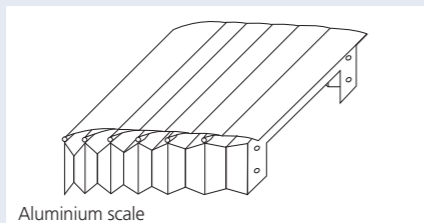
The Flexecke developed and patented by the MöllerWerke pioneers a quite new application field. Every conceivable geometry can be covered with the help of the Flexecke.



Flexecke

Aluminium scale

Low weight, can be folded open, welding sputter does not adhere.



Aluminium scale



Bellow with scales



Cover with spring steel scales

Advantages of metal scales

- less accelerated mass than with telescopic steel covers
- low vibration travel of the cover without impacts
- almost totally closed surface

Length calculations

These formulae are intended as help for the length calculation of for möllerbalg® way covers with spring steel scales. The results are approximations. In most cases desired deviations therefrom can be realised.

Please contact our application engineers.

Ft	one scale on each fold		one scale on each 2. fold	
	scale width	Lmax	scale width	Lmax
	B	2xFt-20	B	2xFt-20
20			75	28
21			75	30
22			75	32
23			90	34
24			90	36
25			90	38
26			90	40
27			100	42
28			100	44
29			125	46
30	55	40	125	48
31	55	42	125	48
32	55	44	125	52
33	55	46	125	54
34	65	50	125	56
35	65	50		
37	65	52		
37	65	54		
38	65	56		
39	75	58		
40	75	60		
41	75	62		
42	75	64		
43	75	66		
44	90	68		
45	90	70		
46	90	72		
47	90	74		
48	90	76		
49	90	78		
50	90	80		
51	100	82		
52	100	84		
53	100	86		
54	100	88		
55	100	90		



Detail view in the machine

Box and polygonal bellows

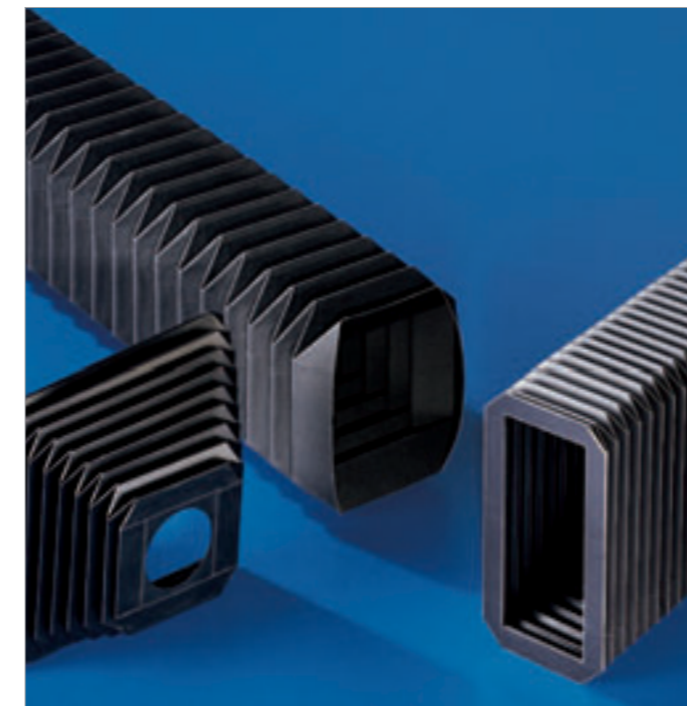
Allround protection with corners.

Box bellows

Box bellows surround the machine components to be protected or the dangerous areas on all four sides. They are provided as protection against dust, dirt or liquids, to feed fresh air or to safely shield dangerous places (e.g. lifting tables).

Box bellows have many advantages

- welded-in supporting frames in each fold – long flanks do not collapse
- numerous proven materials are available
- a divided bellows design facilitates retrofitting without requiring machine/device dismantling
- almost any dimension can be produced; MöllerWerke delivers sizes from a matchbox up to a car garage



Examples of polygonal bellows



Box bellows in an assembly line

Polygonal bellows

Polygonal bellows, like box bellows, provide allround protection. However, no supporting frames are needed. The form stability of the folds is achieved by the multiple-layer structure of the external cover. Polygonal bellows are utilised as cover for piston rods and guide columns in mechanical engineering. They are used as light-proof camera bellows of large format cameras, reproduction cameras and large format copy machines.

MöllerWerke offers polygonal bellows as prism types and conical types in tetragonal, hexagonal and octagonal version as well as special versions.

Advantages of polygonal bellows

- attractive design
- light-proof
- dustproof
- excellent extension ratio
- largely resistant to oil
- in accordance with the NC-production, polygonal bellows are constructed by the MöllerWerke with CAD support

Disc bellows made of elastomers

Smallest mounting dimension – greatest extension.

Disc bellows have a special rank among the bellows. Their mounting dimension is smaller than that of all other bellows – and their extension ratio is enormous. They are assembled with individual discs connected alternately at the outer diameter and the inner diameter. Thereby the material makes a homogeneous connection which is inseparable and completely impervious. Sleeves or flanges can be mounted on both ends of the disc bellows.

Disc bellows are mostly utilised to protect machines or machine components. The application fields are diverse, ranging from hydraulic and pneumatic pistons via threaded and ball roll spindles to processing and measuring machines. The forms of the disc bellows are as manifold as the products which they protect. The classical disc bellows are circular, but other geometries are possible, too, with corresponding tools.



Disc bellows

Disc bellows protect persons against injury by moving machine elements

- dust and dirt
- wood and metal chips
- liquids such as water, oil, emulsions and chemicals

Standard materials:

CSM rubber:

If no special requirements are imposed with regard to the resistance to oil, we usually recommend CSM rubber. Its advantages are high weather resistance combined with adequate resistance to oil and chemicals. The permissible operating temperature range is -20°C to +110°C. Extreme resistance to flexural fatigue.

NBR rubber:

NBR rubber is particularly resistant to oil, emulsions and fuel. However, it is not as weather resistant as CSM rubber.

Special materials:

Viton:

This fluoroelastomer is particularly resistant to acids and of all the materials mentioned here it features the highest permissible thermal stress (- 20°C to approx. + 160°C).

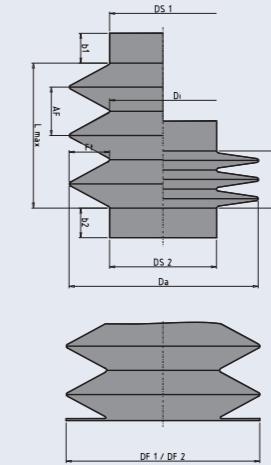
PUR:

Polyurethane is very resistant to abrasion, torsionally stiff and resistant to acids and alkalis. Furthermore, this material is physiologically innocuous and therefore eminently suitable for utilisation in medical equipment as well as in the food industry.

Information with regard to the definition of the disc bellows

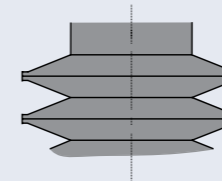
Explanation of the abbreviations:

- Da = external diameter
- Di = internal diameter
- Ft = fold depth
- Fz = number of folds
- AF = extension per fold
- Lmin = length in compressed state
- Lmax = length in extended state
- H = stroke
- DS 1 = sleeve diameter 1
- DS 2 = sleeve diameter 2
- DF 1 = flange diameter 1
- DF 2 = flange diameter 2
- b 1 = sleeve width 1

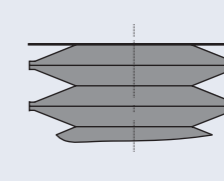


$$\begin{aligned} \text{Fold depth Ft} &= (Da - Di) : 2 \\ \text{Extension per fold AF} &= Ft \times 1.1 \\ \text{Maximum length L max} &= AF \times Fz \\ \text{Number of folds Fz} &= L \text{ max} : AF \\ \text{Minimum length L min} &= Fz \times 2.5 \end{aligned}$$

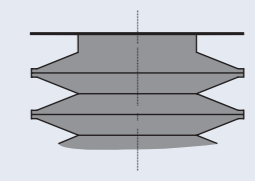
Selection of the attachment



A) Sleeve for attachment with hose binders. Combination with flange is possible.



B) Flange formed from the last fold. Attachment with sheet metal ring and recessed head screws. Combination with sleeve is possible.



C) Spacer flange fixing with sheet metal flange and screws. Combination with sleeve is possible.

You can request your product solution now.

Please send your fax to: MöllerWerke GmbH

Kupferhammer • 33649 Bielefeld • Fax Nr.: +49 (0) 521-44 77 333

Inquiry/order	order No. <input type="text"/>	date <input type="text"/>	signature <input type="text"/>
your company <input type="text"/>			
your name <input type="text"/>			
your fax No. <input type="text"/>		your phone No. <input type="text"/>	

Customised design disc bellows

Di = attachment A B C

Da = DS 1 mm mounting orientation: horizontal vertical

stroke = DS 2 mm for smooth shaft for threaded spindle

b 1 mm the bellows are continually wetted with oil or grease yes no

b 2 mm

Bellows: Standard forms drawn, sewn and clamped

Supporting machine components – complete systems

Your requirements imposed on our bellows are as diverse as your machines. Therefore we utilise our entire know-how and long acquired experience in technical design to offer tailor-made solutions. Depending on the mechanical, thermal or chemical stress involved, we choose suitable materials and production methods from our large repertoire. Your advantage: With MöllerWerke you profit from numerous freely available drawing moulds and low tooling costs even in the case of special forms – with sewn and clamped bellows there are no tooling costs.

What makes MöllerWerke so strong?

- modern constructional aids such as 2D and 3D CAD with computer assisted motion simulation
- product development in our own research laboratory equipped with a modern test field
- customer service on site by competent engineers
- innovative power and know-how for individual new developments

MöllerWerke Bellows:

- protect persons from injury
- prevent machine failures
- extend machine service lives
- reduce maintenance costs

Bellows are utilised on:

- shafts and articulated joints
- pistons and threaded spindles
- guiding columns of large presses
- tumbler discs for helicopter rotors
- large area flexible design and functional elements
- continuous casting plants
- columns and spindles for rolling mills exposed to strong radiant heat
- height variable air conditioners for large studios
- machines with health endangering emissions as complete encapsulation
- machines for food processing



Drawn bellows as flexible vacuum chamber

Process conditioned moulds

Drawn bellows:

cylindrical, rectangular and polygonal, conical, combined geometries provided that they can be extracted from the mould

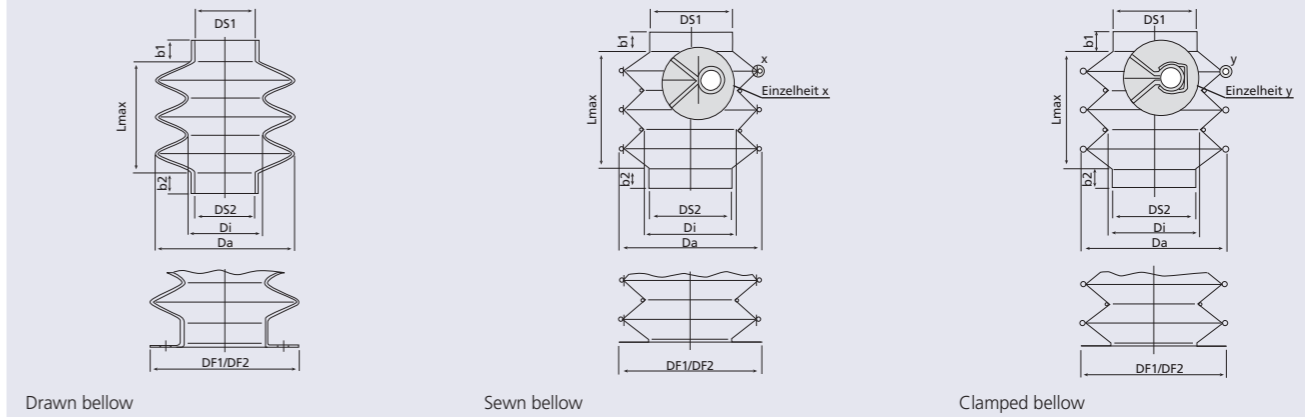
Sewn bellows:

cylindrical, rectangular and polygonal, conical

Clamped bellows:

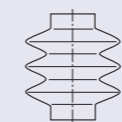
cylindrical, rectangular and polygonal, conical

Type designations



Calculation example for approximate values

Drawn bellows



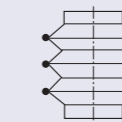
$$F_t = \frac{D_a - D_i}{2}$$

$$F_z = \frac{L_{max}}{L_{max}/F}$$

$$L_{max}/F \approx F_t \times 1,4$$

$$L_{min} \approx F_z \times 6 \text{ mm}$$

Sewn bellows



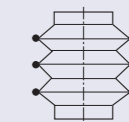
$$F_t = \frac{D_a - D_i}{2}$$

$$F_z = \frac{L_{max}}{L_{max}/F}$$

$$L_{max}/F \approx F_t \times 2 \text{ (-35 mm)}$$

$$L_{min} \approx F_z \times 15 \text{ mm}$$

Clamped bellows

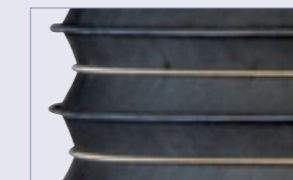
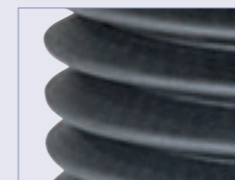


$$F_t = \frac{D_a - D_i}{2}$$

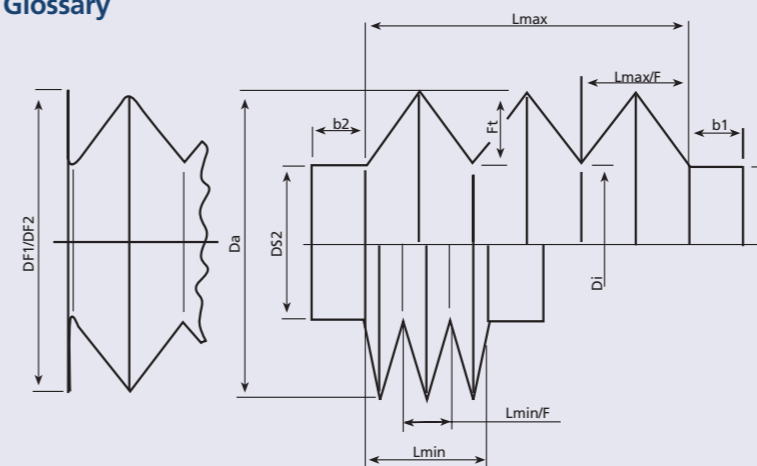
$$F_z = \frac{L_{max}}{L_{max}/F}$$

$$L_{max}/F \approx F_t \times 2 \text{ (-45 mm)}$$

$$L_{min} \approx F_z \times 20 \text{ mm}$$



Glossary



Da = external diameter
Di = internal diameter
Ft = fold depth
Fz = number of folds

Lmin = minimum compressed length, also block measurement
Lmax = maximum extended length
Lmin/F = minimum length per fold
Lmax/F = maximum length per fold

DS 1 = sleeve diameter 1
DS 2 = sleeve diameter 2
DF 1 = flange diameter 1
DF 2 = flange diameter 2
b 1 = sleeve width 1
b 2 = sleeve width 2

In simple cases bellows can be designed using a calculation formula. The above formula is suitable for calculating an approximate value. However,

we recommend to consult specialists at MöllerWerke already in the drafting stage of a project. This avoids unnecessary effort and misunderstandings. Furthermore, in many

instances we can offer even better solutions. Please contact us before you plan the next bellows.

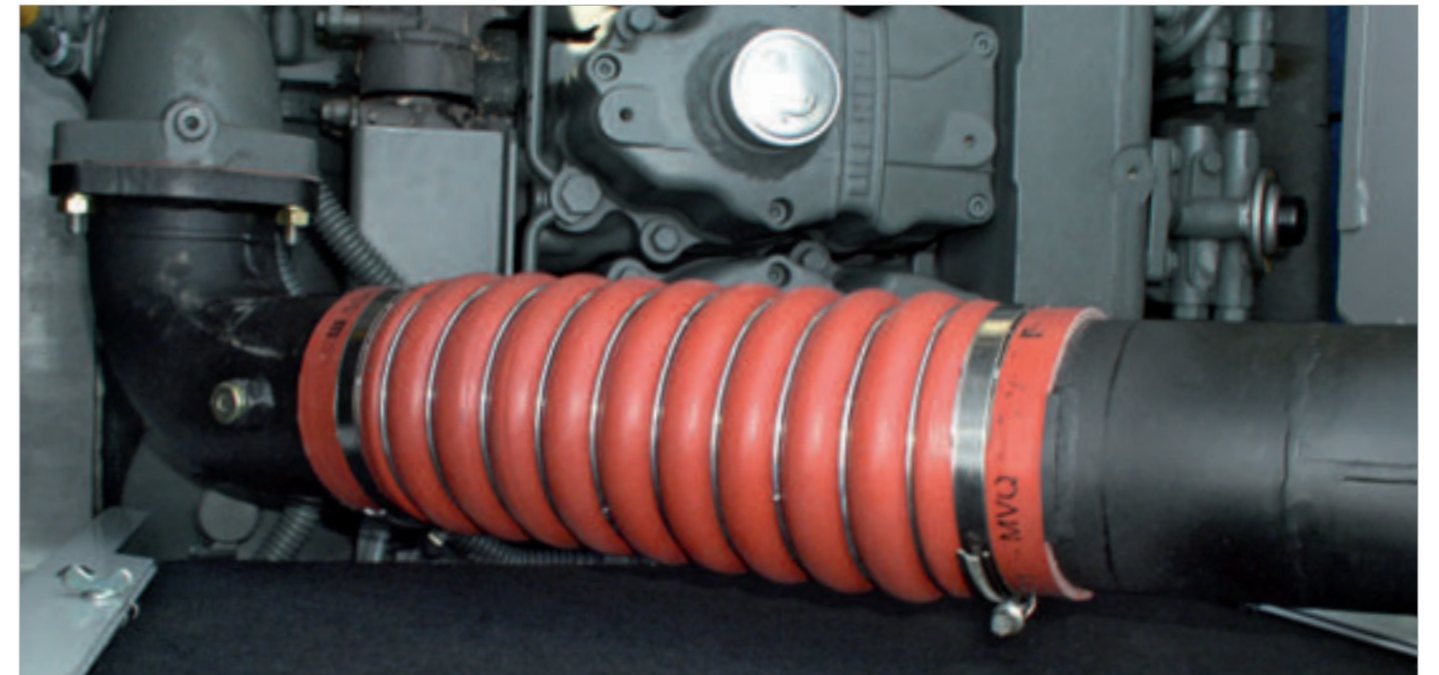
The materials and their properties

The choice of the right material is prerequisite for the proper functioning of bellows. A large selection of practice proven materials as well as combinations of materials with different mutually complementary properties is available. Thus MöllerWerke can offer the most suitable and economically efficient material for almost any application.

Material matrix for folding bellows

No.	material	utilisation	properties/suitability													
			colour	impervious to liquids	high mechanical strength	oil and grease resistant	chemikalienbeständig	Flame retarding and self-extinguishing	electrically conducting	combination with other materials possible	suitable for the drawing method	max. constant temperature in °C measured at the material				
B1	natural leather	General applications for protection against dust and in the case of slight stress with moisture and oils	natural			●										-20 to +70
B2	leather/PU coated inside/outside	Same as B 1, but for higher stress with oil, grease and moisture	black silver	●		●										-20 to +70
B3	CSM rubber CSM rubber fabric	High performance applications, very good weather resistance and good resistance to acids	black	●	●	●	●					●	●			-40 to +110
B4	CR rubber CR rubber fabric	High performance applications, good ageing and weather resistance, moderate oil resistance	black	●	●	●						●	●			-40 to +110
B5	Nitril rubber Nitril rubber fabric	High performance applications in the automotive field and when wetted with oil and fuel	black	●	●	●				●		●	●			-20 to +90
B6	MVQ (silicone) silicone caoutchouc fabric (Nomex)	For extreme thermal performance requirements in vehicle and plant construction	rot	●	●				●			●	●			-50 to +200
B7	CR rubber fabric, coated with PTFE film inside/outside	High performance applications in the chemical industry, the automotive industry and mech. engineering, abrasion protected	black	●	●	●	●			●			●			-40 to +100
B8	Tarpaulin material, polyester coated with PVC	General, also large volume applications exposed to the weather	black others possible	●		●										-20 to +70
B9	M-Kevlar, metallised Kevlar fabric	At high temperatures and with demanded strength, e.g. in the iron and steel industry	silver							●			●			up to +180
B10	siliglas, glass silk fabric coated with silicone caoutchouc	General applications in plant construction, large temperature range, weather resistant	red	●	●											-50 to +200
B11	pyresit plus, (preoxidised fabric)	High performance applications in all industrial branches, resistant to sparks and welding sputter	black		●				●				●			up to +150
B12	darlyn (special PTFE/ glass fabric)	For highest performance requirements with regard to temperature and resistance to chemicals, weather resistant, resistant to abrasion	black	●	●	●	●						●			-60 to +230
B13	polyurethane film	In the field of foodstuffs and medical technology, but also for general applications, abrasion resistant, physiologically innocuous	natural	●	●	●	●									-20 to +100
B14	combinations with stranded copper wire									●						

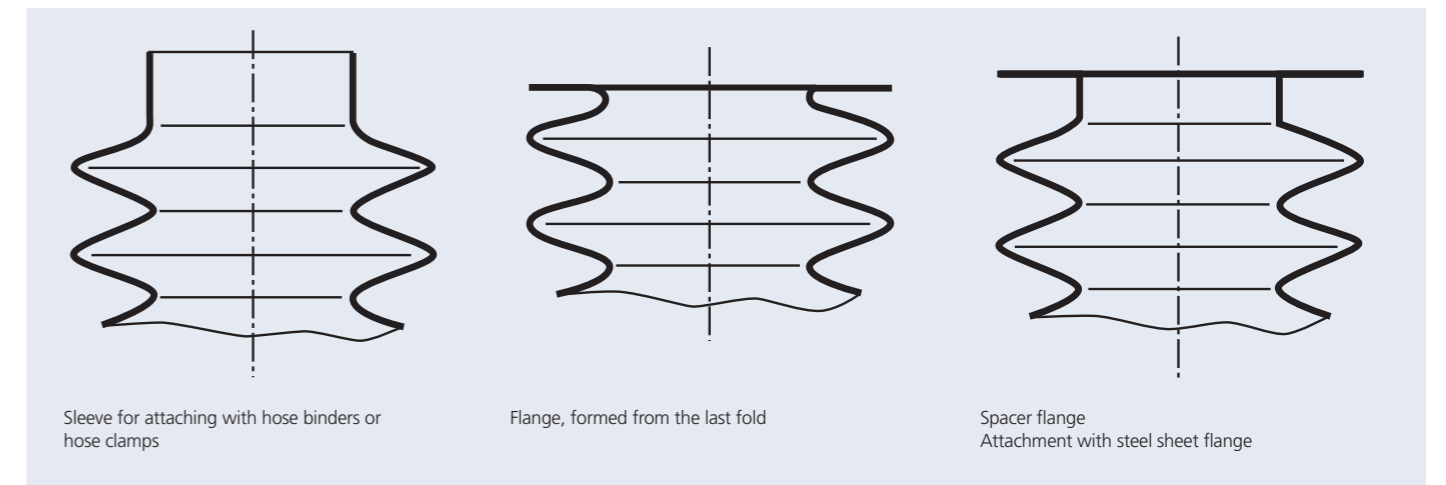
Extract from the möllerbalg® list of materials ● Property/suitability fulfilled ○ property/suitability conditionally fulfilled



Application as pressure hose

Attachment

Sleeves and flanges for attaching on the machine



Sectioning

By zip fastener and cleat fastener



Folding bellows sectioned with zip fastener



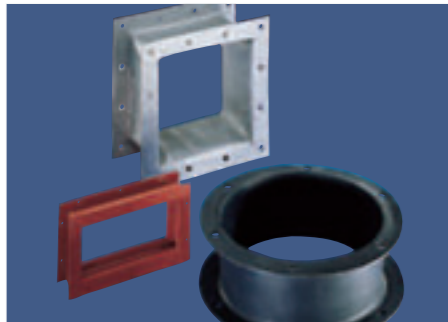
Drawn bellows

Compensators

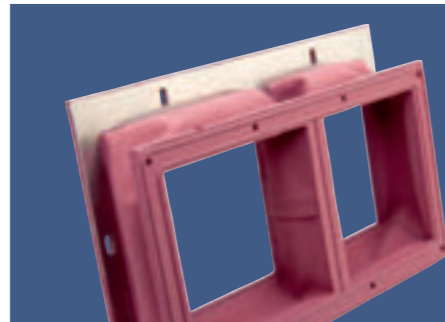
Perfect is what connects.

Soft material compensators are ready-to-install flexible connecting elements that can be inserted in piping systems for taking up radial and axial displacements.

Very favourable solutions are often achieved in plant construction with soft material compensators. They can be adapted to many application-specific requirements by choosing the right material and the correct material structure.



Compensators



Two chamber compensator



Compensator – special form

Soft material compensators, single layer or multiple layers

For slight thermal and chemical stress a single layer structure of synthetic fabrics, raw or coated, is sufficient in most instances. However, MöllerWerke also has special fabrics available that can be processed as single layers and can be welded. Excellent sealing is achieved therewith. The compensators have high resistance to chemicals and can be thermally stressed up to 200°C.

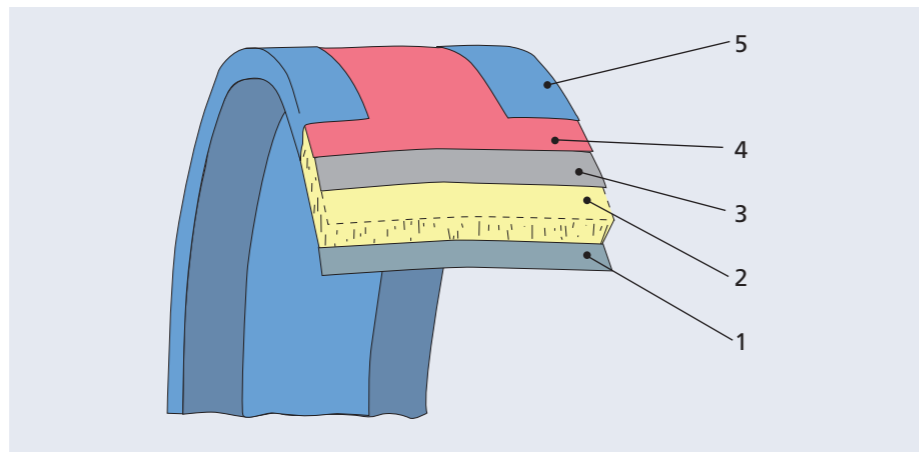
A structure of several layers is necessary for higher gas temperatures. The selection of the utilised materials depends on the

magnitude of the gas temperature and the chemical stress. MöllerWerke has available material combinations that can be utilised at temperatures up to 600 °C in multiple layer construction and with aggressive media inside the pipeline.

The standard structure of MöllerWerke compensators is based on internal line pressures of up to 50 mbar. However, if needed and under certain conditions, the structure can be designed for higher operating or fault state pressures.

The material layers and their functions

1. Glass or isothermal fabric as protection and support for the insulating material
2. Glass or ceramic fleece for thermal lagging
3. PTFE film as diffusion seal and sealing layer resistant to chemicals
4. Silicone glass fabric as weatherproof outer skin
5. Edge reinforcement as connection and edge mounting of all layers with additional insulating function in the flange region



Material layers of a compensator

möllerbalg® compensators

- compensate thermal expansions
- compensate constructionally conditioned tolerances of the pipelines
- attenuate vibrations
- reduce noise transmission

The advantages

- short constructional length
- small deformation forces
- light weight
- easy mounting
- favourable price

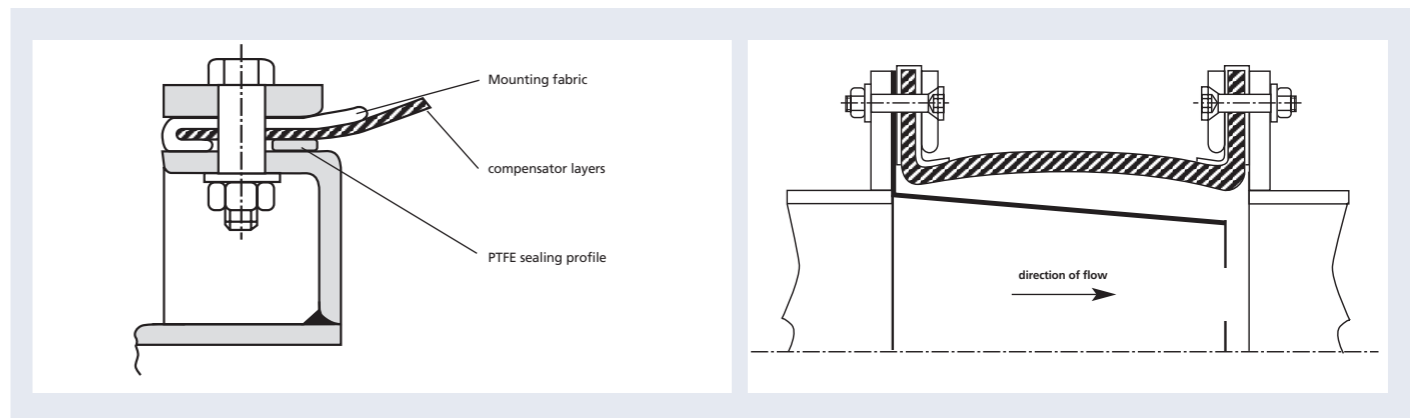
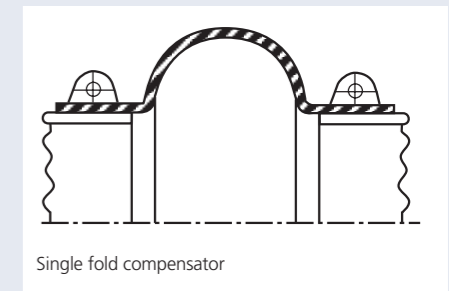
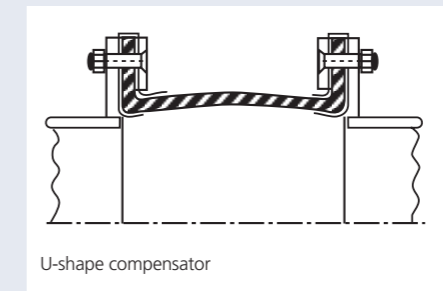
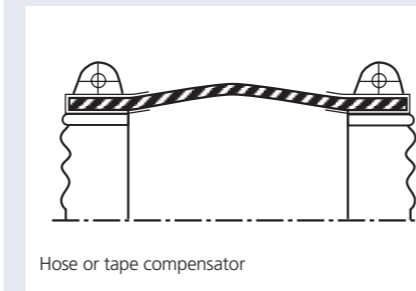
A selection of frequently utilised materials

Application

temperature	≤ 100°C single layer	≤ 200°C single layer/ multilayer	≤ 400°C multilayer	≤ 600°C multilayer
medium				
air, hot air	PVC polyester (70°C) PU polyester (70°C) PU film (70°C) CSM polyester polyester Si-polyester	polyester (150°C) Si-polyester (150°C) Si-glass fabric (180°C)	glass fabric • glass needles mat • Siliglass layer from inside to outside	Isotherm 750 (1000) • ceramic fleece • glass needles mat • Siliglass layer from inside to outside
flue gas, dry chemical exhaust gases	Texfilm 604-2 TCI – 700 TCI – 1400 CR rubber fabric CSM rubber fabric NBR rubber fabric	Texfilm 604-2 TCI – 700 TCI – 1400 silicone-Nomex fabric glass fabric • PTFE film • Siliglass layer from inside to outside	glass fabric • glass needles mat • PTFE film • Siliglass layer from inside to outside	Isotherm 750 (1000) • ceramic fleece • glass needles mat • PTFE film • Siliglass layer from inside to outside
slightly aggressive moist gases	Texfilm 604-2	Texfilm 604-2		
aggressive moist gases	Darlyn 1100 CB	Darlyn 1100 CB (235°C)		

The basic parameters for material selection and compensator structure are: Required movement take up and attachment mode, continuous operating temperature and peak temperature in case of failure, chemical stress, pressure stress and special safety requirements

Attachments



The size of the compensator, the pressure stress and the sealing requirements are the decisive factors for designing the attachment. The MöllerWerke specialists can recommend or deliver the right attachment for all stress combinations.

Multiple layer compensators are seated in the flange/sleeve region with a fabric strip and are therefore not gastight. If gastight sealing is demanded, we recommend an additional PTFE seal.

Baffle plates

Necessary incorporation of baffle plates must be defined already in the planning phase. High gas velocities, high temperatures as well as dust and ash loading of the gases usually require baffle plates. The design and dimensioning of the baffle plates depend on the following factors:

- mechanical stress, e.g. axial and lateral movements
- gas flow direction
- mounting possibility for the compensators

Bellows and form components made of molerit®

Any shape for your particular application.



Dip moulded components – product diversity

The MöllerWerke have been able to solve almost all constructional problems with this special dip moulding method for more than 40 years. All customers profit from this experience and the continually growing know-how of our specialists.

molerit® is one of our own material developments involving a thermoplastic based on PVC. When demanded by the utilisation conditions or when new specific material information is available, the material molerit® is adapted by our personnel in the development department and laboratory. The method itself is continually re-checked and optimised regarding economic efficiency and quality.

Bellows and form components manufactured by the dip moulding method are utilised throughout the industry, for example in mechanical engineering, medical technology, vehicle construction, electrical and sanitary engineering as well as for manufacturing prototypes. The dip moulding method is also suitable for coating metallic components.

The outstanding advantages of the dip moulding method are:

- nearly all shapes are possible, including complex geometries
- small batches can be produced with low tool costs
- various hardness ranges possible within one dip moulded component
- 2 colours possible within one dip moulded component
- surface optionally mat or glossy
- standard colours: black, red, yellow, grey, transparent; special colours can be selected if required
- an alternative to injection moulding and pressing methods for medium quantities up to 10,000 pieces per year.



Utilisation in vehicle engineering



Ergometer by Ergoline

The material

molerit® is a special mixture based on PVC. Careful selection of the components is made according to the aspects of health compatibility, environmental compatibility and technological properties. With PVC as a basis, a polymer with high chemical resistance is utilised, which is well known through

decades of experience. The properties of molerit® depend strongly on the auxiliary materials and the production mode, and they can be adapted to suit a wide diversity of technical requirements. An extensive range of types with a broad spectrum of properties is available: low temperature

suitability, high temperature suitability, haptic, optics, flame retarding, individually optimised media resistance (oil, grease, petroleum ether, salts, acids and alkalis). Furthermore, molerit® can be manufactured in almost any colour – even as glass-transparent component.

Material properties of molerit®

material molerit®	hardness shore A +/-5%	cold fracture temperature acc. to DIN 53372	max. utilisation temperature (°C) ²⁾	mechanical properties	resistance against				flame retarding according to UL 94
					oil and grease	petroleum ether	alkaline washing solution (1%)	weather (UV ¹⁾ ozone, water)	
molerit® T 50 M	50	-45	70 ⁴⁾	●	○	○	●●	●	–
molerit® T 56 K	52	-50	70	●	○	○	●●	●	–
molerit® T 56 KS	50	-52,5	70	●	●	●	●	●●	–
molerit® T 59	59	-32,5	70	●	●	●	●	●●	–
molerit® T 59 FL	59	-30	70	●●	●	●	●	●●	V-0
molerit® T 60 F	60	-22,5	70	●●	●	●●	●	●●	–
molerit® T 60/60	60A/60D ³⁾	-40	70/100 ³⁾	● / ●●	● / ●	● / ●	●	●●	–
molerit® T 70	70	-22,5	70	●●	●	●	●●	●●	–
molerit® T 80	80	-32,5	70	●●	●	●	●●	●	–

F = good resistance to oil and grease
 FL= equipped to be flame resistant
 K = very good cold resistance
 M = mat surface

●● very good
 ● good
 ● satisfactory
 ○ conditional

¹⁾ with dark coloration
²⁾ short-term stress up to +120°C possible
³⁾ radiation crosslinked (Shore D +5/-10)
⁴⁾ in vehicle interior also for occasional surface temperature up to 85°C

The outstanding properties of molerit® are

- high resistance to cracking due to ageing or the effect of light
- good resistance to UV radiation
- cold stability down to -50°C
- thermal form stability up to +70°C, in the cabin area up to +85°C
- with radiation crosslinking up to +100°C
- very good resistance to acids, alkalis, sea water and gases
- material types in many hardness grades, see the material table on this page
- special type for enhanced resistance to mineral oil and grease



The method

The heated dip core is immersed in liquid molerit®. The material gelatinates around the dip core. The core exactly images the internal contour of the dip moulded component. The wall thickness of the dip moulded component is determined by the dwell time in the molerit® and by the thermal capacity of the tool. The fully gelatinated and cooled dip moulded component is pulled off the dip core.

Radiation crosslinking after dipping

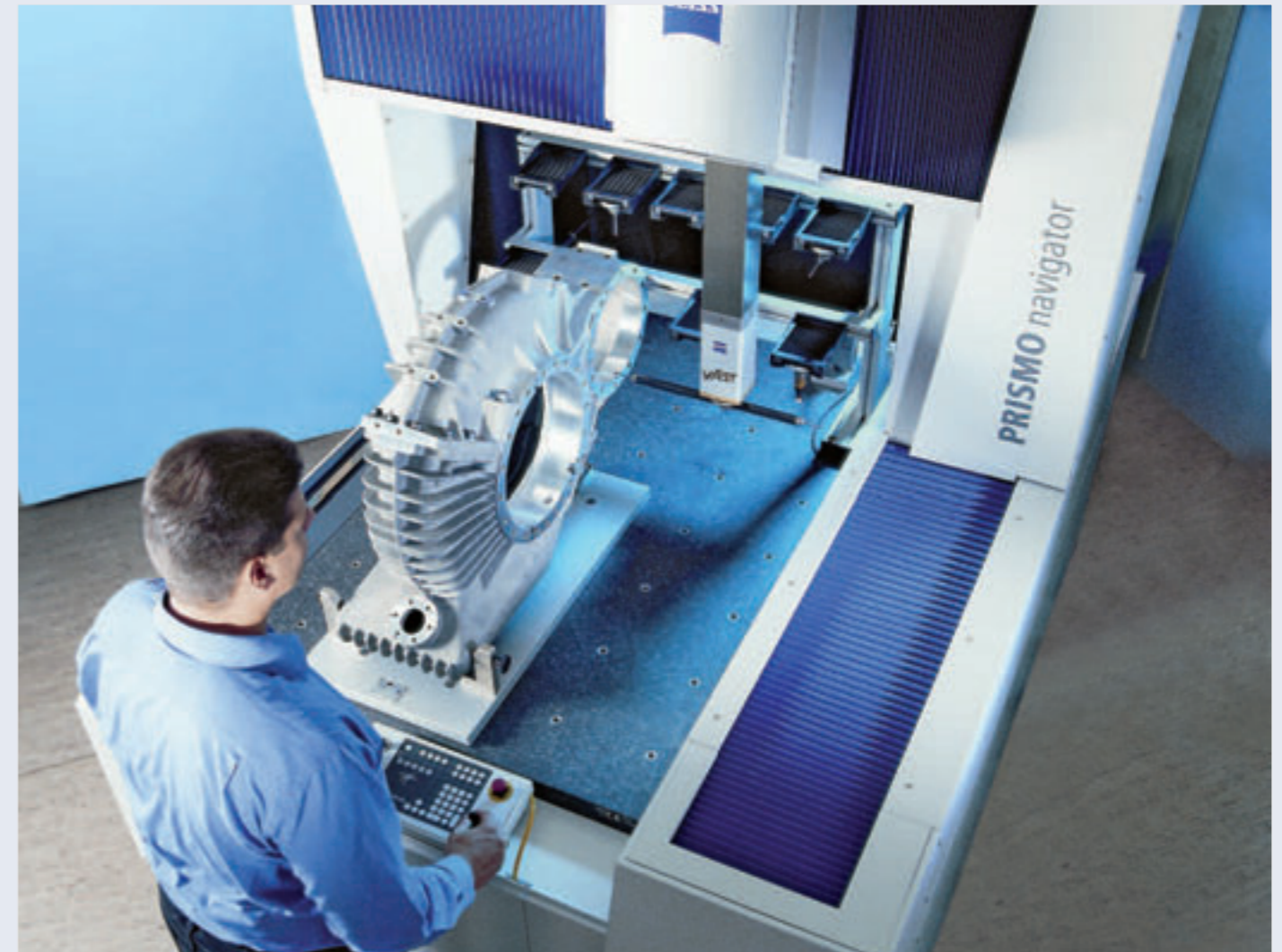
This process produces two material properties in one component. The desired flexibility of the soft plastic component is retained in certain areas, whereas in defined zones the form stability and hardness of hard plastic parts is produced. The areas of the dip moulded component which are to be crosslinked are exposed to a dosed beta radiation. This alters the material and hard zones evolve with have greater mechanical strength and thermal form stability.

Dip moulding tools – quick and cost-effective, available already starting at 500,- Euro

MöllerWerke constructs dip moulded components and their tools with the help of 2-D and 3-D CAD systems. The tools are produced on modern CNC machines. If modifications of the tools become necessary during the pilot phase, they can usually be implemented quickly and cost-effectively.

Special versions of the dip moulding parts:

- can also be combined with each other as components
- venting or exhaust ventilation of the form components can be provided with additional air flaps or air screens
- increase of the stability with inserted wire rings
- can be sectioned by sewing-in zip or cleat fasteners
- print marking possible
- metal or plastic flanges can be incorporated



MöllerWerke GmbH – customer proximity is our topmost principle!

We have the right möllerbalg® for your machine or application.

Let us solve your cover problems.

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We deliver a large number of diversified products with various properties. The products and services presented in this brochure as well as the descriptions and specifications are to be understood as examples. They do not constitute guaranteed features or suitability for a particular application. The actual properties and suitabilities can deviate from what is described here.

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