



Bellows

**ELASTIC
SAMURAI**

HEMA has produced for more than two decades bellows protective systems for application in any different fields of industry. The standard production line is the ELASTIC bellows. The production of many thousands of ELASTIC bellows directly flows into consulting work and into the design of new spe-

cific customer solutions. New developments and adaptations resulting from customers' orders ensure continuous development and performance and an extension of application areas.

ELASTIC bellows



Requirements

Requirements for safety, compactness and speed of machines are constantly rising, demanding new materials and designs of protective covering systems.

We meet market expectations by developing system components and integrated solutions which can be mounted complete.

The solutions proposed by HEMA are answers to problems defined as follows:

- no surplus space – reducing the machine size by special materials and space saving designs
- Everything by one provider – bellows integrated into the rear wall covering of the machine, complete with guides and mounting devices

- if it get's hot – high temperature resistant materials up to 600°C for laser, plasma and welding applications

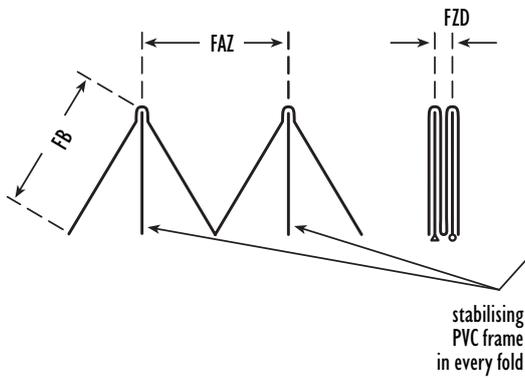
- specialities as requested – dust proof, free from silicone, antistatic surface and compatible to food processing – important for electronics, wood working, medical technology, automotive industry and many other areas

- fast as lightning – efficient chip protection and coolant impermeability at HSC applications by SAMURAI bellows with high contact pressure and protection on several sides

- the new generation – replacement of steel covers by intelligent SAMURAI bellow walls may often be realised

Technical data

ELASTIC bellows comprise a product series with many combination options, the basic component material, form, way of processing, dimensions being easily adaptable.



Beside PVC we offer PP, Nomex and polyamid as an alternative material for the support frames.

All ELASTIC bellows may be deployed horizontally or vertically (mixed positions possible). By deploying efficient glider profiles, roller and ball

bearings improved quiet running, long life cycles and low friction movement are achieved with HSC applications as well.

At high start accelerations, a reduction of the load to the first folds, an even extension and the stability of the travel movement is achieved by extension limiters.

The essential component of the ELASTIC bellow is a stabilising PVC frame within every fold. This frame is joined unsolvable to the outer fold material by two basically different processes.

For more than 80 % of the bellows the thermal bonding process is applied. By the influence of heat and with the help of a specially developed flux a permanent bonding is reached between the inner PVC frame and the outer fold material. Thermal bonded ELASTIC bellows are maintenance free, water and dust proof as well as oil resistant and conditionally acid resistant.

The "sewn" version is mainly applied for high temperature materials. By strong fabrics (i.e. Kevlar) a long lasting solution will be achieved even under extreme loads. The PVC frames are fixed to every fold by sewing, stabilising the bellow as well.

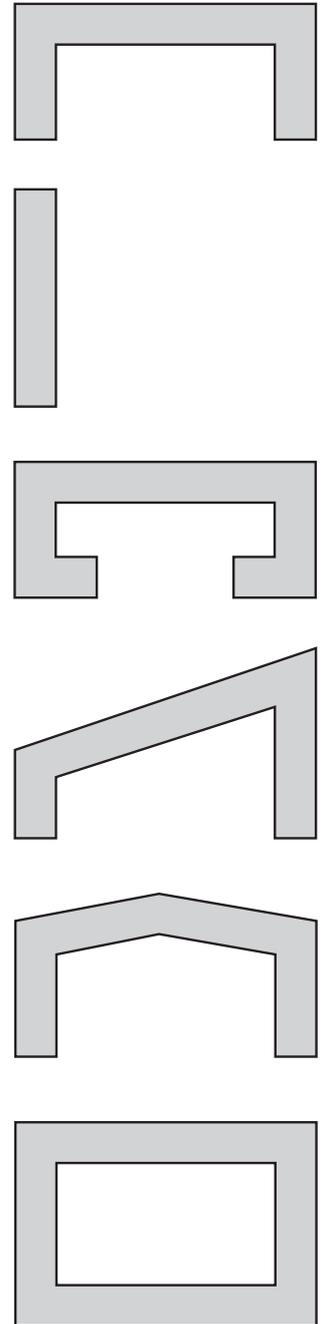
The ELASTIC bellows show high dimensional stability due to the built-in PVC frame. With direct impacts to the bellow reversion to the original shape is guaranteed.



ELASTIC bellow with pantograph systems

ELASTIC bellows

Standard types



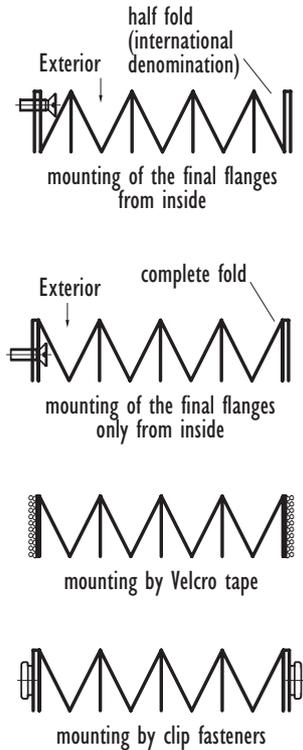
ELASTIC bellows

Even surface properties, regularity of the contours and availability of various colours of the ELASTIC bellows provide an attractive visual over all appearance for your machine.

The basic geometrical shapes of the ELASTIC bellows are the venetian and the U-shaped type. Additional stability may be achieved by using overlapping structures maintaining a grip on the guiding ways. The draining of liquids may be facilitated by using inclined or roof-shaped designs. The rectangular shape is used mainly for platform applications (elevating platform, medical equipment). It may be retrofitted as well by using bonding tape, Velcro tape or other adhesives.

Mounting

Mounting of the ELASTIC bellows to the machines is easily achieved by components usually supplied ex works. Normally a frame made from metal or synthetic material, designed according to customer's specifications, is attached to both ends, and is used for fixing. The mounting by Velcro tape is even easier, providing fast and efficient maintenance work. Further alternatives are clip fasteners and fixing straps.



Technical design information

- Abbreviations:
- FB = width of the fold
 - FZ = number of folds
 - FZD = compression per fold
 - FAZ = extension per fold
 - BE = width of the terminal fixture
 - Lmax = maximum extension
 - Lmin = minimum compression

Formulae for calculation:

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

$$FZ = \frac{L_{max}}{FAZ}$$

$$L_{min} = \left(\frac{L_{max}}{FAZ} \times FZD \right) + BE$$

$$L_{max} = \frac{(L_{min} - BE) \times FAZ}{FZD}$$

Dimensions:

| FB (mm) | FAZ (mm) | FZD* (mm) |
|---------|----------|-----------|
| 15 | 20 | 3–5 |
| 17,5 | 24 | 3–5 |
| 20 | 30 | 3–5 |
| 25 | 38 | 3–5 |
| 30 | 48 | 3–5 |
| 35 | 55 | 3–5 |
| 40 | 65 | 3–5 |
| 45 | 75 | 3–5 |
| 50 | 85 | 3–5 |

* depending on the material



ELASTIC bellow for travelling support columns, WALLCONCEPT

SAMURAI – one of the world's most complete product ranges in the area of lamella bellows.

HEMA developed the first SAMURAI bellows in 1980 and had protected this idea in important markets. The concept is aimed to open new markets and applications to the traditional bellow by the addition of a high-performance, lightweight protector in the shape of lamellas. The lamellas act like the armour once worn by Japanese SAMURAI warriors.

Having produced many thousands of bellows, HEMA has acquired comprehensive experience available to our customers in search for innovative specific solutions. Constant new development and adaptation derived from customer experience facilitate the high performance of the product line.

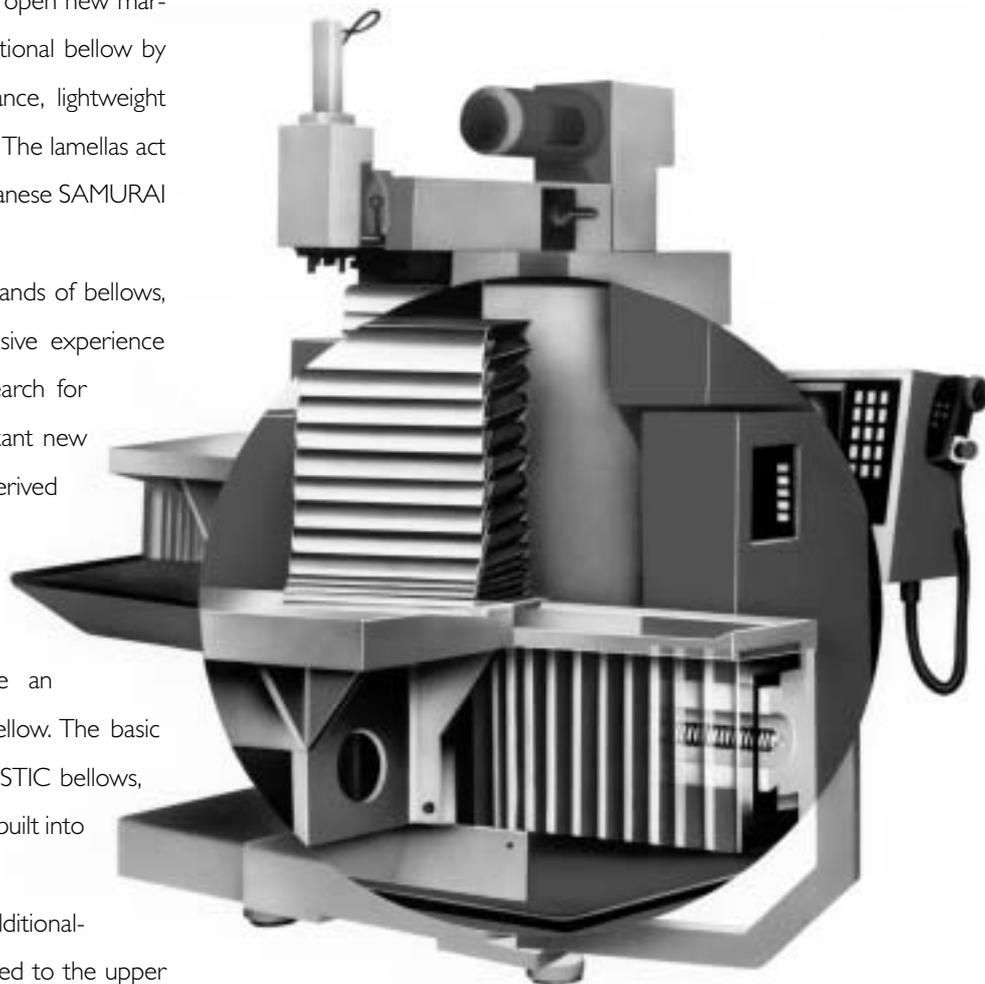
The SAMURAI bellows are an advancement of the ELASTIC bellow. The basic concept corresponds to the ELASTIC bellows, here as well a PVC frame may be built into each fold to guarantee stability.

The SAMURAI bellows are additionally reinforced by lamella sheets fixed to the upper edge of the folds. In this way, an efficient protection of the bellows against swift, very hot and sharp edged chips is achieved.

The more simple SAMURAI lamellas aprons are to be considered as a variety of the SAMURAI bellow. The substructure does not consist of an ELASTIC bellow but only a carrier material on

which the lamella sheets are fixed. These types are denominated FASTLAP and are deployed in large numbers in machining centres as compact rear wall panelling (z-axis).

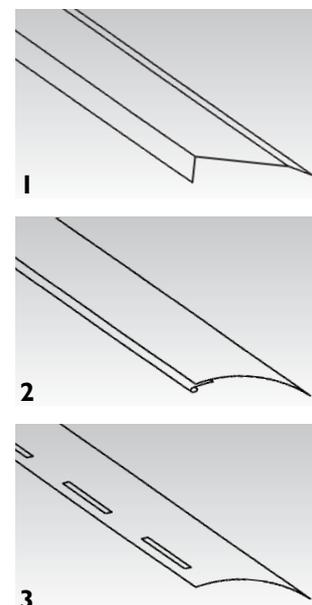
The SAMURAI concept



Design of the lamellas

We use three basic ways of fastening the lamellas. From these three basic ways result the different types of products and their denominations. The product types FASTAF/ FASTAC are provided with fixed lamellas **1**). For the product types FASTAM/ FASTLAP flexible lamellas are deployed. The flexible lamellas are offered in two different

versions, either with a hinge **2**) or with clips **3**), depending on deployment conditions. For the hinge types, you may choose between versions with or without preload.



FASTAF FASTAC

Technical design information:

- Abbreviations: FB = width of the fold
 FZD = compression per fold
 FAZ = extension per fold
 2FAZ = one sheet of lamella is protecting two folds
 FHUB = stroke per fold
 BE = width of the mounting device (flange, Velcro)
 Lmax = maximum extension
 Lmin = minimum compression
 X = horizontal space required for the lamellas
 Y = vertical space required for the lamellas



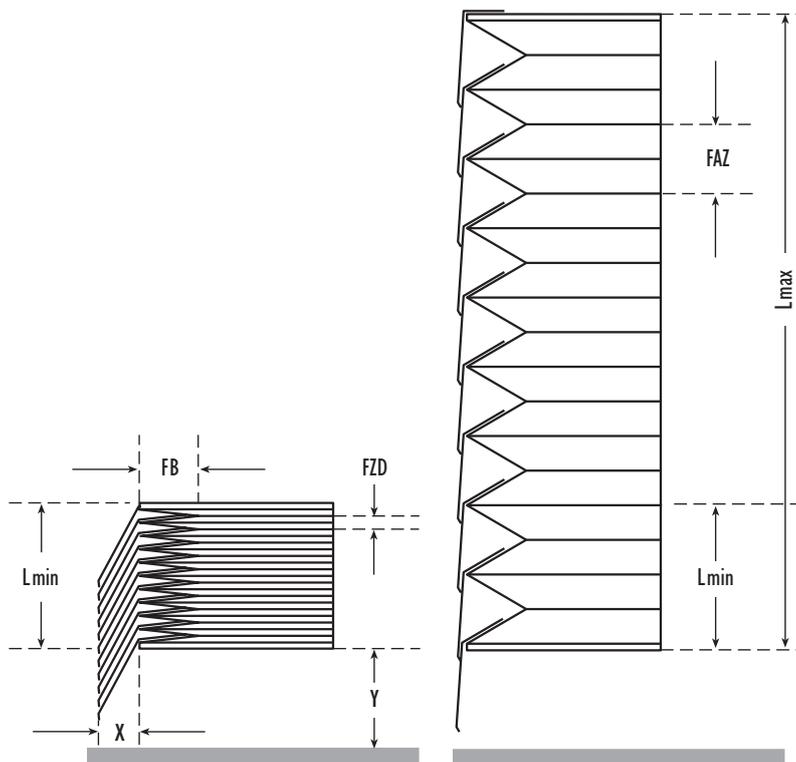
SAMURAI two-sided protection by lamellas covering the corner

The FASTAC type has fixed lamellas travelling in a telescopic way (boxes), spreading completely across the frontage and the sides, forming a closed surface. The closed lamellas bellows FASTAC usually provide a movable alternative to telescopic steels covers or machine covers, respectively.

For all SAMURAI bellows with fixed lamellas, due to the technical design an overhang has to be taken into account. This can be avoided by the flexible varieties (FASTAM/ FASTLAP).

The lamellas used are produced from stainless steel or aluminium as a standard. There is a large variety of profiles available which are designed according to customer's specifications. The basic versions are available in flat or rounded shape. Usually the final edges of the lamellas are formed in the shape of a wiper, creating a very good closing and sealing on the top side of the SAMURAI bellows.

There is a high contact pressure across the whole lamella contact area. Lamellas guarantee by



FASTAF

| FB (mm) | FAZ (mm) | FZD (mm) | X (mm) | Y (mm) |
|---------|----------|----------|--------|--------|
| 17,5 | 20 | 4 | 20 | 40 |
| 20 | 25 | 5 | 20 | 45 |
| 25 | 32 | 5 | 20 | 50 |
| 30 | 35 | 5 | 20 | 70 |
| 35 | 45 | 5 | 20 | 75 |
| 40 | 60 | 5 | 20 | 90 |
| 45 | 65 | 5 | 20 | 95 |
| 50 | 75 | 5 | 20 | 110 |

FASTAC / FASTAF – 2 folds

| FB (mm) | 2FAZ (mm) | 2FZD (mm) | Y (mm) |
|---------|-----------|-----------|--------|
| 15 | 40 | 5-10 | 65 |
| 17,5 | 45 | 5-10 | 75 |
| 20 | 55 | 5-10 | 75 |
| 25 | 70 | 5-10 | 90 |
| 30 | 85 | 5-10 | 105 |
| 35 | 100 | 5-10 | 120 |
| 40 | 125 | 5-10 | 155 |

indication: consider the telescopic structure of the X-dimension



SAMURAI: protection by lamellas including roof covering

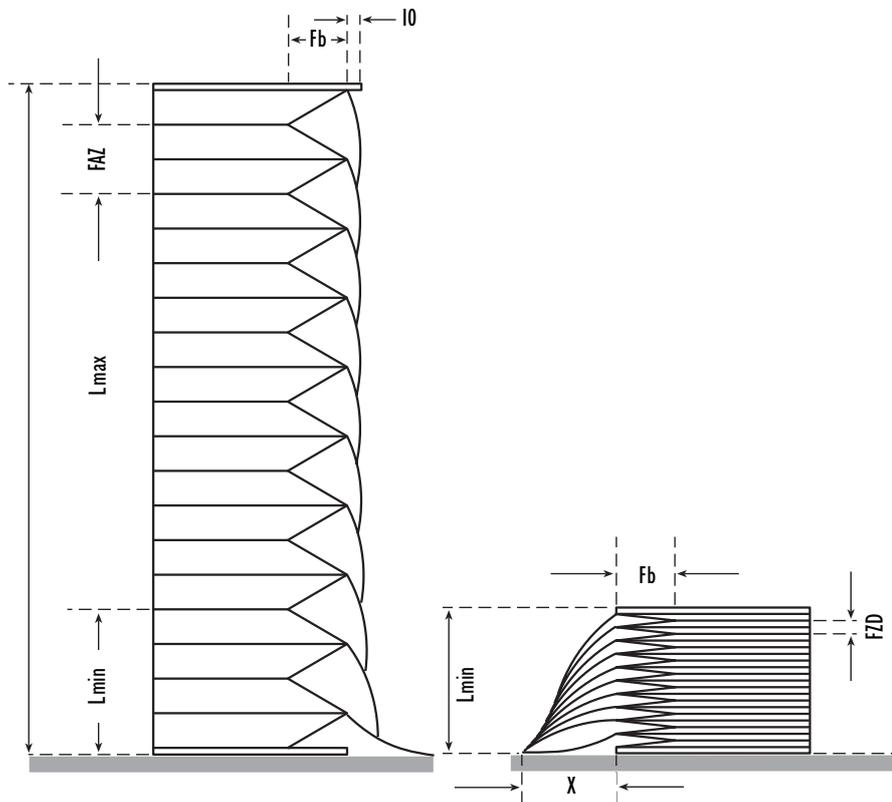
The SAMURAI bellows are very well suited for HSC applications. Solutions for machining centres have been realised at a speed of more than 100 m/min and an acceleration of more than 2 G.

FASTAM

their efficient wiper edge that debris does not access the interior of the bellows.

After use, there is a normal, regular formation of stripes created on the lamellas by the shape of the edges, which have no influence on function or life cycle. The quality of the lamellas is well tried within thousands of applications for many years. The lamellas are stainless and acid proof, but not accessible. All edges of the lamellas are deburred, preventing the risk of injuries while mounting.

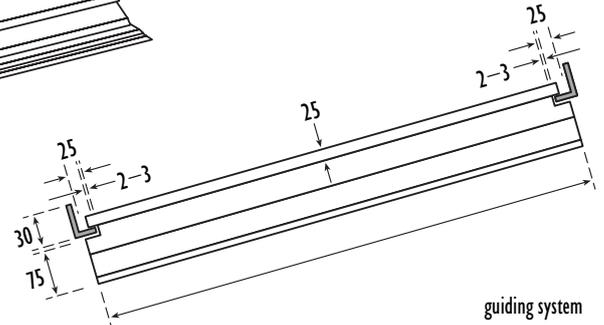
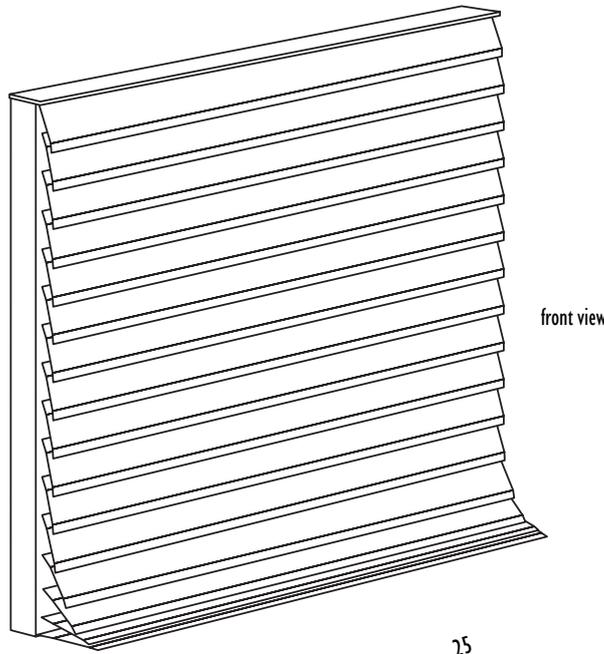
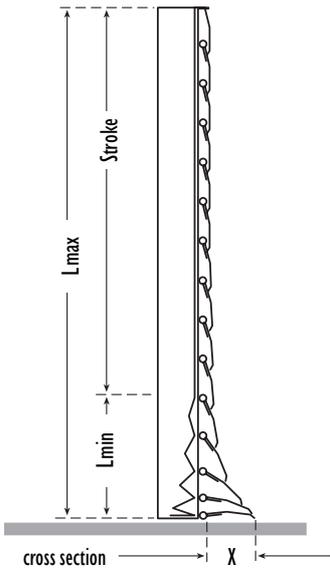
At the SAMURAI bellows, all materials, shapes, types of processing and dimensions of the ELASTIC series may be combined at random. Additionally, the customer is free to choose the position of the lamellas. It is possible to fasten the lamellas at the front side, on each of the side parts as well as in any combination thereof. Furthermore, in-house production of the lamellas ensures all shape designs, i.e. inclined or roof-type shapes, may be realised.



FASTAM

| FB (mm) | FAZ (mm) | FZD (mm) | X (mm) |
|------------|-------------|-------------|-----------|
| 17,5 | 22 | 4 | 50 |
| 20 | 30 | 5 | 50 |
| 25 | 38 | 5 | 65 |
| 30 | 48 | 5 | 75 |
| 35 | 55 | 5 | 85 |
| 40 | 65 | 5 | 85 |
| 45 | 75 | 5 | 100 |
| 50 | 85 | 5 | 110 |

FASTLAP



The FASTLAP lamellas aprons require a defined guiding system on both sides by which friction-free movement is possible. The customer should use the standardised system developed by HEMA.

The maximum width of the lamellas may be up to 4000 mm. Special sizes can be produced, depending on the circumstances. The lamella plates consist of stainless steel with a thickness up to 1,5 mm.



Consultation with our customers in difficult projects is our strength. We will come to your location, bringing along our experience from former projects, working hand in hand with your

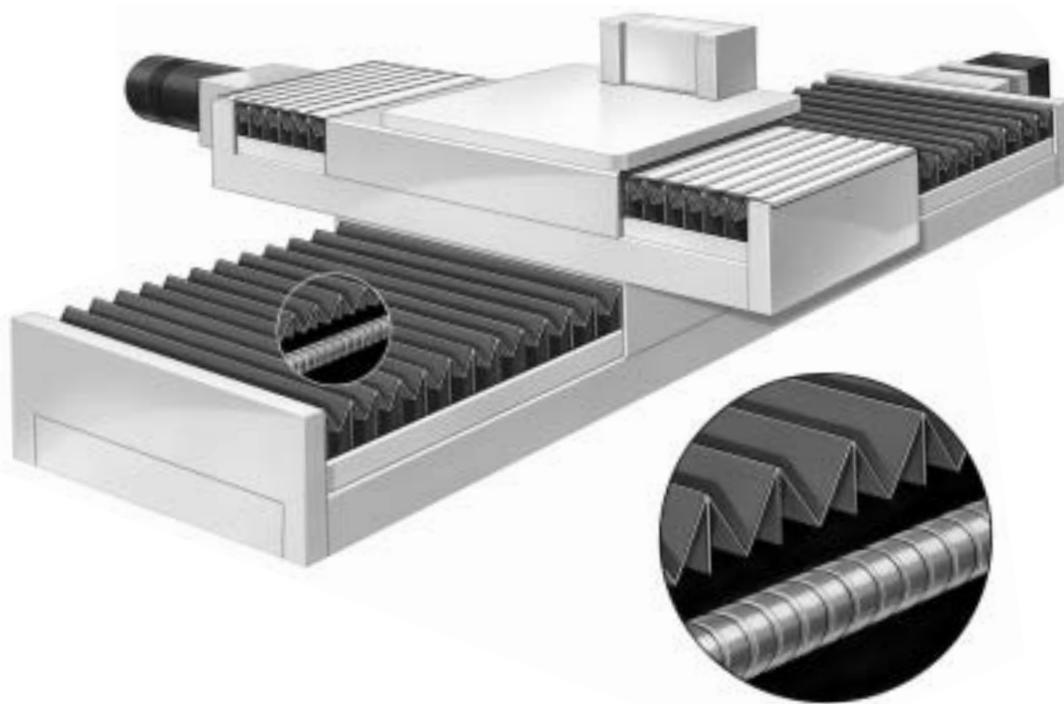
other suppliers, too, as system leader or as system partner. On the following pages, we chose some application areas as examples.

Application areas

Bellows for linear guides

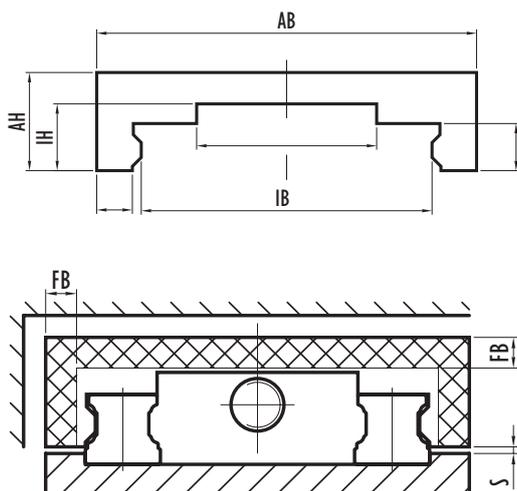
Linear drives are equipped with bellows as a standard ex factory or can be retrofitted by the final customer. HEMA has specialised in this area and offers bellows customised for the leading international manufacturers (INA, IKO, ISELE, NSK,

Schneeberger, SKF, STAR and THK). By the accurate type denomination the parts can be manufactured correctly to size.



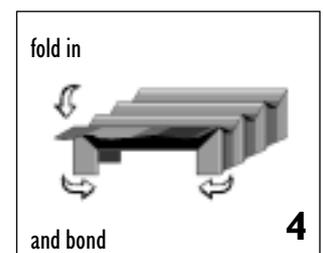
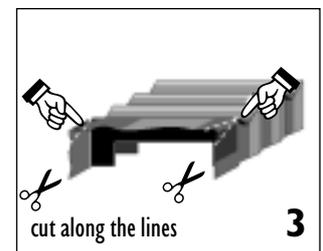
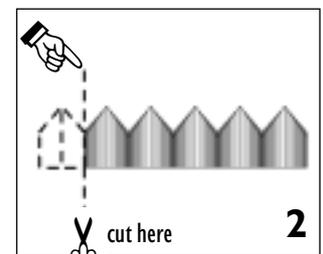
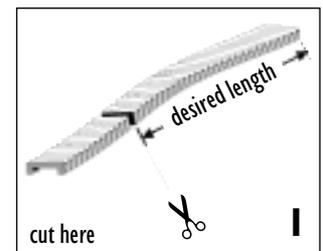
The internal guiding ways, which require accurate production of the guiding components of the bellows, are of special importance during the design and the production of the linear guide covers. Our guiding components consist of high

quality synthetics, they are water-jet cut and can be supported by gliding elements. They can be designed for specially quiet running and are characterised by a uniform extension behaviour. By using especially thin and tear resistant materials we achieve excellent compression values. The thermally bonded varieties are also dust- and waterproof.



An additional service and cost saving performance consists in delivering the bellows as "endless version" with 200 or more folds altogether. In this way the customer can configure himself the desired extension at any time (see lateral pictures 1 - 4), remaining flexible without delivery time problems. We will be pleased to inform you in detail about this possibility.

Configuration of the endless type



Application areas

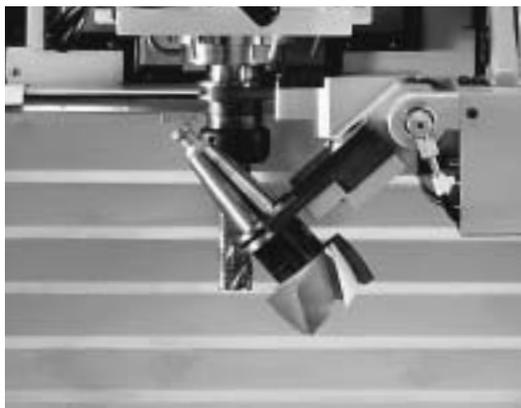
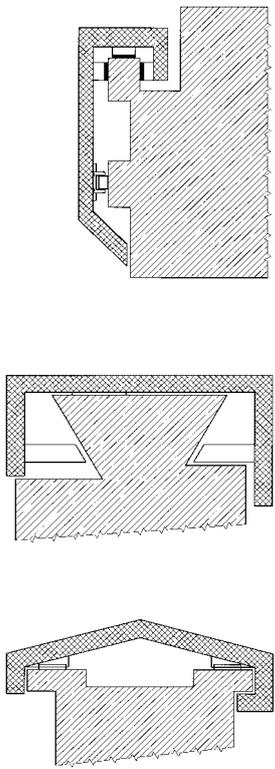


SAMURAI bellows for machining centres

Since the foundation of the company, the core application area for HEMA products has been the machine tool business. Due to increasing machine specifications, higher requirements were also imposed upon the protective covering system.

Machining centres require the most demanding protective covers. High performance machining centres work with aggressive emulsions, they cut in a very restricted space sharp-edged chips at high speed and precision. Mainly with our SAMURAI production series, we effectively support the

leading suppliers of machining centres. Our products optimally combine costs and benefits both in horizontal and vertical applications. A suitable solution for every application is provided from the most demanding FASTAC types down to the more simple FASTLAP lamella aprons.

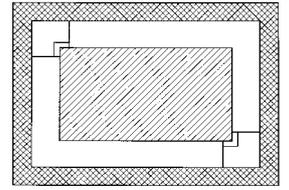


Bellows for elevating platforms/ lifting platform units

Within the automotive production and in medical technology comprehensive safety regulations have to be fulfilled. For protecting the mechanical and hydraulic components as well as the working area of the personnel we offer ELASTIC and SAMURAI bellows. They are available for platform

dimensions up to 30 sqm in the standard colours light beige or black, optionally as well in RAL colours and with stainless steel lamellas. Usually the mounting is by Velcro tape or by a metal flange. Short delivery times are guaranteed.

Application areas



Bellows for jet cutting machines

Modern jet cutting machines (powered by laser, plasma or water) use bellows for the protection of the jet canal and the mechanical components (spindle, guides). The jet canal bellows require a high level of guiding, tightness and cleanliness. In the other application areas, resistance to welding spatter, humidity and high bending fatigue is important. The fold material Preotex is suitable for that purpose being permanently resistant up to 600°C, impermeable to fluids and available in different thickness of 0.3, 0.35 and 0.6 mm. Compact assembly dimensions are requested. Use our consulting service in these application areas.

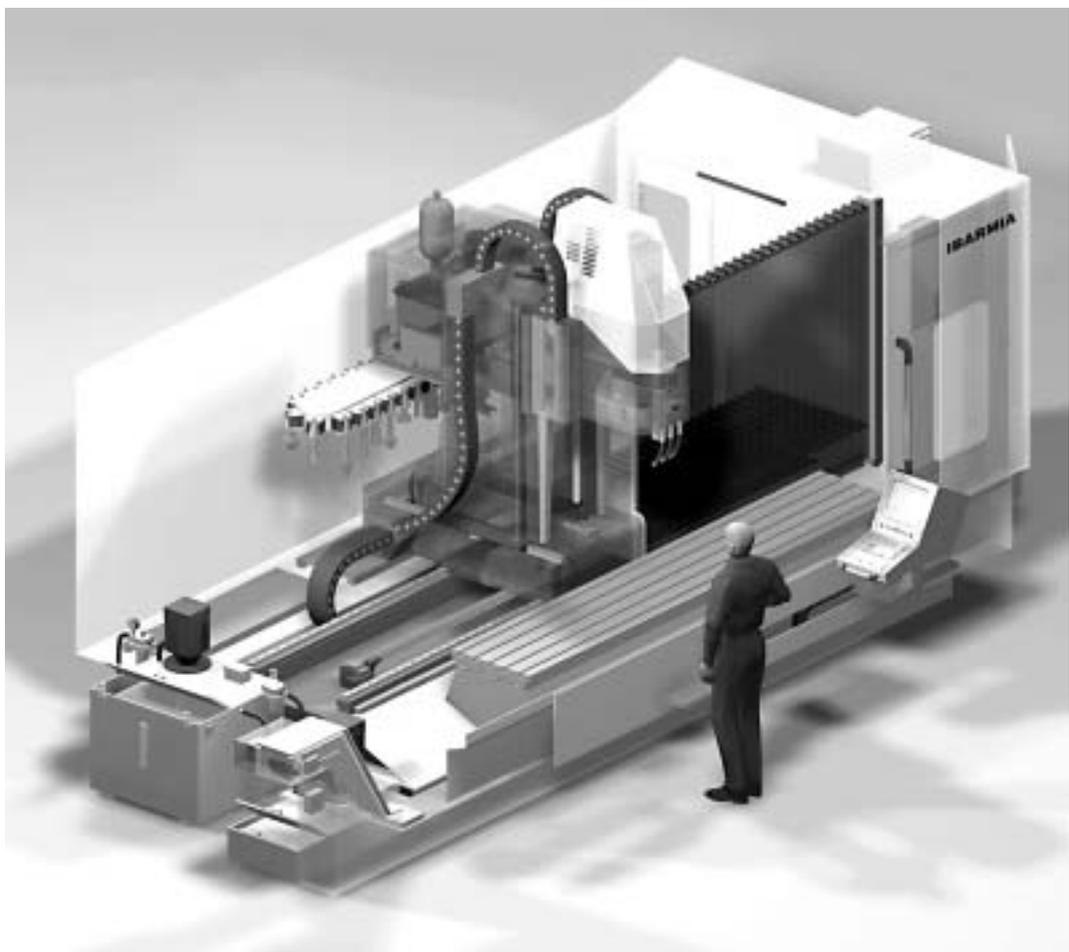
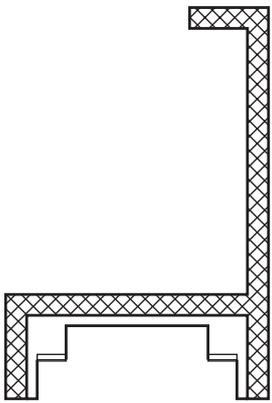


WALLCONCEPT bellows

Bellocs for travelling columns

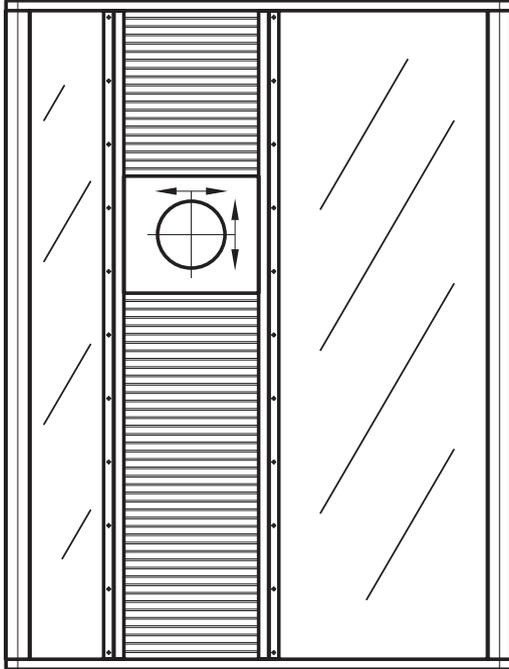
Manufacturers of machine tools with travelling columns trust HEMA to design the rear wall cover. The flexible protective walls are manufactured with extensions of more than five meters (with

additional lamellas as well). Despite these dimensions, a speed of more than 100 m/min is achieved by intelligent gliding and pantograph systems. We will consult with you at your premises.



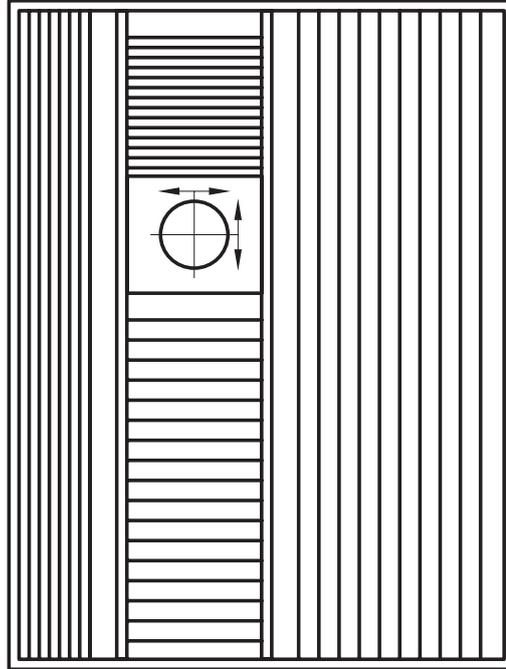
Bellow + Machine Cabin Component = System

The car door is delivered complete (glass, metal plate, electronics) to the assembly line of the car manufacturer by the system supplier; ready to be fitted "just in time". Why not combine this great example of automotive industry to machine building with the right partner?



System Roller cover/Apron

Nowadays HEMA is already delivering many components (protective systems, guiding, pane, spin windows) altogether – along with advice and service, as required, directly into your Kanban system. Tailor-made protective systems – a promise that is kept!



System bellow ELASTIC/SAMURAI/LAMINAT

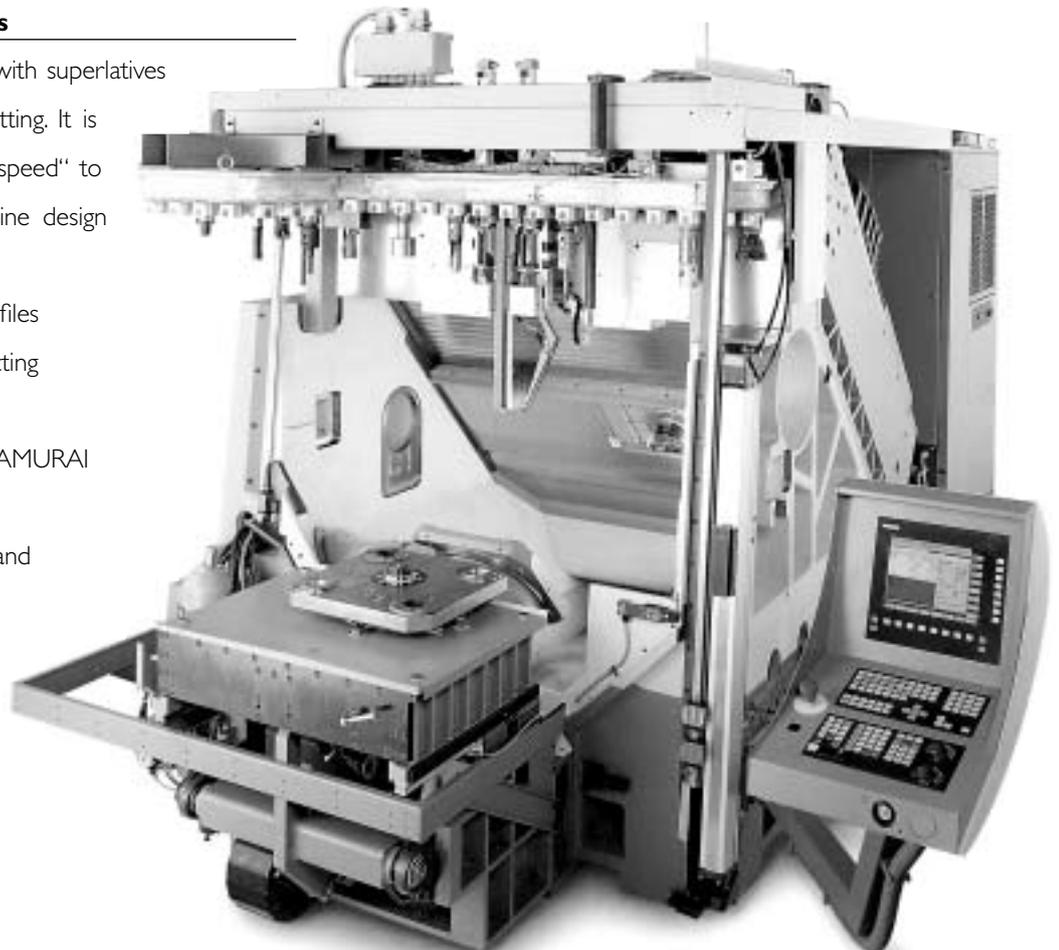
Application areas

Bellows for HSC applications

Everyone is topping each other with superlatives regarding HSC = high speed cutting. It is essential for the conquering of "speed" to bring "quietness" into the machine design within the area of bellows by

- optimised glider and roller profiles
- damping techniques counteracting the impact of the folds
- high contact pressure of the SAMURAI lamellas
- aligned travel by pantographs and extension limiters

THE RESULT: a functional chip protection under extreme conditions. Many manufacturers already take profit of this insight.





Bellows

**LAMINAT
KAMERA**

LAMINAT bellows

In former times, many bellows were manufactured by the LAMINAT principle (= several layers of foil bonded together). The LAMINAT bellows are used because of their variety of shapes and their inherent stiffness.

The production of many thousands of LAMINAT bellows proves our experience and application competence. Especially for older tooling machines we are able to provide many spare parts by the drawing number or to make a new design according to the former specifications and to reproduce them.

Applications

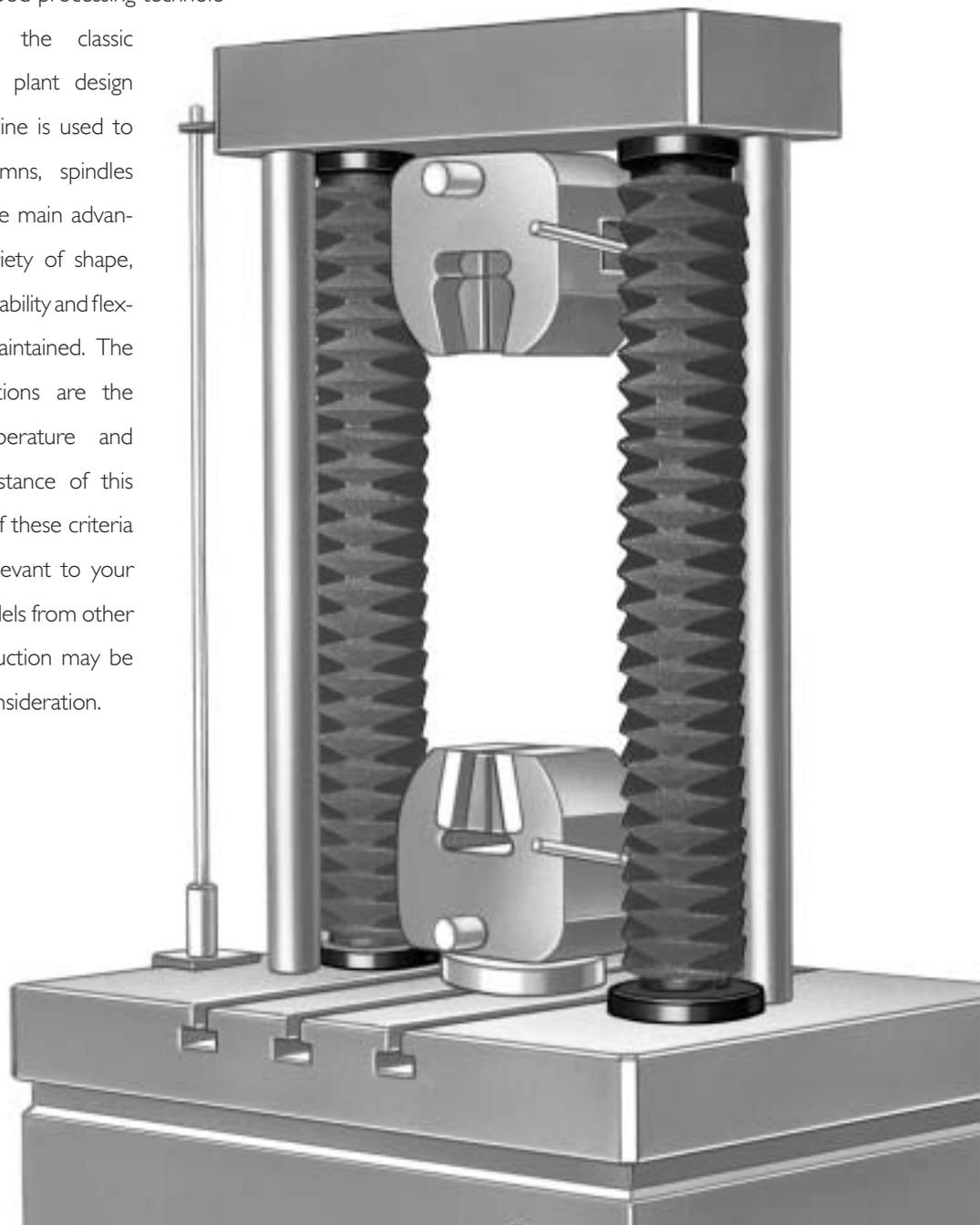
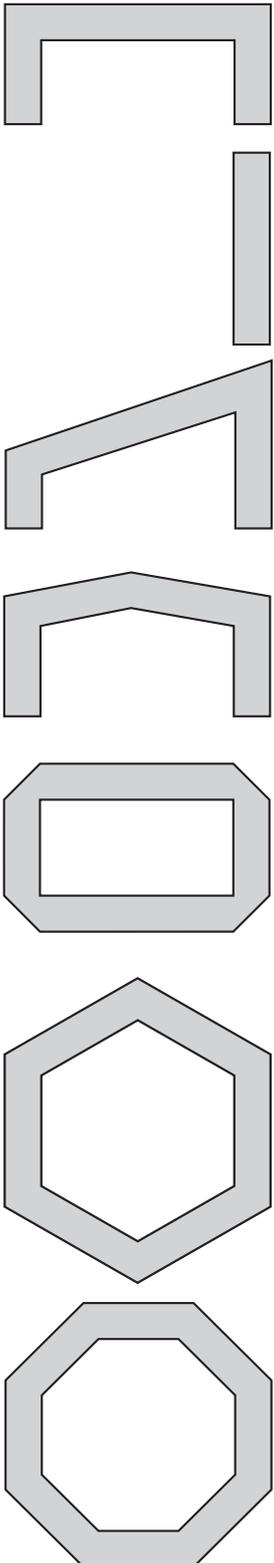
LAMINAT bellows are nowadays deployed within camera, medicine, measuring, musical instruments, control and food processing technologies. Within the classic machine and plant design this product line is used to protect columns, spindles and shafts. The main advantages are variety of shape, dimensional stability and flexibility are maintained. The design limitations are the limited temperature and humidity resistance of this product line. If these criteria should be relevant to your problem, models from other lines of production may be taken into consideration.

Technical data

LAMINAT bellows can be adapted by selecting their basic components material, shape, colour and dimensions to suit your problem.

The basic design concept of the LAMINAT bellows is founded on material with a two-component structure. A manufacturing technique developed to perfection enables the combination of the outer material according to customer's wishes with the appropriate interior material selected to fit by the HEMA designer. For the interior material, there are different varieties available based on synthetic or Triflexil fabrics (Triflexil = Nomex/Aramid compound). The bonding between outer and interior material is insoluble under ordinary application conditions. All LAMINAT bellows can be used in

Standard shapes:



vertical or horizontal position (mixed forms as well). They permit smooth and very quiet running properties. The surface structure and the regularity of contours provide an appealing overall appearance.

Many bellows are deliverable in rectangular, hexagonal, octagonal and twelve-angled shape. Furthermore we produce U, roof and inclined shapes and Venetian blind style as standards. The bellows are available in split-design as well. This

With the polygon shapes, using spacers and circular guide/support systems ensures optimum gliding efficiency on columns, spindles and shafts.

Large machining centres

LAMINAT types are preferred for outer widths of more than 2000 mm, because they provide a more rigid basic structure compared to the ELASTIC types. Another advantage is their segmental structure, allowing an exchange of damaged segments

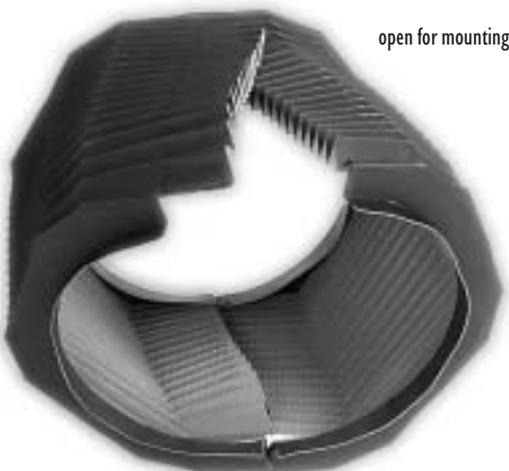
Design information for technical layout



allows retrofitting and easy maintenance. The bellows can be closed afterwards with the help of adhesive tape, Velcro tape or bonding.

The gliding properties of the LAMINAT bellows (standard design) on the guiding rails differ only slightly from the ELASTIC bellows, when optionally fitted with a PVC frame or a wire hoop in every second or third fold. Furthermore they can be supported by special gliders or roller systems, usually at a speed higher than 30 m/min.

of the LAMINAT bellow at any time. This reduces maintenance costs considerably, which offsets the somewhat higher initial purchase price.

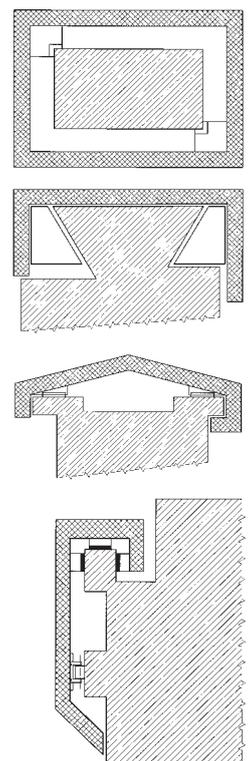


open for mounting



closed after mounting

retrofit possible without dismantling the machine



LAMINAT bellows

Design information for technical layout

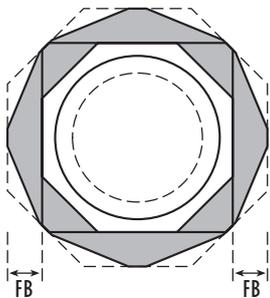
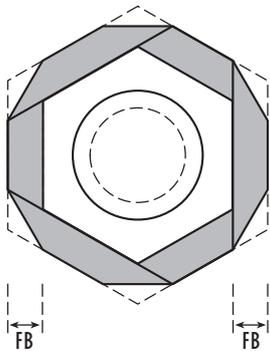
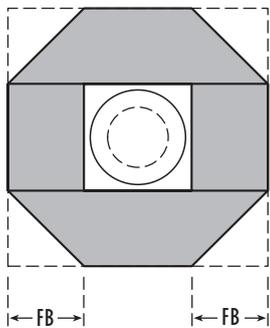
Abbreviations:

- FB = fold width of bellows
- FAZ = extension per fold
- FZD = compression per fold
(depends on material)

Dimensions:

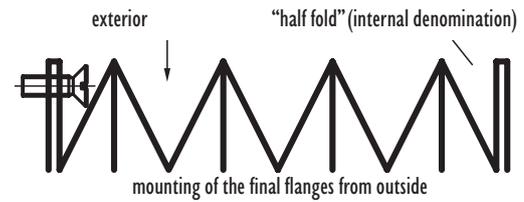
| FB (mm) | FAZ (mm) | FZD (mm) |
|------------|-------------|-------------|
| 7,5 | 10 | 3 |
| 10 | 13 | 3 |
| 12,5 | 17 | 3 |
| 15 | 20 | 3 |
| 17,5 | 23 | 3 |
| 20 | 25 | 3 |
| 25 | 30 | 3,5 |
| 30 | 35 | 3,5 |
| 35 | 40 | 4 |
| 40 | 45 | 4 |
| 45 | 50 | 4 |
| 50 | 55 | 4 |

Examples of the wide variety of shapes enabled by LAMINAT construction:



Mounting

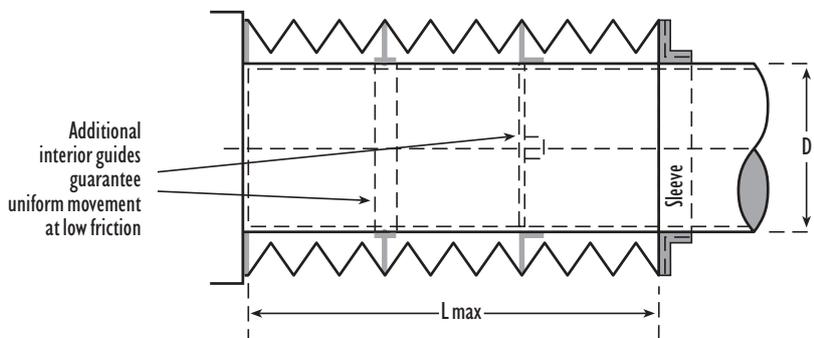
Mounting of the LAMINAT bellows to the machine is easily achieved by components usually supplied ex works. Normally a frame made from metal or synthetic material, designed according to customer's specifications, is attached to both ends, and is used for fixing. The mounting by Velcro tape is even easier, providing fast and efficient maintenance work. Further alternatives are clip fasteners and fixing straps.



Cross section:

Polygonal shape with support elements:

This sectional view shows an example of a design solution for horizontal application. Subframes with guides or guide rings are employed here for support on the shaft or spindle.



Alternative solutions:

HEMA offers a great variety of different approaches to solutions for protecting columns, spindles, shafts and other round parts.

As an alternative, you can also use flat coil springs, circular-stitched bellows, rubber bellows, Soft-PVC bellows, leather bellows or rubber disc bellows.

History

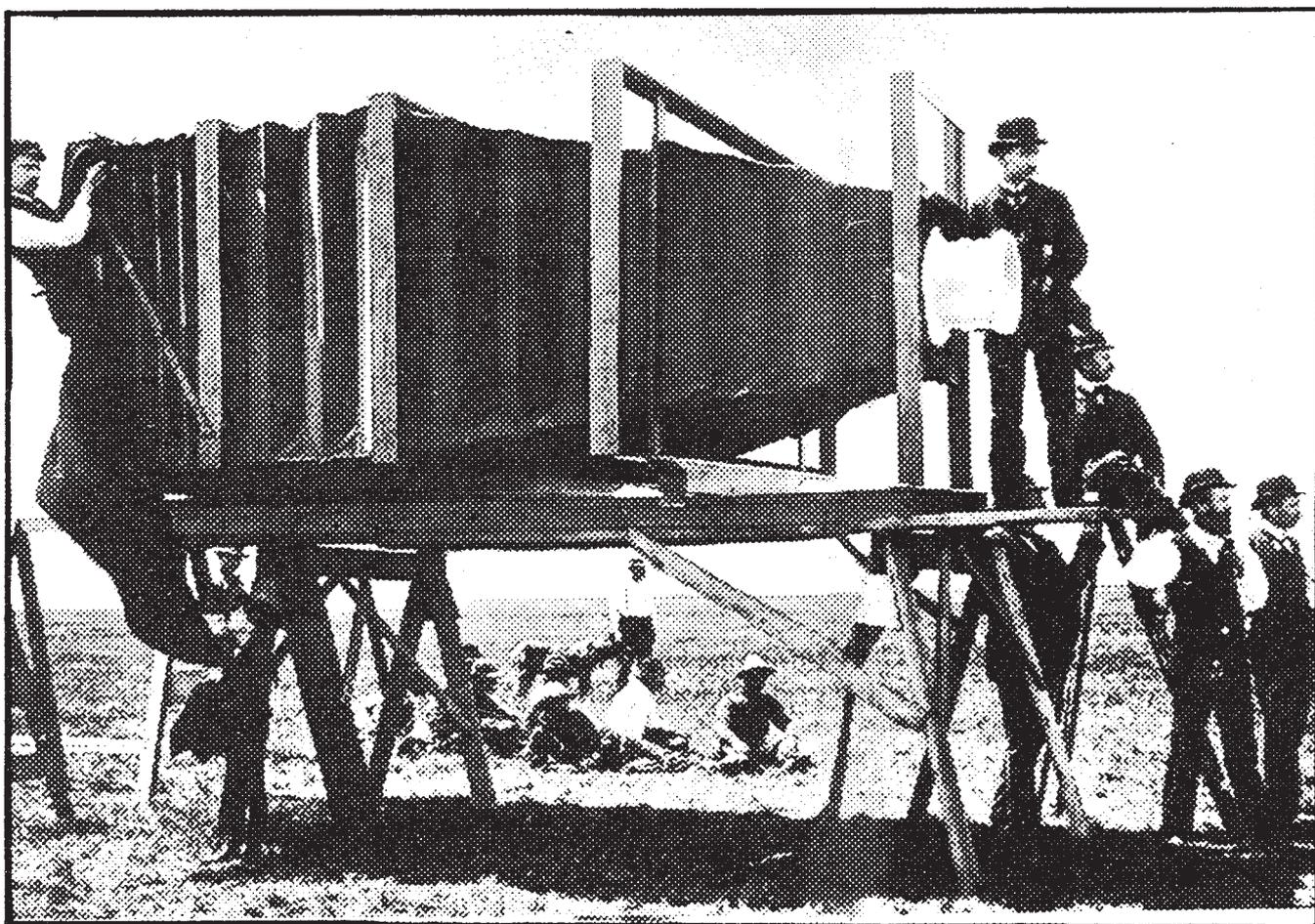
Bellows for cameras stand out as a specialty of the bellows series. They are still being used in the camera and reproduction industry. However, due to progress in automation and microelectronics, this traditional application has become a mere niche market.

We still supply replacement equipment and produce for new units.

the other the compression and the weight must remain within specific tolerances. HEMA's solution is to calculate the series of folds with absolute geometric precision, enabling the width and extension of the folds to change.

The ground glass screen is in the wider end of the KAMERA bellows and the lens system in the smaller end. They are attached with wood or metal frames produced to customers' specifications and supplied by the factory.

KAMERA bellows



Technical design

KAMERA bellows have three great advantages compared with conventional bellows: the minimum compression close to zero, absolutely light proof and the ability to achieve different pitch by changing the width of the bellows.

As a result of the fact that their shape tapers to one side, their design is very difficult to lay out for production. On the one hand, the extension and the exterior width must stand in a uniform, smoothly tapering relation to each other, while on

When we make our KAMERA bellows, we use special three-layer materials guaranteed to be absolutely light proof and dustproof. The inside of the material is dull black, and the connecting corners are additionally reinforced. The corners of the KAMERA bellows can be supplied in standard or tapered shape.

We distinguish between two basic types. The smaller, Type 50, has an extension per fold of 35 millimeters, while in the larger, Type 75, this can reach as much as 50 millimeters. Moreover, various

KAMERA bellows



If you are interested, we will be happy to provide you with more detailed information on our KAMERA bellows. Our dedicated employees will come up with a solution tailored to your specific needs within a few days.

Design information on technical layout:

Abbreviations: FB = fold width of bellows

FAZ = extension per fold

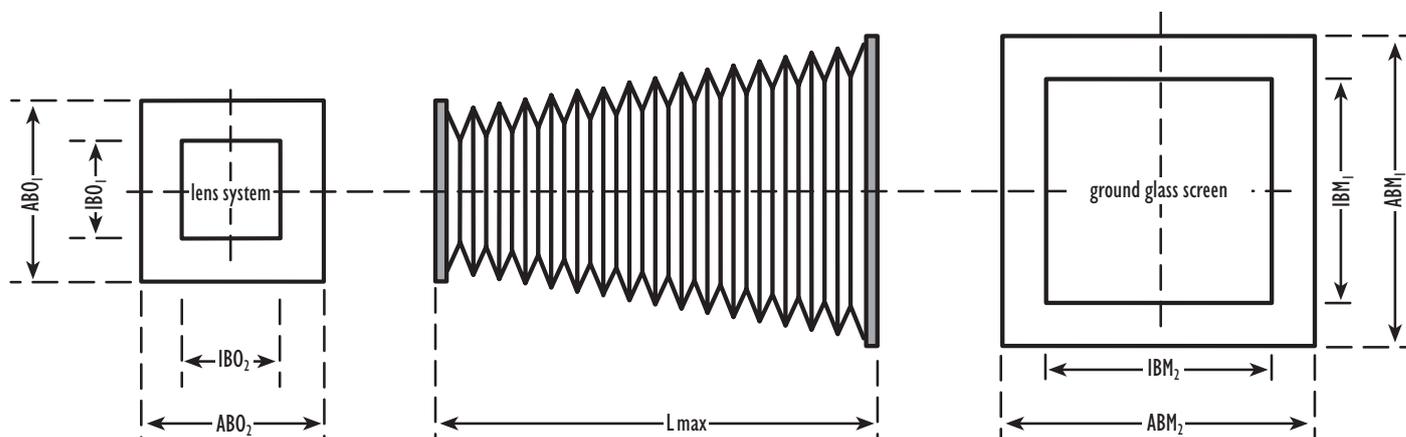
Lmax = total extension

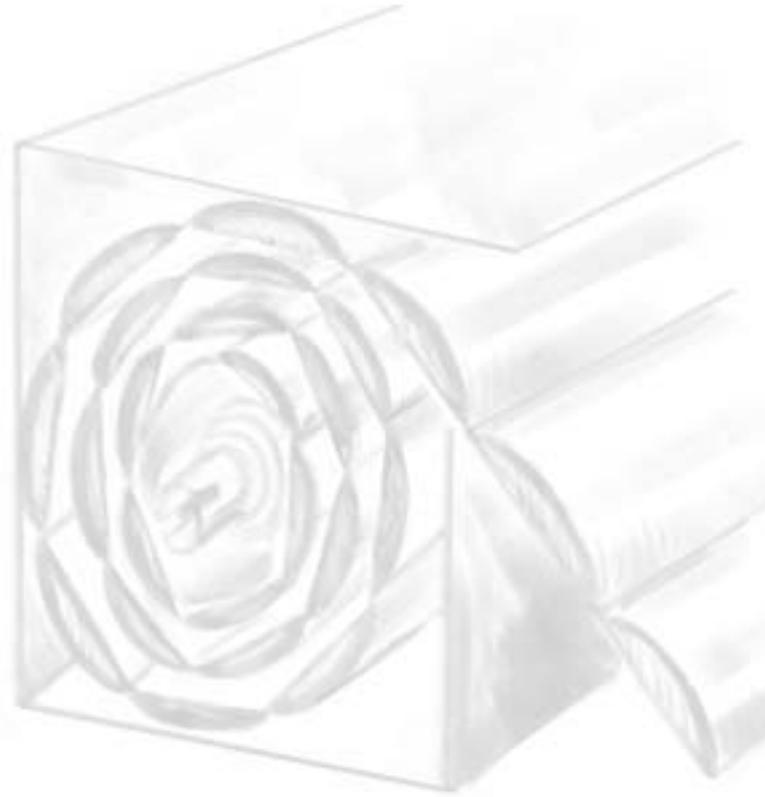
Lmin = total compression

| Type | FB (mm) | FAZ (mm) |
|--------|-----------|----------|
| 50 G | 25 | 35 |
| 50 S5 | 22,5/27,5 | 35 |
| 50 S10 | 20/30 | 35 |
| 75 G | 37,5 | 50 |
| 75 S5 | 35/40 | 50 |
| 75 S10 | 32,5/42,5 | 50 |
| 75 S15 | 30/45 | 50 |

itches per fold width are available (sizes 5 to 15) for each fold width. If you select the appropriate relation between pitch and fold width, then the folds will be kept in a straight line.

KAMERA bellows with an extension length of more than 1,200 millimetres are made in several pieces (in two pieces starting at 1,200 millimetres and in three pieces up to 1,600 millimetres, while larger bellows come in segments of 500 millimetres each). Apart from the standard design, we also have many different special designs.





ROLLER Covers

FLEX Aprons

HEMAFLEX Cable Conduits

MAXIFLEX Coolant Hoses

Design information on technical layout

| Design options | ROLLER with TF drive | ROLLER with SA drive | ROLLER with FM drive |
|---------------------------------------|-------------------------|------------------------------------------|-------------------------------------------|
| Type of drive: Torsion spring(s) | • | | |
| Type of drive: steel band spring | | • | • |
| Enclosure available | • | • | • |
| Side mount available | • | • | • |
| Link apron available | • | | • |
| Outer band made of synthetic material | • | | • |
| Outer band made of stainless steel | | • | • |
| Outer band made of normal steel | | • | • |
| Maximum band width in mm | 6,000 | 300 | 6,000* |
| Maximum extension length in mm | 8,000 | 10,000 | 10,000 |
| Maximum travelling speed* | 90 m/min | 60 m/min | 50 m/min |
| Rapid change of direction | • | • | limited |
| Continuous load | very high | average | high |
| Resistant to dust/dirt | low | average | low |
| Tension forces | uniform | greatly increased when fully extended | slightly increased when fully extended |
| Product cost | low | low | average |

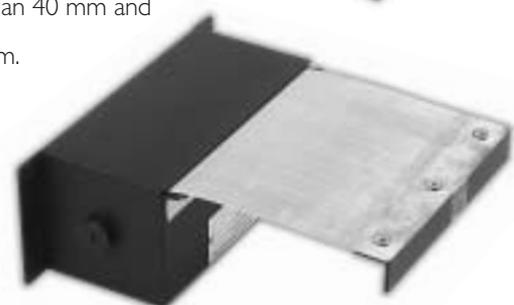
Note: *valid for band made of synthetic material, steel band only up to 1,000 mm

ROLLER Cover Systems



Torsion springs (TF) are very well suited for long working life performance at low loads. We recommend the application of TF drives predominantly with synthetic bands. The torsion springs are manufactured from a special high quality alloyed wire. It is proven by tests and praxis to reach up to 10 times of the working life of common spring wires.

If steel is used for outer band material we recommend for safety reasons a type with housing. For smaller roller diameters and shorter extensions this may be left out. Steel band should not be used for roller diameters smaller than 40 mm and band widths of more than 1 000 mm.



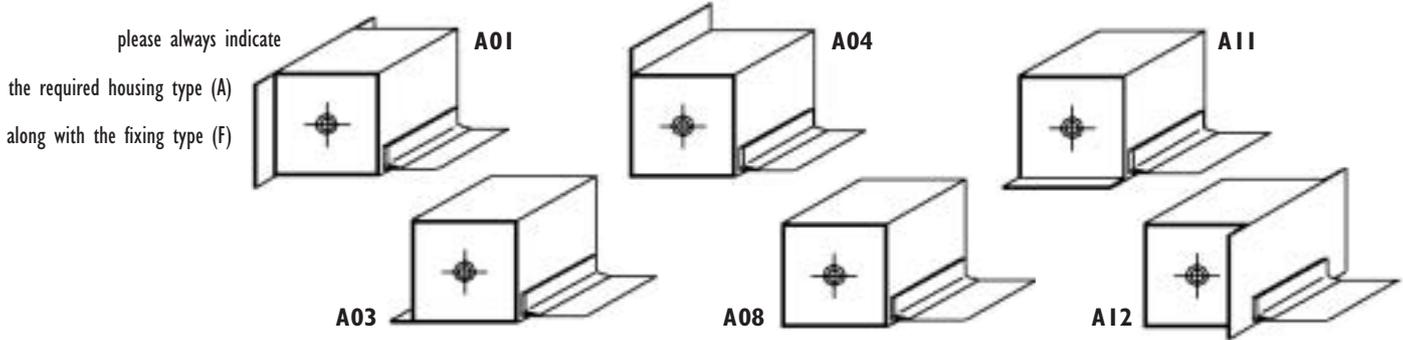
ROLLER Cover Systems

Synthetic band offers a larger selection regarding drive and dimensions for synthetic band. With a synthetic band, you can choose for a smaller amount of dirt and coolant the cost-saving version without housing.

The dimensions of the ROLLER covers depends on several crucial factors, which are shown

in the construction data tables. Basically, they are valid for standard applications, the final design will be determined by HEMA in agreement with the customer.

The outer band is subjected to a wide variety of stresses. For high temperature application, there are steel bands or synthetic bands from glass fibres,



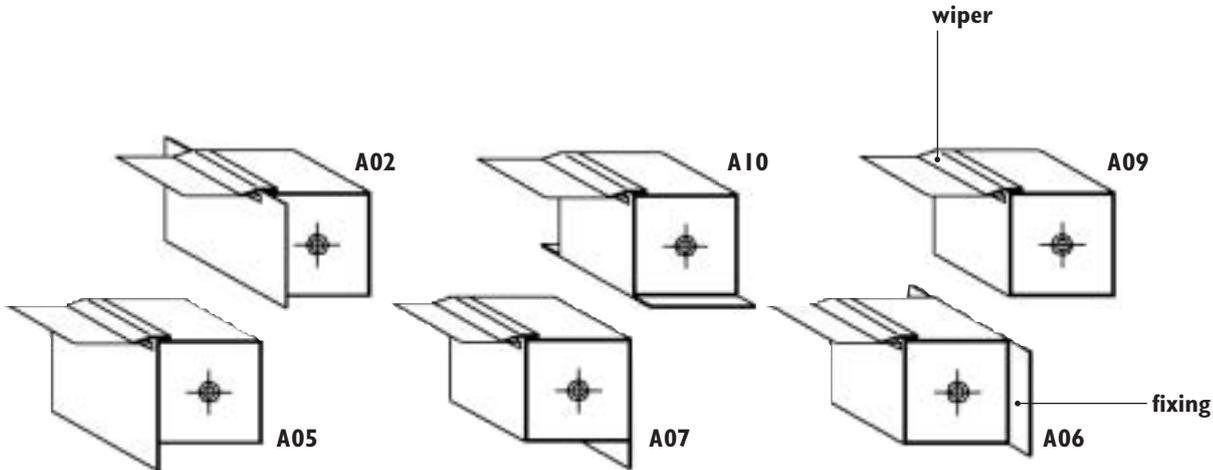
Design data for dimensioning housing and drive

| band width | extension | ROLLER with TF drive without housing/ roller diameter | ROLLER with TF drive with housing/ housing dimensions | ROLLER with FM drive without housing/ roller diameter | ROLLER with FM drive with housing/ housing dimensions | ROLLER with SA drive with housing/ housing dimensions |
|------------|--------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| up to 150 | up to 300 | 21 / 28* | 40 × 40 | 40 / 50 | 60 × 60 | 40 × 40 |
| up to 150 | up to 500 | 21 / 30 | 50 × 50 | 40 / 50 | 60 × 60 | 50 × 50 |
| up to 150 | up to 1.000 | 30 / 32 | 60 × 60 | 45 / 50 | 70 × 70 | 60 × 60 |
| up to 150 | up to 1.500 | 50 / 60 | 80 × 80 | 50 / 60 | 80 × 80 | 70 × 70 |
| up to 150 | up to 2.000 | — | — | 60 / 70 | 90 × 90 | 75 × 75 |
| up to 150 | up to 2.500 | — | — | 70 / 80 | 110 × 110 | 80 × 80 |
| up to 150 | up to 3.000 | — | — | 80 / 90 | 120 × 120 | 90 × 90 |
| up to 150 | up to 4.000 | — | — | 90 / 100 | 130 × 130 | 100 × 100 |
| up to 150 | up to 5.000 | — | — | 100 / 120 | 140 × 140 | 110 × 110 |
| up to 150 | up to 7.000 | — | — | 120 / 133 | 150 × 150 | 120 × 120 |
| up to 150 | up to 9.000 | — | — | 120 / 133 | 160 × 160 | 120 × 120 |
| up to 150 | up to 10.000 | — | — | 120 / 150 | 170 × 170 | 120 × 120 |
| up to 300 | up to 300 | 21 / 28 | 40 × 40 | 40 / 45 | 60 × 60 | 40 × 40 |
| up to 300 | up to 500 | 21 / 28 | 50 × 50 | 50 / 60 | 70 × 70 | 50 × 50 |
| up to 300 | up to 1.000 | 30 / 32 | 60 × 60 | 50 / 60 | 70 × 70 | 60 × 60 |
| up to 300 | up to 1.500 | 40 / 45 | 70 × 70 | 50 / 60 | 80 × 80 | 70 × 70 |
| up to 300 | up to 2.000 | 50 / 60 | 80 × 80 | 60 / 70 | 90 × 90 | 75 × 75 |
| up to 300 | up to 2.500 | 50 / 60 | 80 × 80 | 70 / 80 | 100 × 100 | 80 × 80 |
| up to 300 | up to 3.000 | 60 / 70 | 90 × 90 | 80 / 90 | 110 × 110 | 90 × 90 |
| up to 300 | up to 4.000 | 70 / 80 | 100 × 100 | 90 / 100 | 120 × 120 | 100 × 100 |

Viton or Preetex available. For sharp edged chips we use as well BLV 36/70 beside steel bands. In medical technology and leisure time applications, special materials such as E4/1 or awning cloth offer an effective design. The design will be further upgraded by an individually painted metal housing.

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. HEMA provides steel bands with rounded edges, reducing injury risk and increasing work life.

ROLLER Cover Systems



Design data for dimensioning housing and drive

| band width | extension | ROLLER with TF drive without housing/ roller diameter | ROLLER with TF drive with housing/ housing dimensions | ROLLER with FM drive without housing/ roller diameter | ROLLER with FM drive with housing/ housing dimensions | ROLLER with SA drive with housing/ housing dimensions |
|------------|--------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| up to 300 | up to 5,000 | 80 / 90 | 120 × 120 | 90 / 100 | 130 × 130 | 110 × 110 |
| up to 300 | up to 7,000 | — | — | 100 / 120 | 150 × 150 | 120 × 120 |
| up to 300 | up to 9,000 | — | — | 100 / 120 | 160 × 160 | 140 × 140 |
| up to 300 | up to 10,000 | — | — | 120 / 150 | 170 × 170 | 150 × 150 |
| über 300 | up to 300 | 21 / 28 | 40 × 40 | 40 / 45 | 60 × 60 | — |
| über 300 | up to 500 | 21 / 28 | 50 × 50 | 45 / 50 | 70 × 70 | — |
| über 300 | up to 1,000 | 30 / 32 | 60 × 60 | 45 / 50 | 70 × 70 | — |
| über 300 | up to 1,500 | 40 / 45 | 70 × 70 | 50 / 60 | 80 × 80 | — |
| über 300 | up to 2,000 | 50 / 60 | 80 × 80 | 60 / 70 | 90 × 90 | — |
| über 300 | up to 2,500 | 50 / 60 | 80 × 80 | 70 / 80 | 110 × 110 | — |
| über 300 | up to 3,000 | 60 / 70 | 90 × 90 | 80 / 90 | 120 × 120 | — |
| über 300 | up to 4,000 | 70 / 80 | 100 × 100 | 80 / 100 | 130 × 130 | — |
| über 300 | up to 5,000 | 80 / 90 | 120 × 120 | 90 / 100 | 140 × 140 | — |
| über 300 | up to 7,000 | 90 / 100 | 130 × 130 | 100 / 120 | 150 × 150 | — |
| über 300 | up to 9,000 | 100 / 120 | 150 × 150 | 100 / 120 | 160 × 160 | — |
| über 300 | up to 10,000 | 100 / 120 | 150 × 150 | 120 / 150 | 170 × 170 | — |

Remark:

- all dimensions in mm, special types and dimensions upon request
- square housing outer dimensions
- roller size means outer diameter of the tube

- for types without housing: first number for regular spring force/ second number if higher spring force is required,
- housing dimensions for AIR drives on request*

* Aid for interpretation

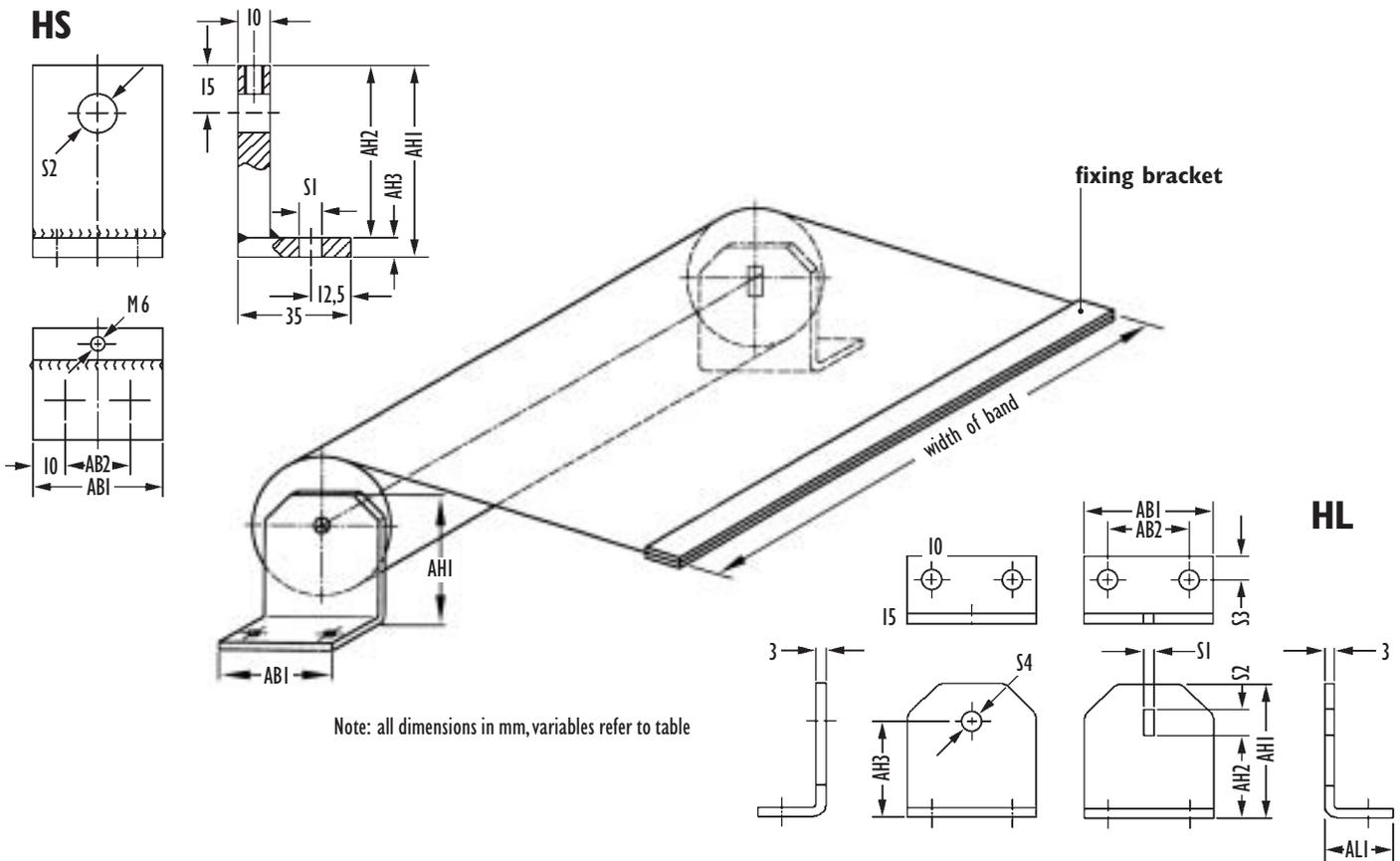
21/28 means a roller diameter of 21 mm for regular and 28 mm for high load

ROLLER Cover Systems

Mounting

All ROLLER systems are pre-tensioned at the factory in conformance with customer specifications or HEMA's own standard, and are ready to install. We offer a wide variety of different mounting possibilities. Mounting is especially easy with the encased models, which enable 12 different standard positions. For ROLLER covers without

housing, standard holders can be used (see drawing), guaranteeing a simple and stable fixing. HEMA has developed two basic types of standard holders which should be applied depending on the type of load. All necessary design data are included in the tables. Upon request we manufacture also special holder systems for you.



Construction data for standard holder systems:

| HEMA Holder type | Roller diameter | AH1/AH2/AH3 | AB1/AB2 | ALI | S1 | S2 | S3 | S4 |
|------------------|-----------------|-------------|---------|-----|----|----|-----|----|
| HL 21-28 | 21 up to 28 mm | 42/26/30 | 40/25 | 21 | 3 | 8 | 7,5 | 8 |
| HL 30-35 | 30 up to 35 mm | 48/32/37 | 45/30 | 21 | 4 | 10 | 7,5 | 8 |
| HL 40-50 | 40 up to 50 mm | 57/40/45 | 50/35 | 21 | 4 | 10 | 7,5 | 10 |
| HL 50-60 | 50 up to 60 mm | 80/49/55 | 75/50 | 25 | 4 | 12 | 10 | 12 |
| HS 40 | 40 mm | 60/54/6 | 40/20 | — | 7 | 12 | — | — |
| HS 45 | 45 mm | 65/59/6 | 50/30 | — | 9 | 12 | — | — |
| HS 50 | 50 mm | 70/64/6 | 50/30 | — | 9 | 12 | — | — |
| HS 60 | 60 mm | 75/65/10 | 60/40 | — | 9 | 12 | — | — |
| HS 70 | 70 mm | 85/75/10 | 70/50 | — | 9 | 12 | — | — |
| HS 80 | 80 mm | 95/85/10 | 80/60 | — | 9 | 12 | — | — |
| HS 90 | 90 mm | 105/95/10 | 90/70 | — | 9 | 12 | — | — |
| HS 100 | 100 mm | 115/105/10 | 100/80 | — | 9 | 12 | — | — |

Note: Holders HL for normal conditions, holders HS for heavy duty conditions, holders HS all edges are fazed; special holders are available upon request; S2 equals axis diameter

Design data for calculation:

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

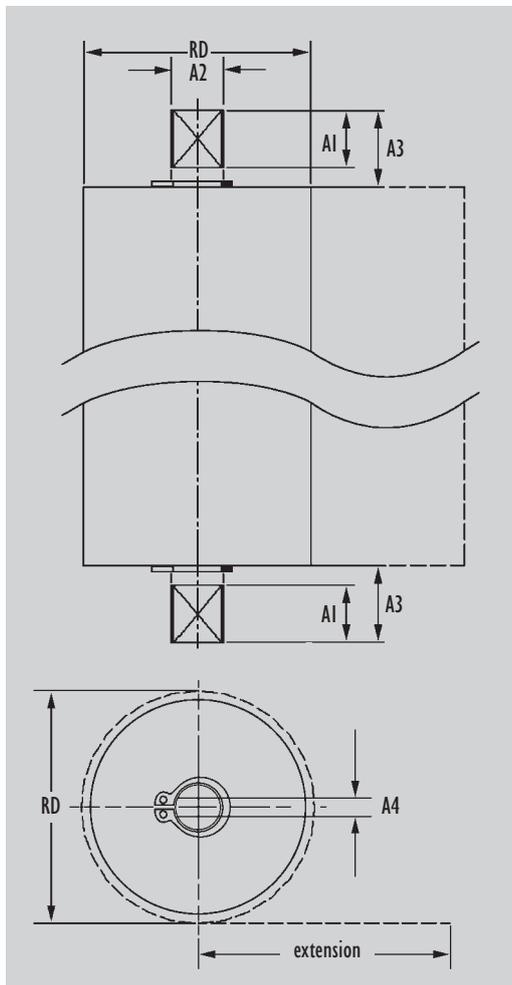
- a speed of travel
- b intended total number of cycles, working life
- c frequency and speed of changes in travel direction
- d mounting position, direction of swarf

Data relating to the axis seat:

For the technical layout of your axle seats, depending on the roller diameter; pay attention to the different parameters given in the following table:

| tube diameter | | | | |
|---------------|-----|------|------|-----|
| RD | A1 | A2 | A3 | A4 |
| 21 - 28 mm | 8mm | 8mm | 11mm | 3mm |
| 30 - 50 mm | 8mm | 10mm | 11mm | 4mm |
| above 50 mm | 8mm | 12mm | 11mm | 4mm |

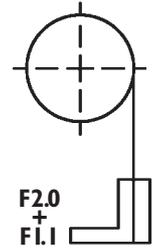
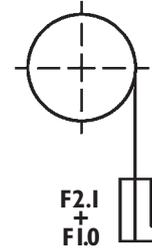
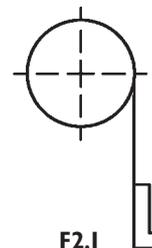
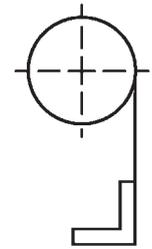
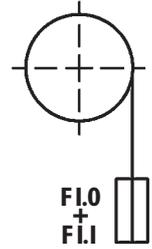
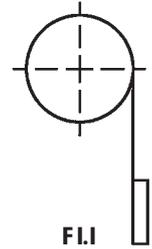
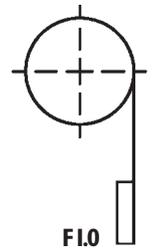
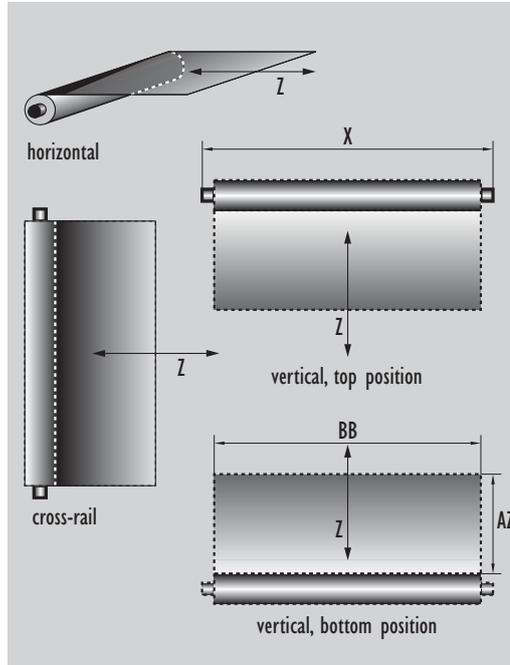
Roller axis:



Fixing of the band

The fixing of the band is achieved according to your demand by flat or angular steel brackets, which are bonded or riveted to the band from one or two sides.

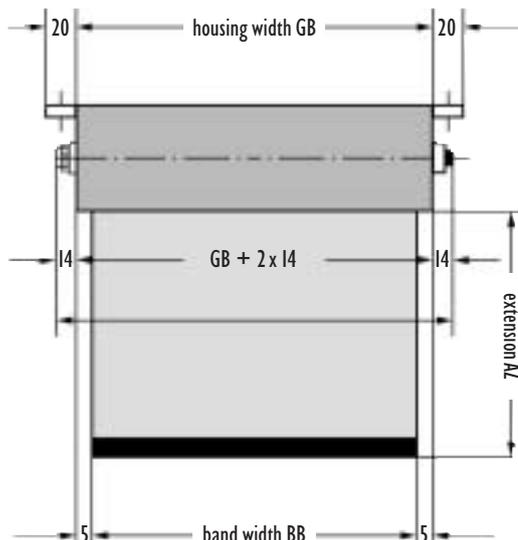
Operating positions:



Operating position

Exact information on the operating position is essential for a perfect operation of the protective cover. Here it is of special importance from which direction – front or rear – the swarfs and coolants are coming.

Housing dimensions

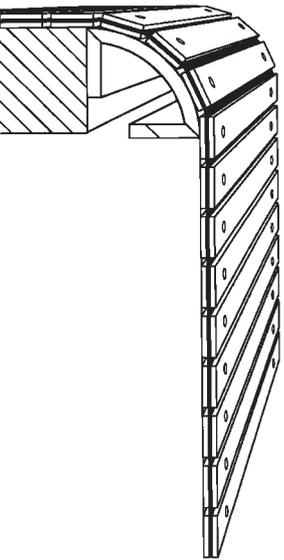


Please always indicate the required band fixing type (F) along with the housing type (A)

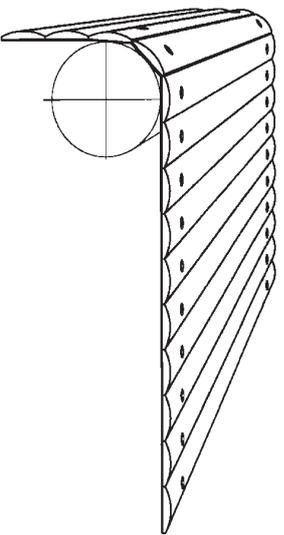
ROLLER Link aprons

Link aprons are a low-priced type of cover. These products provide excellent service in frontal protection against chips and coolant. They offer good flexibility, are mounted easily and require little space.

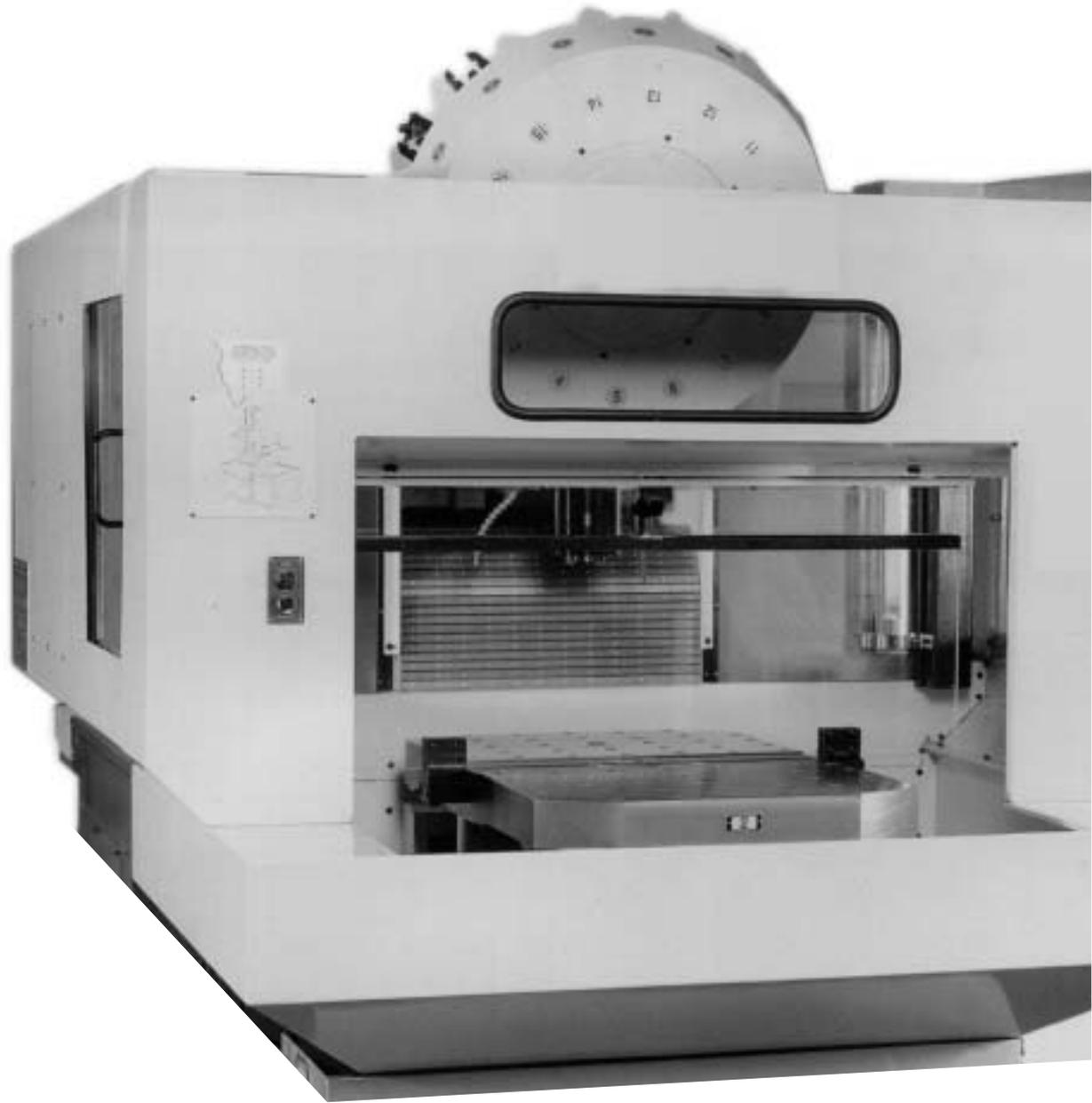
The metal sections are manufactured from aluminium, brass or steel in flat or semi-circular profiles. These sections have a standard width from 14 to 16 mm.



FLEXPRO



FLEXPRO

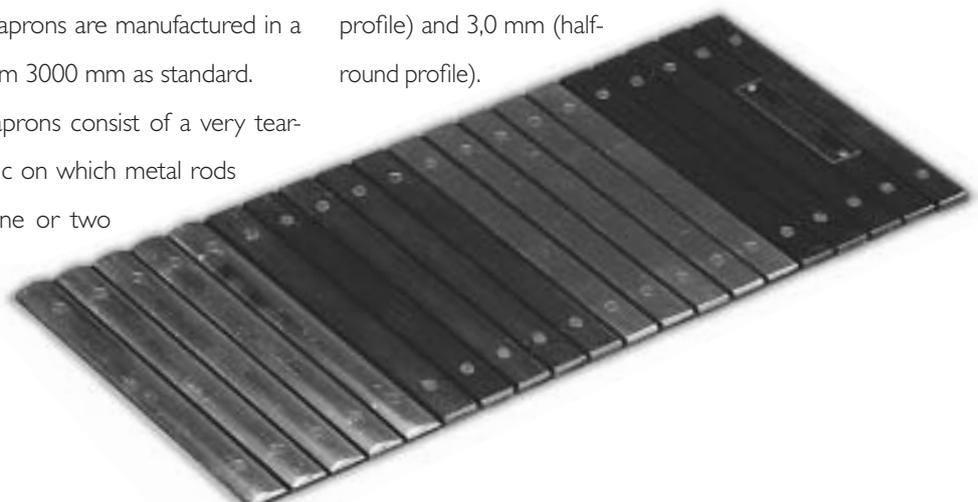


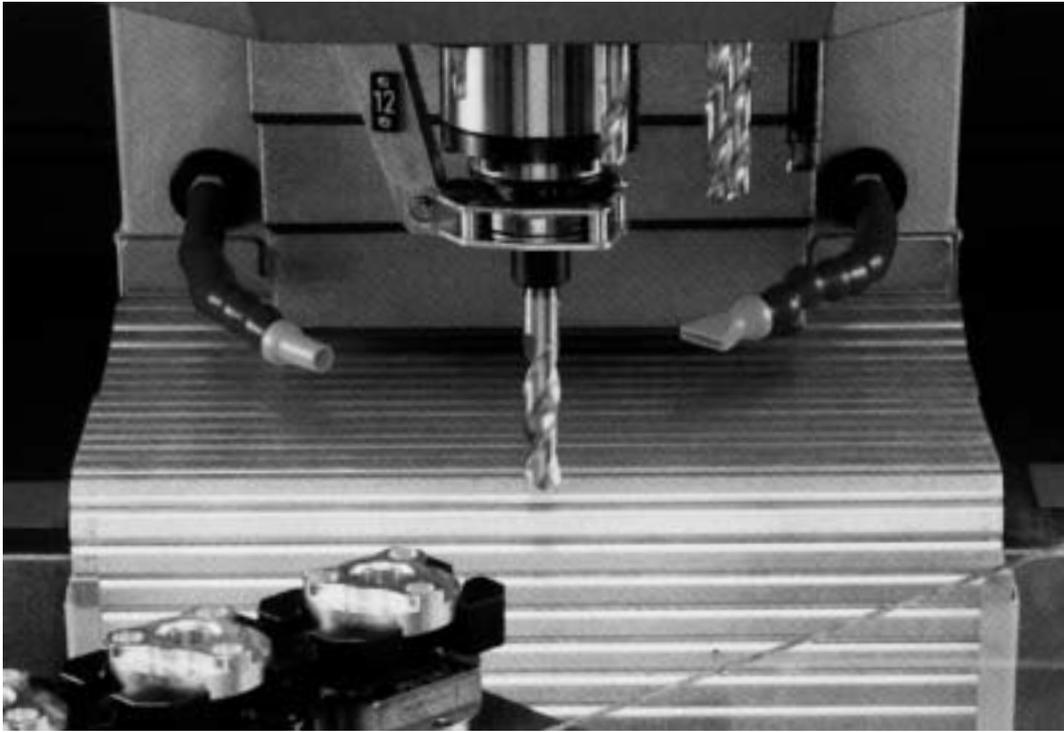
Technical data

The HEMA link aprons are subdivided into several basic types. The link aprons are manufactured in a width up to maximum 3000 mm as standard.

The FLEXPRO aprons consist of a very tear-resistant carrier fabric on which metal rods are bonded from one or two sides and riveted consecutively.

The height of the rods is between 2,0 mm (flat profile) and 3,0 mm (half-round profile).

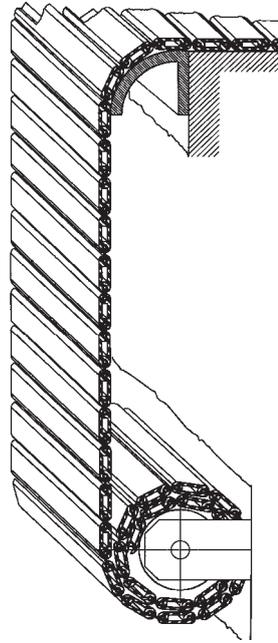




ROLLER Link aprons

The FLEXSTAR type consist of anodised aluminium hollow profiles joined by a polyurethane strip. On the visual side, the glider elements are rounded at the edges (FLEXSTAR-S) or straight

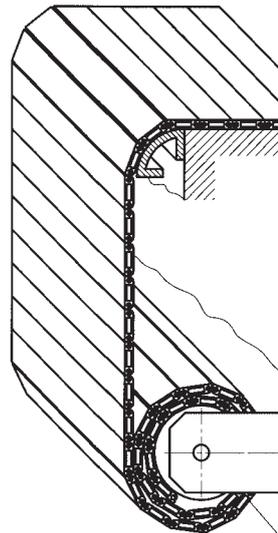
laid out in such a way as to provide the best possible protection for the polyurethane strip. Good protection is offered against coolant and flying chips. By the simple, but effective joining technique of the sections an economic production and a very flexible range of use is enabled.



FLEXSTAR-S



In many cases, link aprons are serving as a protective hanging curtain or run over a guide roller to ensure especially smooth running. They are fastened by an aluminium hollow profile angle, a metal ledge or a metal angle at the end of the apron. These are connected to the machine. Customers are free to choose the shape or fixing hole pattern.



FLEXSTAR-C/CR

(FLEXSTAR-C/CR). Both rod types are fixed by indentation. FLEXSTAR-S is completely movable in both directions, while FLEXSTAR-C/CR permits only a one-sided unwind movement, hereby taking a stable position in the other direction. End caps to be chosen from different colours improve gliding properties and visual appearance.

Both hollow profile solutions are produced with the highest accuracy. The gap dimensions between the profiles are



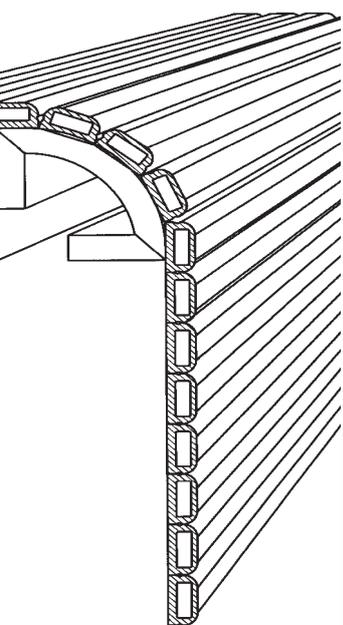
ROLLER Link aprons

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 wound-up condition (at least by the factor 2 compared to the value given in the table on page 60/61).

The drive unit is exactly matched to the additional weight and forces. We offer complete guide systems basing on travel rails, steel cables or aluminium profiles.

FLEXWALK

Due to the continuously increasing requirements on stability and load capacity of the aprons, HEMA has advanced the existing apron program. We offer the FLEXWALK type in two section sizes. It is a combination of extremely stabile aluminium hollow profiles and a carrier fabric made from synthetic band or stainless steel band. This is used in cases where the customer requires an accessible solution. The aprons with a steel band as carrier material are joined by a high-performance bond guaranteeing after hardening for 30 hours high bonding power combined with the required flexibility. Only in this way the steel band aprons can be used permanently on roller blind systems as well.



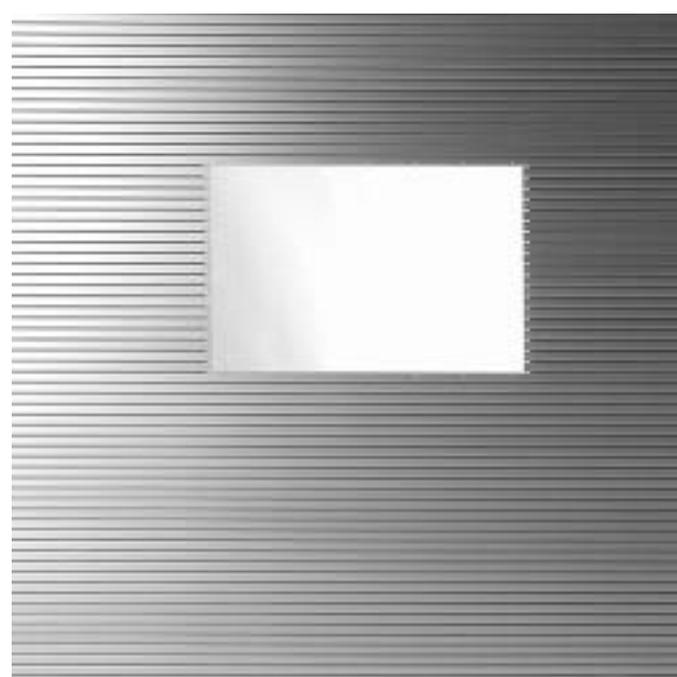
FLEXWALK

FLEXSTAR-CR

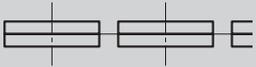
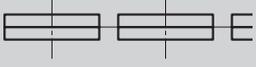
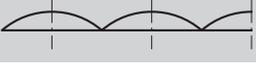
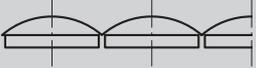
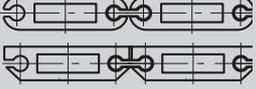
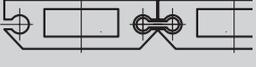
The new aluminium hollow profile FLEXSTAR-CR is the big brother of the C type. It was designed for higher loads. The advantages of the FLEXSTAR series with its flexible profile and the new slanted rear profile provide high stiffness.

FLEXSTAR windows

In the mounting area, FLEXSTAR aprons combined with vision inserts are very popular. We offer different types with rigid polycarbonate inserts or flexible see-through foil. For long extensions lengths stiffeners are required due to the window inserts.

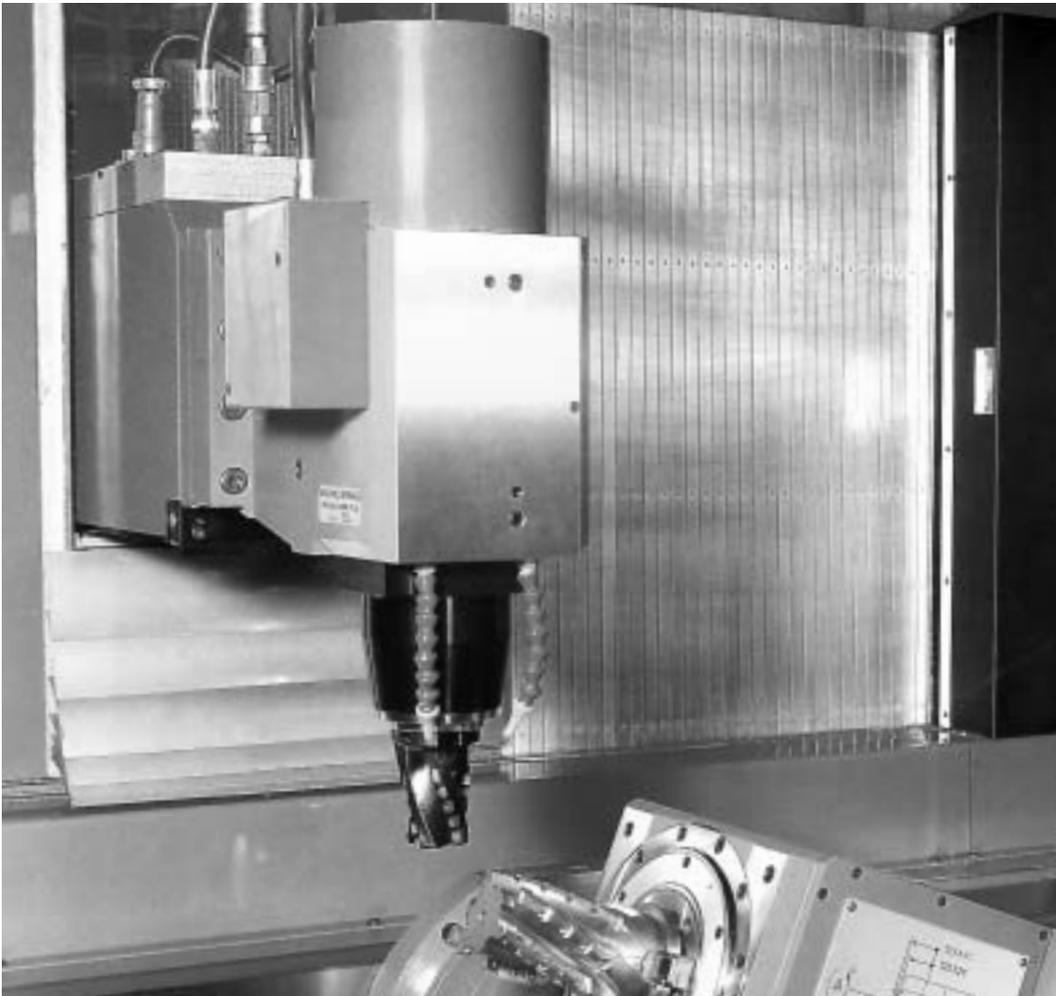


Design data for the layout of link aprons:

| link apron type interior/exterior section fixing | connecting material | section width mm | section height mm | smallest unwind radius 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 half-round aluminium/ aluminium bonded and riveted | synthetic carrier band | 16/15 | 3,0/2,0 | 35 |  |
| FLEXWALK aluminium hollow profile, eloxed bonded and riveted | synthetic carrier band or stainless steel | 22 18 | 10,0 8,0 | 40* |  |
| FLEXSTAR-S FLEXSTAR-C aluminium hollow profile, eloxed**, indentation | synthetic rand connection end caps available | 20 | 5,5 | 35 |  |
| FLEXSTAR-CR aluminium hollow profile, eloxed**, indentation | synthetic rand connection end caps available | 25 | 8,0 | 40 |  |

*only for synthetic band, for steel band 100

** inserts from see-through foil or polycarbonate links (WINDOW) possible



FLEXPRO in application

Bellows

SPEZIAL



Circular-stitched bellows

Apart from spiral springs, different bellow versions are available for protecting shafts, columns, spindles and other round rotating parts.

The circular-stitched bellows consist of punched disks, which are stitched inside and outside. Especially good shape stability and high transverse stiffness are achieved by stitching. We take GN 807 as standard material, aluminium glass fibre or glass fibre Viton is used for high-temperature applications.

The circular-stitched bellows are extremely resistant and can withstand even exposure to sharp chips especially for smaller sizes. They are only conditionally suitable as protection against liquids or oil.

Circular-stitched bellows can be used horizontally or vertically. In the case of horizontal use, we



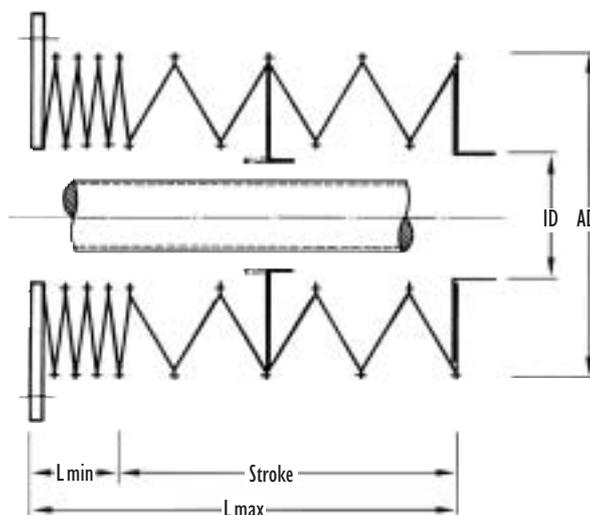
recommend installing additional support and guide rings made of synthetics or aluminium which guarantee a uniform distance from the spindle and

thus increase operating life. With large extensions, the stability of the bellows can be increased by installing a wire ring in every fold. We usually use metal frames for connection and mounting, sleeves are also possible as an alternative.

Design information:

It is important for the selection of the type of bellows that the diameter should be selected approx. 10 mm larger than the round part to be protected. Use the following formula for dimensioning:

$$\text{Extension} = (\text{stroke} / \text{F stroke}) \times \text{FAZ} + 5.$$



Abbreviations:

AD = Outside diameter FB = Fold width

ID = Inside diameter FAZ = Fold extension

FZD = Fold compression Fstroke = stroke per fold

Data table:

| HEMA-Type | AD | ID | FB | FAZ | FZD | Fstroke |
|-----------|-----|-----|------|-----|-----|---------|
| RF 50 | 50 | 25 | 12,5 | 10 | 2,5 | 7,5 |
| RF 72 | 72 | 33 | 19,5 | 18 | 2,5 | 15,5 |
| RF 85 | 85 | 45 | 20 | 18 | 2,5 | 15,5 |
| RF 95 | 95 | 53 | 21 | 18 | 2,5 | 15,5 |
| RF 100 | 100 | 63 | 18,5 | 18 | 2,5 | 15,5 |
| RF 120 | 120 | 82 | 19 | 18 | 2,5 | 15,5 |
| RF 122 | 122 | 76 | 23 | 15 | 2,5 | 12,5 |
| RF 130 | 130 | 90 | 20 | 18 | 2,5 | 15,5 |
| RF 135 | 135 | 85 | 25 | 15 | 2,5 | 12,5 |
| RF 140 | 140 | 102 | 19 | 18 | 2,5 | 15,5 |
| RF 145/1 | 145 | 93 | 26 | 15 | 2,5 | 12,5 |
| RF 145/2 | 145 | 105 | 20 | 18 | 2,5 | 15,5 |
| RF 150 | 150 | 110 | 20 | 18 | 2,5 | 15,5 |
| RF 160 | 160 | 112 | 24 | 18 | 2,5 | 15,5 |
| RF 170 | 170 | 125 | 22,5 | 18 | 2,5 | 15,5 |
| RF 180/1 | 180 | 132 | 24 | 20 | 2,5 | 17,5 |
| RF 180/2 | 180 | 141 | 19,5 | 18 | 2,5 | 15,5 |
| RF 190 | 190 | 150 | 20 | 18 | 2,5 | 15,5 |
| RF 200 | 200 | 152 | 24 | 18 | 2,5 | 15,5 |
| RF 220 | 220 | 170 | 25 | 18 | 2,5 | 15,5 |
| RF 235 | 235 | 190 | 22,5 | 18 | 2,5 | 15,5 |
| RF 245 | 245 | 200 | 22,5 | 20 | 2,5 | 17,5 |
| RF 260 | 260 | 202 | 29 | 18 | 2,5 | 15,5 |
| RF 266 | 266 | 216 | 25 | 20 | 2,5 | 17,5 |
| RF 300 | 300 | 250 | 25 | 18 | 2,5 | 15,5 |
| RF 365 | 365 | 320 | 22,5 | 18 | 2,5 | 15,5 |
| RF 400 | 400 | 340 | 30 | 20 | 2,5 | 17,5 |

The soft-PVC bellows occupy a special position among the different types of bellows. Normally 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 on the other hand are moulded parts, i.e. a certain minimum quantity or corresponding tooling must be

Because tooling is already available for many configurations, attractive prices are offered even for smaller quantities. The dimensions and shapes shown in the catalogue are available as standard; we would be pleased to assist you in the design of special types going beyond these.

Soft-PVC-bellows

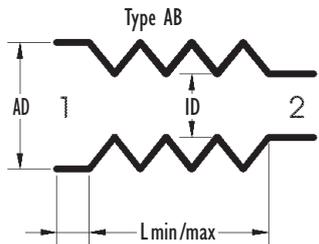


available to justify economic production. Correspondingly, cost reduction can be achieved with larger quantities which makes these parts particularly well suited for large-series use.

We use a special PVC as standard material. The bellows are resistant to alkalis and acids, they are water- and dust-proof. The operating temperature range is between -20°C and $+80^{\circ}\text{C}$ (maximum up to $+120^{\circ}\text{C}$). Versions in transparent material are also possible (black is standard)



Soft-PVC-bellows



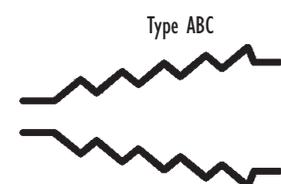
Abbreviations:

- ID = Inside diameter
- AD = Outside diameter
- FZD = Fold compression
- FAZ = Fold extension

| HEMA-Type | ID | AD | FZD | FAZ | HEMA-Type | ID | AD | FZD | FAZ |
|-----------|----|-----|-----|-----|-----------|-----|-----|-----|-----|
| 10 | 10 | 20 | 4 | 12 | 80-4 | 80 | 140 | 7,5 | 53 |
| 18 | 18 | 28 | 4 | 12 | 80-5 | 80 | 150 | 8 | 58 |
| 20 | 20 | 36 | 4,5 | 18 | 80-6 | 80 | 160 | 8 | 65 |
| 22 | 22 | 40 | 5 | 20 | 89-1 | 89 | 110 | 7,5 | 24 |
| 25-1 | 25 | 36 | 5 | 15 | 89-2 | 89 | 125 | 8 | 36 |
| 25-2 | 25 | 45 | 5,5 | 24 | 89-3 | 89 | 140 | 8 | 46 |
| 28-1 | 28 | 40 | 5,5 | 19 | 89-4 | 89 | 150 | 8 | 55 |
| 28-2 | 28 | 50 | 5,5 | 23 | 89-5 | 89 | 160 | 8 | 60 |
| 32-1 | 32 | 46 | 5 | 16 | 89-6 | 89 | 170 | 8,5 | 65 |
| 32-1 | 32 | 56 | 6,5 | 26 | 100-1 | 100 | 128 | 7,5 | 29 |
| 36-1 | 36 | 50 | 5 | 17 | 100-2 | 100 | 140 | 8 | 40 |
| 36-1 | 36 | 63 | 7 | 28 | 100-3 | 100 | 150 | 8 | 46 |
| 40-1 | 40 | 56 | 6 | 21 | 100-4 | 100 | 160 | 8 | 55 |
| 40-1 | 40 | 71 | 7,5 | 34 | 100-5 | 100 | 170 | 8,5 | 60 |
| 45-1 | 45 | 63 | 6,5 | 22 | 100-6 | 100 | 180 | 9 | 65 |
| 45-2 | 45 | 80 | 7 | 34 | 110-1 | 110 | 130 | 7,5 | 24 |
| 50-1 | 50 | 71 | 6 | 23 | 110-2 | 110 | 140 | 7,5 | 30 |
| 50-2 | 50 | 89 | 8 | 39 | 110-3 | 110 | 150 | 8 | 40 |
| 56-1 | 56 | 80 | 6,5 | 27 | 110-4 | 110 | 160 | 8 | 47 |
| 56-2 | 56 | 89 | 7,5 | 36 | 110-5 | 110 | 170 | 8 | 56 |
| 56-3 | 56 | 100 | 8,5 | 45 | 110-6 | 110 | 180 | 8,5 | 60 |
| 63-1 | 63 | 89 | 6,5 | 26 | 110-7 | 110 | 190 | 9 | 65 |
| 63-2 | 63 | 100 | 7,5 | 36 | 110-8 | 110 | 200 | 9 | 70 |
| 63-3 | 63 | 110 | 7,5 | 40 | 120-1 | 120 | 140 | 7,5 | 24 |
| 63-4 | 63 | 125 | 7,5 | 48 | 120-2 | 120 | 150 | 8 | 30 |
| 71 | 71 | 100 | 7 | 30 | 120-3 | 120 | 160 | 8 | 40 |
| 75-1 | 75 | 100 | 7 | 28 | 120-4 | 120 | 170 | 8 | 47 |
| 75-2 | 75 | 110 | 7 | 32 | 120-5 | 120 | 180 | 8,5 | 55 |
| 75-3 | 75 | 125 | 7,5 | 42 | 120-6 | 120 | 190 | 9 | 60 |
| 75-4 | 75 | 140 | 7,5 | 55 | 120-7 | 120 | 200 | 9 | 65 |
| 75-5 | 75 | 150 | 7,5 | 58 | 125-1 | 125 | 150 | 7,5 | 28 |
| 80-1 | 80 | 100 | 7 | 24 | 125-2 | 125 | 160 | 8 | 38 |
| 80-2 | 80 | 110 | 7,5 | 32 | 125-3 | 125 | 170 | 8,5 | 42 |
| 80-3 | 80 | 125 | 7,5 | 44 | 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 |

| HEMA-Type | ID | AD | FZD | FAZ | HEMA-Type | ID | AD | FZD | FAZ |
|-----------|-----|-----|-----|-----|-----------|-----|-----|-----|-----|
| 140-6 | 140 | 210 | 10 | 60 | 210-2 | 210 | 250 | 10 | 40 |
| 140-7 | 140 | 220 | 10 | 65 | 210-3 | 210 | 260 | 10 | 47 |
| 150-1 | 150 | 170 | 8 | 24 | 210-4 | 210 | 280 | 10 | 65 |
| 150-2 | 150 | 180 | 8,5 | 30 | 210-5 | 210 | 300 | 10 | 75 |
| 150-3 | 150 | 190 | 9 | 40 | 220-1 | 220 | 250 | 10 | 30 |
| 150-4 | 150 | 200 | 9 | 47 | 220-2 | 220 | 260 | 10 | 40 |
| 150-5 | 150 | 210 | 10 | 56 | 220-3 | 220 | 280 | 10 | 57 |
| 150-6 | 150 | 220 | 10 | 60 | 220-4 | 220 | 300 | 10 | 70 |
| 150-7 | 150 | 230 | 10 | 65 | 220-5 | 220 | 320 | 10 | 80 |
| 150-8 | 150 | 240 | 10 | 70 | 230-1 | 230 | 260 | 10 | 30 |
| 160-1 | 160 | 190 | 8,5 | 30 | 230-2 | 230 | 280 | 10 | 48 |
| 160-2 | 160 | 200 | 9 | 40 | 230-3 | 230 | 300 | 10 | 65 |
| 160-3 | 160 | 210 | 10 | 47 | 230-4 | 230 | 320 | 10 | 75 |
| 160-4 | 160 | 220 | 10 | 56 | 240-1 | 240 | 280 | 10 | 40 |
| 160-5 | 160 | 230 | 10 | 60 | 240-2 | 240 | 300 | 10 | 58 |
| 160-6 | 160 | 240 | 10 | 65 | 240-3 | 240 | 320 | 10 | 70 |
| 160-7 | 160 | 250 | 10 | 70 | 240-4 | 240 | 360 | 10 | 90 |
| 170-1 | 170 | 200 | 9 | 30 | 250-1 | 250 | 280 | 10 | 30 |
| 170-2 | 170 | 210 | 10 | 40 | 250-2 | 250 | 300 | 10 | 45 |
| 170-3 | 170 | 220 | 10 | 47 | 250-3 | 250 | 320 | 10 | 60 |
| 170-4 | 170 | 230 | 10 | 56 | 250-4 | 250 | 360 | 11 | 85 |
| 170-5 | 170 | 240 | 10 | 60 | 280-1 | 280 | 320 | 10 | 40 |
| 170-6 | 170 | 250 | 10 | 65 | 280-2 | 280 | 360 | 10 | 72 |
| 170-7 | 170 | 260 | 10 | 70 | 280-3 | 280 | 400 | 11 | 90 |
| 180-1 | 180 | 210 | 9 | 30 | 300-1 | 300 | 360 | 10 | 60 |
| 180-2 | 180 | 220 | 10 | 40 | 300-2 | 300 | 400 | 10 | 80 |
| 180-3 | 180 | 230 | 10 | 47 | 320-1 | 320 | 360 | 10 | 40 |
| 180-4 | 180 | 240 | 10 | 56 | 320-2 | 320 | 400 | 10 | 72 |
| 180-5 | 180 | 250 | 10 | 60 | 320-3 | 320 | 450 | 11 | 100 |
| 180-6 | 180 | 260 | 10 | 65 | 360-1 | 360 | 400 | 10 | 40 |
| 190-1 | 190 | 220 | 9 | 30 | 360-2 | 360 | 450 | 10 | 80 |
| 190-2 | 190 | 230 | 10 | 40 | 360-3 | 360 | 510 | 11 | 110 |
| 190-3 | 190 | 240 | 10 | 47 | 400-1 | 400 | 450 | 10 | 50 |
| 190-4 | 190 | 250 | 10 | 60 | 400-2 | 400 | 510 | 10 | 85 |
| 190-5 | 190 | 260 | 10 | 70 | 400-3 | 400 | 530 | 11 | 100 |
| 190-6 | 190 | 280 | 10 | 75 | 450-1 | 450 | 490 | 10 | 40 |
| 200-1 | 200 | 230 | 9 | 30 | 450-2 | 450 | 510 | 10 | 55 |
| 200-2 | 200 | 240 | 10 | 40 | 450-3 | 450 | 530 | 11 | 75 |
| 200-3 | 200 | 250 | 10 | 47 | 450-4 | 450 | 560 | 12 | 85 |
| 200-4 | 200 | 260 | 10 | 57 | 510 | 510 | 650 | 12 | 105 |
| 200-5 | 200 | 280 | 10 | 70 | 560 | 560 | 650 | 12 | 75 |
| 210-1 | 210 | 240 | 10 | 30 | 650 | 650 | 770 | 12 | 90 |

Standard types and dimensions



Rubber disk bellows

Rubber disk bellows are of the highest quality and optically the most attractive protective covers for pistons and spindles. They are completely leak-proof. Since each rubber disk lies 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 lead 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.



Dimensions

Rubber disk bellows are delivered in standard sizes of inside diameters of 20 to 400 mm and outside diameters of 40 to 480 mm. We supply the bellows in 5 mm graduation up to a diameter of 200 mm and in 10 mm graduation above this. As an alternative square, rectangular or oval profiles can also be produced. The extended length of the rubber disk bellows can be up to 10 metres.

The rubber disk bellows are fastened with the aid of Velcro tape, sleeve or metal flange like the other bellows. The Velcro tape connection is the least expensive version. 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 internally located wire rings. In the case of complex applications, guide plates by which the bellows are guided with the aid of rods or cable systems are drawn onto the bellows.

Technical data

The standard rubber disk bellows are produced from CSM rubber foil. CSM has especially good resistance to light and atmospheric conditions and is suited for outdoor 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 especially high temperature requirements.

Calculation formula:

$$L_{\max} = FZ \times FB$$

$$L_{\min} = FZ \times 2,5$$

$$FB = (AD - ID) / 2$$

$$FZ = L_{\max} / FB$$

$$FZ = \text{Stroke} / (FB - 2,5)$$

If bellows are subject to especially heavy wear, high pressure conditions or high temperatures up to 200°C, rubber fabric bellows can be used. Typical fields of application are piston rods with the resulting high ambient temperatures, or cardan shafts.

CR rubber fabric. All materials can be laminated with Teflon foil. A speciality are fabric bellows made from leather and carbon fibre with Aramid.

Rubber fabric bellows

Sizes

We manufacture rubber fabric bellows in the standard sizes with inside diameters of 30 to 2,900 mm and an outside diameter of 50 to 3,000 mm. There are no tool costs for the customary round shapes. As an alternative square, rectangular or oval profiles can also be produced. The bellows are fastened like the rubber disk bellows.



Rubber fabric bellows consist of a two-component structure, whereby the supporting fabric is coated with a special synthetic material. We use high-quality aluminium moulds, which are designed and built according to your special wishes.

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. Rubber fabric bellows are delivered as standard in



Calculation formula:

(for material with 1 mm thickness)

$$L_{\max} = FB \times FZ \times 1,4$$

$$L_{\min} = FZ \times 6$$

$$FB = (AD - ID) / 2$$

$$FZ = L_{\max} / FB / 1,4$$

Abbreviations:

| | | |
|------------------|---|-------------------------------|
| FB | = | Fold width/depth |
| FZ | = | Number of folds |
| L _{max} | = | Maximum extension of bellow |
| L _{min} | = | Minimum compression of bellow |
| AD | = | Outside diameter |
| ID | = | Inside diameter |

Bellows

SPEZIAL



Circular-stitched bellows

Apart from spiral springs, different bellow versions are available for protecting shafts, columns, spindles and other round rotating parts.

The circular-stitched bellows consist of punched disks, which are stitched inside and outside. Especially good shape stability and high transverse stiffness are achieved by stitching. We take GN 807 as standard material, aluminium glass fibre or glass fibre Viton is used for high-temperature applications.

The circular-stitched bellows are extremely resistant and can withstand even exposure to sharp chips especially for smaller sizes. They are only conditionally suitable as protection against liquids or oil.

Circular-stitched bellows can be used horizontally or vertically. In the case of horizontal use, we



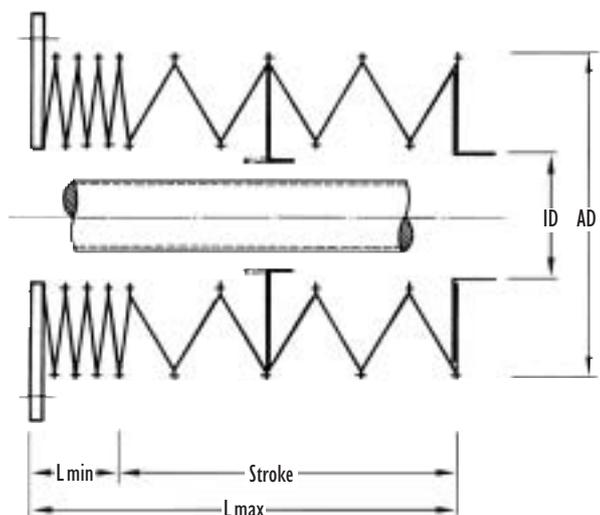
recommend installing additional support and guide rings made of synthetics or aluminium which guarantee a uniform distance from the spindle and

thus increase operating life. With large extensions, the stability of the bellows can be increased by installing a wire ring in every fold. We usually use metal frames for connection and mounting, sleeves are also possible as an alternative.

Design information:

It is important for the selection of the type of bellows that the diameter should be selected approx. 10 mm larger than the round part to be protected. Use the following formula for dimensioning:

$$\text{Extension} = (\text{stroke} / \text{F stroke}) \times \text{FAZ} + 5.$$



Abbreviations:

AD = Outside diameter FB = Fold width

ID = Inside diameter FAZ = Fold extension

FZD = Fold compression Fstroke = stroke per fold

Data table:

| HEMA-Type | AD | ID | FB | FAZ | FZD | Fstroke |
|-----------|-----|-----|------|-----|-----|---------|
| RF 50 | 50 | 25 | 12,5 | 10 | 2,5 | 7,5 |
| RF 72 | 72 | 33 | 19,5 | 18 | 2,5 | 15,5 |
| RF 85 | 85 | 45 | 20 | 18 | 2,5 | 15,5 |
| RF 95 | 95 | 53 | 21 | 18 | 2,5 | 15,5 |
| RF 100 | 100 | 63 | 18,5 | 18 | 2,5 | 15,5 |
| RF 120 | 120 | 82 | 19 | 18 | 2,5 | 15,5 |
| RF 122 | 122 | 76 | 23 | 15 | 2,5 | 12,5 |
| RF 130 | 130 | 90 | 20 | 18 | 2,5 | 15,5 |
| RF 135 | 135 | 85 | 25 | 15 | 2,5 | 12,5 |
| RF 140 | 140 | 102 | 19 | 18 | 2,5 | 15,5 |
| RF 145/1 | 145 | 93 | 26 | 15 | 2,5 | 12,5 |
| RF 145/2 | 145 | 105 | 20 | 18 | 2,5 | 15,5 |
| RF 150 | 150 | 110 | 20 | 18 | 2,5 | 15,5 |
| RF 160 | 160 | 112 | 24 | 18 | 2,5 | 15,5 |
| RF 170 | 170 | 125 | 22,5 | 18 | 2,5 | 15,5 |
| RF 180/1 | 180 | 132 | 24 | 20 | 2,5 | 17,5 |
| RF 180/2 | 180 | 141 | 19,5 | 18 | 2,5 | 15,5 |
| RF 190 | 190 | 150 | 20 | 18 | 2,5 | 15,5 |
| RF 200 | 200 | 152 | 24 | 18 | 2,5 | 15,5 |
| RF 220 | 220 | 170 | 25 | 18 | 2,5 | 15,5 |
| RF 235 | 235 | 190 | 22,5 | 18 | 2,5 | 15,5 |
| RF 245 | 245 | 200 | 22,5 | 20 | 2,5 | 17,5 |
| RF 260 | 260 | 202 | 29 | 18 | 2,5 | 15,5 |
| RF 266 | 266 | 216 | 25 | 20 | 2,5 | 17,5 |
| RF 300 | 300 | 250 | 25 | 18 | 2,5 | 15,5 |
| RF 365 | 365 | 320 | 22,5 | 18 | 2,5 | 15,5 |
| RF 400 | 400 | 340 | 30 | 20 | 2,5 | 17,5 |

The soft-PVC bellows occupy a special position among the different types of bellows. Normally 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 on the other hand are moulded parts, i.e. a certain minimum quantity or corresponding tooling must be

Because tooling is already available for many configurations, attractive prices are offered even for smaller quantities. The dimensions and shapes shown in the catalogue are available as standard; we would be pleased to assist you in the design of special types going beyond these.

Soft-PVC-bellows

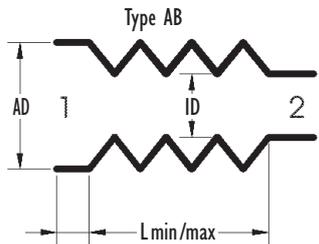


available to justify economic production. Correspondingly, cost reduction can be achieved with larger quantities which makes these parts particularly well suited for large-series use.

We use a special PVC as standard material. The bellows are resistant to alkalis and acids, they are water- and dust-proof. The operating temperature range is between -20°C and $+80^{\circ}\text{C}$ (maximum up to $+120^{\circ}\text{C}$). Versions in transparent material are also possible (black is standard)



Soft-PVC-bellows



Abbreviations:

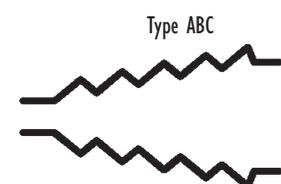
- ID = Inside diameter
- AD = Outside diameter
- FZD = Fold compression
- FAZ = Fold extension

| HEMA-Type | ID | AD | FZD | FAZ |
|-----------|----|-----|-----|-----|
| 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 |

| HEMA-Type | ID | AD | FZD | FAZ |
|-----------|-----|-----|-----|-----|
| 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 |
| 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 |

| HEMA-Type | ID | AD | FZD | FAZ | HEMA-Type | ID | AD | FZD | FAZ |
|-----------|-----|-----|-----|-----|-----------|-----|-----|-----|-----|
| 140-6 | 140 | 210 | 10 | 60 | 210-2 | 210 | 250 | 10 | 40 |
| 140-7 | 140 | 220 | 10 | 65 | 210-3 | 210 | 260 | 10 | 47 |
| 150-1 | 150 | 170 | 8 | 24 | 210-4 | 210 | 280 | 10 | 65 |
| 150-2 | 150 | 180 | 8,5 | 30 | 210-5 | 210 | 300 | 10 | 75 |
| 150-3 | 150 | 190 | 9 | 40 | 220-1 | 220 | 250 | 10 | 30 |
| 150-4 | 150 | 200 | 9 | 47 | 220-2 | 220 | 260 | 10 | 40 |
| 150-5 | 150 | 210 | 10 | 56 | 220-3 | 220 | 280 | 10 | 57 |
| 150-6 | 150 | 220 | 10 | 60 | 220-4 | 220 | 300 | 10 | 70 |
| 150-7 | 150 | 230 | 10 | 65 | 220-5 | 220 | 320 | 10 | 80 |
| 150-8 | 150 | 240 | 10 | 70 | 230-1 | 230 | 260 | 10 | 30 |
| 160-1 | 160 | 190 | 8,5 | 30 | 230-2 | 230 | 280 | 10 | 48 |
| 160-2 | 160 | 200 | 9 | 40 | 230-3 | 230 | 300 | 10 | 65 |
| 160-3 | 160 | 210 | 10 | 47 | 230-4 | 230 | 320 | 10 | 75 |
| 160-4 | 160 | 220 | 10 | 56 | 240-1 | 240 | 280 | 10 | 40 |
| 160-5 | 160 | 230 | 10 | 60 | 240-2 | 240 | 300 | 10 | 58 |
| 160-6 | 160 | 240 | 10 | 65 | 240-3 | 240 | 320 | 10 | 70 |
| 160-7 | 160 | 250 | 10 | 70 | 240-4 | 240 | 360 | 10 | 90 |
| 170-1 | 170 | 200 | 9 | 30 | 250-1 | 250 | 280 | 10 | 30 |
| 170-2 | 170 | 210 | 10 | 40 | 250-2 | 250 | 300 | 10 | 45 |
| 170-3 | 170 | 220 | 10 | 47 | 250-3 | 250 | 320 | 10 | 60 |
| 170-4 | 170 | 230 | 10 | 56 | 250-4 | 250 | 360 | 11 | 85 |
| 170-5 | 170 | 240 | 10 | 60 | 280-1 | 280 | 320 | 10 | 40 |
| 170-6 | 170 | 250 | 10 | 65 | 280-2 | 280 | 360 | 10 | 72 |
| 170-7 | 170 | 260 | 10 | 70 | 280-3 | 280 | 400 | 11 | 90 |
| 180-1 | 180 | 210 | 9 | 30 | 300-1 | 300 | 360 | 10 | 60 |
| 180-2 | 180 | 220 | 10 | 40 | 300-2 | 300 | 400 | 10 | 80 |
| 180-3 | 180 | 230 | 10 | 47 | 320-1 | 320 | 360 | 10 | 40 |
| 180-4 | 180 | 240 | 10 | 56 | 320-2 | 320 | 400 | 10 | 72 |
| 180-5 | 180 | 250 | 10 | 60 | 320-3 | 320 | 450 | 11 | 100 |
| 180-6 | 180 | 260 | 10 | 65 | 360-1 | 360 | 400 | 10 | 40 |
| 190-1 | 190 | 220 | 9 | 30 | 360-2 | 360 | 450 | 10 | 80 |
| 190-2 | 190 | 230 | 10 | 40 | 360-3 | 360 | 510 | 11 | 110 |
| 190-3 | 190 | 240 | 10 | 47 | 400-1 | 400 | 450 | 10 | 50 |
| 190-4 | 190 | 250 | 10 | 60 | 400-2 | 400 | 510 | 10 | 85 |
| 190-5 | 190 | 260 | 10 | 70 | 400-3 | 400 | 530 | 11 | 100 |
| 190-6 | 190 | 280 | 10 | 75 | 450-1 | 450 | 490 | 10 | 40 |
| 200-1 | 200 | 230 | 9 | 30 | 450-2 | 450 | 510 | 10 | 55 |
| 200-2 | 200 | 240 | 10 | 40 | 450-3 | 450 | 530 | 11 | 75 |
| 200-3 | 200 | 250 | 10 | 47 | 450-4 | 450 | 560 | 12 | 85 |
| 200-4 | 200 | 260 | 10 | 57 | 510 | 510 | 650 | 12 | 105 |
| 200-5 | 200 | 280 | 10 | 70 | 560 | 560 | 650 | 12 | 75 |
| 210-1 | 210 | 240 | 10 | 30 | 650 | 650 | 770 | 12 | 90 |

Standard types and dimensions



Rubber disk bellows

Rubber disk bellows are of the highest quality and optically the most attractive protective covers for pistons and spindles. They are completely leak-proof. Since each rubber disk lies 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 lead 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.



Dimensions

Rubber disk bellows are delivered in standard sizes of inside diameters of 20 to 400 mm and outside diameters of 40 to 480 mm. We supply the bellows in 5 mm graduation up to a diameter of 200 mm and in 10 mm graduation above this. As an alternative square, rectangular or oval profiles can also be produced. The extended length of the rubber disk bellows can be up to 10 metres.

The rubber disk bellows are fastened with the aid of Velcro tape, sleeve or metal flange like the other bellows. The Velcro tape connection is the least expensive version. 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 internally located wire rings. In the case of complex applications, guide plates by which the bellows are guided with the aid of rods or cable systems are drawn onto the bellows.

Technical data

The standard rubber disk bellows are produced from CSM rubber foil. CSM has especially good resistance to light and atmospheric conditions and is suited for outdoor 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 especially high temperature requirements.

Calculation formula:

$$L_{\max} = FZ \times FB$$

$$L_{\min} = FZ \times 2,5$$

$$FB = (AD - ID) / 2$$

$$FZ = L_{\max} / FB$$

$$FZ = \text{Stroke} / (FB - 2,5)$$

If bellows are subject to especially heavy wear, high pressure conditions or high temperatures up to 200°C, rubber fabric bellows can be used. Typical fields of application are piston rods with the resulting high ambient temperatures, or cardan shafts.

CR rubber fabric. All materials can be laminated with Teflon foil. A speciality are fabric bellows made from leather and carbon fibre with Aramid.

Rubber fabric bellows

Sizes

We manufacture rubber fabric bellows in the standard sizes with inside diameters of 30 to 2,900 mm and an outside diameter of 50 to 3,000 mm. There are no tool costs for the customary round shapes. As an alternative square, rectangular or oval profiles can also be produced. The bellows are fastened like the rubber disk bellows.



Rubber fabric bellows consist of a two-component structure, whereby the supporting fabric is coated with a special synthetic material. We use high-quality aluminium moulds, which are designed and built according to your special wishes.

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. Rubber fabric bellows are delivered as standard in



Calculation formula:

(for material with 1 mm thickness)

$$L_{max} = FB \times FZ \times 1,4$$

$$L_{min} = FZ \times 6$$

$$FB = (AD - ID) / 2$$

$$FZ = L_{max} / FB / 1,4$$

Abbreviations:

FB = Fold width/depth

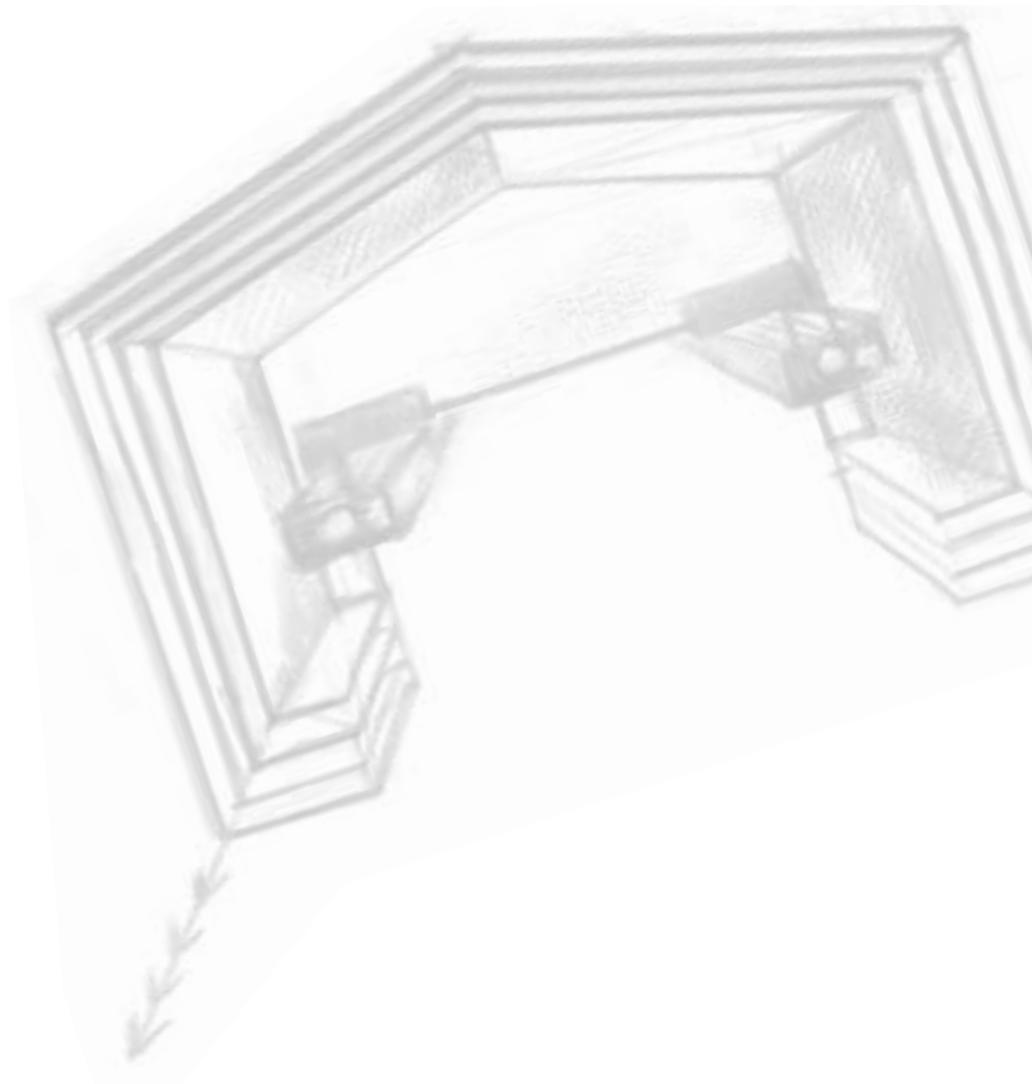
FZ = Number of folds

L_{max} = Maximum extension of bellow

L_{min} = Minimum compression of bellow

AD = Outside diameter

ID = Inside diameter



GLADIATOR
Telescopic Steel Covers
Wiper Systems

GLADIATOR Telescopic steel covers

Telescopic steel covers are the traditional cover of machining tools. They are used wherever the effective protection against the intrusion of chips and other sharp-edged particles is essential. The intrusion of coolant can be effectively reduced by design techniques and suitable wiper systems.

THE OFFER:

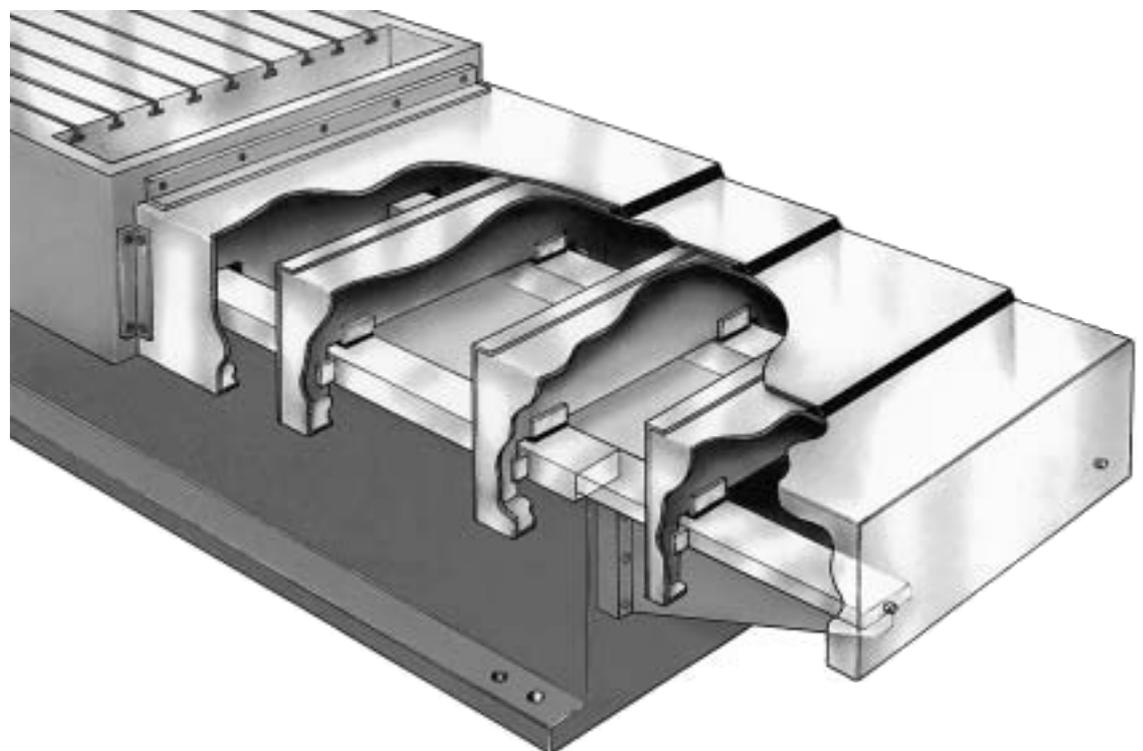
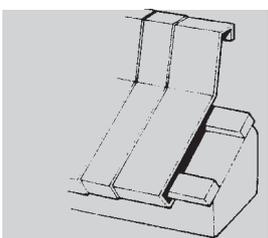
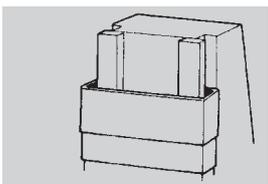
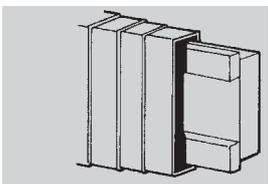
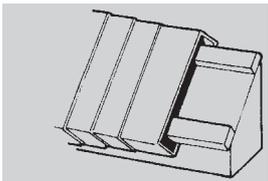
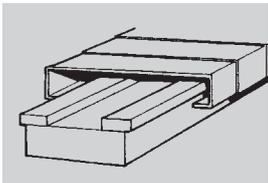
- cost efficient production at our partner HESTEGO in the Czech Republic, where production facilities are of the latest standard
- redesigned wiper systems
- high quality of production
- innovative solutions in the area of telescopic steel covers
- support and advice by the HEMA distributors network
- repair service and spare parts ex stock
- short design and delivery times

THE RESULT: high level of quality and good service at a fair price.

Basics of design

- prices are almost directly proportional to the number of cover boxes, the more boxes are required, the higher the price

- the depth of one box should not be larger than 750 mm
- the relation of box depth to box width should not exceed 1:6
- the lateral cover height should not be larger than the depth of the box because of danger of overturning
- principally, use only graded types (structure graded in length), because otherwise dirt will get into the cover by protruding wipers
- with coolant exposure, the top side of the covers should be inclined by an angle of 5°
- principally, allow space for an under-return of the boxes, this will stiffen the structure and will provide a constant pretension
- the minimum distance of the smallest box to the guiding should be 12 mm
- for calculating the travel of the cover, add 5 mm of reserve per box to the travel of the machine
- for covers used in vertical position, gliders should be used for the undergrip, which should be screwed on at least to one side for later (dis)mounting
- the general rule is: maximum extension and minimum compression should be at least in the relation 10:1



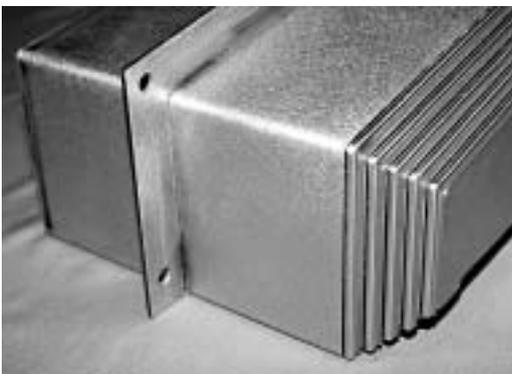
Material and impermeability

The steel covers are produced from high quality cold-worked sheet steel in material thickness from 1,5 to 3 mm, on demand in stainless steel quality as well. By special treatment of the surface the design of the cover is additionally upgraded. We offer the suitable type of cover (horizontal, vertical, inclined, traversal) for all common types of machines together with the corresponding guide way solutions.

Due to the design of the steel covers a complete impermeability to fluids is guaranteed. The standard types generally provide sufficient protection, for extreme loads help is available by a special channel system or a thermal bonded ELASTIC bellow as further protection. By additional sealing solutions which will require regular service, the intrusion of coolant can be prevented.

Material and impermeability

Wiper profiles:



Redesigned wipers with exchangeable lip and lip protection (DSP 8/12, DV 12) as well as standard wipers (P 01/P 02). Both come with optimised wiper profiles and differing degree of hardness for dry and wet machining.

Supporting rollers:



required for covers with more than 50 kg of unloaded weight; hardened guide ways (> 58 HRC) or separate support/guide ways, no matter how large the total number of rollers is, the total weight should not be spread on more than 4 rollers.

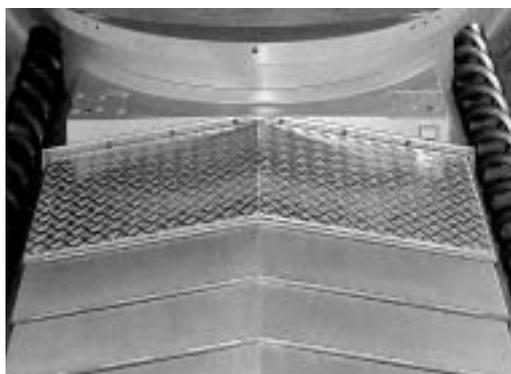
Components

Support and guide gliders:



Special profiled brass parts with sufficient contact width (appr. 5 mm) suitable for hardened and soft guide ways, also with PUR lips

Checker plate/tool deposit plate:

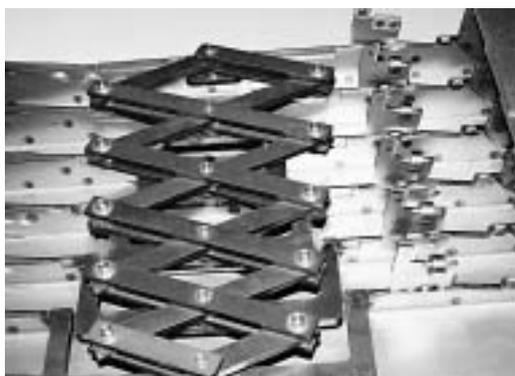


Walk-on is optionally possible, please make note when ordering.

Components

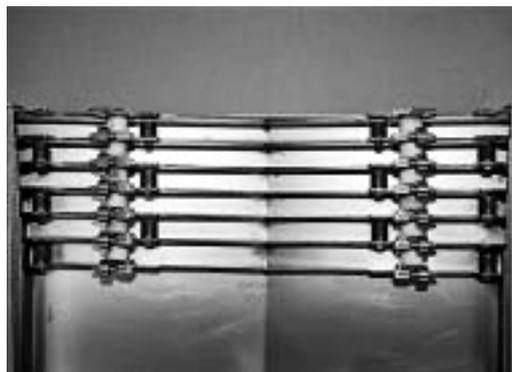
Pantograph systems:

For high speed of more than 30m/min we build in pantograph systems (graded versions as well), the required space is enlarged in this case.



Glide and damper systems:

Glide and damper systems reduce impact, noise and friction, optionally, wipers with dampers can be used as well.



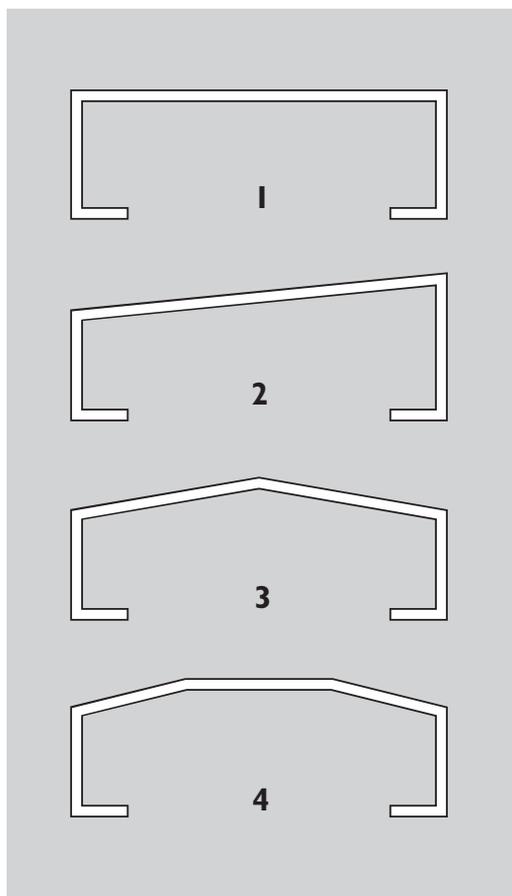
Suspensions:

For mounting/dismounting and transport suitable suspensions can be used.

Design versions

For most applications the cost-efficient standard design is suited (1). It can be used without any problem up to a width of 900 mm. For larger widths, additional edges are required to raise the traversal stiffness. This is guaranteed by the roof shape with single (3) or double edges (4). Furthermore, it provides along with the inclined shape (2) an optimal draining of liquids and chips.

Standard shapes:



If the compression exceeds the available free bearing length, a support has to be created by extension supports. For the reversed case, the smallest front box section may be extended by a

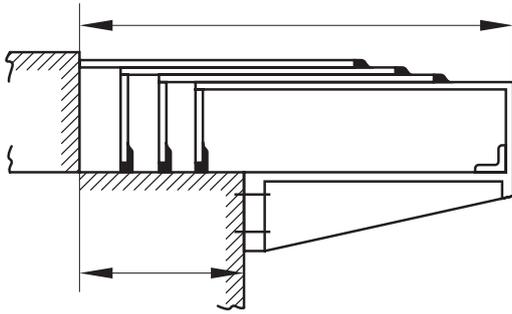


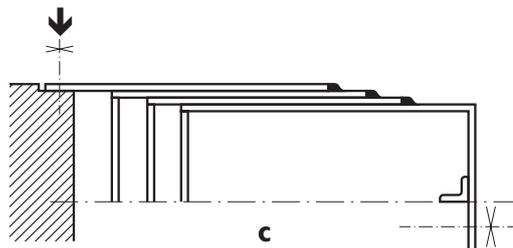
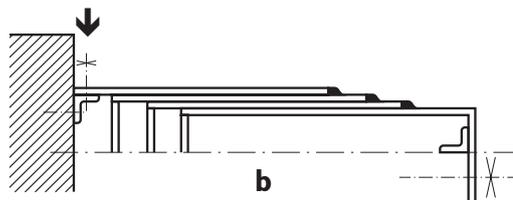
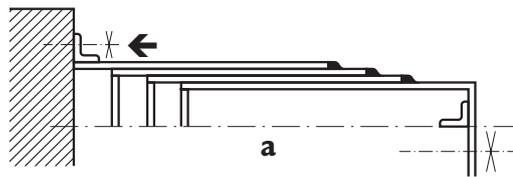
plate. The problem here is that chips and dirt may accumulate impairing the functioning of the cover:

Pay attention to a gapless transition from the guide way to the machine bed extension. Extensions are required only in the area of guide or support gliders. They can be manufactured from common steel (i.e. St37K).

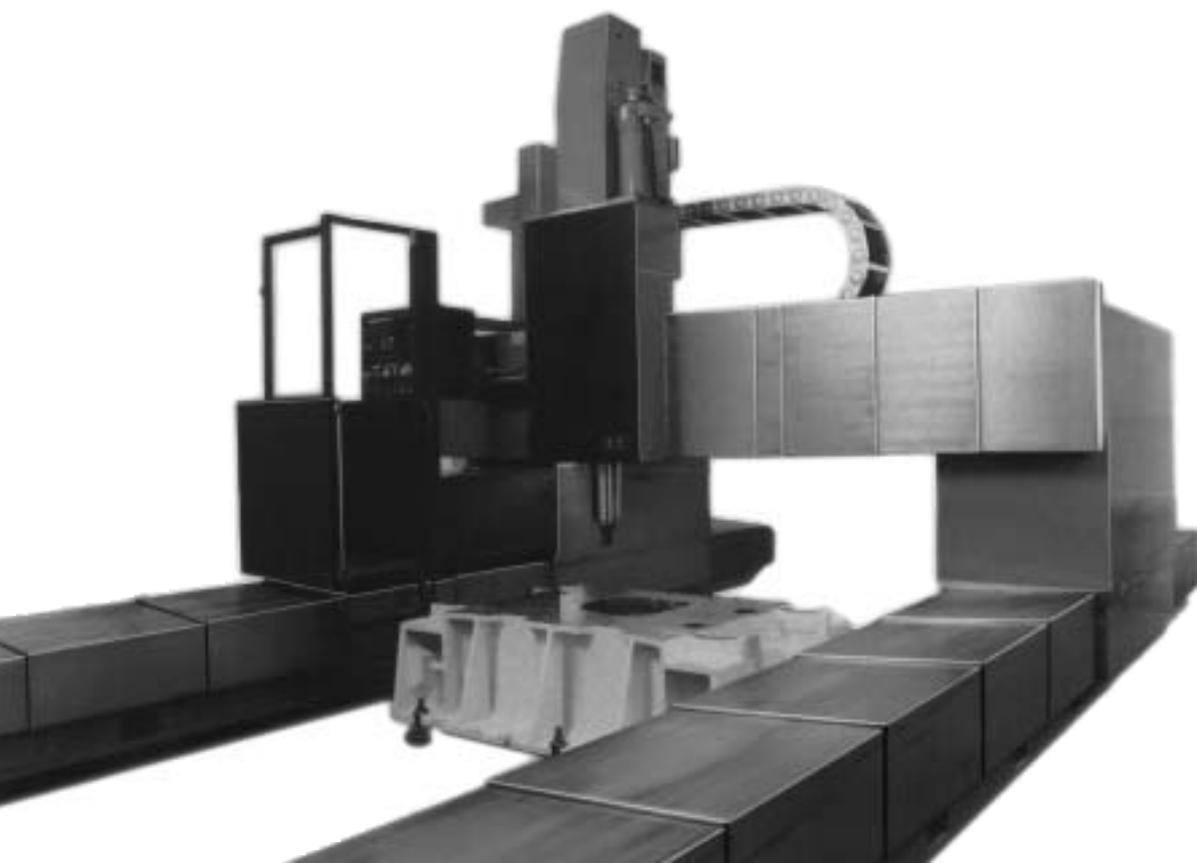
Engine bed extension

For mounting and fixing of the steel covers we offer you solutions specifically to the customer's individual situation. The covers are fixed either directly to the corresponding starting or final box section or by additional fixing shoulders/knee which may be attached internally or externally.

- The optimum:
fixing by lateral external knee **(a)**
- must be without strain:
fixing by upper internal knee **(b)**
- requires high accuracy for mounting:
fixing the box directly from the top **(c)**



Mounting and fixing



Set-up and transport

The covers are transported in the closed position, additionally they should be stored in an environment free of humidity.

Before shipping, the telescopic steel covers are sprayed with an anti-corrosion oil and wrapped

into plastic foil. This will protect your steel cover against corrosion during transport and longer storage periods. Please lubricate the entire steel cover from the outside before operation.

Service and maintenance

Telescopic steel covers require only minimum maintenance during deployment. To avoid damages, you should give them a regular inspection and cleaning (depending on the degree of pollution). Please observe the following topics:

Surface of the steel covers:

Please extend the steel covers and clean off any dirt. Next you should rub the steel cover with an oil-soaked rag. This will prevent early wear and corrosion.

Do not clean by compressed air, because foreign particles will be forced into the interior of the steel cover.

Steel covers and chip exposure:

When heavily exposed to chips, the steel cover should be checked frequently and regularly for intruded chips. If chips have intruded to the inside, e.g. by swirling, the steel cover is to be disassembled and cleaned carefully.

Chips located in between the boxes will cause destruction of the steel cover.

Wearing parts and service:

Regular, preventive maintenance is the basic for long-term reliable operation. Please assure that the following wearing parts are exchanged at regular intervals, depending on wear:

- wipers
- rollers
- pantographs
- gliders
- guiding ledges

Guide ways:

For inspecting the guide ways of the machine, fold the steel cover together and disconnect the joint at the largest box. Please spray at this opportunity the lower surface of the cover with oil.

Wiper lips:

Wipers and their lips should be inspected frequently and regularly. Please renew the wipers and lips if the covering boxes underneath them are no longer wiped properly.

This can be recognised by smear formation or remaining coolant and chips.

Glider:

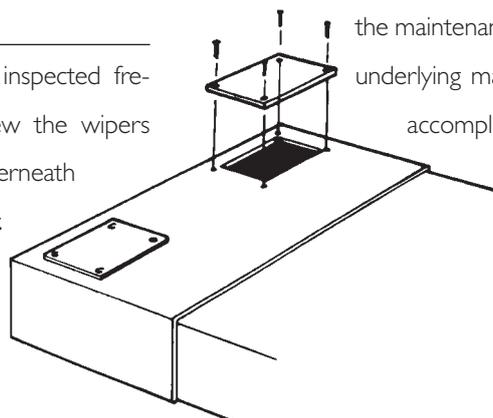
Please renew the gliders when their bearing surface shows heavy wear or deformation or when chips have been included.

Seals:

Check regularly joints which had been treated with sealant. Should these spots detach or dissolve, e.g. by aggressive coolants, they have to be sealed with appropriate sealant (e.g. PU or silicon).

Access windows (option):

By building in access windows into the largest box, the maintenance and repair of the underlying machine parts can be accomplished without having to remove the complete cover.



The current program range comprises slide way wipers, wipers for telescopic steel covers and sealing wipers for guides. For inquiries/orders simply specify the desired type, area of application and order quantity or send a drawing.

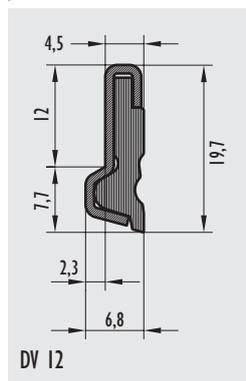
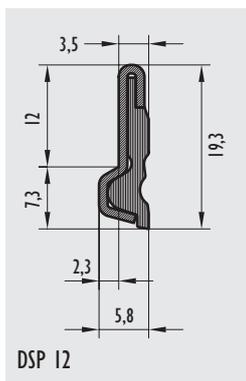
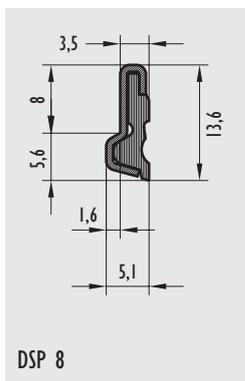
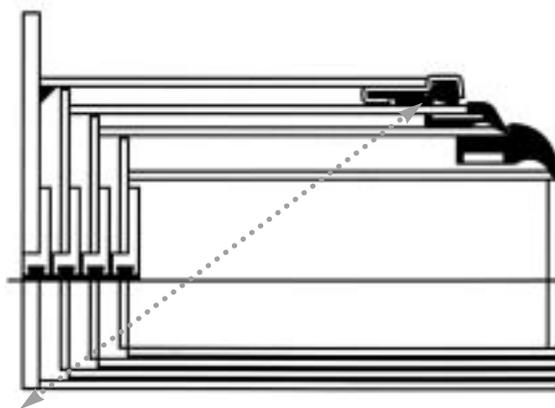
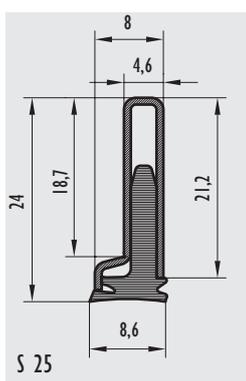
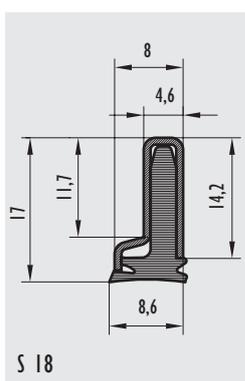
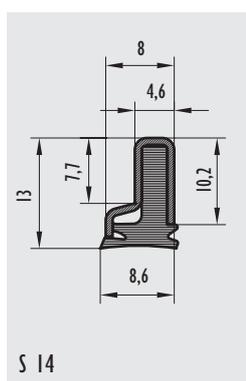
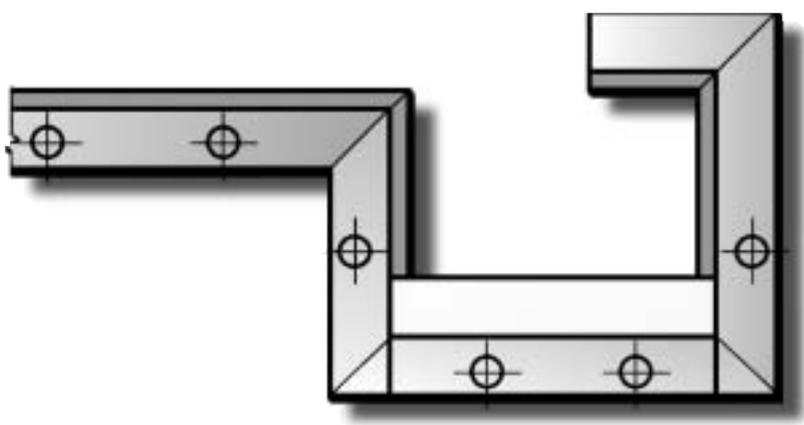
The lips of the wipers are manufactured from high-grade polyurethane or synthetic rubber showing excellent mechanical and chemical properties. They are temperature resistant up to maximum 130°C (rubber 135°C), continuously up to 90°C (rubber 100°C).

Data of guideway wipers

The guideway wipers – specially suited to be build into limited space – are manufactured in many shapes, sizes and different materials. We offer profiled wipers ready for installation according to customer's specifications. Standard wipers are usually available ex stock starting from a length of 500 mm. All wipers can be cut to length by the customer himself.

The basic S-line possess a specially designed two-sided lip serving as an additional rear sealing against under-flushing by coolant. Its outer support of nickel chromium steel offers high rigidity and stability under load.

Telescopic wipers can be used in vertical position for guideways, too.



Technical data

Wiper data for telescopic steel covers

The wiper systems for steel covers can be subdivided into two main groups.

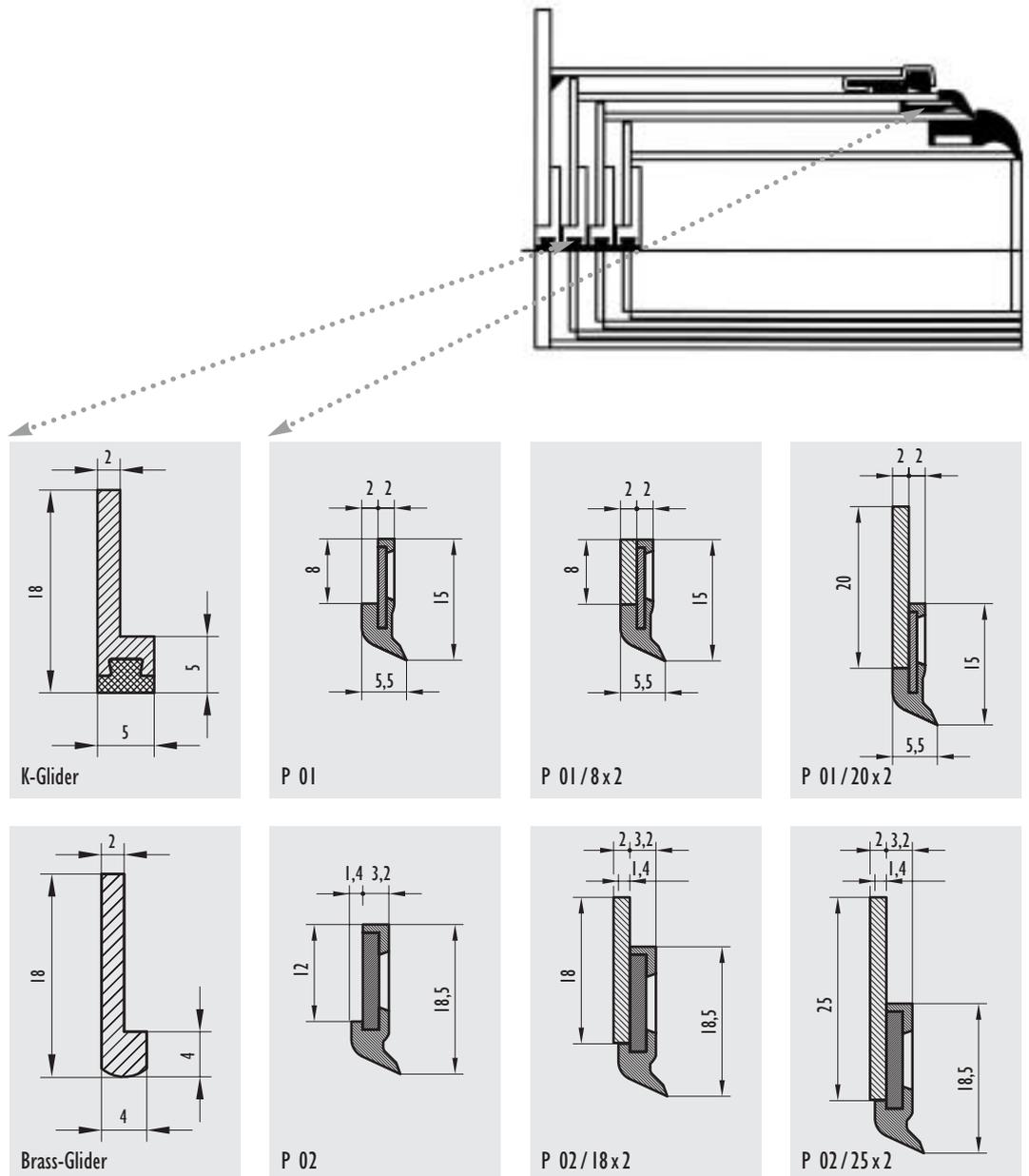
The P 01/P 02 series can be used universally. It can be used horizontally for telescopic steel covers or vertically for guideways. A polyurethane wiper lip is vulcanised onto one or two steel profiles and thus permanently bonded. Therefore the complete wiper must be replaced when worn. They are available in lengths starting from 500 mm.

In contrast to these, the wipers DSP and DV differ due to easy replaceability of the wiper lips and high compatibility with systems common in the market.

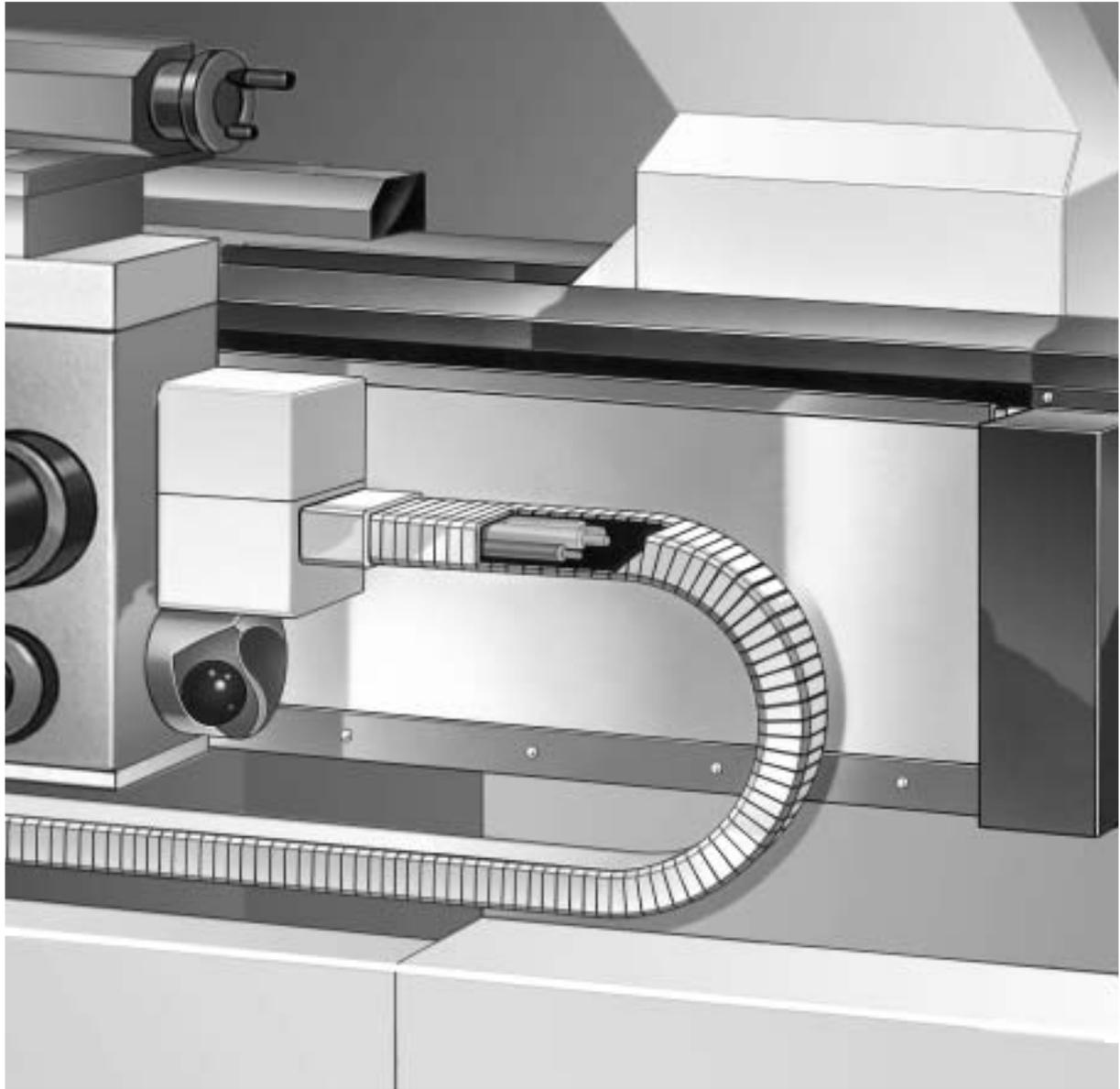
The lips of the P 01/P 02 wipers are manufactured from high-grade polyurethane and show good mechanical and chemical properties. They are temperature resistant up to maximum 130°C, continuously up to 90°C. Fixing is possible by screwing, welding or riveting.

The wipers are available ex stock as a rule. The wiper lips and metal profiles may be ordered separately for the series P 01 and P 02. The wiper lips are delivered in lengths from 1,000 up to 10,000 mm, the metal profiles from 1,000 to 3,000 mm.

Vulcanised wiper systems are available according to customer's drawing. Further wiper types on demand.



Cable conduits



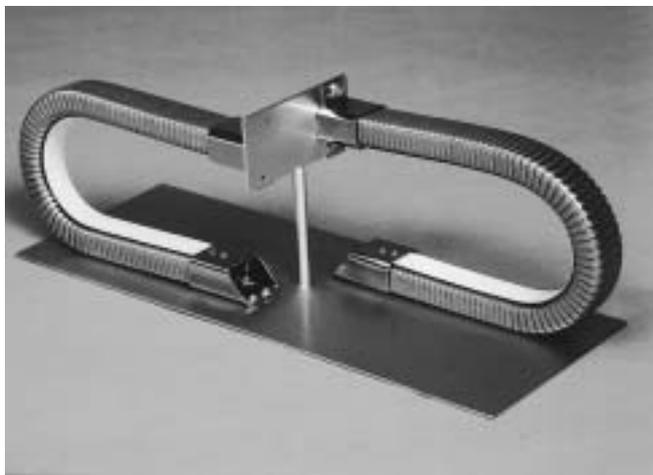
For a number of years, HEMA has been offering metal tubing for effective protection of supply lines in machine tools. HEMA protective tubing pre-

vents supply lines from being damaged by breakage, bending, abrasion or the like. This tubing offers good protection thanks to its rigid metal wall

and by having the cable routed properly through the inside.

HEMA cable tubing is called HEMAFLEX and is made from galvanised steel tubes.

The separate elements of the tubing have a spiral shape and thus form a square tube body. A stainless steel band (synthetic optional) is permanently bonded on that surface of the exterior of the tubing which lays inside of the bend. This makes the tubing perfectly stable in all directions and extremely precise when travelling or bending.



The bonding of that steel band is one of the essential quality-related factors to which we pay much attention.

Technical data:

The excellent quality of HEMAFLEX' materials and processing show up in their extended service life and numerous areas of application. The temperature can range continuously between -40° C and +120° C, short-term ratings up to 180° C. HEMAFLEX exhibits good resistance to commonly used cooling agents.

HEMAFLEX types are to be laid out for a speed up to 90 m/min. Choose type RM up to 20 m/min, type RS up to 50 m/min and type RV for higher speed.

HEMAFLEX is available in different basic sizes, which you will find listed in the data matrix. Depending on the model, the load capacity amounts to 17 kg/m. To calculate the cables' space requirement, add about 10% to the external diameter of the cable. Always adhere to the sizes recommended by the manufacturer:

Formula for total length

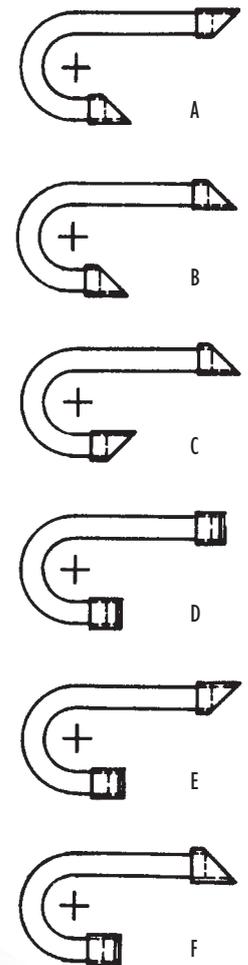
Use the following formula to calculate the total length:

$$\text{Total length } L = (0.5 \times \text{distance traversed } L_s) + (2 \times \text{TF}) + (4 \times \text{bending radius } KR) + 50 \text{ mm}$$

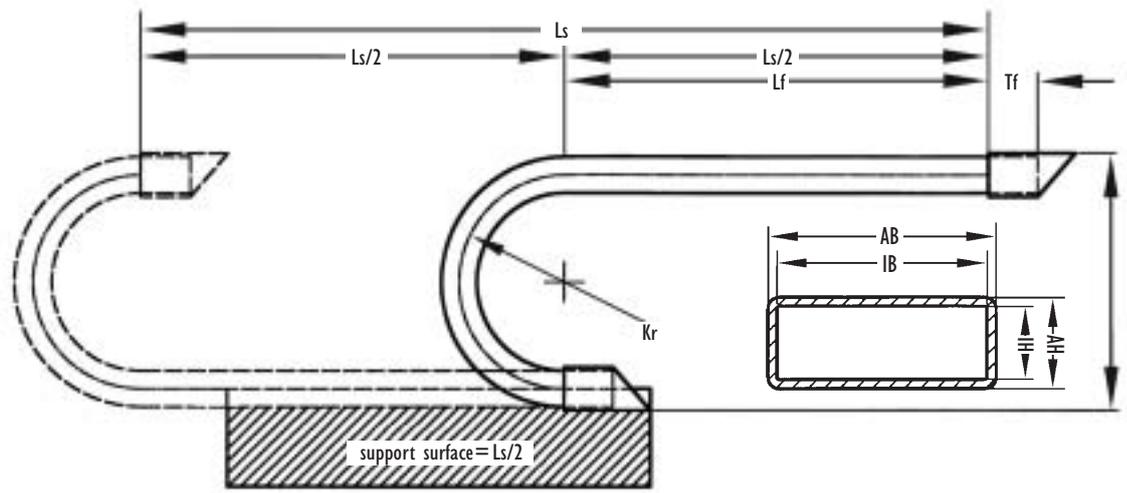
The bending radius (KR) of the cable tubing has a design- and production-related tolerance of +/- 10 %. The forces acting on the HEMAFLEX are essentially determined by its mounting height, unsupported distance and bending radius. The smaller the bending radius the greater the stress placed on the tubing and the supply lines inside it. Therefore the parameters for bending radius KR, height H and the guided length of the tubing (L-Lf) must be set as large as possible. The action of the forces can be improved with a support trough which should be half as long as the distance traversed. As an alternative for even larger traversed distances running over an unsupported distance of more than 2,500 mm, a supporting system of roll mounts can achieve even better stability, service life and traverse accuracy. Ask our engineers what would be best for your individual needs.

Cable conduits

Mounting positions of connecting flanges



Cable conduits



Design information for technical layout:

Abbreviations:

AB = external width IB = internal width KR = bending radius H = maximum height
 AH = external height IH = internal height Tf = length of tubing lost in flange
 Lf = unsupported length Ls = distance traversed MSS = metal protection tubing G = weight

| Type | AB | AH | IB | IH | TF | KR | H | Lf | Ls* | G** |
|---------|-----|-----|-----|-----|----|-----|-----|-------|----------------|------|
| MSS 0 | 30 | 20 | 26 | 16 | 25 | 55 | 144 | 1,000 | 4,000 (2,000) | 0.6 |
| MSS 1 | 50 | 30 | 43 | 23 | 30 | 72 | 194 | 1,500 | 6,000 (3,000) | 1.25 |
| | | | | | | 110 | 269 | | | |
| | | | | | | 165 | 379 | | | |
| MSS 1 A | 50 | 50 | 45 | 45 | 50 | 110 | 294 | 2,000 | 8,000 (4,000) | 1.7 |
| MSS 2 | 80 | 45 | 73 | 38 | 45 | 110 | 290 | 2,000 | 8,000 (4,000) | 2.25 |
| | | | | | | 220 | 510 | | | |
| | | | | | | 275 | 620 | | | |
| MSS 2 A | 95 | 50 | 90 | 45 | 52 | 130 | 300 | 2,000 | 10,000 (5,000) | 2.9 |
| MSS 2 B | 85 | 60 | 80 | 55 | 65 | 165 | 415 | 2,500 | 10,000 (5,000) | 2.4 |
| MSS 3 | 110 | 60 | 102 | 52 | 60 | 155 | 400 | 2,500 | 10,000 (5,000) | 3.6 |
| | | | | | | 250 | 590 | | | |
| | | | | | | 330 | 750 | | | |
| MSS 3 A | 115 | 80 | 109 | 74 | 80 | 220 | 550 | 2,500 | 10,000 (5,000) | 3.8 |
| MSS 4 | 170 | 80 | 162 | 72 | 80 | 205 | 520 | 2,500 | 10,000 (5,000) | 5.6 |
| MSS 5 A | 175 | 110 | 170 | 104 | 80 | 285 | 660 | 2,500 | 10,000 (5,000) | 5.8 |

Note: all data in mm; * numbers in brackets without support; ** in kg/m without flange
 Type: RM (up to 20 m/min), RS (up to 20-50 m/min), RV (more than 50 m/min)

Mounting:

The high traversing speeds and instances of sudden acceleration require a solid mount of the cable tubing on the machine. HEMA has developed four

basic types of flange which are spot-welded and riveted to the cable tubing, and screwed to the machine. Select the right flange for your con-



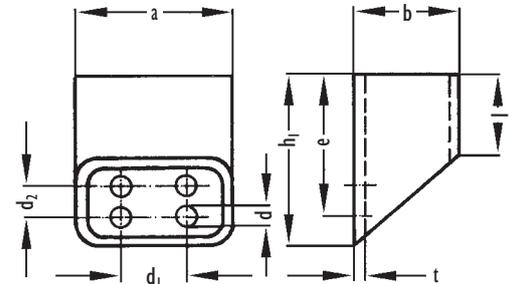
nection. The connection data are found in the matrices. You will obtain complete connection information by combining the basic data with the data related specifically to the respective type of flange. Depending on the type of flange selected,

various combinations are possible. The position at which the flange is attached to the tubing is also important. Please indicate this in the order sheet attached.

Cable conduits

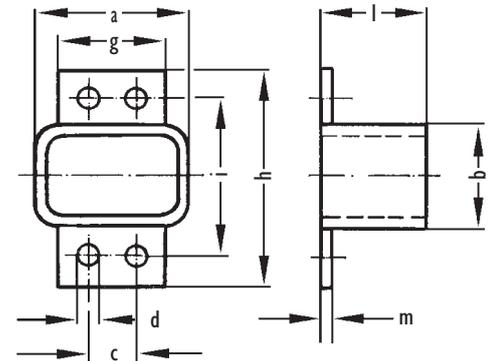
standard flange S:

| type of cable support | a | b | d ₁ | d | e | k ₁ | k | t | d ₂ |
|-----------------------|-----|-----|----------------|---|------|----------------|-----|-----|----------------|
| MSS 0 | 34 | 24 | 13 | 6 | 40 | 50 | 25 | 1,5 | |
| MSS 1 | 54 | 34 | 22 | 7 | 45 | 60 | 30 | 1,5 | |
| MSS 1A | 54 | 54 | 20 | 7 | 75 | 100 | 50 | 1,5 | |
| MSS 2 | 85 | 50 | 50 | 7 | 67,5 | 90 | 45 | 2 | |
| MSS 2B | 90 | 65 | 50 | 7 | 118 | 130 | 65 | 2 | 40 |
| MSS 3 | 115 | 65 | 70 | 9 | 90 | 120 | 120 | 2 | |
| MSS 3A | 120 | 85 | 80 | 9 | 143 | 165 | 165 | 2 | 40 |
| MSS 4 | 175 | 85 | 100 | 9 | 120 | 160 | 160 | 2 | |
| MSS 5A | 182 | 117 | 140 | 9 | 158 | 195 | 195 | 3 | 40 |



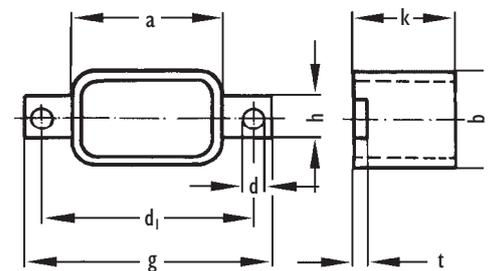
standard flange A:

| type of cable support | a | b | d ₁ | d | g | h | d ₂ | k | t |
|-----------------------|-----|----|----------------|---|-----|-----|----------------|----|-----|
| MSS 1 | 54 | 34 | 18 | 7 | 35 | 70 | 55 | 30 | 1,5 |
| MSS 2 | 85 | 50 | 45 | 7 | 65 | 85 | 70 | 45 | 2 |
| MSS 3 | 115 | 65 | 60 | 9 | 80 | 110 | 90 | 60 | 2 |
| MSS 4 | 175 | 85 | 95 | 9 | 120 | 130 | 110 | 80 | 2 |



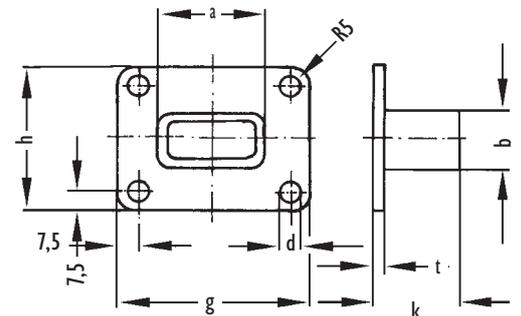
standard flange B:

| type of cable support | a | b | d ₁ | d | g | h | k | t |
|-----------------------|-----|----|----------------|---|-----|----|----|-----|
| MSS 1 | 54 | 34 | 75 | 7 | 90 | 15 | 30 | 1,5 |
| MSS 2 | 85 | 50 | 105 | 7 | 120 | 30 | 45 | 2 |
| MSS 3 | 115 | 65 | 140 | 9 | 160 | 35 | 60 | 2 |
| MSS 4 | 175 | 85 | 200 | 9 | 220 | 40 | 80 | 2 |



standard flange C:

| type of cable support | a | b | d | g | h | k | t |
|-----------------------|-----|-----|---|-----|-----|----|-----|
| MSS 0 | 34 | 24 | 6 | 60 | 50 | 25 | 1,5 |
| MSS 1A | 54 | 54 | 7 | 85 | 85 | 50 | 1,5 |
| MSS 2A | 100 | 55 | 7 | 130 | 85 | 60 | 2 |
| MSS 2B | 90 | 65 | 7 | 120 | 95 | 65 | 2 |
| MSS 3A | 120 | 85 | 9 | 150 | 115 | 80 | 2 |
| MSS 5A | 182 | 117 | 9 | 210 | 145 | 80 | 3 |



MAXIFLEX Coolant hoses

MAXIFLEX is a universal supply line system for liquid and gaseous media up to a pressure of four bars.

MAXIFLEX is made of high-quality synthetic material. This synthetic material is manufactured on modern machines in Switzerland and is extremely

resistant to chemicals and corrosion. MAXIFLEX tubing is not electrically conductive.

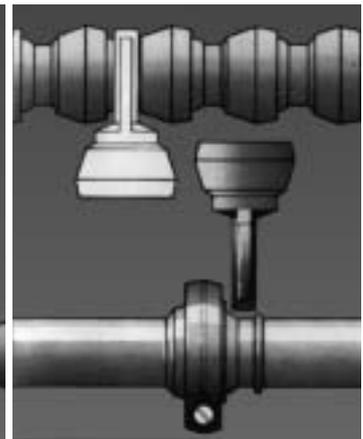
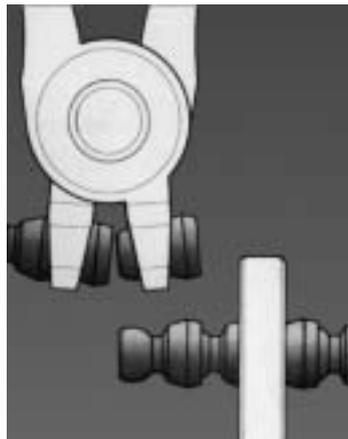
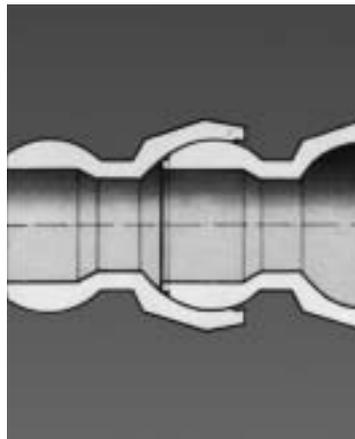
MAXIFLEX is extremely flexible thanks to its many standard components and can be adapted optimally to any required length, position and appli-

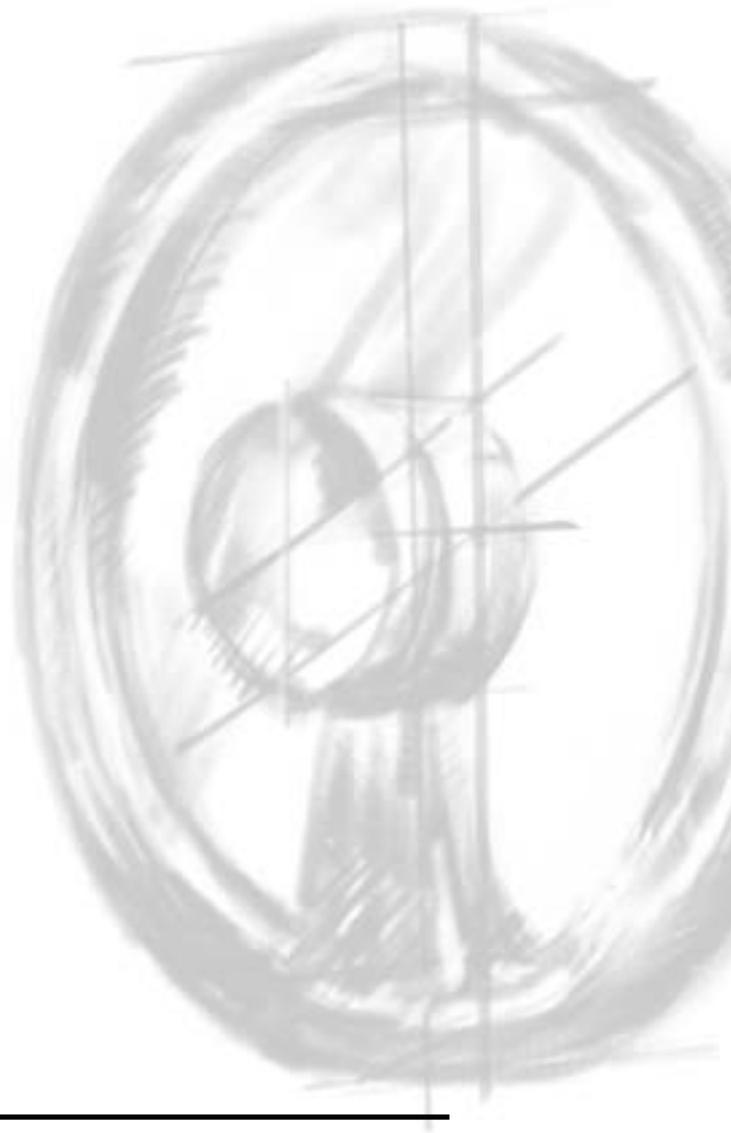
cation. When properly used, neither medium flow nor machine vibrations can change the set position. In addition, the flow area remains practically constant in any position and thus ensures uniform flows. You can use magnetic feet or magnetic distributor blocks to facilitate mounting.



When properly used, neither medium flow nor machine vibrations can change the set position. In addition, the flow area remains practically constant in any position and thus ensures uniform flows. You can use magnetic feet or magnetic distributor blocks to facilitate mounting.

The MAXIFLEX system is structured on the modulare principle. There are the two standard types, 3200 and 3400, which are compatible with each other and with other manufacturers' systems. The 3200 system has a diameter of 6 mm / 1/4"; the 3400 system offers diameters of 12 mm / 1/2". The individual components are mounted or separated with the aid of special tools included at delivery (circlip pliers, separating wedge). This allows you to configure any lengths you want. Finally, you can choose from a number of flat or hole-type





Polycarbonate Safety Windows
VISIPOINT Spin Windows
EAGLEVISION
integrated Spin Window

The manufacturers of machining centres are demanding safety regulations and product liability.

A special focus of attention are the safety risks of safety windows testified in recent years. The replacement of unprotected polycarbonate panes is recommended by VDMA (Association of German machine and plant manufacturers) after only two years of use.



Polycarbonate safety glass with stainless steel frame

Safety glass

Where should polycarbonate safety panes be used?

| Application of safety pane | Safety panes provide to the user effective protection against ... |
|----------------------------|-------------------------------------------------------------------|
| turning ... | Broken chuck components and machined parts |
| milling ... | Hot chips, broken tools and machined parts |
| grinding ... | Pieces of broken grinding discs |

Overview

Background information on the topic of safety glass

Safety glass is a restraining protective device on machining centres. It prevents tools, machined parts and broken particles being thrown out of the working space of the machinery and protects persons from injuries. Statistics show that workers being hit is still a common cause of industrial accidents.

Viewing panes at machining centres, ideally combined with a spin window system, provide a good view to the operator and transparency to the manufacturing process. Viewing panes within the trajectory path of parts must show a sufficient strength.

According to the latest empirical tests polycarbonate is the material best suited for safety glass. This is due to the high energy absorption of the material. The restraint capability of a polycarbonate pane of 8 mm thickness is about the same as of a 3mm St 12.03 steel sheet. A disadvantage of the polycarbonate is its sensitivity to scratching and it will be damaged by the impact of hot chips and sparks. Furthermore it has low resistance against the effects of coolants, grease and oil which will

result in embrittlement of the polycarbonate. By this process the restraint capability can be reduced within a few years.

Polycarbonate safety glass manufactured by HEMA/BSA is protected permanently and efficiently from these external influences by its encapsulation and sealing.

Background information

Polycarbonate safety glass (standard design)

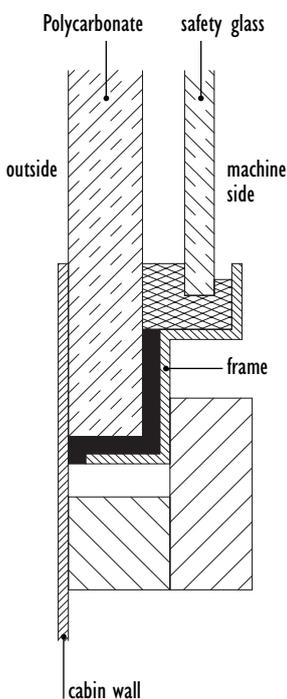


Safety glass

Any safety glass showing damage from external mechanical impact, for example cracks or deep scratches or deterioration resulting from exposure to chemicals must be exchanged because its protective functioning is no longer guaranteed.

At present there exist three technical standards for metal cutting tools: DIN EN 12415 (for turning machines), DIN prEN 13128 and DIN prEN 12417 (for milling machines and machining centres). These standards form the basis for our safety glass and spin window systems. You may determine the relevant safety classification and the corresponding minimum thickness of the polycarbonate from the tables on the following pages. The influential factors are the mass of the tool and of the machined part and the speed and rotation.

cross-section: safety window with metal frame



Safety glass ... the solution.

- Manufactures of turning, milling and grinding machines have trusted for many years in the quality of HEMA's business partner BSA Luftfahrt- und Sicherheitstechnik GmbH & Co.
- BSA is a partner of the European machine construction and aviation industry delivering excellent certified quality at prices in line with market requirements.
- Only certified quality panes made of polycarbonate with an efficient surface coating providing protection against chemicals, abrasion and scratching are used.
- Polycarbonate panes from renowned manufactures such as GE Plastics, B.V. or Makroform are used
- The polycarbonate panes can be supplied at any marketable thickness. The basic material consists of panes from 4 to 15 mm thickness.
- They are protected on the machine side by an additional single or multiple layer safety glass pane. According to customer specifications the structure may comprise polycarbonate, foils and glass.
- As standard we use laminated glass which has a low risk of injury when damaged due to its

The restraint capability of safety glass not only depends on the thickness of the polycarbonate but also on the sheet metal design of its containment. Clamps or bonding or an adequate frame are best suited for the mounting. The joints should be well covered to prevent the screen from being pushed through the frame if hit by an impact of parts.

- splinterproof properties and also reduces time for cleaning and machine standstill.
- The edges of the panes are completely sealed and resistant to coolants. In addition they can be fitted with an aluminium or stainless steel frame for optimal mounting.
- Panes and their components are tested by the IVF institute in Berlin according to EN 12415, restraint categories A1 to C3, and to safety standards CEN/TC 143/WG3.
- The customer will receive a 5-year warranty on the encapsulated and sealed safety pane (according to our warranty conditions).
- The integration of modern intelligent spin window solutions such as VISIPOINT or EAGLEVISION is possible without any safety risk or additional mounting expenditure.

Classification according to EN DIN 12415 tested on standard windows 500 x 500 mm

| Material / classification | A1 | A2 | A3 | B1 | B2 | B3 | C1 | C2 | C3 |
|---------------------------|-------|-------|-------|------|------|------|------|------|------|
| Mass of projectile in kg | 0,625 | 0,625 | 0,625 | 1,25 | 1,25 | 1,25 | 2,50 | 2,50 | 2,50 |
| Kinetic energy [Nm] | 320 | 781 | 2000 | 1562 | 2480 | 4000 | 3124 | 4960 | 8000 |
| PC 6 mm | + | | | + | | | | | |
| PC 8 mm | + | + | | + | + | | + | | |
| PC 10 mm | + | + | + | + | + | | + | + | |
| PC 12 mm | + | + | + | + | + | + | + | + | |
| PC 15 mm | + | + | + | + | + | + | + | + | + |
| PC 19 mm laminated | + | + | + | + | + | + | + | + | + |

Technical data and performance

Appendix:

+ test passed by polycarbonate panes tested by BSA at IWF according to DIN EN 12415

Calculation of the safety classification and the required thickness of polycarbonate for turning machines

Impact energy and speed may be calculated by the following data:

1. DIAMETER OF ROTATION

= maximum outer diameter of the clamping jaw at the machine

2. ROTATIONAL SPEED OF THE SPINDLE

= maximum speed of the machine according to the manufacturer

3. MASS OF CLAMPING JAW

= mass of one clamping jaw (classification according to proposed standard)

As a special service we offer you the calculation with a PC program to verify current pane systems and to design future solutions.



Deployment testing device at the IMF, Berlin. Impulse test according to EN DIN 12415 passed in classification C3

Safety classification for turning machines

| max. diameter of clamping jaw (mm) from | max. diameter of clamping jaw (mm) up to | circumferential speed v (m/s) | Projectile dimensions D x a (mm x mm) | Projectile mass m (kg) | impact speed v (m/s) up to | impact energy (Nm) up to | safety classification* | minimum thickness of polycarbonate (mm) |
|-----------------------------------------|------------------------------------------|-------------------------------|---------------------------------------|------------------------|----------------------------|--------------------------|------------------------|-----------------------------------------|
| | 130 | 25 40 63 | 30 x 19 | 0,625 | 32 50 80 | 320 781 2.000 | A1 A2 A3 | 6 6 8 |
| 130 | 250 | 40 50 63 | 40 x 25 | 1,250 | 50 63 80 | 1.562 2.480 4.000 | B1 B2 B3 | 6 8 12 |
| 250 | | 40 50 63 | 50 x 30 | 2,500 | 50 63 80 | 3.124 4.960 8.000 | C1 C2 C3 | 8 10 15 |
| 500 | | | | 2,500 | 89 | 10.000 | PK 1 | 15 |
| 500 | | | | 5,000 | 63 69 | 10.000 12.000 | PK 2 PK 3 | 15 19 |
| 500 | | | | 8,000 | 55 59 | 12.000 14.000 | PK 4 PK 5 | 19 19 |

*A1 to C3 = classification according to EN 12415; PK1 to PK5 = classification according to VDW

Safety classification for milling machines

Calculation of the safety classification and the required thickness of polycarbonate for milling machines according to prEN1247

Impact energy and speed may be calculated by the following data:

As a special service we offer you the calculation with a PC program to verify current pane systems and to design future solutions.

1. DIAMETER OF ROTATION
= maximum outer diameter of the cutting tool unit at the machine concerned
2. ROTATIONAL SPEED OF THE SPINDLE
= maximum speed of the machine according to the manufacturer
3. MASS OF CUTTING TOOL
= defined for 100 g only according to proposed standard

| Projectile mass m (kg) | impact speed v (m/s) up to | impact energy (Nm) up to | minimal thickness of Polycarbonate (mm) |
|------------------------|----------------------------|--------------------------|-----------------------------------------|
| 0,100 | 85 | 361 | 4 |
| 0,100 | 100 | 500 | 6 |
| 0,100 | 120 | 720 | 8 |
| 0,100 | 145 | 1063 | 10 |
| 0,100 | 150 | 1125 | 12 |
| 0,100 | 170 | 1445 | 15 |
| 0,100 | > 170 | > 1445 | 19 |

Our application counselling is not binding. Responsibility for application and deployment of our products lies with the purchaser, also regarding

potential claims of third parties. Technical data relating to the safety panes are standard values. Final design and calculation will be performed by BSA.

Unprotected? Current results relating to safety glassing

Exposed polycarbonate panes may lose their safety restraining properties partly or completely after only a few months of use. This was impressively demonstrated by tests at the BIA Institute. Systematic research showed that polycarbonate panes splashed with coolant possessed a retaining potential of only 60% after nine months of exposure.

But how can exposure be defined and the necessary protection realised?

According to our definition safety glass may be considered exposed as long as it is not completely encapsulated by an additional glass layer or a special foil. This encapsulation and sealing can only be verified by specialised companies.

Despite manufacturers of milling/drilling machines having lower safety classification requirements and pane thickness of less than 6 mm polycarbonate still buy their panes directly from the manufacturer. This pane thickness will correspond to the safety classification of the machine but panes are unprotected, i.e. not encapsulated or sealed. But polycarbonate panes for machines should be protected against chemical attacks to guarantee their long term safety functioning.

Retrofit for CNC-machining centres and machines

We offer complete solutions with and without lacquered and drilled frames and also as replacements for products.

The safety glass fulfils the valid recommendations of VDMA and guarantees a restraint safety classification from A1 to C3. It is non-ageing, resistant against coolant and oil and heavy impact.

The increasing import of machining centres from low-cost countries always means a safety risk, the legal requirements not always being met by these products. By retrofitting these inexpensive machines according to the required European safety standards a safe operation can be realised.

Even if the original equipment was not manufactured by Hema/ BSA we can easily offer a cost effective solution to meet your safety regulations.

Complete solutions – machine panes with integrated spin window

Many customers nowadays wish to have a good view to the working space of the machine. Despite high quality coating of the machine panes they need a “windscreen wiper”, the spin window cleaned by centrifugal forces.

We offer the integration of the most modern intelligent spin window solutions such as VISIPOINT or EAGLEVISION without additional mounting expenditure. You will get demand orientated, cost optimised solutions directly from the manufacturer. The systems may be configured in such a way that it only needs to be mounted and connected. All systems fulfil the relevant safety requirements.

Features and advantages

- Non-ageing according to the latest technology by all around protection of the build-in polycarbonate pane.
- Fulfils EN 12415, prEN 12417 and prEN 13128.
- By use of multiple layer glass we have short delivery times for small batches and highly improved shatter resistance.
- Optimal solutions adapted to the space requirements of the customer.
- Optimisation of the work conditions of the operator by noise level reduction and sight improvement.
- Reduced down times of the machine due to quick replacement of the pane.
- Individual retrofit for imported machines possible, fulfilling the standards.
- 5 years warranty on the integral strength (according to the warranty regulations).
- Retrofit possible for all common turning and milling machines.
- Integration of spin window systems EAGLEVISION and VISIPOINT at HEMA factory.
- Inscription and labelling of the panes according to the recommendations ofVDW – Additional customer specific data as required.
- Attractive cost-performance ratio.



VISIPORT SPIN WINDOWS – the eye for your CNC machine

As manufacturer of machines you are exposed to global competition and try to offer your customers optimally adapted, use-oriented machines. Your products are characterized by a high degree of innovation, safety and differentiation from the competition. You follow the trend of visualization and creating transparency in your operations and processes. Your company will be an enthusiastic user of VISIPORT Spin Windows. VISIPORT systems have already been for several years in hard everyday continuous use among leading international manufacturers.

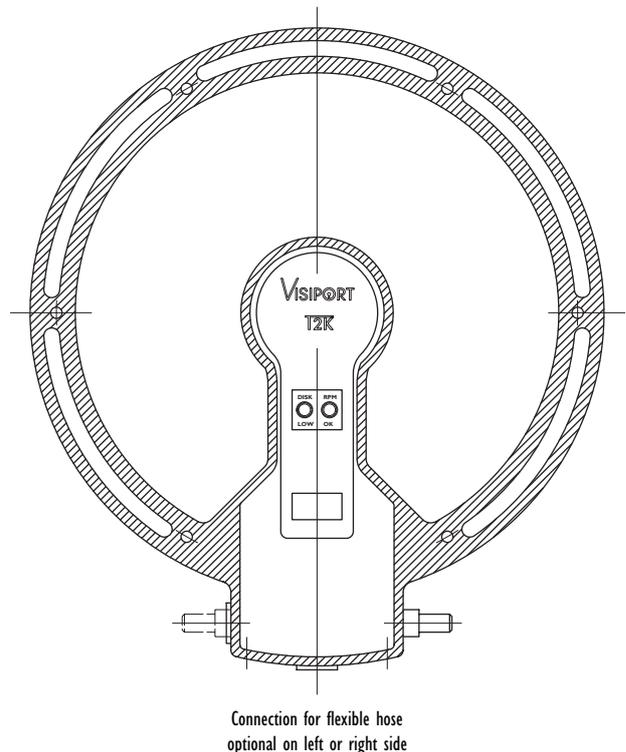
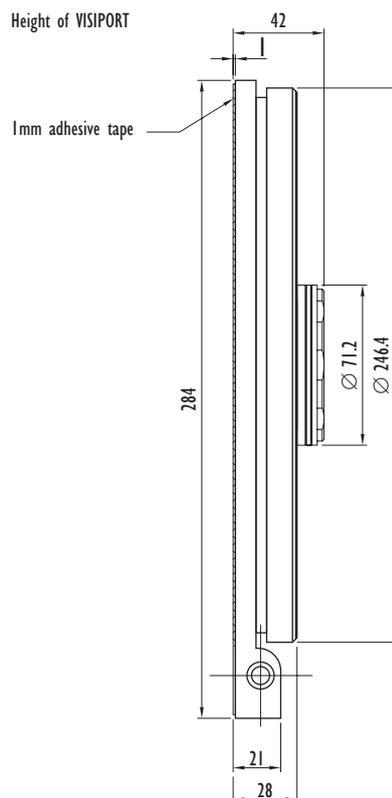
We give suitable eyes to your machine

You optimize your processes and improve your working ergonomics and productivity in that you can observe the actual machining process in the machine without your view being impaired by coolant or chips. The electrically driven Visiport Spin Windows are suitable for all types of CNC milling machines, lathes and machining centres both in original equipment and for subsequent installation.



Simple installation and optimum maintenance due to modular design reduce the costs. With their low weight and a generous visible surface, VISIPORT adapt optimally to the design of your machines. Additional electronic safety features complete the perfect impression.

VISIPORT 215A



Advantages

- VISIPOINT means taking active safety precautions: Without VISIPOINT, the operator can be tempted to bypass the safety circuit of the machine to see what is happening in the machine. This implies a danger potential for severe accidents. With regard to product liability and safety regulations, a glance at the safety advantages of VISIPOINT can pay.
- Our system is suitable for CNC high-speed milling/grinding machines. It is also the system suitable for lathe applications. The VISIPOINT is suitable for OEM first equipment and retrofitting.
- The flat construction enables the VISIPOINT to be adapted to widely differing door and window designs. VISIPOINT is also suitable for fastening to sliding doors with limited intermediate space.
- No hole has to be drilled in the machine cabin. The unit is either fastened on the bonded mounting plate or bonded directly to the window. When the mounting plate is used (only model 220A and DiscAir 230), fast replacement of the VISIPOINT unit is possible.

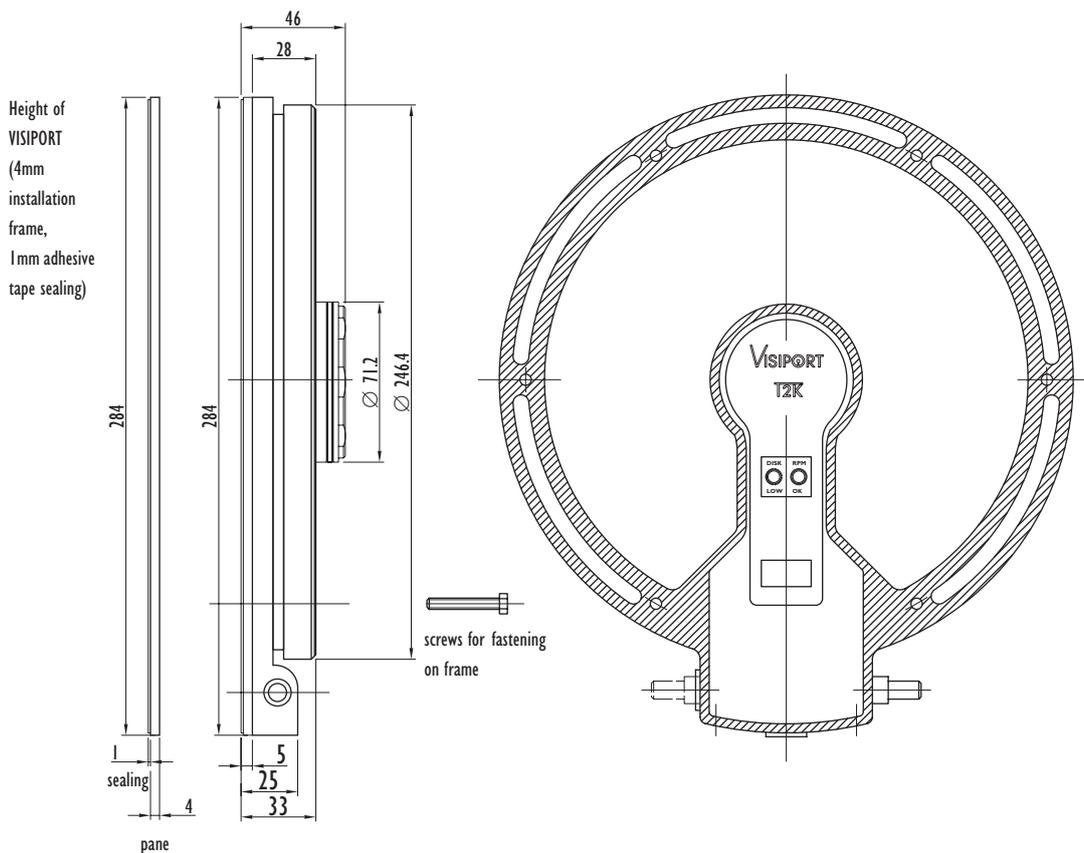
- Subsequent installation is also simple and fast. Low space requirements enable it to be used for most window configurations on new and also older machines, a through-hole installation is also possible.

VISIPOINT 21 5A and 220A:

- Spinning disk mounted on the machine side, giving clear vision to the process by its high rotation speed (> 2000 rpm)
- Integrated electronic control unit giving protection against reverse voltage and overvoltage
- Driven by integrated brushless DC-motor; power supply 24 V, minimum 4 A continuous current required
- Fulfils CE standards on low tension voltage
- Standby current without coolant load: 500 mA
- Rotor bearing by precision ball bearings
- Balanced rotating disc made from hardened glass, 3 mm thickness
- Waterproof steelflex connecting hose or metal tubing system
- Connection box with on/off/reset switch
- Power supply cable with standard length of 10 m, safety classification 300/ 500 V

VISIPOINT SPIN WINDOWS

Technical properties



VISIPOINT 220A

Technical data VISIPOINT 215A and 220A

- Low weight (1,7 kg for model 215-A, 2 kg for model 220-A)
- Outer diameter 253 mm

Mounting by bonding

Easy mounting of the VISIPOINT is done by a high-tech adhesive sheet (adhesive based on closed cellular acrylic foam). Simply remove the protective foil on the rear side of the VISIPOINT and bond the VISIPOINT to the desired position on the pane which should have been cleaned thoroughly before. The optimal setting time is 72 hours.

Afterwards it is practically impossible to separate the VISIPOINT from the surface it is bonded to, provided the surface had been cleaned sufficiently before. As soon as the adhesion to the surface has reached 80% of its maximum value, a

safety factor of 20 or better will be attained according to our calculations. In other words, the adhesive power is no problem at all. The adhesion is extremely strong and insoluble. On demand there is an additional fastening by screws available.

In the case of VISIPOINT models with installation frame an artificial vacuum can be generated by a special small vacuum pump reducing the bonding time to a few hours and giving additional strength to the bonding.

Product quality

All VISIPOINT models come with a twelve month guarantee ex works. Wearing parts are excluded. Many components are made of high-grade aluminium. The ball bearings are lubricated for life and replaceable. The flexible metal connecting

hose or the tube system are temperature resistant up to 300° C. The electronic components were specifically developed for the VISIPOINT. Ambient influences are excluded by the optimum installation position and sealing. All parts and components of the VISIPOINT are tested for quality of material and life endurance.



VISIPOINT complete installation to polycarbonate pane ex works



Thorough cleaning of the polycarbonate pane



Preparing the VISIPOINT for installation

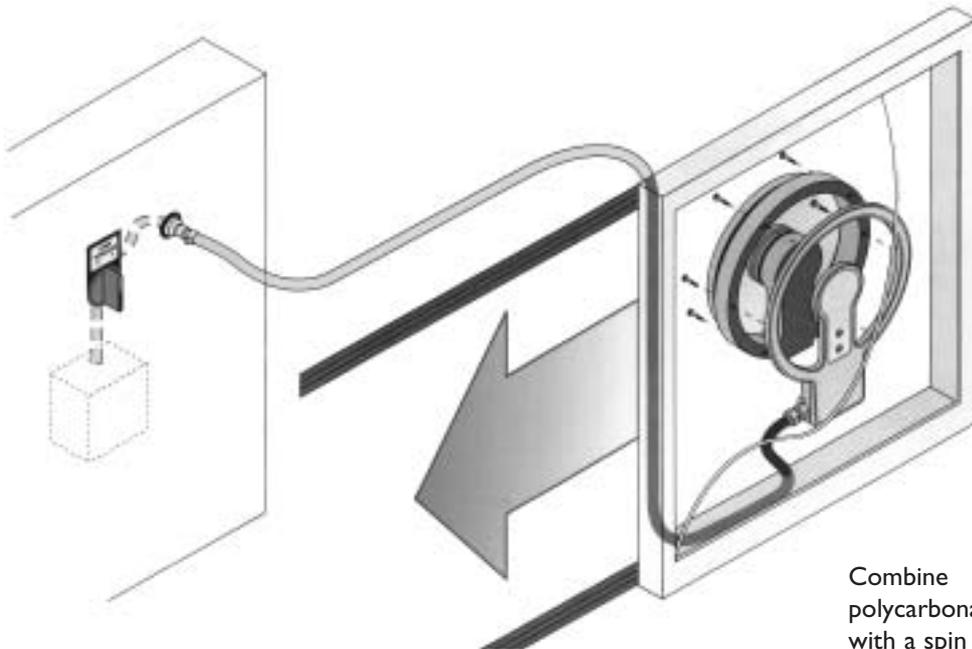
Ventilation and aeration of the VISIPOINT

VISIPOINT has a patented system whereby the required quantity of air for interior ventilation of the VISIPOINT is guaranteed by the flexible hose supplied separately. The flexible hose protects the wire harness between the VISIPOINT and the connecting box. The air circulation was specially important in the development of the flexible hose. If you wish to use a different connection for certain reasons please consult our engineers about this. Ventilation should always be guaranteed.

Installation

The VISIPOINT can be installed vertically or up to 30° from the vertical. It is best installed to a fixed (permanently closed) window. The VISIPOINT will function best with waterbased coolants and with mineral oils. High Viscous oil impairs the functioning.

VISIPOINT SPIN WINDOWS



Combine polycarbonate pane with a spin window!

Basic drawing



Installation and bonding of the VISIPOINT



Sealing and protection of the adhesive sealing foil



Installation of the protective cap

VISIPORT DiscAir SPIN WINDOWS

Air-driven VISIPORT DiscAir models

Beside the electrically operated VISIPORT models development was also made for different forms of drive. The DiscAir models are driven by compressed air available at almost every machine or at every workshop. Its operation is possible by simply connecting the VISIPORT DiscAir to the compressed air supply, – without costly electric wiring. It is fastened similarly to the electric VISIPORT by simple bonding technique directly onto the machine pane.

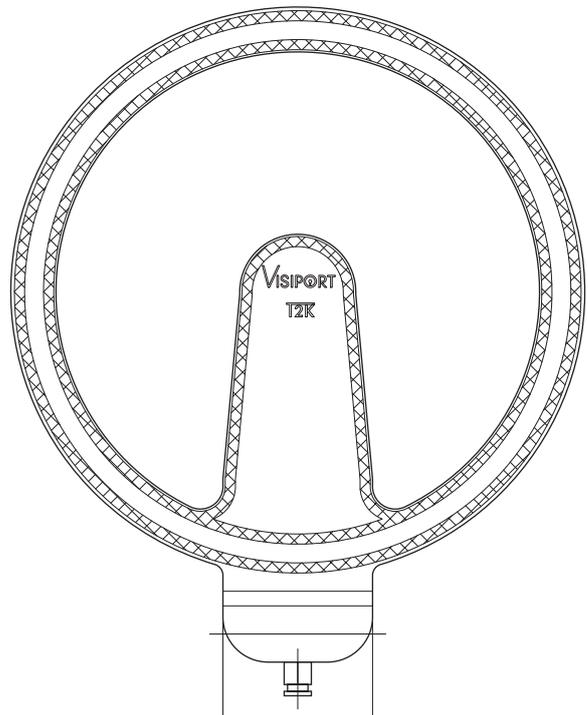
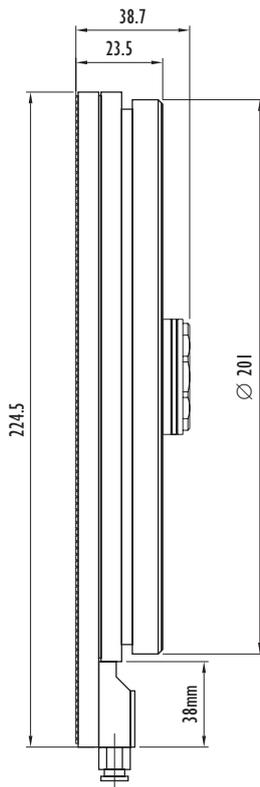


The air consumption is between 5 l and 170 l/min. Due to design and drive the DiscAir models generate more noise than the extremely low noise electrical VISIPORTS. Due to an optimum designed air circulation system as well as highly precise manufacturing process the DiscAir models are silent and fulfil the legal directives. Therefore very little difference may be discerned compared to the running noise of the machine when the cabin door is closed.

The air outlet has been designed in such a way that it gives a supportive protection against the intrusion of coolant and chips.

The VISIPORT DiscAir models round off the VISIPORT line of products to the bottom end and represent an excellent offer with regard to their price-performance ratio. They enable every CNC machine operator to adopt the spin window technology at a price considerably lower than that of electrical models.

VISIPORT DiscAir 175



| specification | VISIPOINT-model | | |
|------------------------|---------------------|---------------------|---------------------|
| | DiscAir 175 | DiscAir 225 | DiscAir 230 |
| required air pressure | 6.2 - 7.3 bar | 6.2 - 7.3 bar | 6.2 - 7.3 bar |
| nominal speed at 6 bar | 2600 rpm | 2400 rpm | 2400 rpm |
| air consumption | 51 l/min | 170 l/min | 170 l/min |
| noise level* | 74 dB | 74 dB | 74 dB |
| outer diameter | 201 mm | 253 mm | 253 mm |
| visual field | 199 cm ² | 288 cm ² | 288 cm ² |
| weight | 0.7 kg | 1.53 kg | 1.78 kg |
| height | 40 mm | 40 mm | 44 mm |
| thickness of spin disk | 2 mm | 3 mm | 3 mm |

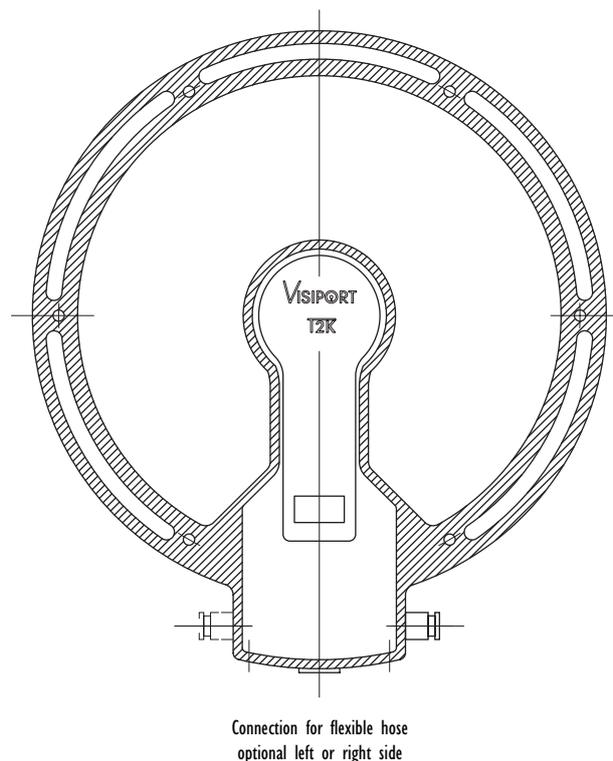
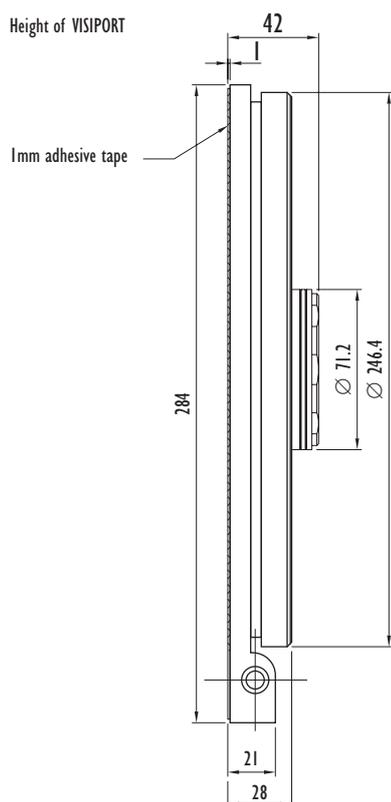
* without housing at a distance of 3 m

VISIPOINT DiscAir 175, 225 and 230:

- Spin disk located on the machine side, giving clear vision of the machining by its high rotating speed (> 2000 rpm)
- Driven by purified compressed air, no electrical connection required
- Suitable for use with intermittent coolant spraying
- Rotor mounted on precision ball bearing
- Connection of the air hose by plug-in socket
- Patented high efficient turbine ring

Product properties

Technical properties



VISIPOINT DiscAir 225

Overview on the VISIPOINT models



VISIPOINT 220A installed on a Polycarbonate safety window



VISIPOINT 220A installed on machining center

| MODEL | Diagonal dimension of viewing area in mm | Speed rpm | Application | Installation |
|----------------------------|------------------------------------------|-----------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| 215A (electric drive) | 215 | 2,100 | standard version, cost saving, universal application, very silent, flat design | directly mounted onto the machine pane |
| 220A (electric drive) | 215 | 2,100 | multiple shift operation, high flexibility, easily detachable, very silent, minimum down time | Installation frame (4mm) directly mounted onto the machine pane, VISIPOINT on installation frame |
| DiscAir 175 (air drive) | 175 | 2,600 | basic model, cost effective, ideal for retrofitting | same as 215A |
| DiscAir 225 (air drive) | 215 | 2,600 | same as DiscAir 175 | same as 215A |
| DiscAir 230 (air drive) | 215 | 2,600 | same as 220A | same as 220A |

VISIPOINT repair and spare part service



Test of motor and balancing



Test/replacement of spin disk



Test of the electronics



Replacement of rotor

Special disks – ideal for aluminium processing and coolant containing oil

Machining of aluminium or magnesium creates chips which condense like a film on the pane and the spin disk. This problem leads to obscured vision after only a short time.

We offer two innovative and efficient solutions for the VISIPOINT spin disk. After comprehensive testing for 18 months under severe conditions in the mechanical production at Boeing in Seattle, T2K has now released the new "Golden Eye", a diamond-hard coating of the disk with a gold coloured tint. In addition we offer a low cost alternative, the "BSA non-stick coating".

Both varieties may be retrofitted or directly ordered with the main unit for the models VISIPOINT 215A and 220A.

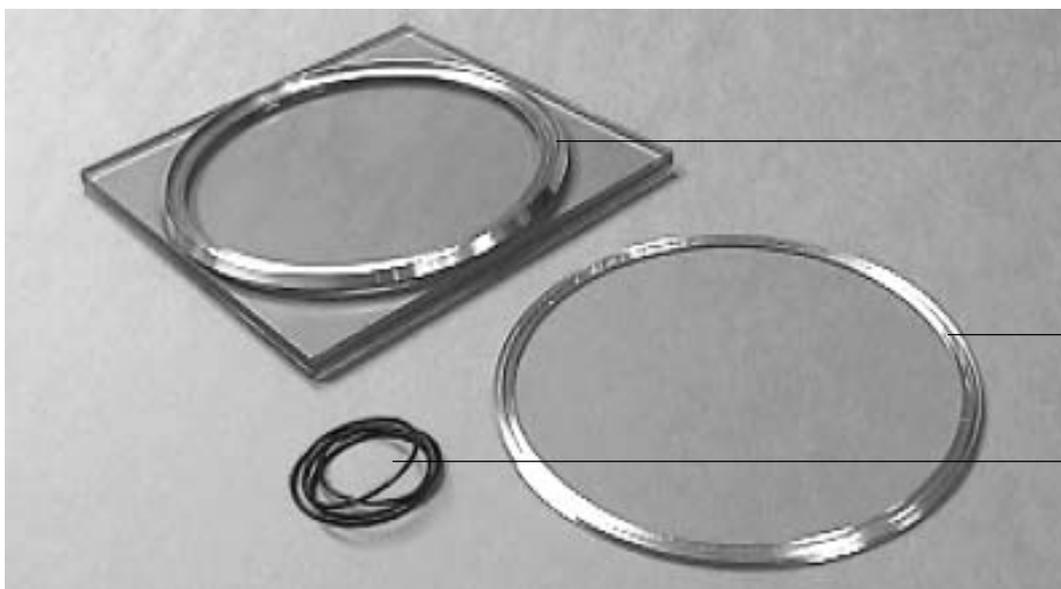


Special Disks

Protective system PERMAPORT PR260

- A round base ring is bonded by proven VISIPOINT adhesive technology onto the pane.
- A round safety glass pane in an aluminium turnable mounting is screwed to the basic frame.
- The pane is protected against scratching from dry and wet machining. Optimum protection of a section of the machine pane (e.g. made from polycarbonate) by an additional safety glassing which can be exchanged at any time and is scratch proof and chemical resistant.
- Exchange of the complete pane due to scratches and lack of visibility no longer necessary.
- Round safety glass made of VISIPOINT material may be replaced within minutes at minimal cost.
- High flexibility and optimum serviceability

PERMAPORT – additional protection for polycarbonate panes



base ring

safety glass disk

sealing

EAGLEVISION – making innovation visible

We give an insight to your machine

Keeping an eagle eye on everything, this expression applies more than ever today in our world of constantly tighter safety regulations and high speed processing.

In addition to the VISIPOINT spin windows now being deployed for more than 10 years we offer you with EAGLEVISION an integrated solution for your vision and safety problem as part of the HEMA range of products.

EAGLEVISION – the integrated solution in spin windows

Optimise your processes, improve your ergonomics and productivity by being able to watch the ongoing work process within the machine without your view being impaired by coolant or chips. The electrically or hydraulically driven EAGLEVISION spin window solutions are suitable for all machining centres with compact cabin dimensions and high safety requirements.

Advantages



top: view from operator's side; bottom: view from machine side

Due to the surface flatness on the machine side and a generous area of view EAGLEVISION will optimally adapt to the design of your machine (e.g., mounting to a sliding door with wipers is possible without any problem). Additional safety features make the perfect impression complete.

1. Tested certified safety

■ EAGLEVISION stands for tested certified safety. Safety requirements by employer's liability insurance associations and by legal demand from the manufacturer of working machines to proof and safeguard the safety requirements of the relevant security classification. By its integrated application EAGLEVISION offers a comprehensive solution to this problem: a spin window integrated into the multiple layer safety glass! You will receive a system impact tested according to the current regulations and standards complete with all the documentation necessary for verification. The spin window does not cause any weakening of the pane due to our patented solution developed by us. With EAGLEVISION we fulfil the requirements of all safety classifications up to C3. If required we will calculate the safety classification applicable to your machine.

2. Active safety precaution

■ EAGLEVISION means active safety precaution: Without EAGLEVISION the operator might be tempted to bypass the safety circuit of the machine to see what is happening inside the machine. This may lead to serious accidents. In regard to product liability and safety regulations a look at the safety advantages of the EAGLEVISION might well pay off. The large viewing area (about 575 cm²) with its diagonal view of about 300 mm is optimally designed and does not show any blind spots within the viewing area.

3. Complete surface flatness

■ EAGLEVISION means little space requirement. Our system is suited for machining centres with little space available within the cabin (e.g. high speed CNC turning, milling or grinding machines). By the complete surface flatness on the machine side of the EAGLEVISION chips may be wiped off by wiper systems from the inside of the door. From outside you can only see the intelligent “cap”, the housing containing the electronic control unit (in case of electric drive) as well as the motor (electric or hydraulic drive). It is designed to meet highest safety standards, still being capable of being integrated in a compact way into the exterior design of the cabin. The flat design provides adaptation possibilities to different door and window designs. The electronic control unit is integrated in an easily serviceable and space saving way.

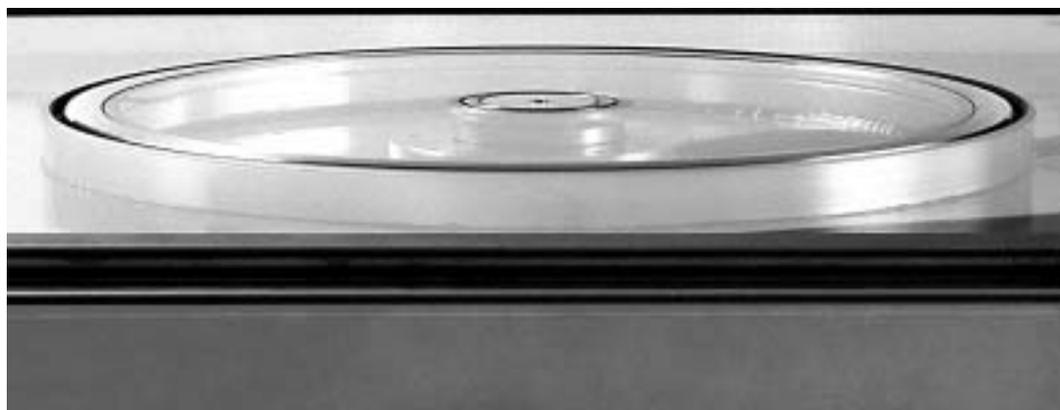
changeable spin disk consists of chemically hardened single safety glass with a thickness of 3 mm. Upon demand a coating may be applied providing high resistance against bombardment by aluminium chips and an even better spin off effect for coolant containing oil. The spin disk of

EAGLEVISION advantages



the EAGLEVISION rotates at a speed of >2000 rpm and has a high rate of accelerating. In this way clear vision is created quickly. Impacting particles are flung off by centrifugal forces. Furthermore the disc can be cleaned easily and is quickly replaced in case of damage.

impact test successfully passed at safety classification C3



4. Security of investment

■ The risk of operation, installation or improper handling is reduced and the cost spiral is cut. The unit is delivered completely ready for installation and installed into the cabin like any regular pane. We give a 5-year warranty on the restraint safety of the polycarbonate pane. This is possible by completely encapsulating and sealing the polycarbonate pane, which is sensitive to chemical exposure, from both sides by foil and safety glass in a costly process. The ex-

5. Quality of product

■ All EAGLEVISIONS come with a twelve month guaranty ex works. Exempted from that are parts typically subjected to wear like the spin disk itself. Many of the components, e.g. spin disk, rotor or electronic control unit, are exchangeable. All repair work with the exemption of changing the spin disk will be undertaken by us.

■ Many components are manufactured from high grade stainless steel. The ball bearings have life

EAGLEVISION

lubrication and are exchangeable. The electronic control unit was designed specifically for the EAGLEVISION. By the optimum installation position environmental influences are excluded.

- All parts and components of the EAGLEVISION are tested for quality of material and life cycle endurance.
- The drives are manufactured by companies with many years of experience in special drives.



Model "Hydra"

Electrically driven EAGLEVISION – the model "Elektra"

The connection is directly to the 24V DC power supply of the machine (direct current). The drive consists of an electronically commutated brushless DC-motor (24 V, power consumption maximum 5 A, nominal power 105 W). Power consumption is about 800 mA without coolant load at continuous operation. The integrated electronic control unit is supplied with an overload and reverse voltage protection. The operation is extremely silent. The noise level remains clearly below the legal demands.

EAGLEVISION driven by fluid – the model "Hydra"

Besides the electrically driven EAGLEVISION, developments with alternative drive systems were carried out. The fluid driven EAGLEVISION models are powered by the coolant of the machine by directly connecting it to the coolant pump. Careful design of the turbine system as well as the precise manufacturing processes ensures, that the fluid driven EAGLEVISION models are very silent, their noise level remaining below legal requirements. They are quieter than the operating noise of the machine. The coolant outlet is directly into the bottom of the machine. The speed of the fluid driven EAGLEVISION models may be determined by the intake pressure of the coolant and is more than 2000 rpm.

The intake pressure must be between 7 and 10 bar. If necessary, the intake pressure has to be regulated to the correct value by a pressure reduction valve available as an accessory. The maximum permissible size of particles contained within the coolant is 200 µm. That is about twice the value valid for most coolant pumps.

The fluid driven EAGLEVISION model needs minimum service and is lower priced than the electrical version.

At the end – the highlights

- Flat surface on the machine side allowing its use on sliding doors with wipers; specially suitable for turning centres due their small height.
- Safety design: the multiple layer safety glass guarantees impact resistance up to the highest safety classification C3. The polycarbonate pane showing only a small relief for the motor housing. The broad supporting surfaces of the housing and the screwed connection ensures an even distribution of impact forces.
- EAGLEVISION is offered as a completely assembled multiple layer system which only has