MöllerWerke



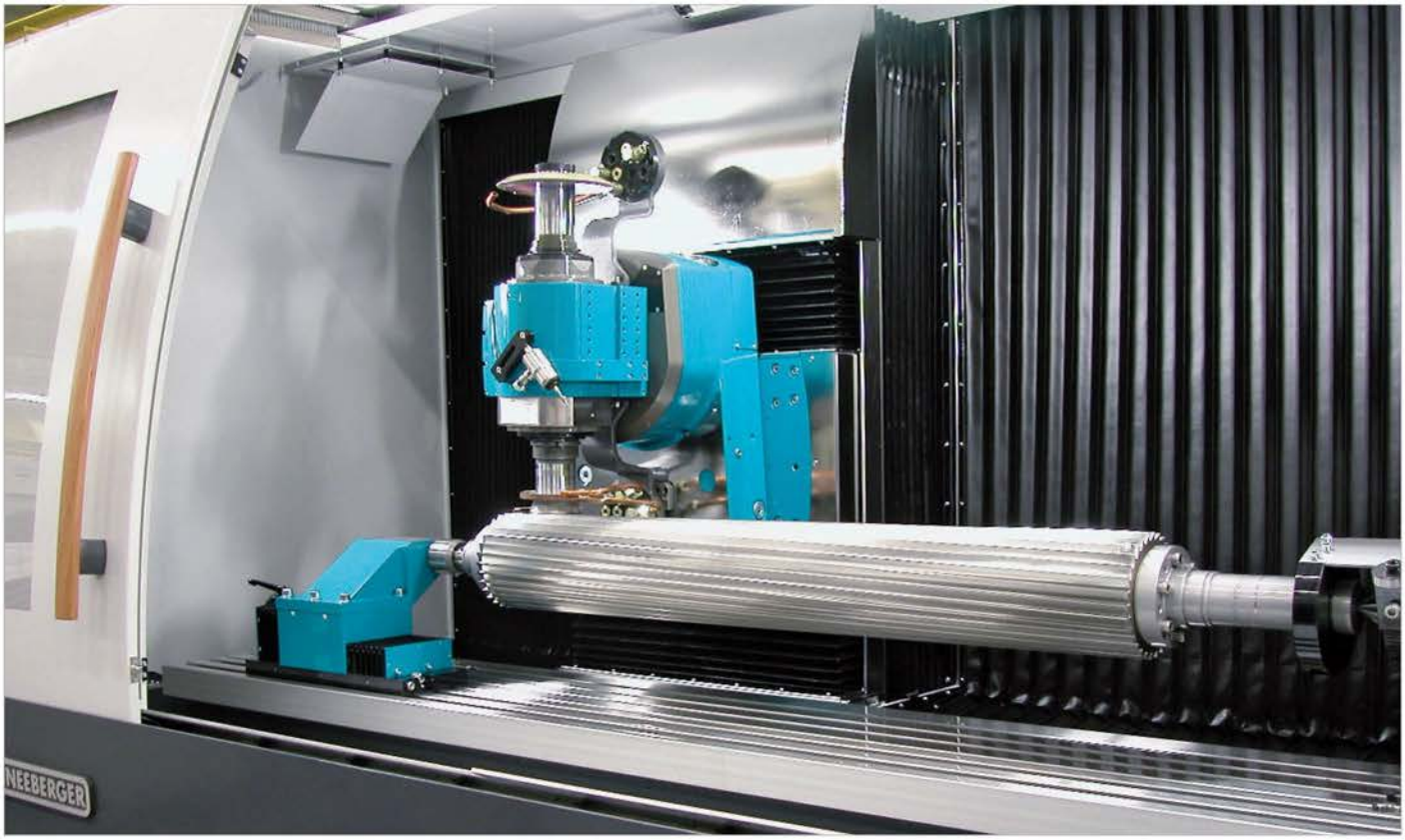

Peak performance

Flexible covers for machine tools and linear guide systems

MöllerWerke

Standard way covers and folding aprons

You have the machine. We have the cover solution.



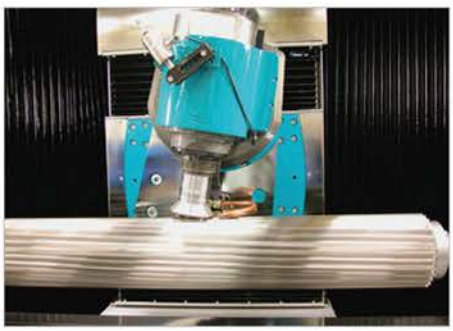
Cover in a milling machine

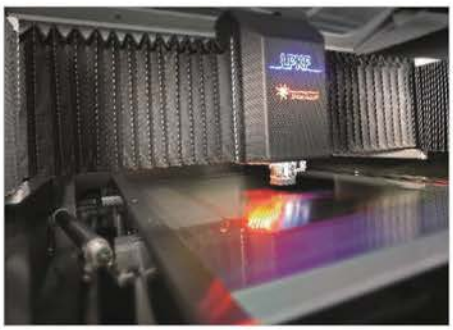
möllerbalg® way covers are carefully produced, quickly available for delivery, have high performance and are keenly priced. They convince with high quality materials, perfect workmanship and prevent ingress of chips, dust and liquids. The machine operates in the long run with undiminished precision,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

MöllerWerke way covers

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





Structure of the MöllerWerke 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

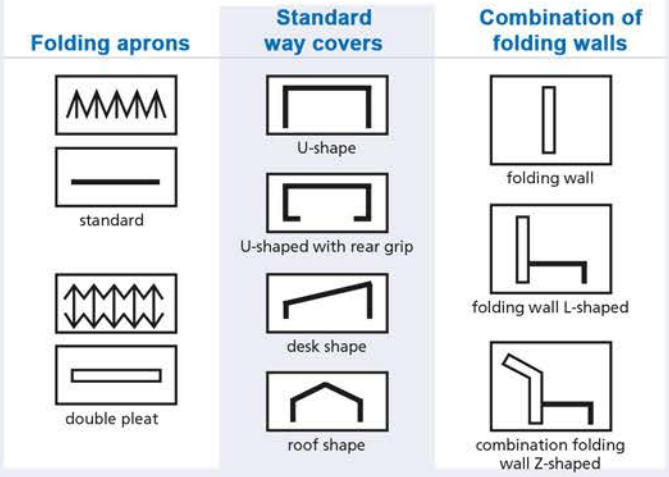
New proven materials enable

- 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

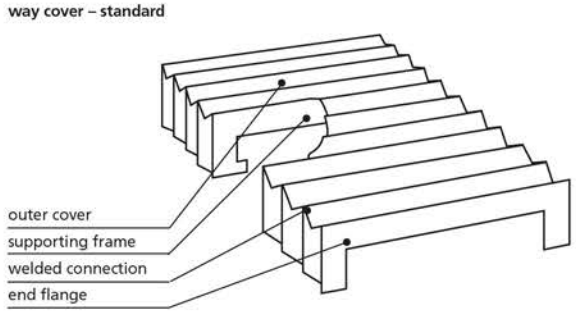


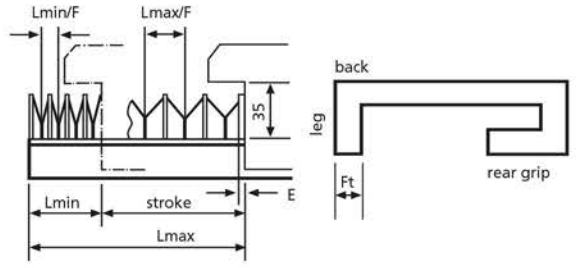
Example of Lmin per fold in mm with a supporting frame thickness of 1 mm depending on the outer cover

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

Constructional principle and designations

way cover – standard





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

Lmax = stroke + Lmin

Lmin = (Fz x Lmin/F) + (2 x E)

VZ = Ratio of Lmax/F to Ft

VZ = 1,3 if Ft ≤ 15 mm
VZ = 1,5 if Ft = 16-39 mm
VZ = 1,6 if Ft ≥ 40 mm

Lmax/F = Ft x VZ

$$Fz = \frac{Lmax}{Ft \times VZ}$$

$$Fz = \frac{stroke}{Ft \times VZ - Lmin/F}$$

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.

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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 protect-ion	imper-vious to liquids	water restistant	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
FR4	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 aramid 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	e.g. Nomex	PU	PU	black	●	●	●	●	◑	●	◑	◑	-20 to +100
FR 6	para-aramid fabric*) one-sided metallised silver colour	For radiant heat	0,5	e.g. Nomex	–	PET-Alu	silver	●	●	●			◑		◑	-20 to +100
FR 7	para-aramid fabric*) two-sided metallised silver colour	For radiant heat metallised silver colour	0,8	e.g. Kevlar	Alu	Alu	silver	●	●	●			◑	◑	●	-20 to +180
FR 8	pyresit plus	Mixed fibre Preox/para-aramid with flame-protected PUR outer coating. Application: for protection against slag sputter	0,4	Preox/ para-aramid	–	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 grey-white	0,4	PES	PU	PU	grey-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 position1, but coated internally with TPU 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 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
F 12	Longlife 0,3	Significantly improved kink-resistance. For use in milling, turning and grinding machines.	0,3	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

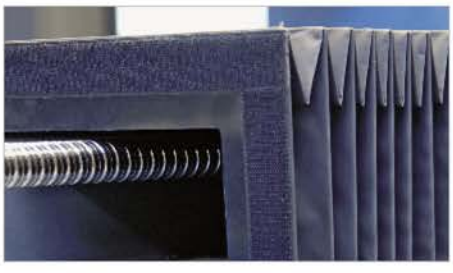
End flanges are delivered with stipulated drilled holes pattern or without drilled holes. If absolute sealing between the cover/end flange and the machine is demanded, we deliver corresponding reliable variants.

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



MöllerWerke

Large way covers and very large way covers

With us you are the greatest.

Very large way covers

MöllerWerke GmbH devises economically efficient solutions appropriate for the particular machine due to a comprehensive know-how. In close cooperation with our customers we constantly supplement our knowledge.

Large bellows on a portal machine

MöllerWerke produces covers which can completely seal off the processing compartment of the machines. This means that no chip or coolant lubricant can penetrate to the sensitive parts of the machine. The guide elements as well as the electric and electronic parts of the machine are reliably protected. This is also true in particular for very large travel stand machines, portal milling machines and processing centres. Large way covers having a height greater than 4 m and an extension of 25 m are among our proven products.

For the design criteria and materials, please see the tables in the front section.

Large bellows are convincing

- high stability achieved by crimping and/or with reinforces supporting frames
- uniform extension with scissor elements or special damping systems
- lightweight moving systems permit high speeds and large accelerations with low friction and little noise production
- stabilising and damping elements ensure parallel extension with low wear
- long service live with maintenance-free operation

Combination folding walls

möllerbalg® combination folding walls are special cover systems from the MöllerWerke, which are assembled from large bellows and other bellows. They can serve as wall covers for the rear part of the machine or as a roof cover. Thus a hermetically enclosed working compartment can be achieved without requiring particularly great effort for designing the machine housing. With the help of special safety systems these bellows systems can also be made puncture-proof. In the case of a tool breakage, the kinetic energy of the ejected fragment is dissipated without endangering persons or systems in the environment.

The new guide frames guarantee special form stability. By consistent weight optimisation and utilisation of lightweight moving systems, möllerbalg® combination folding walls achieve high travel speeds and accelerations.

Combination folding wall in a machine

Combination folding wall in a long bed machine

Because of their dead weight very large combination folding walls are always a challenge for the constructional design with respect to the desired running characteristics. The inertial forces produced by the large dead weight in response to the required accelerations must be skilfully diverted or dissipated to keep the mechanical stress to which the components are subjected as small as possible.

In order to achieve a safe and functional solution, new large combination folding walls are tested on our own linear motor test stand. Thus the customer can be sure that a proven system is delivered for his machine.

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Equipment with scales

Protective shield against hot and sharp chips.

Folding wall with scales in a processing centre

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.

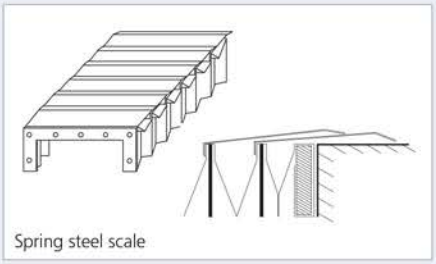
The advantages of metal scales

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

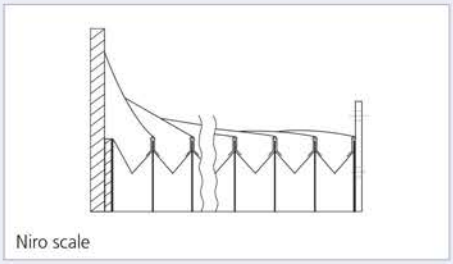
Bellow with scales

Application example

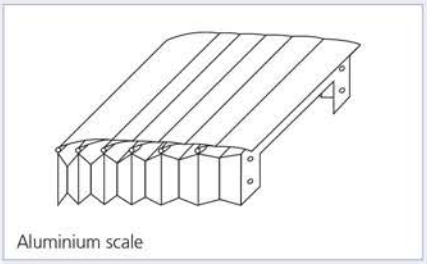
For every application the right scale



Spring steel scale



Niro scale



Aluminium 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.

Niro scale

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

Aluminium scale

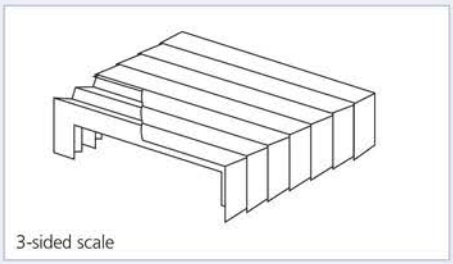
Low weight, can be folded open, welding sputter does not adhere.

3-sided scale

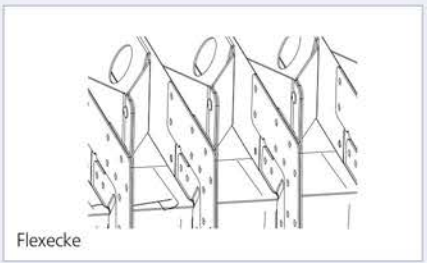
This alternative for the telescopic steel cover, with all advantages of the spring steel scale protects the guide track on all accessible sides and is impervious to liquids.

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.



3-sided scale



Flexecke

	one scale on each fold		one scale on each second fold	
Ft	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		

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.

Detail view in the machine

Cover with spring steel scales

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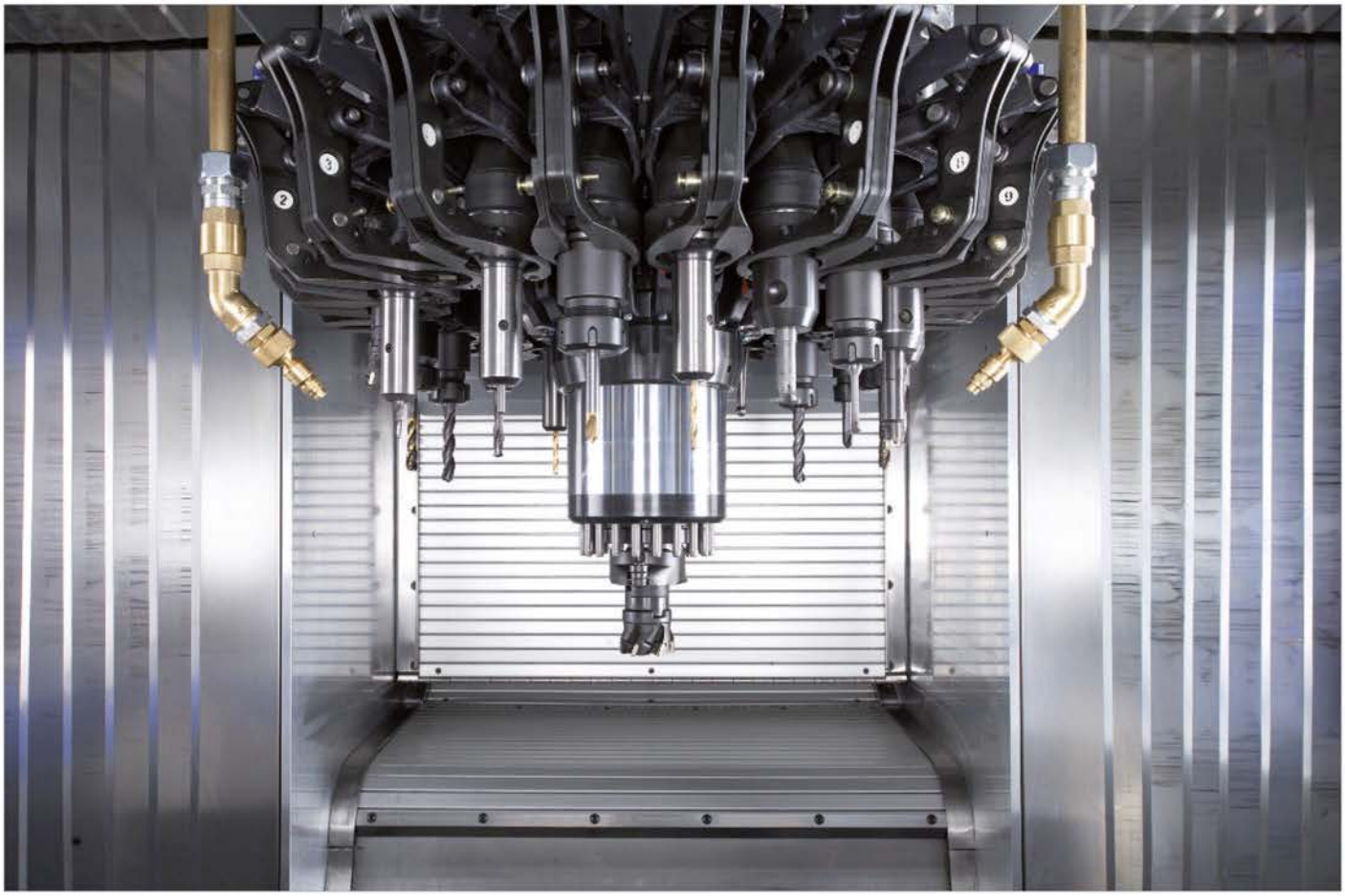
Stahlflex® covers

Stahlflex® – high speed engineering.



View of processing centre

Ultra-modern engineering achieves high speeds and accelerations in machine tools, entailing mechanic stress magnitudes at the absolute limit or beyond the capabilities of conventional cover systems. Thus there is a demand for solutions with maximised wear resistance and minimised mass combined with extremely steady travel behaviour. The reply to this challenge is Stahlflex®.

This innovative cover system from the MöllerWerke in lightweight construction consists of metal and plastic connecting elements. The low mass of the cover permits very high travel speeds and accelerations. The mechanical stress of the components and the machine is thus small, achieving steady uniform motion. The almost closed metal surface of the cover, whose elements show a wiping action, to protect the machine against hot sharp-edged chips.

Our new covering system is maintenance-free, long-lived and attractively priced. Individual elements that have been damaged can be easily replaced due to the modular design. Furthermore, with the help of a plugging system patented by the MöllerWerke, existing covers can be complemented with additional covers in almost any spatial orientation.
These properties make Stahlflex® the optimum solution for modern machine tools.

The advantages at a glance

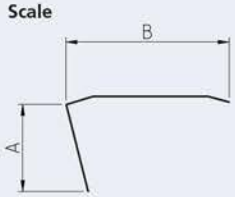
- suitable for large accelerations
- suitable for high speeds
- small mass
- resistant to chips
- maintenance-free
- possible with various geometries
- practice-proven protection system
- cost favourable for procurement and maintenance
- long service life
- can easily be complemented

View of a travel stand machine

Stahlflex® Abdeckungen - einteilig für den Überkopf- oder vertikalen Einbau

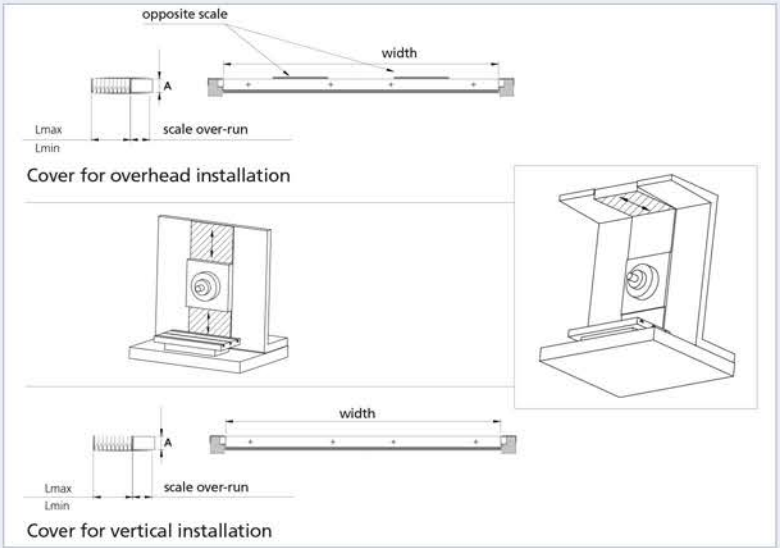
Scale		Lmax /scale	Lmin/scale
scale width **B**	scale bevel **A**	extension per scale	block dimension per scale
65 mm	40 mm	50 mm	6 mm
75 mm	45 mm	60 mm	6 mm
85 mm	50 mm	70 mm	6 mm
100 mm	60 mm	85 mm	6 mm
115 mm	70 mm	100 mm	6 mm

Scale



FZ = Lmax / Lmax per scale

Lmin = FZ x Lmin per scale
plus scale over-run



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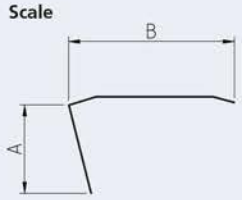
Stahlflex® covers - single piece or modular design for large area vertical installation

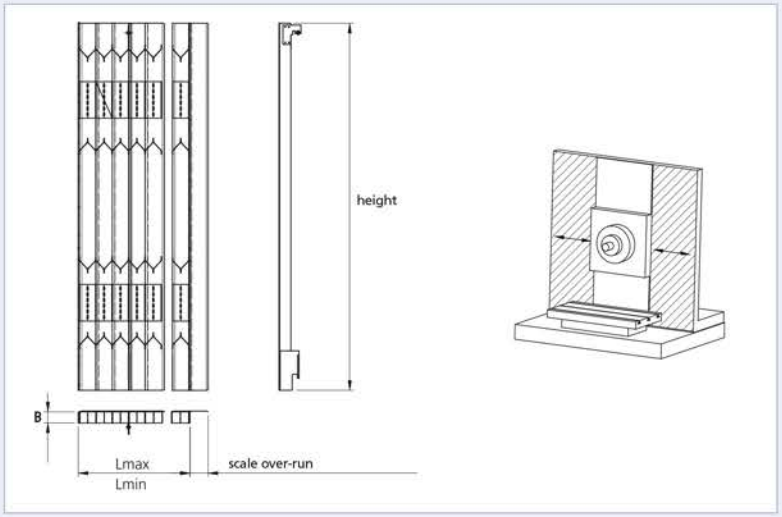
Scale		Lmax /scale	Lmin/scale
scale width **B**	scale bevel **A**	extension per scale	block dimension per scale
65 mm	40 mm	50 mm	7,5 mm
75 mm	45 mm	60 mm	7,5 mm
85 mm	50 mm	70 mm	7,5 mm
100 mm	60 mm	85 mm	7,5 mm
115 mm	70 mm	100 mm	7,5 mm

Scale



FZ = Lmax / Lmax per scale

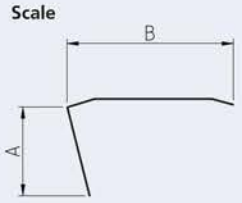
Lmin = FZ x Lmin per scale
plus scale over-run



Stahlflex® covers as a system solution - single piece or modular design for wall and roof

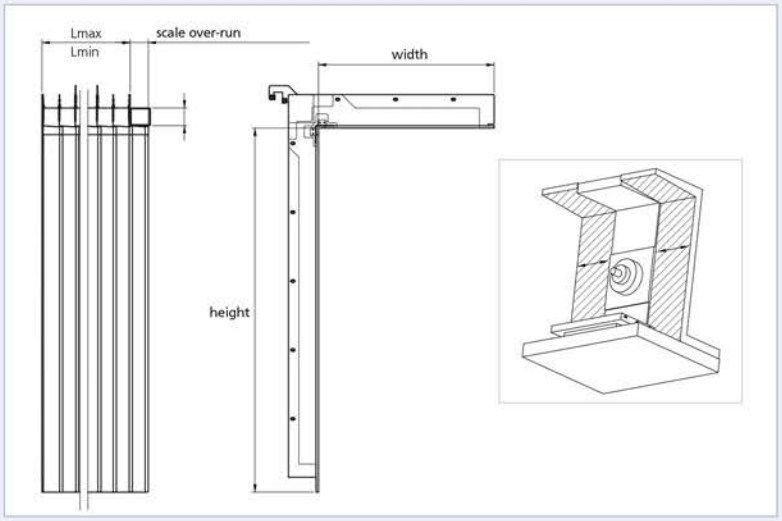
Scale		Lmax /scale	Lmin/scale
scale width **B**	scale bevel **A**	extension per scale	block dimension per scale
65 mm	40 mm	50 mm	7,5 mm
75 mm	45 mm	60 mm	7,5 mm
85 mm	50 mm	70 mm	7,5 mm
100 mm	60 mm	85 mm	7,5 mm
115 mm	70 mm	100 mm	7,5 mm

Scale



FZ = Lmax / Lmax per scale

Lmin = FZ x Lmin per scale
plus scale over-run



Stahlflex® cover rear view

Stahlflex® cover front view

Stahlflex® cover corner solution rear view

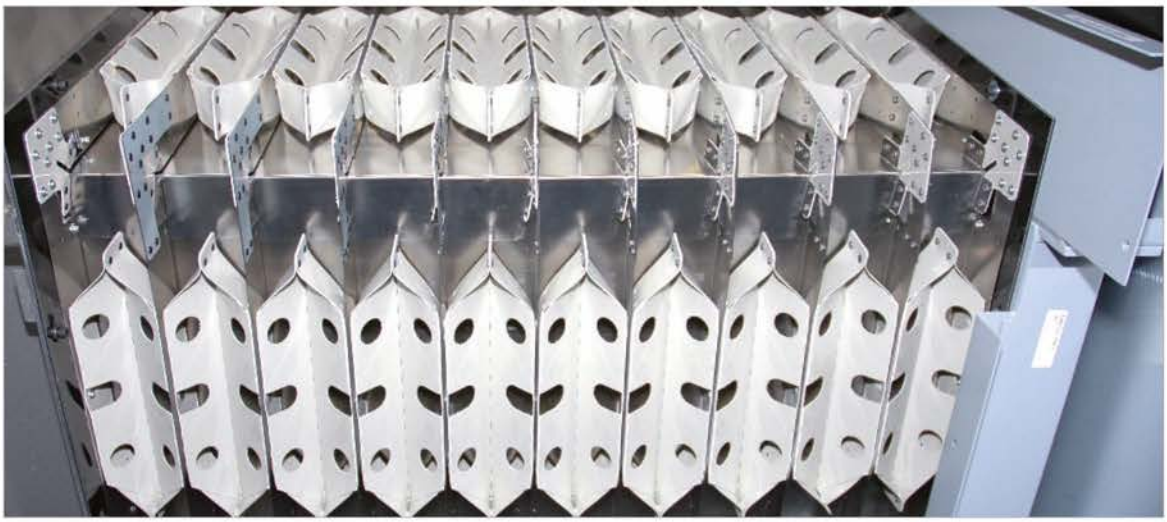
Plugged system

The plugged system developed by the MöllerWerke makes it possible to firmly couple the nevertheless be detached. The plugged spring element latches into a pocket-shaped holder in which it is locked into position. To break the connection, the plugged spring element must be pressed together to release it out of the locking device. This can be repeated any number of times, because the deformation of the spring element takes place in the elastic range.

Detail view of plugged system

Exchangeable scales

A further development step of the Stahlflex® covers is the modular system design with exchangeable scales. In this system the spring steel elements of the cover are connected to plastic elements. The special feature of this system: The connection is devised such that individual elements can be mounted and dismounted. This makes it possible to replace destroyed scales individually. This advantage is welcomed by the machine operators, because it means that the repair effort and the costs for replacement parts are significantly reduced.



Detail view of exchangeable scales

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Complete units

Supporting machine components – complete systems.

Thus the MöllerWerke decided a few years ago not only to take up this trend, but also to set own standards. Today machine manufacturers tend to require complete modules, as modern machine tools are based on modular design. The task amounted to developing a multifunctional complete unit.

In detail this entailed: Integration of the guides for the covers. A weight-optimised light and compact design was required, which can be mounted quickly in the machine without great effort. The complete unit performs a supporting function for the machine shrouding.

3-D depiction of a complete unit

The complete units are safely delivered to the machine on a transport frame or other suitable transport device. The scope of delivery also includes the mounting instructions for all steps from releasing the transport securing devices to the finished installation in the machine. On request installation of the first complete unit can be managed on site by our engineers.

View of a complete unit before mounting in the machine

Top view on complete unit

Bottom view on complete unit

MöllerWerke complete units

Convince yourself of the high performance of our complete units. We are pleased to take over the complete development from the first constructional design file to the finished product.

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Box and polygonal bellows

Allround protection with corners.

Box bellows

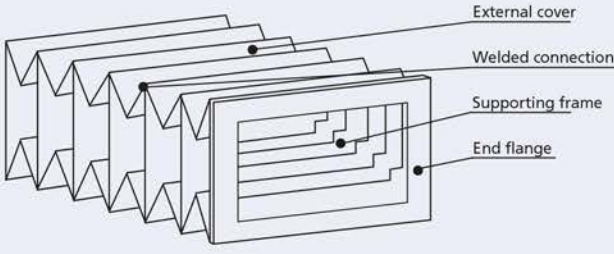
Box bellows surround the machine components to be protected or the dangerous areas on all four sides. They are provided as protection against dust, dirt or liquids, to feed fresh air or to safely shield dangerous places (e.g. lifting tables).

Box bellows in an assembly line

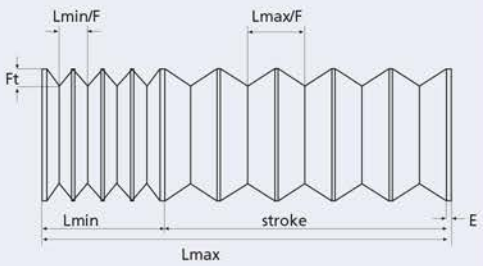
Box bellows have many advantages

- 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

Structure of MöllerWerke box bellows



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



Length calculations

Standard materials		Example for Lmin per fold in mm for a support frame thickness of 1 mm, depending on the external cover
PUR fabric	0,20	3,0
PUR fabric	0,40	4,5
PUR fabric + teflon film	0,30	4,0
PUR fabric + PUR film	0,30	4,0
EM meta aramid fabric	0,50	3,5
Pyresit-plus	0,40	4,5
Pyresit-plus	0,75	7,0
special materials	on inquiry	

Lmax = stroke + Lmin

Lmin = (Fz x Lmin/F) + (2 x E)

VZ = ratio of Lmax/F to Ft

VZ = 1,3 if Ft ≤ 15 mm
VZ = 1,5 if Ft = 16-39 mm
VZ = 1,6 if Ft ≥ 40 mm

Lmax/F = Ft x VZ

$$Fz = \frac{Lmax}{Ft \times VZ}$$

$$Fz = \frac{stroke}{Ft \times VZ - Lmin/F}$$

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

Beam guide bellows in a laser machine

Laser beam protection bellows as box bellows or polygonal bellows

MöllerWerke is a development partner of renowned laser machine manufacturers and well known for its special solutions and new developments. The personnel of the MöllerWerke is pleased to assist you with the design of your laser beam protection bellows.

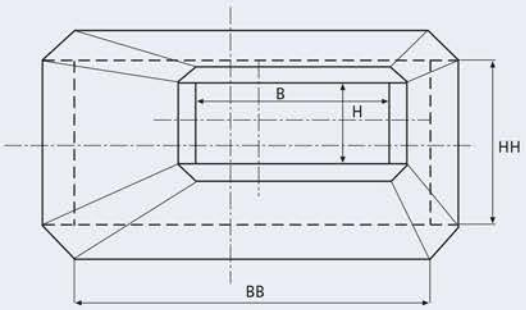
Polygonal bellows

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.

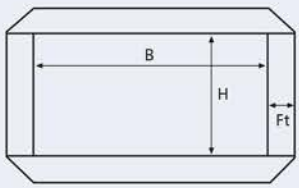
Advantages of polygonal bellows

- 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

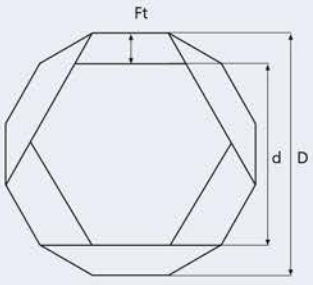
Required constructional specifications for polygonal bellows



- Lmin
- Lmax
- inner rectangular dimensions of both connecting sides
- depth of fold
- centre offset of the two connecting sides relative to each other



Lmin, Lmax, Ft,
inner rectangular dimension or
outer rectangular dimension



Lmin, Lmax, D, d or Ft

MöllerWerke

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 bellow.

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 protect persons against injury by moving machine elements

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

Disc bellows

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.

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