

Elastomer Composite Parts and Precision Mouldings

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Elastomer Composite Parts and Precision Mouldings

Elastomer composite parts and precision mouldings from Simrit make made-to-measure and functionally optimised applications possible for the customer for complex requirements from sections of the seal and vibration control technology.

The most modern materials technology and innovative process for product and tool design ensure a precise implementation of the desired component.

Requirements

Specific requirements on environmental effects such as media and temperatures

- Lengthening of the product service life
- Specific requirements for vibration damping and noise decoupling
- Friction reducing developments for special applications
- Functional enhancement of the products (e.g. sensors)
- Linking of media circuits.



Features

Elastomer composite parts and precision mouldings with firm bonding of elastomers to metals, plastics or fabrics

- Precision mouldings, that are completely manufactured from elastomers
- Special profiles for customer-specific design components, that are manufactured using an extrusion process
- PTFE parts with outstanding media and temperature resistance.

Application area

Innovative elastomer composite parts and precision mouldings from Simrit are used in nearly all branches of general industry where current branch solutions cannot be used optimally. The following application condition examples are only a small selection of the great variety of application possibilities

- Valves and fittings
- Prime movers and diesel engines
- Drive technology
- Systems for steering, fuelling and exhaust
- Pumps and compressors
- Heavy current engineering.



Support Components

When rubber elasticity and stiffness are required within a component, elastomers can be mechanically or chemically bonded with metals or plastics.

The rigid medium or metal insert gives the elastomer moulded component the required rigidity. The rigid media are usually metal materials such as: unalloyed steel, heat-treated steel, rust-resistant and acid-resistant steels, NE metals as well as plastics.

Examples:

Unalloyed steel according to DIN EN 10139, e.g. DC 01 (1.0330).

Rust- and acid-resistant steels according to DIN EN ISO 3506 Section 1 to 3 e.g.

- 1.4301 (X 5 Cr Ni 1810)
- 1.4571 (X 6 Cr Ni Mo Ti 17122)
- 1.4112 (X 90 Cr Mo V 18)
- 1.4542 (X 5 Cr Ni Cu Nb 174).

Heat-treated steel according to DIN EN 10132 e.g.

- 1.0501 (C35)
- 1.0503 (C45)
- 1.1191 (CK 45).

Plastics

- PA66 GF30
- PPS GF 30.

Today, almost all elastomer composite parts are manufactured with an insoluble chemical binding, whereby the firm binding is created under pressure and temperature during the vulcanisation in the tool.

Several design notes are to be observed for the product design:

- The support component should, when possible, have a low mass so that after inserting in the tool, the least thermal energy is lost which would then be missing for the vulcanisation process or would have to be reached again through an increased heating time. However, when the support component must have a large volume or mass for functional reasons, the support component can be preheated to solve this problem.
- The rubber layer on the support component should be at least 0,5 mm, so that the flow speed of the elastomer during the filling procedure of the tool can be kept as small as possible. For too narrow a gap, there is the risk, through the nozzle effect, that the bonding agent will be pushed by the support component and that bonding errors and/or flow errors will arise.
- If the support component is to be only partially encased with elastomer, there must be sufficient surface on the support component for the moulding edges of the tool. The width of the moulding surface should be at least 1 mm when possible.
- The injection nozzles should be arranged as perpendicular to the support component as possible for tool construction of IM tools (injection moulding) so that a shifting of the bonding agent is avoided here as well.
- With completely encased shaped parts, the centring of the support component in the tool must be made possible through lugs and/or pins. In addition, the bonding strength can be increased when undercuts or boreholes for anchoring the elastomer are provided on the support component.

- For tight tolerances or fits, the support component should be dimensioned sufficiently large enough for a possible end processing. The surface treatment of the support component is of particular importance. It behaves similarly to a patching a bicycle tube. If the work is performed in a clean and careful way, a long service life will be the reward.

The support component must be freed from grease and adhering dirt. The surface is then enlarged and roughened up, whereby we use the following process:

- Blasting
- Zinc phosphating
- Etching.

We use a.o. steel shot, quartz sand, plastic granulate, glass powder blastings to give the surface a defined roughness.

The zinc phosphating of unalloyed steel widely used by us produces a fine crystalline, spicular sandwich structure and offers a temporary rust prevention in addition.

After this type of activation of the surface has been performed, the treatment with the bonding agent system follows. The bonding agents are applied in one or multiple layers by coating, spraying or barrel finishing and air is exhausted from around the product or it is annealed.

The bonding agent system used is matched to the elastomer and support component to be bonded. We primarily use three bonding systems, whereby predominately water-based bonding agents are used for protection of the environment and health.

- Phenolic resin with hardener
- Polymer dispersions with filler and cross-linking agent
- Reactive silane.

These systems are process-safe and offer a very good mechanical, thermal and chemical resistance of the elastomer composite parts after the vulcanisation.



Elastomer Materials and Manufacturing Processes

The elastomers used for the composite parts are, as a rule, also the standard materials that are used for general moulded components in dependence on the application conditions. There are, of course, significant differences in the bonding propensity of the elastomers that are also influenced by the composition of the compound. The following is valid as a general rule: All-round chemical resistance of elastomer and support component (FKM and Niro) lessens the bonding propensity. Soft and mixtures with softeners are more difficult to bond than hard mixtures (72 NBR 902 and unalloyed steel sheet) with a large degree of fillers. The quality of bonding of a component depends on the precise matching of the support component to material, the bonding system and the elastomer material. Testing of the quality of bonding is still only possible through a destructive test. Even ultrasound or X-rays do not provide clear results.

In the development stage of a component, for determining the optimal bonding system, test specimens are manufactured from the support-component material and vulcanised in a test tool with the specified elastomer. These test specimens are then subjected to a destructive tensile test in a tensile test machine. Pliers are used for this procedure for subsequently finished parts from the series.

In both cases the tear formation is judged optically and classified according to a scale (DIN 53531):

- R = Separation in the elastomer
- RC = Separation between elastomer and bonding agent
- CP = Separation between two bonding agent layers
- M = Separation between support component and bonding agent.

The corresponding percentage rate of the surface to be judged is estimated and given in percent, e.g. 90% R – 10% RC.

Other possibilities of the destructive bonding test are mechanical functional loading of the test body for e.g. tension, pressure, bending, torsion or the test of the chemical resistance through placing in the operating medium at increased temperature. This also includes atomised spray tests with different sodium chloride solutions according to DIN 50021.

The usual manufacturing processes are used for manufacture of elastomer composite parts

- CM Compression Moulding
- FM Flashless Moulding
- TM Transfer Moulding
- IM Injection Moulding

as well as the special process for moulded components:

- RM Ready Moulding
- IRM Injection Ready Moulding.

Product Examples

A few practical examples from the great variety of elastomer composite parts are described and shown below. The components are generally more expensive than moulded components without support component but they can provide significant cost savings in the application through more simple, faster and more secure installation.

Valve needles

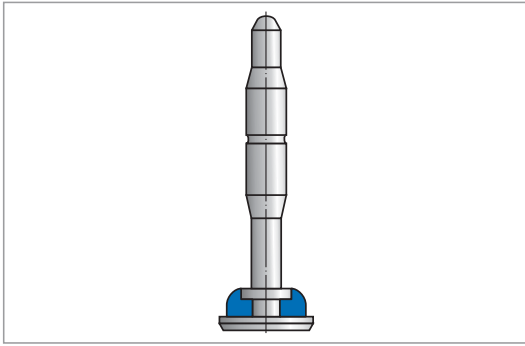


Fig. 1 Valve needle

→ Fig. 1 shows a valve needle for a fuel injection pump. The needle is made of niro steel and the seal seat is made from an FKM elastomer. On this design you can see that an O-ring was used previously as a seal here. This current design saves logistical and installation costs.

Sealing plate

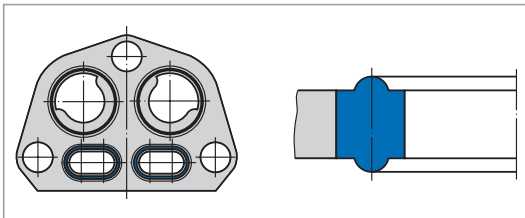


Fig. 2 Sealing plate

In → Fig. 2, a sealing plate is shown which is braced between two hydraulic blocks in the brake callipers of hydraulic disc brakes. Previously, the sealing components – also known as manhole seals – were individually mounted and then the block was bolted together. In the final check, the block was then subjected to a hydraulic pressure test with brake fluid. If leakages occurred, the seals were defective or were not installed at all. With the use of the sealing plate, this test is omitted. A simple visual inspection determines whether the sealing plate is installed since in this case, the silver-coloured front faces of the aluminium sheet are clearly raised from the golden chromated brake calliper. Moreover, it is guaranteed that the seal is always placed at the correct location.

Sealing plate

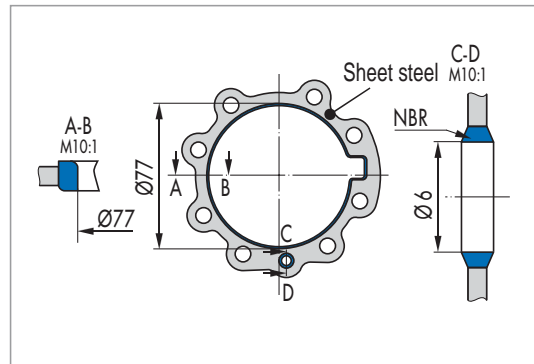


Fig. 3 Sealing plate

The sealing plate shown in → Fig. 3 facilitates the installation work significantly. Nine individual O-rings and a very instable moulded component are joined by the support component into an easily installed and dimensionally stable unit. In this way, such sealing plates can also be easily installed using a robot.

Valve bodies

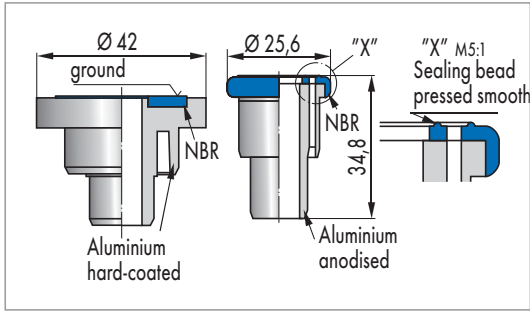


Fig. 4 Valve bodies

See → Fig. 4 for elastomer composite parts that receive a special subsequent machining after the vulcanisation. The part in the upper half of the figure shows a bore-hole that is attached later. The aluminium support component is subsequently anodised. The rubber-metal bond must also be resistant to the anodising chemicals. The seal surface made from NBR elastomer on the part in the lower half of the figure is precision-ground to be especially flat and the aluminium support component then receives a particularly wear-resistant hard coat layer. The hard coating of the aluminium is used everywhere that corrosion protection, wear resistance, dimensional stability and good gliding behaviour is required. Through the anodisation to produce an oxide coating, a surface finishing with a layer thickness of e.g. 30 – 60 µm can be attained. The hardness then amounts from 450 to 550 HV and thus lies in the range of a hardened heat-treated steel.

Small elastomer composite parts

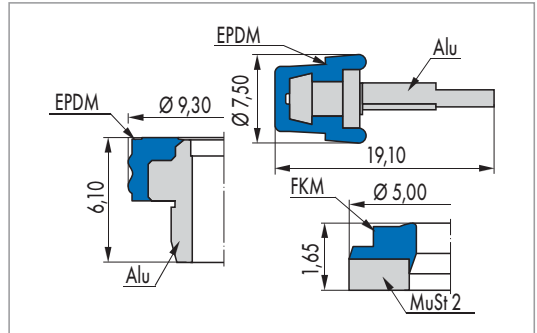


Fig. 5 Small elastomer composite parts

Fig. 5 shows examples of markedly small elastomer composite parts that require a particularly complex handling during the manufacturing process due to their "watchmaker dimensions".

Plug & Seal Connections

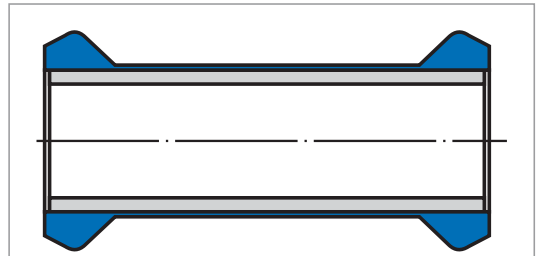


Fig. 6 Plug & Seal Connections

The plug connectors shown in → Fig. 6 are pipe sections with a rubberised outside surface with sealing beads and stop dampers. They serve as a tight connection between two housings or units for the secure transport of media such as oils, water, air, etc. They facilitate a secure, simple and cost-effective installation, provide an acoustic and mechanical decoupling, compensate the centre offset and allow for greater tolerances in the housing. Through the flexible elastomer and component part product range, these plug connections can be used in nearly all areas of fluid and gas transport.

The support component which can consist of steel or aluminium pipe sections should have a minimum wall thickness of 1 mm. Plastic support components made of plastic (PA66 GF30) can also be used. However, the wall thickness of the support component is to be increased in this case. Plastics are used as support components for elastomer composite parts when they have advantages over metals in their application, such as for corrosion resistance, low weight or complex shaping.

Usit Rings

From the great variety of elastomer composite parts, one design has the status of a norm component – and that is the Usit Ring. The name Usit is unmistakable as the code for the washer and Simrit material. Usit Rings are metallic flat rings with trapezoidally formed sealing beads that serve for the sealing of threaded fittings and flange connections. They are self-sealing washers, however, not screw-locking devices. Their types are categorised by 2 standard designs, the Type U, with sealing bead on the inside, and the type UA with sealing bead on the outside, as well as the special Type USF with a centring diaphragm (→ Fig. 9).

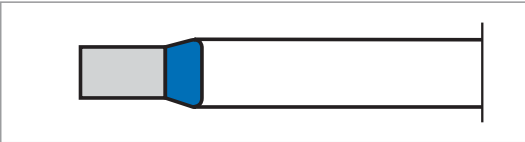


Fig. 7 Inner sealing, Usit Ring Type U

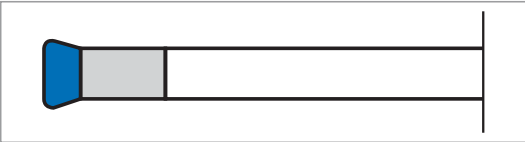


Fig. 8 Outer sealing, Usit Ring Type UA

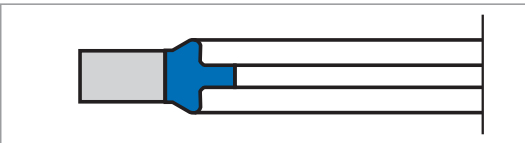


Fig.9 Inner sealing with centring diaphragm, Usit Ring Type USF

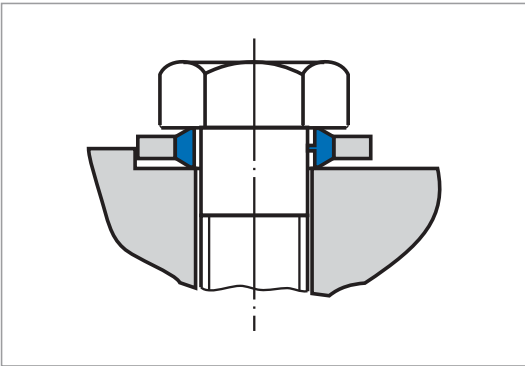


Fig. 10 Installation example for Usit Ring with and without counter bore

Through the use of a centring diaphragm (right) an additional housing (left) for the required centring of the Usit Ring is saved. When tightening the threaded fasteners, the rubber-elastic sealing bead is deformed until metal force closure over the flat ring is attained. With counter bore, operating pressures up to 100 Mpa can be sealed. Without counter bore the pressure range is up to 40 Mpa for $\varnothing > 40$ mm. For normal steel design, the maximum fastening torque is the same as for threaded fasteners with screw grade 5.6.

For high-strength steel and niro steel design, the maximum fastening torque is as for threaded fasteners with a grade of 8.8. It is important that the inner borehole on the edge not have any countersink so that the sealing bead does not get squished and thus become leaky.

Different materials combination for support component and sealing bead are used depending on the operating conditions.

NBR mild steel	Air and mineral oils up to 100 °C
FKM mild steel	Air up to 250 °C and mineral and synthetic oils up to 150 °C

The mild steel (SPCC n. JIS G 3141) as well as high-strength steel (SPCC – 1B) has a rust protection through a zinc-nickle layer. For harsh corrosion conditions, niro steel SUS 304 n. JIS 4305 (equivalent 1.4301) is used.



Precision moulded parts

We got to know the most significant precision moulded part already in the O-Ring chapter and determined in the process that the O-Ring is a moulded component of the highest precision with virtually perfect surface finish and very tight dimensional tolerances.

Thus, the most important characteristics of the precision moulded parts are defined, which in turn are significantly determined by the tool technology and manufacturing method.

In this regard, the correct selection of the tool steels and the manufacturing and maintenance of the tools are the most important prerequisites for a successful tool design and an optimal elastomer processing. These prerequisites have been fulfilled in Freudenberg's own toolmaking facility for decades. In general, the tool manufacture is performed through the turning, milling and drilling machining process. But electro-erosion machining is also used for many tools.

The right selection of steel type and the right surface treatment of the moulding tool is of significant importance since many elastomers have a high amount of wear-producing fillers and moreover, through oxidising excretions during the vulcanisation, corrosion is induced on the tool steels.

Stainless steel with an alloying component of more than 15% is frequently used which has a high chemical resistance through its passivity. Or the abrasion resistance and corrosion resistance of the ground and polished tool surfaces are improved through hard chrome plating or PVD coating (Physical Vapour Deposition).

Naturally, the quality of the tools must be continuously monitored and maintained through preventative maintenance. The most simple means for this is the evaluation of the surface quality of the moulded part itself. Even the smallest changes of the tool surface are optically visible as mirror image on the moulded part long before the dimensional changes can be measured.

The following manufacturing methods are primarily used for the manufacture or moulding of the precision moulded parts:

- CM Compression Moulding
→ Fig. 11
- TM Transfer Moulding
→ Fig. 12
- IM Injection Moulding
→ Fig. 13

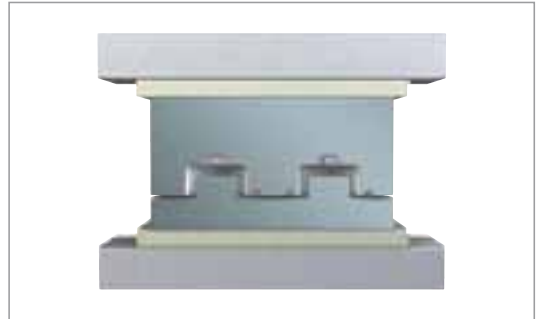


Fig. 11 Compression Moulding

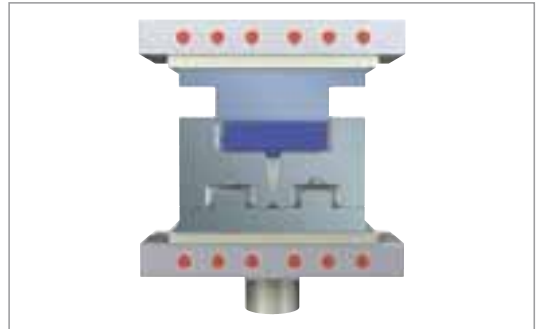


Fig. 12 Transfer Moulding

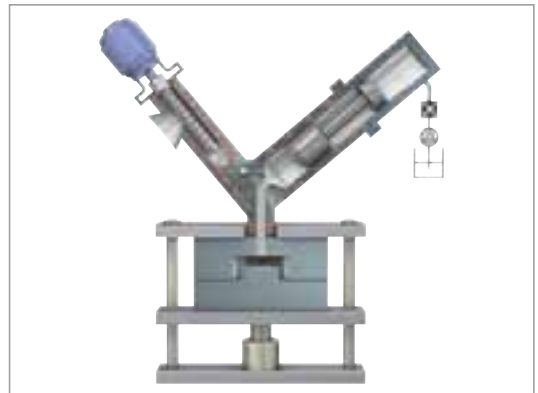


Fig. 13 Injection Moulding

To answer the question "When do I use which procedure?", you can use the following rough guide for the selection:

	CM	TM	IM
Number of pieces per year	<1000 pieces	>1000 pieces	>1000 pieces
Shore A – Hardness of the material	>80 Shore A	<80 Shore A	<80 Shore A
Diameter of the moulded part		<30 mm Ø	>30 mm Ø

Naturally, the tool costs also play a role for this observation, because the high tool costs must stand in reasonable proportion to the required number of pieces in order to perform a financially viable manufacturing.

An equally important role during the cost consideration is the design of the mould part, i.e. the required tolerances and the end processing state. The requirement for freedom from burrs is on many requirement drawings, that means burrs or spew in the form separation layers must be removed. In many cases it is not needed for the application and can create costs in individual cases that are higher than the total manufacturing and material costs of the moulded part itself. It is wise to specify the permitted burr elongation, e.g. 0,3 x 0,5 mm (maximum

dimension of the thickness and length of the burr) in the drawing specification. During the manufacture of moulded components, dimensional deviations arise through production tolerances for the tool manufacture, through the manufacturing procedure of the elastomer mixture, the moulding procedure and through the shrinking behaviour of the elastomer mixture during the vulcanisation.

The permitted dimensional deviations are described in DIN 7715. The adjacent table is an excerpt from the Part 2 of this norm, whereby F represents the dimensions related to the mould and C represents the dimensions related to the mould closure.

If no tolerance class is specified in the product drawing, class M3 (medium degree of accuracy) is usually valid. A manufacturing in tolerance classes with a higher degree of accuracy is only then sensible when higher requirements for accuracy are essential because this is always associated with a higher expenditure. Therefore, take this into consideration in the design or the specifications in your technical documents:

Specify only tolerances that are functionally absolutely important! Tolerances that are too tight increase the product cost. If we look at the Fig. 11 to 13 again for shaping, it becomes clear that the elastomer mixture must travel different flow lengths for the filling of the mould cavities.



	Class M1		Class M2		Class M3		Class M4	
	F	c	F	c	F	c	F	c
	±	±	±	±	±	±	±	±
	Permissible dimensional deviations in mm							
≤6,3	0,10	0,10	0,15	0,20	0,25	0,40	0,50	0,50
> 6,3 ≤10	0,10	0,15	0,20	0,20	0,30	0,50	0,70	0,70
>10 ≤16	0,15	0,20	0,20	0,25	0,40	0,60	0,80	0,80
>16 ≤25	0,20	0,20	0,25	0,35	0,50	0,80	1,00	1,00
>25 ≤40	0,20	0,25	0,35	0,40	0,60	1,00	1,30	1,30
>40 ≤63	0,25	0,35	0,40	0,50	0,80	1,30	1,60	1,60
>63 ≤100	0,35	0,40	0,50	0,70	1,00	1,60	2,00	2,00
>100 ≤160	0,40	0,50	0,70	0,80	1,30	2,00	2,50	2,50
	Permissible dimensional deviations in %							
>160	0,30	*)	0,50	*)	0,80	*)	1,50	1,50

Tab. 1 Permissible dimensional deviation

*) Values only after agreement

If the mould filling procedure is completed, the vulcanisation must be completed as quickly as possible so that the next moulding procedure can commence.

These procedures are called rheologie and rheological studies of rubber mixtures serve as predictor of the manufacturing behaviour. Devices which measure this procedure are called rheometers or rheovulcameters and they are used by Simrit for the continuous control of the materials.

In → Fig. 14 a typical rheovulcameter curve can be seen, whereby the respective measured torque shows the manufacturing status of the mixture. After heating of the raw mixture, the flow procedure begins in the mould, at which whose end the vulcanisation procedure begins and ends after a specified time when the vulcanisation optimum has been reached.

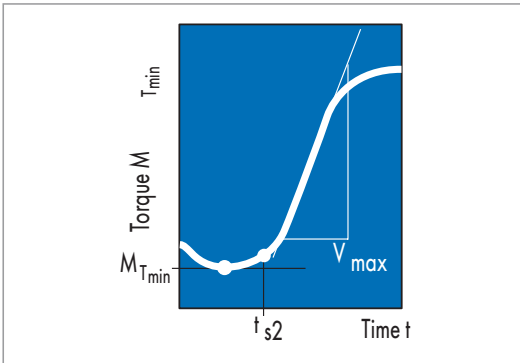


Fig. 14 Rheovulcameter curve

The sequence of these procedures is primarily determined by the mixture composition and the tool temperature.

The mixture developer adjusts the behaviour of his mixture to the respective manufacturing process through the specification of the mixture viscosity, the selection of the vulcanisation system and the remaining composition of compound. The optimal processing conditions are then achieved via the machine control (pressure and temperature).

It can be seen from these explanations that an elastomeric material is selected for a manufacturing process and that when the manufacturing process is modified, a mixture modification is often the result.

The often specified clause in the materials specification that once a material has been approved according to this specification, that it may not be modified is thus, in many cases, not able to be adhered to. Because in order to achieve prices in line with the market, product-adapted manufacturing processes must be selected and that in turn means that the mixture developer must be granted enough freedom so that he can optimally adjust his mixture.

Several examples from the precision moulded parts production are shown in the figures 15 to 19.

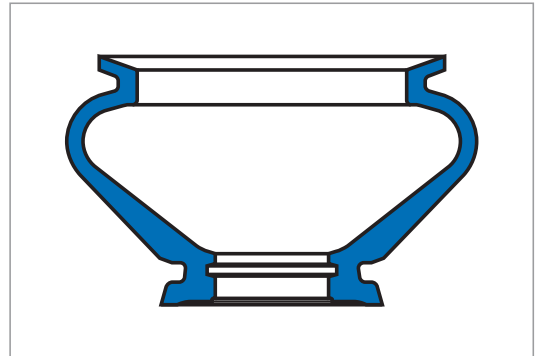


Fig. 15 Ball joint protective cap

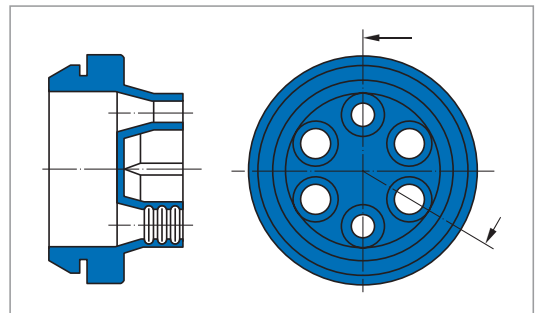


Fig. 16 Cable bushing

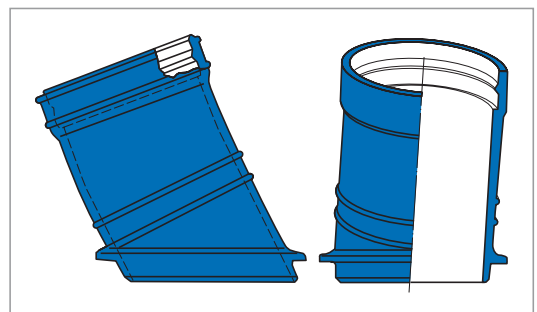


Fig. 17 Hose connecting pieces

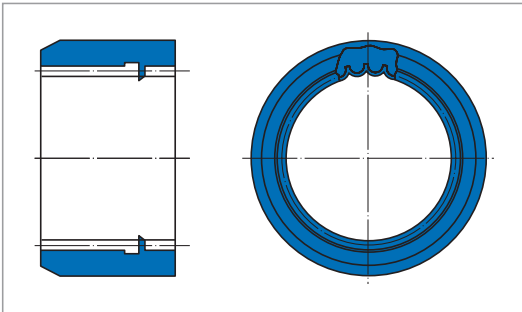


Fig. 18 Formed components with barbing

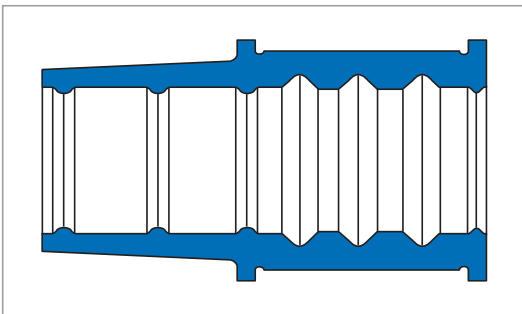


Fig.19 Damping bushing with guide bush

Large formed components

Large formed components take a special position in the range of formed components since due to their unusually large dimensions, they go beyond the "normal" scope of a rubber manufacture which for a vulcanisation pressing plate dimension from approx. 600 x 600 mm is at its limit.

In the large part pressing plant, the largest vulcanisation press has a plate dimension of 2000 x 2000 mm.

Due to the size of the formed components and the mostly small number of pieces, the CM process is used exclusively in this separate manufacturing area. The large formed components created in this manufacturing process have their design origin in practically all product families so that a 1000 mm long bellows is manufactured in one press while a rotary shaft seal with a sealing lip diameter of 1000 mm is produced in a neighbouring press.

The variety of products and the low number of pieces are the reasons why only a relatively low degree of automation can be carried out in this factory. Naturally, a high degree of technical skill is required of the production workers since many elastomers have a very limited hot tear resistance at a tool temperature of 160 – 180 °C and can therefore be easily damaged during demoulding.

Sheets and profiles

At companies such as Simrit, that are involved with seal technology, sheets and profiles are often manufactured as semi-finished product. A semi-finished product is referred to as a production between raw mixture and finished product.

Gaskets are produced from sheet goods by punching, drilling, puncturing, cutting, water jet cutting amongst others.

The sheets themselves are manufactured out of press tools as single sheets or continuously in so-called roller head systems as rolled goods (→ Fig. 20).

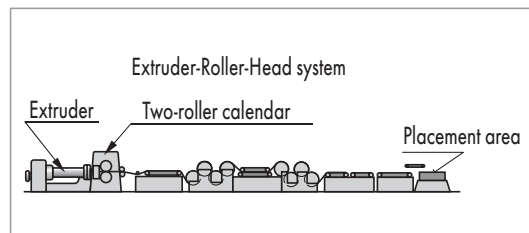


Fig. 20 Roller head system for continuous production of rolled goods

An extruder – equipped with wide injection head and wide slot nozzle feeds the plasticised and warmed mixture in a 2-roller calendar roll. The roll is formed in roller gaps and conveyed via a steel band in heated roller pairs to the automatic vulcanisation.

The edges are then trimmed, the surfaces powdered (if necessary) and the sheets are rolled up or trimmed to strips or individual sheets.

The width of the sheets amounts to max. 500 mm and the thickness to max. 3 mm. The tolerances of the sheets correspond to the degree of accuracy "fine" according to DIN 7715 and can be formed to be even more narrow through grinding.

Thickness	Smooth	Ground
≥0,5 ... ≤1,5 mm	± 0,10	± 0,10
>1,5 ... ≤2,5 mm	± 0,15	± 0,10
>2,5 ... ≤3,0 mm	± 0,20	± 0,10

A special feature of the sheet manufacture is the overlaying of the sheets with a thin PTFE layer with a thickness of e.g. 0,25 mm. The layer is permanently bonded to the elastomer using a chemical bonding system.

In general, it can be said that the die cut, shear cut or razor cut seals from sheets or rolls offer a cost-effective alternative to moulded seals.

Another method for manufacturing semi-finished product is extrusion. The extrusion process works continuously and is used for the manufacture of pipes or hoses for moulding blank manufacture and for sealing profiles. The extruder consists of a cylinder which contains a rotating worm gear and a drive unit, (→ see Fig. 21). The worm gear plasticises and conveys the mixture on the extruder head through a nozzle which gives the exiting elastomer its desired form. The manufacture of the nozzle tools is a science in itself and requires the technical know how of experienced specialists.

The forming of the profile is completed by hand with engineers' files and individually adjusted for every elastomer mixture. This is necessary because every mixture exhibits a different, so-called nozzle expansion that can amount to between 5 and 150%. Further units are installed downstream of the extruder which serve for vulcanisation of the extruded product. The following processes are used for this:

- Vulcanisation in water steam
- Vulcanisation through ultrahigh frequency

For the calendering and the extruding, specially developed elastomer mixtures are required because both manufacturing processes work with vulcanisation units separate from the shaping.

The semi-finished products must therefore have sufficient form stability for the further handling and the pressure-less vulcanisation.

After the vulcanisation, sheets and rolls are supplied as semi-finished product to blanking shops. Profiles are handled differently. They first become seals through the assembly process via confectioning.

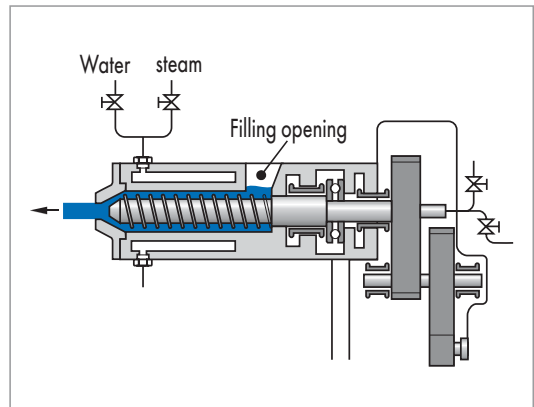


Fig. 21 Extruder for the manufacture of seal profiles.

Confectioning is understood to mean a manufacturing method which primarily consists of hand work. Fig. 22 shows a U-ring profile:

- This profile was manufactured in the extruder and was vulcanised in the autoclave. A closed sealing component is now to be finished from these semi-finished products produced by the metre. The profile is cut to length, the cut surface is roughened up by grinding and cleaned with solvent.
- After air has been exhausted around the product, adhesive is applied to the cut surfaces and again air is exhausted around the product according to specifications. The profile ends are then joined together and vulcanised at the joint.
- After vulcanisation, the joint section is reworked with filing equipment.

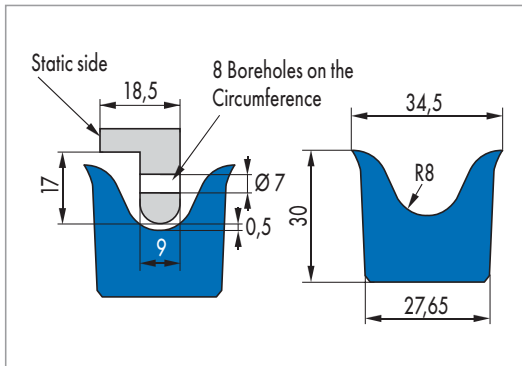


Fig. 22 Extruded U-Ring profile (the mating ring is used for operating pressures over 10 bar)

A further process is known, whereby a rotary shaft seal profile is confectioned on site at a shipyard in the housing. In this way, waiting times for the servicing are kept to a minimum and thus save costs. You can see from this example that even old processes from the rubber industry – such as calendering, extruding and confectioning – are still used today.

PTFE seals and design components

PTFE (polytetrafluoroethylene) is one of the most capable materials in sealing technology due to its unique combination of outstanding material properties. The application possibilities resulting from this make this material indispensable in nearly all areas of industry. The areas where PTFE is used include the mechanical engineering, chemicals and plant engineering, electrical engineering and semiconductor, pharmaceuticals and foodstuffs industries as well as medicine and analysis technology (amongst others).

The advantages of PTFE at a glance:

- Nearly universal chemical resistance
- Wide application temperature range from -200 to $+260$ °C
- Best electrical isolation values and good dielectric properties
- Photostable and resistance to atmospheric corrosion
- No aging
- Physiologically harmless in the range up to $+200$ °C
- Very smooth sliding, no "stick-slip" effect

- Self-lubricating, so that bearings and moving seals can even run dry under certain conditions
- Anti-adhesive behaviour
- Non flammable
- No water absorption whatsoever.

Several adverse properties limit the use of pure PTFE:

- Low wear resistance
- Cold flow behaviour
- Low resistance against high energy radiation
- Poor adhesive bonding capacity.

These adverse characteristics can be compensated for through the use of fillers or they can be partially minimised. The most important fillers are:

- Bronze, steel
- Glass fibre, glass beads
- Carbon, carbon fibre, graphite
- High-performance polymers such as Polyamide, PEEK, PPS, Aramide (Kevlar)
- Lubricants like MoS₂ (Molybdenum Disulfide)
- Ceramic fillers e.g. aluminium oxide.

The PTFE compounds produced with the help of the fillers mentioned above are processed into semi-finished product before the actual geometry of the finished piece is created using mechanical chipping.

A classical thermoplastic processing in the injection moulding process cannot be done due to the high molecular weight of PTFE. PTFE still has a firm, gel-like consistency in the melting range of 327 °C.

The manufacture up to the finished piece runs through the following steps:

1. The form is filled with PTFE compound
2. The material is pressed at specific pressures >45 Mpa
3. The pressed piece is sintered at temperatures >360 °C
4. The pressed piece is annealed
5. Mechanical further processing.



Bush manufacture

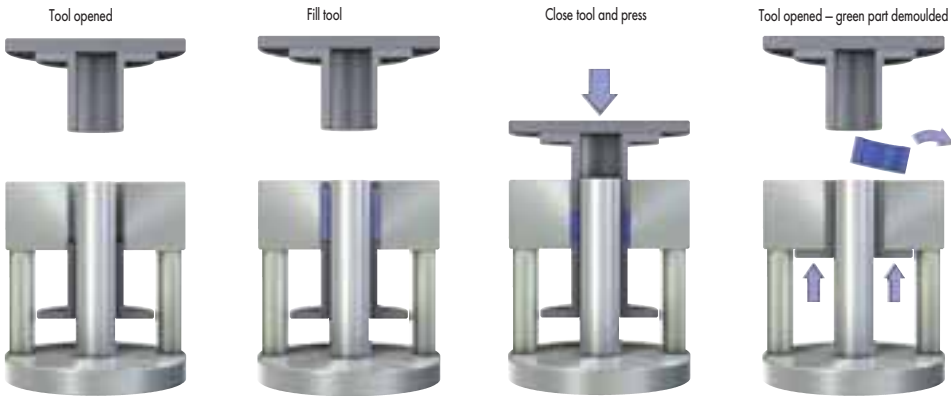


Fig. 23 Pressing of hollow cylinders

RAM extrusion principle

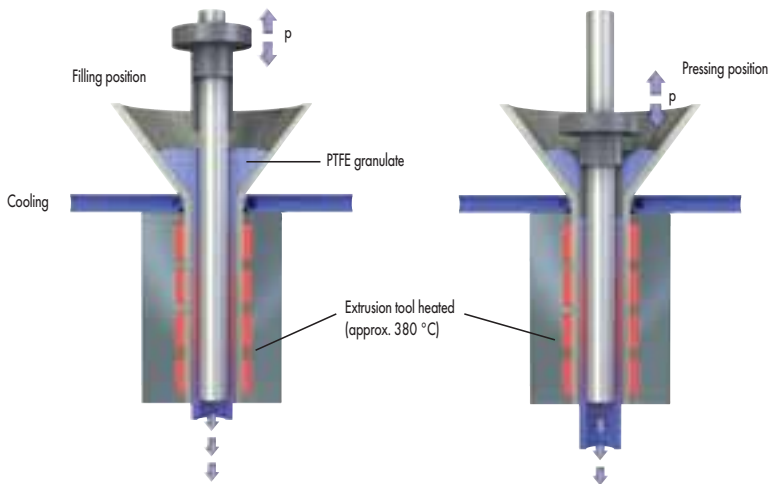


Fig. 24 Ram extrusion principle

The ability to manufacture parts from semi-finished product using mechanical chipping makes the shaping of the seals particularly flexible. Prototypes are normally machined from existing semi-finished product, which significantly shortens the prototype technical-release times.

These process steps are found in all production methods:

- Manual press-sinter procedure for the manufacture of semi-finished product (→ Fig. 23)
- Ram extrusion for the manufacture of endless bar stock and pipes (→ Fig. 24)
- Pelleting process – fully automated press-sinter process for the manufacture of complex formed components with and without mechanical further processing

- Automated press-sinter process for the manufacture of thin-walled hollow cylinders from semi-finished products.

Downstream process steps of the mechanical processing are:

- Peeling of layers and die cutting of formed components on die cutting equipment
- Turning and casting of seal geometries on mechanical automatic lathes or CNC machines from pressed/extruded semi-finished products.

In contrast to elastomers, PTFE has a very low intrinsic elasticity. This means that the stiff, hard material is less suitable for compensating the tolerances. For this, PTFE sealing components are usually provided with a contact pressure element. This can be either elastomer elements such as O-rings or rectangular rings or metal springs (spiral, meander springs) are used.

The selection of the contact pressure element is dependent on the relative application. Here, it must be weighed in dependence on the temperatures and the media, which elastomer material can be used, in the case of O-rings, or which steel quality for a spring as contact pressure element can be considered.

A short overview of the products shows which variety of constructions there can be.

Piston rings made from PTFE

Low friction, wear-resistant PTFE rings with square section. In part with grooves (notches) for the pressure activation of the contact pressure element (e.g. O-ring): Use in hydraulic power steering systems (amongst others). Rings with different slot geometries are mainly used in automatic transmissions as alternative to metal piston rings. These are installed in closed grooves and seal off specific fluid circuits e.g. using O-ring contact pressure. Can tolerate slight leakage amounts, suffices a system-sided contact pressure over the oil pressure.

Materials: Special PTFE compounds with special fillers for high tribological loads involved.

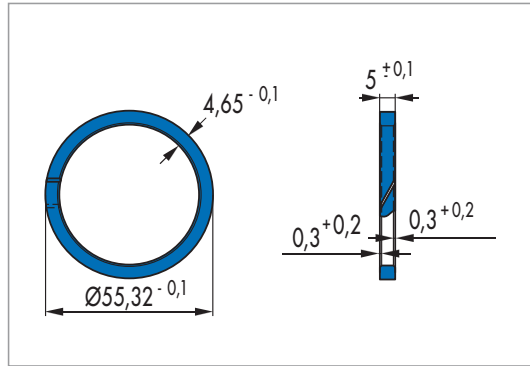


Fig. 25 Piston Rings

Forseal FOI (inside sealing), FOA (outside sealing) made of PTFE

One-sided pressure applied, U-ring type piston or rod seal made from PTFE compound with a metal spring as static pre-load component. Spring material preferred from stainless steel (1.4310). For aggressive media, spring materials such as Hastelloy or Elgiloy are used.

Advantage: Extreme media and temperature resistance, good dry running properties and low static and dynamic friction values. Suitable for O-ring housings (ARP568, Mil-P5514). Special forms for other groove dimensions are adaptable.

Usage limits: Operating pressure max. 30 MPa;
Temperature range: -200 to 260 °C.

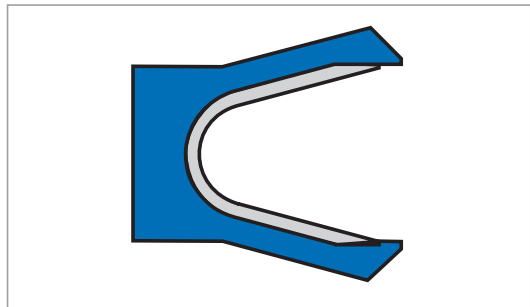


Fig. 26 Forseal FOI, FOA

PTFE cable bushings

PTFE formed components, manufactured in press-sinter process.

Function: Isolation of wiring harnesses e.g. in lambda probes (exhaust systems). Low dielectric constants as well as high specific contact resistance.

Temperature range: -40 to 280 °C transient.

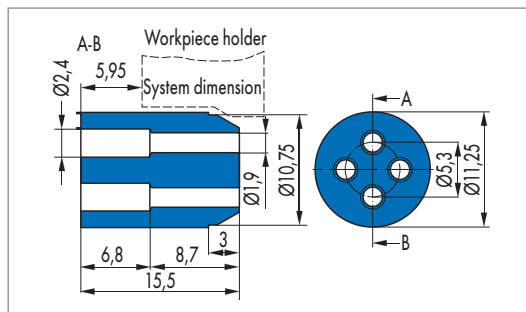


Fig. 27 Cable bushings

Mechanical composite parts made from PTFE

PTFE sealing component e.g. piston rings with contact pressure element, are already premounted and calibrated on a support component at the factory, e.g. pistons.

Advantage: Lower vertical range of manufacture through preconfected components.

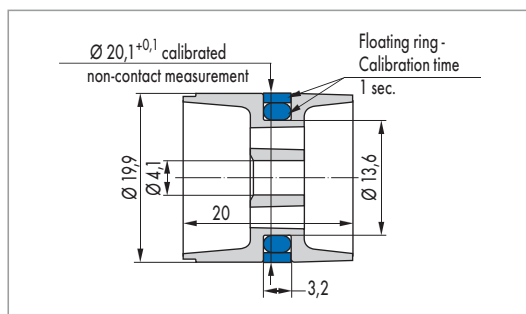


Fig. 28 Mechanical composite parts

PTFE seals

Stamped lip seals with memory effect. Thus lower friction, lower contact pressure compared to seals with contact pressure element. Initial seal effect through memory effect. Wide application range in different applications.

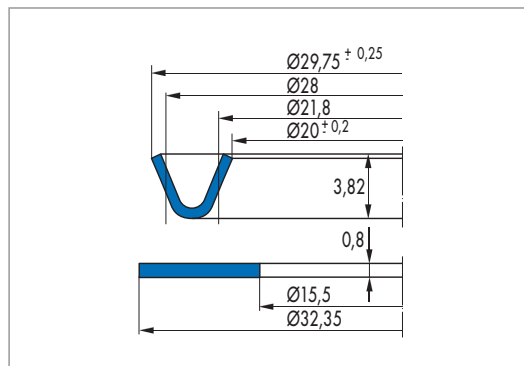


Fig. 29 Seals

Sealing ring with and without support

PTFE special seals with elastomer element or metal spring for maintenance of the contact pressure in the different application temperature ranges, as complement to the catalogue standard series for hydraulics.

Materials: Special PTFE compounds with special fillers for high tribologic loads involved.

Temperature range: Depending on the elastomeric material used.

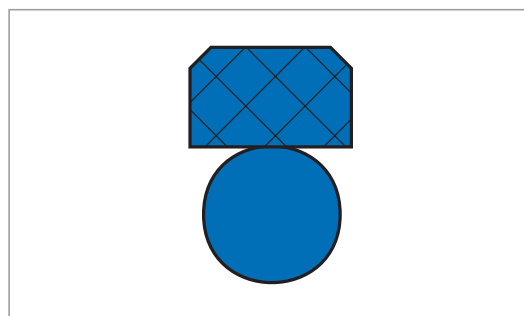


Fig. 30 Omegat seal

Guide elements made from PTFE

Guide element with rectangular cross-section. Manufactured as pivoting part or as band material. Blanks are possible for any piston or rod diameter. Guide elements are generally provided with a bevel cut due to the thermal expansion. Special designs stair cut is available on enquiry.

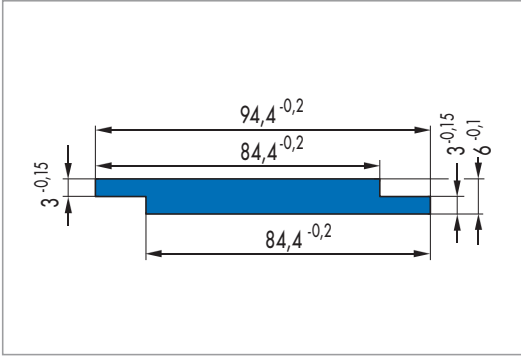


Fig. 32 Guide element

Back-up rings and spiral back-up rings made from PTFE

Depending on the gap width, operating pressure and material hardness, O-rings are provided with back-up rings against gap extrusion. In addition to our standard program, we also supply back-up rings in special materials and sizes.

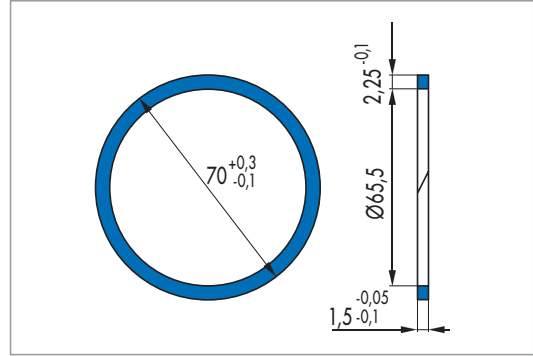


Fig. 33 Back-up rings



Products

Profiles, Cords and Hoses

_____ 620

Back-Up Rings

Back-Up Ring SRA _____ 643

Back-Up Ring SRI _____ 644

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Sealing Plates/Rubberised Sheet Seals

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Surface Treatment RFN (Reduced Friction by Nanotechnology)

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Micro- resp. Miniature Parts/ Simriz® Precision Mouldings and Composite Parts

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Seal with Flexible Printed Circuit Board

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Rubberised Drive Wheels

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Belt Pulley with Elastomer Track _____ 699

Decoupled Chain Gear _____ 700

Decoupled Gears _____ 701

Decoupling Elements

_____ 702



Profiles, Cords and Hoses

Product overview

- Profiles
 - U-rings
 - Mating rings for U-rings
 - Hat Seals
 - X Profiles
 - Other special profiles
- Cords
 - Cord
 - Cord rings
- Hoses
 - Hoses
 - Hose rings.

- All common elastomers can be utilised
- Special materials competency
- Low number of pieces/amounts possible
- Profile rings in NBR and FKM are available with vulcanisation to butt. Advantages of batch vulcanisation:
 - Peak tensile strength values
 - Identical elastomer as connecting element provides long-lasting durability.

Application

Components manufactured from profiles perform sealing tasks in numerous industrial sectors.

- Heavy-duty mechanical engineering, e.g. tunnel driving technology, cement/rock mills
- Plant engineering, e.g. turbines, shut-off valves, process cylinders
- Prime movers, e.g. ships' engines
- Separators, e.g. filtering technology, large separators.

Product description

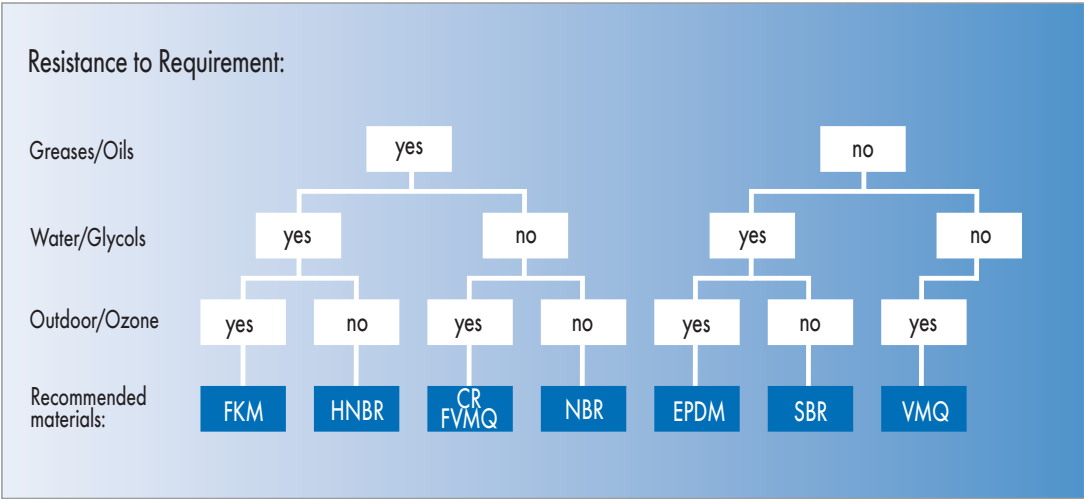
Special profiles, cords or hoses are utilised whenever large sealing contact areas cannot be effectively sealed by form seals or O-rings, for example, in tunnelling machines, ships engines and hatchways. Over 3500 different profile nozzles as well as numerous materials are available. In addition, the development and production of customer-specific designs is possible, where the tool costs are very low compared to shape related components.

Product advantages

- Sealing large seal contact areas that cannot be sealed by an O-ring or a shape related component
- Customer-specific product development
- Low tool costs in comparison to shape related components
- Proprietary tool construction to ensure short supply times

Material

Besides the common materials with shorter delivery times, numerous special materials are also offered. These feature outstanding quality and durability. In the following overview, suitable materials can be selected according to their requirements.



Material configuration

Material	Colour	Operating temperature range
50 NBR 121 *	Black	-30 ... +90 °C
60 NBR 122	Black	-30 ... +90 °C
70 NBR 221	Black	-25 ... +90 °C
70 NBR 803	Grey	-25 ... +90 °C
70 NBR 173216	Black	-30 ... +70 °C
72 NBR 872	Black	-30 ... +100 °C
79 NBR 105	Black	-30 ... +90 °C
80 NBR 709*	Black	-30 ... +90 °C
85 NBR 714	Black	-20 ... +90 °C
88 NBR 101	Black	-30 ... +100 °C
39 CR 174240*	Grey	-40 ... +80 °C
55 CR 852	Black	-40 ... +110 °C
67 CR 853	Black	-40 ... +110 °C
67 CR 215595	Black	-40 ... +80 °C
58 EPDM 215550	Grey	-40 °C ... +120 °C
70 EPDM 275	Black	-40 °C ... +120 °C
70 FKM 598	Green	-15 °C ... +200 °C

Material	Colour	Operating temperature range
70 FKM 215450	Black	-10 °C ... +200 °C
72 FKM 588	Black	-10 °C ... +200 °C
60 FVMQ 143026	Beige	-80 °C ... +175 °C
50 VMQ 570	Beige	-40 °C ... +200 °C
50 VMQ 114721	Yellow transparent	-40 °C ... +180 °C
58 VMQ 518	Red brown	-40 °C ... +200 °C
60 VMQ 114722	Yellow transparent	-40 °C ... +180 °C
70 VMQ 114723	Yellow transparent	-40 °C ... +180 °C
78 VMQ 526	Red	-40 °C ... +200 °C

* Special material on enquiry

Design notes

Tolerances

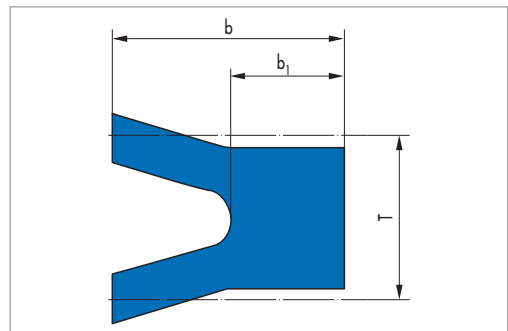
All profiles, cords and hoses are manufactured according to DIN ISO 3302-1 E2. In exceptional cases, production according to E1 is also possible.

Limits for dimensions of cross sections of extruded components not supported (all dimensions in mm):

Nominal dimension		Tolerance class	
over	to	E1*	E2
0	1,5	0,15	0,25
1,5	2,5	0,20	0,35
2,5	4,0	0,25	0,40
4,0	6,3	0,35	0,50
6,3	10,0	0,40	0,70
10	16	0,50	0,80
16	25	0,70	1,00
25	40	0,80	1,30
40	63	1,00	1,60
63	100	1,30	2,00

* Sometimes possible in individual cases

U-rings

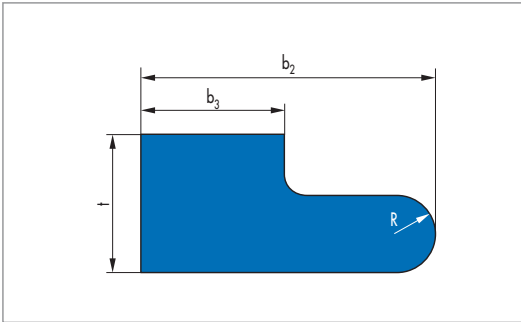


U-rings are produced, extruded and bonded to the butt for use as piston or rod seals. U-rings made of NBR and FKM are also available with vulcanisation to butt. They can be supplied at extremely short notice.

Fitting & installation

The inner diameter of the U-ring should be at least 1.5 times the profile cross section dimension (T).

Mating rings for U-rings



Mating rings are used for fastening and prevent axial movement of the U-rings, which can damage the sealing edges at the sealing lips. They are manufactured using extruders. The mating rings are always supplied by the metre.

Fitting notes

During fitting, the two ends are placed flush to one another. The mating rings can be seated on the U-rings with a slight axial tension.

Hat seals

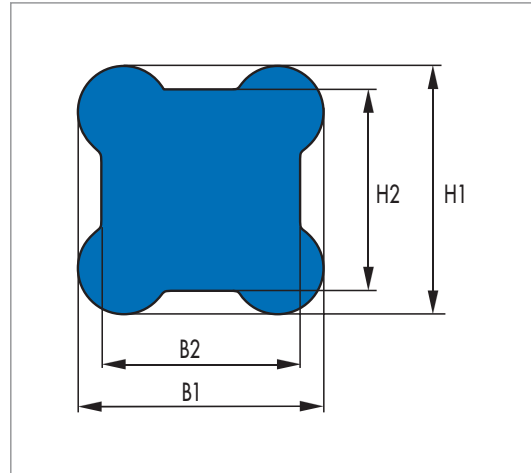
Hat seals are used for sealing axially moving rods. This design is not suitable for use on rotating shafts. The hat seals are bonded to the butt in extruded form. A support of the sealing lip by a metal back-up ring is advisable. This is not part of the Simrit range. Hat seals can be supplied at extremely short notice.

Operating conditions

Operating pressure: ≤ 10 bar

Running speed: $< 0,5$ m/s.

X-Profiles



X-Profiles are used for sealing rods, cylinders and housings. The lower compression required as a result of the four lip sealing profile makes them favourable to round profiles and results in cost advantages during installation. In addition, X-Profiles can easily be used in a rectangular groove thanks to their contour. The decisive advantage of the X-Profile is that the risk of tilting and twisting is minimised due to the larger bearing surface.



Other special profiles

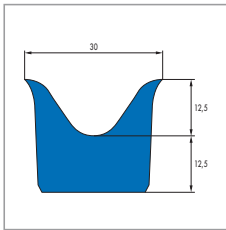
Profiles can be produced and supplied as follows:

- By the metre
 - With/without integral bend
- Profile sections
 - Produced to customer requirements (up to 2000 mm without integral bend possible)
- Profile rings
 - Bonded to butt or batch vulcanised.

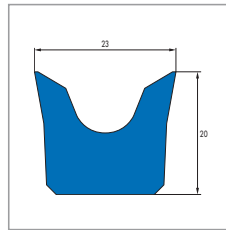
Profile nozzles

Below is a selection of the 3500 profile nozzles in stock.

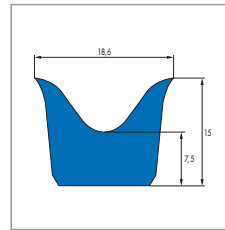
Individual tools can be developed and produced for special designs on enquiry. This normally takes around 4 weeks.



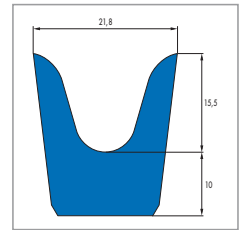
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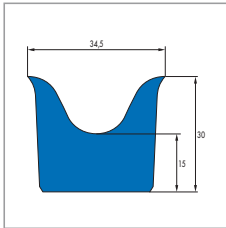
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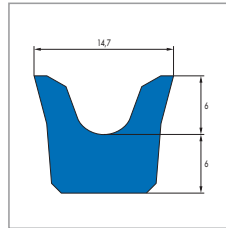
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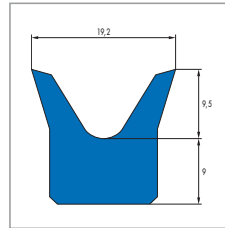
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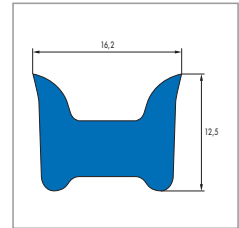
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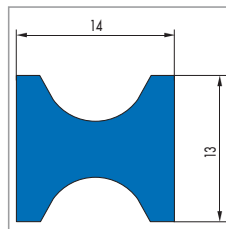
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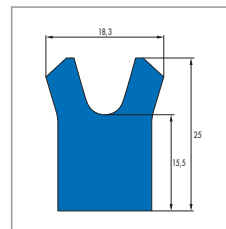
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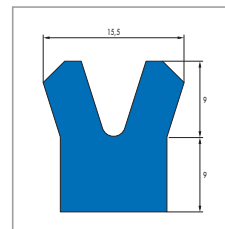
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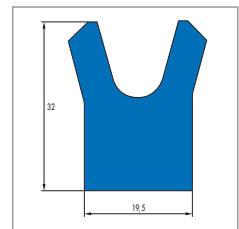
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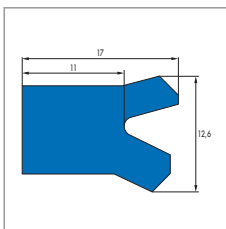
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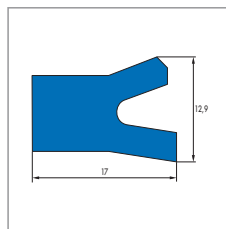
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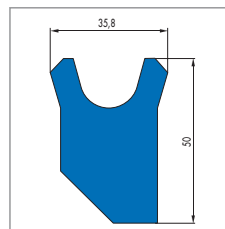
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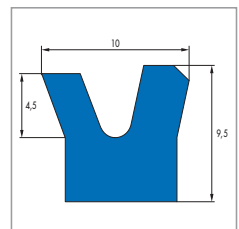
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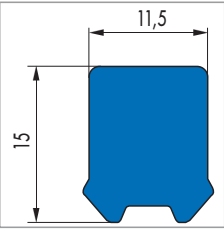
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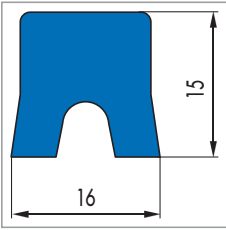
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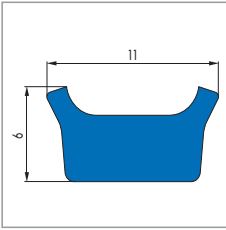
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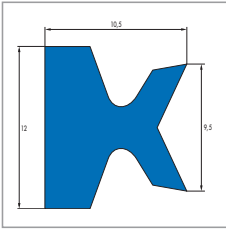
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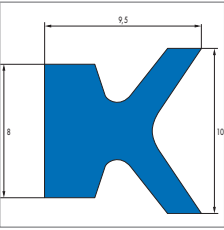
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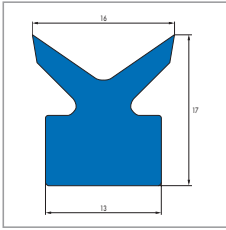
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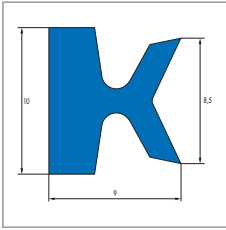
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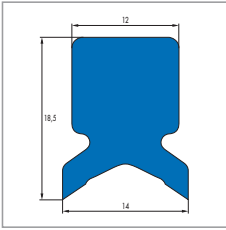
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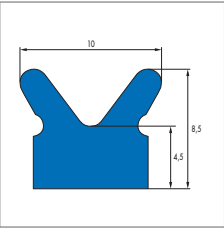
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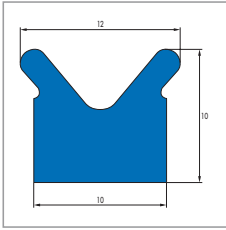
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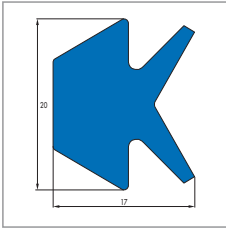
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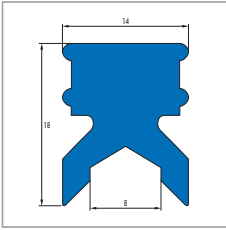
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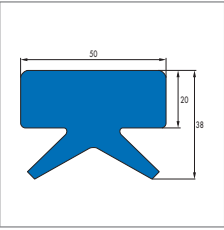
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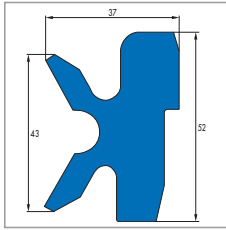
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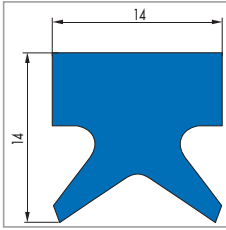
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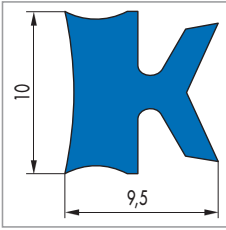
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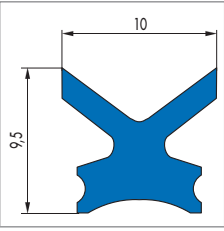
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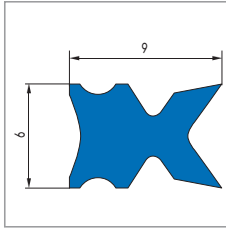
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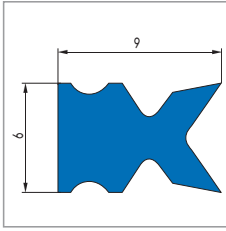
Profile 20413



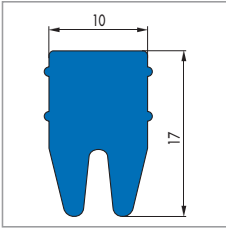
Profile 20418



Profile 20429

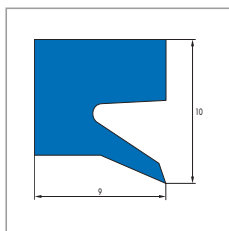


Profile 20457

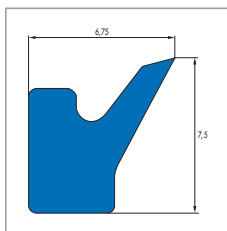


Profile 20458

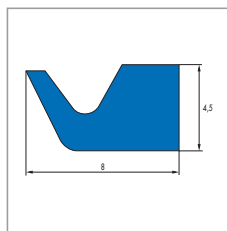




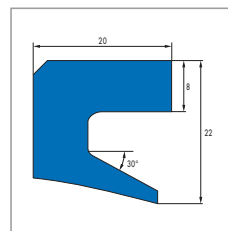
Profile 1101



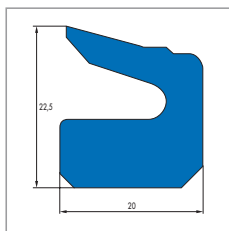
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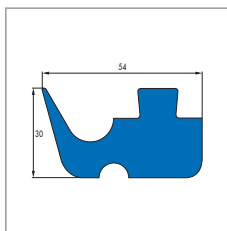
Profile 2345



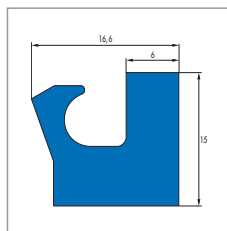
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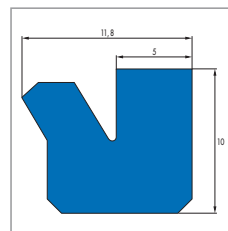
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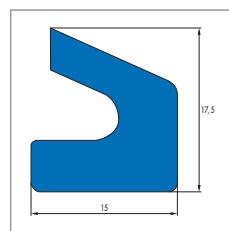
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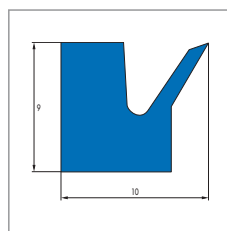
Profile 2529



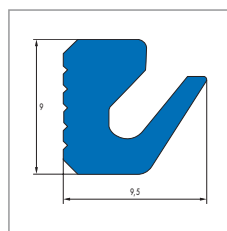
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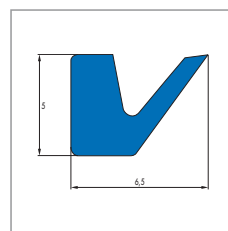
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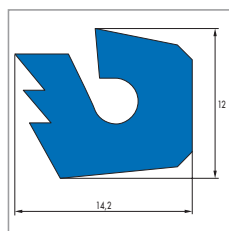
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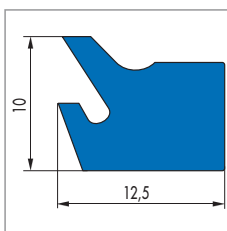
Profile 3231



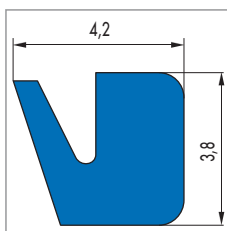
Profile 3279



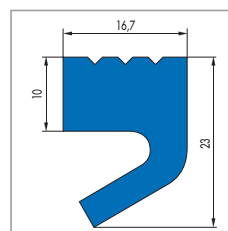
Profile 20128



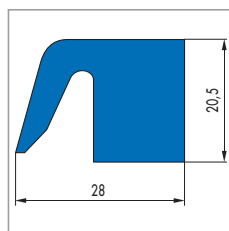
Profile 20136



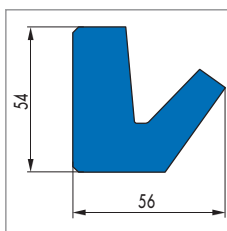
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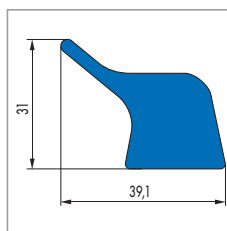
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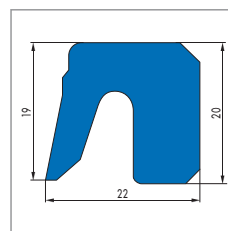
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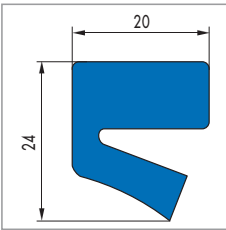
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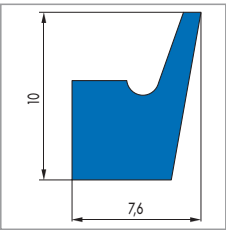
Profile 20334



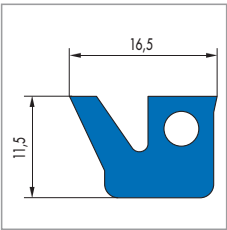
Profile 20346



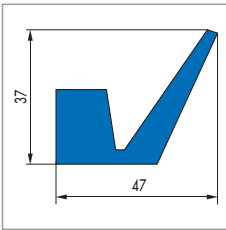
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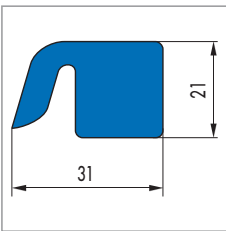
Profile 20459



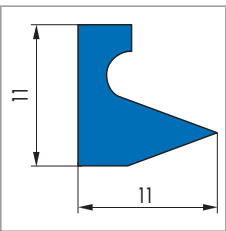
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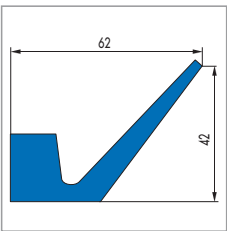
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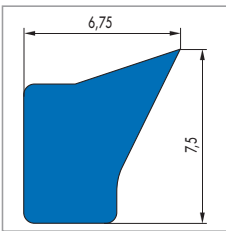
Profile 20469



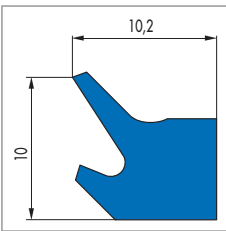
Profile 20473



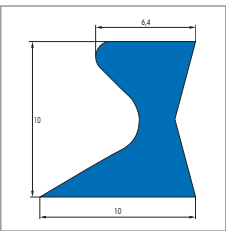
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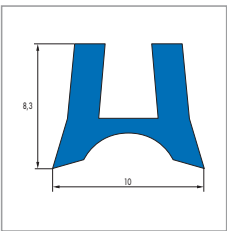
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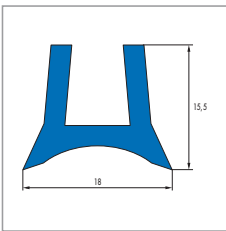
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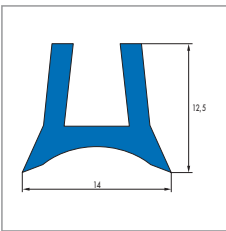
Profile 522



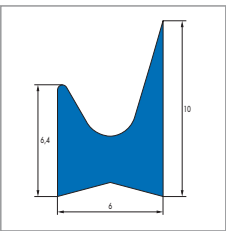
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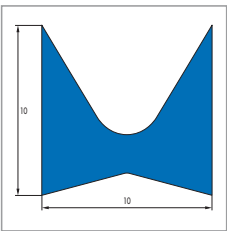
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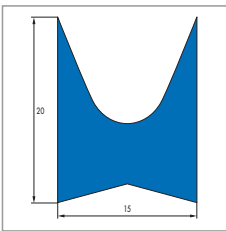
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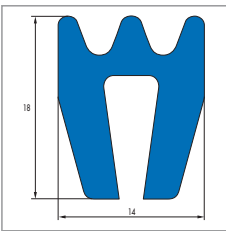
Profile 1931



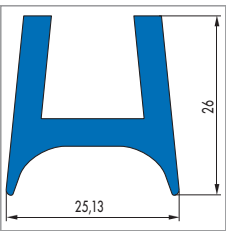
Profile 3149



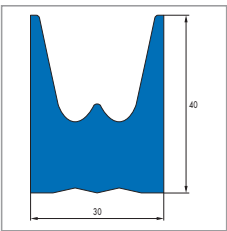
Profile 3150



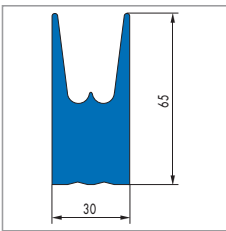
Profile 20141



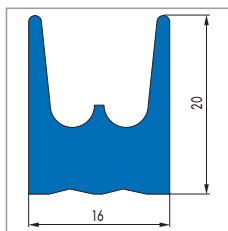
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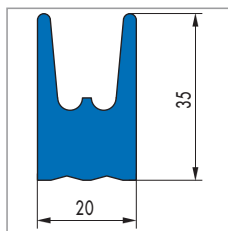
Profile 20347



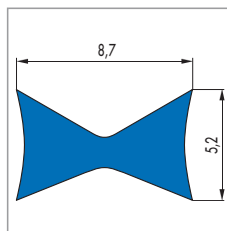
Profile 20348



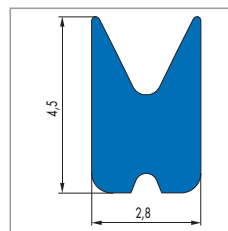
Profile 20370



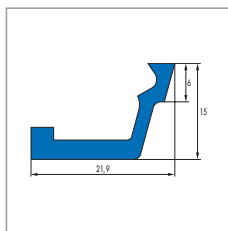
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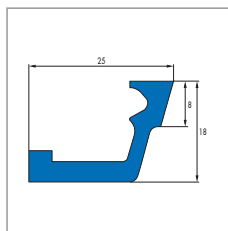
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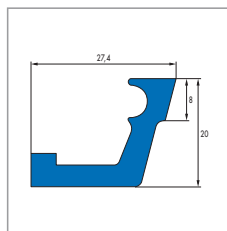
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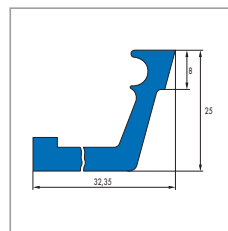
Profile 162



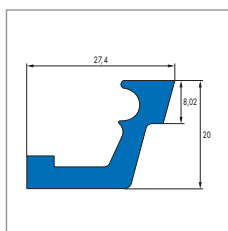
Profile 163



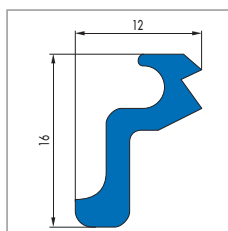
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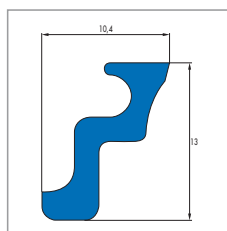
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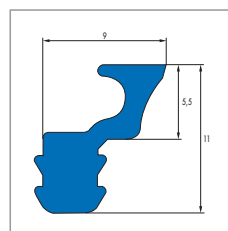
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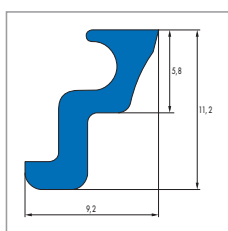
Profile 20428



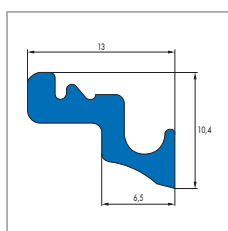
Profile 2849



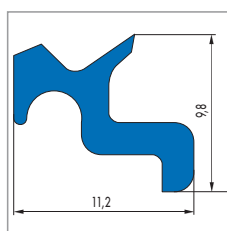
Profile 3061



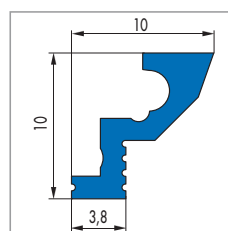
Profile 3311



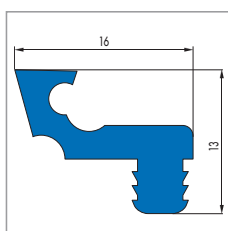
Profile 3348



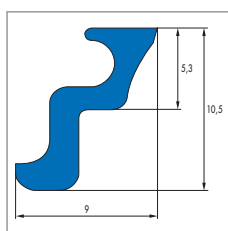
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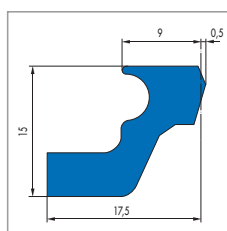
Profile 20171



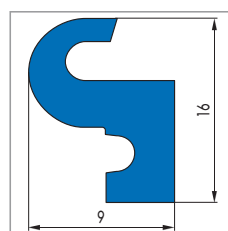
Profile 20200



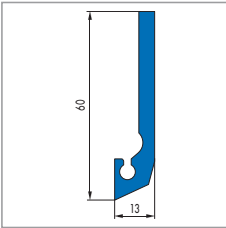
Profile 20276



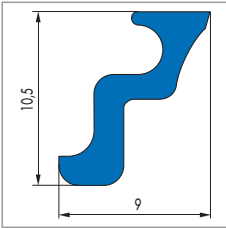
Profile 20331



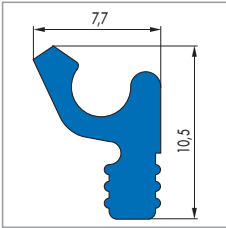
Profile 20338



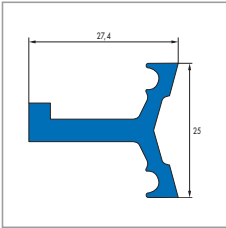
Profile 20343



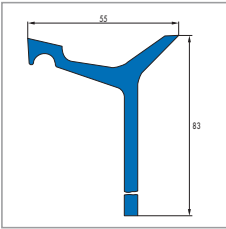
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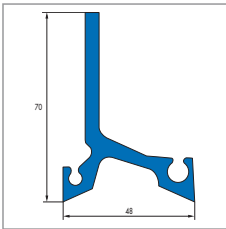
Profile 20504



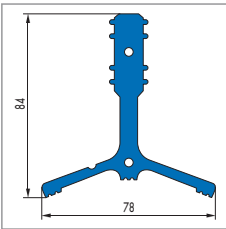
Profile 1222



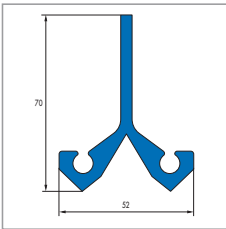
Profile 1771



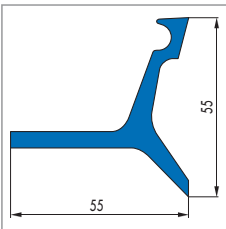
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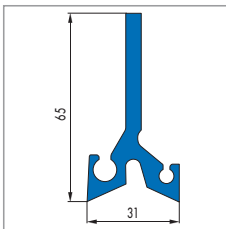
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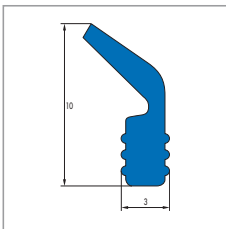
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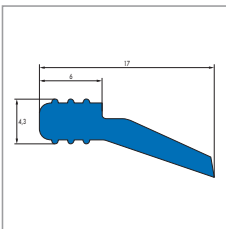
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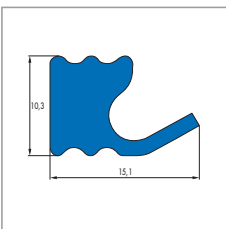
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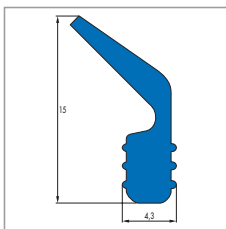
Profile 2757



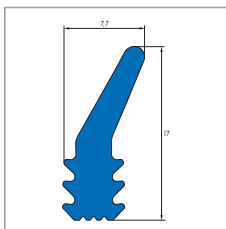
Profile 2775



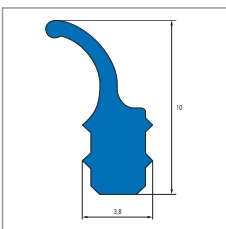
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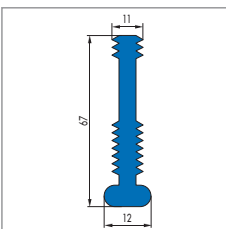
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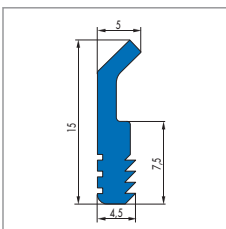
Profile 3180



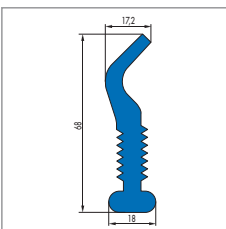
Profile 3181



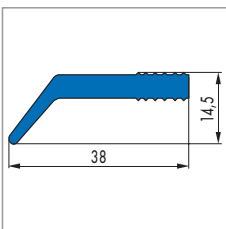
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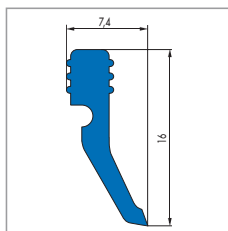
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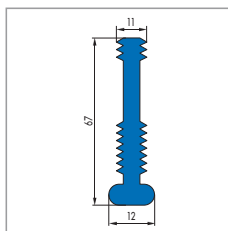
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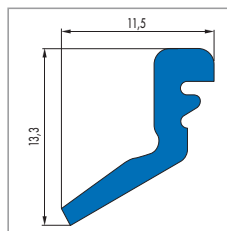
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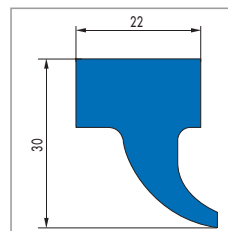
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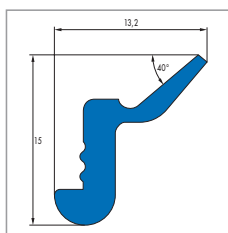
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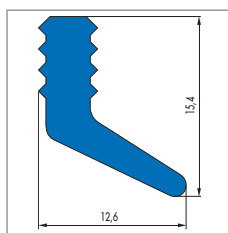
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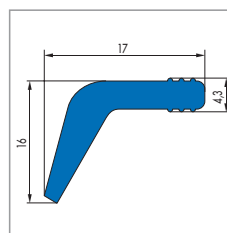
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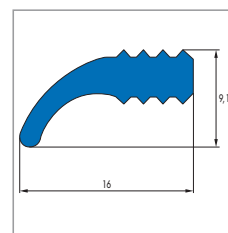
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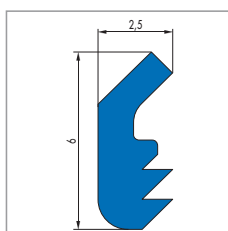
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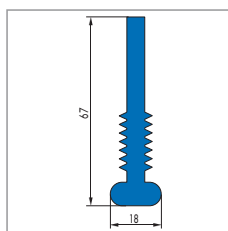
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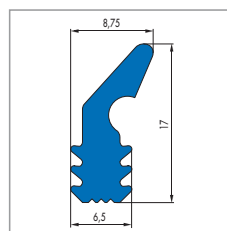
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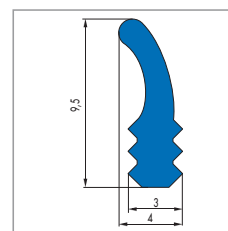
Profile 20154



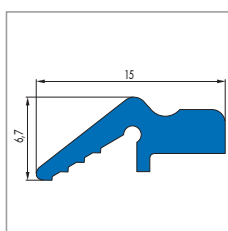
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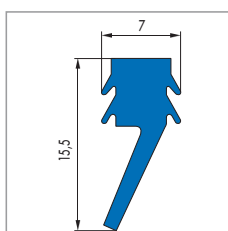
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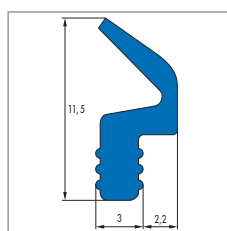
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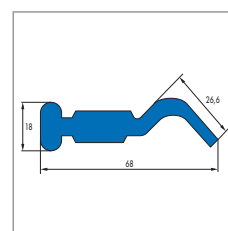
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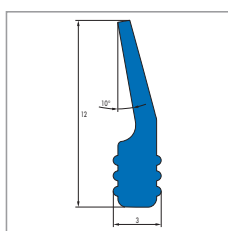
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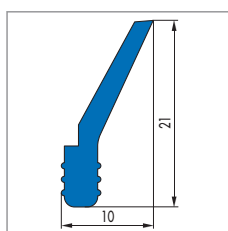
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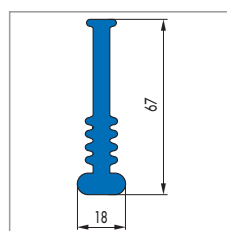
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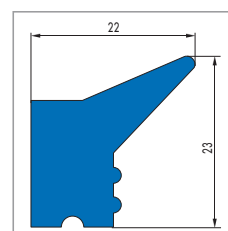
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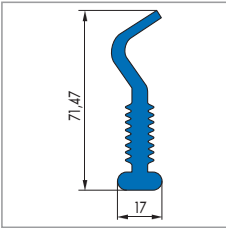
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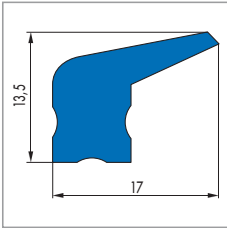
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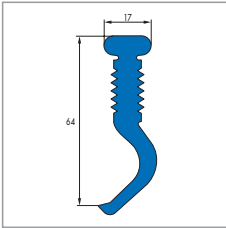
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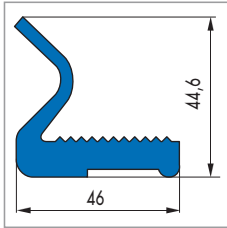
Profile 20420



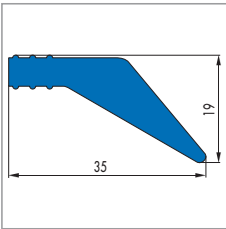
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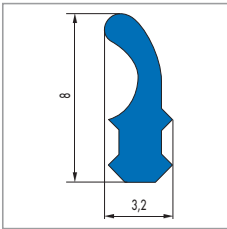
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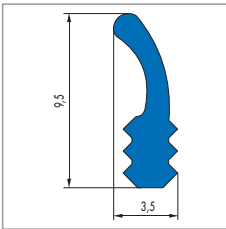
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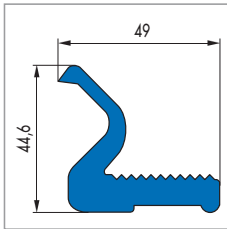
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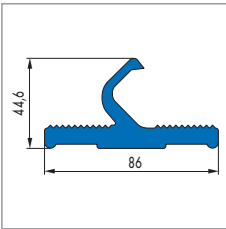
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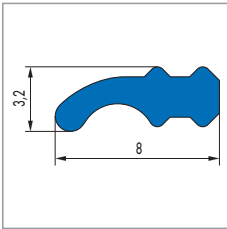
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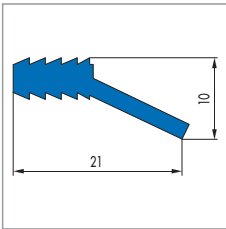
Profile 20481



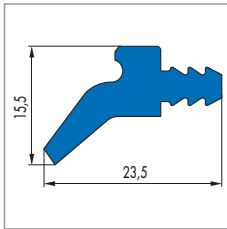
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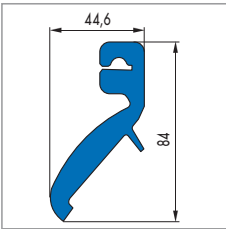
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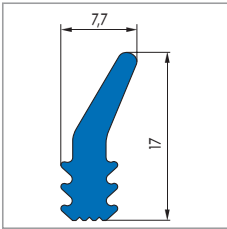
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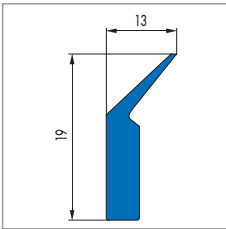
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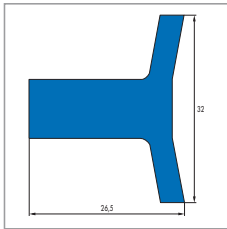
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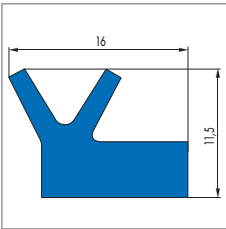
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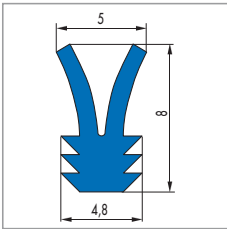
Profile 20520



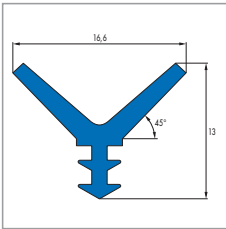
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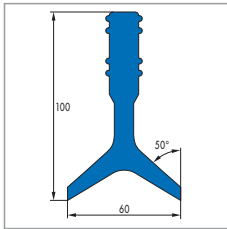
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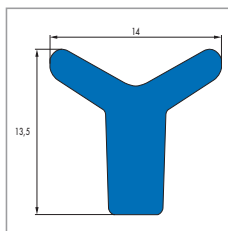
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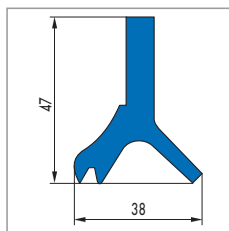
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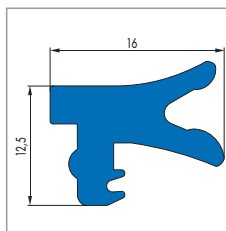
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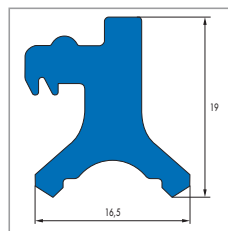
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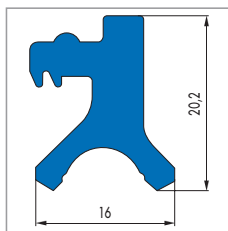
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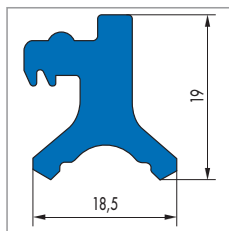
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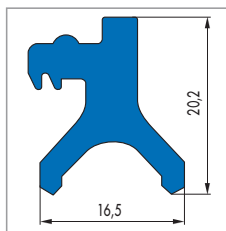
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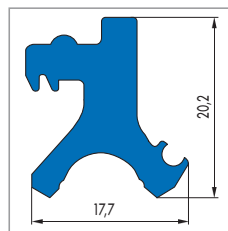
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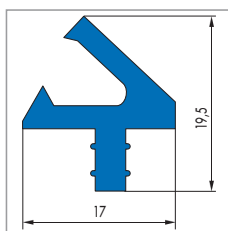
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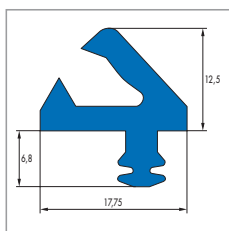
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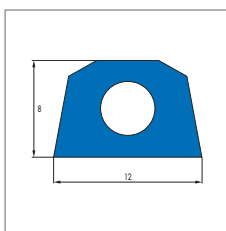
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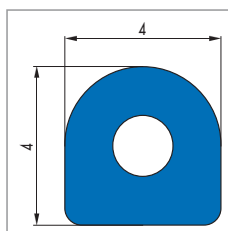
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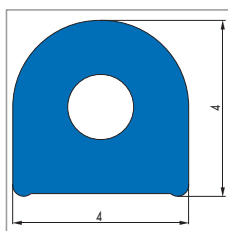
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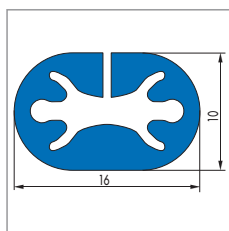
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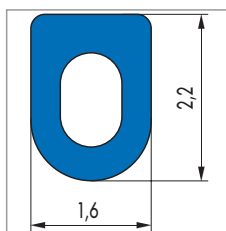
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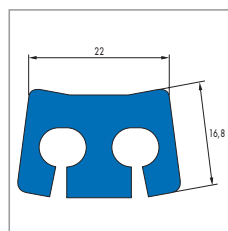
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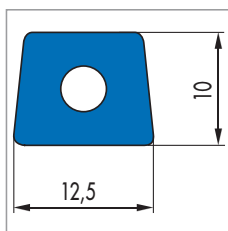
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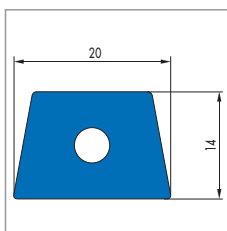
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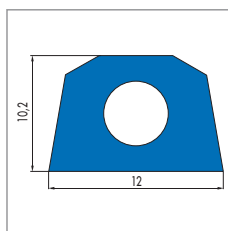
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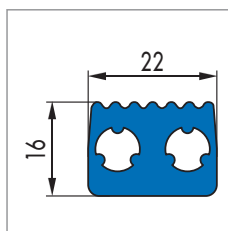
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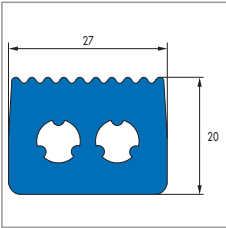
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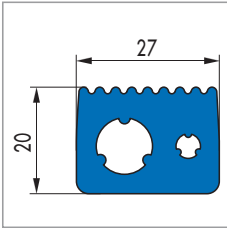
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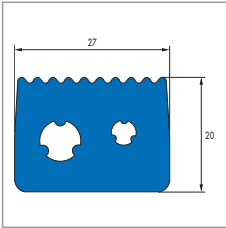
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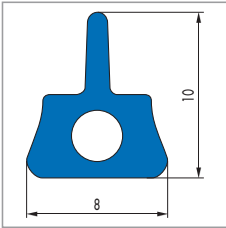
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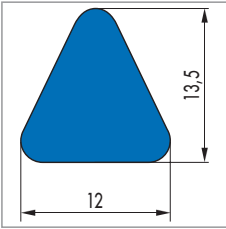
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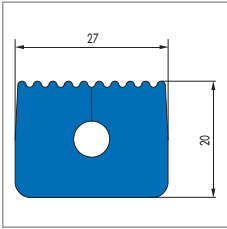
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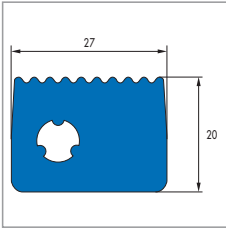
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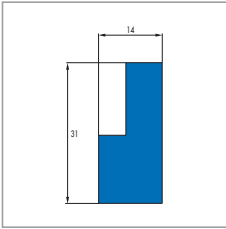
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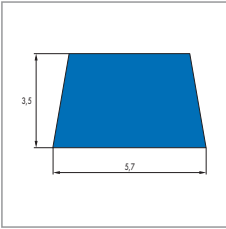
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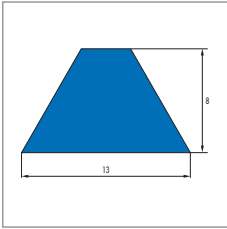
Profile 20443



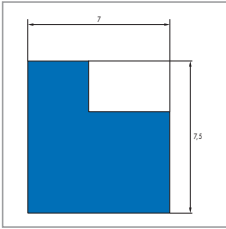
Profile 160



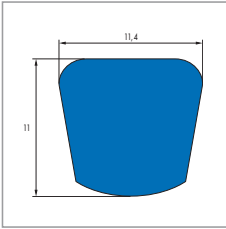
Profile 532



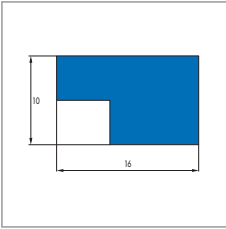
Profile 2130



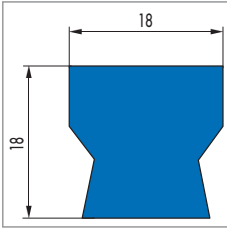
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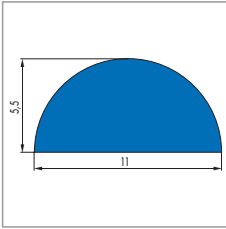
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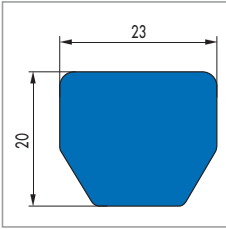
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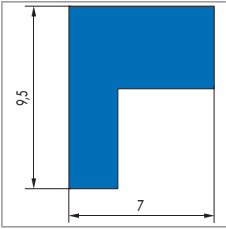
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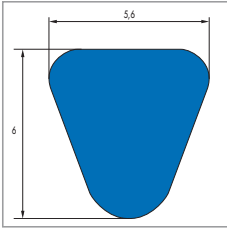
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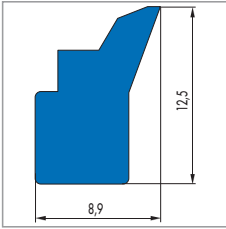
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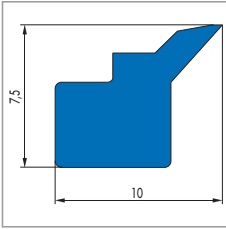
Profile 20161



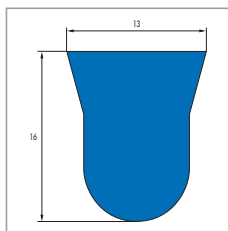
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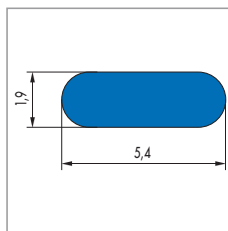
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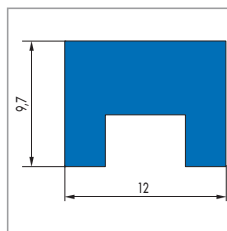
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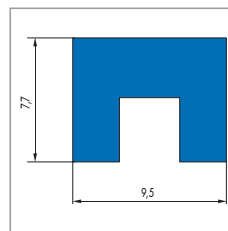
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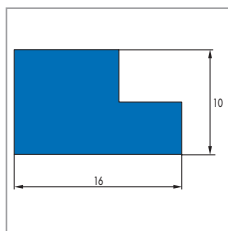
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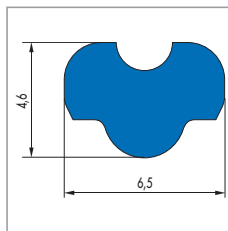
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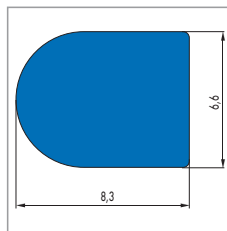
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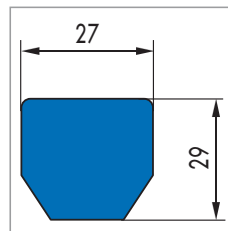
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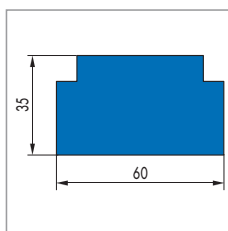
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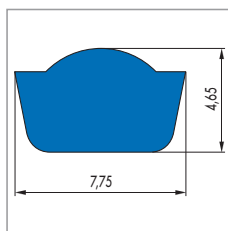
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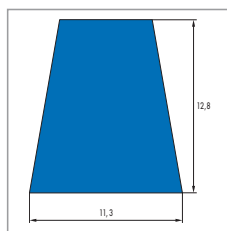
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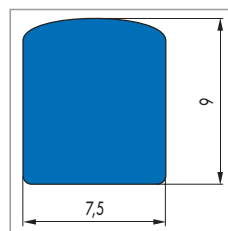
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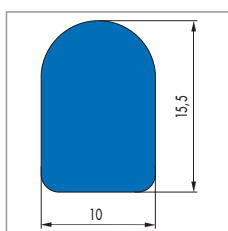
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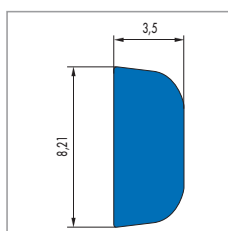
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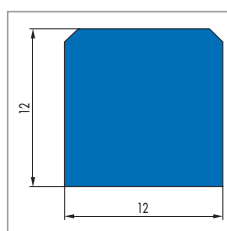
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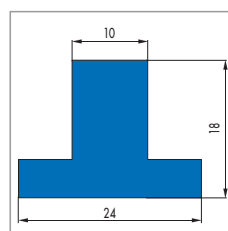
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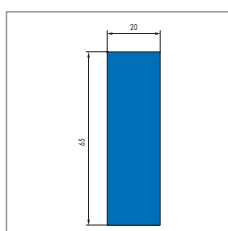
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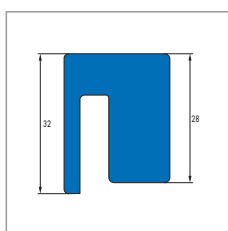
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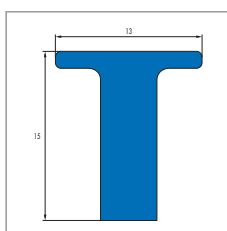
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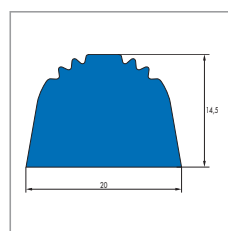
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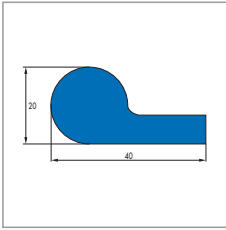
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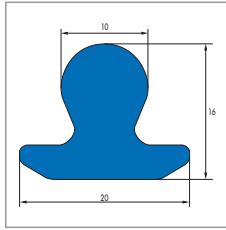
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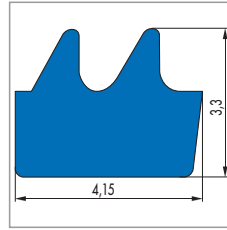
Profile 3225



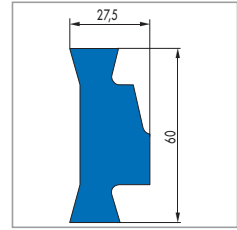
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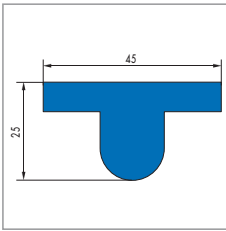
Profile 3387



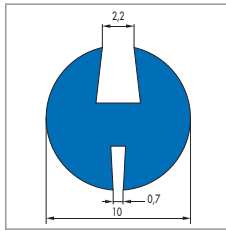
Profile 20092



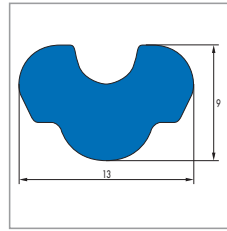
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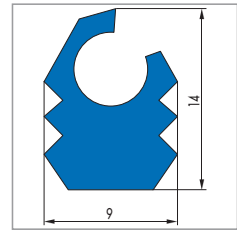
Profile 20129



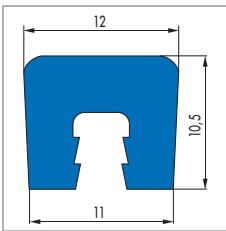
Profile 20133



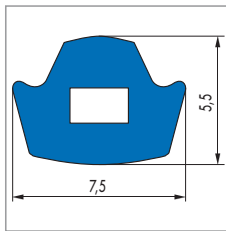
Profile 20162



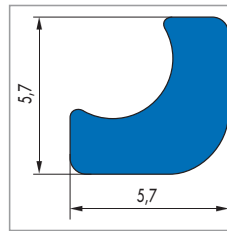
Profile 20172



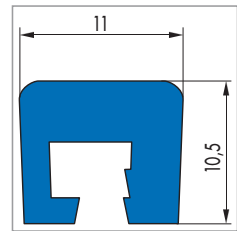
Profile 20174



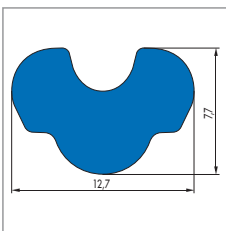
Profile 20179



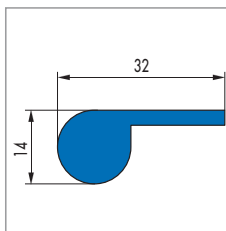
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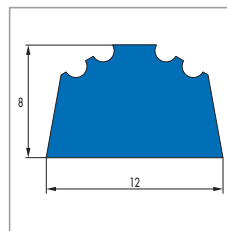
Profile 20190



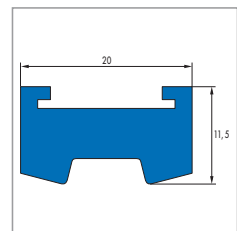
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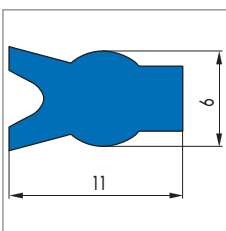
Profile 20229



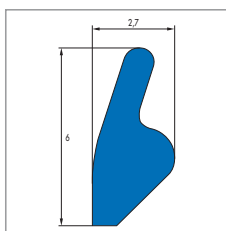
Profile 20260



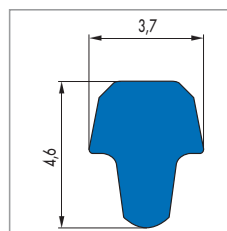
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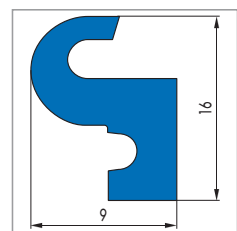
Profile 20332



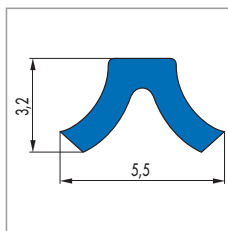
Profile 20335



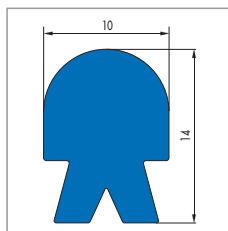
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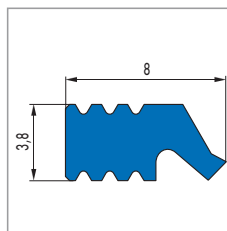
Profile 20339



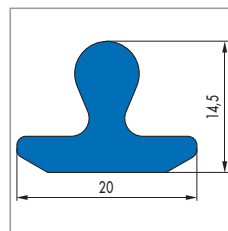
Profile 20340



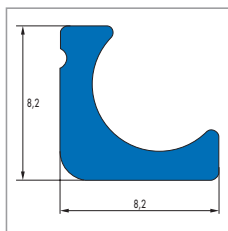
Profile 20360



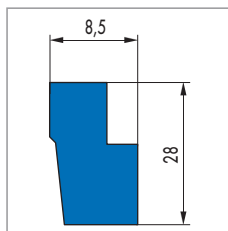
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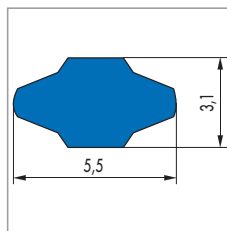
Profile 20371



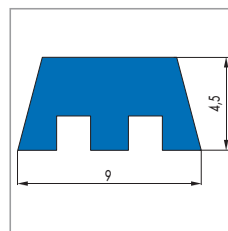
Profile 20377



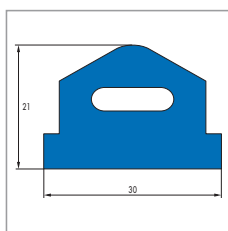
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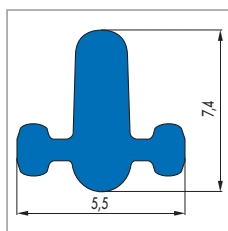
Profile 20394



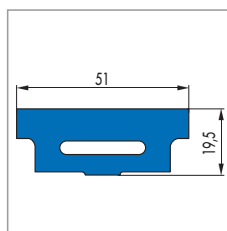
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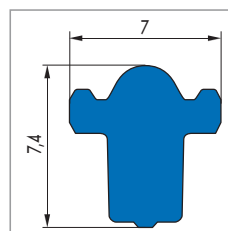
Profile 20424



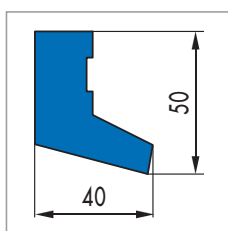
Profile 20434



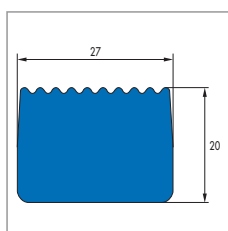
Profile 20449



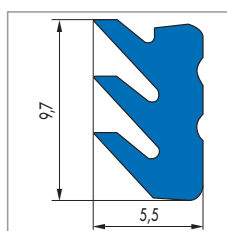
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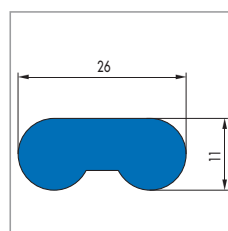
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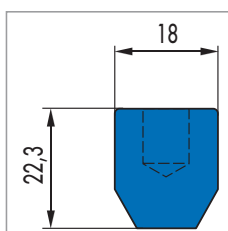
Profile 20465



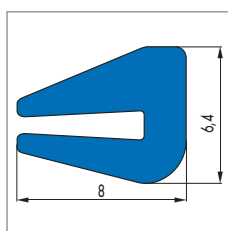
Profile 20476



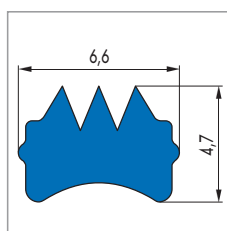
Profile 20483



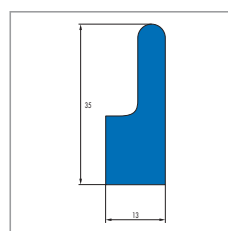
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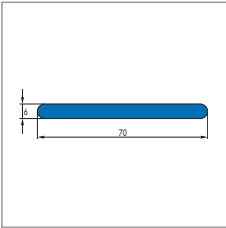
Profile 20496



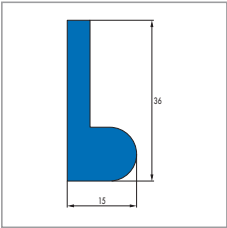
Profile 20506



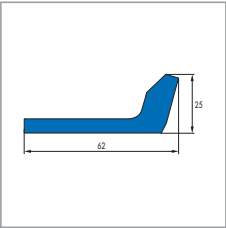
Profile 272



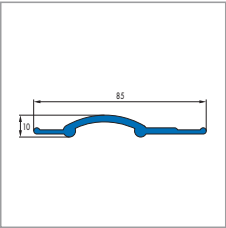
Profile 330



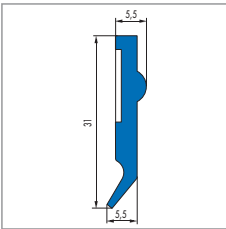
Profile 452



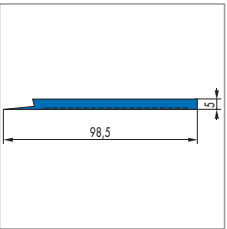
Profile 553



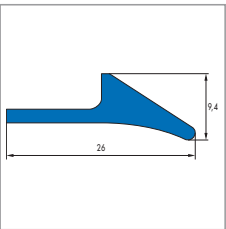
Profile 2766



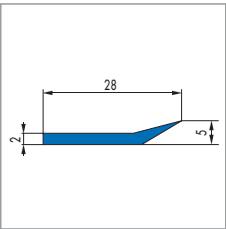
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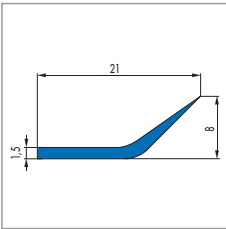
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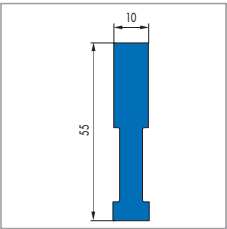
Profile 20146



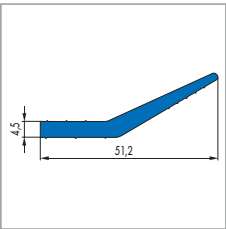
Profile 20178



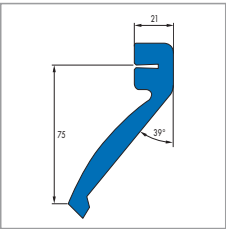
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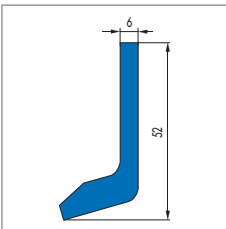
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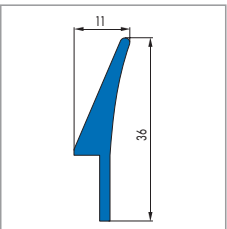
Profile 20439



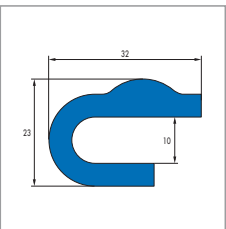
Profile 20460



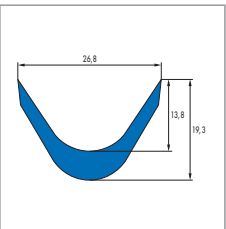
Profile 20509



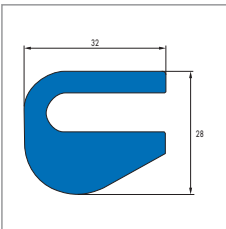
Profile 20512



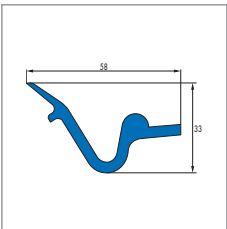
Profile 346



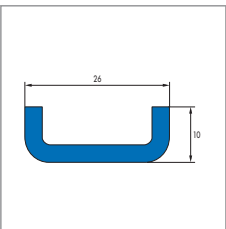
Profile 441



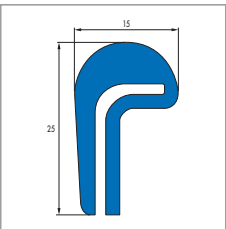
Profile 775



Profile 851

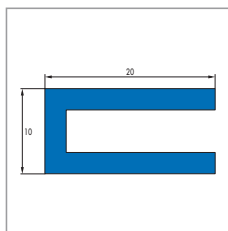


Profile 1235

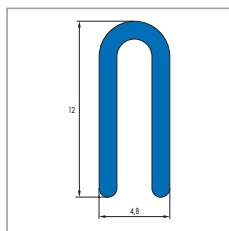


Profile 1425

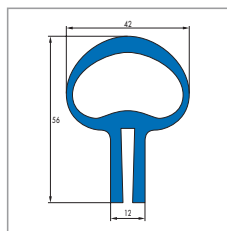




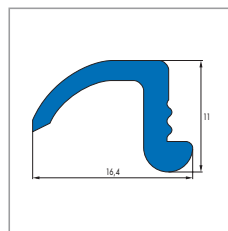
Profile 1930



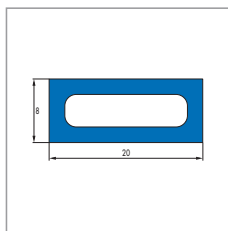
Profile 1966



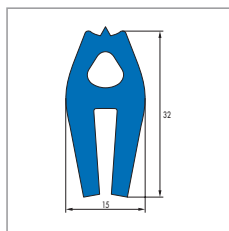
Profile 2018



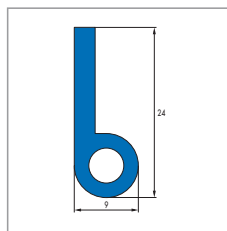
Profile 2278



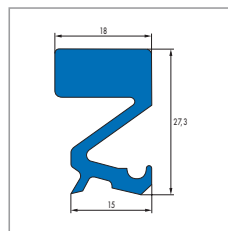
Profile 2295



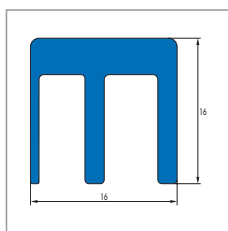
Profile 2584



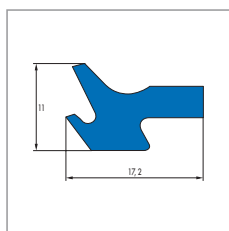
Profile 2976



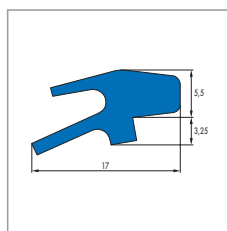
Profile 3255



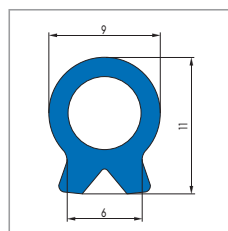
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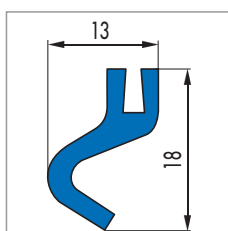
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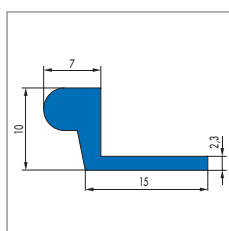
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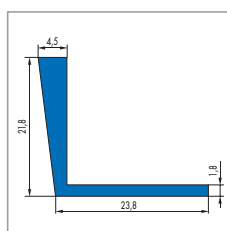
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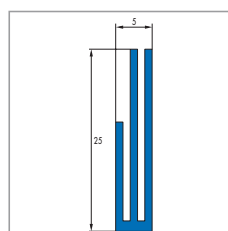
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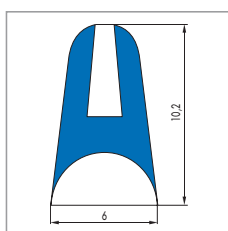
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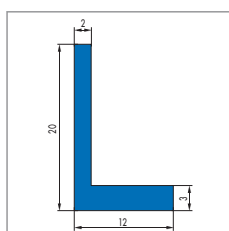
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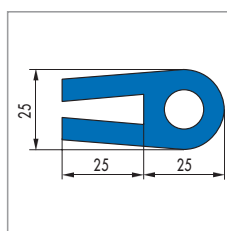
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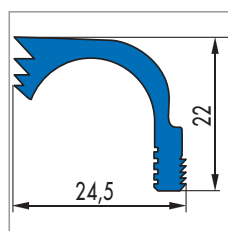
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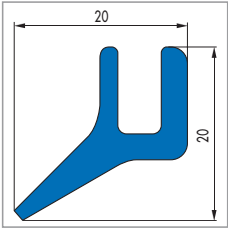
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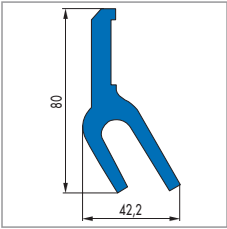
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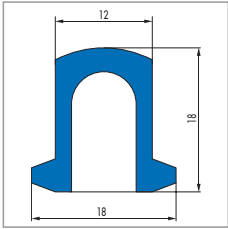
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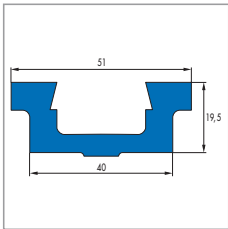
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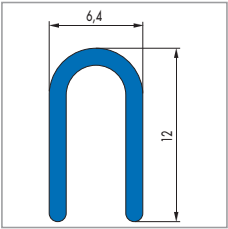
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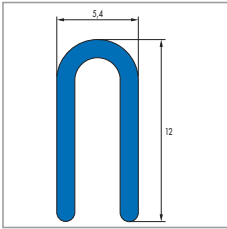
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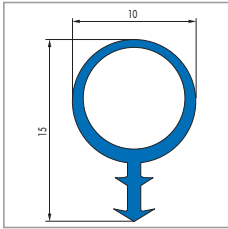
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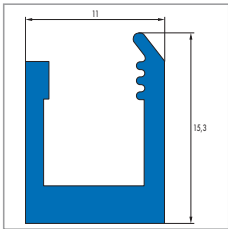
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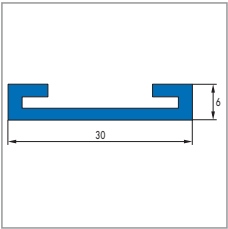
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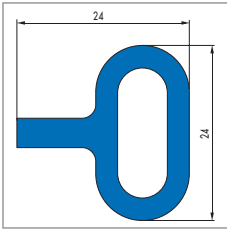
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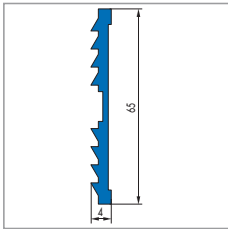
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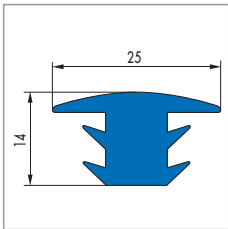
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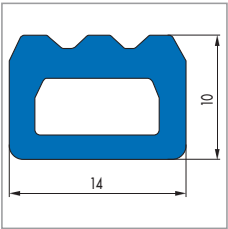
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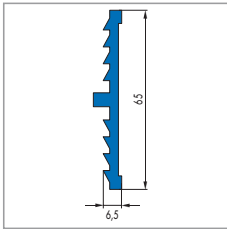
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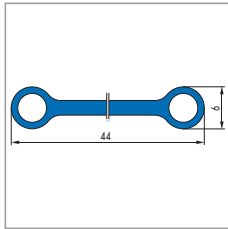
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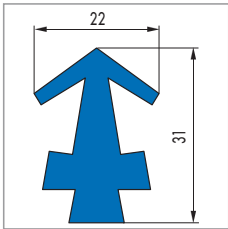
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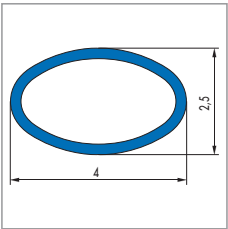
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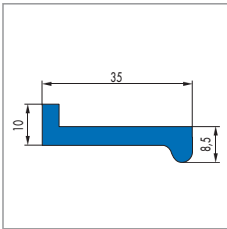
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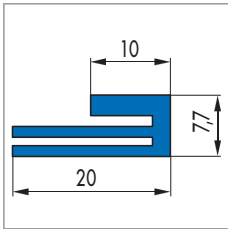
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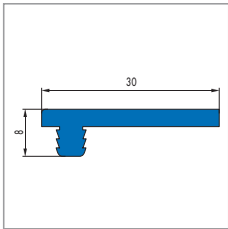
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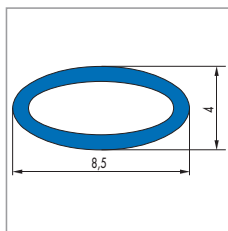
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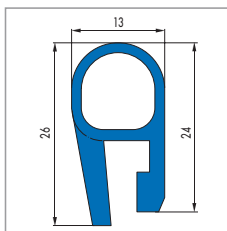
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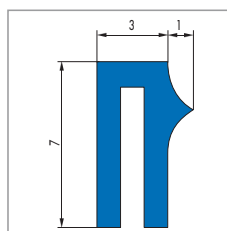
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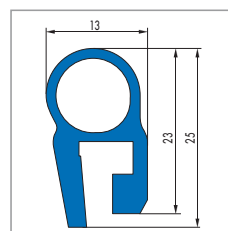
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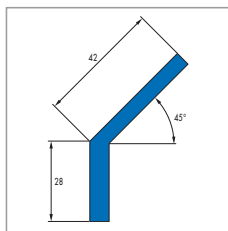
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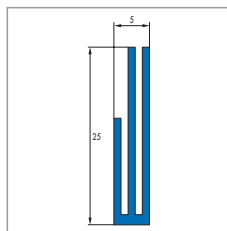
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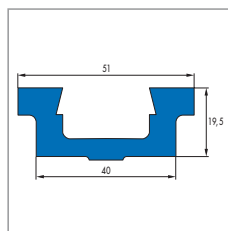
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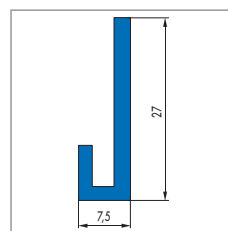
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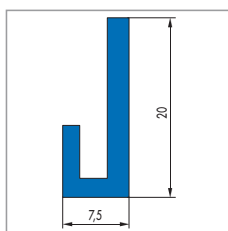
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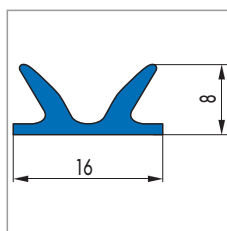
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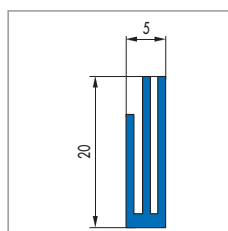
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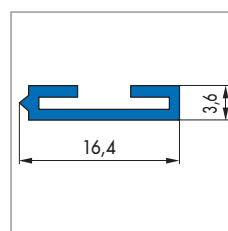
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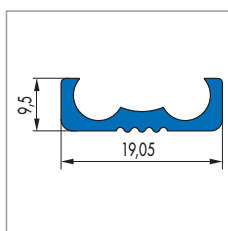
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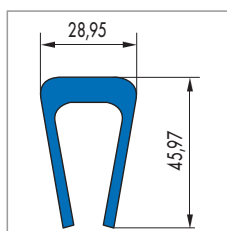
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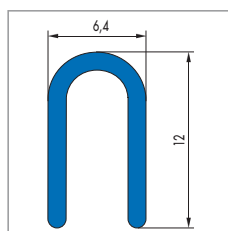
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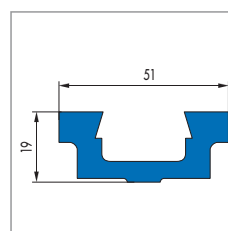
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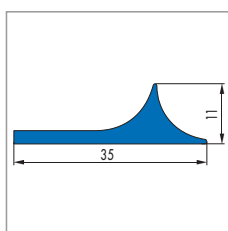
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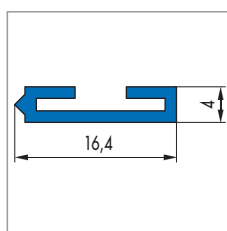
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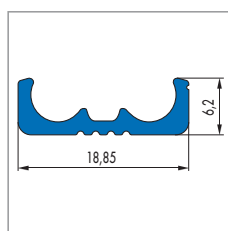
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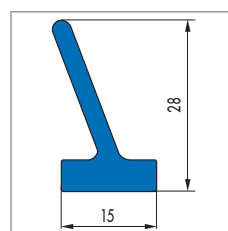
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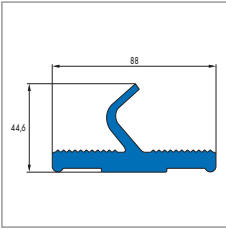
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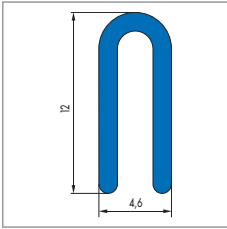
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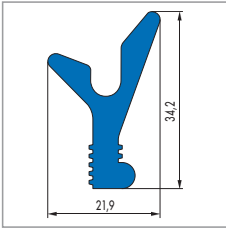
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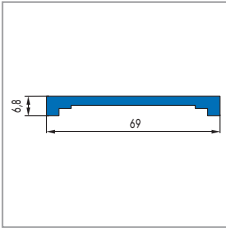
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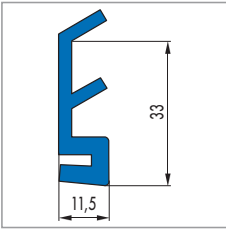
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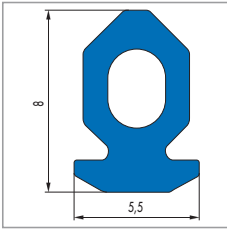
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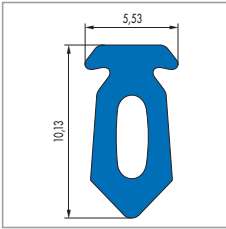
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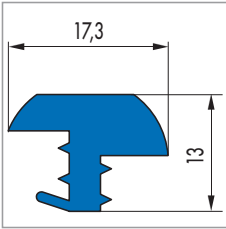
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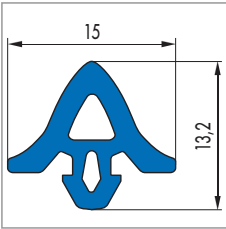
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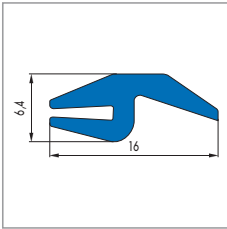
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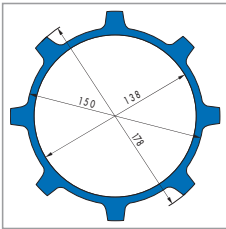
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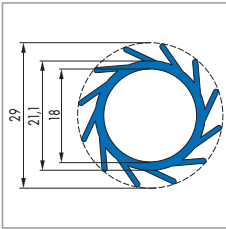
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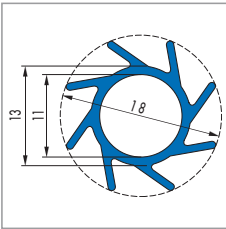
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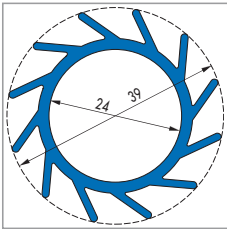
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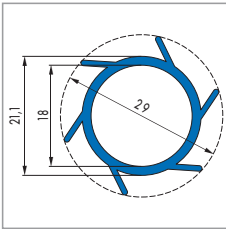
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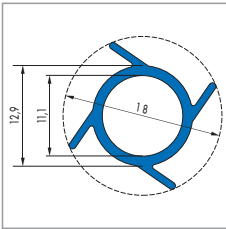
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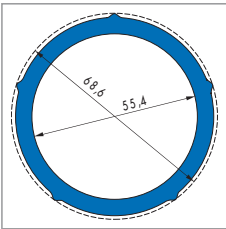
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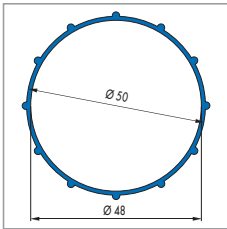
Profile 20181



Profile 20182



Profile 20189



Profile 20325



Cord

The endless, extruded cord with O-ring profile serves as base material for cord rings, among others. These are used, for example, for the sealing of larger flanges or tank lids.

Range

- By the metre:
 - From 1 to 40 mm cord diameter available
- Cord sections:
 - Produced from cord supplied by the metre
 - From 1 to 40 mm cord diameter
 - Up to 2000 mm length without integral bend possible.

Cord rings

Cord rings are extruded cords, which are cut to the appropriate diameter and bonded or vulcanised to butt.

Range

Cord rings are produced from cord supplied by the metre. They are available with a cord diameter from 1 to 40 mm. A two-part adhesive can be used for bonding to butt. NBR and FKM product versions are available ex works with vulcanisation to butt.

Tolerances

The range of tolerances tends towards the negative side as a certain amount of elongation of rings with a large diameter is possible at any time during installation without causing an appreciable tapering of the cross section.

Hoses

Hoses are produced from all standard elastomer materials. Hoses are "mandrel vulcanised", which means that they can be produced with precision tolerances for particular individual applications. They are processed by grinding the outside diameter.

Range

Hoses are supplied in the following designs always in agreement/on enquiry.

- By the metre
 - up to 20 mm hose inside diameter possible
- Hose sections
 - up to 2000 mm length without integral bend possible
- Hose rings
 - produced from hoses supplied by the metre
- Drive belts, press rings, clearer roller covers
 - up to 200 mm hose inside diameter possible.

Hose rings

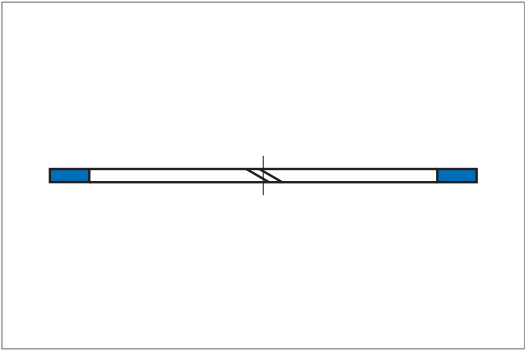
Hose rings are rings punched from the hose and produced as hose by the metre. Hose rings made from precision hoses have absolute sharp inside and outside edges. The inside diameter is smooth and absolutely cylindrical. If necessary, a chamber and/or coloured marking is also possible.

Due to the special manufacturing process, a particularly good compression set is achieved.

Range

Hose rings are available always in agreement/on enquiry with a wall strength from 1 mm and up to an inside diameter of 200 mm.

Back-Up Ring SRA



Back-Up Ring SRA

Product description

Slit bearing component with rectangular cross-section for ISC O-Rings sealing on the outside.

Product advantages

- Enlargement of the operating conditions of O-rings
- High material and product quality
- Wide selection of standard dimensions.

Application

Bearing element to prevent gap extrusion of radial sealing ISC O-Rings used dynamically.

Material

Material	Code
Unfilled PTFE	PTFE00/F52800 or PTFE 177509

Operating conditions

Media	Temperature
All fluids used in hydraulics	-70 ... +260 °C* (only valid for PTFE component)

* according to the O-ring material used

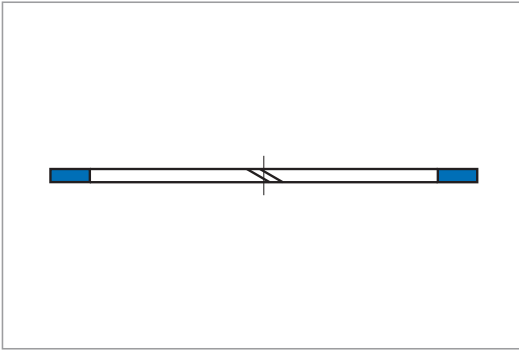
Fitting & installation

The surface finish requirements correspond to the values stipulated.

Gap width: when using PTFE spiral back-up rings, gap widths up to 0,3 mm can be bridged at operating pressures <40 MPa (400 bar).



Back-Up Ring SRI



Back-Up Ring SRI

Material

Material	Code
Unfilled PTFE	PTFE00/F52800 or PTFE 177509

Operating conditions

Media	Temperature
All fluids used in hydraulics	-70 ... +260 °C* (only valid for PTFE component)

* according to the O-ring material used

Product description

Slit bearing component with rectangular cross-section for ISC O-Rings sealing on the inside.

Product advantages

- Enlargement of the operating conditions of O-rings
- High material and product quality
- Wide selection of standard dimensions.

Application

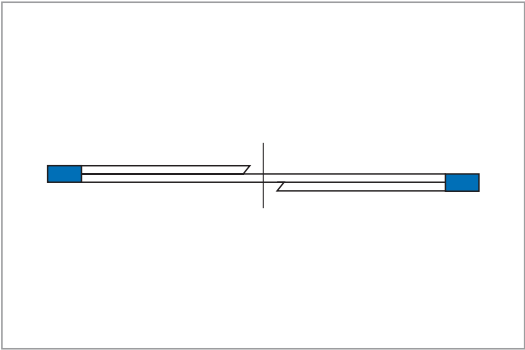
Bearing element to prevent gap extrusion of radial sealing ISC O-rings used dynamically.

Fitting & installation

The surface finish requirements correspond to the values stipulated.

Gap width: when using PTFE spiral back-up rings, gap widths up to 0,3 mm can be bridged at operating pressures <40 MPa (400 bar).

Spiral Back-Up Ring SPR



Spiral Back-Up Ring SPR

Product description

Spiral-shaped split bearing component with rectangular cross section.

Product advantages

- Advantage compared to conventional back-up rings:
- Even in cases where considerable temperature fluctuations occur, i.e. if there is post-shrinkage of the back-up ring, at least one turn of the spiral will be left to support the ISC O-Ring over the gap at any point around the circumference.
 - Also suitable for non-standard diameters, as the ring can be shortened and thus adapted to fit.

Application

Bearing component to prevent gap extrusion of radial sealing ISC O-Rings.

Material

Material	Code
Unfilled PTFE	PTFE00/F52800 or PTFE 177509

Operating conditions

Media	Temperature
All fluids used in hydraulics	-70 ... +260 °C* (only valid for PTFE component)

* according to the O-ring material used

Fitting & installation

The surface finish requirements correspond to the values stipulated.

Gap width: when using PTFE spiral back-up rings, operating pressures ≤ 40 MPa (400 bar) or gap widths up to 0,3 mm can be bridged. Special sizes or special materials are available on enquiry.



Usit Rings U, UA, USF



Usit-Ring U

Product description

Metal gasket with internally (U) or externally (UA) vulcanised, trapezoidal, rubber-elastic sealing bead for static sealing of

- Threaded fittings
- Flange connections
- (USF) with centring diaphragm.

Product advantages

- Easy fitting
- Force-fit connections
- Secure, self-reinforced sealing
- Suitable for high pressures.

Application

Sealing of threaded fittings and flange connections e.g. in mechanical engineering.

Material

Metal ring	Steel SPCC Steel SPCC-1B Stainless steel (SUS 304)
Sealing bead	NBR rubber 72 NBR 99041 FKM rubber 75 FKM 99104 Other materials are available on enquiry from special production.
Surface protection metal ring	SPCC/NBR zinc chrome plated (CR VI free coating) SPCC-1B/NBR zinc chrome plated (CR VI free coating) SPCC/FKM phosphated SPCC-1B/FKM phosphated

Operating conditions

NBR

Media	Mineral oils (as per DIN 51524), hydraulic fluids HFA, HFB, HFC (as per VDMA 24320)
Temperature	-30 ... +100 °C

FKM

Media	Hot air (+250 °C) Mineral oils (as per DIN 51524, +150 °C) Hydraulic fluids (as per VDMA 24320, +150 °C)
Operating pressure	<100 MPa (installation in counter bore) <40 MPa (installation without counter bore for Ø <40 mm; only USF) <25 MPa (installation without counter bore for Ø <40 mm)

Design notes

Installation

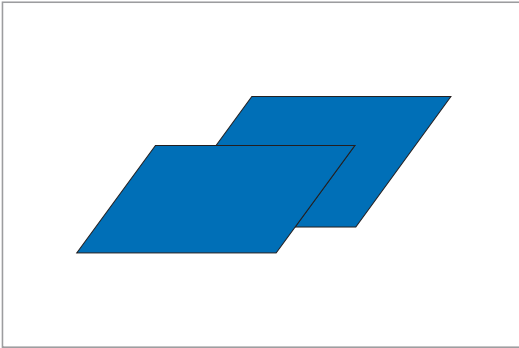
Surface	Flat surfaces	$R_{\max} \leq 15 \mu\text{m}$ $R_a \leq 3 \mu\text{m}$
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Tolerances on finished parts

	D_M	D_M		s
≤ 28	$+0,15/-0,10$	$+0,10/-0,20$	1,0	$+0,08/-0,15$
28 – 50	$+0,20/-0,10$	$+0,10/-0,30$	1,5	$+0,13/-0,20$
> 50	$+0,25/-0,10$	$+0,10/-0,40$	2,0	$+0,13/-0,20$
			3,0	$+0,20/-0,25$
			3,5	$+0,20/-0,30$



Sheets and Rolls



Sheets and Rolls

Product description

Sheets can be manufactured as pure elastomer sheets, as fabric reinforcement, as well as PTFE layers or inserts. In the majority of cases they are further processed to flat diaphragm or other shaped parts.

Product advantages

By means of the selection of elastomer, fabric and PTFE layer, the characteristic properties of the sheets can be individually adjusted to suit the required application.

The fabric sheets for the fabric reinforced sheets include various synthetic fabric types.

For sheets with a PTFE layer or insert, the PTFE layers are available in a thickness between 0,1 mm and 1 mm.

- Elastomer only sheets:
 - pressed smooth on both sides
 - smallest sheet thickness: 0,5 mm

Thinner sheets are possible on enquiry depending on the material.

- Sheets with fabric layer:
 - one side pressed smooth, opposite side fabric
 - smallest sheet thickness: 0,5 mm + fabric thickness
- Sheets with fabric insert
 - pressed smooth on both sides
 - smallest sheet thickness: 2 x 0,5 mm + fabric thickness
- Sheets with PTFE layer
 - one side pressed smooth, opposite side PTFE fabric
 - smallest sheet thickness: 0,5 mm + PTFE layer
- Sheets with PTFE insert
 - pressed smooth on both sides
 - smallest sheet thickness: 2 x 0,5 mm + PTFE thickness.

The surface quality of the rubber surfaces can be changed by grinding or other suitable methods. Sheets are available in other variants on enquiry.

Application

Parts manufactured from sheets are used in almost all sectors of industry, e. g. machine and aircraft manufacture.

Material

All current elastomeric materials are processed by Simrit. The choice depends on the related application.

Operating conditions

Media	depending on the material configuration
Temperature	depending on material between -50 °C and +200 °C
Sheets with fabric layer	are used for increased pressure load on one side
Sheets with fabric insert	are used if there is a raised pressure load on both sides
Sheets with PTFE layer	are used when very high chemical resistance is required, when the surface must be smooth and repel foreign substances, when low coefficients of friction are necessary
Sheets with PTFE insert	are used in special applications

Design notes

Tolerances for sheet goods

Thickness tolerance of pressed sheets

Material	Sheets 300 x 300 mm Sheets 350 x 350 mm		Sheets 500 x 500 mm Sheets 490 x 490 mm	
	without fabric	with fabric and/ or PTFE layer	without fabric	with fabric and/ or PTFE layer
NBR, SBR, CR, VMQ, FVMQ	±0,10	±0,15	±0,15	±0,20
EBDM, HNBR, FKM	±0,15	±0,20	±0,20	±0,25

Material	Sheets 200 x 200 mm	
	without fabric	with fabric and/or PTFE layer
Simriz	±0,10	not available

Thickness tolerance for continuously manufactured rolls

Thickness [mm]	Both sides smooth	One side ground	With fabric layer	With fabric insert	With PTFE layer
0,5 bis 2,0	±0,15	±0,10			
>1,0 bis 3,0			±0,25	±0,25	±0,25
>2,0 bis 3,0	±0,20	±0,15			



Range

Manufacture and sheet dimensions

Moulded sheets can be supplied in the sizes

- 200 x 200 mm (Simriz)
- 300 x 300 mm
- 350 x 350 mm
- 490 x 490 mm
- 500 x 500 mm

available in the thickness 0,5 to 6 mm in graduations of 0,1 mm.

	Thickness [mm]
Pure elastomer sheets	0,5 – 6
Sheets with fabric layer	0,8* – 6
Sheets with fabric insert	1,2* – 6
Sheets with PTFE layer	0,8* – 6

* Minimum thickness depending on fabric and PTFE layer thickness

Manufacture of rolls

Continuous production is possible for

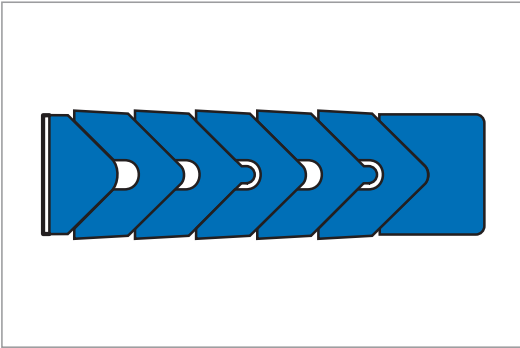
- Order quantities >30 m
- Roll width up to 500 mm
- Roll thickness up to 3 mm.

For Shore hardness below 50, grinding is only possible in special cases.

When sheets are ground or shot blasted, the surface quality is heavily dependent on Shore hardness and on the base material.

Sheets and Rolls are not held in stock.

Chevron Seal Set made of PTFE



Chevron Seal Set made of PTFE

Application

- Chemistry
- Pharmaceuticals
- Measuring and control systems
- General mechanical engineering
- Foodstuffs industry
- Iron and steel industry e.g. regulation and shut-off valves, plunger pumps, metering systems, agitators, hydraulic cylinders, rotary joints.

Materials

- PTFE/PTFE compound
- PTFE impregnated plastic fabric.

Product description

- Proven sealing systems for piston rods, plungers, spindles and slowly rotating shafts
- Sets consisting of pressure ring, chevron seals, back-up ring
- The number of chevron seals in a sealing set depends on the pressure and temperature in the operating range.

Product advantages

- Universal chemical resistance
- High temperature resistance
- Very high resistance to pressure
- Good sliding and lubricating properties
- High wear resistance and dimensional stability
- Very high protection against extrusion.



Operating conditions

Material	PTFE/PTFE compound	PTFE impregnated fabric
Pressure	30 MPa	70 MPa
Linear velocity		
– Continuous operation	0,5 m/s	0,5 m/s
– Intermittent operation	1,2 m/s	0,8 m/s
Temperature	–200 ... +260 °C	–200 ... +260 °C

All operating parameters given are maximum values. Simultaneously occurring maximum loads may require design measures in some circumstances. Please consult our technical advisory service.

Design notes

The dimensions of the housings are given in the lists of dimensions. The housing and the rod or shaft should have lead-in chamfers so that the sealing edges of the seals are not damaged during fitting. The fits and surface qualities of the metal parts as well as the guide affect the function and service life of the seal sets.

Tolerances

Plunger Ø d	Recommended fit	Housing Ø D
... 80	H9/f8	H8
>80 ... 120	H8/f8	
>120 ... 200	H8/f7	

Surface quality

Surface roughness	ISO roughness parameter	Mean roughness R _a
Contact area	4	0,2
Housing outside Ø	6 *	0,8
Housing front faces	8	3,2

Minimum requirement

Fitting notes

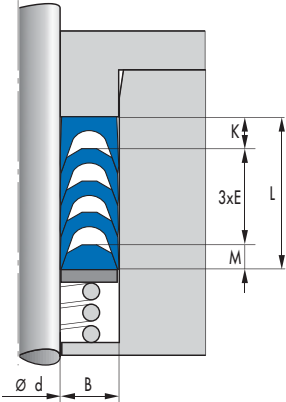
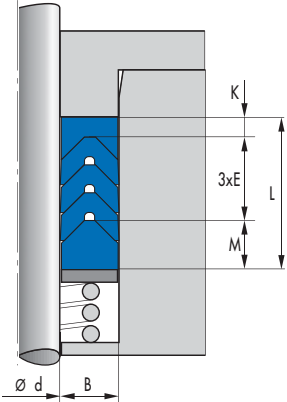
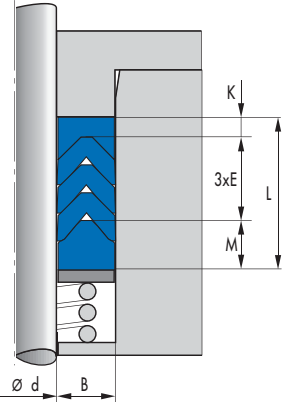
Chevron seal sets made of PTFE

PTFE chevron seals have relatively high thermal expansion. The seal set must therefore be elastically retained under load by a spring component. The spring force depends on the type and dimensions of the seal profile. For the profile 9409 a pre-load of 0,2 N/mm² is necessary. For the profiles 9403 and 9406 the pre-load from the spring must be 0,8 N/mm², also for smaller dimensions beyond this figure. The information on the spring forces apply for standard applications.

PTFE impregnated fabric Chevron Seal Set

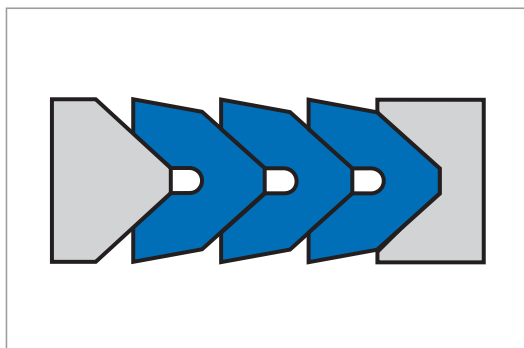
These sets are intended for adjustable housings. As a rule the seal sets are installed without additional spring components.

Recommended Dimensions of the Chevron Seal Sets made of pure PTFE and PTFE Compound

Profile 9409 (single seal)					Profile 9403 (single seal)						Profile 9406 (single seal)						
																	
Article list				0971				0987	0986	0985				0980	0979	0978	0977
B	E	K	M _{min}	L*	E	K	M _{min}	L*			E	K	M _{min}	L*			
				3				3	4	5				2	3	4	5
4	2,7	2,7	4	15	2,4	2,4	3,5	14	16	18	2,6	2,4	3,5	12	14	17	19
5	3,4	3,4	4,6	19	3	2,4	4	16	19	22	3,3	3	4	14	17	21	24
6	4,1	4,1	5	22	3,5	3,5	4,4	19	22	26	3,9	3,5	4,4	16	20	24	28
7,5	5,1	5,1	5,6	26	4	4	5,1	22	26	30	4,9	4	5,1	19	24	29	34
10	6,8	6,8	7	35	5	5	6,1	27	32	37	6,5	5	6,1	25	31	38	44
12,5	8,5	8,5	8,2	43	6	6	7,2	32	38	44	8,1	6	7,2	30	38	46	54
15	10,2	10,2	9,7	51	7,5	7,5	8,1	39	46	54	9,8	7,5	8,1	36	45	55	65

* for number of seals.

Packing Ring TFW made of PTFE



Merkel Packing Ring TFW made of PTFE

Product description

V-shape sealing ring made of PTFE for making up packings, comprising:

- 1 saddle ring TFS
- 3 to 5 angled rings TFW
- 1 mating ring TFG.

Application

Packing rings TFW feature very good chemical and thermal resistance, low friction and favourable break-away forces even after long periods of down-time.

Packing rings TFW are suitable for axially operated valve spindles, rods and plungers, as well as slowly turning shafts

Material

Saddle ring	Angled ring	Mating ring
PTFE on request Metal (customer solution)	PTFE 15/F52902 (graphite-filled PTFE)	PTFE on request Metal (customer solution)

Operating conditions

Pressure	Temperature
31,5 MPa	-200 ... +220 °C

Running speed	on axial movement	on rotary movement
Continuous operation	approx. 0,5 m/s	approx. 0,2 m/s
Intermittent operation	approx. 1,5 m/s	approx. 0,4 m/s

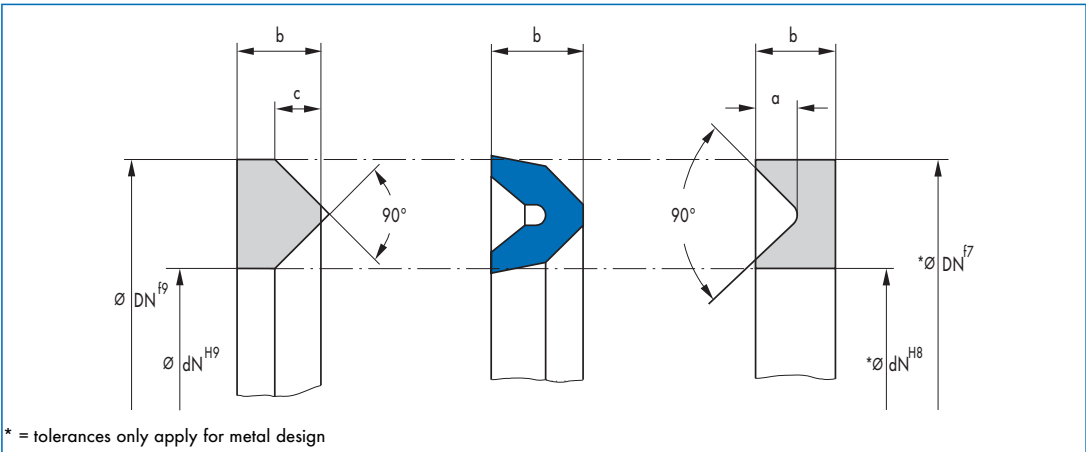
Fitting & installation

With fluctuating operating temperatures or when sealing a rotating shaft, the packing is to be pre-loaded with 1,5 to 2 N/mm² on the pressure side using a spring. If the spring must be installed on the non-

pressurised side then its pre-load is to be matched to the maximum pressure that occurs. If metal saddle and mating rings are manufactured by the customer, the dimensions are to be taken from the table. The number of PTFE angled rings depends on the pressure of the medium

$p \leq 3 \text{ MPa}$	$p > 3 \dots 10 \text{ MPa}$	$p > 10 \text{ MPa}$
3 TFW	4 TFW	5 TFW

List of dimensions



Ø Difference DN-dN	Mating ring TFG ¹⁾		Angled ring TFW	Saddle ring TFS ¹⁾		Packing height	
	b	a	b	b	c	b ₁ ²⁾	Δh ³⁾
8	4	1,4	3,8	4	1,7	15,3	2,9
10	4,5	1,8	4,8	4,5	2,1	17,8	3,6
12	5	2,1	5,8	5	2,5	20,3	4,2
15	6	2,6	7	6	3,1	23,5	4,7
20	7,5	3,4	9,3	7,5	4,3	29,6	6
25	9	4,5	11,2	9	5,4	33,7	6,8
30	10,5	5,5	13	10,5	6,3	38,4	7,7

¹⁾ TFS/TFG available on request

²⁾ Height with 3 TFW

³⁾ Height increase for each additional angled ring TFW

Merkel Grafiflex® 6501

Product description

Merkel Grafiflex is characterised by the highest level of chemical resistance and temperature resistance as well as an excellent sealing effect and persistent elasticity. Regardless of temperature cycle, there is no cold flow, shrinkage or ageing of the material. Merkel Grafiflex meets the purity requirements for seals in nuclear power station valves (content of soluble chlorides <20 ppm).

Merkel Grafiflex rings

Compression moulded Merkel Grafiflex rings are supplied with a density between 1,4 and 1,85 g/cm³.

Merkel Grafiflex Strip

Merkel Grafiflex Strip with crosshatch surface pattern is used to make rings in the event of repairs. The Grafiflex material is approved for use with gaseous oxygen, drinking water and for the food processing industry.

Like Grafiflex 6509, it is also available with corrosion inhibitor. For reworked valves with large gap dimensions, the use of Merkel Grafiflex with Merkel Carbo-steam 6550 endrings is recommended.

Product advantages

- Very high temperature and chemical resistance
- Excellent sealing effect and constant elasticity
- Fast delivery times without additional tool costs.

Application

Valves.

Operating conditions

Operating pressure	Temperature	pH value
1000 bar	-200 ... +450 °C ¹⁾	0 ... 14
	-200 ... +700 °C ²⁾	
	-200 ... +2500 °C ³⁾	

¹⁾ the majority of media and air

²⁾ steam

³⁾ inert gas

Media

Hot water, feed water, steam, heat transfer oil, hydro-carbons and many other media. Exceptions: strongly oxidising media.

Merkel Grafiflex®-Cover Seal

Product description

Merkel Grafiflex cover seals are supplied as pre-pressed rings and are proven in self-sealing covers, e.g. in large valves and in high-pressure water pre-heaters.

Product advantages

Merkel Grafiflex stays elastic even with continually varying temperature and pressure up to 200 N/mm² surface pressure. It correctly bridges gap widths on large, self-sealing covers up 0,3 mm. Larger gaps are controlled by Merkel Grafiflex using springs made of material 1.4571 integrated into the corners of the packing rings by pressing.



Application

Valves.

Operating conditions

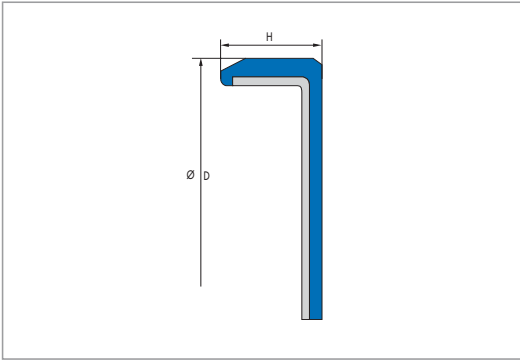
Operating pressure	Temperature	pH value
1000 bar	-200 ... +550 °C ¹⁾	0 ... 14
	-200 ... +700 °C ²⁾	
	-200 ... +2500 °C ³⁾	

¹⁾ the majority of media and air

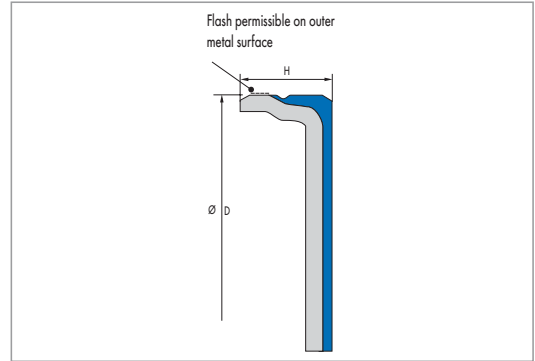
²⁾ steam

³⁾ inert gas

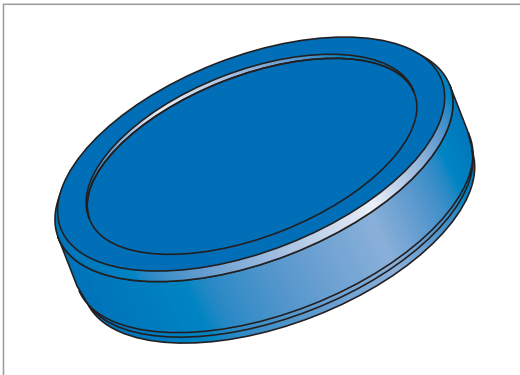
Sealing Cover GA, GSA



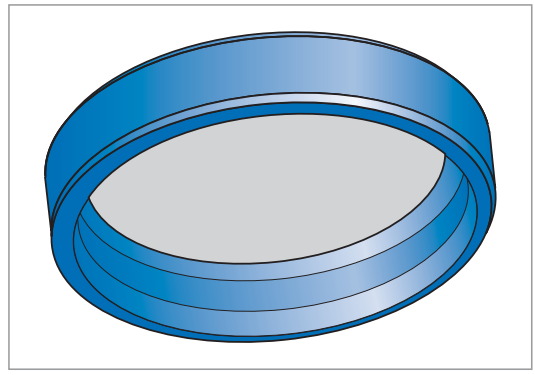
Sealing Cover GA



Sealing Cover GSA



Sealing Cover GA – Top view



Sealing Cover GA – Bottom view

Product description

- GA (normal design, rubber outside): sealing cover with vulcanised metal inserts made of sheet steel
- GSA (special design, rubber/steel outside): sealing cover with vulcanised metal inserts made of sheet steel with metal seat (H8).

Product advantages

- Secure sealing to the housing bore, even with increased roughness of the bore, higher thermal expansion and split housings
- Very stable construction
- Can be painted
- Variety of standard versions.

Application

Sealing cover for the static sealing of boreholes in housings with press fitting e.g. shaft pass through walls in gearbox housings.

Material

Acrylonitrile-butadiene rubber

Designation	75 NBR 99004
Colour	Black
Hardness	approx. 75 Shore A
Metal insert	unalloyed steel DIN EN 10139 (DIN 1624)

Sealing covers made of other materials and in other dimensions available on enquiry.

Operating conditions

Media	All common mineral oils
Temperature	-40 ... +100 °C



Fitting & installation

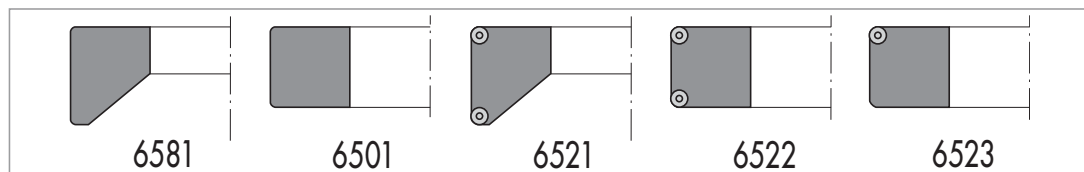

Design of locating bore

Tolerance	ISO H8
Roughness type GA	$R_{\max} \leq 25 \mu\text{m}$ $R_a = 1,6 \dots 6,3 \mu\text{m}$ $R_z = 10 \dots 25 \mu\text{m}$
Roughness type GSA	$R_{\max} \leq 16 \mu\text{m}$ $R_a = 0,8 \dots 3,2 \mu\text{m}$ $R_z = 6,3 \dots 16 \mu\text{m}$

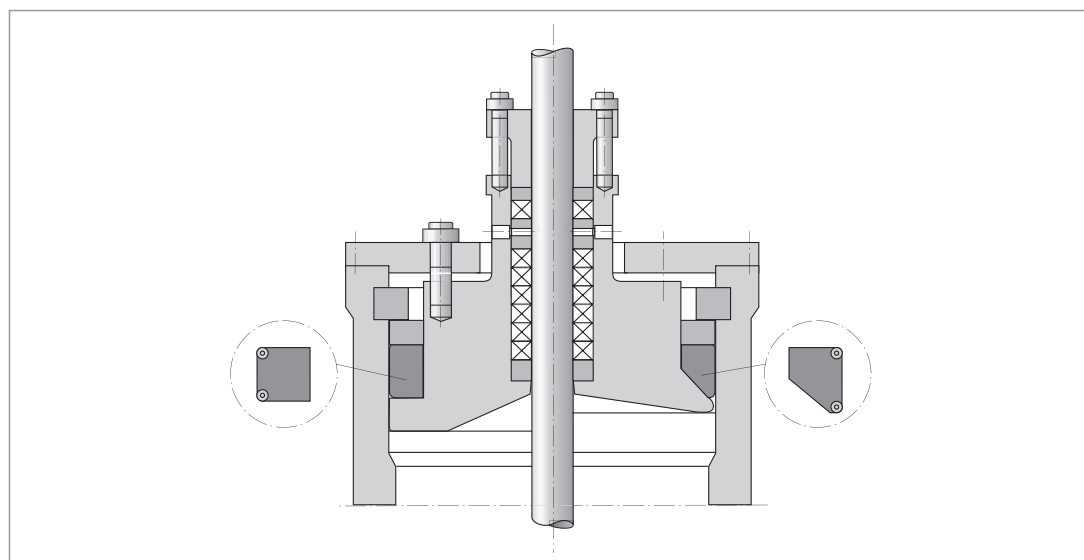
Media

Hot water, feed water, steam, heat transfer oil, hydro-carbons and many other media.

Exceptions: strongly oxidising media.

Ø D	B	S _(centr)
350	20	0,8
350	>20	1,2
>350	20	0,8
>350	25	1,2
>350	>25	1,5



Merkel Flex-O-Form S

Product description

Seal according to DIN 28091-TF-Z-O.

Merkel Gasket Flex-O-Form S, a modified, light PTFE material with low content of a mineral filler, is used in chemically and thermally critical cases on flange and pipe connections.

Product advantages

- Best sealing values even with temperature change
- Good adaptability even on very rough sealing surfaces
- High chemical resistance (low filler content)
- High thermal resistance
- Good resetting ability
- Anti-adhesive
- Good sealing effect even at surface pressure beyond 12 N/mm² due to the homogeneity of the material.

Operating conditions

Seal characteristics according to DIN 28091, Part 3

Characteristic values	Value
Density	2,2 g/cm ³
Cold buckling value E KSW	12,6%
Cold resilience value E KRW	3,8%
Warm settling value E WSW	46,2%
Thermal resilience value E WRW	8,4%
Resilience R	0,159 mm
Spec. leak rate 8 λ	<10 ... 4 mg/s

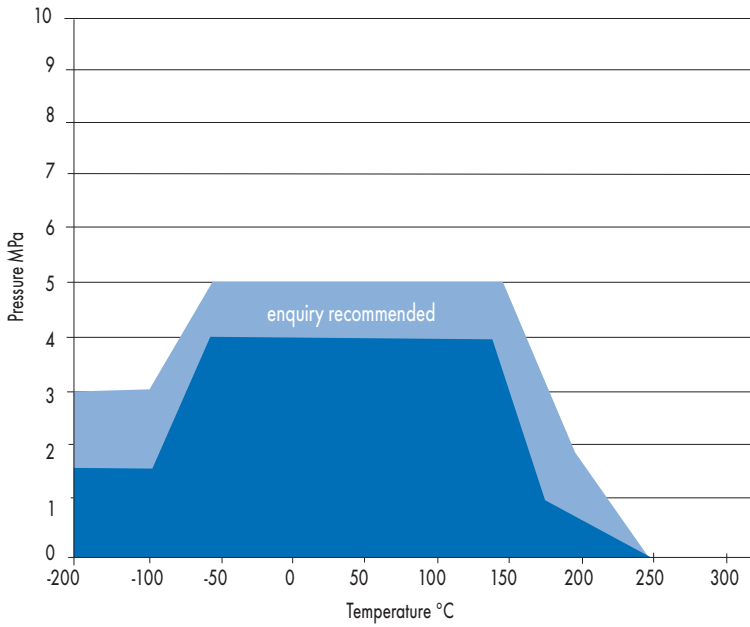
Application

Flanges, pipe connections and boilers in the chemicals industry, foodstuffs industry, plant engineering and armament manufacture, tower cover seals, gauge-glass fittings.

Material

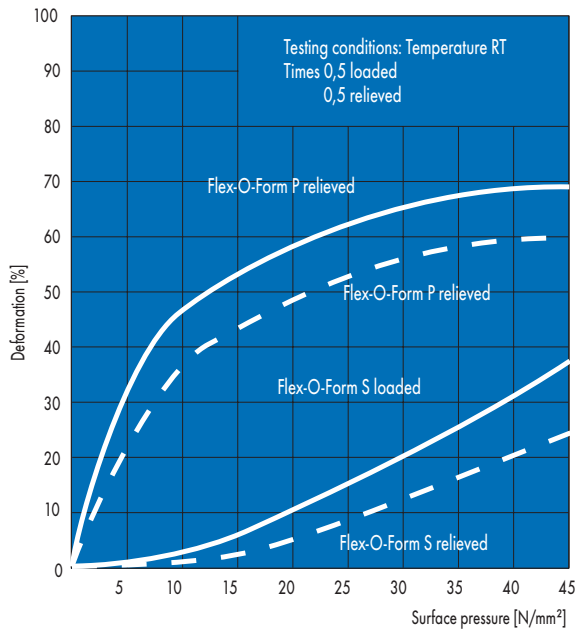
Material	PTFE
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Design notes

Deformation and resetting ability



Merkel Flex-O-Form S is suitable for a separating processing through jet cutting up to 3 mm plate thickness.

Merkel Flex-O-Form P

Product description

Seal according to DIN 28091-TF-C-O.

Merkel Flex-O-Form P, a modified, dark grey PTFE material with a low degree of a special graphite as filler is used in chemically and thermally critical cases on flange and pipe connections as well as housings and as frame seal.

Product advantages

- Very good adaptability on uneven surfaces and flanges
- High compressibility and pressure resistance
- Good resetting ability
- Best sealing values even with temperature change
- High chemical resistance (low filler content)
- High thermal resistance
- Anti-adhesive
- Electroconductive.

Operating conditions

Seal characteristics according to DIN 28091, Part 3

Characteristic values	Value
Density	1,2 g/cm ³
Cold buckling value E KSW	57%
Cold resilience value E KRW	4,1%
Warm settling value E WSW	15,2%
Thermal resilience value E WRW	3,0%
Resilience R	0,064 mm
Spec. leak rate λ	<10 ... 4 mg/s m

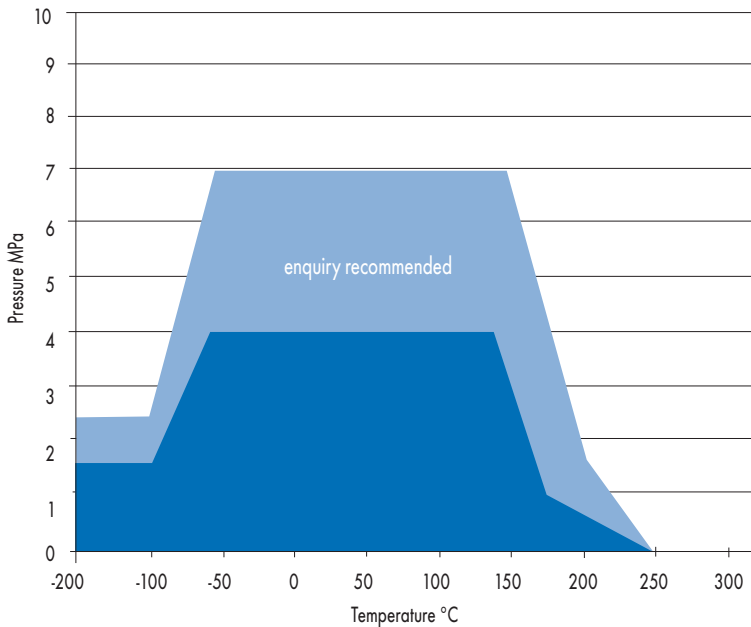
Application

Flanges, pipe connections, boilers and large heat exchangers (Ø >2 m) in the chemicals industry, plant engineering and armament manufacture, glass seals of lamps in industrial ovens, valves on tank cars.

Material

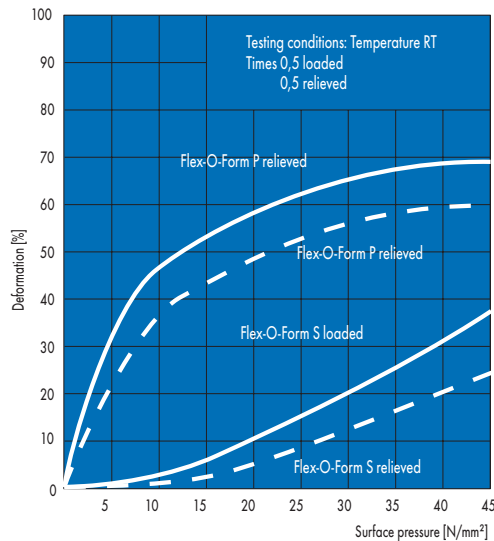
Material	PTFE
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Design notes

Deformation and resetting ability



Merkel Flex-O-Form P has a very good adaptability. It has a good resetting ability (difference between full and dotted line) after a strong deformation of the seal. Merkel Flex-O-Form P is suitable for a separating processing through jet cutting up to 4 mm plate thickness.

Merkel Flex-O-Dit

Product description

Merkel Flex-O-Dit is a durable, resistant flat gasket strip from the roll.
It consists of 100% PTFE and is manufactured in a special process by forming of the fibre structure.

Product advantages

- High chemical and thermal resistance
- Good plastic deformability
- Great adaptability to surface structures
- High pressure resistance

- No cold flow
- Self-adhesive and manageable
- Cost-effective stockkeeping.

Application

Flanges, covers, housing connections, pipes, special valves.

Material

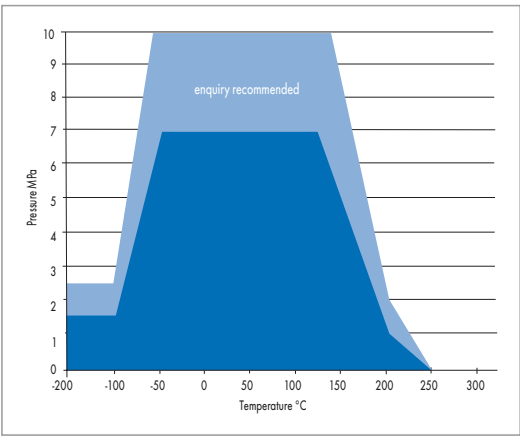
Material	PTFE
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Operating conditions

Media	Pressure	Temperature	pH value
All media, Exceptions: molten alkali metals, elementary fluorine	20 MPa*	Oil hydraulics -240 ... +260 °C	0 ... 1

* depending on temperature and installation conditions



Fitting & installation

The sealing surfaces must be clean, grease-free and dry. The width of the sealing strip is to be determined according to the flange nominal maxima. Remove the protective film of the adhesive strip for installing. Adhere the sealing strip within the hole circle and press lightly. Place the ends in front of a pin in a crossed overlapped arrangement, not joined to butt. Place only one ring in each case.

Merkel Triboflon

Product description

Merkel Triboflon Sealing and Lubricating Paste is universally applicable and can best be used as fitting aid for threaded connections, in the food processing industry, as lubricant between metal bodies, for sealing of fine threads, valves and other moving parts made of glass, ceramic and metal.

Product advantages

- Very good resistance to ageing
- Universal chemical resistance
- Very good adhesion to metal surfaces
- Not volatilisation
- High viscosity, colourless, odourless, water soluble.

Material

Merkel Triboflon Sealing and Lubricating paste is a mixture of polytetrafluoroethylene (PTFE) and perfluoropolyether (PFPE).

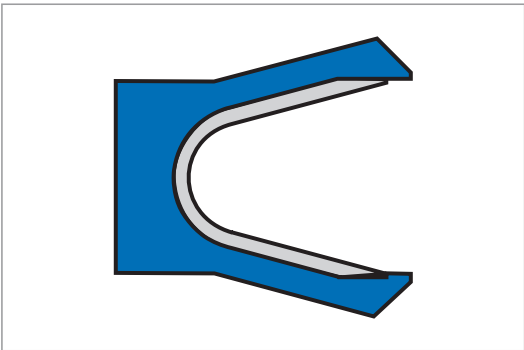
Operating conditions

Media	Temperature
Acids, alkalis, solvents and gases	-30 ... + 300 °C

Fitting notes

Surfaces must be clean and free from grease and oil.
Please request our general fitting notes.

Forseal FOI made of PTFE



Forseal FOI made of PTFE

Product advantages

Axially moving rod seal, interchangeable for O-ring housings (ARP568, MIL-P-5514)

- Extremely media and temperature resistant
- Good dry running properties
- Low static and dynamic friction values.

Application

Hot water valves, accumulators, hydraulic and pneumatic cylinders as well as applications in food processing, medical and chemical technology.



Product description

Single acting, U-ring type PTFE seal with metal tension spring.

Material

Material	Code	Tension spring
Carbon-filled PTFE	PTFE 10/F56110	Standard stainless steel (part no. 1.4310)

Operating conditions

Material	PTFE 10/F56110 + 1.4310
	Temperature range in °C
Hydraulic fluids, oil, water, steam, air, solvents, pharmaceutical goods, foodstuffs or all media that do not attack PTFE and stainless steel	-200 ... +260
Pressure p in MPa	30
Running speed v in m/s	15

Material	PTFE 10/F56110 +spring Hastelloy C276 (Not available ex-works)
	Temperature range in °C
Aggressive acids and alkalis	-200 ... +260
Pressure p in MPa	30
Running speed v in m/s	15

Rotary and pivoting motions possible. No rotation.

Surface quality

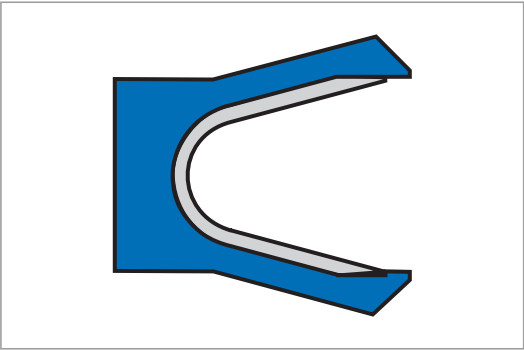
Sealing surfaces	R _a	R _{max}
Lead-in chamfers	≤0,4 µm	0,5 ... 2 µm
Sides of groove	≤1,6 µm	≤10 µm

Design notes

Beside the default dimensions, all special dimensions considering the U-ring profiles are available on request without surcharge for the tool.

Dimensions available from Ø 5 mm (rod) to approx. 2000 mm. In general, installation is only possible in split, axially accessible grooves. Installation in half-open grooves possible in exceptional cases.

Forseal FOA made of PTFE



Forseal FOA aus PTFE

Product advantages

- Axially moving piston seal, interchangeable for O-ring housings (ARP568, MIL-P-5514)
- Extremely resistant to media and temperature
 - Good dry running properties
 - Low static and dynamic friction values.

Application

Hot water valves, accumulators, hydraulic and pneumatic cylinders as well as applications in food processing, medical and chemical technology.

Product description

Single acting, U-ring type PTFE seal with metal tension spring.

Material

Material	Code	Tension spring
PTFE carbon-filled	PTFE 10/F56110	stainless steel (Material No. 1.4310)

Operating conditions

Material	PTFE 10/F56110 + 1.4310
	Temperature range in °C
Hydraulic oils, oil, water, steam, air, solvents, pharmaceutical goods, foodstuffs or all media that do not attack PTFE and stainless steel	-200 ... +260
Pressure p in MPa	30
Running speed v in m/s	15

Material	PTFE 10/F56110 +spring Hastelloy C276 (Not available ex-works)
	Temperature range in °C
Aggressive acids and alkalis	-200 ... +260
Pressure p in MPa	30
Running speed v in m/s	15

Turning-pivoting movements possible. No rotation.

Surface quality

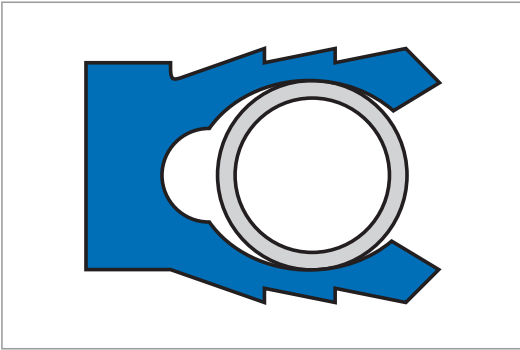
Sealing surfaces	R _a	R _{max}
Lead-in chamfers	≤0,4 µm	0,05 ... 2 µm
Sides of groove	≤1,6 µm	≤10 µm

Design notes

Beside the default dimensions, all special dimensions considering the U-ring profiles are available on request without surcharge for the tool.

Dimensions available from Ø 10 (piston) to approx. 2000 mm. In general, installation is only possible in split, axially accessible grooves. Installation in half-open grooves possible in exceptional cases.

Merkel U-Rings made of PTFE



Merkel U-Rings made of PTFE

Product description

- One-sided with pressure applied to seal
- Metal spring is used as pre-load component for the sealing lips
- System pressure overrides the pre-load during operation.

Product advantages

- Small housing
- Suitable for high pressures and vacuum
- Suitable for stroke, rotary, pivoting movements and for static applications
- Universal chemical resistance
- Large temperature range
- Good dry running properties
- Low friction forces
- Free of stick-slip
- Resistant to ageing
- Permanently elastic due to metal spring.

Application

Fittings manufacture, general chemistry, mechanical engineering, foodstuffs industry, pharmaceuticals, petrochemicals.

- e.g. ball cocks, flanges/covers, rotary joints and manifolds, hot water and steam valves, valve journals, control shafts, reciprocating pumps, bearings.

Material

The mechanical properties such as pressure resistance and resistance to abrasion, thermal expansion etc. can be improved for specific applications through the addition of fillers.

The most important materials are:

- PTFE/carbon
- PTFE/carbon fibre
- PTFE/ glass/MoS₂
- PTFE/ekonol
- PTFE/aramide
- UH MW PE

Spring materials: 1.4310 (AISI 301),
2.4711, elgiloy.



Operating conditions

Material	PTFE
Pressure p^* in MPa	dynamic <45, static <120
Temperature range in °C	-200 ... +260
Sliding speed v in m/s	reciprocating <10, rotating <2,5

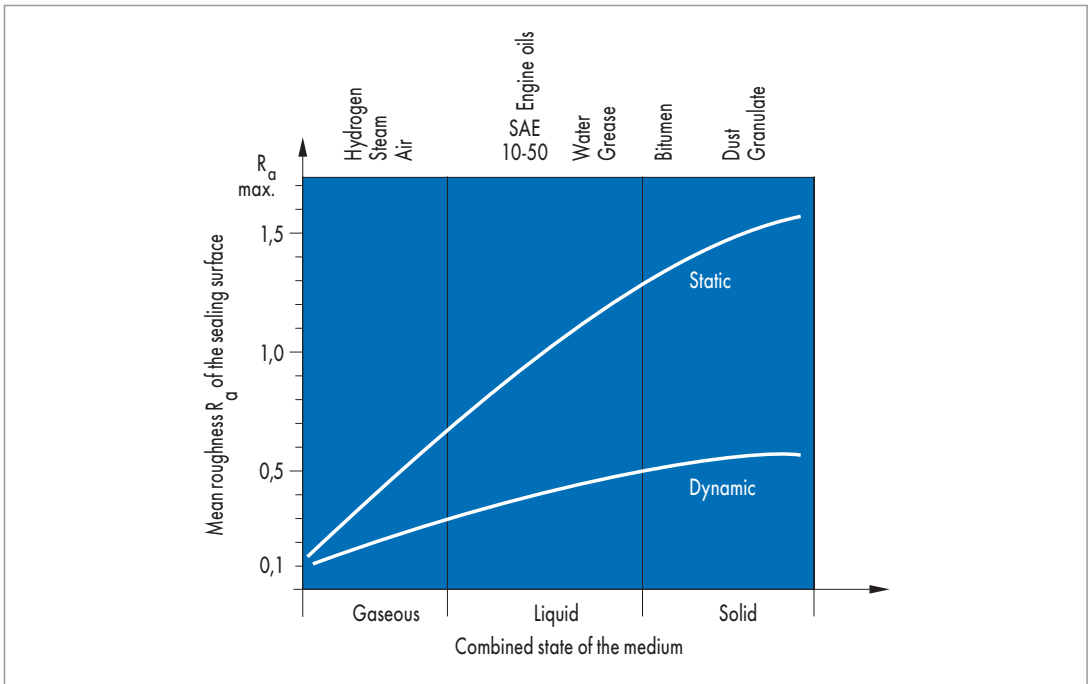
* From 25 MPa the usage of back-up rings can be necessary (depending on gap width, temperature, pressure, material). Also gaps caused by the expansion of the components can make the usage of back-up rings necessary. Please consult our advisory service.

Surface quality

Sealing surfaces, dynamic/static: → Fig.

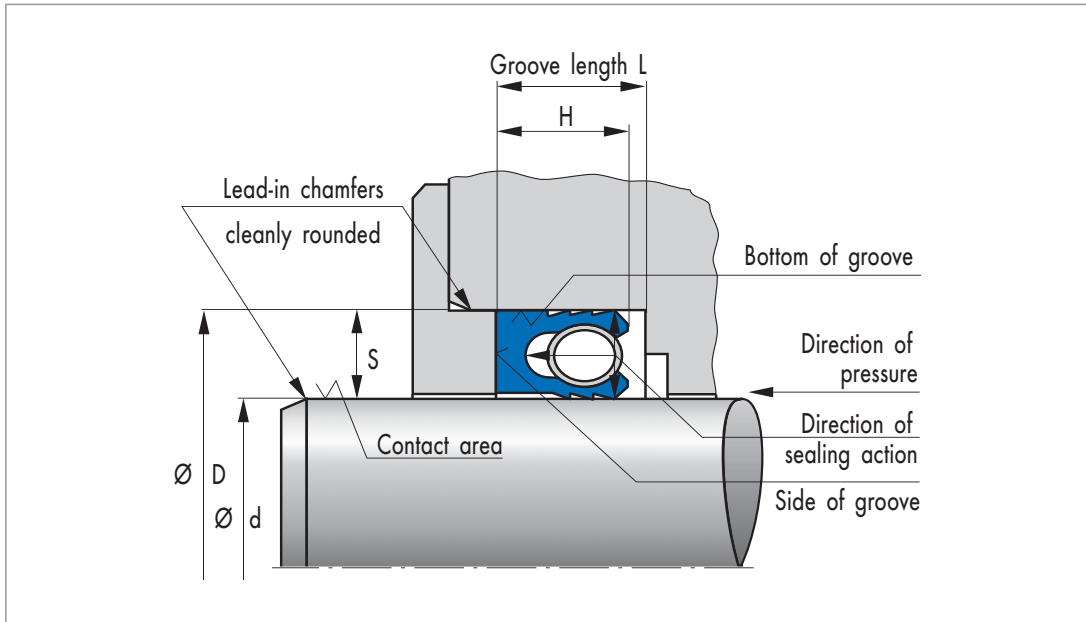
Lead-in chamfers: $R_a < 1,6 \mu\text{m}$

Groove flanks: $R_a < 2,5 \mu\text{m}$



Surface recommendation for sealing surfaces

Fitting & installation



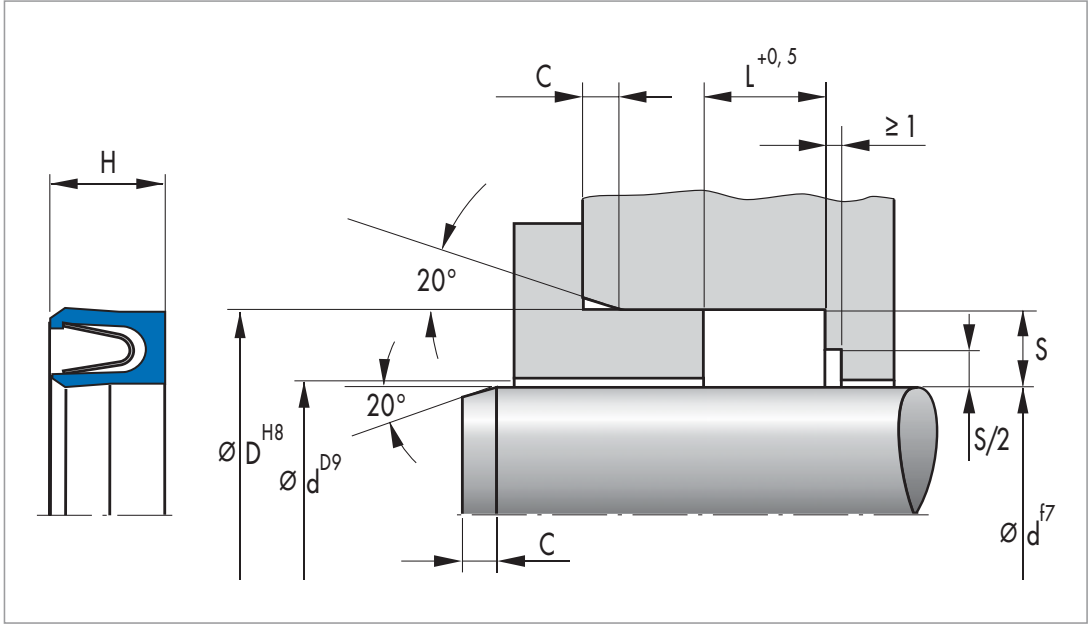
Terms for the housings

Installation preferably in axially accessible grooves.

- If it is necessary to clip or snap, e.g., into half open housings, please consult us
- Provide lead-in chamfers on rods and housings
- Avoid sharp edges
- The housings must be clean and free of foreign bodies.

U-Ring NRVI (Type 9492 with V-shaped spring)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example

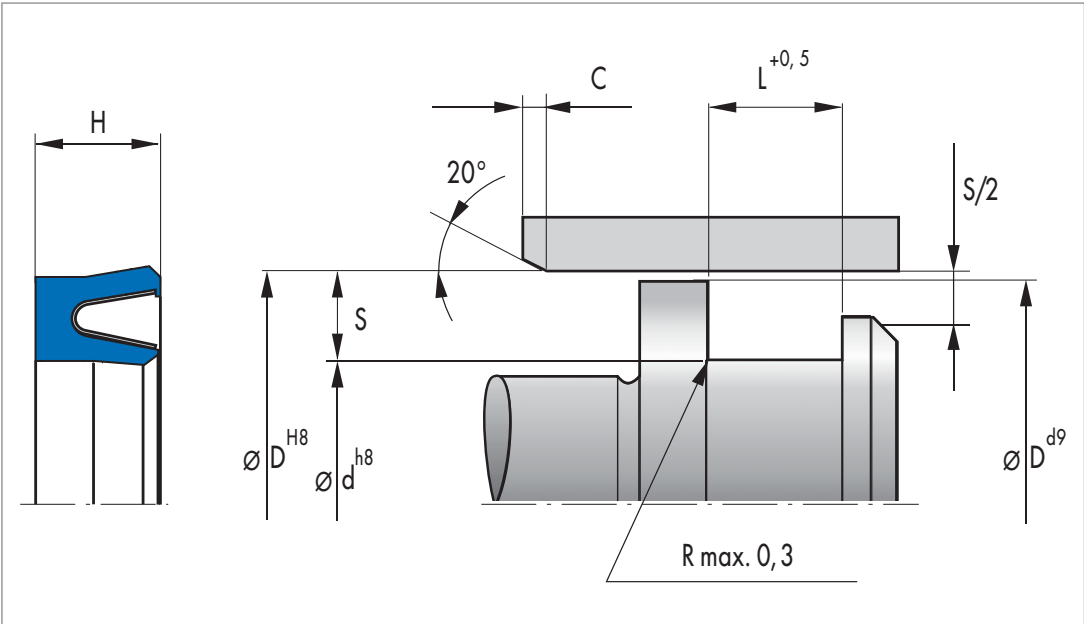
Sizing recommendation

This sizing recommendation is an addition to the article list. It is only used if the article list does not contain a suitable size.

Available dimension range d		S	H	L	C
from	to				
>10	20	2,25	3,10	3,60	>1,0
>20	40	3,10	4,30	4,80	>1,2
>40	150	4,70	6,50	7,10	>1,5
>150	2000	6,10	8,50	9,50	>2,0

U-Ring NRVA (Type 9490 with V-shaped spring)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example

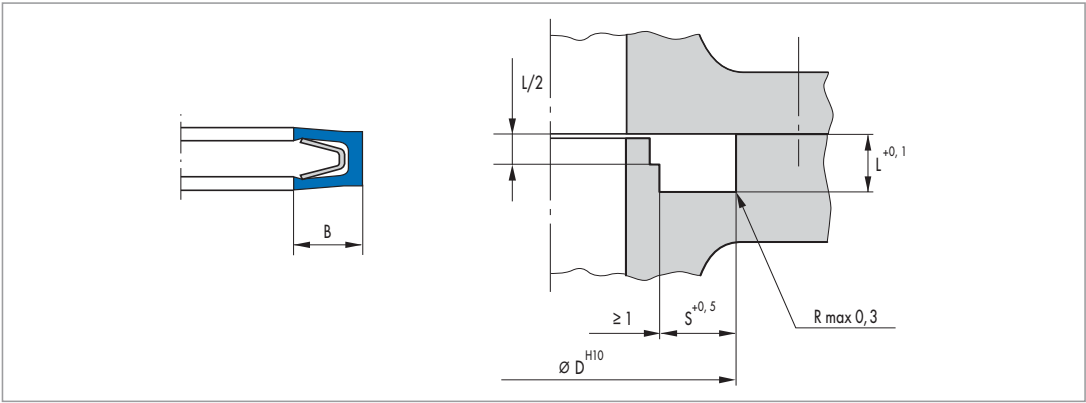
Sizing recommendation

This sizing recommendation is an addition to the article list. It is only used if the article list does not contain a suitable size.

Available dimension range d		S	H	L	C
from	to				
>15	25	2,25	3,10	3,60	≥1,0
>25	45	3,10	4,30	4,80	≥1,2
>45	155	4,70	6,50	7,10	≥1,5
>155	2000	6,10	8,50	9,50	≥2,0

U-Ring NRVFA (Type 9494 with V-shaped spring – external pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



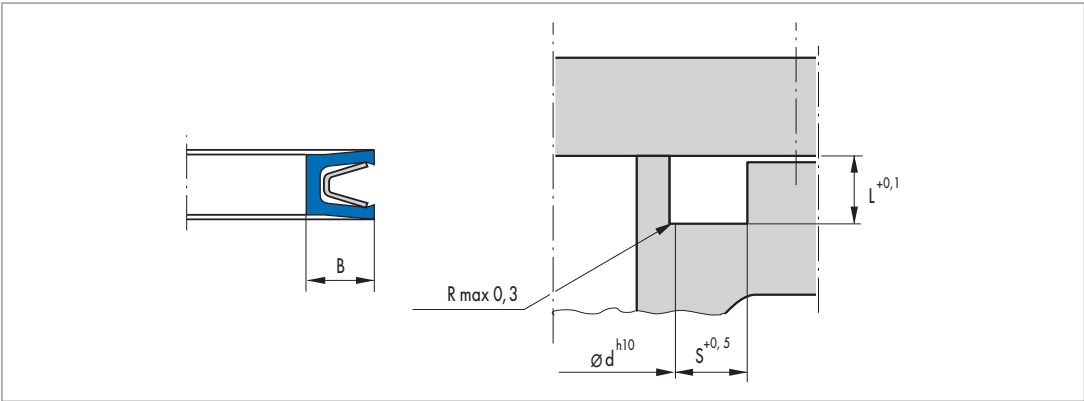
Installation example

Sizing recommendation

Available dimension range d		B	L	S
from	to			
30	150	3,1	2,25	3,6
50	500	4,3	3,10	4,8
70	1000	6,5	4,70	7,1
100	1400	8,5	6,10	9,5

U-Ring NRVFI (Type 9493 with V-shaped spring – internal pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example

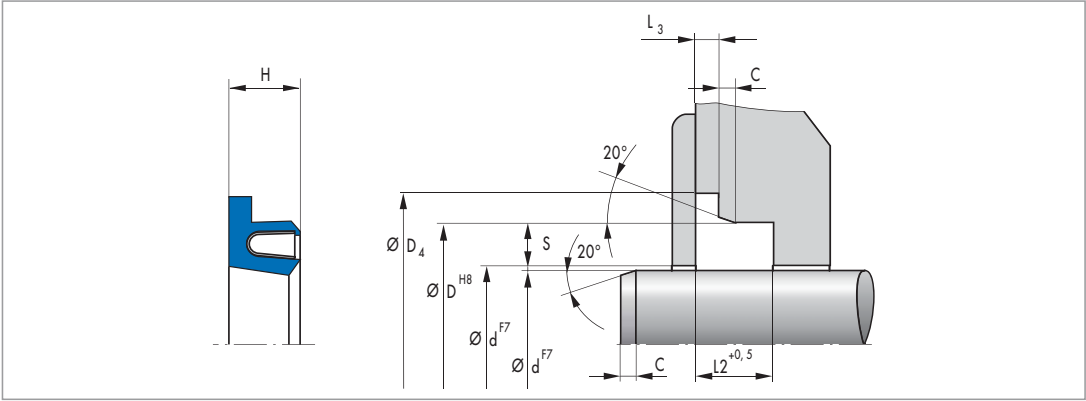


Sizing recommendation

Available dimension range d		B	L	S
from	to			
40	250	3,1	2,25	3,6
50	500	4,3	3,10	4,8
70	1000	6,5	4,70	7,1
100	1400	8,5	6,10	9,5

U-Ring NRVR (Type 9489 with V-shaped spring)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



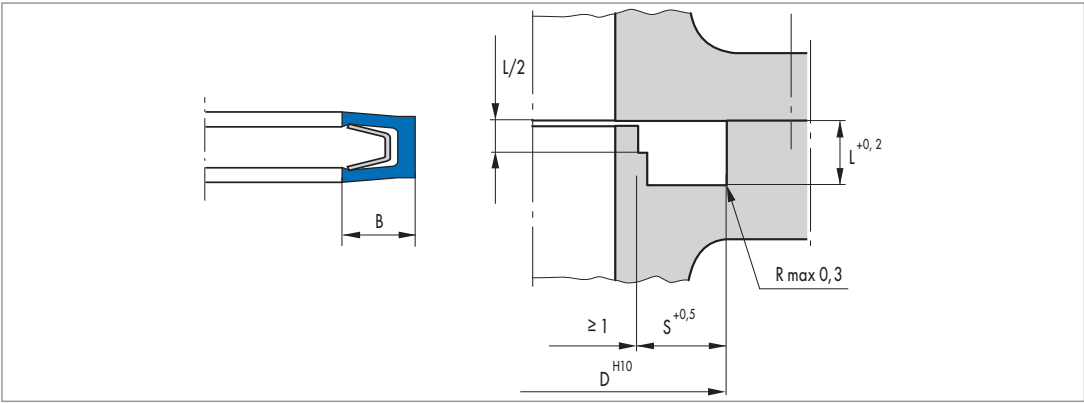
Installation example

Sizing recommendation

Available dimension range d		S	H	D4	L2	L3 - 0,1	C
from	to						
10	20	2,50	3,1	d+9,0+0,15	3,6	0,85	1,0
>20	40	3,50	4,3	d+12,5+0,2	4,8	1,35	1,2
>40	200	5,25	6,5	d+17,5+0,3	1,8	7,80	1,5

U-Ring NRUF1 (Type 9487 with U-shaped spring – internal pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example



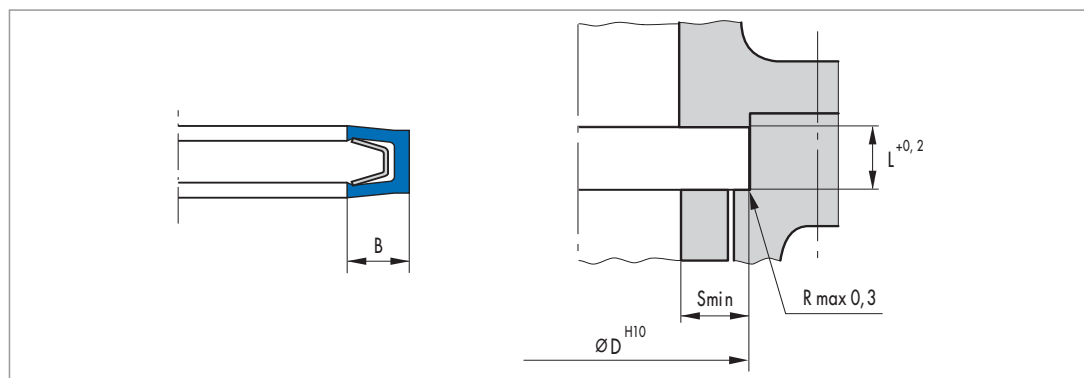
Sizing recommendation

Available dimension range d		B	L*		S
from	to		von	bis	
60	1400	11,5	10,0	13,0	B+0,5
75	1400	14,5	12,0	15,0	B+0,5
100	1400	17,0	14,0	18,0	B+1,0
150	1400	20,0	17,5	21,0	B+1,0

* Use of medium heights are to be used as a matter of preference

U-Ring NRUFA (Type 9486 with U-shaped spring – external pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example

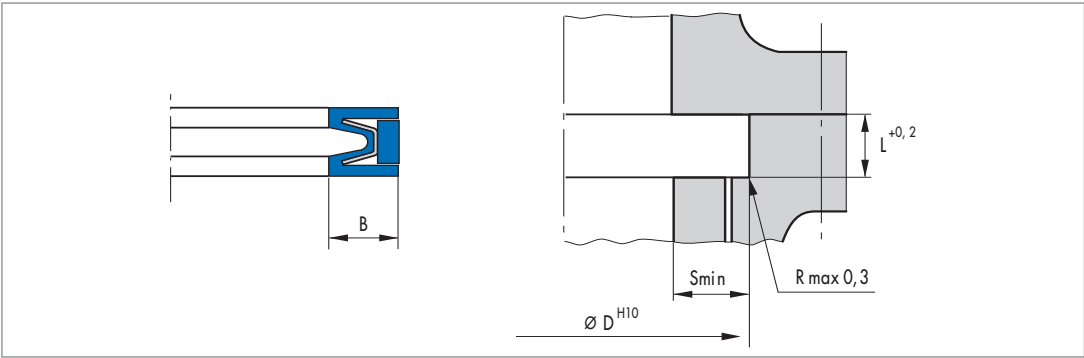
Sizing recommendation

Available dimension range d		B	L*		S
from	to		von	bis	
60	1400	11,5	10,0	13,0	B+0,5
75	1400	14,5	12,0	15,0	B+0,5
100	1400	17,0	14,0	18,0	B+1,0
150	1400	20,0	17,5	21,0	B+1,0

* Use of medium heights are to be used as a matter of preference.

U-Ring NRUF1 (Type 9499 with closed U-shaped spring – internal pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



Installation example

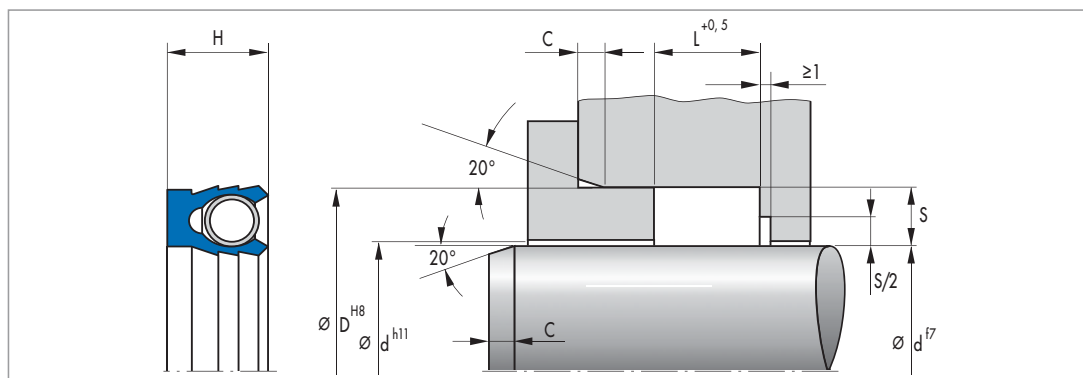
Sizing recommendation

Available dimension range d		B	L*		S
from	to		von	bis	
60	1400	11,5	10,0	13,0	B+0,5
75	1400	14,5	12,0	15,0	B+0,5
100	1400	17,0	14,0	18,0	B+1,0
150	1400	20,0	17,5	21,0	B+1,0

* Use of medium heights are to be used as a matter of preference.

U-Ring NRRI (Type 9442 with round spring)

Standard material	Spring material
PTFE carbon/PTFE glass/MoS ₂	1.4310 (AISI 301)



Installation example

Sizing recommendation

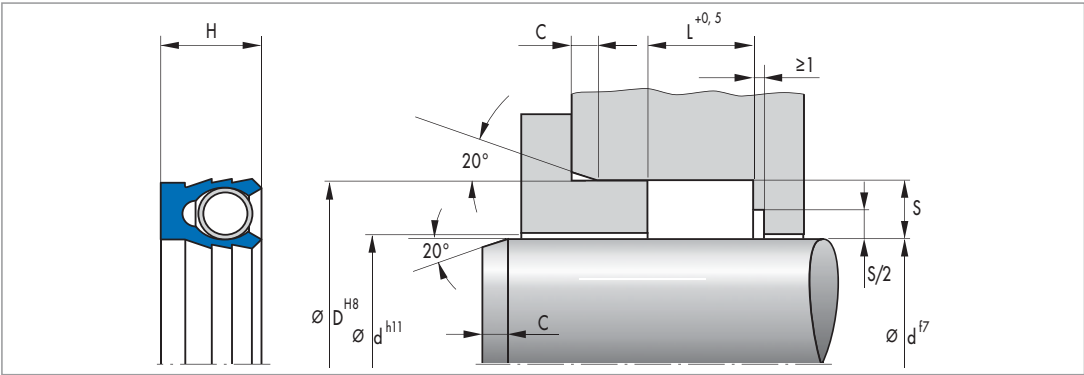
This sizing recommendation is an addition to the article list. It is only used if the article list does not contain a suitable size.

Available dimension range d		S	H	L	C
from	to				
10	70	3,0*	4,2	4,7	>2
12	100	4,0*	5,0	5,5	>2
12	200	5,0*	7,5	8,0	>3
20	300	6,0	8,0	8,5	>3
40	500	7,5	11,0	11,5	>3
50	1000	10,0	15,0	15,5	>4
70	1400	12,5	18,0	18,5	>4
100	1400	15,0	22,5	23,0	>5
100	2000	20,0	30,0	30,5	>6

* for a profile dimension ≤ 5 mm one sealing edge

U-Ring NRRA (Type 9474 with round spring)

Standard material	Spring material
PTFE carbon/PTFE glass/MoS ₂	1.4310 (AISI 301)



Installation example

Sizing recommendation

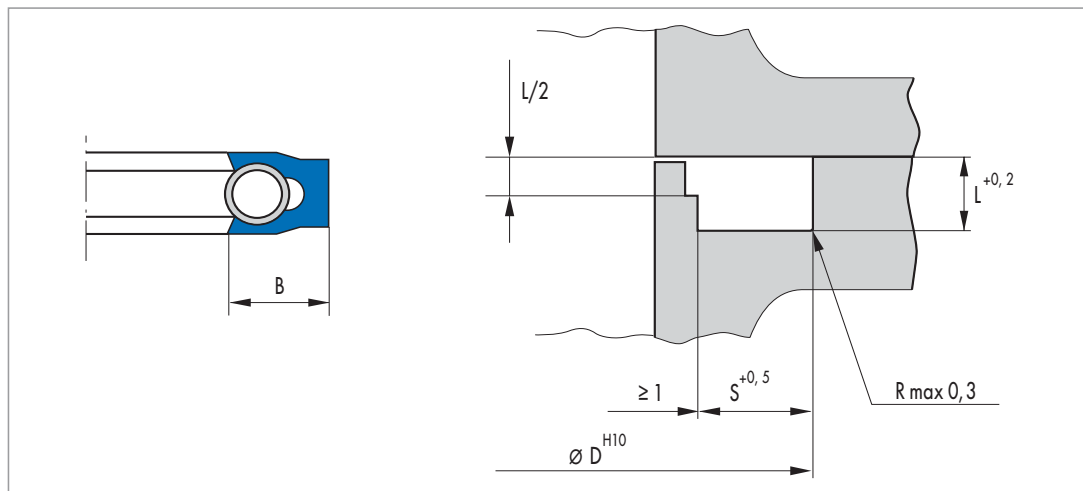
This sizing recommendation is an addition to the article list. It is only used if the article list does not contain a suitable size.

Available dimension range d		S	H	L	C
from	to				
16	70	3,0*	4,2	4,7	>2
23	100	4,0*	5,0	5,5	>2
30	200	5,0*	7,5	8,0	>3
42	300	6,0	8,0	8,5	>3
55	500	7,5	11,0	11,5	>3
70	1000	10,0	15,0	15,5	>4
95	1400	12,5	18,0	18,5	>4
130	1400	15,0	22,5	23,0	>5
140	2000	20,0	30,0	30,5	>6

* for a profile dimension ≤ 5 mm one sealing edge

U-Ring NRRFI (Type 9459 with round spring – internal pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)



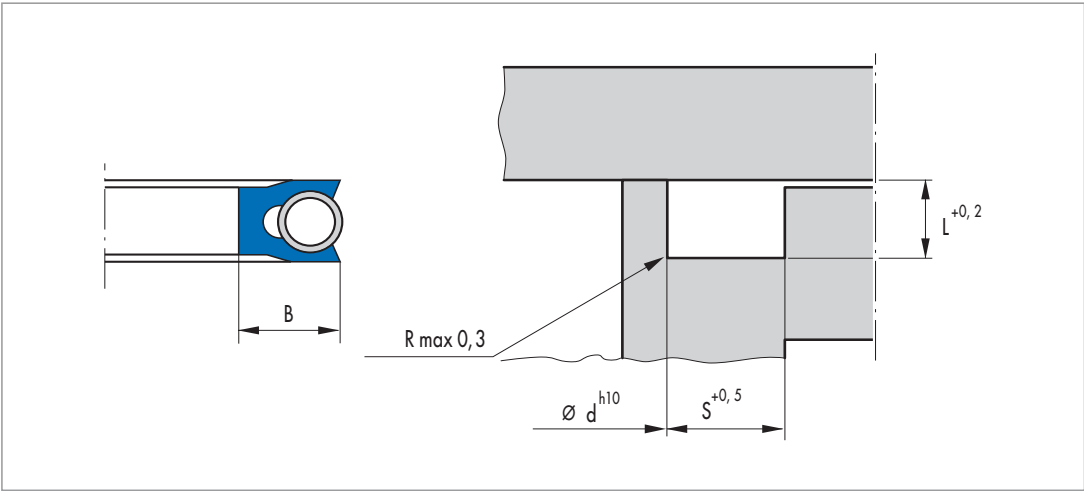
Installation example

Sizing recommendation

Available dimension range d		B	L	S
from	to			
25	70	4,2	3,0	4,7
30	100	5,0	4,0	5,5
50	200	7,5	5,0	8,0
60	300	8,0	6,0	8,5
80	500	11,0	7,5	11,5
100	1000	15,0	10,0	15,5
150	1400	18,0	12,5	18,5
250	1400	22,5	15,0	23,0
500	1400	30,0	20,0	30,5

U-Ring NRRFA (Type 9485 with round spring – external pressure)

Standard material	Spring material
PTFE carbon	1.4310 (AISI 301)

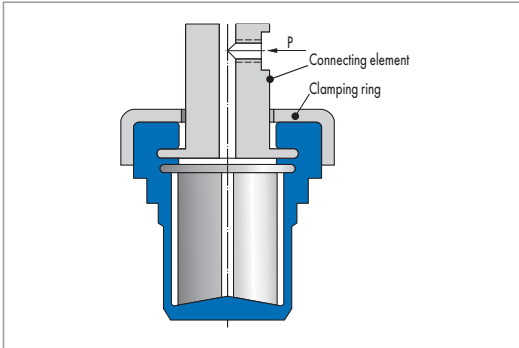


Installation example

Sizing recommendation

Available dimension range d		B	L	S
from	to			
15	70	4,2	3,0	4,7
20	100	5,0	4,0	5,5
35	200	7,5	5,0	8,0
45	300	8,0	6,0	8,5
60	500	11,0	7,5	11,5
70	1000	15,0	10,0	15,5
115	1400	18,0	12,5	18,5
200	1400	22,5	15,0	23,0
440	1400	30,0	20,0	30,5

Grippers GR2



Grippers

Product description

The precision grippers from Simrit are used for extremely sensitive goods.

Product advantages

For the automation in series production, installation and materials/packaging handling equipment, the increased use of systems is required whose individual elements have a great degree of flexibility.

Simrit has developed pneumatic grippers that fulfil the requirements for flexible, universal applicability very well.

- Very easy installation
- Numerous application possibilities
- High product quality.

Application

Pneumatically operated grippers are used in the automation handling technology: for handling of sensitive goods made of ceramic, elastomer, metal in the area of machine coating and installation support.

Material

The grippers are manufactured from wear-resistant elastomers that are adapted to the application requirements like temperature resistance, surface finish for various materials.

Elastomer part

NBR

Operating conditions

Media

Mineral oils and greases, selected acids and bases, aqueous solutions

Temperature range

-30 ... +100 °C

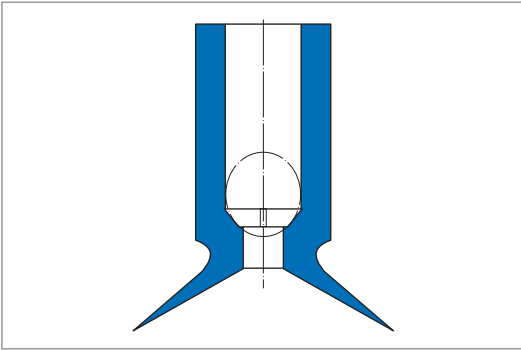
Design notes

The associated tensioning elements are different depending on the application and should therefore be manufactured by the user.

Fitting & installation

The grippers are simply snapped on as connecting element and held in place with a lip ring.

Adherent Suction Caps GR4



Adherent Suction Caps GR4

Product description

Adherent suction caps can be used whenever workpieces have a smooth and airtight gripping surface. Through the geometry of the adherent suction cap, even products with curved surfaces can be gripped. Adherent suction caps remove the need for a vacuum system. Adherent suction caps are only pressed onto the surface. Placing the handled good simply requires a compressed air release impulse on the ball valve. This ensures a quick disconnection of the handled good. Without the ball valve, adherent suction caps can be operated as vacuum suction.

Product advantages

For the automation in series production, installation and materials/packaging handling equipment, the increased use of systems is required whose individual elements have a great degree of flexibility.

Simrit has developed pneumatic suction cups that fulfil the requirements for flexible, universal applicability very well.

- No additional mounting elements required
- Numerous application possibilities
- High product quality.

Application

Pneumatically operated suction cups are used in the automated handling technology: for handling of workpieces with smooth and airtight surfaces.

Material

The suction cups are manufactured from wear-resistant elastomers that are adapted to the application requirements like temperature resistance, surface finish for various materials.

Elastomer part

SBR



Operating conditions

Media	Water, alcohols, selected acids and bases
Temperature range	-30 ... +100 °C

Design notes

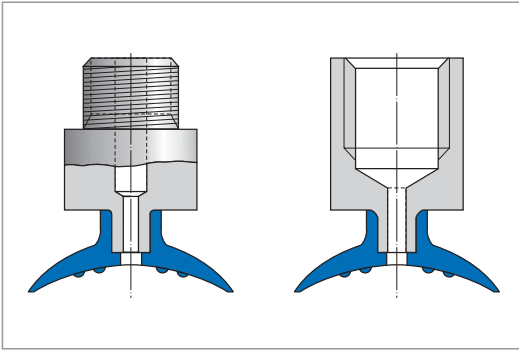
The associated tensioning elements are different depending on the application and should therefore be manufactured by the user.

Fitting & installation

Adherent suction cups require no additional mounting elements:

simply fit onto the pipe with a bead and where necessary, the attachment of a hose clamp.

Vacuum Suction Caps GR4A, GR4J



Vacuum Suction Caps

Product description

Vacuum suction caps, in contrast to adherent suction caps, are supplied with suction via vacuum systems. They are suitable for use on less smooth to "rough" and even porous workpiece gripping surfaces. The retention force is dependent on the surface quality of the handled good and the performance of the vacuum pump. Distribution over multiple suction caps is recommended to increase operational safety.

Product advantages

For the automation in series production, installation and materials/packaging handling equipment, the increased use of systems is required whose individual elements have a great degree of flexibility.

Simrit has developed pneumatic suction caps that fulfil the requirements for flexible, universal applicability very well.

- Vulcanised mounting elements for quick and easy fitting
- Numerous application possibilities
- High product quality.

Application

Pneumatically-operated suction caps are used in automated handling technology.

- Handling of workpieces with smooth and airtight surfaces.

Material

The suction cups are manufactured from wear-resistant elastomers that are adapted to the application requirements like temperature resistance, surface finish for various materials.

Elastomer part	SBR
Connecting element	Steel, vulcanised with inner or outer threads

Operating conditions

Media	Water, alcohols, selected acids and bases
Temperature range	-30 ... +100 °C

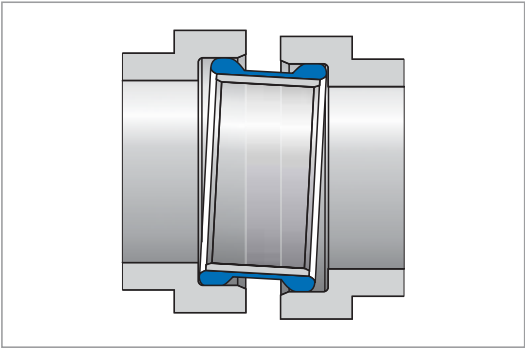
Design notes

The associated tensioning elements are different depending on the application and should therefore be manufactured by the user.

Fitting & installation

Vulcanised mounting elements

Plug & Seal Plug Connections



Plug & Seal Plug Connections

Product description

Plug & Seal Plug Connections are pipe sections with a rubberised outer surface with sealing beads and stop dampers. They are used to establish a tight connection between two housings or units - and for secure transport of media such as oils, water or air. As well as standard design Plug & Seal products, Simrit also offers individual solutions tailored to specific customer applications.

Product advantages

- Reliable sealing even under high pressures
- Simple, secure and cost-effective installation
- Acoustic and mechanical decoupling
- Reduced amount of maintenance through improved durability

- Compensation of middle offset
- Large tolerances in installation permissible
- Lower logistical complexity
- Integration of multiple functions into one component
- Low total costs.

Application

- Water and oil circulation or ventilation systems for combustion engines
- Engine auxiliaries, such as compressors, turbochargers or intake manifolds
- Manual and automatic transmissions
- Valves and pipe systems
- Heating and climate-control systems of plants and buildings.

Material

Tube	Precision steel (min. St 35, phosphatised) Aluminium, plastic on enquiry
Seal	EPDM, FKM rubber AEM, ACM, NBR, HNBR, VMQ on enquiry



Operating conditions

Operating pressure

max. 10 bar

Higher pressures on enquiry.

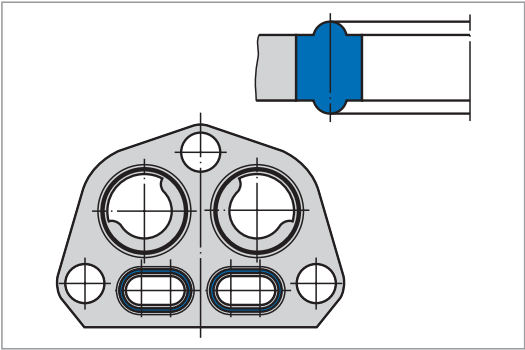
Elastomer	Media	Temperature	Possible Applications
EPDM	Not oil-resistant	-40 ... +140 °C	Cooling water, brake fluid, aqueous media
FKM	Oil-resistant	-10 ... +220 °C	Charge air with oil components, cooling water, fuels such as diesel, biodiesel, petrol
VMQ	Oil-resistant	-40 ... +220 °C	Charge air with oil components, intake air
AEM	Oil-resistant	-25 ... +150 °C	Charge air with oil components, engine oil
ACM	Oil-resistant	-25 ... +150 °C	Engine oil
NBR	Oil-resistant	-30 ... +90 °C	Gear oil
HNBR	Oil-resistant	-30 ... +140 °C	Gear oil, engine oil, diesel fuel

Fitting & installation

Specifications for finish of housing:

- Surface roughness R:
 - Static pressures
 $R_{\max} < 16 \mu\text{m}$,
 - Pulsating pressures
 $R_{\max} < 6 \mu\text{m}$
- Tolerance ISO H8
- Recommended lead-in chamfers:
 - Chamfer min. 20°,
 - Chamfer length (a) ca. 2 mm,
 - Edges free of burrs and rounded
- Depth of housing (t1): $\geq 7 \text{ mm}$
- Max. axial offset by consultation.

Sealing Plates/Rubberised Sheet Seals



Sealing Plates/Rubberised Sheet Seals

Product description

Sealing plates/rubberised sheet seals join multiple, often varying sealing contact areas with each other. In principle, sealing plates consist of a support component (e.g. punched metal plate) with vulcanised sealing lips. Multiple sealing components (e.g. O-rings) are combined in one single component. The support component design guarantees a defined compression of the sealing bead, nearly independently of the tightening torque of the connecting screws.

Product advantages

- Cost reduction of the entire system:
 - Simple and secure installation
 - No grooves are necessary for the installation of seals
 - System simplification through component reduction (amongst others low logistical costs)
 - Automatisatation of the installation possible

- Increased system reliability:
 - Clearly defined seal compression
 - High sealing pressures
 - Simple installation checking possible (seal present/not present)
 - Stiff sealing element (simple, automated installation possible).

Application

Hydraulic systems, engines and gearboxes, auxiliary units

Material

Elastomer part	NBR, EPDM, FKM, HNBR, VMQ
Support component	Aluminium, steel, brass, plastic

Other materials on enquiry.

The support component and elastomer materials must always be selected according to the operating conditions.

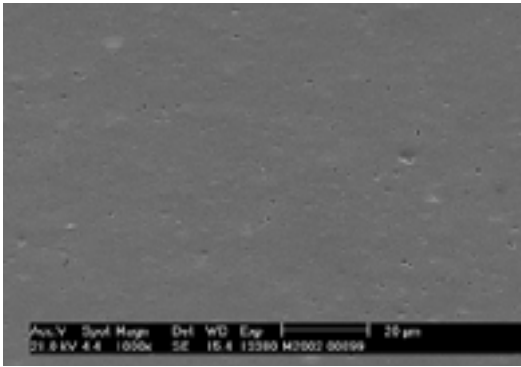
Operating conditions

Media	Hydraulic media, mineral oils, fuels
Temperature	–40 ... +180 °C
Pressure	max. 250 ... 400 bar, in exceptional cases ... 800 bar

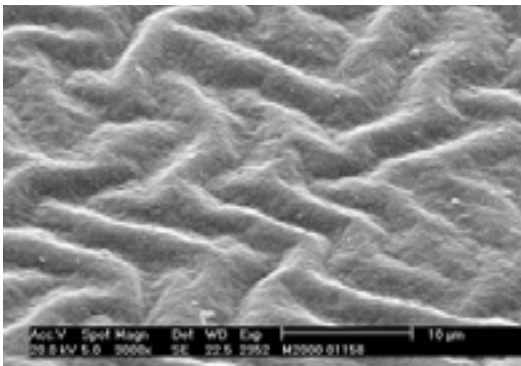
Fitting & installation

Fitting is done between two flat surfaces with defined roughness (recommended max. R_z 16).

Surface Treatment RFN (Reduced Friction by Nanotechnology)



Without Surface Treatment RFN



With Surface Treatment RFN

Product description

Components made of elastomer materials have a functionally determined degree of deformability, but also in many cases a distinctive coefficient of friction. This friction can be of functional advantage, however, it is hindering for the automated installation as well as for dynamic loading of the elastomer component.

The contact surface, thus the part geometry, roughness and topology, the contact pressure, the mechanical and technological material properties (hardness, module, damping), the surface chemistry, the lubricating medium and the counteracting surface all have a direct influence on the amount of friction.

The Surface Treatment RFN (Reduced Friction by Nanotechnology) allows Simrit to offer an innovative method for the reduction of friction and adhesion for elastomer components. Through the use of nano-scaled materials, elastomer materials are modified in such a way as to not only significantly reduce the friction but also this friction optimisation remains constant over the entire service life of the component.

Product advantages

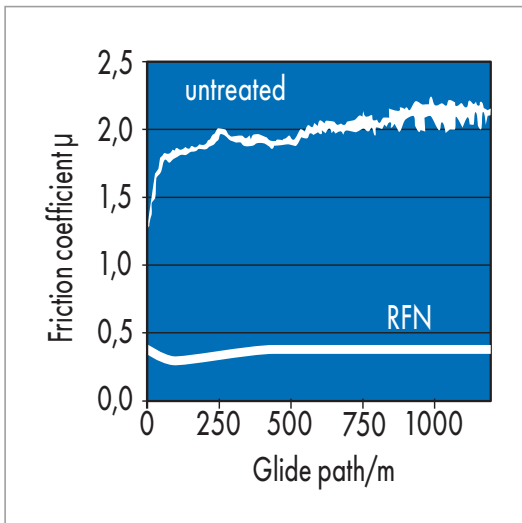
- Reduction of friction and adhesion
- Improved media resistance
- Increase of the service life
- Identical mechanical-technological properties and resistance
- Reduction of the permeation, barrier effect
- Optimised wetting behaviour
- FDA-compliant
- Environmentally-friendly and process safe operation.

Application

Reduction of friction and adhesion on elastomer composite parts and precision mouldings.

Material

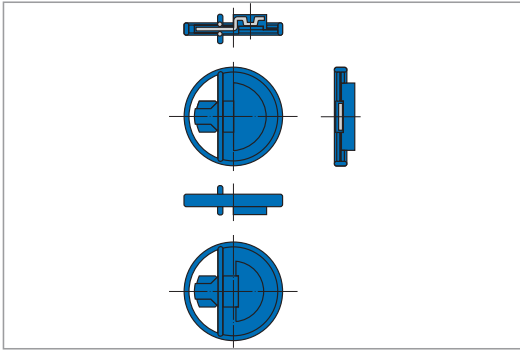
The possibilities and results of a RFN surface treatment, amongst others, are dependent on the component geometry, the material as well as the surface finish. The treatment possibilities as well as sample treatments can be individually clarified on enquiry and on short notice.



Nearly constant coefficient of friction over the entire service life of the component through RFN.



Micro- resp. Miniature Parts/ Simriz® Precision Mouldings and Composite Parts



Micro- resp. Miniature Parts/
Simriz Precision Mouldings and Composite Parts

Application

Fluid control systems in medicine, analysis and biotechnology, solenoid valves, process technology, hydraulics and pneumatics.

Material

Elastomer part	Simriz, FKM, NBR
Support component	Stainless steel, steel, brass, PEEK

Other materials on enquiry.

The circuit board materials and elastomer materials must always be selected according to the operating conditions.

Product description

Micro and miniature elastomer composite parts and moulded parts developed for the individual customer application. Can be manufactured in a great variety of materials and designs. In particular, composite parts made from Simriz (FFKM) and special and support components are used for very high media resistant requirements. Additional advantages are multifunctional properties of the miniature parts e.g. sealing, damping or magnetic control.

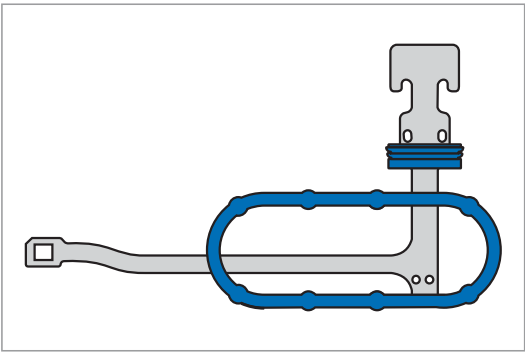
Operating conditions

Media	Mineral oils, hydraulic fluids, CIP/SIP cleaning media
Temperature	max. 260 °C (Simriz)

Product advantages

- Made-to-measure miniature parts/sealing components in wide material and design variety
- High product quality through special manufacturing process
- Numerous application possibilities
- Very high media and temperature resistance with the use of Simriz materials
- High fitting reliability and resilience.

Seal with Flexible Printed Circuit Board



Seal with Flexible Printed Circuit Board

Product description

New possibilities are created by flexible circuit paths, in combination with an -elastomer seal. The sensor, electrical conductor, seal, support and connecting element can be integrated into one module. The wide selection of available variants with different materials leads to fascinating new solutions. Manifold variation possibilities arise from:

- The combination of different flexible circuit paths and sealing materials
- The connection of sensors for the measuring of pressure, temperature or other physical or even chemical parameters
- Different plug connections and various support materials.

Product advantages

- Versatile product variants through the integration of signal transmission, sensor and plug
- Versatile applications through variable material combinations
- Optimisation potential even with existing sealing solutions through the embedding of the flexible circuit path into the sealing layer

- Constructive simplification of sealing solutions with added "signal transmission" function, separate cabling no longer necessary
- The reduction of parts minimises the costs for procurement, testing, storage, handing and installation (reduction of the process costs).

Application

Engine and transmission applications e.g. fuel-injection systems, engine management systems, solenoids, water metres, hydraulic and pneumatic systems.

Material

Elastomer part	FKM, NBR
Flexible circuit board	Pyralux

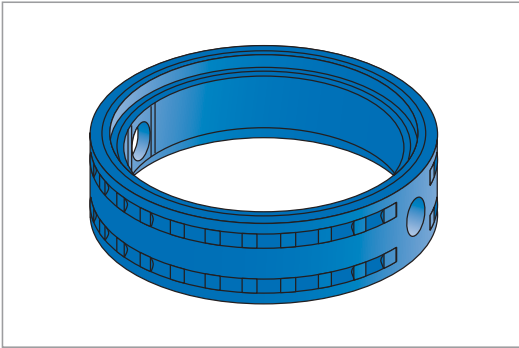
Other materials on enquiry.

The circuit board materials and elastomer materials must always be selected according to the operating conditions.

Operating conditions

Media	Engine oils and gear oils, diesel fuel, motor fuel, mineral oils, engine compartment area
Continuous temperature	max. 135 ... 150 °C

Butterfly Valve Seal



Butterfly Valve Seal

- Guarantee of a maximum of switching cycles
- Outstanding actuation properties
- Application in many media with the corresponding approvals
- High chemical resistance
 - Reliable use in CIP/SIP media.

Application

Butterfly valves in process control plants and systems. Process plants in the beverage industry, dairy farming and the chemicals and pharmaceuticals industries

Material

The preferred materials used are FDA, BGA and USP Class VI certified or ATEX certified elastomer mixtures based on VMQ, EPDM, FKM and NBR. In addition, special high-performance elastomers from Simriz can be offered for individual customer applications. The butterfly valve seal material must always be selected in accordance with the operating conditions.

Product description

Butterfly valve seals are utilised as seal in thousands of butterfly valves in the process control of plants and systems. The elastomer moulded ring is compressed radially during the closing procedure and thus seals high and low viscosity media. The decisive factor for the correct function of the seal is a low friction and a low compression set of the butterfly valve seal as well as the high-temperature and media resistance explicitly also in cleaning media (CIP – Cleaning In Place/SIP – Sterilisation In Place).

Product advantages

- Outstanding operational performance
 - High reliability
 - Optimised service life
 - Low friction torque when operated
 - Very good sealing behaviour
- Broad range of applications
 - Resistance within a wide temperature range
 - Broad range of materials matched to the most diverse applications

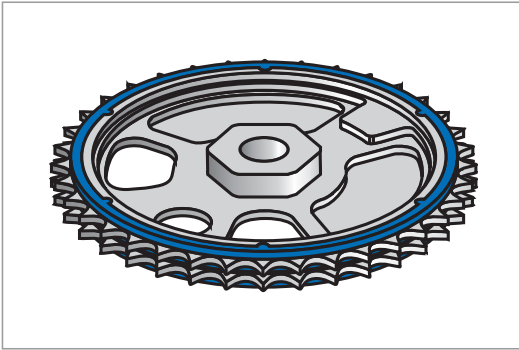
Operating conditions

	EPDM	VMQ	HNBR	FKM
Lower temperature	-40 °C	-40 °C	-20 °C	-20 °C
Upper temp. duration	140 °C	110 °C	140 °C	160 °C
Upper temp. short	160 °C	120 °C	150 °C	180 °C
DVR	+++	+++	+	+
Sliding property	+++	+	+	+
Aqueous media	+++	+++	+	+
Steam	+++	0	+	+
CIP/SIP	+++	++	+	+
Dairy products	0 ... +	+	+++	+++
Hydro-carbon aliph.	-	+	++	+++
Hydro-carbon arom.	-	-	++	+++
Essential oils/citrus juices	0	0	+	+
Hot worts	++	-	++	-

+++ very good, ++ recommendable, + applicable, 0 limited use, - unsuitable.



Rubberised Sprockets



Rubberised Sprockets

Application

- Engines with chain drives
- Steel or sintered sprockets for high-speed chain drives.

Material

Elastomer	HNBR
Sprocket	steel

Operating conditions

Media	Engine oil
Temperature	-25 ... +140 °C

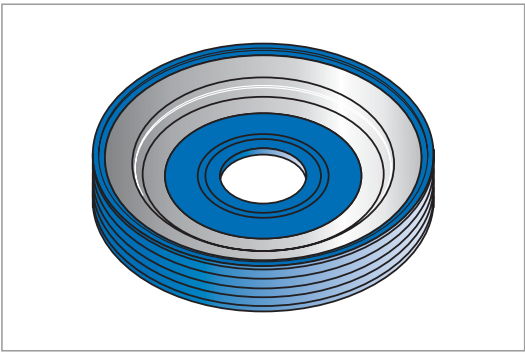
Product description

In the engine area chains and sprockets wheels are used to drive crankshafts and camshafts as well as auxiliary units. The advantages of chain drives are the long service life and low maintenance requirements. However, conventional chain drives tend to be relatively noisy. As a result Simrit has developed rubberised steel or sintered sprockets for high-speed chain drives. Defined elastomer pads on both sides of the sprockets make the system run more smoothly. The damping effect comes from the fact that the chain enters the elastomer before it reaches the metal sprocket surface. This effectively damps noises caused by vibrations in the chain.

Product advantages

- Long-life designs with maximum friction resistance and quiet chain running with high degree of expertise in elastomer combinations and specially developed HNBR elastomers
- Noise levels significantly reduced at medium r.p.m. by approximately 1 to 3 dB (A).

Belt Pulley with Elastomer Track



Belt Pulley with Elastomer Track

Product description

The belt pulley with elastomer track is used to damp vibration and noise. Drive pulleys and drive belts are used for power transmission in motorcycles in some cases. These drive pulleys begin to vibrate at specific speed ranges and generate noise. To solve the problem Simrit has developed a drive pulley with vulcanised, defined elastomer pads. This damps the vibrations of the pulley and reduces noise.

Product advantages

- Long-life designs with a high degree of expertise in elastomer combinations and specially developed HNBR elastomers
- Significant reduction of vibrations and noise.

Application

- Spur gear drive of auxiliary units in diesel engines, spur gear of an air compressor
- Engines for construction machinery, tractors and other agricultural machinery.

Material

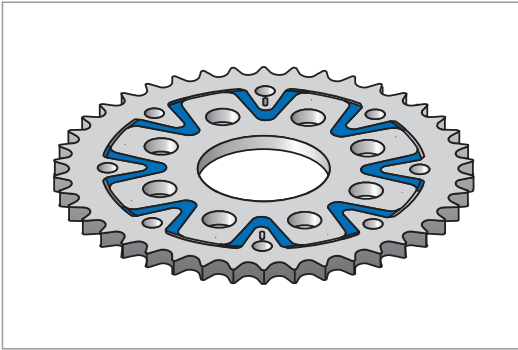
Elastomer	HNBR
Pulley	steel

Operating conditions

Media	Engine oil
Temperature	-25 ... +140 °C



Decoupled Chain Gear



Decoupled Chain Gear

Application

- Deflection wheel for chain drive of a diesel engine
- Steel or sintered sprockets for high-speed chain drives
- Medium and large diesel engines with sprocket/spur gear drive for construction machinery, tractors and other agricultural machinery.

Material

Elastomer	HNBR
Sprocket	steel

Product description

In the field of engines chains and sprocket are frequently used to drive crankshafts and camshafts as well as auxiliary units. The gear teeth a contact conditions in the chain drive are similar to the geared drive. The chain links grip so deeply into the spaces between the teeth that both edges are in contact with them.

In the chain drive vibrations occur when the load on the chain is relieved. Simrit has developed a deflection wheel in the reference case that decouples the shaft from the gear wheel to prevent transmission of vibrations by bonding elastomer between the inside component attached to the shaft and the outer gear wheel. Vibrations and noise can be significantly reduced. Because the elastomer is incompressible, there is still a reliable power transmission.

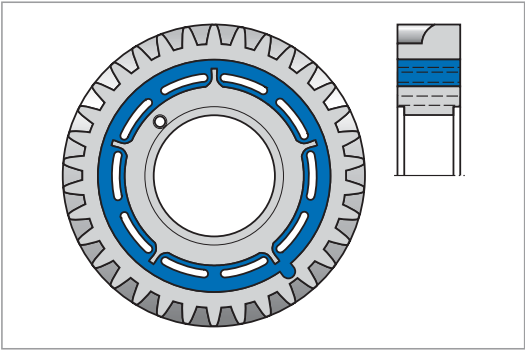
Product advantages

- Significant noise reduction by approximately 1 to 3dB (A)
- Long-life designs with a high degree of expertise in elastomer combinations and specially developed HNBR elastomers.

Operating conditions

Media	Engine oil
Temperature	-25 ... +140 °C
Pressure	max. 3 bar

Decoupled Gears



Decoupled Gears

Product description

Spur gears are used to drive the camshafts and auxiliary units for diesel engines. The auxiliary units develop unwanted vibrations that cause noise and affect the smoothness. Solution: the gears are separated radially, joined by an elastomer component again and thus decoupled. Vibrations and noise can be significantly reduced.

Product advantages

- Noise reduction by approximately 1 to 3dB (A)
- Long-life designs with a high degree of expertise in elastomer combinations and specially developed HNBR elastomers.

Application

- Gears for spur gear drives
- Camshaft gear
- Medium and large diesel engines with spur gear drive for construction machinery, tractors and other agricultural machinery.

Material

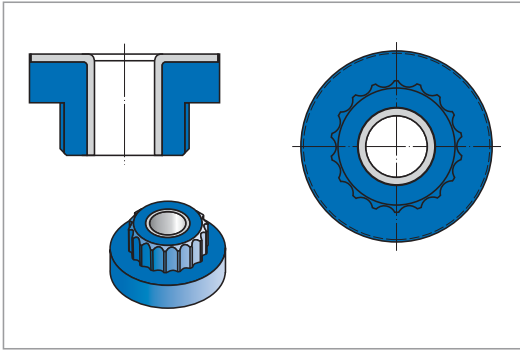
Elastomer	HNBR
Spur gear	steel



Operating conditions

Media	Engine oil
Temperature	-25 ... +140 °C
Pressure	max. 3 bar

Decoupling Elements



Decoupling Elements

Product description

Various elastomer-metal design components are used to reduce vibrations and noise in the area of engines and auxiliary units. These components are used amongst others on the resilient attachment as well as sealing of metal components on the oil sump, the cylinder head cover on the engine block and injector valves. One example in the engine controller of commercial vehicles, which is attached to the vehicle with screws. Elastomer composite components are used for resilient vibration-decoupling attachment.

Product advantages

- Decoupling of structure-borne noise and vibrations
- Reduced components by use of elastomer composite components
- Application-specific design with a wide range of elastomers.

Application

- Resilient attachment as well as sealing of metal components on the oil sump, cylinder head cover on the engine block, injector valves
- Attachment of engine controller (electronic)
- Engines and auxiliary units for construction machinery, tractors and other agricultural machinery.

Material

Composite component of metal and elastomer (with/without bond)

Elastomer	VMQ with low hardness (Shore)
Support component	steel

Operating conditions

Media	Engine oil, spray
Temperature	-25 ... +140 °C