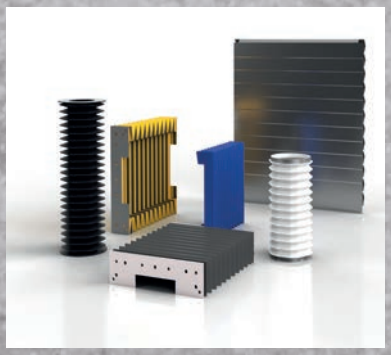
Protection Systems

Bellows
Backwall systems
Roof covers
Roller systems
Spiral springs
Telescopic steel covers



Our range of products

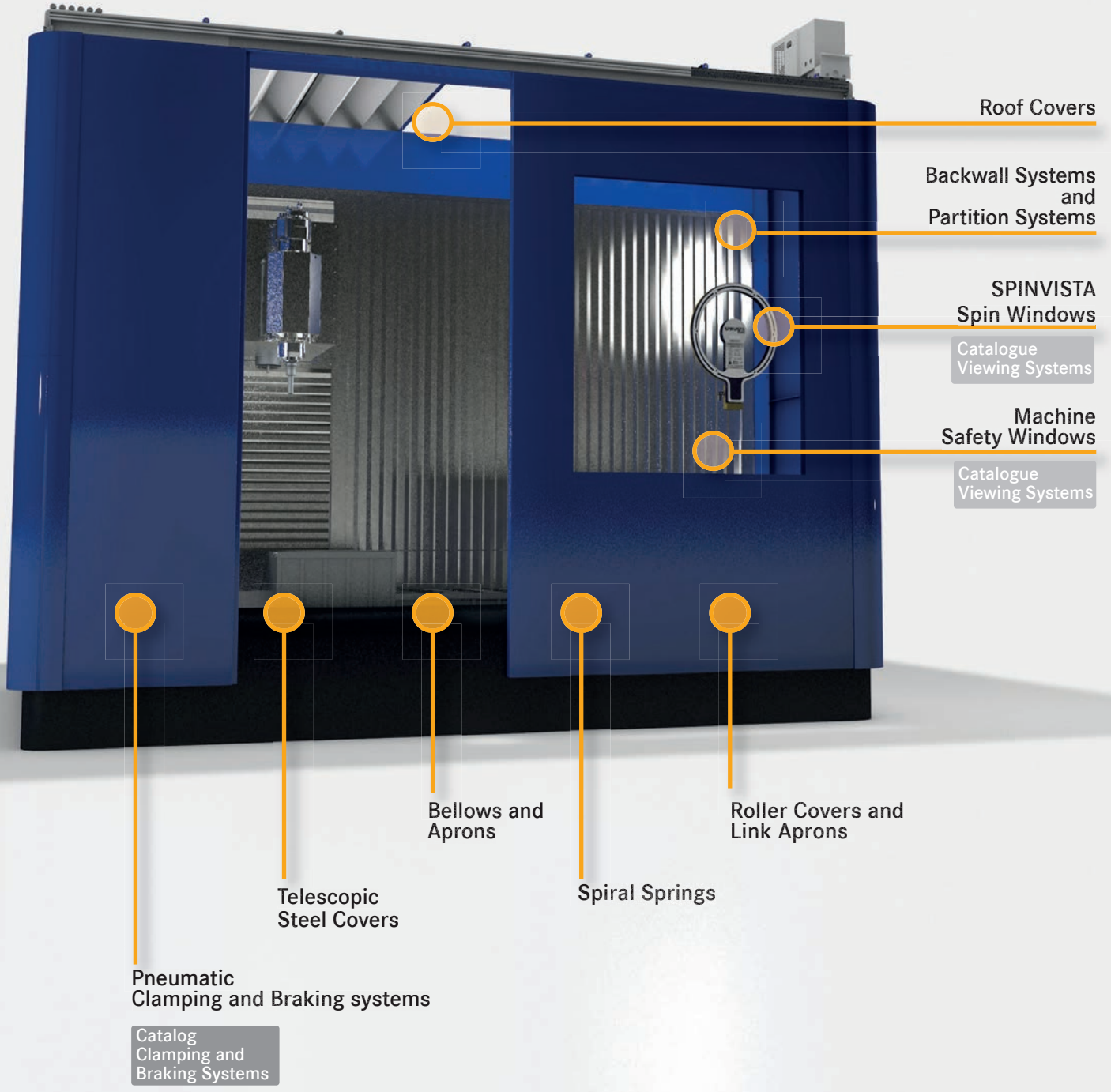
With our wide range of products, we provide a comprehensive range of products around the production machine.

Our product expertise at a glance

Protection systems
We design and manufacture customised bellows, backwall systems, roller covers and link aprons, spiral springs and telescopic steel covers for your individual requirements.

Clamping and braking systems
Our pneumatic clamping and braking systems are suitable for rotational position clamping, clamping and braking of axial loads or for translational applications and are available for many linear guides.

Vision systems
Our product range of vision systems includes SPINVISTA Spin Window as well as safety windows in many designs.



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Note All dimensions in mm unless otherwise indicated. Subject to change and errors.
Inquiry forms available at www.hema-group.com/download

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The design and realisation of large protection systems and complete backwall systems is supervised by an experienced team during all stages of manufacturing.

Engineering and design

All important details of the machine for the design of new protection systems are integrated in the engineering stages. Every cover is individually designed to meet the specific requirements and to fit perfectly for each machine tool.

Production of components

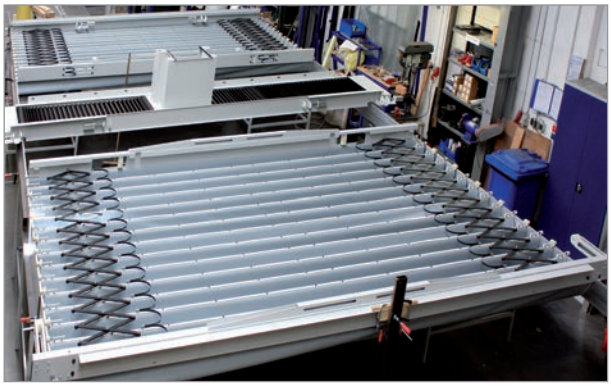
All components are produced with modern machines. Sheet metal components are accurately cut to fit by laser.
Other parts of the covers, such as pantographs or gliders for smooth running, are chosen individually depending on the area of application and travelling speed.

Test set up

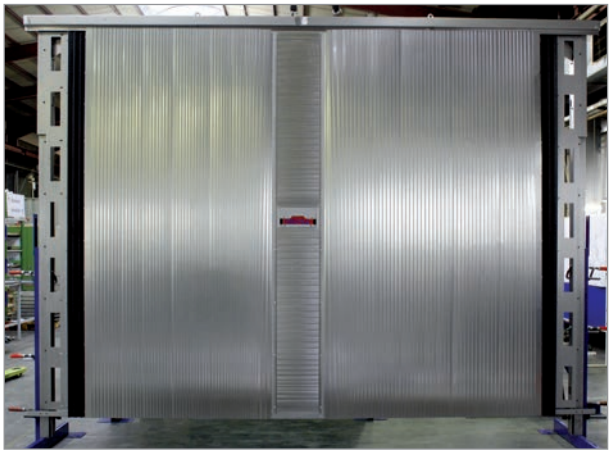
For new designs, a prototype of the complete solution is assembled. The function and fit of the individual components and materials are carefully tested. All necessary adjustments or optimizations, including those related to the assembly process, are recorded and integrated into the component's series production.



Set up



Roof cover with a length of more than nine meters, and a selfsupporting width of more than five meters



Backwall system for XY-axis

Shipment

The assemblies are shipped in secure, compact packaging to keep shipping and handling costs as low as possible.
When designing the packaging, the requirements from the customer's internal processes are also taken into account, and the protective cover is either completely pre-assembled or shipped in modules.



Compact returnable shipping unit for backwall systems (optional)

Covers for Moving Column Machines

To protect the work area of large machining centers, large bellows based on ELASTIC bellows or SAMURAI bellows can also be used.



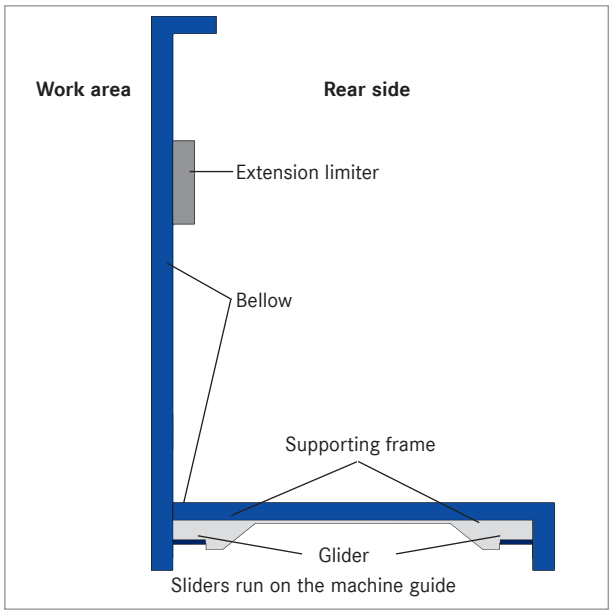
Moving column type cover

However, long travel distances and large working areas of the machines require special solutions regarding protective covers. Depending on the machine type and its concept two design principles are applicable:

- Moving column type cover
- Venetian blind type

Moving column type cover

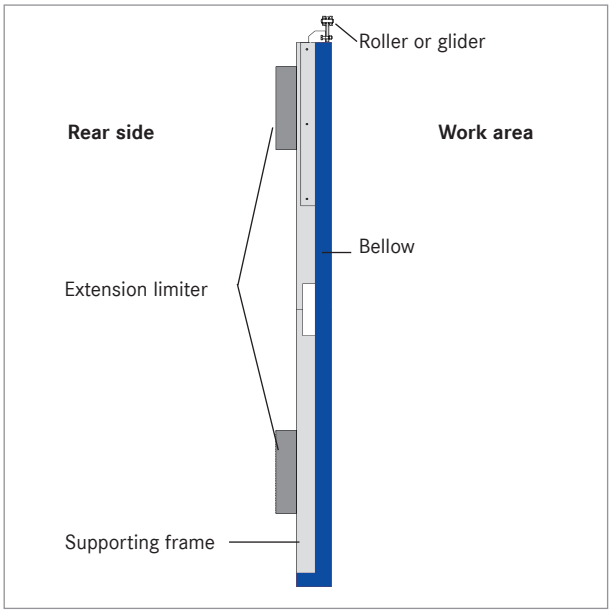
The moving column principle is particularly suitable when the load-bearing, rigid frame cladding on the machines, which provides upper guidance for the covers, is missing. This type has an L-shaped design and runs directly on the machine guides using sliders.



Concept of a moving column type cover

Venetian blind type

If a sufficiently stable upper support is available, the bellows are guided using profiles, roller or rail systems similar to a blind.



Design of venetian blind cover

For machining centres that require continuous coverage of the work area, consisting, for example, of the back wall and roof space, both the moving column bellows and a louver around the roof can be added.
The available installation space can be used more efficiently and chip accumulation, even in corner areas, can be largely avoided.



SAMURAI FASTAF as a moving column type cover in combination with backwall /roof cover

Backwall systems

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Integrating a backwall system requires machine-side connections for power transmission. For optimal power transmission to the X-axis cover, it must be connected to the moving column or other load-bearing machine components at the top and bottom.

SAMURAI bellows are used as protective covers; the overlapping lamellas effectively protect the bellows against hot and sharp-edged chips.

Helm rail with roller gliders

Bellows can be equipped with plastic gliders or roller hangers. For travel speeds exceeding 80 m/min, we almost exclusively use roller hangers, as these have lower friction and can therefore move more dynamically.



Helm rail with roller hangers

Pantograph for highly dynamic loads

Additional elements such as pantographs ensure a smooth and quieter operation of the cover, even under highly dynamic loads.



Pantograph

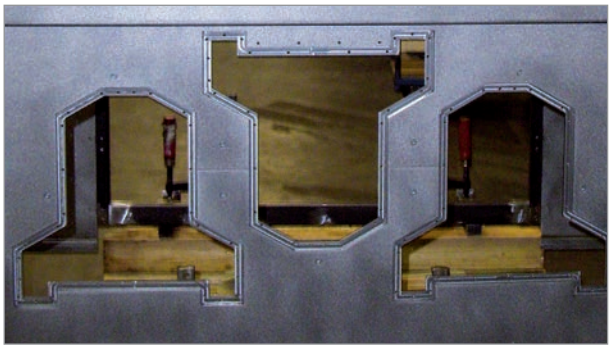
Travel speeds

Our backwall systems can also be used in very large dimensions and at high operating speeds. A travel speed of up to 120 m/min can be achieved.

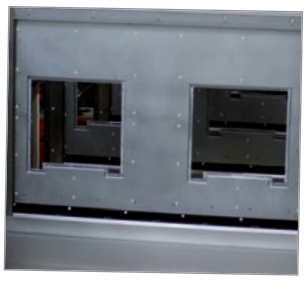
Spindle feedthroughs

We can equip our backwall systems with custom spindle feedthroughs at the factory upon customer request.
If required, the spindle feedthroughs can also be fitted with wipers; the wiper material is selected to suit the application.



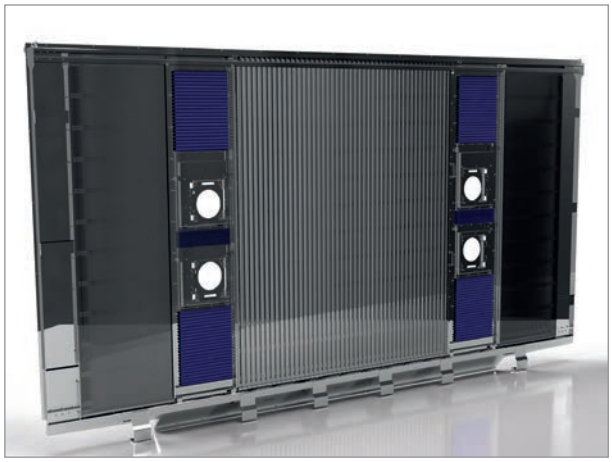




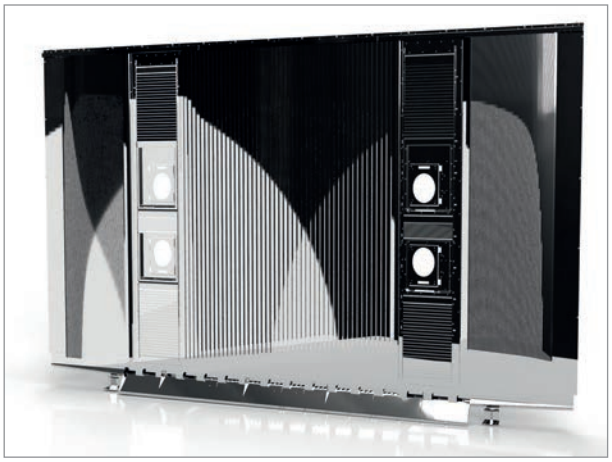


Spindle feedthrough variants

Backwall systems - example solutions



Backwall system with two moving columns, four spindles
Rear view



Backwall system with two moving columns, four spindles,
front view

Backwall systems for multiple spindles

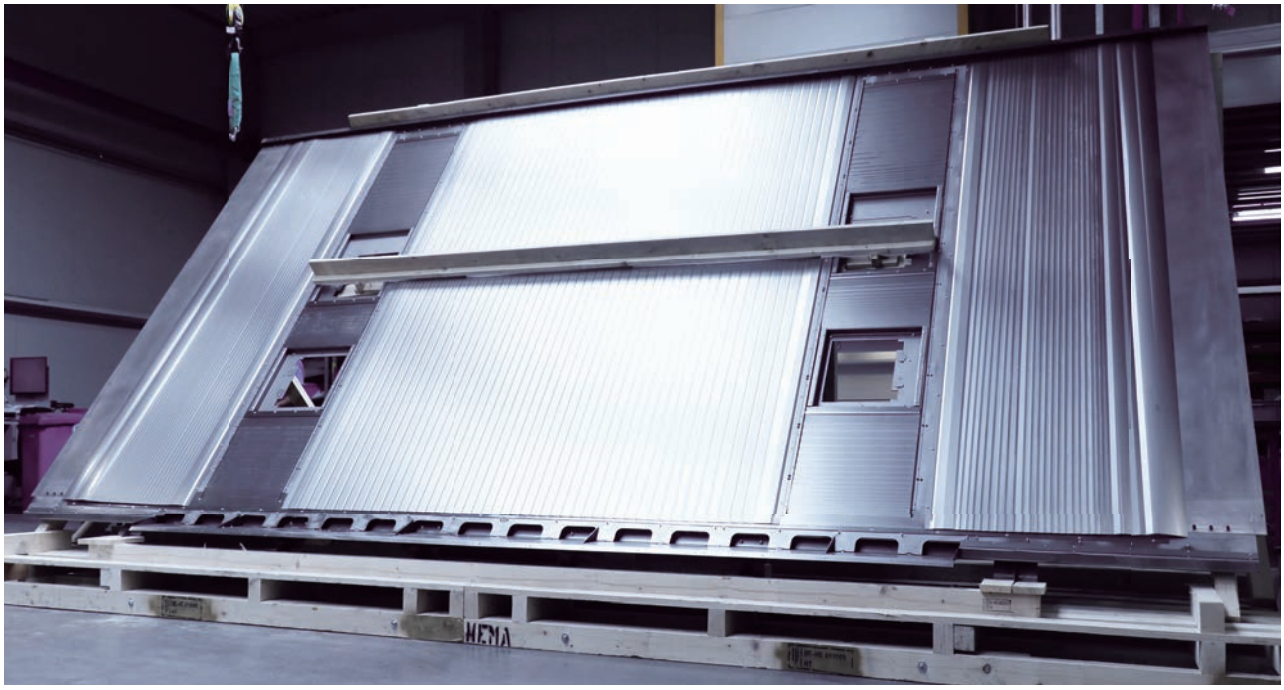
We manufacture back panel systems in many designs; many systems are designed for a moving column with a single spindle feedthrough. These example solutions show implemented back panel systems for two moving columns and up to six spindles.

Assembly and shipping

The prototype is assembled at the factory before series production begins. The backwall system can also be shipped fully assembled upon request. In this case, in addition to handling at the installation site, the overall size of the packaged cover for shipping and any potential transport limitations must be taken into account.



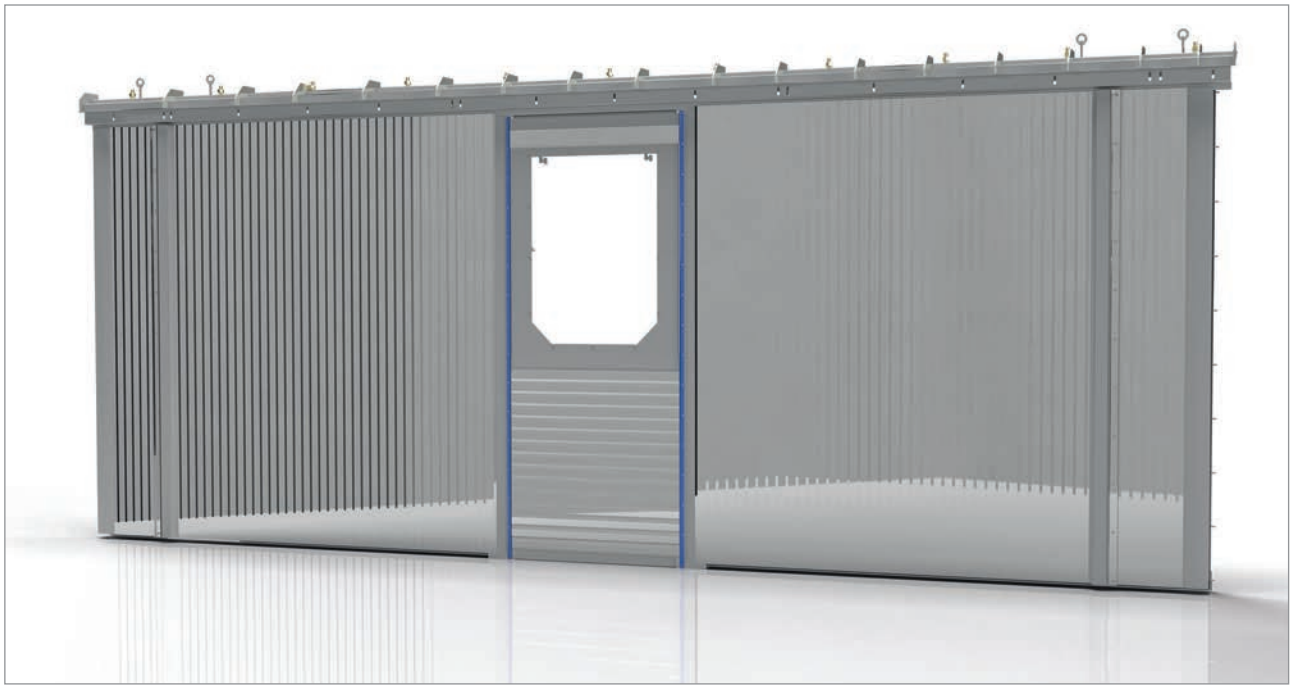
Ready-to-assemble backwall system, ready for shipment



Complete and ready-to-install backwall system, shipped in an inclined position due to the overall height

Backwall systems - example solutions

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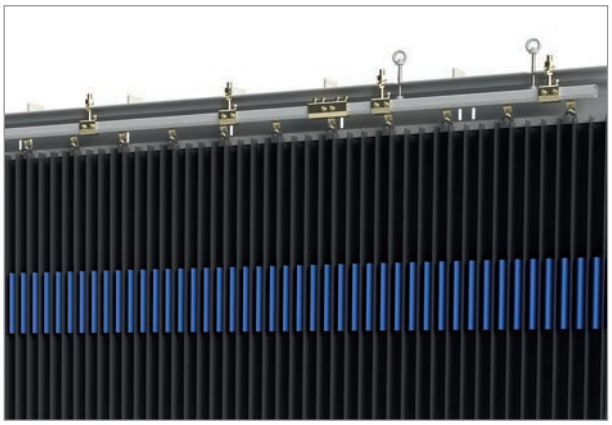
Backwall system without outer frame

Large backwall systems

These examples showcase large-scale rear wall systems with a total width of 15 m and an X-stroke travel of 9 m.
For the overall cover height of almost 6 m, SAMURAI bellows with a lamella length of 5.6 m were manufactured in a single-piece design.

Machine connection

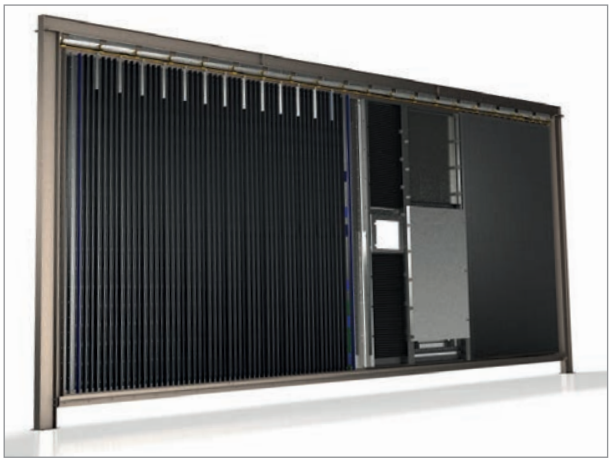
For connection to the machine tool, the backwall systems will be manufactured with a frame construction.
For particularly large overall widths, as an alternative to an external frame, the guides for the bellows on the X-axis can also be attached directly to the machine bed and the cabin by the customer.



Backwall system without outer frame, rear view helm rail



Backwall system with outer frame



Backwall with outer frame, rear view helm rail

Backwall for special machines



Backwall system for a special machine with eight bellows in two levels

Complete backwall system, special machine

For many machine tools, backwall covers are required to protect two axes and a spindle feedthrough and are designed accordingly. These covers incorporate four SAMURAI bellows for the X and Y axes. Combining bellows with FASTLAP lamella bellows in the area of the spindle feedthrough is also possible. All protective systems are typically located on a single plane.

Special machines for special manufacturing processes and conditions place special demands on the protection cover.

This complete system demonstrates a successful implementation of a backwall cover that protects multiple axes which are also located on different levels.

Eight SAMURAI bellows in the FASTAF and FASTAC types were integrated into this backwall:

- A SAMURAI FASTAC Bellows with lamellas bent at a 90° angle for a form-fitting corner seal
- B SAMURAI FASTAF Bellows in a forward second level for an additional travel axis
- C SAMURAI FASTAF Bellows to protect the X-axis



SAMURAI FASTAC Bellow

Due to the complexity of these covers and the manufacturing levels, the outer frame here only serves to guide the bellows for the X-axis.

The bellows for protecting the other axes were directly connected to machine components.

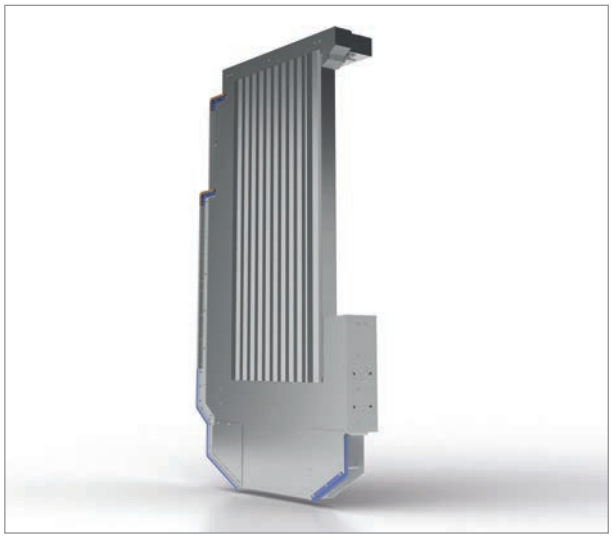
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Partition walls and combined solutions

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Partition wall systems

SAMURAI bellows are also used as a complete solution in partition wall systems for machining centres.
The partition wall system divides the machining area, allowing machining to continue in one segment while the workpiece is changed in the other.



Partition wall system for dividing the processing area

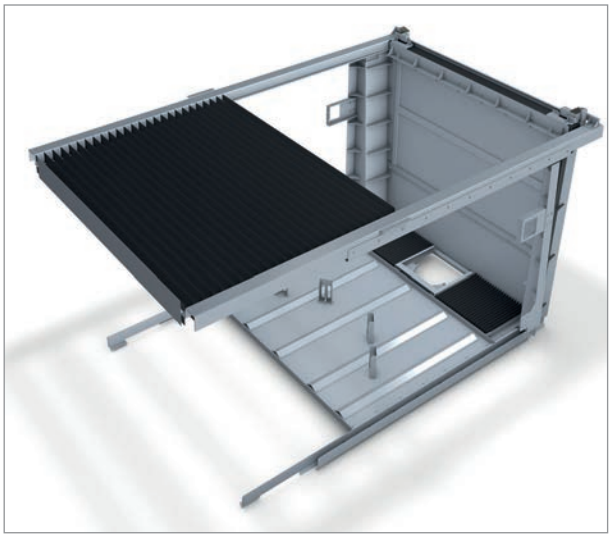
System solution for roof and wall cover

In a complex protective system for a complete internal lining of the work area, many components were integrated into one system - ELASTIC and SAMURAI bellows, roof covers, panels, and guide rails.

SAMURAI bellows are used to cover the work area; they are installed directly in the work area and protect against chips and coolant because of their stainless steel lamellas.



Complete system for the interior lining of a machining room

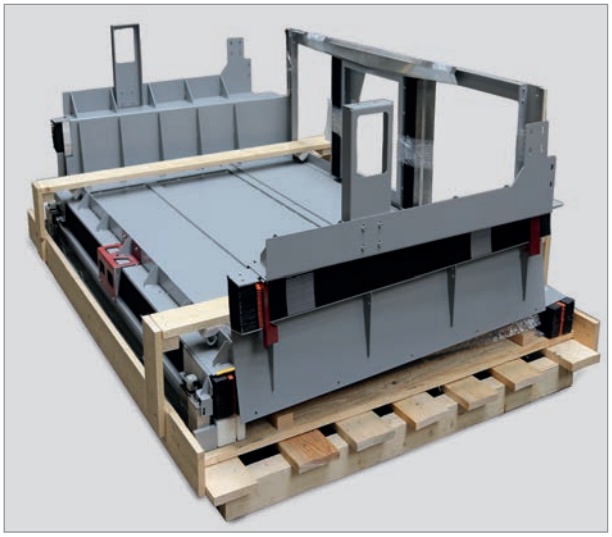


Roof cover based on doubled venetian blinds

Doubled venetian blind covers were used for the roof cover, with their guides securely positioned between the venetian blind covers, forming a kind of labyrinth seal to the outside.

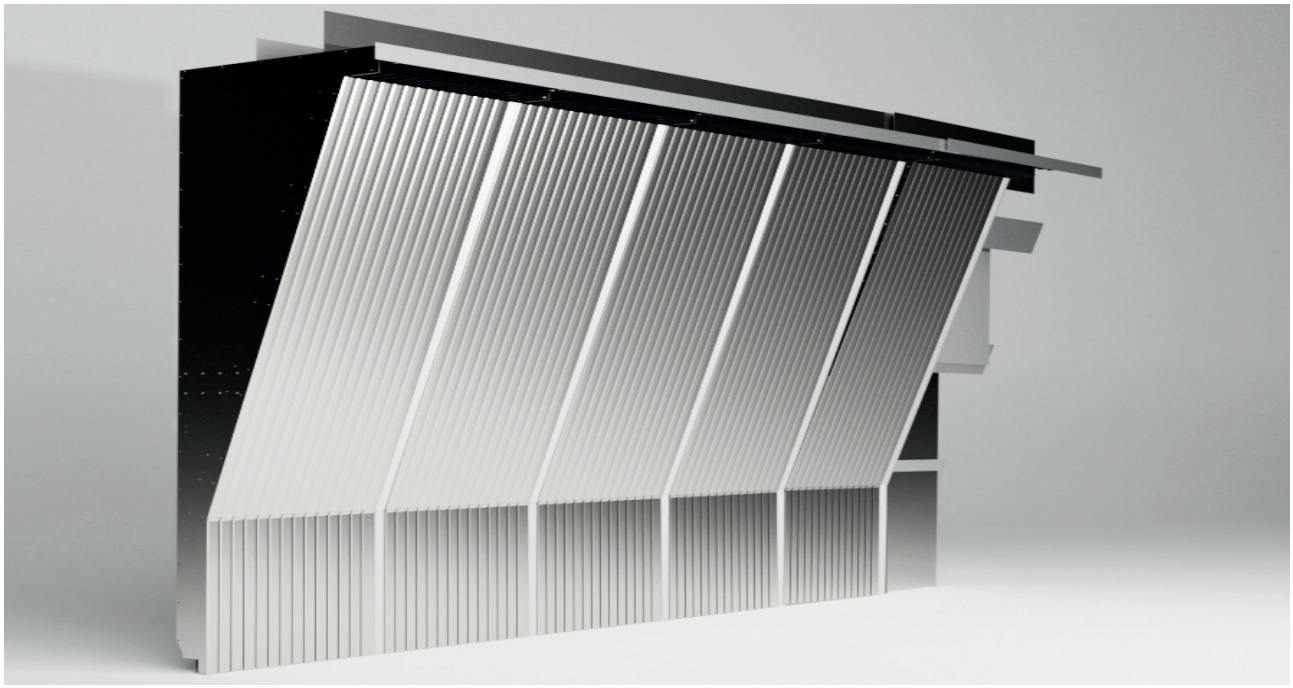
ELASTIC bellows close flexible access points – for the downward moving work spindle and for a loading crane.
A locking system allows the front roof cover to be detached from the cabin wall for opening and removed from the machine as a single unit during transport.

With measures of 2.5 meters wide, 4 meters long and 1.5 meters high, the protective system was initially assembled completely, but for shipping it was disassembled into assembly modules and compactly packed for transport.



Compact transport unit

Complex bellows solutions



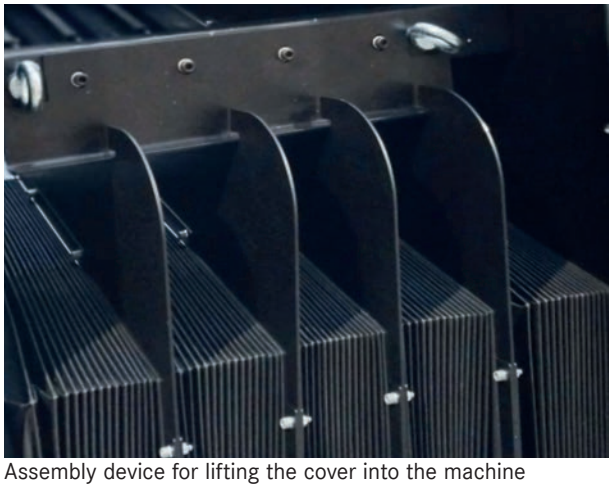
Complex bellows solution, modular design

Modular bellows solution

Large and complex bellows solutions are designed and manufactured modularly and can then be assembled individually. This simplifies installation on the machine, especially with large bellows.

For this special solution, the protective cover was divided into segments, each four meters long and manufactured individually. A pantograph mechanism on the inside of the protection cover, designed for the travel speed of the CNC machine, ensures smooth operation under dynamic loads.

The SAMURAI bellows were designed with a »tilted« shape featuring two-part, overlapping lamellas. This division ensures a smooth movement, while the overlapping design also provides a tight seal even at high speeds.



Assembly device for lifting the cover into the machine



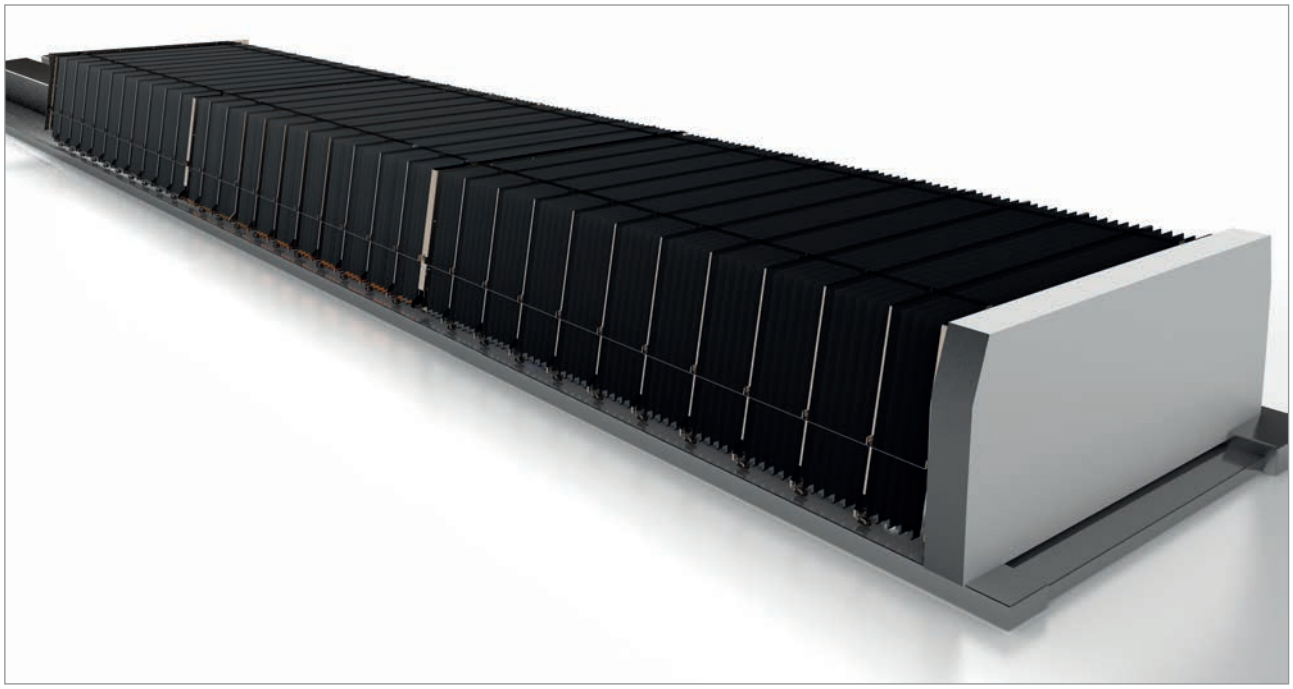
Individual shipping packaging for safe transport

Due to their weight, large protective covers are often manufactured in segments; a single segment frequently weighs several hundred kilograms. These individual segments can then be used to assemble the protection system in the machine tool.

Upon request, the bellows can also be shipped fully pre-assembled and ready for installation. Special transport and installation equipment is then designed and installed to facilitate the handling and installation of these large bellows.

Complex bellows solutions

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XXL bellows solution with a total extension of 17 meters

Bellows solution in XXL

In addition to back wall systems for multiple axes in large dimensions, we have also implemented bellows to protect an axle with extension lengths of up to 30 meters.

In this implemented bellows solution, based on an ELASTIC bellows, the total length was achieved by dividing it into individual segments of approximately 5 meters.

The segments are bolted together to ensure the bellows' total mass can be safely moved at a machine speed of approximately 30 m/min.

When designing a bellow of this size, the inertia and the sequential procedure must be taken into account.



Modular design of the bellows



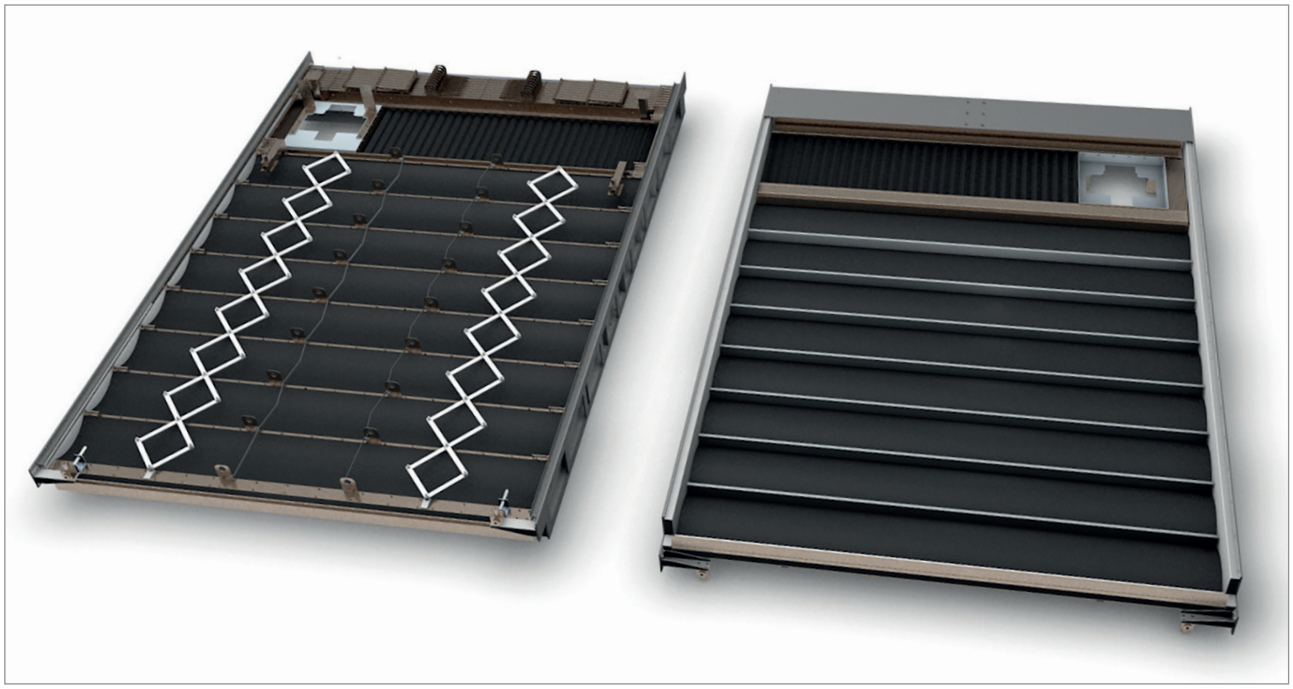
Low-friction running through a combination of roller and gliders

In this process, one fold after another is extended until the total extension length is reached. The stress on the front folds is absorbed by extension limiters.

To ensure the stability of this large design, special reinforcements and an extension limiter were installed, designed to support the total weight of the bellows solution and the travel speed of the system.

The modular design also allows individual segments to be replaced if the bellows is damaged.

Roof cover



Roof covers from above (left) with pantograph system and view from the working space (right)

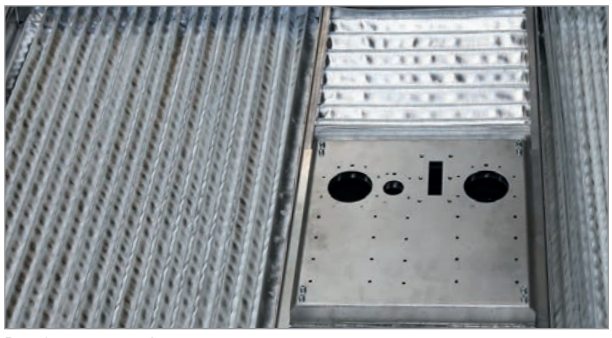
Roof covers in machine tools

Roof covers are used in many applications and machines. Machine tools without roof covers can severely contaminate the production environment with splashing coolant and flying chips.
The ambient air is also contaminated by the fumes generated during machining, and slippery floor surfaces can result.

Roof covers for 3D printers

In addition to roof covers for conventional machine tools, we also manufacture roof covers for 3D printers.
Unlike roof covers used in machining tools, the focus here is on temperature shielding the work area from the manufacturing environment.

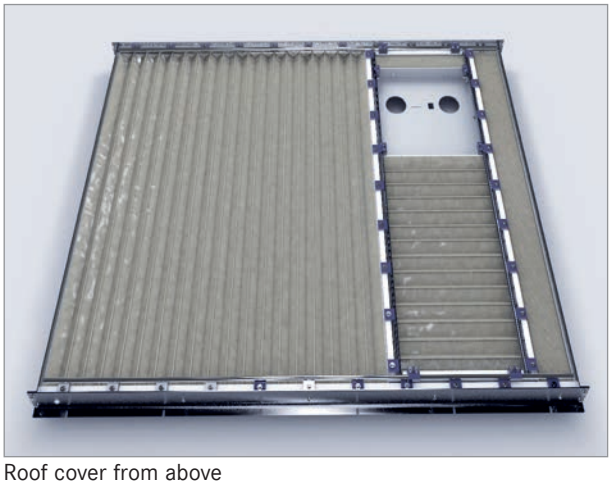
For 3D printers that operate in high-temperature environments, we use special textile materials and a special bellows construction without plastic components such as support frames and without adhesives.



Roof cover work area



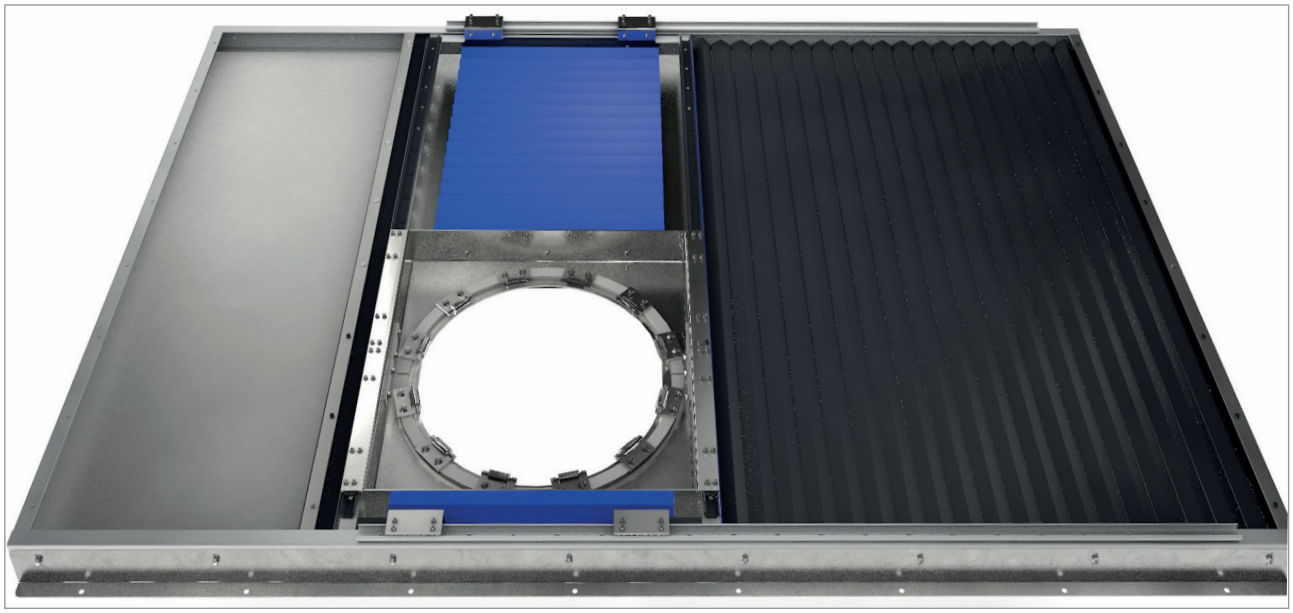
Roof cover, working space side



Roof cover from above

Roof cover, special machines

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Roof cover with special spindle feedthrough

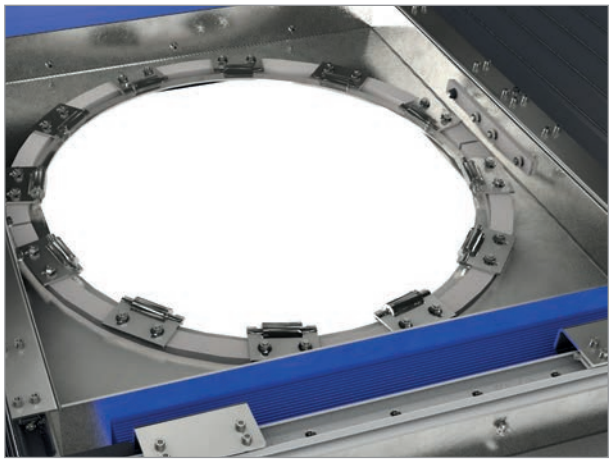
Roof cover for special machines

Special machines require special protective solutions. In this roof cover solution, SAMURAI bellows with lamellas were installed overhead.

The spindle guide was custom-designed for a robot arm with a protective tube and concave guide rollers. This allows for flexible tilting of the spindle axis for a trouble-free and precise machining process.

For low-effort, smooth operation, the roof cover was equipped with linear guides at the spindle window and inner frame for movement along the X and Y axes.





Spindle guide with concave rollers



View from inside the machine

Roof cover X-Velo

The X-Velo roof cover is a special design with translucent material and is suitable for both new and existing machines.

The folds are 250 mm in height, and close almost flush with the cover so that no dirt can get out. If individual chip particles settle on the X-Velo, the open profile of the X-Velo enables the folds to be cleaned easily.

Despite the fact that it is covered, the machining room stays well-lit as the material used for the folds is translucent.



X-Velo roof cover, top view

Because of its modular design, the X-Velo roof structure is extremely adaptable. Roof structures with a width of 10 m or a length of 20 m have already been implemented; even greater lengths are possible after individual assessment.

The X-Velo is designed for travel speeds of up to 75 m per minute.

Thanks to the connecting elements used, the X-Velo roof cover cannot tilt during operation.



X-Velo connecting elements with metal rollers

The X-Velo is available with or without a motor upon request, and depending on the variant, with metal or rubber-coated roller.

The X-Velo roof cover at a glance

- Custom length, up to 20 m, custom solutions on request
- High speeds of up to 75 m/minute
- Material lets in light
- No twisting thanks to our special fasteners
- Easy to clean (open profile)
- Cover is easy to screw on, screw thread goes all the way through the profile
- Guide rails are included with delivery
- A motor drive can be integrated as an option
- Shutters that fit the drive perfectly
- **Ideal for retrofitting and original fitting**



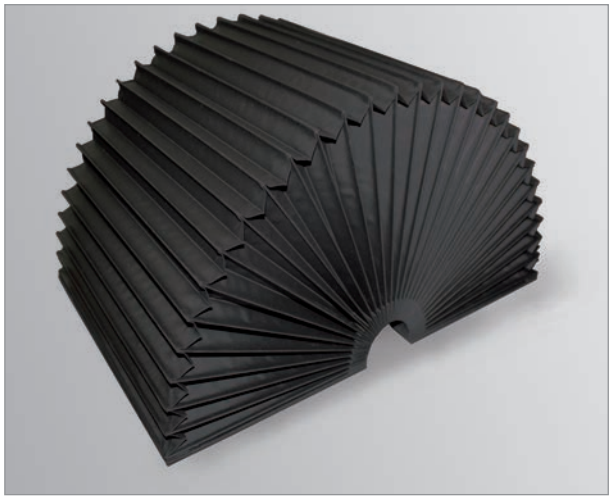
X-Velo roof cover, top view

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ELASTIC Bellows

ELASTIC Bellows are commonly used for protecting machines and devices against debris and chips. Bellows are used in many variations to protect guides from contamination, for example, and also as a safety device to prevent accidental contact.
Based on the design and manufacture of many thousands of bellows and their practical application, we continuously improve this product, incorporating improvements in its shape and processing to extend its service life. Our specialists consistently meet increasing demands due to rising travel speeds, noise levels, and complexity.

We manufacture bellows in many sizes, from just a few centimeters wide to bellows with an extension of 15 meters and more.



ELASTIC bellow

The advantages of bellows as protection covers:

- Optimal use of space
- Special materials and space-saving designs for guideways
- Complete systems - bellows integrated into a machine backwall system, complete with guide and mounting
- High temperature materials for laser, plasma and welding applications
- Special designs for high-temperature environments of 3D printers
- Special designs for high-speed applications
- Impermeability to coolants

Design

ELASTIC bellows comprise a large product range with numerous combination options.
The basic components, material, shape, and manufacturing method are tailored to the specific application.



Bellow for elevating platform in use

Gliders and roller elements

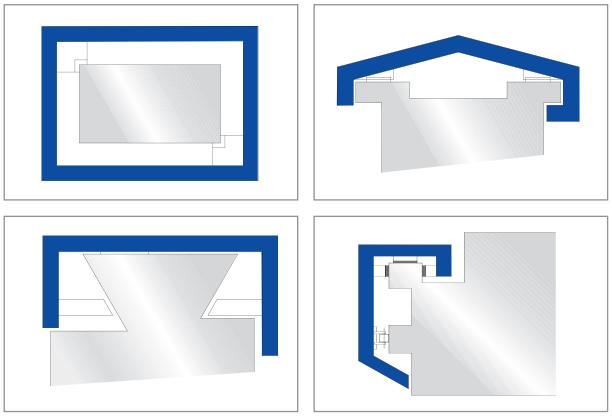
The additional use of gliders, roller elements or ball bearings results in smoother running and thus a longer service life, even in HSC applications, thanks to the low-friction process.

Mounting

ELASTIC bellows are secured at the ends using metal end frames or hook-and-loop fasteners as standard.

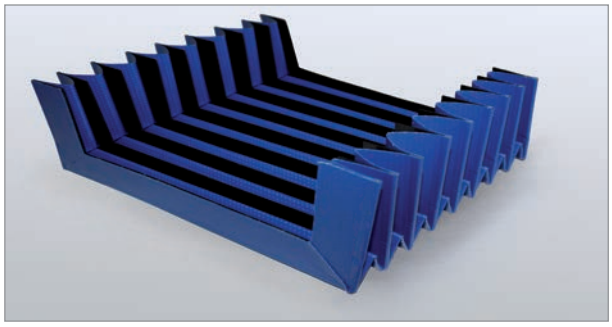
Material

Depending on the intended use of the bellows, the most suitable material is selected from a wide range of standard options. The standard material colour for ELASTIC bellows is black; special colours are available upon request. Heat-resistant and self-extinguishing materials compliant with UL 94 are also available.



Examples of types; special solutions available upon request

ELASTIC Bellows



U-shaped bellow with stabilizing support frame

Design of the ELASTIC bellows

The essential component of the ELASTIC bellows is a stabilizing support frame in each fold, combined with the individual cover material. This support frame ensures consistently high dimensional stability. Even in the event of mechanical deformation, this structure allows the bellows to return to its original shape. Various materials are available for the support frames, depending on the application.
The connection between the bellows material and the support frames can be achieved using different processing methods:

- Thermal bonded version
- HF welded version
- Sewn version

Thermal bonded version

For applications requiring maximum strength, the support frames are bonded under temperature conditions and using special fluxes.
This creates a permanent bond between the inner support frame and the outer bellows material. These bellows are dustproof and oil-resistant.

HF welded version

In the production of large, lamellar bellows, the support frames are joined to the bellows material using high-frequency welding (HF welding). This process achieves not only optimal dimensional stability but also a clean and uniform appearance.

Sewn version

Sewn bellows are used in high-stress applications. Heat-resistant yarns are also available for high temperatures.

Mounting

Bellows are attached to machines and systems primarily by means of:

- End frame made of metal or plastic, manufactured according to individual specifications
- Velcro fastener, quick and easy to clean.

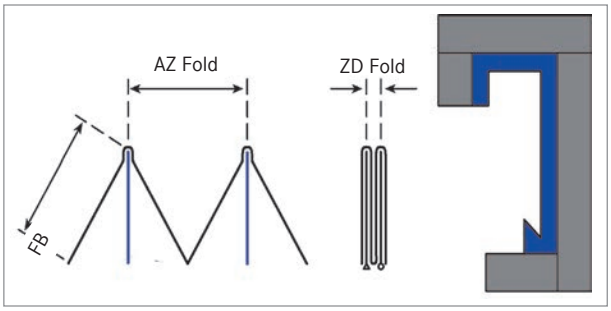
Material ELASTIC Bellows	water-repellent	emulsion (oil) resistant	chemical-resistant	Resistant to hot chips/sparks	self-extinguishing	Colour	Material thickness [mm]	Roll width [mm]	Recommended temperature range min/max [°C]	Material Base
ERA-7810	■	■	□	□	□	black	0.35	1500/2150	-30°C +90°C	Polyester
ERA-7815	■	■	□	□	□	black	0.22	1500	-30°C +90°C	Polyester
OZ-PUR-S	■	■	□	□	□	black	0.35	1500	-30°C +90°C	Polyester
Nylon-PU	■	■	□	□	□	black	0.21	1700	-20°C +70°C	Polyester
OZ 23	■	▪	□	□	□	black	0.23	1500	-30°C +70°C	Polyester
OZ 35	■	▪	□	□	□	black	0.35	1550/2150	-30°C +70°C	Polyester
PP 0.55*	■	■	□	□	□	translucent black	0.55	1600	0°C +70°C	Polypropylen
PU-PTF	■	■	▪	□	□	black	0.35	2150	-30°C +90°C	Polyester
PUR Teflon 0.27	■	■	▪	▪	□	black	0.30	1500	-30°C +90°C briefly °C**	Polyester
Firetex	■	■	□	▪	■	black	0.39	1500	-20°C +160°C briefly °C**	Sonder-Polyester
Preotex 0.30	▪	▪	□	■	■	black	0.40	1500	-20°C +160°C briefly °C**	Panox/Para-Aramid
Preotex 0.35	□	□	□	■	■	black	0.40	1500	-20°C +160°C briefly °C**	Panox/Para-Aramid
Preotex 0.60	▪	□	□	■	■	black	0.55	1500	-20°C +160°C briefly°C**	Panox/Para-Aramid

Other materials for special applications available on request

■ fulfills the requirement ▪ partially fulfills the requirement □ does not meet the requirement
* conditionally suitable for bellows ** Consultation required

ELASTIC BELLOWS

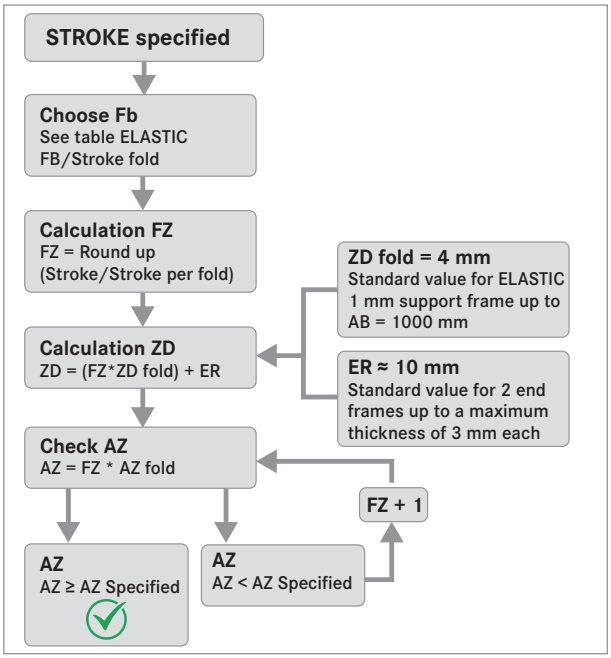
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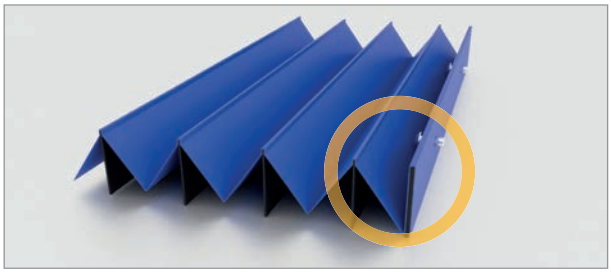


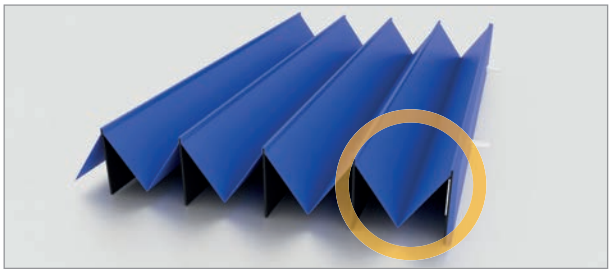
ELASTIC bellows			
Fold width (FB) mm	**Extension per fold (AZ fold) mm**	**Compression per fold (ZD fold) mm**	**Stroke per fold (Stroke fold) mm**
20	30	4 Standard value for ELASTIC bellows with 1 mm support frame, up to AB 1000 mm	26
25	40		36
30	50		46
35	60		56
40	70		66
45	80		76
50	90		86

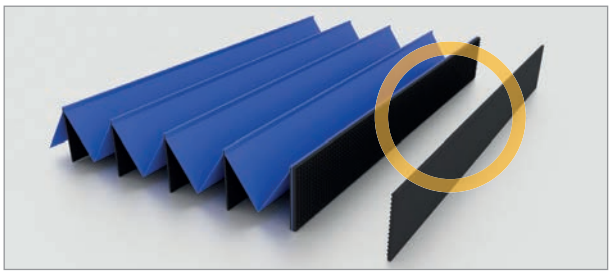
Calculation		
Stroke	given	
FZ	=	Stroke/Stroke fold rounded up to the nearest whole number
AZ	=	FZ*AZ fold
ZD	=	FZ*ZD fold + ER
ER	≈	10 mm (standard value for 2 end frames up to a maximum thickness of 3 mm each)

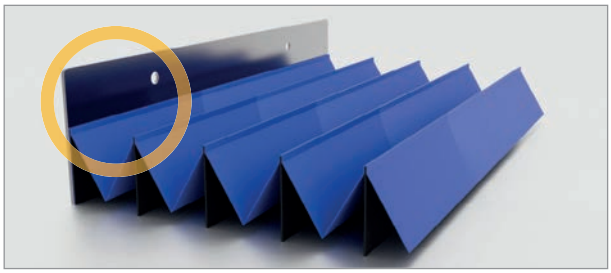
Note:
If, in addition to the hub, the extraction (AZ) and/or compression (ZD) are also specified:
Check that AZ > AZ specification and ZD < ZD specification, otherwise

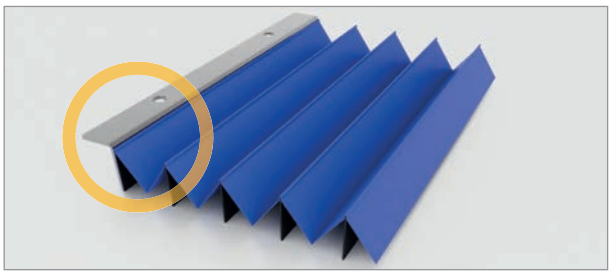



Bellows with »half fold«, end flanges can be attached from the outside (visible side)


Bellows with »full fold«, attachment of the end flanges only possible from the inside (rear)

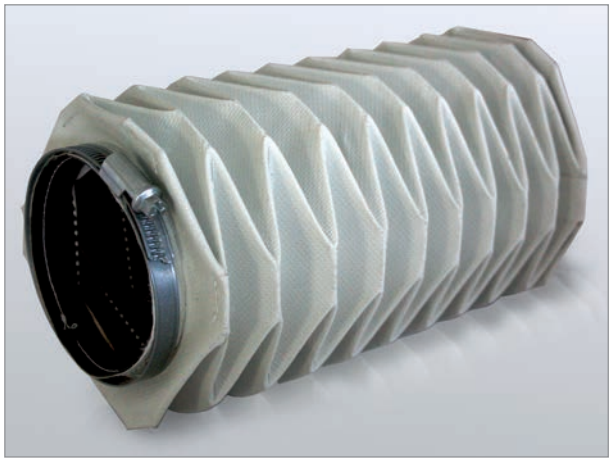

Bellows attachment with velcro tape


Bellows attachment with »protruding« end frame

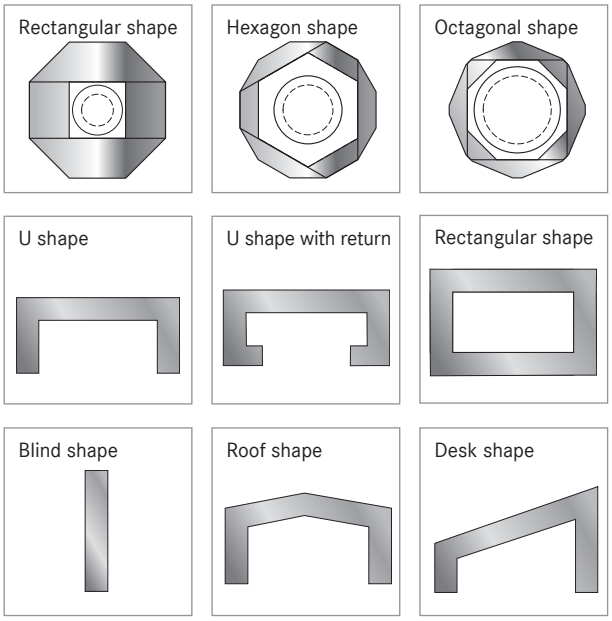

Bellows attachment with end frame »tilted«

LAMINAT BELLOWS

LAMINAT bellows already exhibit high inherent stiffness due to the combination of two materials and can be manufactured in various shapes.



LAMINAT Bellows with octagon section and strap retainer



Selection of possible designs

Application

LAMINAT bellows are used, for example, in spindle lifting drives or measuring machines. They serve as protective elements for columns, guides, rods, spindles, and shafts. All laminate bellows can be used for horizontal and vertical applications and feature smooth and very quiet running characteristics.
The surface structure and the regularity of contours present an appealing overall appearance.

Material

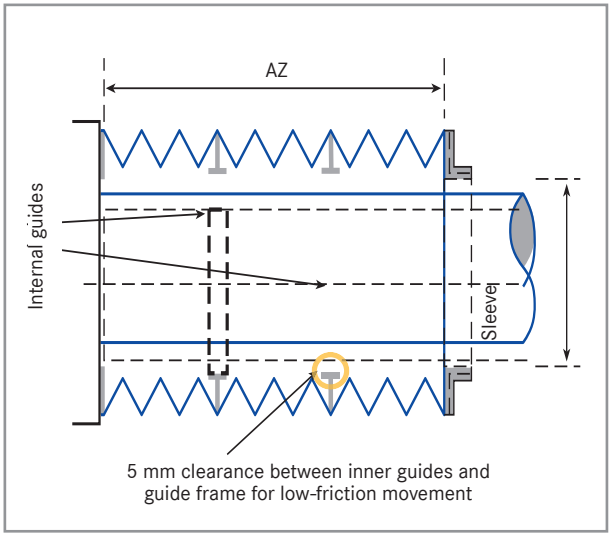
LAMINAT bellows can be customized to the specific application by selecting the appropriate material, shape, colour, and dimensions.
The basic design principle of LAMINAT bellows is based on a two-material component structure. The desired outer material and the inner material selected by HEMA engineers are bonded together. Plastic or metal intermediate frames provide additional stability.

Design

Like the ELASTIC Bellows LAMINAT Bellows can also be designed and produced in a variety of forms.
LAMINAT Bellows are primarily used to cover and protect columns and spindles. Rectangular, hexagonal, octagonal and twelve-sided sections are available as well as roof and inclined shapes and Venetian blind style standards.

Polygonal shape with supporting elements

The cross-sectional view below shows an example of a design solution for horizontal applications.
Additional intermediate frames with guide rings or T-pieces are used for support on the shaft or spindle. With a clearance of 5 mm, these internal guides guarantee smooth and low-friction movement of the laminate bellows.

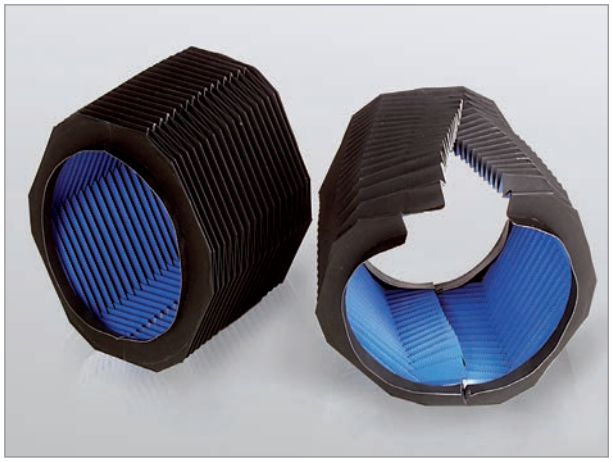


Sectional view of bellow with support elements

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LAMINAT bellows

Laminate bellows are also available in a split design. This design allows for quick replacement and is also suitable for retrofitting.



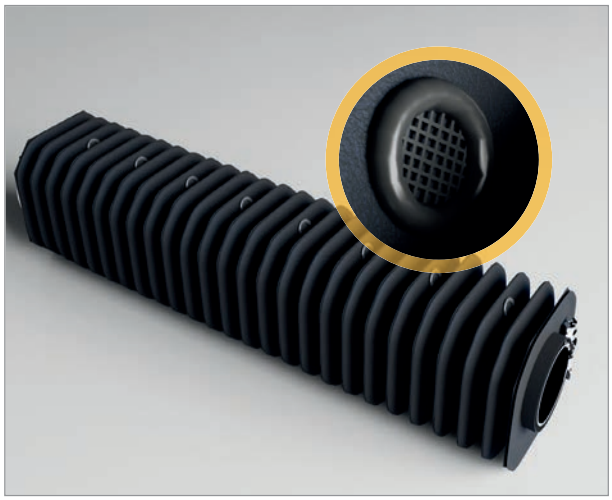
Split version for fast mounting or retrofitting

Mounting

The LAMINAT bellows can be attached using Velcro, metal end frames or sleeves with fastening tension straps (only for polygonal shapes).

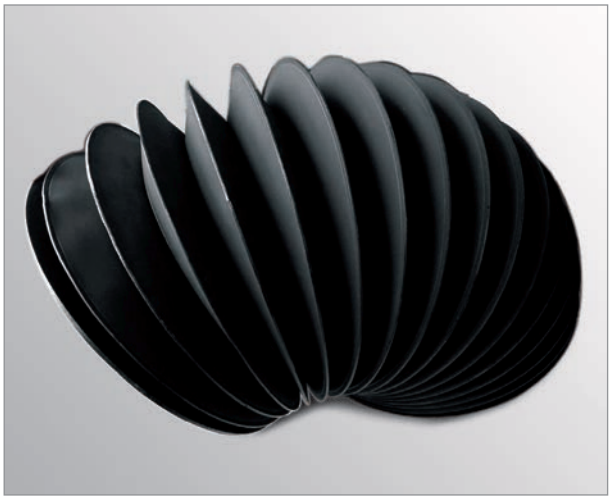
Optional equipment

For LAMINAT bellows in closed molds, adequate ventilation is required; this is achieved at the factory through perforations. Optionally, the perforations can be fitted with filter inserts.



LAMINAT bellow with punching and filter inserts (optional)

HF round bellows



Bellow high-frequency welded

The high frequency welded bellows consist of punched disks welded inside and outside. They offer exceptional dimensional stability, high transverse stiffness, and are characterized by low compression dimensions. This type of bellows is particularly suitable for use on spindles and shafts.

Material

The HF bellows are liquid-tight and resistant to oil and coolants. TPU045/080 is used as the standard material.

Installation position

HF bellows can be used horizontally or vertically. Depending on the design, the bellows can be equipped with additional plastic support and guide rings, which ensure a consistent distance from the spindle.
For large extensions, the stability of the bellows can be increased by installing a wire ring in each fold. Metal frames are used for connection and mounting; alternatively, sleeves are also possible.

Note

When selecting the bellows type, the inner diameter should be **at least 10 mm larger** than the outer diameter of the round part to be protected.

HF ROUND BELLOWS (LIQUID-TIGHT)

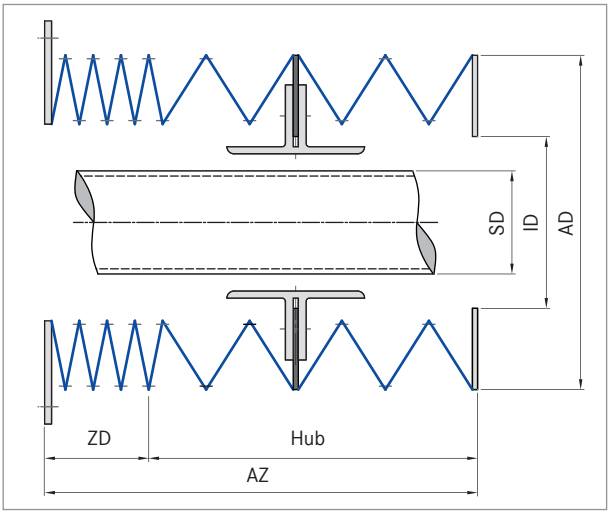
Type	AD [mm]	ID [mm]	FB [mm]	FAZ [mm]	FZD [mm]	Material
HF45	45	15	15	10		
HF54	54	15	19.5	15		
HF61/1	61	26	17.5	12		
HF61/2	61	30	15.5	10		
HF65/1	65	25	20	15		
HF65/2	65	30	17.5	12		
HF65/3	65	35	15	10		
HF70/1	70	25	22.5	16,5		
HF70/2	70	30	20	15		
HF70/3	70	35	17.5	12		
HF75/1	75	25	25	19		
HF75/2	75	30	22.5	16,5		
HF75/3	75	35	20	15		
HF75/4	75	42	16.5	11		
HF80/1	80	30	25	19		
HF80/2	80	35	22.5	16.5		
HF80/3	80	45	17.5	12		
HF80/41	80	50	15	10		
HF85/1	85	45	20	15		
HF85/2	85	50	17.5	12		
HF90/1	90	50	20	15		
HF90/2	90	60	15	10	1.3	TPU045
HF95/1	95	60	17.5	12		
HF95/2	95	65	15	10		
HF100/1	100	60	20	15		
HF100/2	100	65	17.5	12		
HF105/1	105	60	22.5	16.5		
HF105/2	105	65	20	15		
HF105/3	105	70	17.5	12		
HF110/1	110	65	22.5	16.5		
HF110/2	110	70	20	15		
HF120/1	120	80	20	15		
HF120/2	120	85	17.5	12		
HF120/3	120	89	15.5	10		
HF130/1	130	85	22.5	16.5		
HF130/2	130	89	20.5	15		
HF130/3	130	95	17.5	12		
HF135/1	135	85	25	19		
HF135/2	135	89	23	17		
HF135/3	135	95	20	15		
HF145/1	145	95	25	19		
HF145/2	145	115	15	10		
HF150	150	115	17.5	12		

Other dimensions and geometries available upon request

Type	AD [mm]	ID [mm]	FB [mm]	FAZ [mm]	FZD [mm]	Material
HF155/1	155	115	20	15		
HF155/2	155	120	17.5	12		
HF155/3	155	125	15	10		
HF160/1	160	115	22.5	16.5		
HF160/2	160	120	20	15		
HF160/3	160	125	17.5	12		
HF175	175	125	25	19		
HF190/1	190	146	22	16		
HF190/2	190	155	17.5	12	2.2	TPU080
HF216	216	160	28	22		
HF225	225	190	17.5	12		
HF235/1	235	190	22.5	16.5		
HF235/2	235	200	17.5	12		
HF245/1	245	200	22.5	16.5		
HF245/2	245	210	17.5	12		
HF270/1	270	210	30	24		
HF270/2	270	233	18.5	15		
HF310	310	270	20	15		

Other dimensions and geometries available upon request

Legend	
AZ	Maximum extension
ZD	Minimum compression
FAZ	Fold extension
FZD	Fold compression
AD	Outside diameter
FB	Fold width
ID	Inside diameter
SD	Diameter of spindle



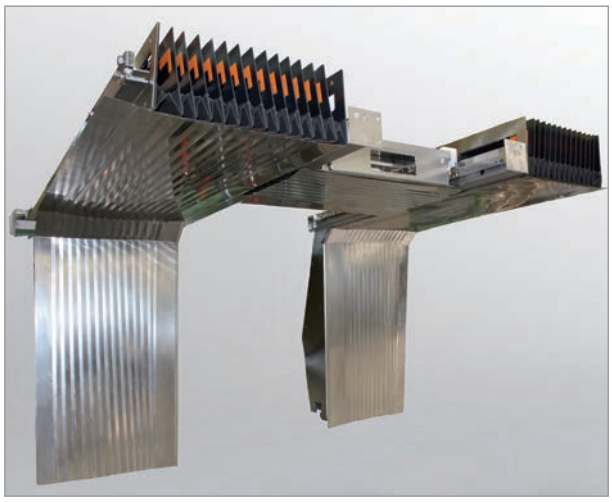
Cross-sectional view of HF bellows

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SAMURAI Bellows

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The SAMURAI bellows in the FASTAF and FASTAC versions consist of an ELASTIC bellows with additional protection provided by lamellas. The lamellas are fixed to the upper edge of the folds, further reinforcing the bellows and effectively protecting the bellows fabric against fast-moving, very hot, and sharp-edged chips during machining.



Example of SAMURAI bellows as a ready-to-install complete solution including locking system for roof loading

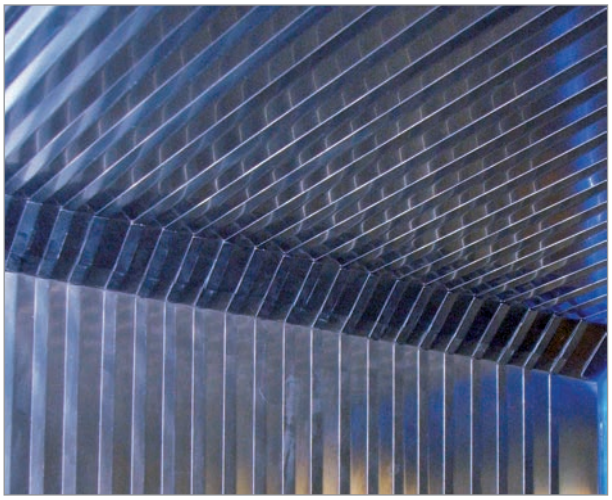
SAMURAI bellows are very well suited for highly dynamic applications with speeds over 100 m/min and accelerations up to 2g.

Design

For the SAMURAI bellows, all materials, shapes, processing methods and dimensions of the ELASTIC series can be combined as desired.

Lamellas

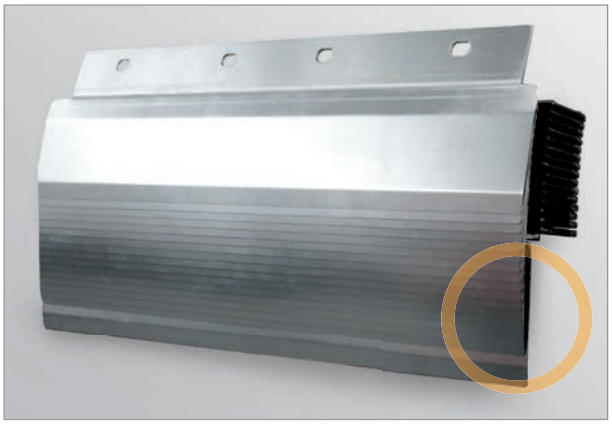
The lamellas are manufactured from stainless spring steel. The high contact pressure and the wiping action of the lamella edge across the entire lamella surface ensure effective wiping.
In accordance with our high quality standards, we use lamellas with rounded wiping edges, which minimizes the formation of abrasion marks on the lamella sheets.
SAMURAI bellows can be installed in any orientation; however, due to their lightweight construction, they are not walkable.
Depending on the application, installation space, and environmental conditions, we use SAMURAI bellows with fixed or movable slats.



SAMURAI Vector bellows with »closed« surface for the machining area

FASTAF

FASTAF types are SAMURAI Bellows with fixed lamellas. Owing to this design the lamellas overlap. The lamellas are hinged or clipped. The design must take into account an overhang of the slats due to the technical concept.
The lamellas can be attached using clips or, alternatively, with eyelets, and can be replaced later if damaged.



SAMURAI FASTAF, example view of the »lamella protection«

Special design FASTAF VECTOR

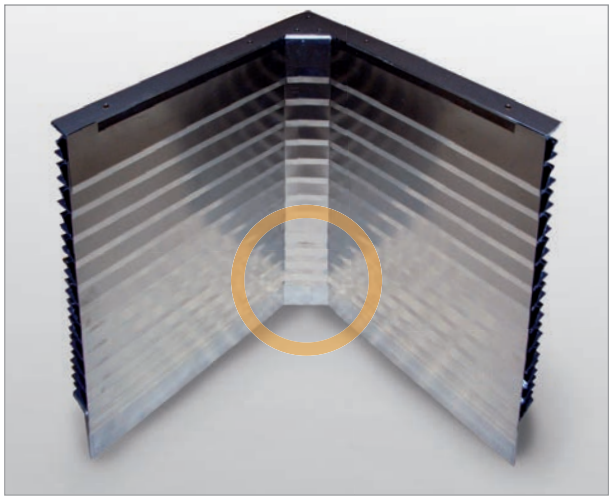
The FASTAF VECTOR bellows type is a specialized solution for machining centres requiring continuous coverage of the work area, including, for example, the back wall and roof space. Due to a special design of the fixed mounted lamellas a complete coverage of the corner area is ensured, and only one bellow is needed for the protection cover.

SAMURAI Bellows



SAMURAI Vector Outside

In a 90° application, two overlapping lamellas in the corner area achieve very good sealing and wiping action; additional lamellas are not required. This allows for better utilization of the available installation space and largely prevents contamination, even in the corner area.

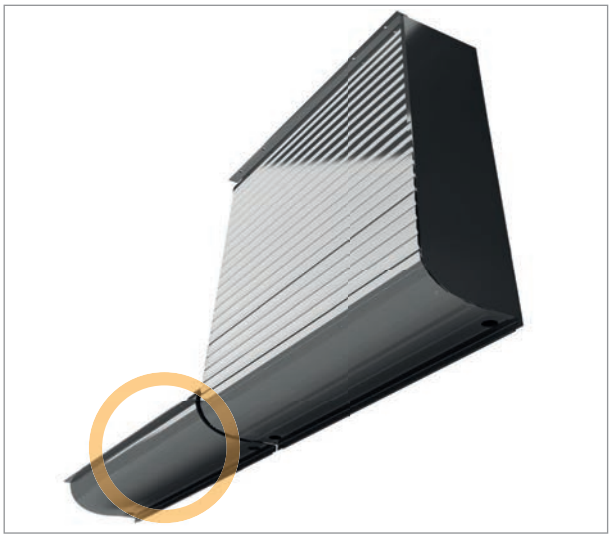


SAMURAI Vector Inside

The VECTOR bellows features two overlapping, angled lamellas as chip protection, attached to each fold.
This design, which remains reliable even at high travel speeds and accelerations, can be flexibly configured in terms of internal angles, external angles, or combinations of several coupled angles.

FASTAF TW for limited installation space

The SAMURAI FASTAF TW is particularly suitable for machines with limited installation space, as this cover »works around the corner«. The compression dimension of the protective cover is shifted by 90°, allowing for greater design flexibility.

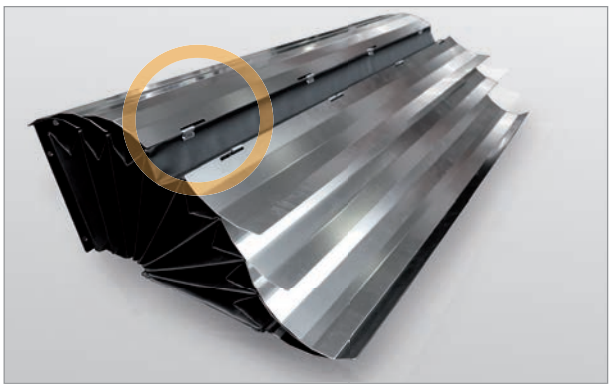


SAMURAI FASTAF TW for limited space

The tightness of the spring steel lamellas in the radius area is essential; this is achieved by cleverly shifting the force flows and stresses of the installed parts.

FASTAM

SAMURAI FASTAM bellows feature flexibly mounted lamellas, eliminating the need to account for lamella overhangs. The lamellas automatically stack up when the cover is closed.
The lamellas are secured with clips or, alternatively, eyelets, and can also be replaced if damaged.



SAMURAI FASTAM, flexible fixed lamellas

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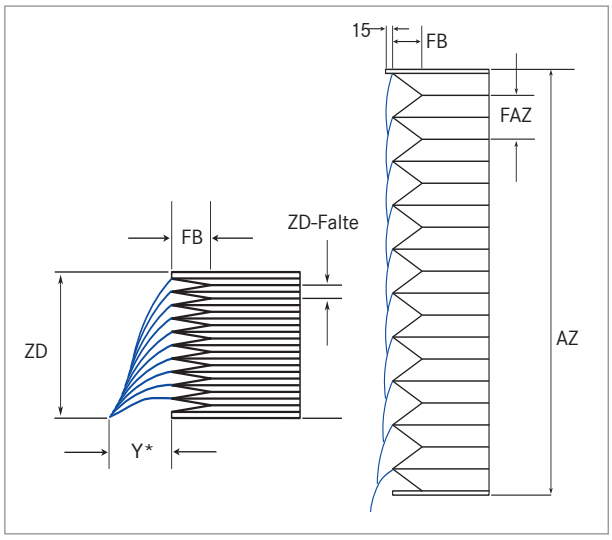
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SAMURAI Bellows FASTAM				
Fold width (FB) mm	Extension per fold (AZ fold) mm	Compression per fold (ZD fold) mm	Stroke per fold (Stroke fold) mm	Y*
20	30	4.5 Standard value for FASTAM bellows with 1 mm support frame, up to AB 1000 mm	25,5	50
25	38		33.5	60
30	48		43.5	70
35	55		50.5	80
40	65		60.5	90
45	75		70.5	100
50	85		80.5	110

Calculation		
Stroke	given	
FZ	=	Stroke/Stroke fold rounded up to the nearest whole number
AZ	=	FZ*AZ fold
ZD	=	FZ*ZD-Falte + ER
ER	≈	10 mm (standard value for 2 end frames up to a maximum thickness of 3 mm each)

Note:
If, in addition to STROKE, the extension (AZ) and/or compression are also specified:
Check that AZ > AZ specification and ZD < ZD specification; otherwise select a different fold with (FB)

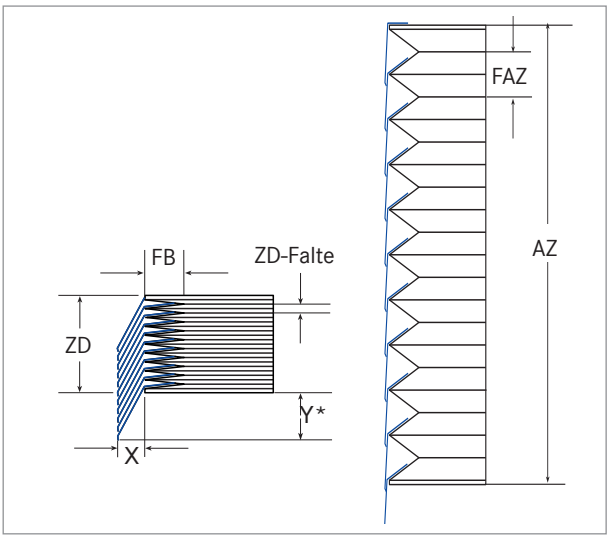


Schematic drawing FASTAM

SAMURAI Bellows FASTAF					
Fold width (FB) mm	Extension per fold (AZ fold) mm	Compression per fold (ZD fold) mm	Stroke per fold (Stroke fold) mm	X	Y*
20	25	4.5 Standard value for FASTAF bellows with 1 mm support frame, up to AB 1000 mm	20.5	20	40
25	35		30.5	25	50
30	45		40.5	25	60
35	50		45.5	30	65
40	60		55.5	35	75
45	70		65.5	40	85
50	80		75.5	50	95

Calculation		
Stroke	given	
FZ	=	Stroke/Stroke fold rounded up to the nearest whole number
AZ	=	FZ*AZ fold
ZD	=	FZ*ZD fold + ER
ER	≈	10 mm (standard value for 2 end frames up to a maximum thickness of 3 mm each)

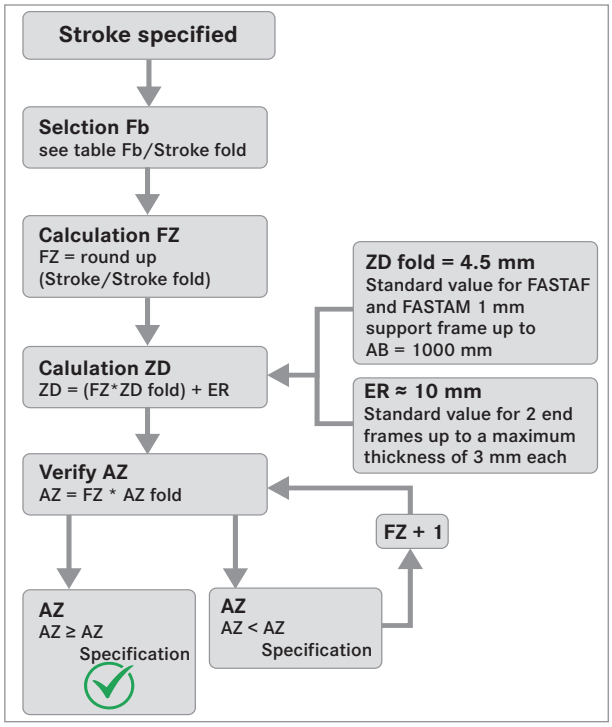
Note:
If, in addition to STROKE, the extension (AZ) and/or compression are also specified:
Check that AZ > AZ specification and ZD < ZD specification; otherwise select a different fold with (FB)



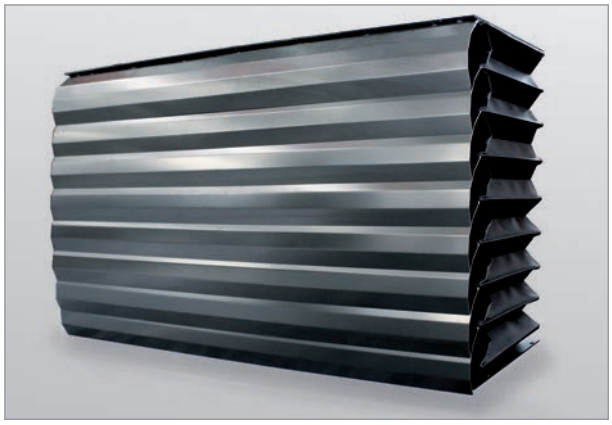
Schematic drawing FASTAF

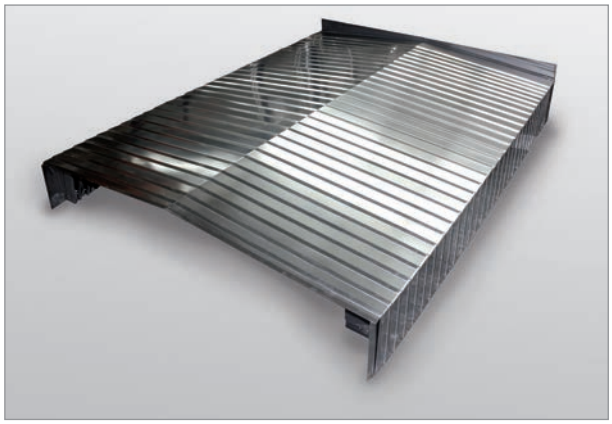
* When using guide plates between the bellows and the lamellas, the lamella projection (Y) must be increased by 15 mm.

SAMURAI Bellows

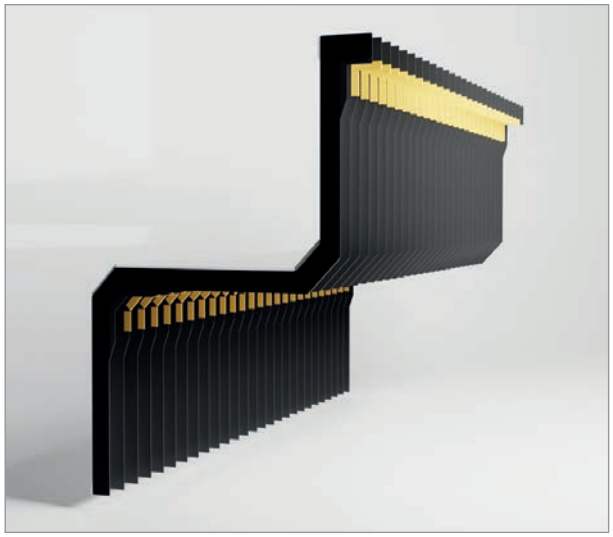


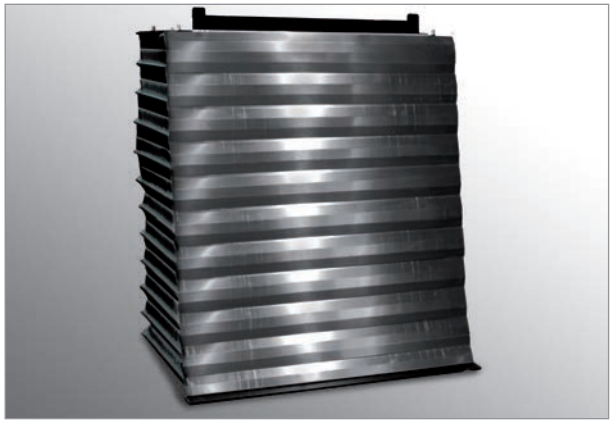
Calculation and verification of FASTAF and FASTAM bellows


SAMURAI FASTAM


SAMURAI FASTAF as a special solution


SAMURAI Vector, special solution combining inside and outside, view »machine workspace«


SAMURAI Vector, custom solution combining inside and outside, rear view


SAMURAI FASTAM

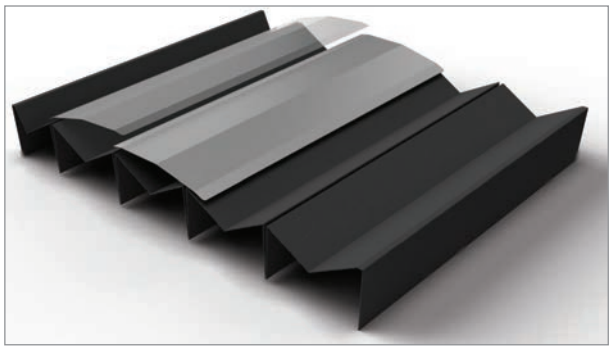
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SAMURAI Bellows

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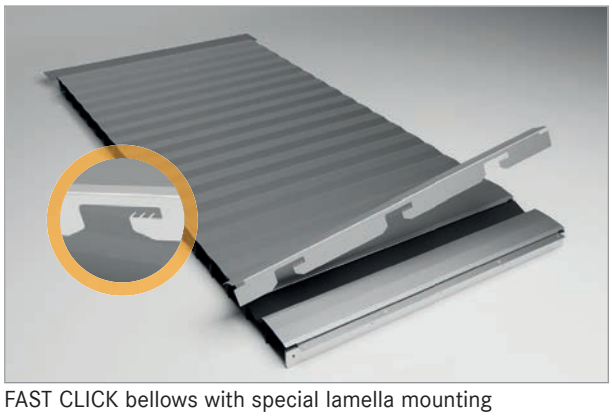
SAMURAI Bellows FAST CLICK

The FAST CLICK bellows feature a high-performance design with an optimized block-to-extension ratio. This type of bellows uses two materials: polypropylene (PP) for the bellows and spring steel for the lamellas.
The lamellas click directly into the bellows material and can be easily replaced if damaged or separated.
FAST CLICK bellows are manufactured without the use of adhesives.



FAST CLICK bellows are characterized by a very good compression-to-extension ratio

- Extension per fold is significantly higher than with other SAMURAI bellows types; fold width can be utilized to 100%.
- Extremely good compression/extension ratio
- Better dynamic running characteristics due to lightweight construction and high lamellas preload
- High-strength joining technology through ultrasonic welding
- Bellows material runs continuously under the lamellas for increased protection and liquid tightness.
- Reduced material variety for faster and easier material separation
- No use of adhesives and PVC
- Lamellas are removable and replaceable.
- Suitable for speeds up to 120 m/min
- Accelerations up to 2g - tested over 1.7 million cycles
- Suitable for oil- and water-based cooling lubricants; other cooling lubricants available on request.
- External widths from 270 mm to 2900 mm possible



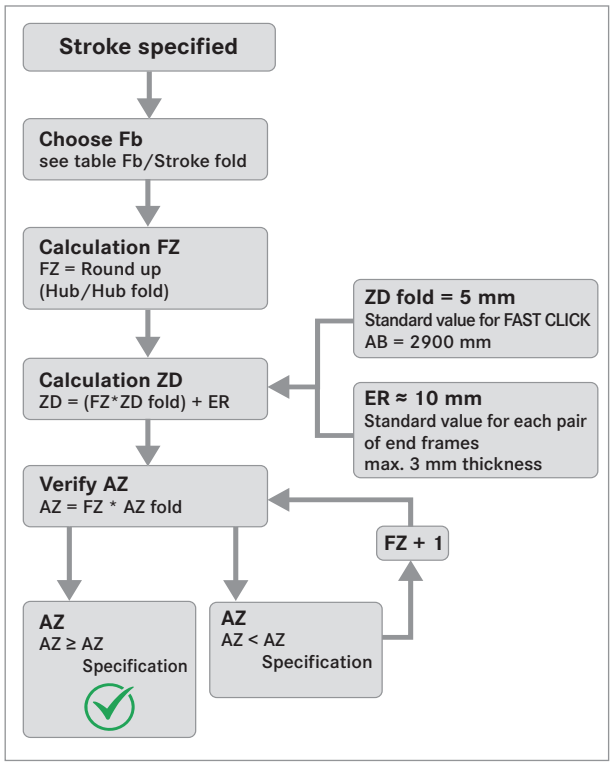
FAST CLICK bellows with special lamella mounting

SAMURAI Bellows FAST CLICK				
Fold width (FB) mm	Extension per fold (AZ fold) mm	Compression per fold (ZD fold) mm	Stroke per fold	Lamella overhang with guide plates
30	60	5 Standard value for FAST CLICK bellows up to AB 2900 mm	55	75
35	70		65	85
40	80		75	95
45	90		85	105
50	100		85	115

Depending on the use of roller hangers or gliders, the block dimensions may vary

Calculation		
Stroke given		
FZ	=	Stroke/Stroke fold rounded up to the nearest whole number
AZ	=	FZ*AZ fold
ZD	=	FZ*ZD fold + ER
ER	≈	10 mm (standard value for 2 end frames up to a maximum thickness of 3 mm each)

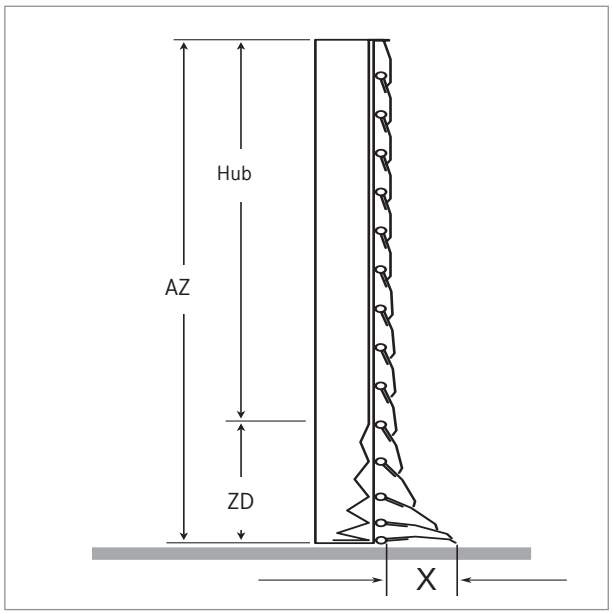
Note:
If, in addition to STROKE, the extension (AZ) and/or compression are also specified:
Check that AZ > AZ specification and ZD < ZD specification; otherwise select a different fold with (FB)

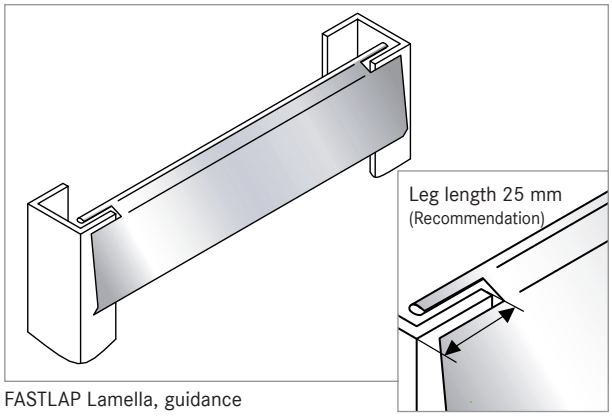


Calculation and verification of FAST CLICK bellows

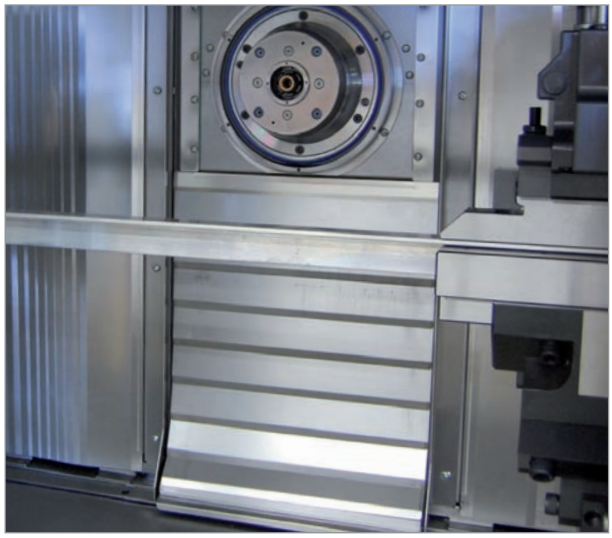
SAMURAI Lamella apron

SAMURAI FASTLAP lamella aprons are a modification of the SAMURAI bellows and were designed for use as vertical covers in machining centres.
The substructure consists of a carrier material onto which the movable lamellar panels are mounted with hinges. The lamellas are made of 0.5 mm thick stainless steel (VA) with a maximum outer width of 4,000 mm. The compression per fold is approximately 4 mm.
The lamellar apron requires guides on both sides of the machine; a leg length of 25 mm is recommended. The lamellas are attached to tear-resistant nylon-PU material, selected according to the specific application. SAMURAI lamella aprons are ideally suited for applications with travel speeds up to 30 m/min.





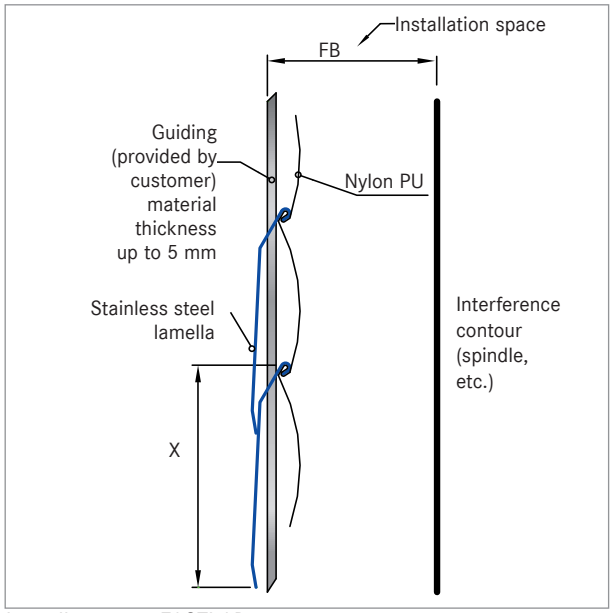
FASTLAP Lamella, guidance



FB [mm]	FAZ [mm]	FZD [mm]	X [mm]
25	38	4	65
30	48	4	75
35	58	4	85
40	68	4	95
45	78	4	105
50	88	4	115

FASTLAP

Legend	
FB	Fold width
FZD	Compression per fold
FAZ	Extension per fold
X	horizontal space requirement of the lamellas



Lamella aprons FASTLAP

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Soft PVC Bellows occupy a special position among the different types of bellows. ELASTIC Bellows (see Chapter ELASTIC Bellows) offer extremely flexible design options with regard to material, dimensions and shape and can nevertheless also be produced economically in very small quantities.



Soft PVC Bellows in standard colour black

Soft PVC Bellows on the other hand are moulded parts, i. e. a certain minimum quantity or corresponding tooling must be available to justify economic production. If a new mould is required, soft PVC bellows are more suitable for mass production.

Tooling is already available for many configurations, therefore attractive prices can be offered even for smaller quantities. The dimensions and shapes shown in the catalogue are available as standard forms. In addition we would be pleased to assist you in the design of special types.



Large variety of forms and colours



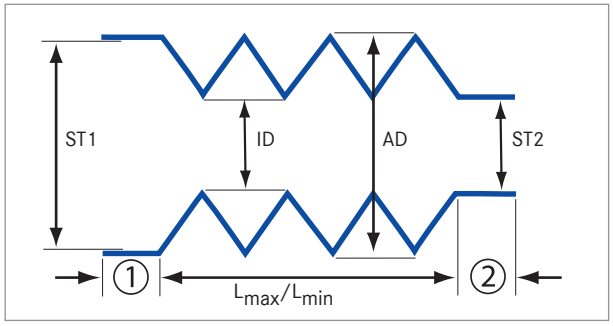
Split version

Material

We use a special PVC as standard material. The bellows are resistant to alkalis and acids; they are water and dust-proof. The standard colour of these bellows is black, but other colours as well as a version in transparent material are also possible.

Temperature

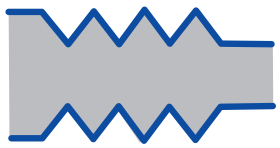
The operating temperature range is between -20°C and +80°C. For a short time a maximum operating temperature up to +120°C is possible.



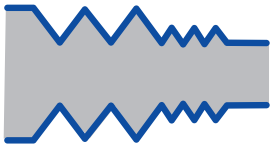
Legend	
ID	Inside diameter
AD	Outer diameter
FAZ	Extension per fold
FZD	Compression per fold
Customer specification resp. incidental by parameter	
L_{min}	Compression of bellow
L_{max}	Extension of bellow
①	Width of sleeve 1
②	Width of sleeve 2
FAZ	Extension per fold
FZD	Compression per fold

Soft PVC Bellows

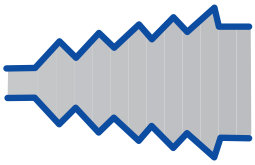
Type AB



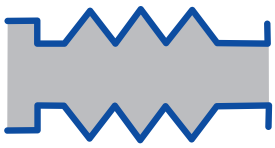
Type APB



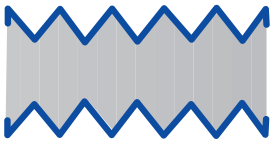
Type ABC



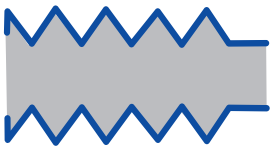
Type AMM



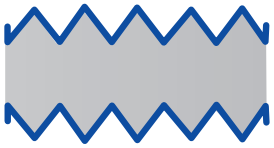
Type H



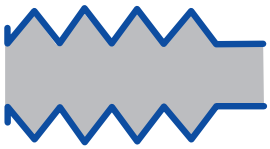
Type HB



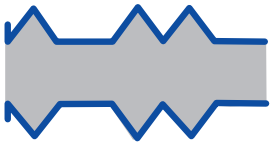
Type J



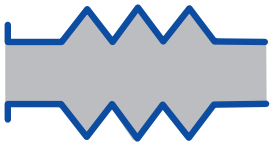
Type JB



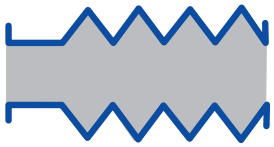
Type JAB



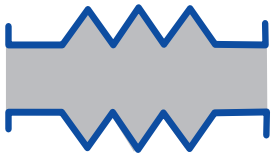
Type MB



Type MJ



Type MM



Type	ID [mm]	AD [mm]	FZD [mm]	FAZ [mm]
10	10	20	4	12
18	18	28	4	12
20	20	36	4.5	18
22	22	40	5	20
25-1	25	36	5	15
25-2	25	45	5.5	24
28-1	28	40	5.5	19
28-2	28	50	5.5	23
32-1	32	46	5	16
32-1	32	56	6.5	26
36-1	36	50	5	17
36-1	36	63	7	28
40-1	40	56	6	21
40-1	40	71	7.5	34
45-1	45	63	6.5	22
45-2	45	80	7	34
50-1	50	71	6	23
50-2	50	89	8	39
56-1	56	80	6.5	27
56-2	56	89	7.5	36
56-3	56	100	8.5	45
63-1	63	89	6.5	26
63-2	63	100	7.5	36
63-3	63	110	7.5	40
63-4	63	125	7.5	48
71	71	100	7	30
75-1	75	100	7	28
75-2	75	110	7	32
75-3	75	125	7.5	42
75-4	75	140	7.5	55
75-5	75	150	7.5	58
80-1	80	100	7	24
80-2	80	110	7.5	32
80-3	80	125	7.5	44
80-4	80	140	7.5	53
80-5	80	150	8	58
80-6	80	160	8	65
89-1	89	110	7.5	24
89-2	89	125	8	36

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Type	ID [mm]	AD [mm]	FZD [mm]	FAZ [mm]
89-3	89	140	8	46
89-4	89	150	8	55
89-5	89	160	8	60
89-6	89	170	8.5	65
100-1	100	128	7.5	29
100-2	100	140	8	40
100-3	100	150	8	46
100-4	100	160	8	55
100-5	100	170	8.5	60
100-6	100	180	9	65
110-1	110	130	7.5	24
110-2	110	140	7.5	30
110-3	110	150	8	40
110-4	110	160	8	47
110-5	110	170	8	56
110-6	110	180	8.5	60
110-7	110	190	9	65
110-8	110	200	9	70
120-1	120	140	7.5	24
120-2	120	150	8	30
120-3	120	160	8	40
120-4	120	170	8	47
120-5	120	180	8.5	55
120-6	120	190	9	60
120-7	120	200	9	65
125-1	125	150	7.5	28
125-2	125	160	8	38
125-3	125	170	8.5	42
125-4	125	180	8.5	52
125-5	125	190	8.5	57
125-6	125	200	8.5	62
125-7	125	210	9	68
140-1	140	160	7.5	24
140-2	140	170	8	30
140-3	140	180	8.5	40
140-4	140	190	9	47
140-5	140	200	10	56
140-6	140	210	10	60
140-7	140	220	10	65

Type	ID [mm]	AD [mm]	FZD [mm]	FAZ [mm]
150-1	150	170	8	24
150-2	150	180	8.5	30
150-3	150	190	9	40
150-4	150	200	9	47
150-5	150	210	10	56
150-6	150	220	10	60
150-7	150	230	10	65
150-8	150	240	10	70
160-1	160	190	8.5	30
160-2	160	200	9	40
160-3	160	210	10	47
160-4	160	220	10	56
160-5	160	230	10	60
160-6	160	240	10	65
160-7	160	250	10	70
170-1	170	200	9	30
170-2	170	210	10	40
170-3	170	220	10	47
170-4	170	230	10	56
170-5	170	240	10	60
170-6	170	250	10	65
170-7	170	260	10	70
180-1	180	210	9	30
180-2	180	220	10	40
180-3	180	230	10	47
180-4	180	240	10	56
180-5	180	250	10	60
180-6	180	260	10	65
190-1	190	220	9	30
190-2	190	230	10	40
190-3	190	240	10	47
190-4	190	250	10	60
190-5	190	260	10	70
190-6	190	280	10	75
200-1	200	230	9	30
200-2	200	240	10	40
200-3	200	250	10	47
200-4	200	260	10	57
200-5	200	280	10	70

Soft PVC Bellow

Type	ID [mm]	AD [mm]	FZD [mm]	FAZ [mm]
210-1	210	240	10	30
210-2	210	250	10	40
210-3	210	260	10	47
210-4	210	280	10	65
210-5	210	300	10	75
220-1	220	250	10	30
220-2	220	260	10	40
220-3	220	280	10	57
220-4	220	300	10	70
220-5	220	320	10	80
230-1	230	260	10	30
230-2	230	280	10	48
230-3	230	300	10	65
230-4	230	320	10	75
240-1	240	280	10	40
240-2	240	300	10	58
240-3	240	320	10	70
240-4	240	360	10	90
250-1	250	280	10	30
250-2	250	300	10	45
250-3	250	320	10	60
250-4	250	360	11	85
280-1	280	320	10	40
280-2	280	360	10	72
280-3	280	400	11	90
300-1	300	360	10	60
300-2	300	400	10	80
320-1	320	360	10	40
320-2	320	400	10	72
320-3	320	450	11	100
360-1	360	400	10	40
360-2	360	450	10	80
360-3	360	510	11	110
400-1	400	450	10	50
400-2	400	510	10	85
400-3	400	530	11	100
450-1	450	490	10	40
450-2	450	510	10	55
450-3	450	530	11	75

Type	ID [mm]	AD [mm]	FZD [mm]	FAZ [mm]
450-4	450	560	12	85
510	510	650	12	105
560	560	650	12	75
650	650	770	12	90



Soft PVC bellows in circular and rectangular form

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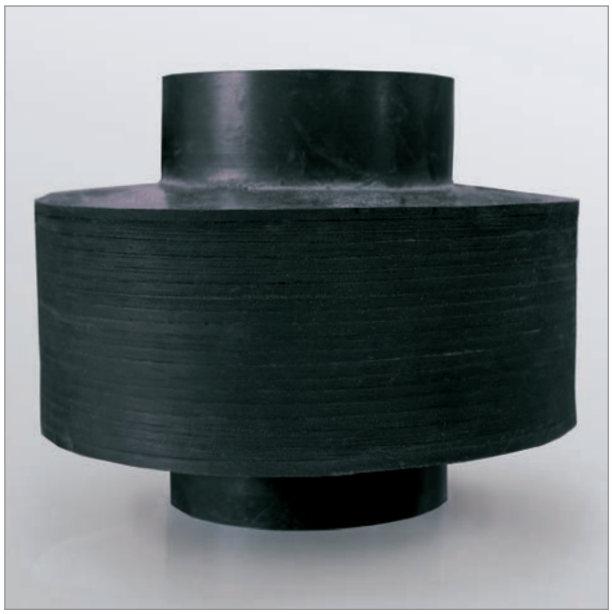
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Rubber disk bellows are of the highest quality and visually the most attractive protective covers for pistons and spindles. They are completely leak proof. Since each rubber disk lies flat on the other, excellent compression dimensions are achieved.
The production of rubber parts depends directly upon the control and monitoring of the production processes. Each process step, from mixing up to rolling out the material, from punching the disks up to the vulcanization process, is performed under the most accurate observation and attention. Stringent quality criteria leads to high process reliability. After vulcanizing, the rubber disk bellows are ground on the outside, so that they have an absolutely smooth surface when closed.

Material

Good resistance to light and atmospheric conditions and are well suited to outside use. If emphasis is on oil or coolant protection in your area of application, then we recommend the use of NBR rubber foil. Alternative materials are available for high temperature requirements.



Compression of Rubber disk bellow

Types

For standard types of this bellow round profiles will be used. As an alternative, square, rectangular or oval profiles can also be produced.

Dimensions

Rubber disk bellows are supplied in standard sizes with inside diameters of 20 to 400 mm and outside diameters of 40 to 480 mm.



Rubber disk bellow

We supply the bellows in 5 mm graduation up to a diameter of 200 mm and in 10 mm graduation above this.
The extended length of the rubber disk bellows can be up to 10 metres.

Mounting

Rubber disk bellows are fastened the same as other bellow types with sleeve or metal flange.

Design

With large extension length and horizontal installation, it is usually necessary to use additional guide elements. In the most simple case, the bellows are stabilized by internal wire rings.
In more complex applications, guiding systems with rods or cables can be incorporated internally externally to the bellows.
When mounting these bellows please pay attention to sufficient aeration.

Construction

Calculation formulae

L_{max}	FZ x FB
L_{min}	FZ x 2,5
FB	$\frac{(AD - ID)}{2}$
FZ	$\frac{L_{max}}{FB}$
FZ	$\frac{Hub}{(FB - 2.5)}$

Fabric Bellows

If bellows are subject to especially heavy wear, high pressure conditions or high temperatures up to 200°C, fabric bellows can be used.



Fabric bellow coated with synthetic material

Typical fields of application are piston rods with high ambient temperatures, or cardan shafts. Fabric bellows consist of a laminated structure, whereby the supporting fabric is coated with a synthetic material.

In contrast to the rubber disk bellows, the fabric bellows have a structural reinforcement which withstands the mechanical forces acting. The external protective effect of the rubber is maintained completely.
Nevertheless, the supporting fabric changes the character of the surface, so that the smoothness of the rubber disk type is lost.



Fabric bellow coated with Alu/Glass fibre coating

Material

Fabric bellows are delivered as standard in CR rubber coated fabric. All materials can be laminated with Teflon foil.
A speciality are fabric bellows made from leather and carbon fibre with Aramid or Alu/Glass fibre.

Types

The fabric bellows will be normally produced in round shapes. As an alternative, square, rectangular or oval profiles can also be produced.
The bellows are fastened like the rubber disk bellows.

Construction

Calulation formulae (material with 1 mm thickness)

Lmax	=	FZ x FB x 1.4
Lmin	=	FZ x 6
FB	=	$\frac{(AD - ID)}{2}$
FZ	=	L_{max} : FB : FZ

Legend

FB	Fold width/depth
FZ	Number of folds
L_{min}	Minimum Compression of bellow
L_{max}	Maximum extension of bellow
AD	Outer diameter
ID	Inner diameter



Fabric bellow - sample of larger size

Dimension

We manufacture fabric bellows in the standard sizes with inside diameters of 30 to 2900 mm and an outside diameter of 50 to 3000 mm.

ROLLER Covers

ROLLER cover systems are a possible substitute for bellow covers in very narrow spaces when only general sealing is required.
Two different types are available:

- ROLLER Systems without housing - this type needs less space, best used with smaller diameters and short extensions
- ROLLER Systems with housing - we recommend this type for safety reasons when longer extensions are used and especially when steel is used for the band material. They are available in many variants.

Drives

The ROLLER systems come with different drive concepts:

- Torsion springs TF/ TFRS: Drive separate to cover band
- Steel band drives SA: Cover band forms drive
- Steel band spring drive FM: Drive separate to cover band
- Electrical drive: to customers specifications

Torsion springs TF

Torsions springs are very well suited for a long working life performance at low loads and for textile band and travel speeds of up to 40 m/min under continuous load.

Torsion springs TF-RS

The TR-RS drive uses special spring mounts and supports, allowing almost the entire spring length to be used for the drive and resulting in a compact design.
The TF-RS drive enables high travel speeds and large extensions with minimized installation space.

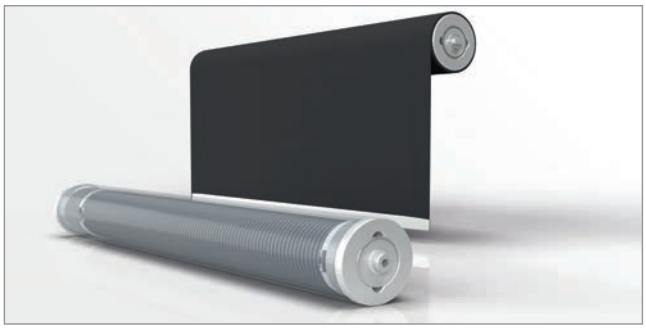
Steel band drive SA

In this ROLLER version, the outer band used for the cover also serves as the spring motor and is made of standard steel band. Suitable for models up to 300 mm wide.



Steel band drive FM

ROLLER Systems with FM steel belt motor are particularly suitable for higher tensile loads and are preferably used with heavy belts and link aprons of the FLEXSTAR type.



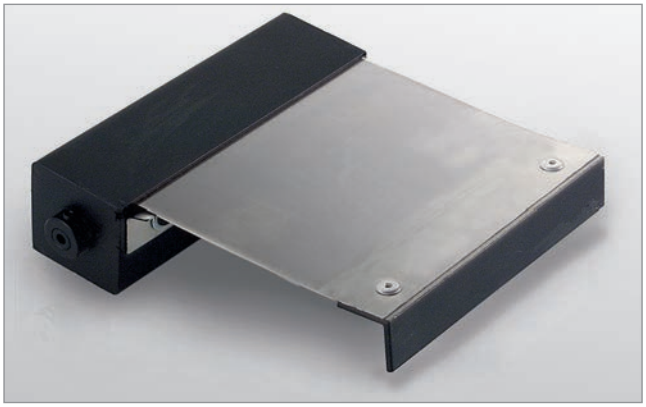
ROLLER System with Torsion Spring TF-RS

ROLLER Systems with housing and dimensions

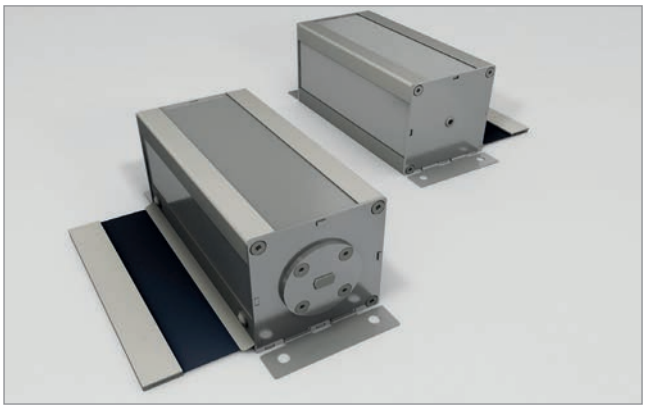
We manufacture several housing designs for the ROLLER systems. The »modular« housing type is made from aluminum profiles and stainless steel side elements. Alternatively, housings made of steel or stainless steel, bent and welded or bolted, are also available.
The steel housings are painted for better protection against rust; in addition to the standard black finish (RAL 9005), other colours are available upon request. When designing ROLLER systems, the drive type must be considered in addition to the belt width and extension.

Design option	Torsion spring TF Drive	Torsion spring TF-3D Drive	Steel band drive SA Drive	Steel band drive FM drive
Housing available	■	■	■	■
Side mounts available	■	■		■
Link Apron available	■ (limited)	■ (limited)		■
Outer band synthetic material	■	■		■
Outer band stainless steel	■ (limited)	■ (limited)		■
Outer band normal steel			■	■
Maximum travelling speed	up to 40 m/min	up to 80 m/min	30 m/min	30 m/min
Rapid change of direction	■	■		
Continous load	high	very high	average	high
Resistance to dust/dirt	low	low	average	low
Tension forces	slightly increased when fully extended	slightly increased when fully extended	increased when fully extended	increased when fully extended

ROLLER Covers



ROLLER blind cover with steel band and housing



ROLLER blind cover with modular housing and textile band

Design

For the design of the ROLLER covers the following factors should be considered:

- Speed of travel
- Acceleration
- intended total number of cycles, working life
- Frequency and speed of changes in travel direction
- Mounting position
- Direction and amount of chips

Cover material

The outer band is subjected to a wide variety of stresses; the material chosen depends on the field of application:

- Steel bands with rounded edges (standard and stainless steel): Protection from cold and hot chips, coolants. Maximum width of steel band standard 300 mm, steel band stainless 1000 mm
- Synthetic bands, e.g. Preotex, awning cloth, Neoprene, etc., Protection from dust, coolants, contact guard
- Link aprons: Protection from large chips, coolants: Recommended for applications requiring additional lateral stability. The link aprons are available in various designs; for further details see p. 42 ff.

Operating position

The operating position can be vertical, horizontal or transverse, with an extension to the left, right, top or bottom side.

Pre-loading

- ROLLER systems with housing are pre-loaded at the factory to customer or HEMA specifications and are ready to install.
- ROLLER systems without housing are not pre-loaded.

Mounting

A variety of mounting positions is available:
Roller cover with housing

- 12 standard mounting positions shown on page 39.

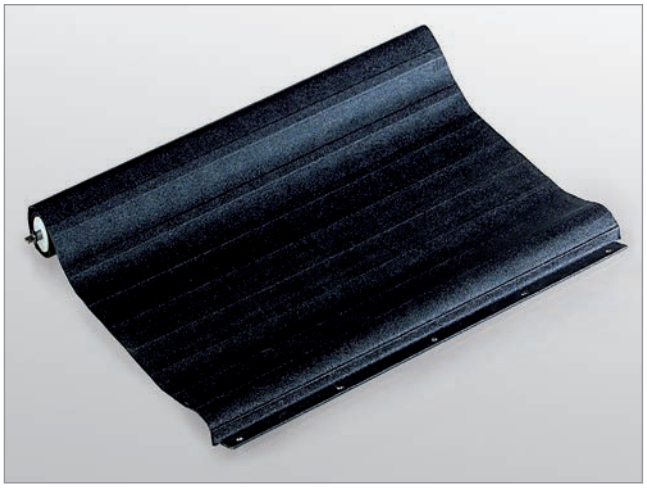
Roller cover without housing

- Standard holder (HL)
- Heavy duty holder (HS)

Customized holders can be produced for special requirements. The front attachment of the roller cover or link apron is done using flat or angle steel strips, which are glued and/or riveted to the end of the strap on one or both sides.

Wiper

In order to keep the case as clean as possible, we use wiper systems as a standard feature.
For special applications we offer wipers for guideways and telescopic covers and brush wipers.



Roller blind cover with textile band

ROLLER COVERS

Band		TF Drive Torsion spring		TF RS Drive Torsion spring		FM Drive Spring motor		SA Drive Steel band motor
Width#	Extension	without housing	with housing	without housing	with housing	without housing	with housing	with housing
in mm	in mm	Ø Rollo in mm	L x B in mm	Ø Rollo in mm	L x B in mm	Ø Rollo in mm	L x B in mm	L x B in mm
over 150	up to 300	21 / 28* ●	40 x 40 ●	-	-	50 ●	60 x 60 ●	40 x 40 ■
over 150	up to 500	21/30 ●	50 x 50 ●	-	-	50 ●	60 x 60 ●	50 x 50 ■
over 150	up to 1,000	40 ●	60 x 60 ●	40 ●	60 x 60 ●	45/50 ●	70 x 70 ●	60 x 60 ■
over 150	up to 1,500	-	-	-	-	50/60 ●	80 x 80 ●	70 x 70 ■
over 150	up to 2,000	-	-	-	-	60/70 ● ■	90 x 90 ● ■	75 x 75 ■
over 150	up to 2,500	-	-	-	-	70/80 ● ■	110 x 110 ● ■	80 x 80 ■
over 150	up to 3,000	-	-	-	-	80/90 ● ■	120 x 120 ● ■	90 x 90 ■
over 150	up to 4,000	-	-	-	-	90/100 ● ■	130 x 130 ● ■	100 x 100 ■
over 150	up to 5,000	-	-	-	-	100/120 ● ■	140 x 140 ● ■	110 x 110 ■
over 150	up to 7,000	-	-	-	-	120/133 ● ■	150 x 150 ● ■	120 x 120 ■
over 150	up to 9,000	-	-	-	-	120/133 ● ■	160 x 160 ● ■	120 x 120 ■
Sondergrößen auf Anfrage								
up to 300	up to 300	21/28 ●	40 x 40 ●	-	-	45 ● ■	60 x 60 ● ■	40 x 40 ■
up to 300	up to 500	21/28 ●	50 x 50 ●	-	-	50/60 ● ■	70 x 70 ● ■	50 x 50 ■
up to 300	up to 1.000	30/32 ●	60 x 60 ●	-	-	60 ● ■	70 x 70 ● ■	60 x 60 ■
up to 300	up to 1.500	40/45 ●	70 x 70 ● ■	40/45 ●	70 x 70 ●	60 ● ■	80 x 80 ● ■	70 x 70 ■
up to 300	up to 2,000	-	80 x 80 ● ■	-	80 x 80 ●	60/70 ● ■	90 x 90 ● ■	75 x 75 ■
up to 300	up to 2,500	-	80 x 80 ● ■	-	80 x 80 ●	70/80 ● ■	100 x 100 ● ■	80 x 80 ■
up to 300	up to 3,000	-	90 x 90 ● ■	-	90 x 90 ●	80/90 ● ■	110 x 110 ● ■	90 x 90 ■
up to 300	up to 4,000	-	100 x 100 ● ■	-	100 x 100 ●	90/100 ● ■	120 x 120 ● ■	100 x 100 ■
up to 300	up to 5,000	-	120 x 120 ● ■	-	120 x 120 ●	90/100 ● ■	130 x 130 ● ■	110 x 110 ■
up to 300	up to 7,000	-	-	-	-	100/120 ● ■	150 x 150 ● ■	120 x 120 ■
up to 300	up to 9,000	-	-	-	-	100/120 ●	160 x 160 ● ■	140 x 140 ■
Sondergrößen auf Anfrage								
over 300 up to 1,000	up to 300	21/28 ●	40 x 40 ● ■	-	-	40/45 ● ■	60 x 60 ● ■	-
over 300 up to 1,000	up to 500	21/28 ●	50 x 50 ● ■	-	-	45/50 ● ■	70 x 70 ● ■	-
over 300 up to 1,000	up to 1,000	30/32 ●	60 x 60 ● ■	-	-	45/50 ● ■	70 x 70 ● ■	-
over 300 up to 1,000	up to 1,500	45 ●	70 x 70 ● ■	45 ●	70 x 70 ●	50/60 ● ■	80 x 80 ● ■	-
over 300 up to 1,000	up to 2,000	60 ● ■	80 x 80 ● ■	60 ● ■	80 x 80 ●	60/70 ● ■	90 x 90 ● ■	-
over 300 up to 1,000	up to 2,500	50/60 ● ■	90 x 90 ● ■	50/60 ● ■	90 x 90 ●	70/80 ● ■	110 x 110 ● ■	-
over 300 up to 1,000	up to 3,000	60/70 ● ■	100 x 100 ● ■	60/70 ● ■	100 x 100 ●	80/90 ● ■	120 x 120 ● ■	-
over 300 up to 1,000	up to 4,000	70/80 ● ■	110 x 110 ● ■	70/80 ● ■	110 x 110 ●	80/100 ● ■	130 x 130 ● ■	-
over 300 up to 1,000	up to 5,000	80/90 ● ■	120 x 120 ● ■	80/90 ● ■	120 x 120 ●	90/100 ● ■	140 x 140 ● ■	-
over 300 up to 1,000	up to 7,000	90/100 ● ■	130 x 130 ● ■	90/100 ● ■	130 x 130 ●	100/120 ● ■	150 x 150 ● ■	-
over 300 up to 1,000	up to 9,000	100/120 ● ■	150 x 150 ● ■	100/120 ● ■	150 x 150 ●	100/120 ● ■	160 x 160 ● ■	-
Sondergrößen auf Anfrage								

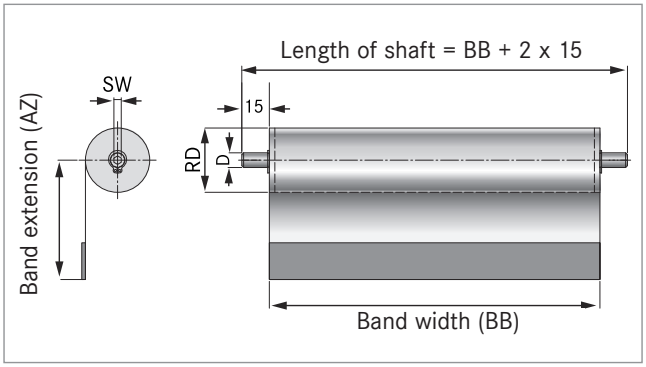
This information serves as an initial overview of possible designs. The final design of the scooter covers will be determined upon preparation of a quotation and production order.

The band with is depending on the kind of drive FM or TF), a FM drive requests a band width of 50 mm min., a TF type 150 mm min.

* 21/28 means a roller diameter of 21 mm for regular load and 28 mm for high load. Other types and sizes on request. Square outer housing, rollo size is equivalent to outer dimension of the tube. Type without housing: first number: standard spring force/second numer: enlarged spring force is required.

● non-metallic/textile band possible ■ steel band possible

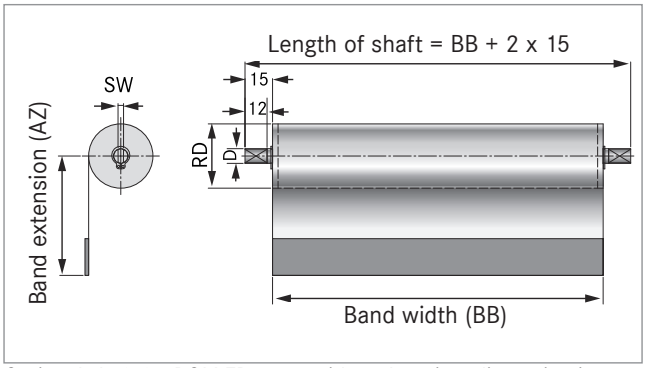
ROLLER Covers



Standard shaft for ROLLER cover without housing, dimension in mm

Type of shaft	Inner hexagon (SW)	Projecting
E1-08	4	2 x 15 mm
E1-10	4 / 6 optional	2 x 15 mm
E1-12	6	2 x 15 mm

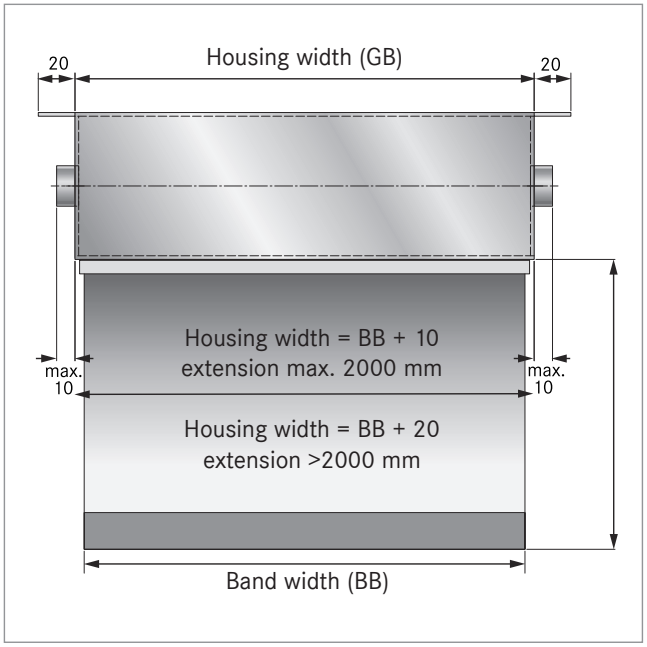
Standard shaft for ROLLER blind without housing



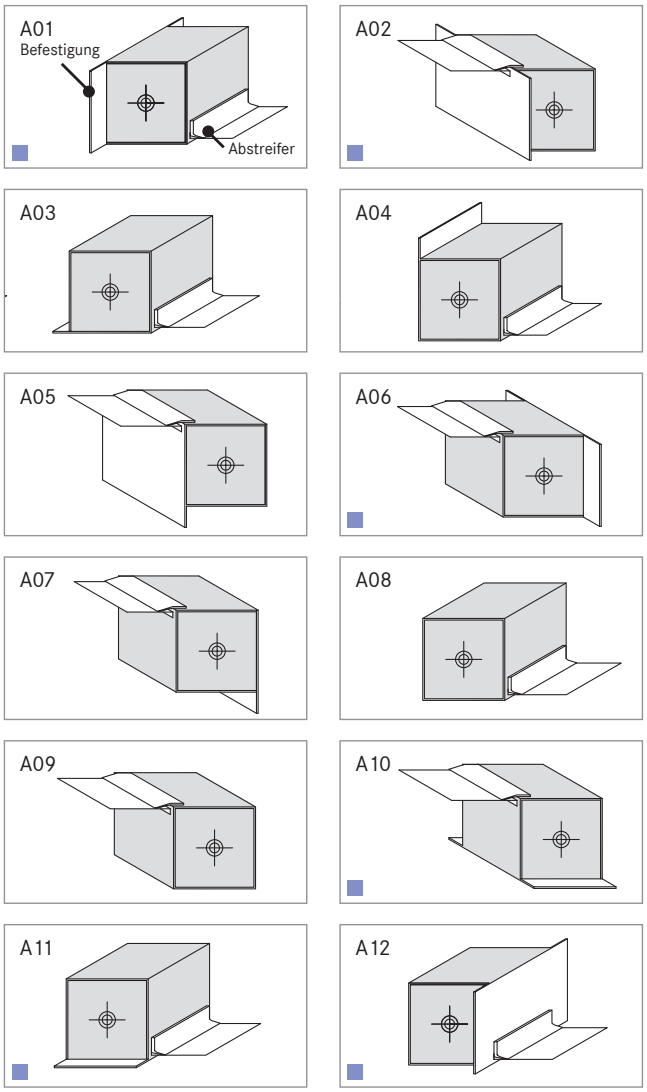
Optional shaft for ROLLER cover without housing, dimension in mm

Type of shaft	Inner hexagon (SW)	Maximum width across flats
E2-08	4	3 x 12 mm
E2-10	4 / 6 optional	4 x 12 mm
E2-12	6	6 x 12 mm

Optional shaft for ROLLER cover without housing



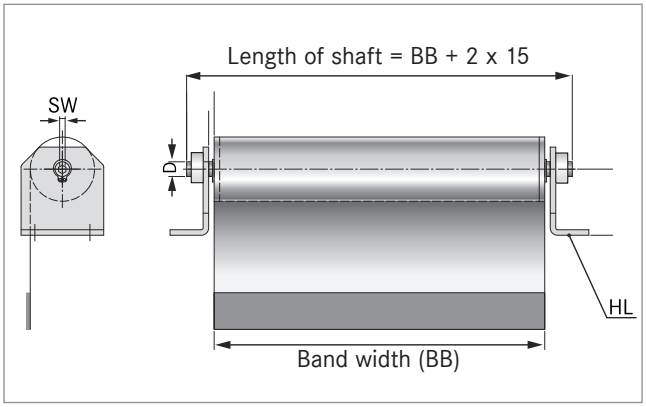
Calculation of housing dimension, dimension in mm



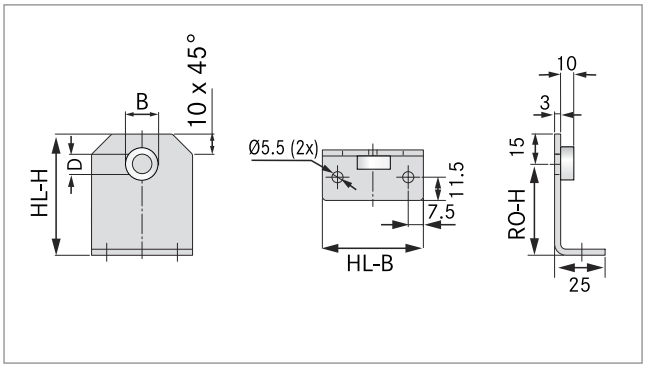
Mounting options for roller covers with housing

especially suitable for modular housing types

ROLLER COVERS



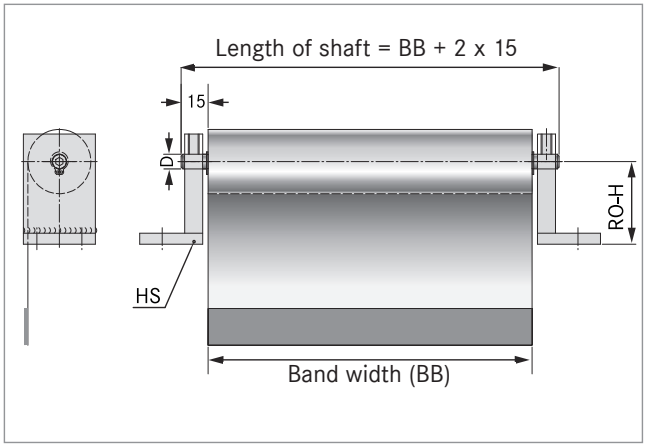
Standard holder (HL), dimension in mm



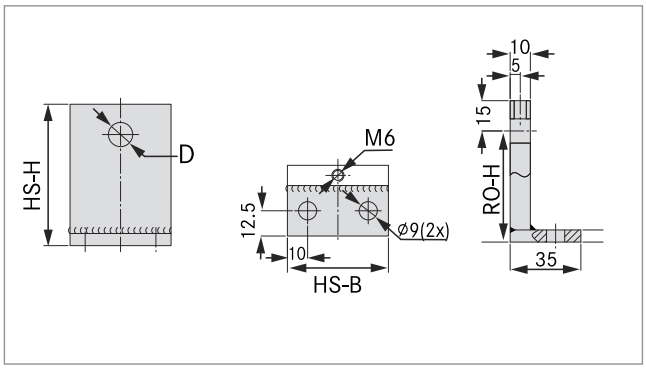
Standard holder (HL), dimension in mm

Legende	
D	Diameter of axle
B	Coller
SW	Wrench size
RO-H	Space axis to holder
HL-B/HS-B	Width holder standard/holder heavy duty
HL-H/HS-H	Height holder standard/holder heavy duty

Type of holder	RO-H [mm]	D [mm]	B [mm]	HL-B [mm]	HL-H [mm]
HL-30/8	30	8	16	40	45
HL-30/10	30	10	20	40	45
HL-30/12	30	12	22	40	45
HL-40/8	40	8	16	45	55
HL-40/10	40	10	20	45	55
HL-40/12	40	12	22	45	55
HL-45/8	45	8	16	50	60
HL-45/10	45	10	20	50	60
HL-45/12	45	12	22	50	60
HL-50/8	50	8	16	65	65
HL-50/10	50	10	20	65	65
HL-50/12	50	12	22	65	65
HL-60/10	60	10	20	65	75
HL-60/12	60	12	22	65	75
HL-70/10	70	10	20	65	85
HL-70/12	70	12	22	65	85
HL-80/10	80	10	20	65	95
HL-80/12	80	12	22	65	95



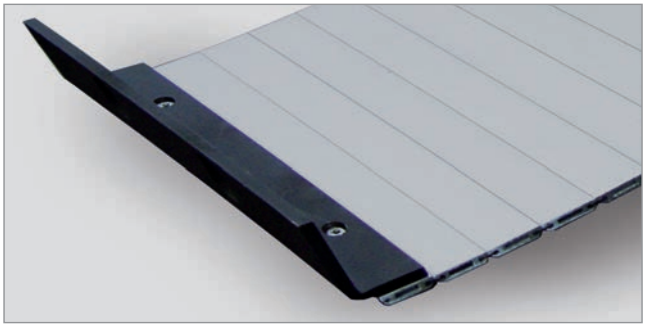
Heavy duty holder (HS), dimension in mm



Heavy duty holder (HS), dimension in mm

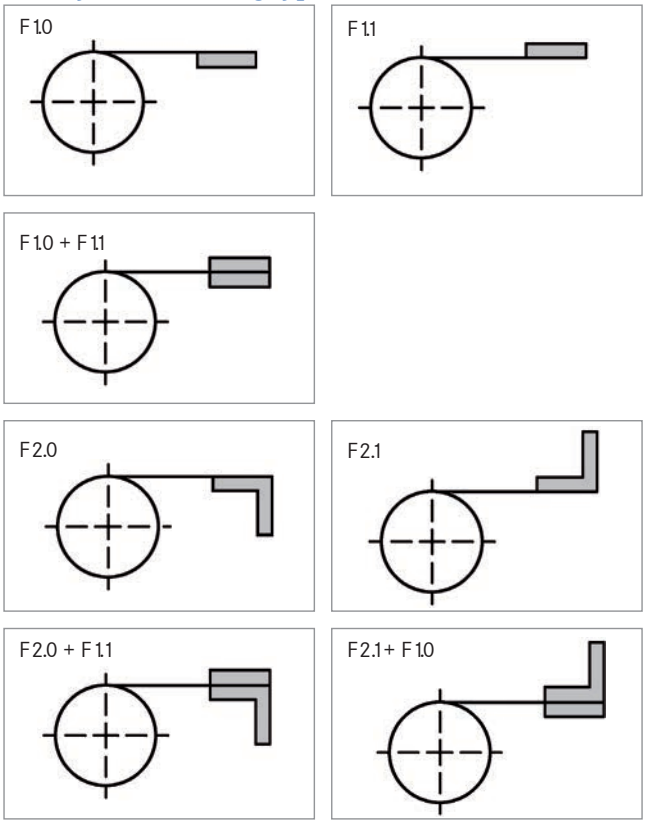
Type of holder	RO-H [mm]	D [mm]	HS-B [mm]	HS-H [mm]
HS-45/10	45	10.2	50	60
HS-45/12	45	12.2	50	60
HS-50/10	50	10.2	50	65
HS-50/12	50	12.2	50	65
HS-60/10	60	10.2	70	75
HS-60/12	60	12.2	70	75
HS-70/10	70	10.2	70	85
HS-70/12	70	12.2	70	85
HS-80/10	80	10.2	90	95
HS-80/12	80	12.2	90	95
HS-90/10	90	10.2	90	105
HS-90/12	90	12.2	90	105
HS-100/10	100	10.2	100	115
HS-100/12	100	12.2	100	115
HS-120/10	120	10.2	100	135
HS-120/12	120	12.2	100	135
HS-140/10	140	10.2	100	155
HS-140/12	140	12.2	100	155
HS-150/10	150	10.2	100	165
HS-150/12	150	12.2	100	165

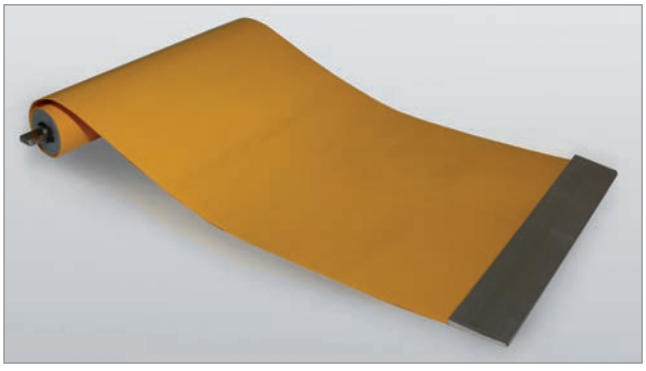
ROLLER Covers



Link Apron with fixing bracket F2.1, riveted

Variety of band fixing types





ROLLER with bonded fixing bracket F 1.1



ROLLER with housing and HEMA serial number



ROLLER with modular housing

Safety information

Please observe the mounting and maintenance information supplied with each ROLLER cover.
These instructions are also available for download at www.hema-group.com.

Replacement

When ordering replacement rollers please quote the serial number for the ROLLER cover. This number can be found either on the roller blind itself or on a label on the housing.

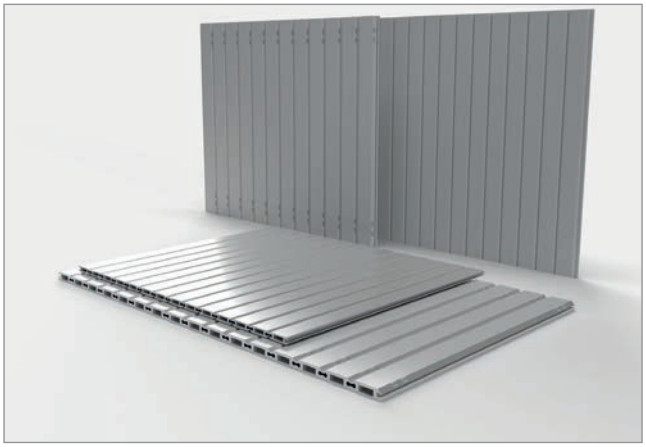
ROLLER COVERS

Material Roller Covers	water-repellent	emulsion (oil) resistant	chemical resistant	Resistant to hot chips/ sparks	self-extinguishing	Colour	Material-stärke [mm]	Rollen-breite [mm]	Recommended temperature range min/max [C°]	Material basis
PUR Teflon 0.27	■	■	▣	▣	□	black	0.3	1500	-30°C +90°C briefly °C**	Polyester
Preotex 0.35	□	□	□	■	■	black	0.4	1500	-20°C +160°C briefly °C**	Panox/ Para-Aramid
Preotex 0.60	▣	□	□	■	■	black	0.55	1500	-20°C +160°C briefly °C**	Panox/ Para-Aramid
Planenstoff*	■	■	□	□	□	black*	0.53-0.7	1500-3000	-10°C +70°C	Polyester
ECO 600 (GN 807)	■	■	□	□	□	black	0.75	1500	-40°C +70°C	Polyester
ECO Seal 652	■	■	□	□	□	black	0.7	1500	-30°C +70°C	Polyester
Neoprene 2003	■	■	□	□	□	black	0.5	1500	-30°C +100°C	Polyester
Steel band (standard)#	▣	▣	▣	▣	■	silver metal	0.2 - 0.3	350	10°C +120°C (x)	Steel band
Stainless steel band	■	■	▣	▣	■	silver metal	0.2 - 0.3	1000	10°C +250°C (x)	Stainless steel

■ fulfills the requirement ▣ partially fulfills the requirement □ does not meet the requirement

* other colours available upon request
** Consultation required
# standard steel band can rust.
(x) Optimal temperature range for the function of steel and stainless steel bands as spring motors

Link aprons



Link aprons are a low-priced type of cover, providing excellent service in front line protection against chips and coolant. In many cases, link aprons serve as a protective hanging curtain or run over a guide roller for especially smooth running. They offer good flexibility, are mounted easily and require little space.

Material

The link aprons are manufactured from hollow profiles with the highest precision. Plastic end caps improve the sliding properties; these are blue as standard, other colours are available as an option.

Mounting

The link aprons can be fastened with

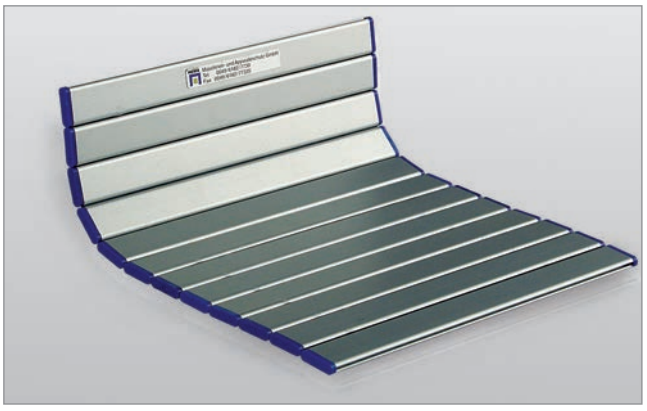
- hollow aluminium section angles
- metal ledges
- metal angles at the end of the apron

Customers are free to choose the shape or fixing hole pattern.

Types

HEMA link aprons are subdivided into the basic types:

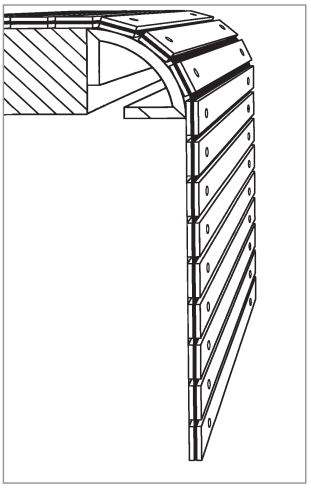
- FLEXPRO Aprons
- FLEXSTAR Aprons



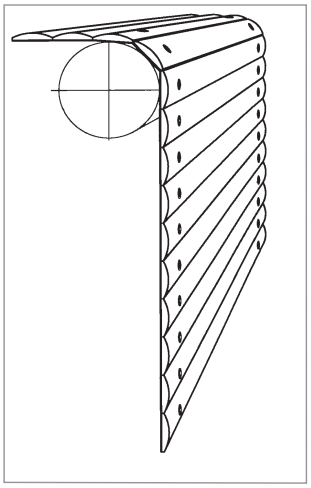
FLEXSTAR Apron aluminium

FLEXPRO Aprons

These aprons consist of a highly tear-resistant plastic carrier material onto which metal rods are glued and then riveted on one or both sides. The metal rods are made of aluminum, brass, or steel as flat or semi-circular profiles, with aluminum semi-circular profiles being the most common. The metal rods are 15 and 16 mm wide, and their height ranges from 2.0 mm (flat) to 3.0 mm (semi-circular).
The aprons can be manufactured up to a width of 3,000 mm.



FLEXPRO (Type 1/2/3)

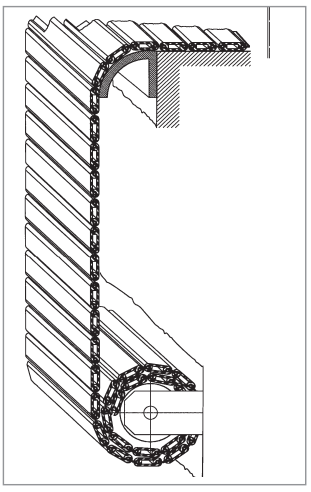


FLEXPRO (Type 4/5)

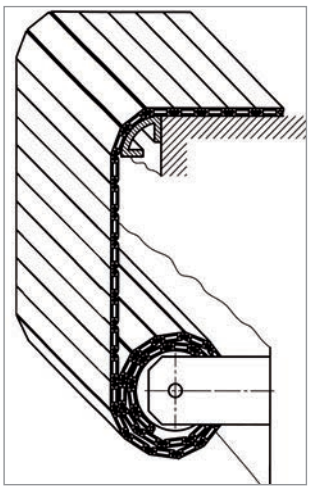
FLEXSTAR aprons

These aprons are made up of anodised hollow aluminium sections joined with a polyurethane strip. On the visual side the glider elements are rounded at the edges (FLEXSTAR-S) or straight (FLEXSTAR-C/CR)..
Both extrusion have bending restraints

- FLEXSTAR-S can move freely in both directions
- FLEXSTAR-C/CR permits only one-way bending, adopting a stable flat position in the other direction



FLEXSTAR-S



FLEXSTAR-C/CR

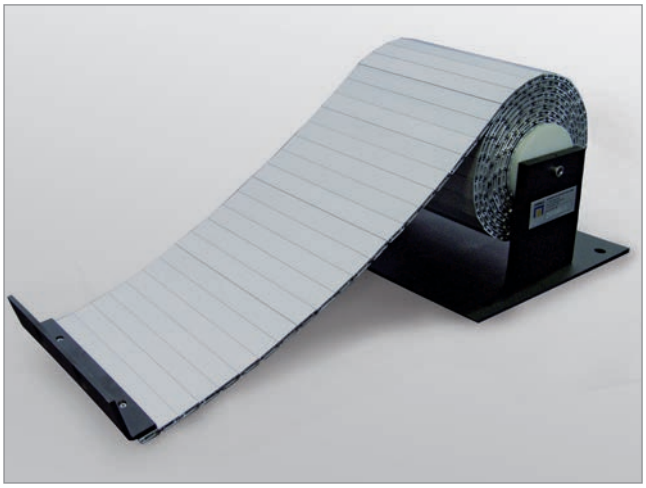
Link aprons

FLEXSTAR-Windows

A special version of the FLEXSTAR aprons is the Window version, featuring additional viewing panels made of sturdy polycarbonate inserts. These FLEXSTAR aprons are particularly suitable for assembly areas.

Combination with ROLLER System

For more demanding solutions, the link aprons are combined with a system of roller blinds. The link apron is wound on top of the ROLLER standard system. The ROLLER diameter is considerably increased in its wound-up state. The drive unit is exactly matched to the additional weight and forces. We offer complete guide systems based on travel rails, steel cables or aluminium profiles.



Linked apron / roller blind combination

Linked aprons with electric drive

We are also manufacture complex solutions for link aprons or roller blind covers with electric drive for you, whether for the initial equipment of your machine or for subsequent retrofitting for more protection and safety.



Application example of a linkable apron with viewing inserts and electric drive, retrofitted machine equipment



Linked apron with individual drive

The link aprons with drive are particularly suitable for openings that need to be opened and closed automatically on a regular basis.
Possible uses include:

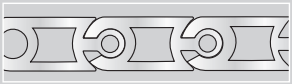
- Machine tools in which an area is partitioned off that is only to be opened for automatic tool or workpiece changes.
- Automated production facilities where parts need to be fed in and out.



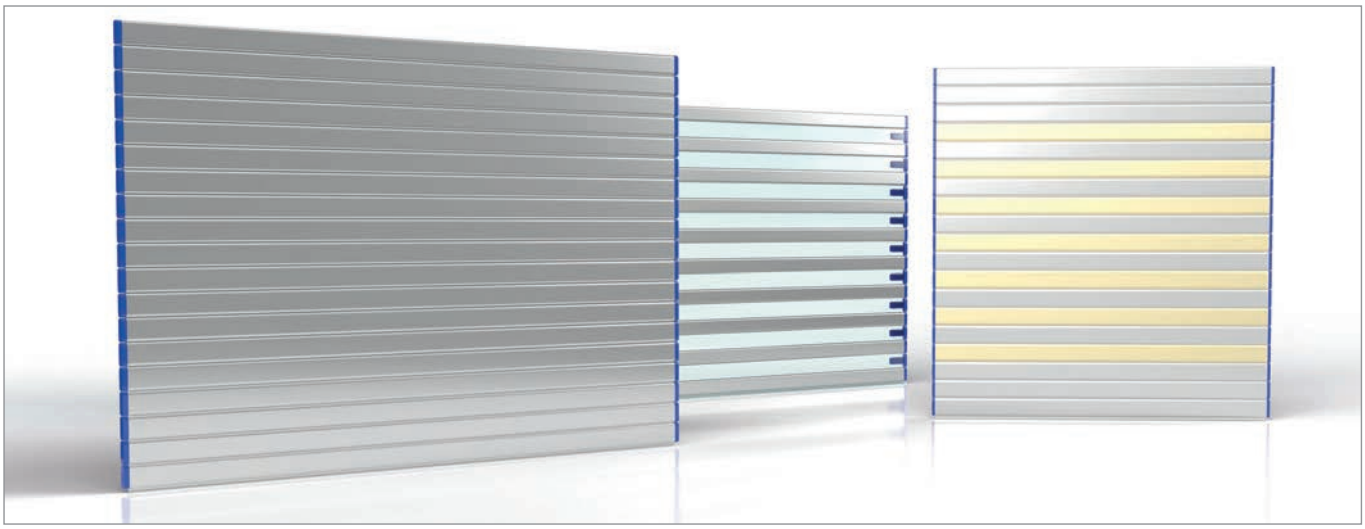
Engine and shift cam

The link aprons are equipped according to application-specific requirements. Motor, guide rails including sensors, roller blind end rail with electrical contact strip, switching cams, and terminal boxes are individually designed according to customer specifications. The link apron is delivered ready for installation; integration into the machine control system is carried out by the customer.

Link aprons

Link apron type exterior / interior section Fastening	Connecting material	Section with in mm	Section height in mm	smallest unwind radius in mm	profile type
FLEXPRO 1 steel/steel bonded and riveted	synthetic carrier band	15/15	2.0/2.0	40	
FLEXPRO 2 steel/brass bonded and riveted	synthetic carrier band	15/15	2.0/2.0	40	
FLEXPRO 3 steel/aluminium bonded and riveted	synthetic carrier band	15/15	2.0/2.0	40	
FLEXPRO 4 half round aluminium bonded and riveted	synthetic carrier band	16	3.0	21	
FLEXPRO 5 semicircular alu./aluminium bonded and riveted	synthetic carrier band	16/15	3.0/2.0	35	
FLEXSTAR-S Hollow alu section, anodised* intendation	synthetic band connection end caps available	20	5.5	35	
FLEXSTAR-C Hollow alu section, anodised* intendation	synthetic band connection end caps available	20	5.5	35	
FLEXSTAR-CR Hollow alu section, anodised* intendation	synthetic band connection	25	8.0	70	
FLEXSTAR ALC14 Hollow alu section, anodised intendation	rivet aluminium	25	14.0	40	
FLEXSTAR ALC25 Hollow alu section, anodised intendation	rivet aluminium	50	25.0	90	

*Inserts made of clear film or polycarbonate (Windows) are possible



Linked aprons in various designs

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DURASPRING Spiral Springs

Spiral springs are used as reliable spindle protection covers and are available in many sizes. The advantages of DURASPRING spiral springs:

- High quality spring steel
- Installation possible in opposite directions or in series
- Special oil for enhanced life
- Anti-corrosive packaging

Material

DURASPRING Spiral Springs are available in two versions:

- **DURASPRING BLUE** - standard spring, blue steel
- **DURASPRING SILVER** - stainless steel version

Dimensions

The standard range now comprises springs in dimensions from 15 mm up to 160 mm internal diameter. Special dimensions are available on request. Spiral springs for vertical use can be produced up to an extended length of 4500 mm.

Speed

DURASPRING Spiral Springs are designed for speeds up to 40 meters per minute as standard. Optimal operating conditions for DURASPRING are achieved in oil-lubricated applications.

Maintenance/Cleaning

DURASPRING coil springs must be cleaned according to the degree of soiling and then a light film of oil applied. Using DURASPRING LONG-LIFE special oil increases the service life of the springs. Observe the safety instructions in the installation and maintenance manual.

Installation/operating position

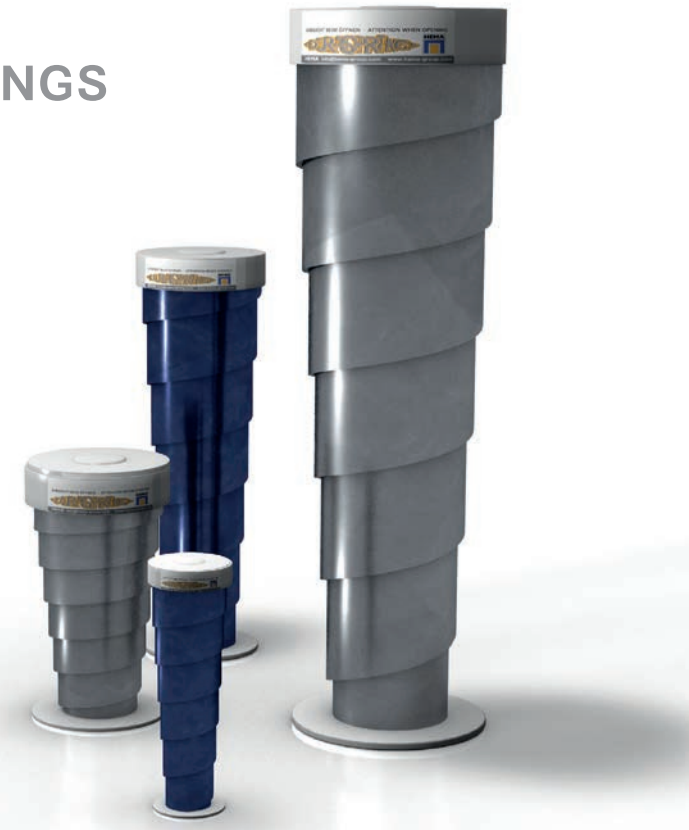
DURASPRING Spiral springs can be installed in both, horizontal and vertical applications:

- Horizontal installation
- Vertical installation

This installation/operating position is taken into account during the manufacturing of each spring; any other installation is not possible. Therefore, the intended installation position must be specified when ordering.



DURASPRING Silver, stainless steel



DURASPRING in standard and stainless steel

Coil spring types with the same designation have different extension lengths depending on the installation position; this information is listed in the tables following.

Horizontal installation

DURASPRING spiral springs for horizontal use are manufactured in such a way that the coil overlaps are larger, thereby eliminating the so-called "sagging", especially with large extension lengths.

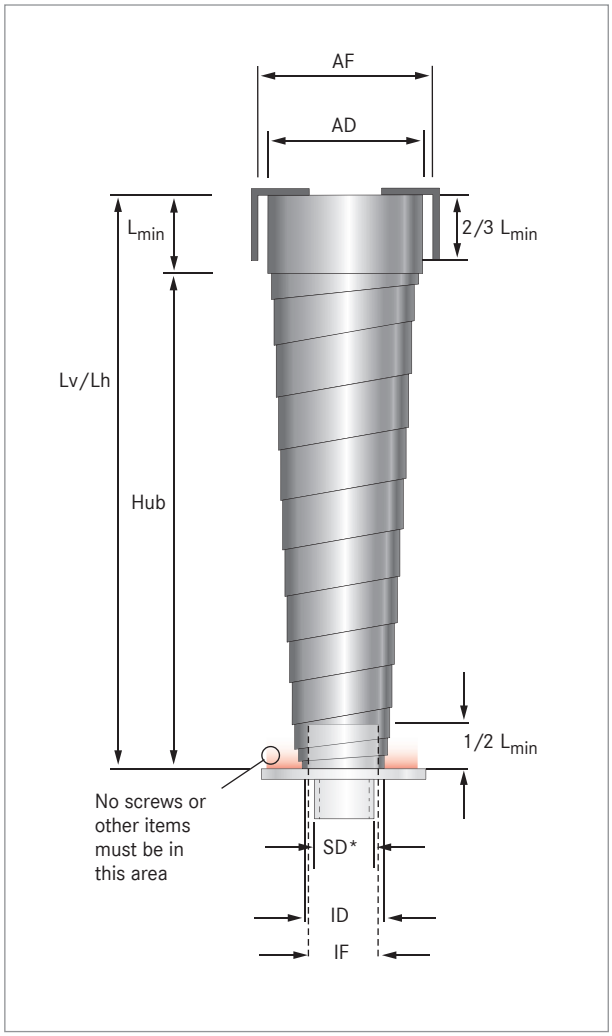
Vertical installation

Vertically installed DURASPRING Spiral Springs generally have greater extension lengths than horizontal types. A critical design factor for this type is the starting force ratio, as the spring works against gravity, among other forces. Vertical types therefore have a high initial force, which ensures that the DURASPRING Spiral Spring extends quickly when the machine starts up or shuts down. For vertical installation, the end with the larger diameter must be installed at the top.

Flanges (optional)

For installation, simple centrering flanges are required at both ends of the DURASPRING Spiral Spring. These flanges must allow the spring's rotational movements to prevent damage. The DURASPRING must be guided freely and must not be screwed or riveted.

DURASPRING Spiral Springs



Legend

SD	Maximum outside diameter of the part to be covered *value is reduced by 6 mm when using flanges
ID	Inside diameter of spiral spring (±1 mm)
AD	Outside diameter of spiral spring (±2 mm)
Lh	Max. extension length for horizontal installation position
Lv	Max. extension length for vertical installation position
BB	Band width, corresponds to L_{min}
SILVER	sizes also in **DURASPRING Silver** available
na	not available

Flange Calculation

Centrering flange (deliverable on demand):

AF	Interior diameter of the larger centrering flange AD + 4mm
IF	Outer diameter of the smaller centrering flange ID - 2mm
Option	through-boring of the flange SD + 2mm

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
15-70-20	11	15	22	na	70	20
15-100-20	11	15	22	60	100	20
15-120-20	11	15	22	90	120	20
15-150-20	11	15	28	110	150	20
15-200-20	11	15	31	160	200	20
15-300-20	11	15	32	260	300	20
20-100-20	16	20	30	60	100	20
20-150-20 SILVER	16	20	33	110	150	20
20-200-20 SILVER	16	20	36	160	200	20
20-250-20 SILVER	16	20	39	210	250	20
20-300-20 SILVER	16	20	41	260	300	20
20-250-30	16	20	36	210	250	30
20-300-30 SILVER	16	20	39	260	300	30
20-350-30 SILVER	16	20	41	310	350	30
20-400-30 SILVER	16	20	43	360	400	30
20-400-40	16	20	35	360	400	40
20-450-40	16	20	41	410	450	40
20-500-40 SILVER	16	20	48	460	500	40
25-100-20 SILVER	21	25	36	60	100	20
25-150-20 SILVER	21	25	38	110	150	20
25-200-20 SILVER	21	25	40	160	200	20
25-250-20 SILVER	21	25	44	210	250	20
25-300-20	21	25	46	260	300	20
25-300-30 SILVER	21	25	42	240	300	30
25-350-30 SILVER	21	25	45	290	350	30
25-400-30	21	25	48	340	400	30
25-450-30	21	25	49	390	450	30
25-450-40 SILVER	21	25	48	370	450	40
25-500-40 SILVER	21	25	49	420	500	40
25-450-50	21	25	41	390	450	50
25-550-50 SILVER	21	25	43	490	550	50
25-600-50	21	25	44	540	600	50
25-650-50 SILVER	21	25	45	590	650	50
25-750-50	21	25	47	690	750	50
25-900-50 SILVER	21	25	57	840	900	50
30-150-30	26	30	39	90	150	30
30-200-30 SILVER	26	30	42	140	200	30
30-250-30 SILVER	26	30	44	190	250	30
30-300-30 SILVER	26	30	46	240	300	30
30-350-30 SILVER	26	30	49	290	350	30
30-400-30 SILVER	26	30	50	340	400	30
30-450-30	26	30	53	390	450	30
30-450-40	26	30	53	370	450	40
30-500-40 SILVER	26	30	55	440	500	40
30-550-40 SILVER	26	30	58	490	550	40
30-600-40	26	30	58	540	600	40
30-650-40	26	30	60	590	650	40
30-700-40 SILVER	26	30	64	640	700	40
30-150-50 SILVER	26	30	40	90	150	50
30-250-50 SILVER	26	30	42	190	250	50
30-350-50	26	30	45	290	350	50

Standard sizes, other sizes on request.

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DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
30-450-50 SILVER	26	30	46	390	450	50
30-550-50 SILVER	26	30	48	490	550	50
30-650-50 SILVER	26	30	55	590	650	50
30-750-50 SILVER	26	30	58	690	750	50
30-650-60	26	30	58	590	650	60
30-750-60 SILVER	26	30	55	690	750	60
30-900-60	26	30	58	840	900	60
30-1000-60	26	30	60	940	1000	60
35-100-20	31	35	45	60	100	20
35-100-30	31	35	44	60	100	30
35-150-30 SILVER	31	35	48	90	150	30
35-200-30 SILVER	31	35	50	140	200	30
35-250-30	31	35	52	190	250	30
35-300-30 SILVER	31	35	55	240	300	30
35-350-30 SILVER	31	35	61	290	350	30
35-400-30 SILVER	31	35	63	340	400	30
35-300-40 SILVER	31	35	48	240	300	40
35-350-40 SILVER	31	35	50	290	350	40
35-400-40 SILVER	31	35	54	340	400	40
35-450-40 SILVER	31	35	58	390	450	40
35-500-40	31	35	60	440	500	40
35-550-40	31	35	62	490	550	40
35-350-50	31	35	51	290	350	50
35-400-50 SILVER	31	35	52	340	400	50
35-450-50	31	35	54	390	450	50
35-500-50 SILVER	31	35	55	440	500	50
35-550-50 SILVER	31	35	57	na	550	50
35-650-50 SILVER	31	35	60	590	650	50
35-750-50 SILVER	31	35	64	690	750	50
35-850-50	31	35	65	790	850	50
35-450-60	31	35	53	390	450	60
35-550-60	31	35	56	490	550	60
35-650-60 SILVER	31	35	59	590	650	60
35-750-60	31	35	60	690	750	60
35-850-60 SILVER	31	35	65	790	850	60
35-550-75	31	35	54	490	550	75
35-650-75	31	35	55	590	650	75
35-750-75	31	35	57	690	750	75
35-850-75 SILVER	31	35	59	790	850	75
40-150-30 SILVER	36	40	51	90	150	30
40-250-30 SILVER	36	40	56	190	250	30
40-350-30 SILVER	36	40	60	290	350	30
40-450-30 SILVER	36	40	64	390	450	30
40-350-40	36	40	61	290	350	40
40-400-40	36	40	63	340	400	40
40-450-40 SILVER	36	40	64	390	450	40
40-500-40 SILVER	36	40	65	440	500	40
40-550-40 SILVER	36	40	68	490	550	40
40-350-50 SILVER	36	40	56	250	350	50
40-450-50 SILVER	36	40	59	350	450	50
40-550-50 SILVER	36	40	61	450	550	50

Standard sizes, other sizes on request.

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
40-650-50 SILVER	36	40	65	550	650	50
40-750-50 SILVER	36	40	69	650	750	50
40-850-50 SILVER	36	40	71	750	850	50
40-350-60	36	40	55	230	350	60
40-450-60 SILVER	36	40	58	450	450	60
40-550-60 SILVER	36	40	59	430	550	60
40-650-60 SILVER	36	40	62	530	650	60
40-750-60 SILVER	36	40	66	630	750	60
40-900-60 SILVER	36	40	70	780	900	60
40-650-75	36	40	63	500	650	75
40-750-75 SILVER	36	40	66	600	750	75
40-900-75 SILVER	36	40	71	750	900	75
40-1100-75	36	40	78	950	1100	75
40-1300-75 SILVER	36	40	84	1150	1300	75
40-1500-75 SILVER	36	40	90	na	1500	75
40-1000-100 SILVER	36	40	68	800	1000	100
40-1200-100 SILVER	36	40	71	1000	1200	100
40-1300-100	36	40	75	1100	1300	100
40-1400-100	36	40	76	1200	1400	100
40-1500-100 SILVER	36	40	78	1300	1500	100
40-1600-100	36	40	81	1400	1600	100
40-1800-100	36	40	82	1600	1800	100
40-1800-120	36	40	82	1560	1800	120
40-2000-120	36	40	86	1760	2000	120
40-2200-120	36	40	90	na	2200	120
45-150-30	41	45	56	90	150	30
45-250-30 SILVER	41	45	61	190	250	30
45-350-30 SILVER	41	45	65	290	350	30
45-400-30	41	45	66	340	400	30
45-350-40	41	45	65	290	350	40
45-400-40	41	45	68	340	400	40
45-450-40 SILVER	41	45	69	390	450	40
45-450-50	41	45	66	350	450	50
45-550-50 SILVER	41	45	68	450	550	50
45-650-50 SILVER	41	45	75	550	650	50
45-350-60	41	45	63	230	350	60
45-450-60 SILVER	41	45	65	330	450	60
45-550-60	41	45	65	430	550	60
45-650-60	41	45	69	530	650	60
45-700-60 SILVER	41	45	70	630	700	60
45-650-75 SILVER	41	45	67	500	650	75
45-750-75	41	45	76	600	750	75
45-900-75 SILVER	41	45	78	750	900	75
45-1100-75 SILVER	41	45	84	950	1100	75
45-1200-75	41	45	86	1150	1200	75
45-1300-75	41	45	89	na	1300	75
45-1000-100	41	45	71	800	1000	100
45-1200-100	41	45	75	1000	1200	100
45-1300-100	41	45	79	1100	1300	100
45-1400-100	41	45	81	1200	1400	100
45-1500-100	41	45	83	1300	1500	100

Standard sizes, other sizes on request.

DURASPRING Spiral Springs

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
45-1600-100	41	45	87	1400	1600	100
45-1800-100	41	45	87	na	1800	100
45-1800-120	41	45	87	1560	1800	120
45-2000-120	41	45	91	1760	2000	120
45-2200-120 SILVER	41	45	100	na	2200	120
50-150-30 SILVER	46	50	63	90	150	30
50-250-30 SILVER	46	50	68	190	250	30
50-350-30 SILVER	46	50	73	290	350	30
50-250-50 SILVER	46	50	62	150	250	50
50-350-50 SILVER	46	50	66	250	350	50
50-450-50 SILVER	46	50	70	350	450	50
50-550-50 SILVER	46	50	73	450	550	50
50-650-50 SILVER	46	50	76	550	650	50
50-350-60 SILVER	46	50	66	230	350	60
50-450-60	46	50	65	330	450	60
50-550-60 SILVER	46	50	68	430	550	60
50-600-60 SILVER	46	50	72	480	600	60
50-650-60	46	50	73	530	650	60
50-750-60 SILVER	46	50	80	630	750	60
50-900-60	46	50	81	780	900	60
50-750-75 SILVER	46	50	78	600	750	75
50-900-75 SILVER	46	50	84	750	900	75
50-1100-75	46	50	90	950	1100	75
50-1200-75	46	50	94	1050	1200	75
50-1100-100 SILVER	46	50	77	900	1100	100
50-1300-100	46	50	80	1100	1300	100
50-1500-100 SILVER	46	50	88	1300	1500	100
50-1600-100	46	50	89	1400	1600	100
50-1700-100	46	50	91	na	1700	100
50-1800-100 SILVER	46	50	94	na	1800	100
50-1700-120	46	50	91	1460	1700	120
50-1900-120 SILVER	46	50	96	1660	1900	120
50-2100-120 SILVER	46	50	100	1860	2100	120
50-2300-120	46	50	105	na	2300	120
50-2500-120	46	50	115	na	2500	120
50-2800-120	46	50	118	na	2800	120
50-2500-150	46	50	116	2200	2500	150
50-2800-150	46	50	118	2500	2800	150
50-3000-150	46	50	123	2500	3000	150
50-3000-180	46	50	123	2640	3000	180
50-3250-180	46	50	128	na	3250	180
50-3250-200	46	50	128	2850	3250	200
50-3500-200	46	50	134	na	3500	200
55-150-30 SILVER	51	55	67	90	150	30
55-250-30 SILVER	51	55	73	190	250	30
55-300-40	51	55	71	220	300	40
55-450-40 SILVER	51	55	76	370	450	40
55-250-50 SILVER	51	55	66	150	250	50
55-350-50 SILVER	51	55	71	250	350	50
55-450-50 SILVER	51	55	74	350	450	50
55-550-50 SILVER	51	55	78	450	550	50

Standard sizes, other sizes on request.

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
55-650-50	51	55	80	450	650	50
55-550-60 SILVER	51	55	75	430	550	60
55-650-60 SILVER	51	55	79	530	650	60
55-750-60 SILVER	51	55	83	630	750	60
55-800-60	51	55	86	680	800	60
55-900-60 SILVER	51	55	89	780	900	60
55-1000-60 SILVER	51	55	92	na	1000	60
55-600-75 SILVER	51	55	80	450	600	75
55-750-75 SILVER	51	55	83	600	750	75
55-900-75 SILVER	51	55	89	750	900	75
55-1100-75 SILVER	51	55	94	950	1100	75
55-1100-100	51	55	85	900	1100	100
55-1300-100	51	55	89	1100	1300	100
55-1500-100	51	55	94	1300	1500	100
55-1800-100 SILVER	51	55	102	1600	1800	100
55-1300-120	51	55	92	1060	1300	120
55-1500-120	51	55	94	1260	1500	120
55-1700-120	51	55	96	1460	1700	120
55-1900-120	51	55	100	1660	1900	120
55-2100-120	51	55	105	1860	2100	120
55-2300-120 SILVER	51	55	110	2060	2300	120
55-2500-120	51	55	116	2200	2500	120
55-2800-120	51	55	123	2500	2800	120
55-2500-150	51	55	118	2200	2500	150
55-2800-150	51	55	121	2500	2800	150
55-3000-150	51	55	126	na	3000	150
55-3500-150	51	55	130	2500	3500	150
55-2800-180	51	55	114	2500	2800	180
55-3000-180	51	55	126	2640	3000	180
55-3250-180	51	55	130	2500	3250	180
55-3500-200	51	55	137	na	3500	180
60-150-30 SILVER	56	60	73	90	150	30
60-250-30 SILVER	56	60	78	190	250	30
60-250-50 SILVER	56	60	73	150	250	50
60-350-50 SILVER	56	60	78	250	350	50
60-450-50 SILVER	56	60	82	350	450	50
60-550-50	56	60	85	450	550	50

Standard sizes, other sizes on request.

Legend

SD	Maximum outside diameter of the part to be covered *value is reduced by 6 mm when using flanges
ID	Inside diameter of spiral spring (±1 mm)
AD	Outside diameter of spiral spring (±2 mm)
Lh	Max. extension length for horizontal installation position
Lv	Max. extension length for vertical installation position
BB	Band width, corresponds to L_{min}
SILVER	sizes also in **DURASPRING Silver** available
na	not available

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60-450-60 SILVER	56	60	78	430	450	60
60-550-60 SILVER	56	60	81	430	550	60
60-650-60 SILVER	56	60	85	530	650	60
60-750-60 SILVER	56	60	89	630	750	60
60-800-60	56	60	96	680	800	60
60-900-60 SILVER	56	60	98	na	900	60
60-750-75 SILVER	56	60	89	600	750	75
60-900-75 SILVER	56	60	95	750	900	75
60-1100-75 SILVER	56	60	102	950	1100	75
60-1300-75	56	60	104	1150	1300	75
60-900-100	56	60	85	700	900	100
60-1100-100 SILVER	56	60	90	900	1100	100
60-1300-100	56	60	94	1100	1300	100
60-1500-100 SILVER	56	60	100	1300	1500	100
60-1800-100	56	60	109	1600	1800	100
60-1700-120	56	60	101	1460	1700	120
60-1900-120	56	60	104	1660	1900	120
60-2100-120 SILVER	56	60	108	1860	2100	120
60-2300-120	56	60	114	2060	2300	120
60-2500-120	56	60	118	2300	2500	120
60-2800-120	56	60	126	2500	2800	120
60-2500-150 SILVER	56	60	118	2300	2500	150
60-2800-150	56	60	123	2500	2800	150
60-3000-150	56	60	128	na	3000	150
60-3500-150	56	60	138	na	3500	150
60-3000-180	56	60	126	2640	3000	180
60-3250-180	56	60	132	na	3250	180
60-3250-200	56	60	132	2850	3250	200
60-3500-200	56	60	139	na	3500	200
65-100-30	61	65	76	90	100	30
65-150-30 SILVER	61	65	78	90	150	30
65-250-30 SILVER	61	65	85	190	250	30
65-250-50 SILVER	61	65	76	150	250	50
65-350-50 SILVER	61	65	84	250	350	50
65-450-50 SILVER	61	65	88	350	450	50
65-550-50 SILVER	61	65	92	450	550	50
65-500-60 SILVER	61	65	86	380	500	60
65-550-60 SILVER	61	65	88	430	550	60
65-650-60 SILVER	61	65	93	530	650	60
65-700-60 SILVER	61	65	94	580	700	60
65-750-60 SILVER	61	65	95	630	750	60
65-800-60 SILVER	61	65	98	680	800	60
65-900-60	61	65	103	780	900	60
65-750-75 SILVER	61	65	93	600	750	75
65-800-75 SILVER	61	65	96	650	800	75
65-900-75 SILVER	61	65	99	750	900	75
65-1100-75 SILVER	61	65	107	900	1100	75
65-1300-75	61	65	111	1100	1300	75
65-1500-75 SILVER	61	65	115	na	1500	75
65-1000-100 SILVER	61	65	91	800	1000	100
65-1100-100 SILVER	61	65	95	900	1100	100

Standard sizes, other sizes on request.

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
65-1300-100 SILVER	61	65	99	1100	1300	100
65-1500-100 SILVER	61	65	108	1300	1500	100
65-1700-100 SILVER	61	65	113	na	1700	100
65-1800-100 SILVER	61	65	119	1600	1800	100
65-1500-120 SILVER	61	65	100	1260	1500	120
65-1700-120	61	65	106	1460	1700	120
65-1900-120 SILVER	61	65	109	1660	1900	120
65-2100-120 SILVER	61	65	113	1860	2100	120
65-2300-120	61	65	118	2060	2300	120
65-2500-120 SILVER	61	65	128	2300	2500	120
65-2800-120	61	65	134	2500	2800	120
65-2400-150	61	65	120	2100	2400	150
65-2800-150	61	65	132	2500	2800	150
65-3000-150	61	65	142	2500	3000	150
65-3000-180	61	65	136	2640	3000	180
65-3250-180	61	65	145	na	3250	180
65-3250-200	61	65	138	2850	3250	200
65-3500-200	61	65	148	na	3500	200
70-150-30 SILVER	66	70	85	90	150	30
70-250-30 SILVER	66	70	93	190	250	30
70-350-30	66	70	99	290	350	30
70-250-50 SILVER	66	70	85	150	250	50
70-350-50 SILVER	66	70	89	250	350	50
70-450-50 SILVER	66	70	94	350	450	50
70-550-50 SILVER	66	70	97	450	550	50
70-650-50	66	70	100	na	650	50
70-550-60 SILVER	66	70	94	430	550	60
70-650-60 SILVER	66	70	97	530	650	60
70-750-60 SILVER	66	70	102	630	750	60
70-900-60	66	70	113	800	900	60
70-500-75	66	70	91	350	500	75
70-600-75	66	70	94	450	600	75
70-700-75	66	70	98	550	700	75
70-750-75 SILVER	66	70	98	750	750	75
70-800-75 SILVER	66	70	102	650	800	75
70-900-75 SILVER	66	70	104	750	900	75
70-1100-75 SILVER	66	70	113	900	1100	75
70-700-100	66	70	88	700	700	100
70-900-100 SILVER	66	70	98	900	900	100
70-1100-100 SILVER	66	70	102	900	1100	100
70-1300-100 SILVER	66	70	106	1100	1300	100
70-1500-100 SILVER	66	70	115	1300	1500	100
70-1800-100 SILVER	66	70	124	1700	1800	100
70-1500-120 SILVER	66	70	110	1260	1500	120
70-1800-120 SILVER	66	70	118	1560	1800	120
70-2000-120 SILVER	66	70	125	1760	2000	120
70-2200-120	66	70	129	1960	2200	120
70-2400-120	66	70	136	2200	2400	120
70-2600-120	66	70	143	na	2600	120
70-3000-120	66	70	147	na	3000	120
70-2000-150	66	70	129	1700	2000	150

Standard sizes, other sizes on request.

DURASPRING Spiral Springs

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
70-2400-150	66	70	135	2100	2400	150
70-2800-150	66	70	139	na	2800	150
70-3000-150	66	70	149	na	3000	150
70-2800-180	66	70	138	2440	2800	180
70-3000-180	66	70	141	na	3000	180
70-3250-180	66	70	152	2500	3250	180
70-3250-200	66	70	144	2500	3250	200
70-3500-200	66	70	155	2500	3500	200
75-150-30 SILVER	71	75	92	90	150	30
75-250-30 SILVER	71	75	98	190	250	30
75-250-50 SILVER	71	75	89	150	250	50
75-350-50 SILVER	71	75	94	250	350	50
75-450-50 SILVER	71	75	101	350	450	50
75-500-50	71	75	105	400	500	50
75-550-60	71	75	100	430	550	60
75-650-60 SILVER	71	75	103	530	650	60
75-750-60 SILVER	71	75	109	630	750	60
75-650-75 SILVER	71	75	99	500	650	75
75-750-75	71	75	104	600	750	75
75-900-75 SILVER	71	75	111	750	900	75
75-1000-75 SILVER	71	75	114	850	1000	75
75-1100-75 SILVER	71	75	118	950	1100	75
75-900-100 SILVER	71	75	102	na	900	100
75-1100-100 SILVER	71	75	108	900	1100	100
75-1200-100 SILVER	71	75	112	1000	1200	100
75-1300-100 SILVER	71	75	112	1100	1300	100
75-1500-100 SILVER	71	75	120	1300	1500	100
75-1700-100 SILVER	71	75	126	1500	1700	100
75-1800-100	71	75	128	1600	1800	100
75-2000-100	71	75	133	1700	2000	100
75-2200-100	71	75	136	1900	2200	100
75-1500-120 SILVER	71	75	115	1260	1500	120
75-1800-120	71	75	122	1560	1800	120
75-2000-120 SILVER	71	75	127	1760	2000	120
75-2200-120 SILVER	71	75	132	1900	2200	120
75-2400-120	71	75	138	2000	2400	120
75-2600-120	71	75	142	2200	2600	120
75-2800-120	71	75	147	na	2800	120
75-2000-150	71	75	135	1700	2000	150
75-2400-150	71	75	140	2100	2400	150
75-2600-150	71	75	144	2300	2600	150
75-2800-150 SILVER	71	75	145	2500	2800	150
75-3000-150	71	75	152	na	3000	150
75-2800-180	71	75	143	2440	2800	180
75-3000-180	71	75	148	na	3000	180
75-3250-180	71	75	156	2500	3250	180
75-3250-200	71	75	148	2850	3250	200
75-3500-200	71	75	158	na	3500	200
80-150-30 SILVER	76	80	98	90	150	30
80-250-30 SILVER	76	80	106	190	250	30
80-250-50	76	80	96	150	250	50

Standard sizes, other sizes on request.

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
80-450-50 SILVER	76	80	111	350	450	50
80-550-50 SILVER	76	80	114	450	550	50
80-450-60	76	80	102	330	450	60
80-550-60	76	80	105	430	550	60
80-650-60 SILVER	76	80	110	530	650	60
80-750-60	76	80	115	630	750	60
80-550-75	76	80	99	400	550	75
80-600-75	76	80	102	450	600	75
80-650-75	76	80	105	500	650	75
80-750-75 SILVER	76	80	108	600	750	75
80-900-75	76	80	119	750	900	75
80-1000-75 SILVER	76	80	123	850	1000	75
80-1200-75 SILVER	76	80	128	1000	1200	75
80-900-100 SILVER	76	80	119	900	900	100
80-1100-100	76	80	115	900	1100	100
80-1300-100 SILVER	76	80	120	1100	1300	100
80-1500-100	76	80	126	1300	1500	100
80-1800-100	76	80	134	1600	1800	100
80-1300-120	76	80	115	1060	1300	120
80-1500-120	76	80	121	1260	1500	120
80-1800-120	76	80	128	1560	1800	120
80-2000-120	76	80	133	1700	2000	120
80-2200-120	76	80	137	1700	2200	120
80-2400-120	76	80	142	na	2400	120
80-2800-120	76	80	145	na	2800	120
80-2000-150	76	80	139	1700	2000	150
80-2200-150	76	80	142	1900	2200	150
80-2400-150	76	80	146	2100	2400	150
80-2600-150	76	80	148	2300	2600	150
80-2800-150	76	80	152	na	2800	150
80-3000-150	76	80	157	na	3000	150
80-2800-180	76	80	148	2440	2800	180
80-3000-180 SILVER	76	80	154	na	3000	180
80-3250-180	76	80	157	na	3250	180
80-3000-200	76	80	154	2600	3000	200
80-3250-200	76	80	160	na	3250	200
80-3500-200	76	80	163	2500	3500	200

Standard sizes, other sizes on request.

Legend	
SD	Maximum outside diameter of the part to be covered *value is reduced by 6 mm when using flanges
ID	Inside diameter of spiral spring (±1 mm)
AD	Outside diameter of spiral spring (±2 mm)
Lh	Max. extension length for horizontal installation position
Lv	Max. extension length for vertical installation position
BB	Band width, corresponds to L_{min}
SILVER	sizes also in **DURASPRING Silver** available
na	not available

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DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
85-150-30	81	85	103	90	150	30
85-250-30	81	85	111	190	250	30
85-250-50	81	85	105	150	250	50
85-350-50	81	85	109	250	350	50
85-450-50	81	85	116	350	450	50
85-550-50	81	85	119	450	550	50
85-650-60	81	85	115	530	650	60
85-550-75	81	85	108	400	550	75
85-900-75	81	85	125	750	900	75
85-1500-100	81	85	127	1300	1500	100
85-1500-120	81	85	126	1260	1500	120
85-2000-120	81	85	138	1700	2000	120
85-2400-150 SILVER	81	85	151	2100	2400	150
85-3500-200	81	85	168	na	3500	200
90-150-30 SILVER	86	90	110	90	150	30
90-250-30	86	90	116	190	250	30
90-150-50	86	90	112	50	150	50
90-250-50	86	90	116	150	250	50
90-350-50 SILVER	86	90	121	250	350	50
90-450-50 SILVER	86	90	125	350	450	50
90-350-60 SILVER	86	90	112	230	350	60
90-450-60	86	90	114	330	450	60
90-450-75	86	90	115	300	450	75
90-550-75 SILVER	86	90	119	400	550	75
90-650-75 SILVER	86	90	124	500	650	75
90-750-75	86	90	128	600	750	75
90-900-75	86	90	133	750	900	75
90-750-100	86	90	115	550	750	100
90-900-100 SILVER	86	90	120	700	900	100
90-1100-100	86	90	126	900	1100	100
90-1300-100 SILVER	86	90	132	1100	1300	100
90-1500-100 SILVER	86	90	144	1300	1500	100
90-1300-120	86	90	126	1060	1300	120
90-1500-120 SILVER	86	90	131	1260	1500	120
90-1800-120	86	90	138	1600	1800	120
90-2000-120	86	90	148	na	2000	120
90-1800-150	86	90	144	1500	1800	150
90-2000-150 SILVER	86	90	149	1700	2000	150
90-2300-150	86	90	154	na	2300	150
90-2600-150	86	90	159	na	2600	150
90-2800-150	86	90	160	na	2800	150
90-3000-150	86	90	166	na	3000	150
90-2600-180	86	90	152	2240	2600	180
90-2800-180	86	90	158	na	2800	180
90-3000-180	86	90	164	na	3000	180
90-2600-200	86	90	153	2400	2600	200
90-3000-200	86	90	162	2500	3000	200
90-3250-200	86	90	166	2500	3250	200
90-3500-200	86	90	170	na	3500	200
90-3700-200	86	90	173	2500	3700	200
90-4000-200	86	90	182	na	4000	200

Standard sizes, other sizes on request.

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
90-4200-200	86	90	185	na	4200	200
90-4500-200	86	90	194	na	4500	200
100-250-60 SILVER	96	100	121	130	250	60
100-350-60 SILVER	96	100	126	230	350	60
100-350-75 SILVER	96	100	119	200	350	75
100-450-75	96	100	124	300	450	75
100-600-75 SILVER	96	100	129	450	600	75
100-800-75 SILVER	96	100	138	650	800	75
100-800-100 SILVER	96	100	126	600	800	100
100-1000-100 SILVER	96	100	132	800	1000	100
100-1200-100	96	100	137	1000	1200	100
100-1500-100	96	100	146	1300	1500	100
100-1100-120 SILVER	96	100	129	860	1100	120
100-1300-120 SILVER	96	100	136	1060	1300	120
100-1500-120	96	100	144	na	1500	120
100-1800-120 SILVER	96	100	148	na	1800	120
100-1500-150	96	100	147	1200	1500	150
100-1800-150	96	100	151	1500	1800	150
100-2000-150 SILVER	96	100	157	1700	2000	150
100-2500-150	96	100	164	na	2500	150
100-3000-150	96	100	188	na	3000	150
100-2500-180	96	100	162	2140	2500	180
100-2800-180	96	100	168	na	2800	180
100-2800-200	96	100	165	na	2800	200
100-3000-200	96	100	170	na	3000	200
110-250-50 SILVER	106	110	130	na	250	50
110-250-60 SILVER	106	110	130	130	250	60
110-350-60 SILVER	106	110	135	230	350	60
110-450-60 SILVER	106	110	139	330	450	60
110-350-75 SILVER	106	110	130	200	350	75
110-450-75	106	110	134	300	450	75
110-600-75 SILVER	106	110	140	450	600	75
110-800-75 SILVER	106	110	154	650	800	75
110-650-100 SILVER	106	110	129	450	650	100
110-750-100 SILVER	106	110	134	560	750	100
110-900-100 SILVER	106	110	139	700	900	100
110-1100-120	106	110	139	860	1100	120
110-1300-120	106	110	145	1060	1300	120
110-1500-120	106	110	155	1260	1500	120
110-1500-150	106	110	155	1200	1500	150
110-1800-150	106	110	157	1500	1800	150
110-2000-150	106	110	160	1700	2000	150
110-2200-180	106	110	165	1840	2200	180
110-2400-180	106	110	170	na	2400	180
110-2400-200	106	110	162	2000	2400	200
110-2800-200	106	110	172	2500	2800	200
110-3000-200	106	110	176	na	3000	200
110-3500-200	106	110	189	na	3500	200
120-250-50	116	120	141	na	250	50
120-350-50 SILVER	116	120	143	na	350	50
120-250-60 SILVER	116	120	141	130	250	60

Standard sizes, other sizes on request.

DURASPRING Spiral Springs

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
120-350-60 SILVER	116	120	145	230	350	60
120-450-60 SILVER	116	120	150	330	450	60
120-350-75	116	120	140	200	350	75
120-450-75 SILVER	116	120	145	300	450	75
120-600-75	116	120	153	450	600	75
120-650-100 SILVER	116	120	142	450	650	100
120-750-100 SILVER	116	120	147	550	750	100
120-900-100 SILVER	116	120	150	700	900	100
120-900-120 SILVER	116	120	148	660	900	120
120-1100-120 SILVER	116	120	153	860	1100	120
120-1300-120	116	120	158	1100	1300	120
120-1500-120	116	120	162	1300	1500	120
120-1300-150 SILVER	116	120	156	1000	1300	150
120-1500-150	116	120	163	1200	1500	150
120-1800-150	116	120	167	1500	1800	150
120-2000-150	116	120	177	1600	2000	150
120-1600-180	116	120	158	1240	1600	180
120-1800-180	116	120	161	1440	1800	180
120-2000-180	116	120	169	1640	2000	180
120-2200-180	116	120	174	na	2200	180
120-2200-200	116	120	165	1800	2200	200
120-2400-200	116	120	170	2100	2400	200
120-2600-200	116	120	174	na	2600	200
130-170-50	126	130	150	na	170	50
130-250-60	126	130	145	210	250	60
130-350-60	126	130	155	na	350	60
130-450-60	126	130	156	410	450	60
130-250-75 SILVER	126	130	145	220	250	75
130-350-75	126	130	150	310	350	75
130-450-75	126	130	156	410	450	75
130-650-100	126	130	157	600	650	100
130-800-100	126	130	164	na	800	100
130-600-120	126	130	158	360	600	120
130-800-120 SILVER	126	130	161	560	800	120
130-1000-120 SILVER	126	130	164	760	1000	120
130-1100-120	126	130	163	na	1100	120
130-900-150	126	130	163	500	900	150
130-1300-150	126	130	170	1000	1300	150
130-1500-150	126	130	174	1200	1500	150
130-1800-150	126	130	185	na	1800	150
130-1650-180	126	130	170	1650	1650	180
130-2000-200	126	130	180	2000	2000	200
140-250-75	136	140	158	150	250	75
140-350-75	136	140	162	250	350	75
140-450-75	136	140	165	350	450	75
140-600-75	136	140	175	na	600	75
140-350-100	136	140	153	250	350	100
140-450-100	136	140	162	350	450	100
140-600-100	136	140	172	500	600	100
140-700-120	136	140	170	460	700	120
140-1000-120	136	140	192	na	1000	120

Standard sizes, other sizes on request

DURASPRING	SD* [mm]	ID [mm]	AD [mm]	Lh [mm]	Lv [mm]	BB [mm]
140-1000-150	136	140	180	700	1000	150
140-1300-150	136	140	187	1000	1300	150
140-1500-150 SILVER	136	140	190	na	1500	150
140-1900-200	136	140	185	1500	1900	200
140-2000-200	136	140	193	1600	2000	200
140-2400-200	136	140	204	na	2400	200
150-350-60	146	150	172	300	350	60
150-450-75	146	150	188	na	450	75
150-500-75	146	150	190	na	500	75
150-600-75	146	150	194	na	600	75
150-750-150	146	150	180	na	750	150
150-1100-150	146	150	187	na	1100	150
150-1300-150	146	150	197	na	1300	150
160-250-60	156	160	178	na	250	60
160-250-75	156	160	180	na	250	75
160-450-75	156	160	189	na	450	75
160-450-100	156	160	182	350	450	100
160-650-120	156	160	191	550	650	120
160-750-120	156	160	193	600	750	120
160-800-150	156	160	197	na	800	150
160-950-150	156	160	200	na	950	150
160-1000-150	156	160	202	na	1000	150
160-1200-150 SILVER	156	160	204	na	1200	150
160-1200-200	156	160	193	na	1200	200
160-1300-200	156	160	200	na	1300	200
160-1400-200	156	160	212	na	1400	200
160-2000-200	156	160	222	na	2000	200

Standard sizes, other sizes on request.



Legend

SD	Maximum outside diameter of the part to be covered *value is reduced by 6 mm when using flanges
ID	Inside diameter of spiral spring (±1 mm)
AD	Outside diameter of spiral spring (±2 mm)
Lh	Max. extension length for horizontal installation position
Lv	Max. extension length for vertical installation position
BB	Band width, corresponds to L_{min}
SILVER	sizes also in **DURASPRING Silver** available
na	not available

GLADIATOR Telescopic Steel Covers

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Telescopic steel covers are among the traditional cover types for machine tools. They are used wherever effective protection against the ingress of chips and other sharp-edged elements is crucial. The ingress of coolant can also be effectively reduced through design measures and suitable wiper systems.

The benefits:

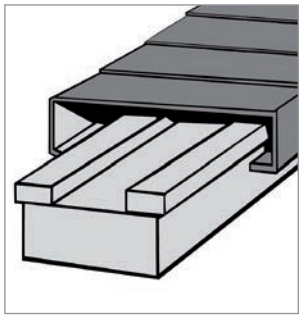
- High quality production
- Repair service and spare parts ex stock
- Fast design and delivery times

Material

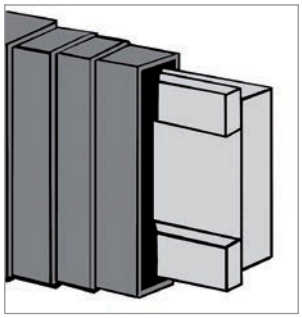
The steel covers are produced from high quality cold-rolled sheet steel in material thickness from 1.5 to 3 mm, or if required in stainless steel.

For all common types of machines a suitable type of cover (e.g. horizontal, vertical, inclined; transversed) together with the corresponding guide way solutions is available.

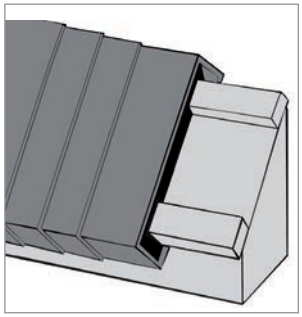
Samples of cover type



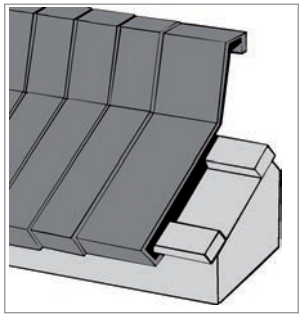
Horizontal



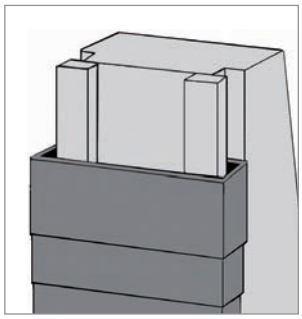
Transversed



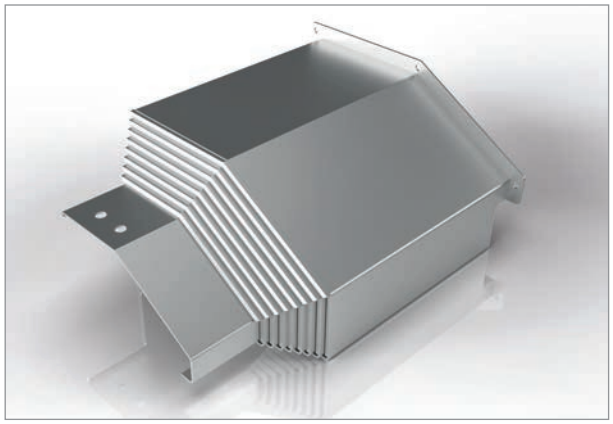
Inclined



Inclined, folded



Vertical



Wiper profiles

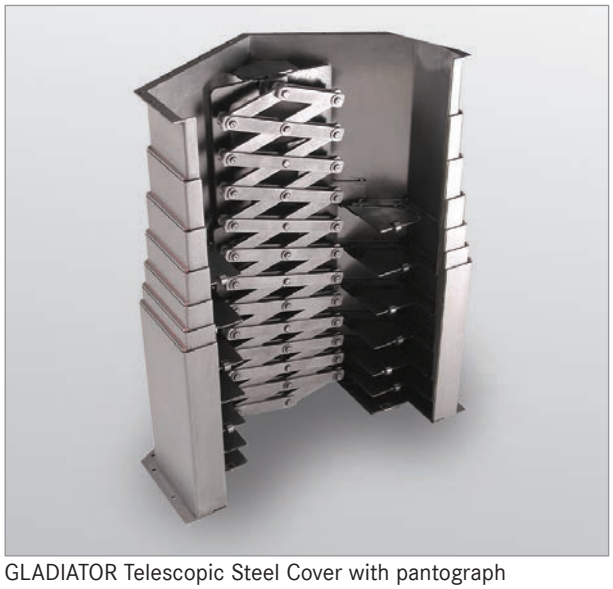
For Telescopic Steel Covers different wiper systems are available. In addition to standard wipers also wiper systems with replaceable lips or additional lip protection are available. For more detailed information of these systems please see the following pages.

Accessibility

Optionally, the largest box can be made walkable by means of an additional corrugated sheet, which facilitates the maintenance of the machine.

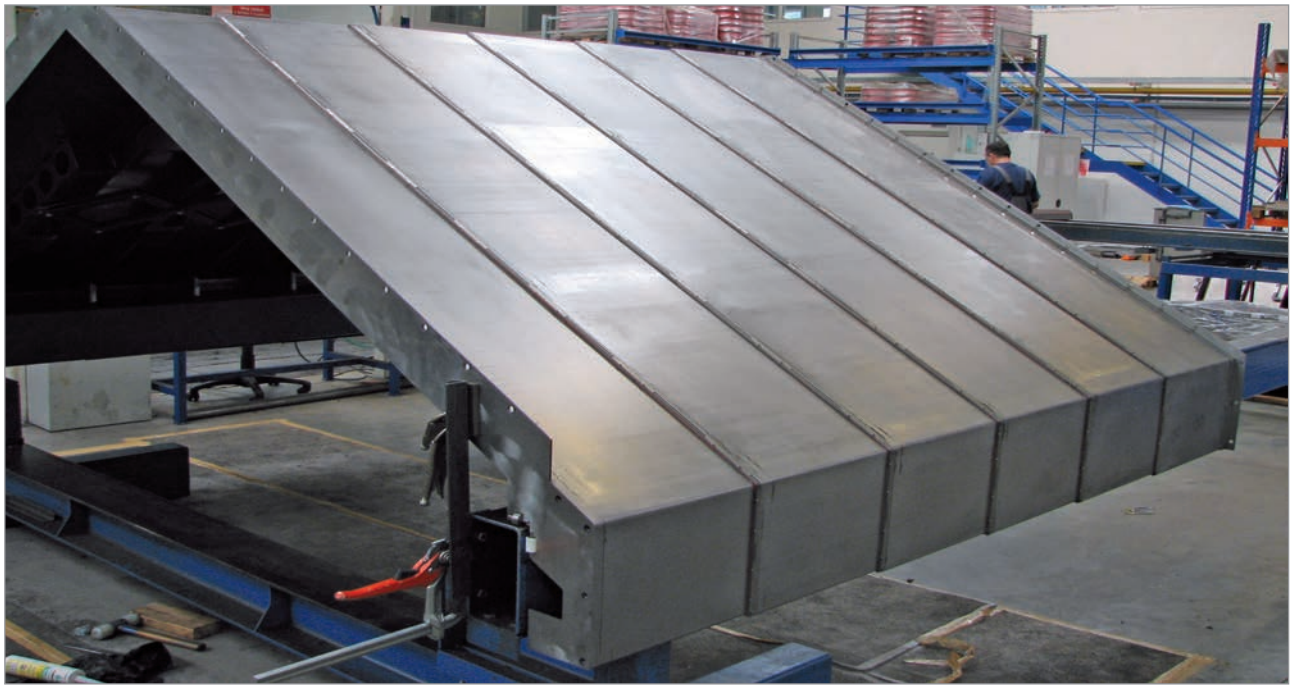
Pantograph systems

For high speed of more than 30m/min we build in pantograph systems (graded versions as well). The space required will be increased in this case.



GLADIATOR Telescopic Steel Cover with pantograph

GLADIATOR Telescopic Steel Covers

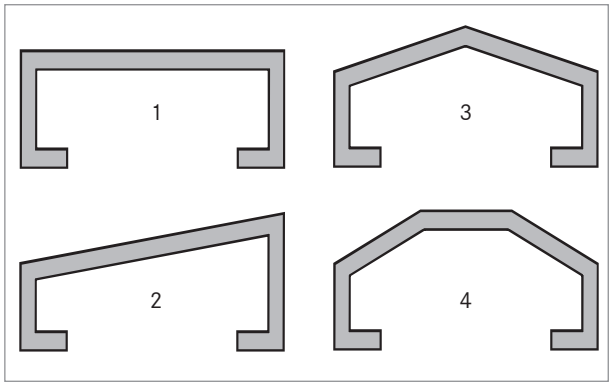


GLADIATOR Telescopic steel cover

Designs

Telescopic steel covers can be produced in different designs:

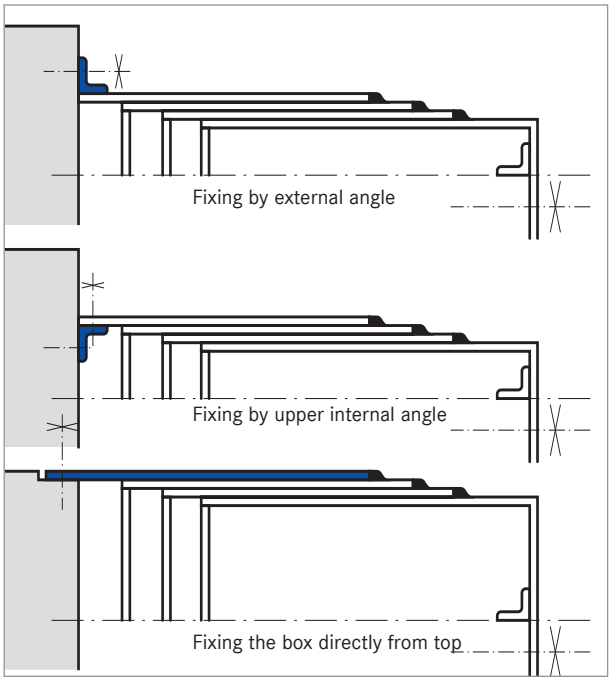
- Standard design (1): cost-efficient, suitable for most standard applications. It can be used without problem up to a width of 900 mm
- Inclined shape (2): provides optimal drainage of liquids
- Roof shape with single edges (3): for larger widths, additional returns are required to increase the cover stiffness. Provides optimal drainage of coolants.
- Roof shape with double edges (4): for larger widths, additional returns to increase the cover stiffness, optimal drainage of fluids.



Mounting

The covers are fixed either directly to the corresponding first or final box section or by additional fixing brackets which may be attached internally or externally.

- Fixing by lateral external angle (recommended)
- Fixing by upper internal angle.
- Fixing the box directly from the top - high positional accuracy is required.



Safety information wiper

Please consider the safety information in the service and maintenance manual included with each delivery.

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The wiper systems for steel covers can be subdivided into three main groups:

- Types P 01/P 02/P03 - wiper lip cannot be replaced
- Types DSP/DV/LP - wiper lip can be replaced
- Types LV - wiper system can be replaced. Replacing of wiper lip **without dismantling of cover**

Wiper type P 01/P 02/P03

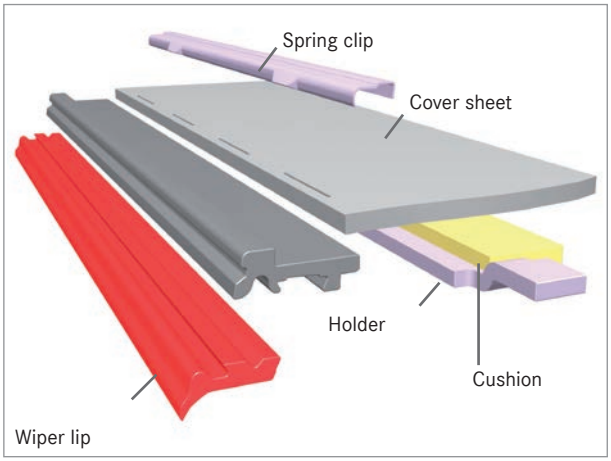
Wiper of types P 01/P 02 can be used universally. They can be used horizontally for telescopic steel covers or vertically for guideway wipers. A polyurethane wiper lip is vulcanised onto one or two steel profiles and thus permanently bonded. An additional support by steel frame is available as an option. When worn, the complete wiper must be replaced. These wipers lips are available in lengths of 500 mm.

Wiper Type DSP/DV/LP

Wiper lips of these types can be replaced when worn. The service should be done by professional service personnel. They are fixed by spot welding. These wipers are compatible with many systems common in the marketplace. The metal profiles are produced from stainless steel.
Wiper lips are available in lengths from 1,000 to 10,000 mm, metal profiles from 1,000 to 3,000 mm length. Wiper lips and metal profiles can be ordered separately.

Wiper Type LV

This innovative system enables a significant reduction of maintenance time and costs. The wiper lips of type LV can easily be changed when worn. Replacement can be made by customers own personnel. For replacement of the wiper lip, only the spring clips have to be loosened, and the profile with wiper removed and replaced.
There is no further dismantling of the cover required.
In comparison to standard wiper systems, machine down time can be reduced by up to 15%.
Wiper lips are available in lengths from 1,000 to 10,000 mm, metal profiles from 1,000 to 3,000 mm.

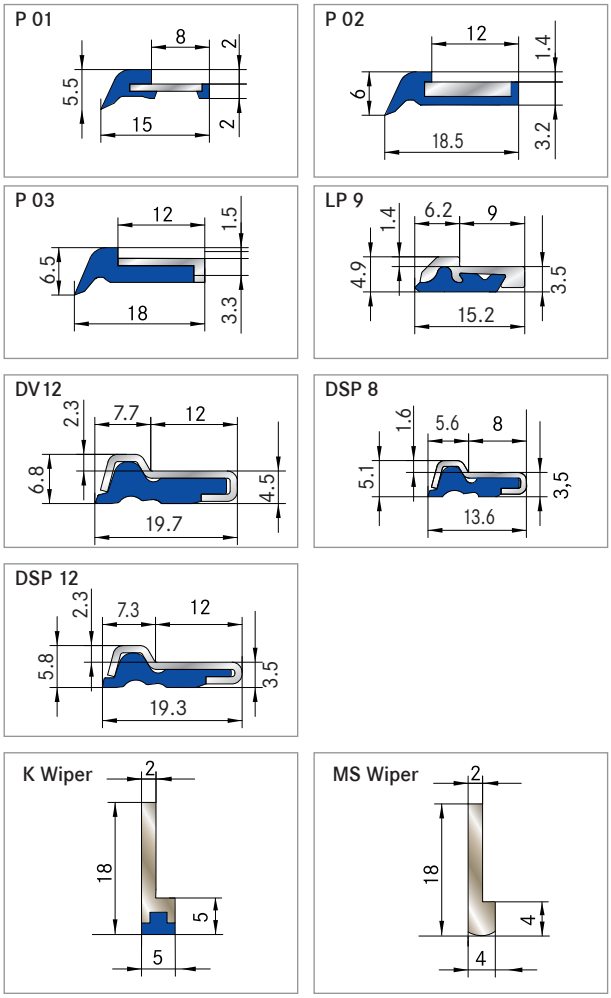


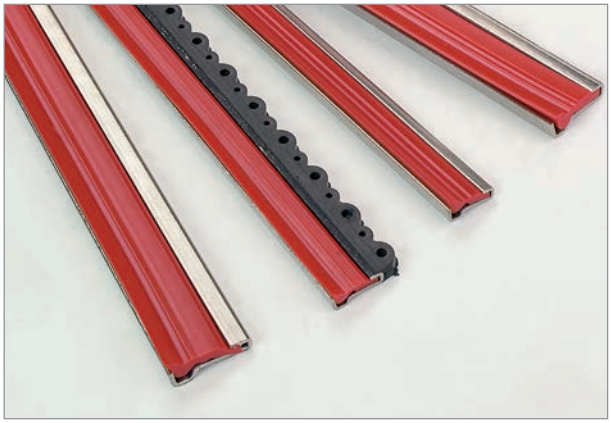
LV Wiper System

Material of wiper lips

The wiper lips are manufactured from high-grade polyurethane and offer good mechanical and chemical properties. They are temperature resistant up to a maximum of 130°C (natural rubber up to 135°C), continuously up to 90°C (natural rubber up to 100°C).

Wiper profiles for Telescopic Steel Covers




Wiper type DSP/DSV

GLADIATOR Telescopic Steel Covers

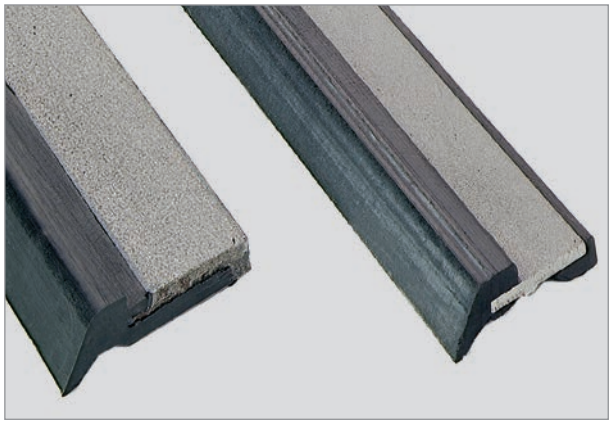
The guideways of machine tools must be kept free of chips and dirt. Therefore wipers are important. Wipers for guideways are designed specifically to occupy minimum space. These wipers can be produced in different forms, dimensions, and in different materials. For each application there will be an optimal version available.

For guideway wipers there are four different types available:

- Wiper Type P
- Wiper Type L
- Wiper Type S - for welded wiper
- Individual designed, vulcanised wiper

Wiper type P

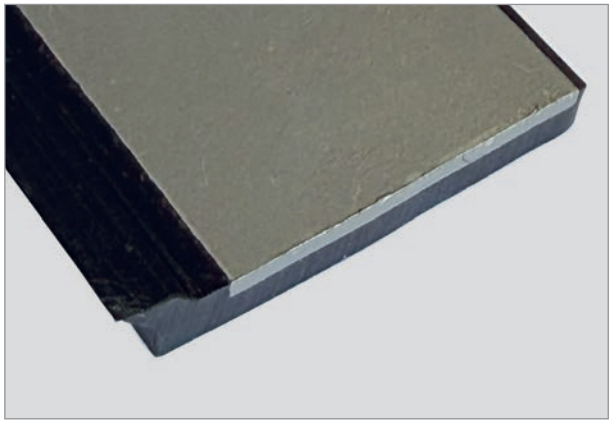
Wipers of this type can be used universally. They can be mounted horizontally for Telescopic Steel Covers or vertically for guideways. A polyurethane lip with a steel core is vulcanised to a steel profile. An additional steel band reinforcement is available as an option.



Wiper type P

Wiper type L

This wiper type is produced as an insert with a lip of natural rubber. This lip possess's excellent mechanical qualities and a high resistance to abrasion. The material is resistant to mineral oils, coolants, and micro-organisms.



Wiper type L

Wiper type S

These wipers are equipped with a special two-sided lip, providing rear sealing to coolant. Its outer support of nickel chromium steel offers high rigidity and stability under load.



Wiper type S with additional metal wiper

Design

Standard wipers are available in the following lengths:

- Wiper Type P: 500 mm
- Wiper Type L: 500 mm
- Wiper Type S: 530 and 1,000 mm

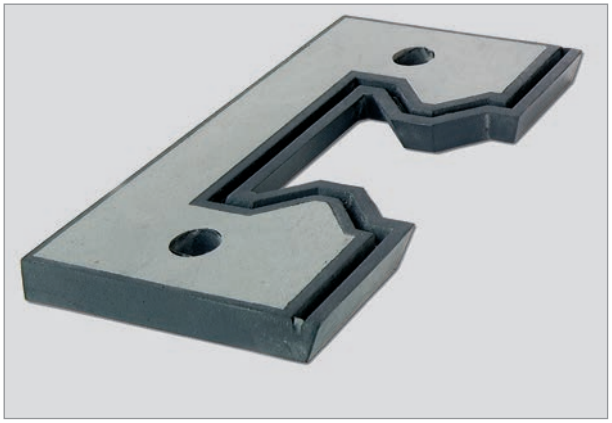
Wipers according to customer's specification can be produced. Additionally they can be equipped with an extra steel wiper. Preload of wiper is generally 1 mm.

Material wiper

- Polyurethane
- Temporary temperature resistant up to 130°C
- Permanent temperature resistant up to 90°C
- Resistant to mineral oils and coolants
- Excellent resistance to absorption
- High resistance to micro-organism's

Individual wiper

The molded, vulcanized wipers can be manufactured in any technically feasible shape. However, for economical production, a minimum order quantity of 20 pieces is recommended. Standard wipers in other shapes or designs are also available upon request.



Individually designed type with vulcanised wiper lip

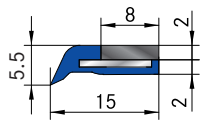
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GLADIATOR Telescopic Steel Covers

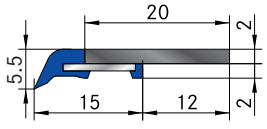
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Wiper profiles for guideways

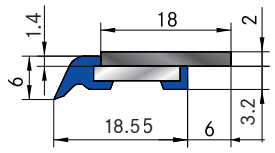
P 01 8x2



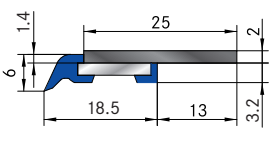
P 01 20x2



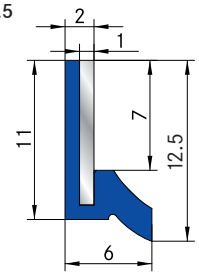
P 02 18x2



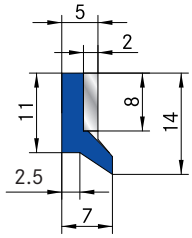
P 02 25x2



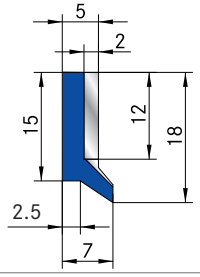
L 12.5



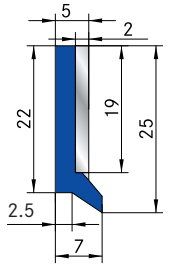
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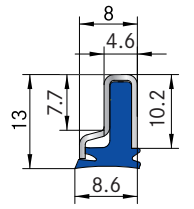
L 18



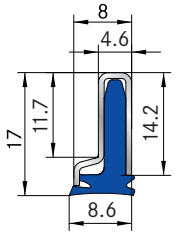
L 25



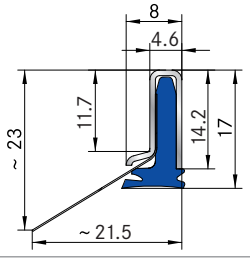
S 14



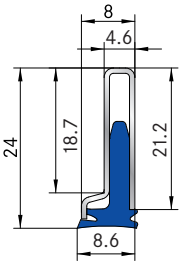
S 18

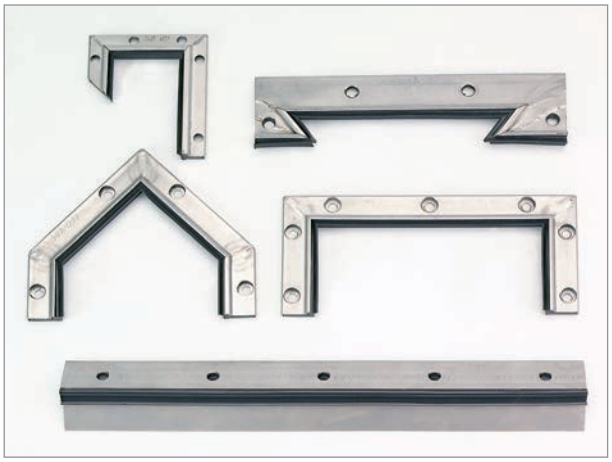


S 18 with pre-wiper

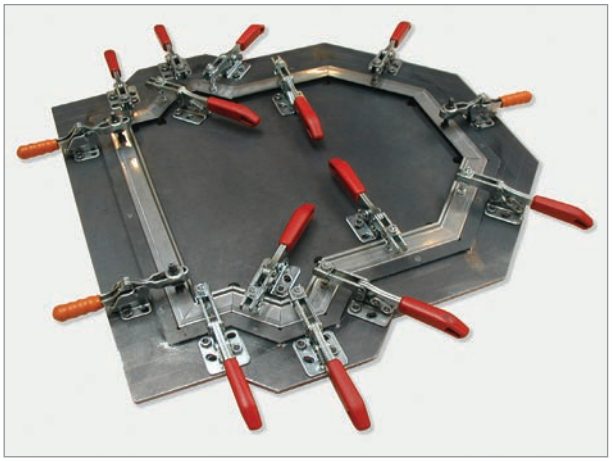


S 25

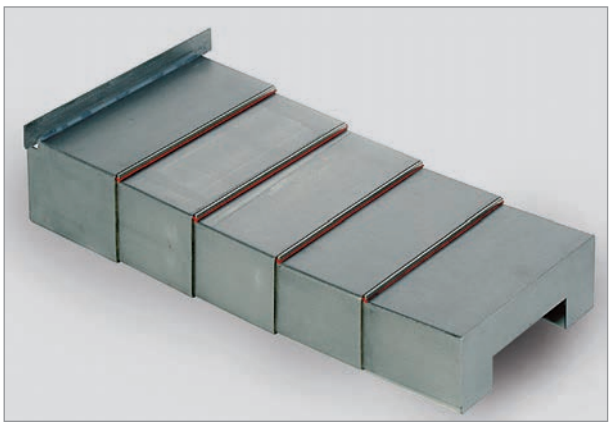




Individual designed wiper according to customer's requirements

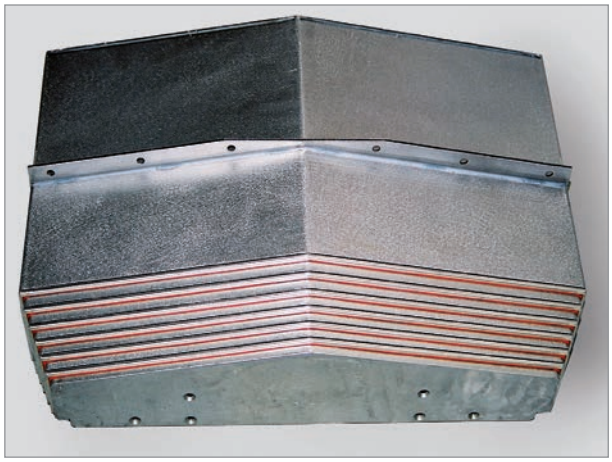


Preparation of wiper

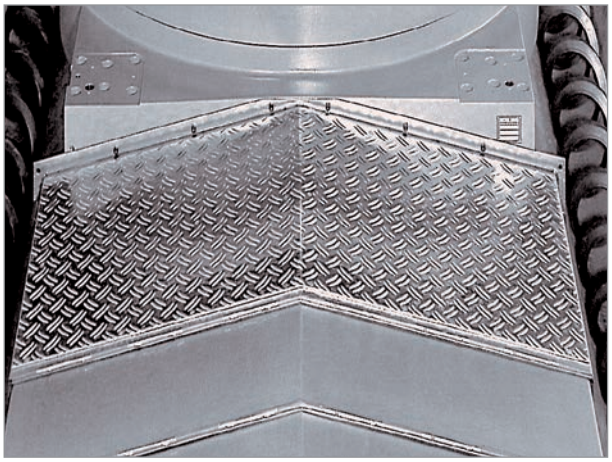


GLADIATOR Telescopic Steel Cover with wiper

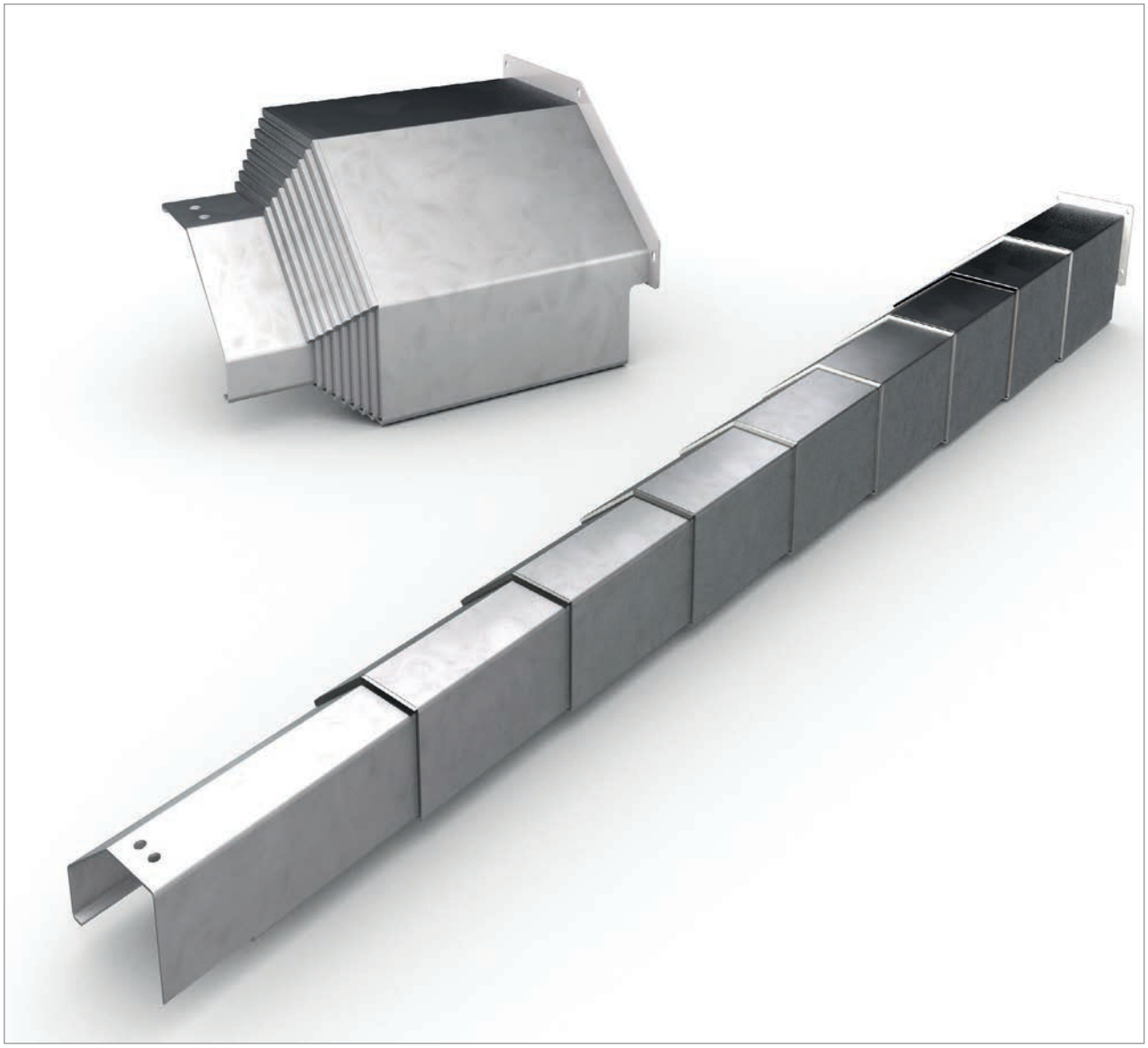
GLADIATOR Telescopic Steel Covers



GLADIATOR Telescopic Steel Cover with wiper



Accessible area on the largest box



Telescopic steel cover - closed and open in comparison

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HEMA QUALITY - MATERIAL & FUNCTION TESTS

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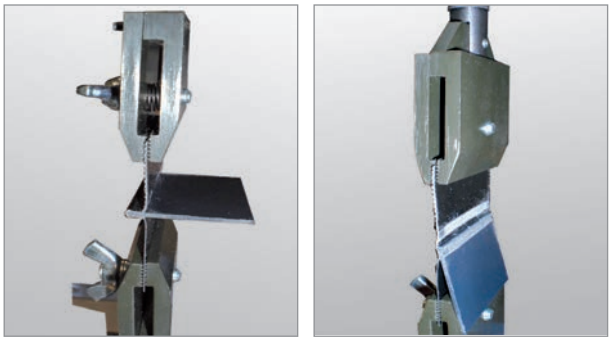
HEMA's protective systems are used in many machine tools and applications. They protect components from contamination and damage caused by cooling lubricants and hot chips generated during the machining process, or serve as impact and underrun protection against potential injuries and damage.

The better the protection system, the more reliable the protective function. We are constantly working on the further development of our products to achieve this.
These measures are often not visible from the outside of the product; however, optimisations to internal components, such as the drives of roller covers or the attachment of lamellas to bellows, also contribute to longer product lifespans.

We regularly check the functionality of our protection systems, further developments, and the materials used.



Bally Flextest for determining buckling resistance



Material stress test - tensile test of textiles and tapes

Material tests

- Tensile testing machine
- Bally bend test
- Dynamic buckling resistance
- Preload measurement
- Reproducible weld spatter test
- Coolant resistance
- Leak test

Functional tests

Impact tests according to DIN EN 12415 and DIN EN 12417

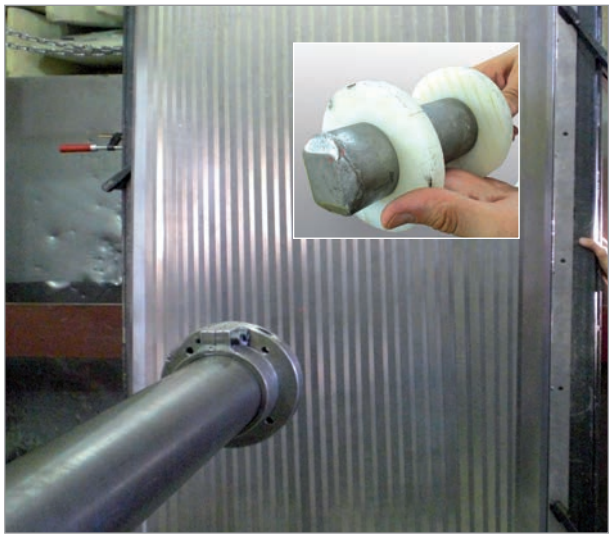
- Safety Windows
- Protection Systems

Dynamic testing of backwall systems and roller covers

- Horizontal and vertical test benches
- Travel distances up to 4,000 mm
- Travel dynamics up to 200 m/min and 2*g* acceleration

Spiral spring test bench

- Spiral spring test bench for testing static and dynamic restoring forces
- Noise level

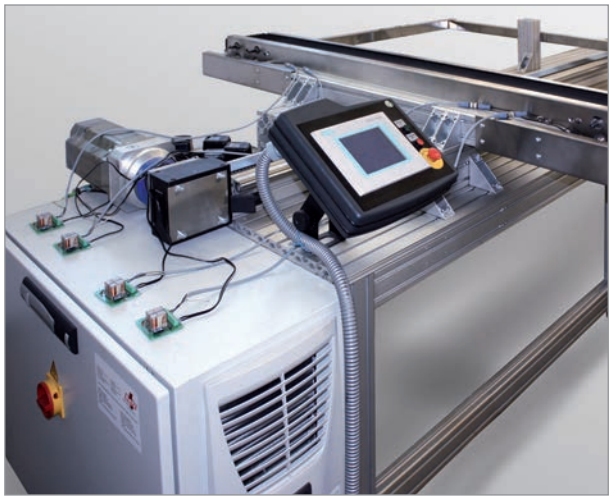


Impact testing according to DIN EN 12417



Testing of static and dynamic restoring forces

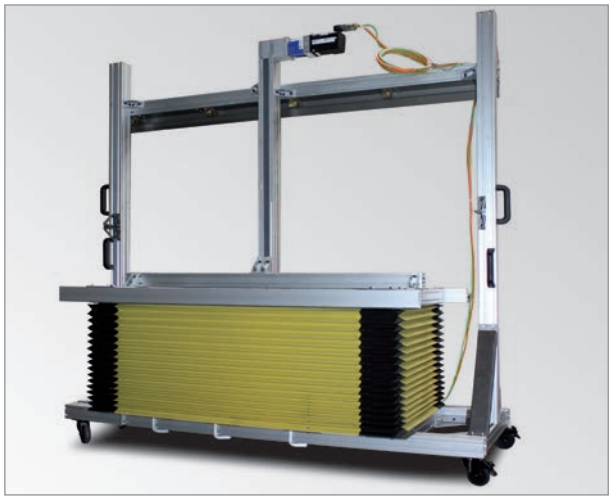
Hema Quality - Material & Function Tests



Mechatronics test - Testing of mechanics and sensors



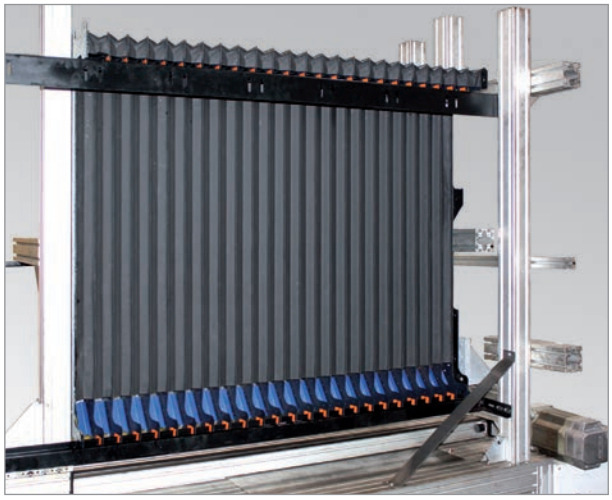
Endurance test of lamellas for durability and noise generation



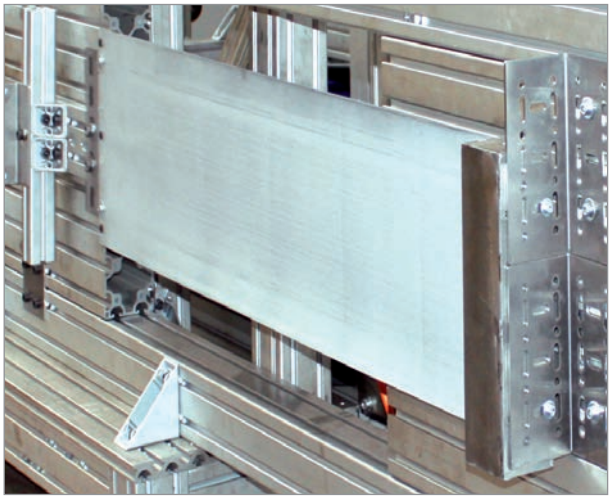
Test of travel speed and wear on lift tables



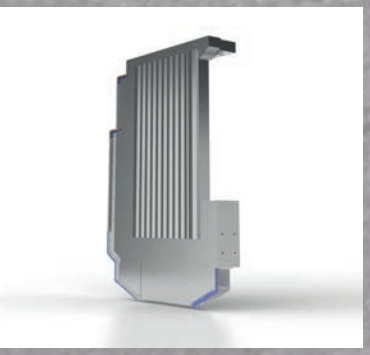
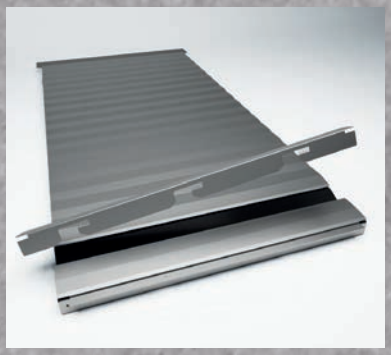
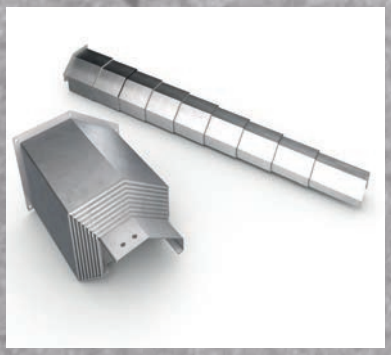
Functional test of a backwall system on a high-speed test bench



Wear test of bellow - up to three million cycles



Wear test of roller cover - up to three million cycles


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