Catalogue 2024/25

sustainable by design

Special requirements dictate special sealing solutions

VR Seals- Innovative, Customised, Reliable

vr-dichtungen.com

VR DICHTUNGEN®

CONTENTS

WHAT HAPPENS WHEN EVERYTHING GOES ROUND IN CIRCLES? WE'RE WITH YOU!

In a rapidly changing world, innovation is the key difference between good and outstanding.

Quality awareness, innovative strength and a sustainable mindset are a permanent fixture in our corporate DNA. These values not only characterise our products, they also define our relationship with our customers. In Übach-Palenberg, we work closely with you to develop solutions that are precisely tailored to your specific needs. This enables us not only to meet your expectations, but to exceed them. At the same time, we endeavour to reduce our ecological footprint in every area of our company. Not only is our commitment to innovation evident here, above all it is reflected in the constantly evolving development of our radial shaft seals. By way of this brochure, we would like to introduce you to our innovative and high-performance sealing solutions. We are convinced that they will meet your demanding requirements and simultaneously protect the environment.

With best regards

Patrick Keulers

VR DICHTUNGEN®

VR Dichtungen GmbH is a development and production company that deals with sealing problems in dynamic systems in a customer-orientated manner using the VR sealing system.

Normal seals are not sufficient, in particular when high speeds, pressure loads or strong thermal and chemical loads apply This is where the VR rotary shaft seal (VR-RWDR) comes into its own. It is characterised by low shaft and housing bore requirements, which saves costs. Users also benefit from its low friction power, which increases product energy efficiency.

Our history

1988 — **Foundation**

1992 — Spin-off from Vredestein

1996 — Relocation of headquarters to Übach-Palenberg

2001 — **First SOA patent**

2014 — Recertification as per DIN 9001:2010

2021 — **Patenting of "Low Friction Seal"**

2024 — Expansion of production and engineering capacities

From the idea to the solution. We have just the team for it.

At VR Dichtungen, we make sure that our sealing solutions fulfil your requirements. Do you need a special seal? We always make sure that you receive the optimum service package. Among other things, we also take cost-efficient housing and shaft machining into account.

We offer you a wide range of high-quality products. Our products range from standard seals for general applications to compact seals for limited space conditions and high-pressure seals. Pressure ratios of 150 bar are even possible. These seals are a cost-effective alternative to expensive mechanical seals. They are also particularly reliable, including under extreme conditions. Many of our advanced sealing solutions are patented and we offer a wide range of materials. More than ten different standard elastomers available from VR-Dichtungen. We manufacture the support bodies of the seals from various materials. Depending on requirements, we use metallic materials such as steel, aluminium or bronze, as well as plastics. We can configure thousands of different seals from the combination of designs, installation dimensions and materials. We also customise them in line with your individual requirements. Didn't find the seal you were looking for in our portfolio? Then simply get in touch with us.

Perfectly fitting seals? Better leave that to us.

We also develop complex new seals and test them on our test benches or directly in your application. Tell us what you need. We will find a solution. Our in-house mould production enables us to react quickly and flexibly to your wishes. Here we can address even the smallest details and produce seals in all technically feasible dimensions. The VR system adapts flexibly, whether for small, medium or large series. We manufacture as many seals as you need - from one piece to a million. We sell the products directly and via our specialised technical trading companies and engineering firms. Our expertise and wealth of experience guarantee that your machines are equipped with perfectly fitting seals.

Toolmaking

Made in Germany

Quality is a fundamental guiding principle for us. "Made in Germany" is a promise on two counts. Our seals are not only produced by us, but also developed here in line with your individual requirements.

Areas of application for our radial shaft seals

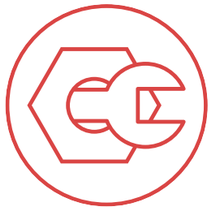
The radial shaft seals from VR-Dichtungen represent r the highest quality and reliability. Thanks to innovative technologies and a wealth of experience, we offer solutions that are important in many industries. They are widely used in the food industry, medical technology and mechanical engineering, for example. Our seals ensure optimum performance and are characterised by their particularly long service life.

Seals by VR-Dichtungen are used in the following areas and applications for sealing rotating shafts:

- General mechanical engineering (e.g. spindle seals)
- Electrical engineering (e.g. motors, encoders)
- Medical technology (e.g. miniature seals for pumps and instruments)
- Pump construction / fan construction (e.g. submersible pumps, centrifugal pumps, axial fans)
- Compressor construction (e.g. screw compressors)
- Automotive (e.g. air conditioning compressors)
- Food processing machines (e.g. kneading machines)
- Agitator and mixer technology (e.g. sausage meat machines, milk powder machines)
- Household appliances (e.g. hand blenders, lye pumps, washing machines)
- Shipbuilding (e.g. ship shafts, transverse jet steering systems)
- Transmission construction (e.g. high-speed transmission gears, spur gears)
- General vehicle construction (e.g. water pump seals, transmission seals)
- Rotary feed-throughs (e.g. pneumatic controls)
- Pharmaceuticals (e.g. vacuum dryers)
- Defence (e.g. sensors)

Food industry

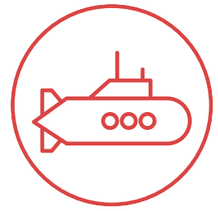
Medical technology



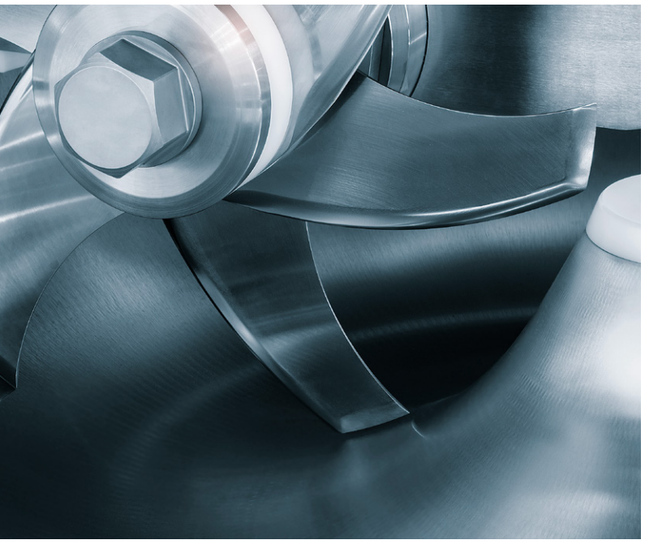
Mechanical engineering

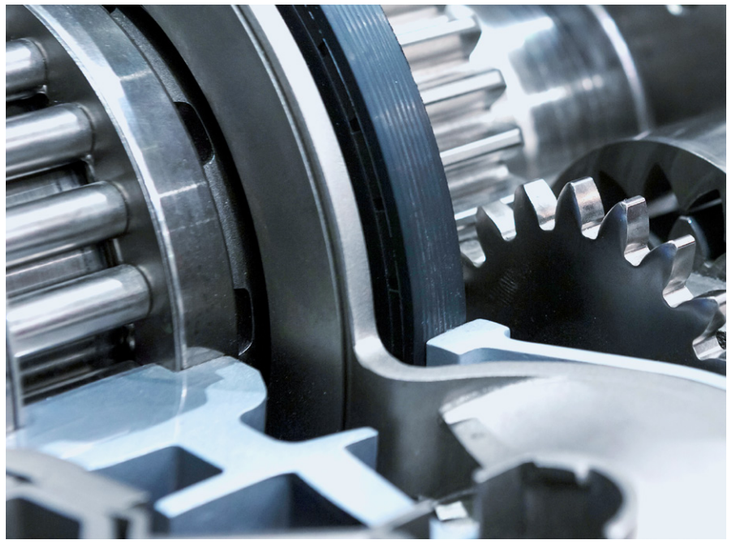
Armoury

Pharmaceuticals



Marine/civil
(above and under water)





Technical principles

Millimetre precision: the basis for high-quality seals.

Every seal must fit with millimetre precision ito reliably perform its main task of sealing. Our technical principles are based on maximum precision and care at every stage of production. This ranges from quality control to the precise processing of materials. This is the only way we can guarantee the quality and reliability of our seals.

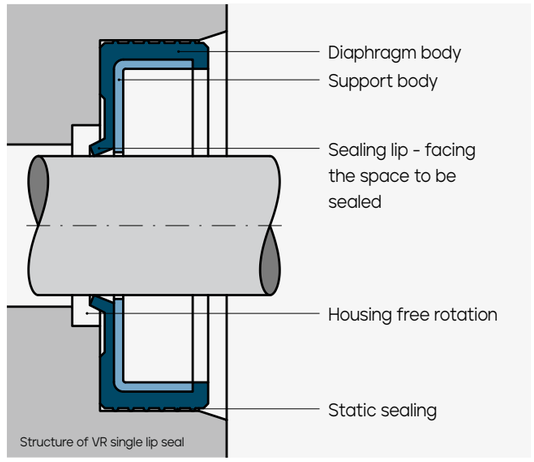
The VR seal

A radial shaft seal seals a rotating shaft against a housing. Due to its special design, the VR seal is suitable for absorbing high circumferential speeds and high pressure loads.

Sealing mechanism of seals by VR-Dichtungen

The functional mechanism of the springless VR radial shaft seal is based on rubber-elastic diaphragm bodies that are tensioned with precise preload over support bodies made of stainless steel or other metals. The subsequent sealing lip, which is arranged at an oblique angle, can face outwards or inwards depending on the installation position and direction of the medium to be sealed. This mechanism is based on the radial and tangential pretensioning of the diaphragm body, which leads to a spring effect between the diaphragm body and the sealing lip. As a result, both radial and tangential forces acting on the sealing lip are equalised when the axes rotate, thereby reducing the resulting shear stresses. Vibrations as well as static and dynamic concentricity variations are absorbed directly in the area of the sealing lip. The design of the sealing ring minimises the partial lifting of the sealing lip with rotating axles and the associated pumping effect.

Comparative measurements have shown that the VR sealing ring requires only 1/3 to 1/4 of the radial force for the same sealing performance compared to the garter spring-supported sealing element. This makes a positive contribution to the energy efficiency of modern products.



Structure of VR single lip seal

VR advantages

- > Low coefficient of friction
- > Low power loss and high service life values
- > Low so-called pumping effect due to tangential and radial preload of the sealing lip
- > Reliable sealing on unhardened and stainless steel shafts*
- > No destructive running-in marks*
- > No post-treatment of the shaft material, such as hardening, nitriding, hard chrome plating or additional liners required*

* Applies only under appropriate operating conditions, please consult us for higher pressures and peripheral speeds or for abrasive media.

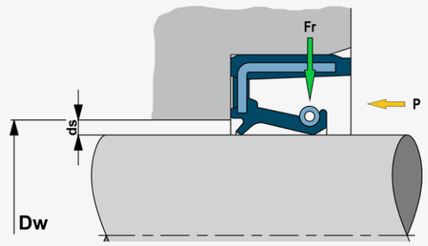
Technical data of the standard seals

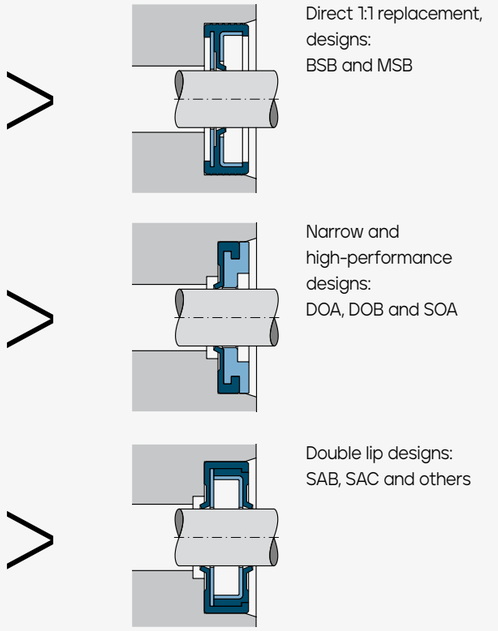
Characteristic	Unit	Value
V_{max}	m/s	*
P_{max}	MPa	1.5*
P_{min}	MPa	0.06*
Temperature range	°C	-50 °C to 220 °C**

Technical data of the SOA high-pressure seals

Characteristic	Unit	Value
V_{max}	m/s	40*
P_{max}	MPa	15*
P_{min}	MPa	0.04*
Temperature range	°C	-50 °C to 220 °C**

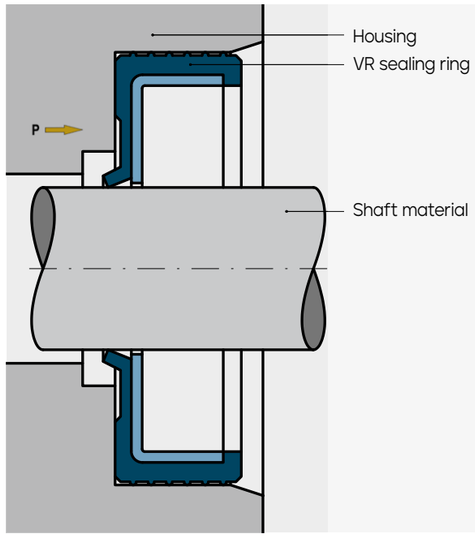
* Value depends on other application parameters and the elastomer used.
** Value dependent on other application parameters and the elastomer used.





The sealing system

In addition to the VR sealing ring described above, a complex system of mutually influencing variables has an effect on the sealing behaviour and service life:



Housing
> Surfaces > Centre offset to shaft > Tolerances > Material

Shaft material
> Diameter > Speed > Eccentricity > Surface
> Axial movement > Material

Medium
> Temperature > Chemical effects > Viscosity
> Lubricity > Pressure > Decomposition products

Environment and operating mode
> Temperature > Dust and dirt > Running and standstill periods

VR-sealing ring
> The design and tolerances > The radial force
> The material > Hardness > Wear resistance
> Resistance to swelling and shrinkage
> Frictional properties

Static sealing

The housing is statically sealed via the outer casing.

> **Caution**
> *When using housing materials with high thermal expansion, it is possible that leakage may occur between the bore wall and the radial shaft seal at correspondingly high temperatures. When installing VR radial shaft seals in thin-walled bearing bodies or in bearing bodies with relatively low elasticity or strength, there is a risk that the housing will expand.*

Dynamic sealing

The sealing lip is always positioned in the direction of the medium. The sealing mechanism in the contact area of the sealing lip is of crucial for the sealing function. It depends on:

- the structure and properties of the elastomer material
- the nature of the shaft surface
- the medium to be sealed

Lubrication and friction

Continual lubrication of the sealing lip over the entire service life is crucial to minimise wear. Effective lubrication reduces friction and therefore abrasion. Even when at rest, the medium that seals and lubricates at the same time penetrates the unevenness of the shaft and sealing lip due to capillary forces. Similar to a plain bearing, the seal passes through various states of friction during operation, from boundary friction to mixed friction to the prevailing hydrodynamic friction. Ensuring that the seal never runs dry is important. It is, therefore, advisable to lightly grease or oil the shaft and sealing lip when installing the seal. The medium to be sealed not only serves as a lubricant, but also as a coolant to dissipate the frictional heat generated.

Even during the design phase, it should be ensured that sufficient lubricant is available on the sealing edge, for example via the holes and channels provided. In some designs of rolling bearings, in particular tapered roller bearings, a significant pumping effect can occur on the medium during operation, which may lead to various oil conditions that may jeopardise the lubrication of the sealing edge. To prevent this, corresponding bores and channels should already be taken into account in the design.

All parameters that influence the radial force and change the lubrication conditions at the sealing lip have an effect on the frictional properties of the seal.

Seals by VR-Dichtungen offer rotary shaft seals made of special elastomers with self-lubricating or PTFE additives, which have certain **"emergency running"**properties. However, their function also depends on the properties of the overall system.

Limit conditions

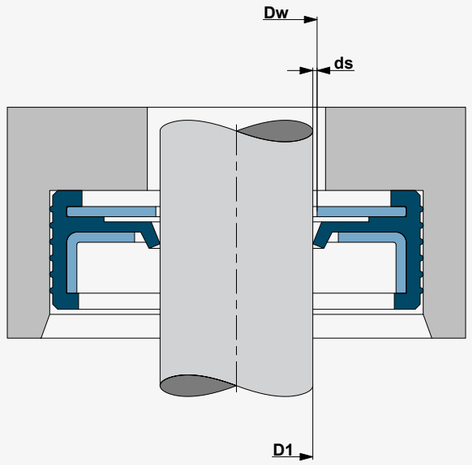
The application limits of the seals by VR-Dichtungen can be reached and exceeded when several limit conditions coincide, such as

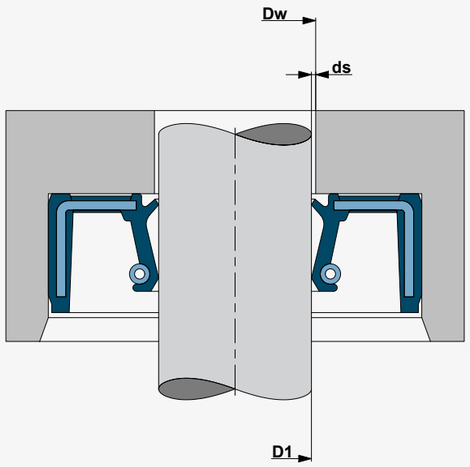
- the maximum permissible circumferential speed
- the maximum permissible temperature
- pressurisation
- poor lubrication or limited heat dissipation.

Causes of leakage

The seal will leak if the complex conditions in the area of the contact zone are disturbed by

- incorrect surface condition of the shaft
- longitudinal grooves, pores and other damage to the shaft and seal
- contamination and decomposition products of the medium
- burning of the sealing lip due to excessive speeds or excessive pressure
- hardening and cracks in the sealing edge





Gap extrusion

Every rotary shaft seal is subject to extrusion under pressure load in the sealing lip area in the direction of the side facing away from the pressure, i.e. the sealant is drawn into the annular gap between the shaft and the effective diameter Dw (distance dimension ds).

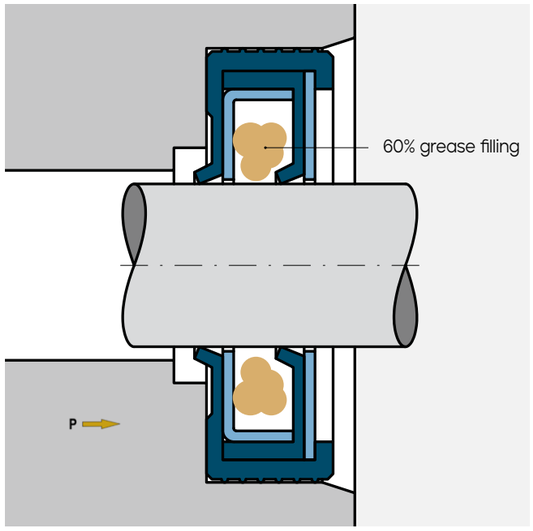
The effective diameter Dw is determined either by the sealing ring design or by the component behind the sealing lip (housing, disc, etc.).

Lubrication

The conditions for dissipating frictional heat are less favourable for sealing against grease than for liquid media.

This can be remedied by reducing the circumferential speed by approximately 50%. If this value is exceeded, consider switching to oil lubrication. To seal grease-lubricated, slow-running shafts, it is recommended that the space is filled as completely as possible with grease in accordance with the bearing manufacturer's specifications.
If there is an insufficient supply of lubricant or in the case of poorly lubricating media such as water and suds, a separate quantity of lubricant must be provided to lubricate the sealing lip.

We recommend the use of VR double lip seals. In this case, the gap should be filled with approximately 60% grease to ensure sealing.



Contamination in the fluid

Contamination occurs, for example, on roller bearings or as decomposition products when the fluid ages.
These impurities have a negative effect on the sealing and wear behaviour of the seals, depending on how they are applied.

Grease overview of seals by VR-Dichtungen

Item no.	Name	Description
89801	LM AL 200-2; NLGI 2 — NSF	Special grease for seals by VR-Dichtungen for food applications. The grease has NSF/H1 approval.
89802	Li 200/2 EP; NLGI 2	Special grease for NBR (-1) and HNBR (-C5), designed for seals by VR-Dichtungen.
89803	Syn HT 100-2; NLGI 2	Special high-performance grease matched to seals by VR-Dichtungen for HNBR (-C5) in the limit range and FKM (-2) (-C2).

The greases are available in all standard packaging and sizes. We can offer other special greases on request.

> **Note**
> *If contact of the sealing lip with contaminants is unavoidable, design measures such as centrifugal or collecting plates should be provided. Very abrasive media can lead to wear of the shaft in the area of the running surface.*

VR elastomers

**Rubber is a very special material. Above all its high resilience (elasticity) stands out.
Seals by VR-Dichtungen make particular use of this property thanks to their design.**

Elastomers consist of a long chain of repeating monomers. Such a chain-like arrangement is called a polymer. In elastomers, this twistability is so pronounced that the molecules twist together to form a so-called polymer ball (rubber elasticity). This endeavour is merely the result of the rotational movement along the chain, which takes place in completely random directions. The arrangement of the individual atoms of the chain around the centre of the molecule corresponds to a Gaussian distribution.

If a polymer is stretched by tensile stress, the chains position themselves preferentially in the direction of the load. The elastomer is, therefore, stretched. As soon as the tensile stress is removed, the chains begin the random rotational movement again, in the course of which they return to the statistically based Gaussian distribution. The chains "relax" and the elastomer contracts again.

Seals by VR-Dichtungen offer you a very wide range of elastomers, from NBR for standard seals to the latest high-performance materials, also for FDA/food requirements.

We would like to highlight the following here:
- VR-HNBR, excellent for use at higher pressures, does not tend to explosive decompression*
- VR-FKM with PTFE or self-lubricating additives

Influences on elastomers

The chemical/physical effects of the media on the sealing materials have a decisive influence. The reactions and interactions are accelerated as the temperature rises.

The materials can harden or soften under the influence of the media:
- Hardening due to ageing processes caused by the media used, in particular atelevated temperatures
- Softening due to swelling caused by the influence of the media

During a chemical reaction, the elastomer reacts with the medium and structural changes occur (e.g. further cross-linking or degradation). This can lead to serious changes in the physical properties. If a material is suitable for a medium, this is referred to as resistance to the medium used.

Elastomer seals can undergo structural changes in the course of use or during storage and, therefore,lose some or all of their elastomer properties.

Rubber ageing manifests itself in the following forms:

Visible changes
- Cracking
- "stickiness" of the surface

Measurable changes
- Hardening or softening
- Decrease in stress values
- Decrease in elastic properties

Exposure to contact media

Seals come into contact with a wide variety of media during use, e.g:
- mineral oils
- synthetic fluids
- vegetable and animal oils
- pressure fluids
- brake fluids
- Fuels
- organic solvents
- Water and aqueous solutions
- organic and inorganic acids
- organic and inorganic bases
- Refrigerants
- Gases and vapours

Contact media can penetrate the rubber and have a:
- physical effect
- chemical effect

Summary

The following parameters are important for the selection of the seal:
- circumferential speed
- pressure
- temperature
- contamination in the fluid
- contamination/dust from outside
- vibrations
- cleaning agents used (in particular in the food industry)
- Fluid/medium to be sealed (lubricating oils, greases, other media such as coolants or cooling lubricants etc.)

Up to now, the service life of the often function-critical component "seal" cannot be calculated (result of a study by the Institute for Machine Elements at the University of Stuttgart), but must be tested on the test bench or in the system. However, by taking the influencing parameters into account, the designer has a considerable influence on the service life of a sealing point.

Elastomer overview

We supply a wide range of elastomers. If you cannot find your kind of elastomer here, please do not hesitate to contact us.

Material	Hardness (Shore [± 5])	Colour	Tensile strength (MPa)	Elongation at break (%)	DVR (%)	Density	Lowest temperature (°C)	Maximum temperature (°C)	Emergency running properties	Foodstuffs	Medical technology	PFAS-free	Metal detectable	Fields of application	Exclusions	Trade names	VR standard
1 (NBR)	74	Black	22.7	401	14	1.28	-20	100				x		Resistant to hydraulic oils, water glycols and oil-in-water emulsions, mineral oils and mineral oil products, animal and vegetable oils, petrol, heating oil, water up to approximately 70 °C, air up to 90 °C, butane, propane, methane and ethane		Perbunan® Hycar® Krynac® Elaprim® JSR-N® Chemigum®	x
2 (FKM)	65	Turquoise	11.7	358	20	2.12	-12	220						FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals.		Viton® Tecnoflon® Fluorel® Dai-el®	x
3 (EPDM)	73	Blue	8	160	8	1.06	-40	150		x		x		Very good ageing resistance even when exposed to UV radiation and ozone (outdoor use). Resistant to diluted acids and e.g. brake fluids that do not contain mineral oil.	Not resistant to mineral oil products!	Vistalon® Buna AP® Dutral® APTK®	x
5 (HNBR)	70	Brown	22.8	405	18	1.21	-40	150		x		x		Resistant to hydraulic oils, water glycols and oil-in-water emulsions, mineral oils and mineral oil products, PAO oils, animal and vegetable oils, petrol, heating oil, water up to approximately 70 °C, air up to 90 °C, butane, propane, methane, and ethane		Therban® Zetpol®	x
6 (VMQ)	73	Red-brown	7.6	280	21	1.22	-50	200				x		For high temperatures, hot air up to +210 °C		Silopren® Silastic® SE® Blensil® Silicone®	x
7 (FKM)	71	Grey	13.5	370	24	2.07	-17	220	x					FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals. In addition, it offers enhanced chemical resistance to hot water and acids.		Viton® Tecnoflon® Fluorel® Dai-el®	x
8 (FKM)	73	White	11.2	296	15	2.17	-17	220	x	x	x			FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals.		Viton® Tecnoflon® Fluorel® Dai-el®	
9 (FKM)	73	Grey	18.4	325	14	2.2	-17	220	x	x			x	FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals. In addition, it offers enhanced chemical resistance to hot water and acids.		Viton® Tecnoflon® Fluorel® Dai-el®	
19 (FKM)	72	Almost white	21.2	314	11	2.17	-17	220	x	x	x			FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals. In addition, it offers enhanced chemical resistance to hot water and acids.		Viton® Tecnoflon® Fluorel® Dai-el®	x
29 (FKM)	73	Blue	18.4	325	14	2.2	-17	220	x					FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals. In addition, it offers enhanced chemical resistance to hot water and acids.		Viton® Tecnoflon® Fluorel® Dai-el®	x
C5 (HNBR)	75	Anthracite	24	280	12	1.19	-25	150	x			x		Resistant to hydraulic oils, water glycols and oil-in-water emulsions, mineral oils and mineral oil products, PAO oils, animal and vegetable oils, petrol, heating oil, water up to approximately 70 °C, air up to 90 °C, butane, propane, methane, ethane		Therban® Zetpol®	x
C2 (FKM)	78	Anthracite	16.1	311	13	1.92	-17	220	x					FKM is characterised by excellent resistance to high temperatures, ozone, oxygen, mineral oils, synthetic hydraulic fluids, fuels, aromatics, many organic solvents and chemicals. In addition, it offers extended chemical resistance to hot water and acids.		Viton® Tecnoflon® Fluorel® Dai-el®	x
CP5 (HNBR)	80	Black	17.5	148	13.9	1.29	-25	150	x			x		Resistant to hydraulic oils, water glycols and oil-in-water emulsions, mineral oils and mineral oil products, PAO oils, animal and vegetable oils, petrol, heating oil, water up to approximately 70 °C, air up to 90 °C, butane, propane, methane, and ethane		Therban® Zetpol®	
M5 (HNBR)	93	Black	23	210	28	1.29	-40	150	x			x		Resistant to hydraulic oils, water glycols and oil-in-water emulsions, mineral oils and mineral oil products, PAO oils, animal and vegetable oils, petrol, heating oil, water up to approximately 70 °C, air up to 90 °C, butane, propane, methane and ethane		Therban® Zetpol®	
71 (FFKM)	75	Black	17.6	160	9.2	1.92	-20	260						FFKM is characterised by excellent chemical and thermal stability with consistent elasticity and is extremely low in gas emission. These favourable material properties combined in one product are not matched by any other synthetic rubber on the market. However, perfluoro rubber is relatively expensive due to the technically very complex manufacturing process and is, therefore, not a mass-produced plastic.		Kalrez® Perlast®	

Design guidelines

Shafts/counterface

The usual steels used in mechanical engineering are sufficient for the shaft running surface. Due to the low contact pressure of the seal, post-treatment is often not necessary.

General requirements in accordance with DIN 3760 and 3761:
- Rz = 1–5 µm
- Ra = 0.1 –0.8 µm
- Freedom from galling
- Diameter tolerance H11
- Roundness IT8

Recommendations for the mechanical production of the mating surface:
- According to DIN 3760 and 3761: Grinding in plunge cut with complete burnout, uneven speed ratio! (Very suitable process.)
- Hard turning with a very low feed rate may also be suitable. However, it depends on the individual case, which is why we cannot recommend this without limitations.
- Scoring orthogonal to the sealing surface must be avoided, which is why we strongly advise against all manual reworking.
- Shaft coatings can significantly increase the frictional power of the overall system; coated shafts should therefore be checked in advance.
- Do not polish shafts

For sealing points subject to high thermal or mechanical loads, good conditioning of the contact surface is essential. Please contact us so that we can work out the special individual case together.

Hardness

The surface hardness of the shaft also has a major influence on the service life of the entire sealing system.

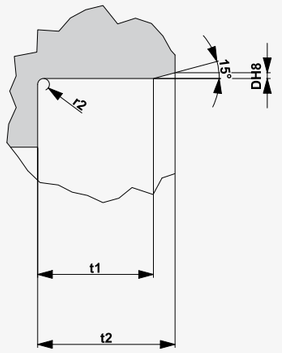
- 25 – 30 HRC for simple applications
- Min. 40 HRC for normal applications
- Min. 55 HRC for external dirt ingress or contaminated media

Housing bore

The following dimensions are to be complied with for seals by VR-Dichtungen.
The following applies to surface roughness:
- Rt ≤ 16 µm (Ra ≤ 3 µm)
- 4.0 µm ≤ Rz ≤ 8.0 µm
- Drill diameter: ISO tolerance H8

The required surface quality can be achieved by finishing.

The housing bore should at all times have a chamfer of at least 15° so that the sealing ring is guided in the housing bore and the diaphragm does not shear off.



Housing bore

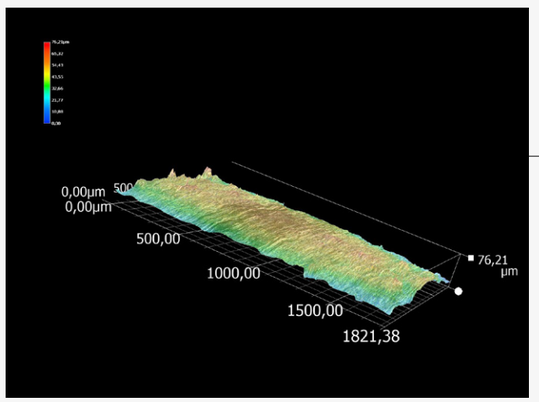
*t1 = B * 0.85 (min.)*
t2 = B + 0.3 mm (min.)
r2 = 0.7 mm (max.)
Concentricity and coaxiality in accordance with DIN 3760

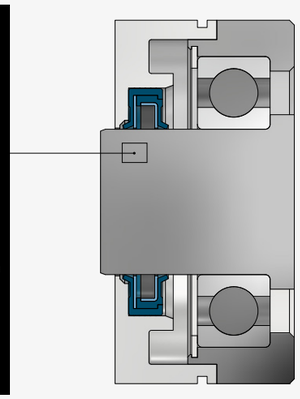
B: Width of the seal

Seal gap determination

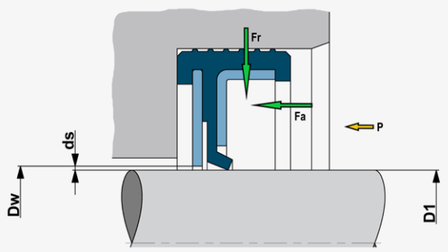
With rotating shafts, the sealing lip of a pressurised radial shaft seal is twisted and high shear stresses occur in the elastomers. These shear stresses are a function of the pressure, the circumferential speed, the coefficient of friction and the annular gap (For distance ds - see illustration). If the distance ds is too long, material burns and shearing of the sealing lips can occur during operation. The distance ds is, therefore, a crucial and controllable factor in whether a seal will hold or be destroyed under the specified pressure and circumferential speed.

VR-RWDRs are offered with different dimensions (D3 or D4) of the support bodies. The purpose of this is to allow for different pressure ranges (see chapter "Gap extrusion" on p. 17).





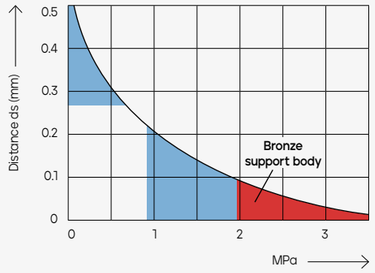
SAC



In the VR sealing system, this distance ds is taken into account by the support body bore dimensions D3 or D4. As standard, the D4 dimension of the punched metal parts is D1 + 0.5 mm and the D3 dimension is D1 + 1.0 mm. Higher and dynamic pressures require smaller distances ds.

Note: ds = (D3 - D1) / 2 or ds = (D4 - D1) / 2

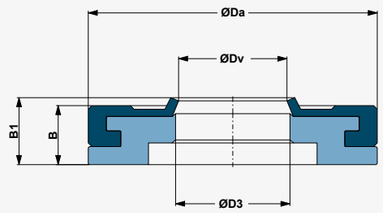
Pressure diagram



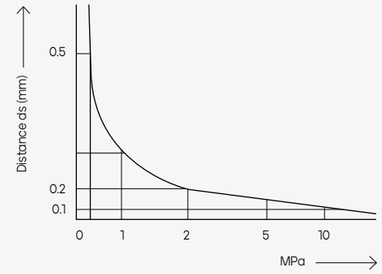
Area I: Support body with D3 dimension
Area II: Support body with D4 dimension
Area III: Support bodies with ds dimension adapted to your application

Remark:

- Support bodies are available in steel, stainless steel (1.4301) or special materials. Please contact us if you are interested in applications in area III.
- For distances ds < 0.10, gunmetal (RG7) is recommended as a support body material to prevent damage to the axle.
- For higher pressure loads on seals, it is necessary to keep the gap extrusion as small as possible. For this purpose, it is necessary to switch from stamped metal parts to the one-piece, turned support body design (SOA design).
- For high-pressure applications, please coordinate your design with us at an early stage.



SOA design



Pressure ds diagram

The SOA support body design enables very small ds distances to be achieved. These in turn are a measure of the maximum pressure load of the seal.

Support body material turned parts are available in:

- >Gunmetal (RG7)
- Aluminium
- Stainless steel (1.4301)
- Steel (1.0319)
- Plastics (e.g. PPS, PEEK, HDPE, PA6)

> **Note**

The support body bore dimension D3 should be specified in orders, otherwise the standard dimension will be used for production:
D3 = shaft Ø + 0.10 $^{+0.05\ -0.00}$
e.g. shaft Ø 30 → D3 = 30.10 $^{+0.05\ -0.00}$

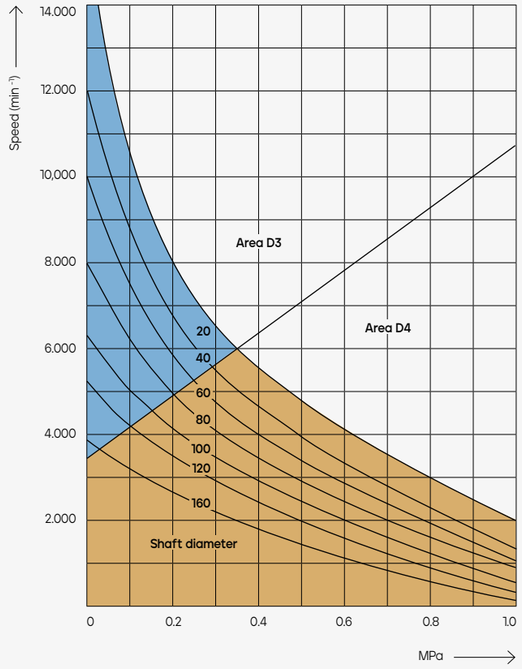
If you have any questions, please contact our technical department.

p-v diagram

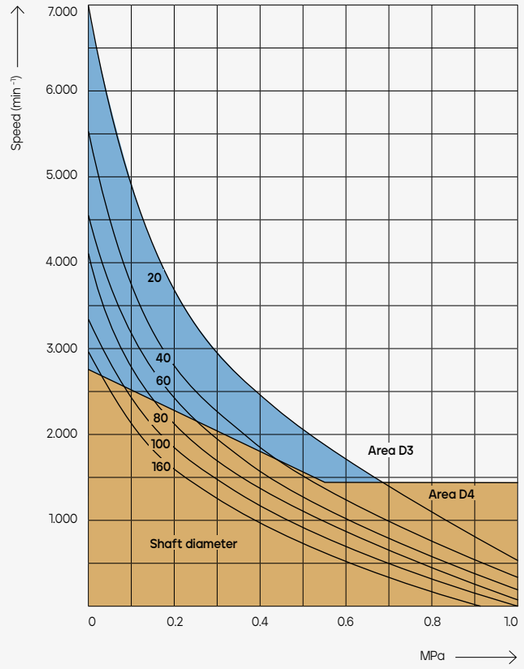
Permissible speed/pressure ratio

- Averaged values
- Lubricated sealing lip without additional cooling
- Pressure data for quasi-static condition. The pressure values must be reduced for impulsive pressure loads.

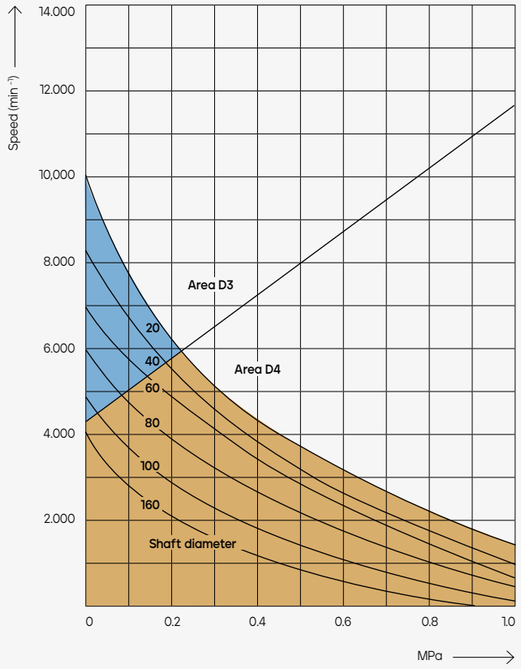
FPM (Viton®)



NBR (Perbunan®)



HNBR (Therban®)



NEW

VR-Low
Friction Seal

VR-Low Friction Seal

Maximum performance. Minimal friction.

Our latest sealing solution sets new standards in sealing technology. It combines the best properties of elastomers and PTFE. Resulting in? A pressure-resistant and energy-efficient rotary shaft seal. The flexibility of the high-quality elastomer ensures optimum adaptation, while the PTFE diaphragm significantly reduces friction. This means maximum efficiency and durability for your applications.

VR-Low Friction Seal

Supported by:

German Federal Ministry for Economic Affairs and Energy

based on a resolution of the German Federal Parliament

Made in Germany

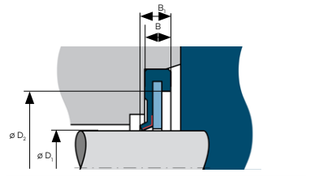
Quality Management ISO 9001 DEKRA certified

The new, optimised VR sealing lip 2K (patented) combines the positive properties of elastomers and PTFE. The flexibility of the seal is guaranteed by the elastomer used, while the greatly improved friction properties are achieved by a firmly bonded PTFE membrane.

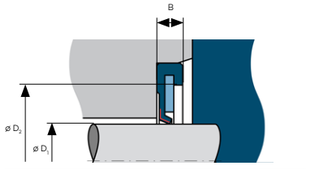
Designs

DOA | DOB | SOA | SAB | SAC

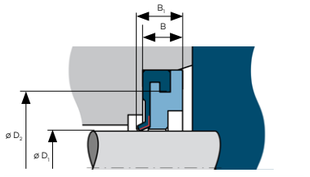
Available sizes



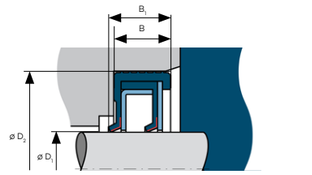
DOA



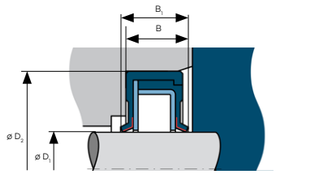
DOB



SOA



SAB



SAC

VR advantages

- Friction minimisation approximately 50 - 70% (depending on the friction condition) compared to standard seals by VR-Dichtungen
- Low heat generation and therefore also suitable for sensitive foodstuffs in fast-rotating pipes (hollow shafts), for example
- Significantly improved dry-running properties
- Leakage minimisation
- Stiffer sealing lip for easier installation
- Increased circumferential speed permitted
- Safe use in difficult lubrication conditions
- Can minimise noise at sealing points, e.g. when using EPDM
- Sustainable, as minimised use of PFAS materials

Applications

- Compressors
- Rotary feed-throughs:
  - for compressed air
  - for vacuum
- Food processing machines
- Medical technology
- You might also be able to use it in your application - get in touch with us!

Available designs

- DOA
- DOB
- SOA
- SAB
- SAC
- Customised seals

VR-Low Friction Seal

Shafts-Dia D1	Housings-Dia D2	Width h	Narrow width	Width SOA	B1	B2	B3
6	16	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
6	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
7	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
8	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
8	24	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
9	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
10	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
10	25	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
10	26	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
12	22	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
12	25	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
12	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
14	24	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
14	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
15	26	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
15	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
15	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
16	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
16	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
18	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
18	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
20	30	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
20	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
20	40	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
22	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
22	40	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
22	47	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
25	35	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
25	40	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
25	47	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
25	52	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
28	40	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
28	47	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
28	52	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
30	40	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
30	42	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm

Shafts-Dia D1	Housings-Dia D2	Width h	Narrow width	Width SOA	B1	B2	B3
30	47	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
30	52	7	3.5	5	B + 1.5 mm	B + 2 mm	B + 3 mm
32	45	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
32	47	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
32	52	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
35	47	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
35	50	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
35	52	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
35	55	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
38	55	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
38	62	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
40	52	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
40	55	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
40	62	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
42	55	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
42	62	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
45	60	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
45	62	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
45	65	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
48	62	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
50	65	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
50	68	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
50	72	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
55	70	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
55	72	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
55	80	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
60	75	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
60	80	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
60	85	8	4	5.5	B + 1.5 mm	B + 2 mm	B + 3 mm
65	85	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
65	90	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
70	90	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
70	95	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
75	95	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
75	100	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm
80	100	10	5	6.5	B + 1.5 mm	B + 2 mm	B + 3 mm

VR customised seals

Made for you.

Do you need a seal that is customised in line with your specific dimensions or a special application? You've come to the just right place! We develop and produce customised seals in accordance with your individual requirements. No matter how demanding your project is, we will find the right solution that is precisely tailored to your needs.

Your partner for customised special designs

We put your needs at the heart of everything we do. We manufacture customised seals that are precisely tailored to your specific requirements. No matter what challenges your application poses - we deliver the perfect solution.

Our customised seals are the result of decades of experience and advanced technology. We understand that every application is unique and places special demands on seals. That is why we attach great importance to understanding your needs precisely and developing customised solutions.

Customised advice and development

At the start of every project, we work with you closely to analyse the specific requirements. Which trade do you serve? What influences affect the machine? What quantities do you need? We clarify these and other questions to develop the perfect product.

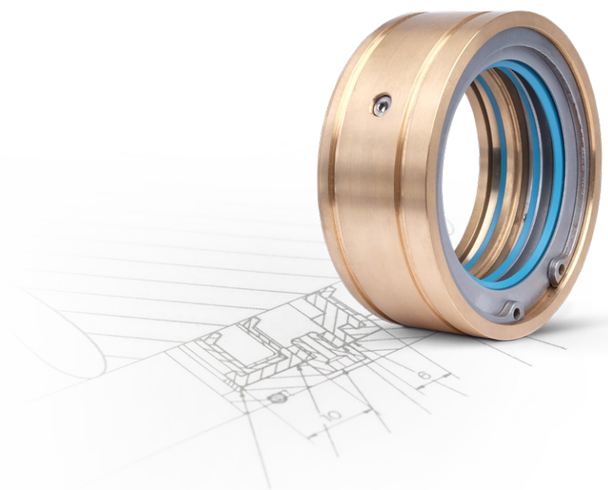
High-quality production

At our Übach-Palenberg plant, we produce the seals with the utmost care. Every seal is thoroughly tested before it leaves our factory. This ensures that you receive a product that meets the highest quality standards.

Durability and flexibility

Our seals are designed to last tough conditions and offer a long service life. However, should a replacement be necessary, we will supply a suitable replacement as quickly and efficiently as possible.

Our customers value the high quality and reliability of our products as well as our ability to respond quickly to individual requirements. Place your trust in our expertise and let us work together to develop the optimum sealing solution for your application.



Get in touch with us!

Do you have special requirements or questions about our customised seals? We are at your disposal. Together we will find the best solution for your project. Simply get in touch with us.

Patrick Keulers
Managing Director

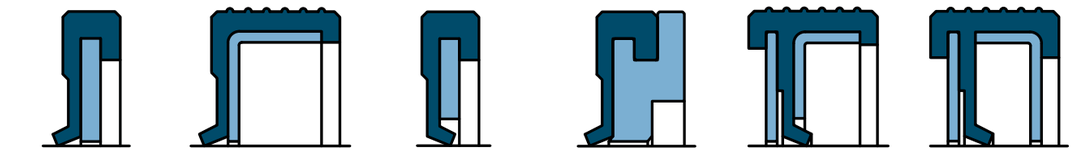
Phone +49 2451 48208-0
info@vr-dichtungen.com
vr-dichtungen.com

Single and double lip seals

Quality that wins you over.

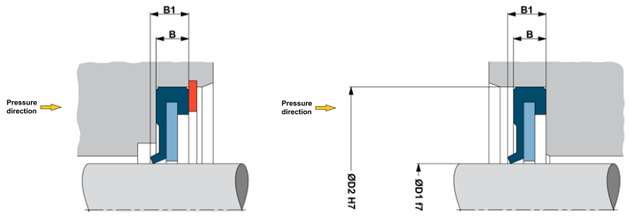
At VR-Dichtungen, we attach great importance to ensuring that every seal fits perfectly and performs its task reliably. Our single and double lip seals are designed to withstand the toughest requirements in a wide range of industries. Come and discover the tangible benefits of our sealing solutions and enjoy the quality and innovative strength of seals by VR-Dichtungen.

Single lip seals



DOA | BOA | DOB | SOA | BSB | MSB

DOA

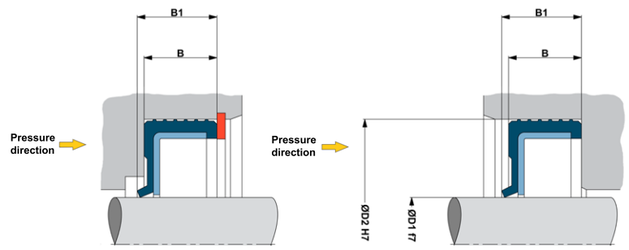


Application:

For sealing shafts when there is limited space available. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760 in half DIN width.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

BOA



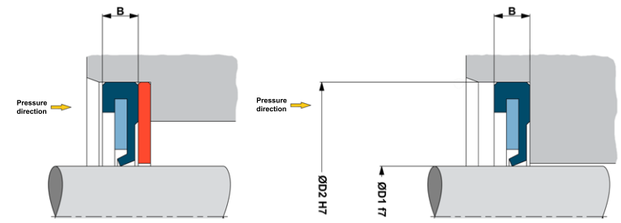
Application:

*For sealing shafts.
Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.*

p_{max}: 1.5 MPa
v_{max}: 40 m/s

Ideal for hygienic applications

DOB

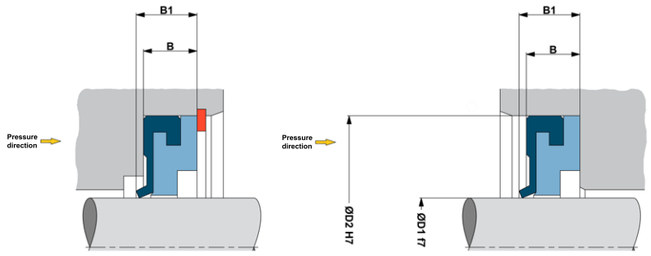


Application:

*For sealing shafts when there islimitedspace available.
Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760 in half DIN width.*

p_{max}: 1.5 MPa
v_{max}: 40 m/s

SOA



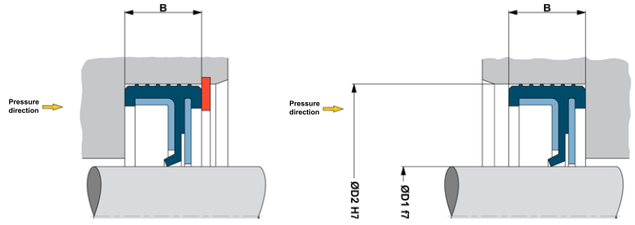
Application:

*Sealing of shafts at higher pressure, e.g. as an alternative to mechanical seals.
Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.*

p_{max}: 15.0 MPa
v_{max}: 40 m/s

BSB

p_{max}: 1.0 MPa



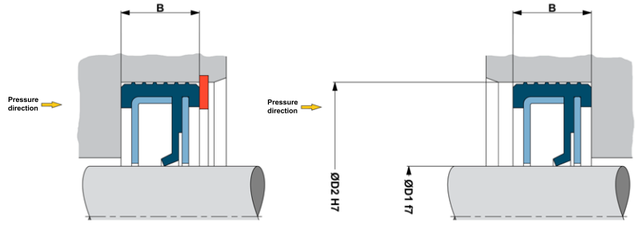
Application:

Sealing of shafts with a different running track to standard seals (shaft seals). Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.0 MPa
v_{max}: 40 m/s

MSB

p_{max}: 1.0 MPa

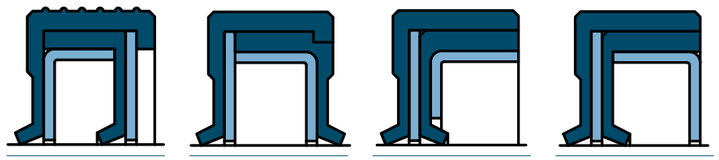


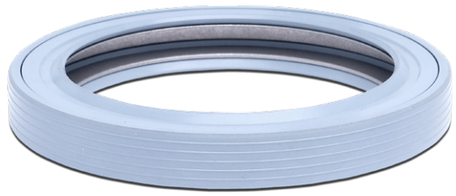
Application:

Sealing of shafts with pulsating pressures. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.0 MPa
v_{max}: 40 m/s

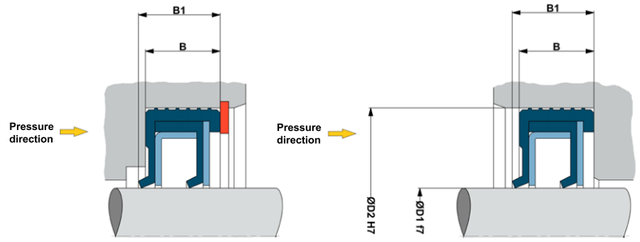
Double lip seals





VR double lip seals are suitable for a wide range of applications. Designed for efficiency and reliability, these seals ensure optimum performance.
VR double lip seals can be lubricated in the free space between the two lips. The SAB has two lips in one direction to help increase seal life. SAC, MSC and MAC are designed to separate two fluids or to seal vacuum and pressure in one seal.

SAB

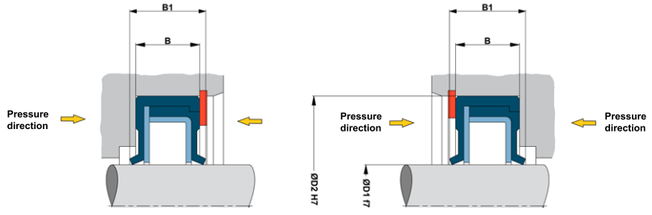


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

SAC

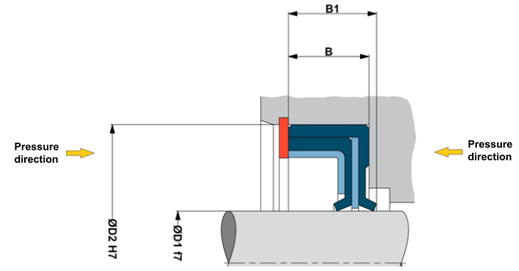


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760. It is often used to separate media or pressure ranges.

p_{max}: 1.5 MPa (Cap side)
1.0 MPa (disc side)
v_{max}: 40 m/s

MAC

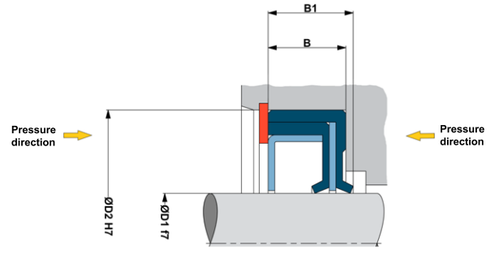


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

MSC



Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

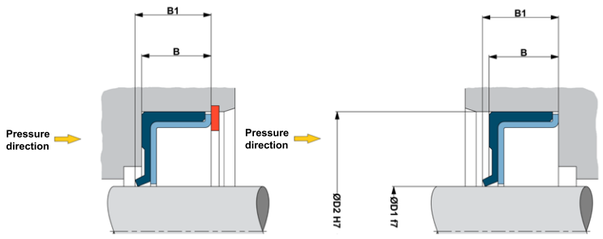
Ideal for hygienic applications

Existing seals

These seals will continue to be produced. Please select the upper seals for new projects.

OOA OOB OAB OBC OAC

OOA

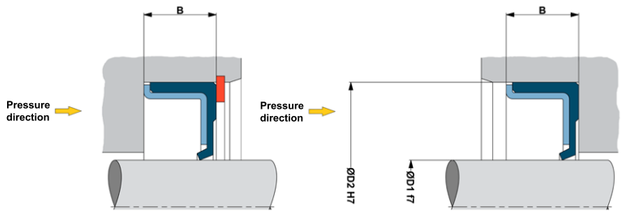


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

OOB

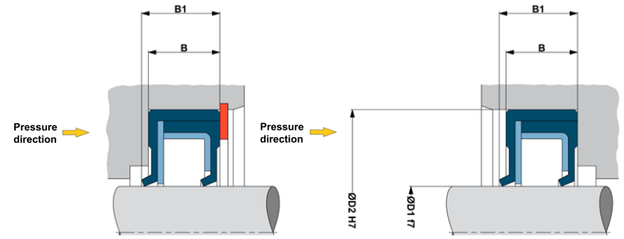


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

OAB

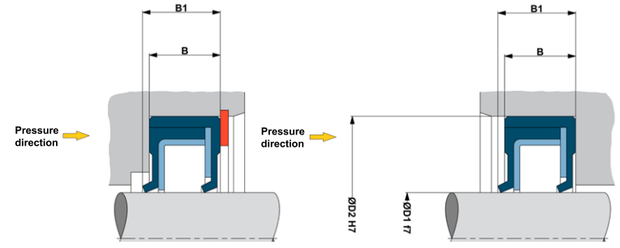


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

OBC

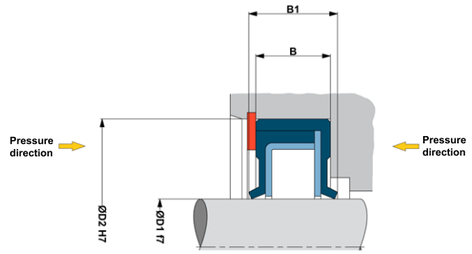


Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa
v_{max}: 40 m/s

OAC



Application:

Sealing of shafts. Rotary shaft seal (RWDR) in dimensions in accordance with DIN 3760.

p_{max}: 1.5 MPa (Cap side)
1.0 MPa (disc side)
v_{max}: 40 m/s

Preferred dimensions

D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2
					20	30	7	8.5	9.5	42	55	10	12.0	13.0	85	110	10	12.5	13.5
						32					62					120	12	14.5	15.5
						35					72				90	110	10	12.5	13.5
						40				45	60	10	12.0	13.0		120	12	14.5	15.5
						47					62				95	120	12	14.5	15.5
6	16	7	8.0	9.0	22	32	7	8.5	10.0		65					125			
	22					35					72				100	120	12	14.5	15.5
						40				48	62	10	12.0	13.0		125			
7	16	7	8.5	9.0		47					72					130			
	22				24	35	7	9.0	10.0	50	65	10	12.0	13.0	105	130	12	14.5	15.5
8	16	7	8.5	9.5		37					68					140			
	22					40					72				110	130	12	14.5	15.5
	24					47					80					140			
9	22	7	8.5	9.5	25	35	7	9.0	10.0	52	68	10	12.0	13.0	115	140	12	14.5	15.5
	24					40					72					150			
	26					42				55	70	10	12.0	13.0	120	150	12	14.5	15.5
10	22	7	8.5	9.5		47					72					160			
	24					52	9	11.0	12.0		80				125	150	12	14.5	15.5
	26				26	37	7	9.0	10.0		85					160			
11	22	7	8.5	9.5		42				56	70	10	12.0	13.0	130	160	12	14.5	15.5
	26					47					72					170			
					28	40	7	9.0	10.0		80				135	170	12	14.5	15.5
12	22	7	8.5	9.5		47					85				140	170	12	14.5	15.5
	24					52	9	11.0	12.0	58	72	10	12.0	13.0	145	175	15	17.5	18.5
	28				30	40	7	9.0	10.0		80				150	180	15	17.5	18.5
	30					42				60	75	10	12.5	13.5	160	190	15	17.5	18.5
						45					80				170	200	15	17.5	18.5
14	24	7	8.5	9.5		47					85				180	210	15	17.5	18.5
	28					50					90				190	220	15	17.5	18.5
	30					52	9	11.0	12.0	62	85	10	12.5	13.5	200	230	15	18.0	19.0
	35					62	10	12.0	13.0		90				210	240	15	18.0	19.0
15	26	7	8.5	9.5	32	45	7	9.0	10.0	63	85	10	12.5	13.5	220	250	15	18.0	19.0
	30					47					90				230	260	15	18.0	19.0
	32					52	9	11.0	13.0	65	85	10	12.5	13.5	240	270	15	18.0	19.0
	35				35	47	7	9.0	10.0		90				250	280	15	18.0	19.0
16	28	7	8.5	9.5		50					100				260	300	20	24.0	25.0
	30					52	9	11.0	12.0	68	90	10	12.5	13.5	280	320	20	24.0	25.0
	32					62	10	12.0	13.0		100				300	340	20	24.0	25.0
	35				36	47	7	9.0	10.0	70	90	10	12.5	13.5	320	360	20	24.0	25.0
17	28	7	8.5	9.5		50					100				340	380	20	24.0	25.0
	30					52	9	11.0	12.0	72	95	10	12.5	13.5	360	400	20	24.0	25.0
	32					62	10	12.0	13.0		100				380	420	20	24.0	25.0
	35				38	52	9	11.0	12.0	75	95	10	12.5	13.5					
	40					55	10	12.0	13.0		100								
18	30	7	8.5	9.5		62				78	100	10	12.5	13.5					
	32				40	52	9	11.0	12.0	80	100	10	12.5	13.5					
	35					55	10	12.0	13.0		110								
	40					62													
						72													

Overview of the dimensions

Here you can see a clear and detailed overview of all available dimensions for our VR single lip seals.
The detailed information will help you find the right product for your application quickly and easily.

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
1	3	1.6			2.6	4.1	4.6					x											
1.5	10	4			5	6.5	7												x				
2	10	3			4	5.5	6						x										
2.3	10	3			4	5.5	6					x		x					x				
3	10	3			4	5.5	6					x		x									
3	14	4			5	6.5	7					x		x									
3.5	10	5			6	7.5	8												x				
4	10	3			4	5.5	6					x	x	x									
4	10	3.5			4.5	6	6.5					x		x									
4	10	5			6	7.5	8												x				
4	16	7			8	9.5	10										x	x	x	x	x	x	x
5	10	3			4	5.5	6					x		x									
5	10	3.5			4.5	6	6.5					x		x									
5	10	5			6	7.5	8												x				
5	11	3			4	5.5	6					x		x									
5	16	3			4	5.5	6					x		x									
5	16	7			8	9.5	10										x	x	x	x	x	x	x
5	22	3			4	5.5	6						x										
5	22	7			8	9.5	10													x			x
6	10	3			4	5.5	6					x		x									
6	10	5			6	7.5	8												x				
6	15	3.5			4.5	6	6.5					x		x									
6	16	3			4	5.5	6					x	x	x									
6	16	5			6	7.5	8					x		x									
6	16	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
6	19	3			4	5.5	6					x		x									
6	22	3			4	5.5	6					x		x									
6	22	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
6	22	8			9	10.5	11										x	x	x		x		
6	24	7			8	9.5	10												x				
7	16	3			4	5.5	6					x	x	x									
7	16	5			6	7.5	8												x				
7	16	7			8	9.5	10			x	x						x	x	x	x	x	x	
7	22	7	x		8	9.5	10			x	x				x	x			x	x		x	x
8	12	3			4	5.5	6					x		x									
8	14	3			4	5.5	6					x		x									
8	16	3			4	5.5	6					x	x	x									
8	16	3.5			4.5	6	6.5						x										
8	16	7			8	9.5	10										x	x	x	x	x	x	x
8	18	3			4	5.5	6					x		x									
8	19	3			4	5.5	6						x										
8	22	3			4	5.5	6					x	x	x									
8	22	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
8	24	3			4	5.5	6					x	x	x									
8	24	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x		
9	12	3			4	5.5	6					x		x									
9	12	3.5			4.5	6	6.5					x		x									
9	22	3			4	5.5	6					x	x	x									
9	22	7	x		8	9.5	10								x	x	x	x	x	x	x	x	x
9	24	7			8	9.5	10													x			x
9	26	7			8	9.5	10				x									x			x

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
9.5	25.4	7			8	9.5	10													x			x
10	16	3			4	5.5	6					x		x									
10	18	4			5	6.5	7					x		x									
10	20	3			4	5.5	6					x		x									
10	22	3			4	5.5	6					x	x	x									
10	22	3.5			4.5	6	6.5					x		x									
10	22	4			5	6.5	7					x		x									
10	22	5			6	7.5	8							x									
10	22	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
10	24	3			4	5.5	6					x	x	x									
10	24	7			8	9.5	10			x	x						x	x	x	x	x	x	x
10	25	7	x		8	9.5	10								x	x							
10	26	3			4	5.5	6					x	x	x									
10	26	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
11	22	3			4	5.5	6					x	x	x									
11	22	7			8	9.5	10			x	x						x	x	x	x	x	x	x
11	24	3			4	5.5	6					x		x									
11	26	3			4	5.5	6					x	x	x									
11	26	7			8	9.5	10			x	x								x	x			
12	20	7			8	9.5	10			x	x												
12	22	3			4	5.5	6					x	x	x									
12	22	3.5			4.5	6	6.5					x		x									
12	22	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	
12	24	3			4	5.5	6					x		x									
12	24	3.5			4.5	6	6.5						x										
12	24	7			8	9.5	10			x	x						x	x	x	x	x	x	x
12	25	3			4	5.5	6					x		x									
12	25	7	x		8	9.5	10								x	x							
12	26	3			4	5.5	6					x	x	x									
12	26	7			8	9.5	10													x			x
12	28	3			4	5.5	6					x	x	x									
12	28	7			8	9.5	10			x	x						x	x	x	x	x	x	x
12	30	3			4	5.5	6						x										
12	30	3.5			4.5	6	6.5					x		x									
12	30	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
13	25	5			6	7.5	8							x									
14	22	3			4	5.5	6					x		x									
14	22	5			6	7.5	8					x		x									
14	24	3			4	5.5	6					x	x	x									
14	24	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
14	26	3			4	5.5	6					x		x									
14	28	3			4	5.5	6					x	x	x									
14	28	3.5			4.5	6	6.5					x		x									
14	28	7			8	9.5	10				x						x	x	x		x	x	
14	30	3			4	5.5	6						x										
14	30	7	x		8	9.5	10								x	x	x	x	x	x	x	x	x
14	35	3			4	5.5	6					x	x	x									
14	35	7			8	9.5	10										x	x	x	x	x	x	x
15	24	3			4	5.5	6					x		x									
15	24	7			8	9.5	10										x	x	x	x	x		
15	25	3.5			4.5	6	6.5						x										
15	26	3			4	5.5	6					x	x	x									
15	26	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
15	30	3			4	5.5	6					x	x	x									
15	30	3.5			4.5	6	6.5						x										
15	30	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
15	32	3			4	5.5	6					x	x	x									
15	32	7			8	9.5	10			x	x						x	x	x	x	x	x	x
15	35	3			4	5.5	6					x	x	x									
15	35	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
16	24	3			4	5.5	6					x		x									
16	24	3.5			4.5	6	6.5					x		x									
16	26	7			8	9.5	10			x	x												
16	28	3			4	5.5	6					x	x	x									

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
16	28	7			8	9.5	10			x	x						x	x	x	x	x	x	x
16	30	3			4	5.5	6					x		x									
16	30	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
16	32	3			4	5.5	6						x										
16	32	7			8	9.5	10			x	x						x	x	x		x	x	
16	35	3			4	5.5	6					x		x									
16	35	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
17	22	3			4	5.5	6					x		x									
17	23	3			4	5.5	6						x										
17	28	3			4	5.5	6					x	x	x									
17	28	7			8	9.5	10			x	x						x	x	x	x	x	x	x
17	30	3			4	5.5	6						x										
17	30	4			5	6.5	7					x		x									
17	30	7			8	9.5	10			x	x								x	x		x	x
17	32	3			4	5.5	6					x		x									
17	32	7			8	9.5	10			x	x								x	x		x	x
17	35	3			4	5.5	6					x	x	x									
17	35	7			8	9.5	10			x	x								x	x	x		
17	40	3			4	5.5	6					x	x	x									
17	40	7			8	9.5	10			x	x								x	x	x	x	x
18	28	7			8	9.5	10			x	x										x		x
18	30	3			4	5.5	6					x	x	x									
18	30	7	x		8	9.5	10			x	x						x	x	x	x	x	x	x
18	32	3			4	5.5	6						x										
18	32	7			8	9.5	10			x	x								x	x	x		
18	35	3			4	5.5	6						x										
18	35	3.5			4.5	6	6.5					x		x									
18	35	7	x		8	9.5	10								x	x	x	x	x	x	x	x	x
18	40	3			4	5.5	6					x	x	x									
18	40	7			8	9.5	10										x	x	x	x	x	x	x
20	30	3			4	5.5	6					x	x	x									
20	30	3.5			4.5	6	6.5					x	x	x									
20	30	5			6	7.5	8							x									
20	30	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
20	32	3			4	5.5	6					x		x									
20	32	3.5			4.5	6	6.5					x	x	x									
20	32	7			8	9.5	10			x	x								x	x		x	x
20	35	3			4	5.5	6					x	x	x									
20	35	3.5			4.5	6	6.5					x		x									
20	35	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
20	40	3			4	5.5	6					x		x									
20	40	5			6	7.5	8							x									
20	40	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
20	42	7			8	9.5	10				x						x	x					
20	47	3			4	5.5	6					x	x	x									
20	47	3.5			4.5	6	6.5					x		x									
20	47	7			8	9.5	10			x	x						x	x	x	x	x	x	x
20	52	10			11	12.5	13													x			x
21	30	3			4	5.5	6					x		x									
22	30	3			4	5.5	6					x	x	x									
22	30	7			8	9.5	10			x	x												
22	32	3			4	5.5	6						x										
22	32	7			8	9.5	10			x	x						x	x	x	x	x	x	x
22	35	3			4	5.5	6					x	x	x									
22	35	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x
22	40	3			4	5.5	6					x		x									
22	40	7	x		8	9.5	10			x	x						x	x	x	x	x	x	x
22	42	5			6	7.5	8							x									
22	47	3			4	5.5	6					x	x	x									
22	47	7	x		8	9.5	10			x	x						x	x	x	x	x	x	x
23	36	7			8	9.5	10										x	x	x			x	
23.75	36.6	4.45			5.45	6.95	7.45							x									
24	35	3			4	5.5	6					x	x	x									
24	35	7			8	9.5	10				x						x	x	x		x	x	

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
24	37	3			4	5.5	6						x										
24	37	7			8	9.5	10														x			x
24	38	7			8	9.5	10										x	x	x			x		
24	40	7			8	9.5	10				x						x	x	x	x	x	x	x	x
24	47	3			4	5.5	6						x											
24	47	7			8	9.5	10										x	x	x	x	x	x	x	x
24	47	9			10	11.5	12														x			
25	32	7			8	9.5	10													x				
25	35	3			4	5.5	6					x	x	x										
25	35	3.5			4.5	6	6.5					x		x										
25	35	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
25	37	7			8	9.5	10			x	x													
25	40	3			4	5.5	6					x	x	x										
25	40	4			5	6.5	7							x										
25	40	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
25	42	3			4	5.5	6					x	x	x										
25	42	7			8	9.5	10			x	x						x	x	x	x	x	x	x	x
25	43	3			4	5.5	6						x											
25	47	3			4	5.5	6					x		x										
25	47	3.5			4.5	6	6.5						x											
25	47	7	x		8	9.5	10			x	x		x		x	x	x	x	x	x	x	x	x	x
25	52	4			5	6.5	7					x		x										
25	52	7	x		8	9.5	10			x	x				x	x					x			
25	52	9			10	11.5	12										x	x	x	x	x	x	x	x
26	37	3			4	5.5	6						x											
26	37	5			6	7.5	8							x										
26	37	7			8	9.5	10										x	x	x	x	x	x		
26	42	7			8	9.5	10			x	x									x	x			
26	47	7			8	9.5	10			x	x									x			x	
28	40	3			4	5.5	6					x		x										
28	40	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
28	47	3			4	5.5	6					x	x	x										
28	47	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
28	52	4			5	6.5	7					x		x										
28	52	7	x		8	9.5	10			x	x				x	x								
28	52	9			10	11.5	12										x	x	x	x	x	x	x	x
30	40	3			4	5.5	6					x	x	x										
30	40	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
30	42	3			4	5.5	6					x	x	x										
30	42	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
30	45	3			4	5.5	6					x		x										
30	45	7			8	9.5	10			x	x									x	x		x	x
30	47	3			4	5.5	6					x	x	x										
30	47	7	x		8	9.5	10			x	x				x	x	x	x	x	x			x	x
30	50	7			8	9.5	10			x	x									x	x		x	x
30	50	9			10	11.5	12										x	x	x		x	x		
30	52	4			5	6.5	7					x	x	x										
30	52	7	x		8	9.5	10			x	x				x	x								
30	52	9			10	11.5	12										x	x	x	x	x	x	x	x
30	62	4			5	6.5	7					x	x	x										
30	62	7			8	9.5	10				x													
30	62	10			11	12.5	13										x	x	x	x	x	x	x	x
32	45	3			4	5.5	6					x	x	x										
32	45	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
32	45	8	x		9	10.5	11								x	x								
32	47	3			4	5.5	6					x	x	x										
32	47	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
32	47	8	x		9	10.5	11								x	x								
32	48	3.5			4.5	6	6.5						x											
32	52	4			5	6.5	7					x		x										
32	52	5			6	7.5	8							x										
32	52	7	x		8	9.5	10			x	x				x	x								
32	52	8	x		9	10.5	11								x	x								
32	52	9			10	11.5	12										x	x	x	x	x	x	x	x

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
32	55	10			11	12.5	13												x				
34	47	3			4	5.5	6					x		x									
35	47	3			4	5.5	6					x	x	x									
35	47	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
35	47	8	x		9	10.5	11								x	x								
35	50	3			4	5.5	6					x		x										
35	50	7	x		8	9.5	10			x	x				x	x	x	x	x	x	x	x	x	x
35	50	8	x		9	10.5	11								x	x								
35	52	4			5	6.5	7					x	x	x										
35	52	7	x		8	9.5	10			x	x				x	x								
35	52	8	x		9	10.5	11								x	x								
35	52	9			10	11.5	12										x	x	x	x	x	x	x	x
35	55	4			5	6.5	7					x		x										
35	55	7	x		8	9.5	10								x	x								
35	55	8	x		9	10.5	11								x	x								
35	55	10			11	12.5	13														x			x
35	62	4			5	6.5	7					x		x										
35	62	7			8	9.5	10			x	x													
35	62	8			9	10.5	11			x	x													
35	62	10			11	12.5	13										x	x	x	x	x	x	x	x
36	47	3			4	5.5	6						x											
36	47	7			8	9.5	10			x	x						x	x	x	x	x	x	x	x
36	50	7			8	9.5	10			x	x									x	x		x	x
36	52	4			5	6.5	7					x		x										
36	52	7			8	9.5	10			x	x													
36	52	9			10	11.5	12														x			x
36	54	10			11	12.5	13			x	x													
36	62	7			8	9.5	10			x	x													
38	50	4.5			5.5	7	7.5					x												
38	50	4.5			5.5	7	7.5							x										
38	52	4			5	6.5	7					x		x										
38	52	7			8	9.5	10			x	x													
38	52	9			10	11.5	12										x	x	x	x	x	x	x	x
38	55	4.5			5.5	7	7.5						x											
38	55	7	x		8	9.5	10								x	x								
38	55	8	x		9	10.5	11								x	x								
38	55	10			11	12.5	13														x			x
38	62	4			5	6.5	7					x	x	x										
38	62	7	x		8	9.5	10			x	x				x	x								
38	62	8	x		9	10.5	11								x	x								
38	62	10			11	12.5	13														x			x
40	45	3			4	5.5	6					x		x										
40	52	4			5	6.5	7					x	x	x										
40	52	7	x		8	9.5	10			x	x				x	x					x	x		x
40	52	8	x		9	10.5	11								x	x								
40	52	9			10	11.5	12										x	x	x	x	x	x	x	x
40	55	4			5	6.5	7					x	x	x										
40	55	7	x		8	9.5	10			x	x				x	x								
40	55	8	x		9	10.5	11								x	x								
40	55	10			11	12.5	13										x	x	x	x	x	x	x	x
40	55	6			7	8.5	9					x		x										
40	57	7			8	9.5	10			x	x													
40	60	10			11	12.5	13														x			
40	62	4			5	6.5	7					x	x	x										
40	62	7	x		8	9.5	10			x	x				x	x								
40	62	8	x		9	10.5	11								x	x								
40	62	10			11	12.5	13										x	x	x	x	x	x	x	x
40	72	4			5	6.5	7					x	x	x										
40	72	7			8	9.5	10			x	x													
40	72	10			11	12.5	13			x	x						x	x	x	x	x	x	x	x
42	55	4			5	6.5	7					x	x	x										
42	55	8	x		9	10.5	11			x	x				x	x								
42	55	10			11	12.5	13														x	x		x
42	58	12			13	14.5	15				x													

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
42	60	10			11	12.5	13												x			x	
42	62	4.5			5.5	7	7.5						x										
42	62	8	x		9	10.5	11			x	x				x	x							
42	62	10			11	12.5	13										x	x	x	x	x	x	x
42	70	10			11	12.5	13													x			
42	72	4			5	6.5	7					x	x	x									
42	72	10			11	12.5	13												x	x		x	x
44	72	10			11	12.5	13										x	x	x		x		
45	60	4			5	6.5	7					x		x									
45	60	4.5			5.5	7	7.5					x		x									
45	60	8	x		9	10.5	11			x	x				x	x							
45	60	10			11	12.5	13										x	x	x	x	x	x	x
45	62	4			5	6.5	7					x	x	x									
45	62	4.5			5.5	7	7.5						x										
45	62	8	x		9	10.5	11			x	x				x	x							
45	62	10			11	12.5	13										x	x	x	x	x	x	x
45	65	4			5	6.5	7					x	x	x									
45	65	8	x		9	10.5	11			x	x				x	x							
45	65	10			11	12.5	13										x	x	x	x	x	x	x
45	68	4			5	6.5	7					x		x									
45	68	10			11	12.5	13												x				
45	72	4			5	6.5	7					x	x	x									
45	72	8			9	10.5	11			x	x												
45	72	10			11	12.5	13				x						x	x	x	x	x	x	x
47	63	4			5	6.5	7						x										
48	62	4			5	6.5	7					x	x	x									
48	62	8	x		9	10.5	11			x	x				x	x							
48	62	10			11	12.5	13										x	x	x	x	x		
48	72	4			5	6.5	7					x	x	x									
48	72	8			9	10.5	11			x	x												
48	72	10			11	12.5	13										x	x	x	x	x	x	
50	61	7			8	9.5	10			x	x												
50	62	10			11	12.5	13												x				
50	65	4			5	6.5	7					x	x	x									
50	65	8	x		9	10.5	11			x	x				x	x							
50	65	10			11	12.5	13										x	x	x	x	x	x	x
50	68	4			5	6.5	7					x	x	x									
50	68	4.5			5.5	7	7.5					x		x									
50	68	8	x		9	10.5	11			x	x				x	x							
50	68	10			11	12.5	13										x	x	x	x	x	x	x
50	70	4			5	6.5	7						x										
50	70	10			11	12.5	13												x	x		x	x
50	72	4			5	6.5	7					x	x	x									
50	72	8	x		9	10.5	11			x	x				x	x							
50	72	10			11	12.5	13				x						x	x	x	x	x	x	x
50	80	4			5	6.5	7						x										
50	80	8			9	10.5	11				x												
50	80	10			11	12.5	13			x	x						x	x	x	x	x	x	x
52	68	4			5	6.5	7					x	x	x									
52	68	8			9	10.5	11			x	x												
52	68	10			11	12.5	13										x	x	x		x		
52	72	8			9	10.5	11			x	x												
52	72	10			11	12.5	13												x	x			
55	70	4			5	6.5	7					x	x	x									
55	70	8	x		9	10.5	11			x	x				x	x							
55	70	10			11	12.5	13				x						x	x	x	x	x	x	x
55	72	4			5	6.5	7					x	x	x									
55	72	8	x		9	10.5	11			x	x				x	x			x				
55	72	10			11	12.5	13				x						x	x	x	x	x	x	x
55	78	10			11	12.5	13														x		x
55	80	4			5	6.5	7					x	x	x									
55	80	8	x		9	10.5	11			x	x				x	x							
55	80	10			11	12.5	13				x	x		x			x	x	x	x	x	x	x
55	85	4			5	6.5	7					x		x									

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
55	85	10			11	12.5	13				x												
58	72	4			5	6.5	7					x	x	x									
58	72	7			8	9.5	10			x													
58	72	8			9	10.5	11				x												
58	72	10			11	12.5	13										x	x	x	x	x	x	x
58	80	4			5	6.5	7					x		x									
58	80	8			9	10.5	11			x	x												
58	80	10			11	12.5	13												x			x	
60	68	3			4	5.5	6						x										
60	72	10			11	12.5	13										x	x	x		x		
60	75	4			5	6.5	7						x										
60	75	8	x		9	10.5	11			x	x				x	x							
60	75	10			11	12.5	13			x	x						x	x	x	x	x	x	x
60	80	4			5	6.5	7					x		x									
60	80	8	x		9	10.5	11			x	x				x	x							
60	80	10			11	12.5	13			x	x						x	x	x	x	x	x	x
60	85	4			5	6.5	7					x		x									
60	85	8	x		9	10.5	11			x	x				x	x							
60	85	10			11	12.5	13			x	x						x	x	x		x		
60	90	4			5	6.5	7					x	x	x									
60	90	8			9	10.5	11			x	x												
60	90	10			11	12.5	13			x	x						x	x	x	x	x	x	x
60	100	4.5			5.5	7	7.5						x										
62	85	10			11	12.5	13														x		
62	90	10			11	12.5	13										x	x	x	x	x	x	x
63	85	4			5	6.5	7					x	x	x									
63	85	10			11	12.5	13												x	x		x	x
63	90	10			11	12.5	13			x	x								x			x	
64	76	5			6	7.5	8							x									
65	80	4			5	6.5	7					x		x									
65	85	4			5	6.5	7						x										
65	85	10	x		11	12.5	13			x	x								x	x	x	x	x
65	90	4			5	6.5	7						x										
65	90	8			9	10.5	11				x												
65	90	10	x		11	12.5	13										x	x	x	x	x	x	x
65	100	4			5	6.5	7					x		x									
65	100	10			11	12.5	13			x	x								x	x	x	x	x
68	90	10			11	12.5	13			x	x										x	x	
69	90	10			11	12.5	13												x				
70	82	4.5			5.5	7	7.5					x		x									
70	90	4.5			5.5	7	7.5					x	x	x									
70	90	4.5			5.5	7	7.5					x		x									
70	90	10	x		11	12.5	13			x	x								x	x	x	x	x
70	95	10	x		11	12.5	13												x	x	x	x	x
70	100	4.5			5.5	7	7.5					x	x	x									
70	100	10			11	12.5	13			x	x								x	x	x	x	x
72	95	4			5	6.5	7					x		x									
72	95	10			11	12.5	13												x	x	x	x	x
72	100	10			11	12.5	13				x								x	x	x	x	x
75	95	4			5	6.5	7					x	x	x									
75	95	10	x		11	12.5	13			x	x								x	x	x	x	x
75	100	4			5	6.5	7					x	x	x									
75	100	10	x		11	12.5	13			x	x								x	x	x	x	x
78	100	4			5	6.5	7					x	x	x									
78	100	10			11	12.5	13												x	x	x	x	x
80	100	4			5	6.5	7					x	x	x									
80	100	5			6	7.5	8					x		x									
80	100	10	x		11	12.5	13			x	x								x	x	x	x	x
80	110	5			6	7.5	8					x	x	x									
80	110	10	x		11	12.5	13			x	x								x	x	x	x	x
82	94	4			5	6.5	7					x		x									
85	110	5			6	7.5	8					x	x	x									
85	110	10			11	12.5	13												x	x	x	x	x
85	110	12	x		13	14.5	15			x	x								x	x			

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
85	120	5			6	7.5	8					x	x	x									
85	120	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
87	98	5			6	7.5	8						x										
88.9	110	5			6	7.5	8						x										
90	110	4			5	6.5	7					x		x									
90	110	5			6	7.5	8					x	x	x									
90	110	10			11	12.5	13										x	x	x	x	x	x	x
90	110	12	x		13	14.5	15			x	x				x	x							
90	120	5			6	7.5	8					x	x	x									
90	120	12	x		13	14.5	15			x	x				x	x	x	x	x	x	x	x	x
95	120	5			6	7.5	8					x	x	x									
95	120	12	x		13	14.5	15								x	x			x	x		x	x
95	125	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
100	120	5			6	7.5	8					x	x	x									
100	120	6			7	8.5	9							x									
100	120	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
100	125	5			6	7.5	8						x										
100	125	12	x		13	14.5	15								x	x	x	x	x		x		
100	130	5			6	7.5	8						x										
100	130	12			13	14.5	15			x	x						x	x	x	x	x		
105	130	12	x		13	14.5	15			x	x				x	x	x	x	x	x	x	x	x
105	140	5			6	7.5	8					x	x	x									
105	140	12			13	14.5	15												x	x		x	x
110	130	5			6	7.5	8					x	x	x									
110	130	12	x		13	14.5	15			x	x				x	x	x	x	x	x	x	x	x
110	140	5			6	7.5	8					x		x									
110	140	12	x		13	14.5	15								x	x			x			x	
115	140	5			6	7.5	8					x		x									
115	140	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
115	150	5			6	7.5	8					x		x									
120	150	5			6	7.5	8					x	x	x									
120	150	12	x		13	14.5	15			x	x				x	x	x	x	x	x	x	x	x
120	160	12			13	14.5	15										x	x	x	x	x		
125	150	5			6	7.5	8					x	x	x									
125	150	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
125	160	5			6	7.5	8						x										
125	160	12			13	14.5	15												x	x			
125	162	5.5			6.5	8	8.5					x		x									
130	160	5			6	7.5	8					x		x									
130	160	12	x		13	14.5	15								x	x	x	x	x	x	x	x	x
130	170	12			13	14.5	15												x			x	
135	170	4			5	6.5	7							x									
135	170	5			6	7.5	8						x										
135	170	12	x		13	14.5	15								x	x			x	x			
140	170	5			6	7.5	8					x		x									
140	170	12			13	14.5	15										x	x	x		x	x	
140	170	15	x		16	17.5	18								x	x							
145	175	15	x		16	17.5	18								x	x				x			
150	180	5			6	7.5	8					x	x	x									
150	180	15	x		16	17.5	18								x	x	x	x	x	x	x	x	x
160	180	15			16	17.5	18													x			x
160	190	15	x		16	17.5	18								x	x				x			x
170	200	6			7	8.5	9						x										
170	200	15	x		16	17.5	18								x	x	x	x	x	x	x		
175	193	6			7	8.5	9						x										
180	210	6			7	8.5	9					x	x	x									
180	210	15	x		16	17.5	18								x	x	x	x	x	x	x	x	x
184	222	6			7	8.5	9						x										
190	220	15	x		16	17.5	18								x	x							
193.67	231.77	6.35			7.35	8.85	9.35					x		x									
200	230	6			7	8.5	9					x		x									
200	230	15	x		16	17.5	18								x	x			x	x		x	x
210	240	15	x		16	17.5	18								x	x			x				
220	250	15	x		16	17.5	18								x	x			x	x			x

Dia shafts D1	Dia Housings D2	Width B	ISO/DIN	VR standard	Width B1	Width B2	Width B3	Special design width SOA	BOA	BSB	MSB	DOA	DOB	SOA	SAB	SAC	MAC	MSC	OOA	OOB	OAB	OAC	OBC
230	260	7			8	9.5	10						x										
230	260	15	x		16	17.5	18								x	x							
240	270	15	x		16	17.5	18								x	x			x	x		x	
250	280	15	x		16	17.5	18								x	x							
250	280	20			21	22.5	23												x				
260	300	20	x		21	22.5	23								x	x							
280	320	20	x		21	22.5	23					x		x	x	x	x	x	x	x	x	x	x
300	340	20	x		21	22.5	23								x	x							
320	360	20	x		21	22.5	23								x	x	x	x	x	x	x		
340	380	10			11	12.5	13						x										
340	380	20	x		21	22.5	23					x			x	x			x			x	
360	400	20	x		21	22.5	23								x	x				x			
380	420	20	x		21	22.5	23								x	x			x		x	x	
400	440	20	x		21	22.5	23								x	x			x				
440	480	20	x		21	22.5	23								x	x							
460	500	20	x		21	22.5	23								x	x							
480	520	20	x		21	22.5	23								x	x							
500	540	20	x		21	22.5	23								x	x							
560	600	10			11	12.5	13					x		x									
600	640	20			21	22.5	23			x	x												
635	670	20			21	22.5	23																x

Order code

Design		
B	O	A
B	S	B
M	S	B
D	O	A
D	O	B
S	O	A
S	A	B
S	A	C
M	A	C
M	S	C
D	O	A
O	O	B
M	S	B
O	A	B
O	B	C
O	A	C

D1		
	7	0

D2		
	9	0

B	
3.5	
3.5	
	7
	9
1	0
1	2
1	5
2	0

Elastomer	
1	NBR
2	FKM
3	EPDM
5	HNBR FOOD
6	VMQ
19	FKM PTFE Food
29	FKM PTFE Food MD
C2	FKM-C
C5	HNBR-C
Special materials, see elastomer table	

Support body (D3)	
3	Non Stainless steel (1.4301) D3 = D1 + 0.5 mm
4	Non stainless steel (1.4301) D3 = D1 + 1 mm
5	Aluminium
6	Bronze RG7
7	Special material, e.g. 1.4571
8	Plastic

Sample order

VR double lip seal, design OBC, for shaft diameter 40 mm and housing diameter 60 mm. Material of the sealant: FKM PTFE Food; support body material: 1.4301 for pressures between 5 and 10 bar:
(design) (D1).(D2).(B)-(elastomer)(support body) = OBC 40.60.10-193

SUSTAINABILITY

Our answer to the demands of our time: efficient radial shaft seals

Sustainability is more than just a word for us — it is a promise that we pursue with passion and commitment. Our advanced radial shaft seals facilitate technological excellence that helps protect the planet.

In today's world, it is crucial to minimise the CO_2 footprint in all areas of life. Our versatile products play an important role in this and make a significant contribution. This is because they improve the efficiency of machines and systems. At the same time, they save energy and reduce environmental pollution. Find out how these small but powerful components can make a huge difference. Their efficiency makes it possible to operate more sustainably in many areas. Help preserve the environment for future generations with VR-Dichtungen.

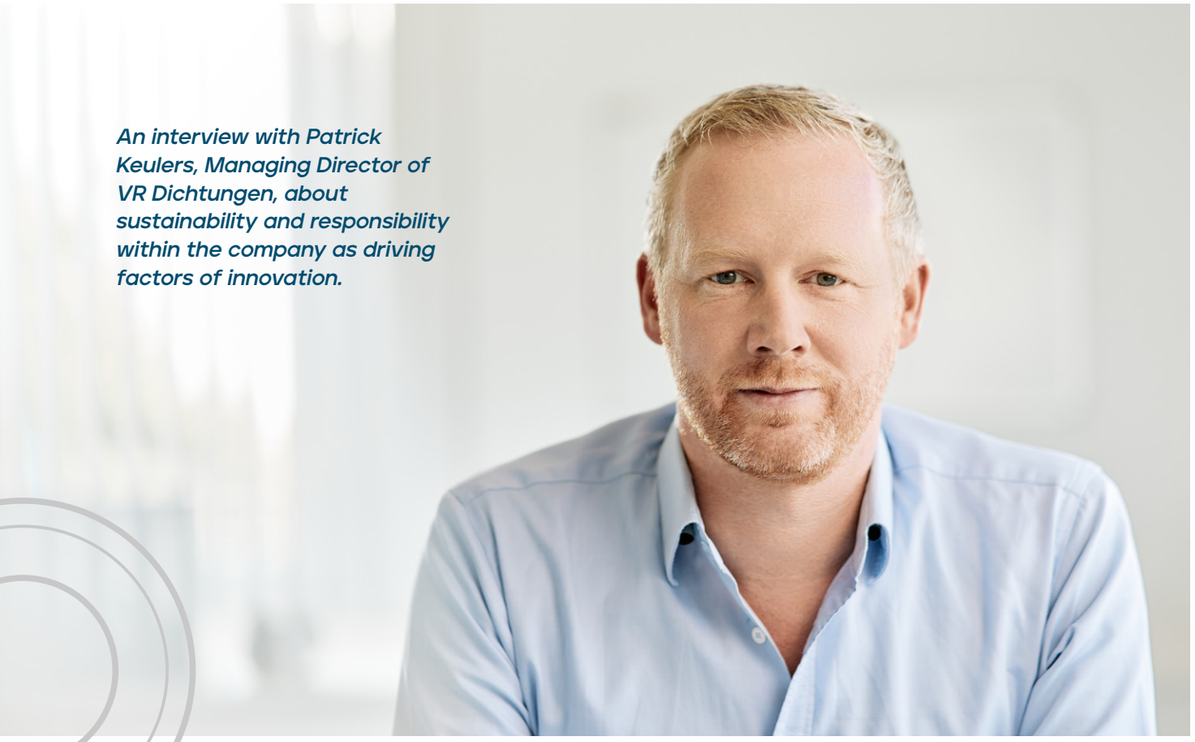
Here are our 8 pledges to you

1. CO_2-savings
2. Extension of the maintenance intervals
3. Tested rubbers for the food industry and medical technology
4. 1/3 of the friction power of a standard shaft seal
5. Less heat influence
6. Higher circumferential speeds
7. Narrow seal designs
8. Double lip seals in a small installation space

sustainable by design

When our sustainable actions are replicated, it means we have got a lot of things right

An interview with Patrick Keulers, Managing Director of VR Dichtungen, about sustainability and responsibility within the company as driving factors of innovation.



Sustainability and responsibility are not just buzzwords, rather they are key principles that ensure the success and future viability of a company. These are the values that are at the fore of VR Dichtungen's operations. In this interview, Managing Director Patrick Keulers provides insights into how the company makes a sustainable contribution by way ofinnovative technologies and environmentally conscious decisions — from the development of energy-efficient products to the involvement of customers in the sustainability process. Find out how VR Dichtungen is embracing responsibility and proactively shaping the future.

Mr Keulers, can you give us an insight into why sustainability and energy efficiency play such an important role for your company?
> *P. Keulers:* We do not see sustainability as a hot trend that will no longer play a role in a year's time. Rather, sustainability is a fundamental part of our corporate philosophy. We take our responsibility for the environment very seriously. If we can contribute to actively protecting and preserving it, then we have made the right adjustments. A key element here is the energy efficiency of our products. We firmly believe that even the smallest energy-saving measures can make a significant difference. Not only do they help to reduce environmental impact, they are also crucial in shaping a more sustainable future.

How do your energy-efficient rotary shaft seals contribute to sustainability in the industry?
> *P. Keulers:* Our rotary shaft seals are designed to not only offer the highest performance, but also to minimise energy consumption. By using high-quality elastomers and innovative technologies, we are able to significantly reduce friction loss and, therefore,lower the energy requirements of machines and devices. As a result, our products make a direct contribution to energy efficiency and promote the reduction of the CO_2footprint.

What does the future hold for energy-efficient rotary shaft seals?
> *P. Keulers:* The future of our energy-efficient rotary shaft seals is brimming with promise. Global awareness of environmental protection is growing. At the same time, it is becoming increasingly necessary to operate in a more sustainable manner. Therefore, we anticipate an upturn in demand for our innovative sealing solutions. Our products effectively help to reduce energy consumption and emissions. They may seem inconspicuous at first glance, but they are a key component for progress in industrial sustainability. I am convinced that their importance will continue to grow in the coming years. They will play a key role in the environmentally friendly design of industrial processes.

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Radial shaft seals — form a key component for progress in industrial sustainability.

How are you dealing with the current issue of PFAS?
> *P. Keulers:* The issue of PFAS, an abbreviation for per- and polyfluorinated chemicals, is of great importance to our company. We not only endeavour to manufacture high-quality and efficient products. It is equally important to us to ensure their environmental compatibility.
We recognise the need to reduce the use of these so-called "eternal chemicals", in particular when there are viable alternatives. However, we take a critical view of a general ban on these chemicals, as they also offer significant advantages. We adhere to strict guidelines and standards in our product development process.
These ensure that the proportion of PFAS-free rotary shaft seals increases. We work closely with our suppliers to ensure compliance with these standards. We also invest in research and development on an ongoing basis. Our aim is to find alternative materials and manufacturing processes. These should be more environmentally friendly and at the same time ensure or even improve the performance of our products.

What specific challenges do you see in the development of sustainable products in your industry?
> *P. Keulers:* Developing sustainable products is a complex challenge that involves both technical and economic aspects. From a technical point of view, finding materials that are both environmentally friendly and efficient is a challenge. Economically, we need to keep an eye on the cost of such innovations to ensure that they remain affordable for our customers. This calls for a careful balance between longevity, efficiency and cost. In addition, it is important that we constantly stay on top of the latest technology and legislation to ensure that our products remain relevant not only today, but also in the future.

To what extent is the involvement of your customers in the innovation process important for your company?
> *P. Keulers:* We attach prime importance to customer integration. By involving our customers in the development process, we receive direct feedback about the specific requirements and challenges they face. This enables us to develop customised solutions that really offer added value. In addition, this close cooperation promotes understanding and creates trust — both aspects are essential for building and maintaining long-term business relationships.
We see our customers as partners in a continual process of improvement and innovation.

What role does digitalisation play in improving the sustainability of your products?
> *P. Keulers:* Digitalisation plays a crucial role in increasing the sustainability of our products. By using modern technologies and data-driven approaches, we can improve the efficiency of our production processes and minimise the consumption of resources. Digital tools also enable us to analyse and optimise the life cycle of our products more precisely. This produces less waste and creates a longer product life cycle. Digitalisation also helps us to determine more precise maintenance intervals, which in turn leads to less downtime and better machine performance for our customers.

General terms and conditions of sale

Section 1 General information

1. In addition to the other contractual agreements, These General Terms and Conditions of Sale of Sale, apply exclusively to all business transactions between our company and the Buyer, Principal or Ordering Party, hereinafter referred to as the Ordering Party. The terms and conditions shall be deemed to have been recognised by the Ordering Party when the order is placed or, at the latest, when the goods are accepted. We do not recognise any terms and conditions of the Ordering Party that conflict with or vary from our terms and conditions of sale — including in the case of unconditional performance or acceptance of payment — unless we expressly agree to their validity in writing.

This shall also apply to general terms and conditions of business outside the Ordering Party's general terms and conditions of purchase, in particular, but not exclusively, to quality assurance agreements, framework supply agreements, contracts for the provision of materials, consignment stock agreements and confidentiality agreements of the Ordering Party, insofar as the provisions therein have not been negotiated with us.

2. These General Terms and Conditions of Sale apply exclusively to entrepreneurs within the meaning of Section 310(1), in conjunction with Section 14, BGB (German Civil Code), legal entities under public law or special funds under public law within the meaning of Section 310(1), BGB.
3. These General Terms and Conditions of Sale also apply to all future transactions with the Ordering Party, insofar as these are legal transactions of a related nature, without renewed inclusion until we issue new General Terms and Conditions of Sale.
4. All agreements made between us and the Ordering Party in the course of contract negotiations are to be recorded in writing for reasons of proof and confirmed by both parties.
5. Subsidiary agreements, subsequent amendments to the contract and the assumption of a guarantee, in particular the assurance of properties, or the assumption of a procurement risk are subject to the written form if they are made by persons who are not authorised representatives.
6. Our silence does not imply consent.
7. Even in the case of participation on electronic platforms of the Ordering Party and activation of selection fields to be activated by the system, no legally binding acceptance of the terms of use or other general terms and conditions of business shall apply.

Section 2 Consultancy and documents

1. We provide all forms of verbal and written advice to the best of our knowledge based on our experience. Our advice is product- and performance-related and extends exclusively to the products we supply and services we render. It does not refer to contract-independent advice, i.e. to such explanations that are given without products being sold or services being rendered by us.
2. Details and information about the suitability and application of our products do not release the Ordering Party from the obligation to conduct their own tests and trials. In particular, the Ordering Party is not exempt from testing the suitability of our products for the intended purpose. The Ordering Party is responsible for complying with statutory and official regulations when using our products.
3. We reserve the property rights and copyrights to all documents we make available. Any disclosure or forwarding to third parties are subject to our written consent. If the order is not placed, all documents are to be returned without delay upon request. The Ordering Party's documents may be made accessible to third parties to whom we wish to transfer deliveries or services.

Section 3 Conclusion of contract

1. Our offers are non-binding and are deemed to be an invitation to the Ordering Party for the submission of an offer. As a matter of principle, the order placed by the Ordering Party constitutes the offer to conclude a contract. If the order placed by the Ordering Party varies from our offer, the Ordering Party is to indicate the variations separately.
2. We can accept orders within 2 weeks.
3. The first processing of an offer is free of charge, unless we expressly point out to the Ordering Party in advance that costs shall be incurred. Further offers and design work shall only be free of charge insofar as the order becomes and remains valid.
4. Descriptions and illustrations of our products in technical documents, brochures, company brochures, catalogues and price lists etc. are non-binding unless their inclusion in the contract has been expressly agreed; they do not exempt the Ordering Party from conducting its own tests. Product and service descriptions on the internet can, of course, only be of a general nature; if the Ordering Party wishes to derive binding quality agreements or the suitability for use for the application it intended, it must make reference to this in the order.
5. The order must contain all details regarding execution of the order. This applies to all our deliveries, services, work and other performances. This includes in particular, but is not limited to, information about article designation, quantity, dimensions, material, material composition, pre-treatment, processing specifications, treatment instructions, storage, standards and all other technical parameters and physical characteristics. Lacking, incorrect or incomplete information shall be deemed expressly not agreed and shall not give rise to any obligations on our part, neither in terms of performance and warranty claims nor in terms of claims for damages. We are entitled to obtain further information that serves the proper execution of the order.
6. Orders shall be placed in writing or electronically (EDI); orders transmitted verbally or by telephone shall be executed at the risk of the Ordering Party.
7. Orders as well as telephone and verbal agreements and agreements with our representatives are to be confirmed by us in writing. Invoices or computerised printouts designated by us as binding shall be deemed to be a written order confirmation. If we do not confirm the order in writing or in text form, the contract shall be deemed to have been entered into at the latest upon execution of the order.
8. If the Ordering Party cancels an order accepted by us, we shall be entitled to charge 10% of the delivery or service price for the costs incurred in processing the order and for the loss of expected profits, without prejudice to the possibility of asserting a claim for the actual damage we sustained as a result. The Ordering Party reserves the right to furnish proof of less damage.
9. Our services are stipulated in the order confirmation.

Section 4 Call-offs

1. Call-off orders shall be entered into for a maximum period of 12 months, whereby call-off dates and quantities shall be specified when the order is placed. As a matter of principle, call-offs must be made in such a way that the last delivery is made no later than 1 year after receipt of the order by us.
2. Call orders and delivery schedules require written delivery time agreements.
3. In the case of call orders, we are entitled to procure the material for the entire order and to produce the entire order quantity immediately.
4. Additional costs caused by a delayed call-off or subsequent changes to the call-off in terms of time or quantity by the Ordering Party shall be borne by the Ordering Party; our calculation shall be authoritative in this respect.
5. Unless otherwise agreed, all call-off orders are to be accepted within 6 months of the order being placed without the need for a request for acceptance. If this period has expired, we shall be entitled to invoice the goods and to dispatch them at the expense and risk of the Ordering Party or withdraw from the contract and claim damages.

Section 5 Changes, measuring methods

1. A separate contractual agreement is required for changes to the delivery item or service requested after conclusion of the contract.
2. We reserve the right to change the object of delivery or service appropriately in the event of lacking or incorrect information. Any disadvantages resulting from missing or incorrect information, in particular additional costs or damages, shall be borne by the Ordering Party.
3. We reserve the right to make technical changes to the object of delivery or service which do not jeopardise the contractual objective. If the Ordering Party considers changes to be unauthorised, it is to inform us without delay. Any changes requested by the Ordering Party can no longer be considered after our acceptance of the order, unless this has been expressly agreed.
4. For production-related reasons, we reserve the right to make excess or short deliveries to the extent customary in the industry, up to a maximum of 10% of the agreed order quantity. In the case of small orders, we reserve the right to charge a reasonable and customary minimum quantity or a reasonable and customary minimum flat-rate charge.
5. Partial deliveries are permissible insofar as they are reasonable for the Ordering Party. They are to be paid for separately on the corresponding partial invoice. If payment for a part delivery is delayed, we shall be entitled to refuse further execution of the order.
6. For tests for which certain temperatures, times and other measurement or control values are to apply, the corresponding measurement methods must be specified and recognised by both parties before delivery begins. If no specification is made, our measurement methods shall apply.

Section 6 Delivery period, force majeure, delay

1. The delivery period begins at the earliest with the despatch of the order confirmation. The start of the delivery period stated by us takes for granted complete clarification of all technical questions. Compliance with the deadline requires the timely receipt of all documents to be supplied by the Ordering Party, necessary authorisations, releases, the timely clarification and approval of plans, compliance with the agreed terms of payment and other obligations as well as the timely delivery of the items provided by the Ordering Party. The period shall otherwise be extended by a reasonable period. The delivery periods stated by us are approximate deadlines. The determination of the delivery period shall be subject to the correct and timely delivery by our own suppliers, taking due care to conclude congruent covering transactions. Compliance with our delivery obligations is subject to the timely and proper honouring of the Ordering Party's obligations to cooperate.
2. The delivery period shall be deemed met if the consignment has been dispatched within the delivery deadline or notification has been given that the delivery is ready. If the delivery is delayed for reasons for which the Ordering Party is responsible, the period shall be deemed to have been met upon notification of readiness for dispatch within the agreed deadline.

3. In cases of force majeure, our delivery and performance periods shall be extended by the duration of the disruption that has occurred. Force majeure also includes, but is not limited to, circumstances for which we are not responsible, such as operational disruptions of all kinds, mobilisation, war, riots, strikes, traffic accidents, natural disasters, sabotage, serious illness of essential employees, pandemics, epidemics, quarantine, sovereign or official interventions and measures as well as other comparable events affecting us, subcontractors or upstream suppliers. This shall also apply if we were already in default when these circumstances occurred. We shall inform the Ordering Party immediately of the beginning and end of such hindrances. If delivery or performance is delayed by more than 6 weeks, both the Ordering Party and we shall be entitled to withdraw from the contract as part of the performance affected by the disruption. The contracting parties shall not be entitled to compensation in this respect.
4. We shall only be liable for damages caused by delay if we are responsible for the cause of the delay.
5. If the Ordering Party is in default with the acceptance of our products, we shall be entitled, after setting a reasonable grace period, to withdraw from the contract at our discretion and, if necessary, claim damages. This shall not affect the statutory provisions on the dispensability of setting a period and on asserting further claims to which we are legally entitled.
6. The filing of insolvency proceedings, submission of an affidavit in accordance with Section 807, ZPO, (German Code of Civil Procedure), discovery of a significant deterioration in financial circumstances, other payment difficulties and default in payment shall entitle us to withhold further deliveries until all due invoices have been settled, refuse to execute current contracts and demand the return of products subject to our retention of title and advance payments for products yet to be delivered by way of security. In such cases, outstanding claims shall fall due for payment immediately.
7. Unless expressly agreed otherwise, all Incoterms used by us refer to the Incoterms 2020 published by the International Chamber of Commerce (ICC).

Section 7 Transfer of risk, transport and packaging
1. As a matter of principle, delivery "ex works" is agreed upon. Dispatch shall be at the expense and risk of the Ordering Party irrespective of the place of dispatch. Risk shall pass to the Ordering Party as soon as the consignment has been handed over to the person carrying out the transport or has left our warehouse for the purpose of despatch. Even if carriage paid delivery has been agreed, delivery shall be handled at the risk of the Ordering Party. If dispatch is delayed at the Ordering Party's request, risk shall pass to the Ordering Party upon notification of readiness for dispatch. Unless otherwise agreed in writing, we shall determine the means of transport and the transport route. In the event of damage to or loss of the goods during transport, the Ordering Party is to arrange for an inventory to be performed without delay and inform us accordingly.
2. If dispatch or delivery is delayed at the instigation of the Ordering Party, we shall claim storage charges amounting to 1% of the invoice amount for each month or part thereof, up to a maximum of 5% of the net amount, subject to proof of higher damages. The Ordering Party reserves the right to furnish proof of less damage.
3. Return shipments are to be agreed with us in advance and may only be performed by forwarders commissioned by us. The cheapest method of despatch is at all times to be chosen, taking transport safety into account.
4. If the Ordering Party specifies a particular mode of transport, the additional costs shall also be borne by the Ordering Party.
5. Unless otherwise agreed, we shall determine the type and scope of packaging. The choice of packaging shall be made to the best of our judgement, with consideration given to due care. Disposable packaging shall become the property of the Ordering Party.
6. Our registered office is deemed the place of performance for the services and payments stated in the order.

Section 8 Tools and equipment
1. Tools and equipment manufactured by us or by third parties on our behalf shall remain our property, including if the manufacturing costs are borne in full or in part by the Ordering Party.
2. In the case of tools owned by the Ordering Party or tools provided by the Ordering Party on loan, our liability with regard to storage and care shall be limited to the same care as in our own affairs. Costs for maintenance and insurance shall be borne by the Ordering Party.

Section 9 Reservation of title, securities and offsetting
1. The delivered products shall remain our property until payment in full of all claims resulting from the Ordering Party's business relationship with us.
2. In the event of behaviour contrary to the contract on the part of the Ordering Party, in particular in the event of default of payment, we shall be entitled to take back the delivery. The taking back or seizure of the delivery by us shall not constitute a cancellation of the contract unless we expressly confirm this in writing. We shall be authorised to realise the goods; the proceeds of realisation shall be set off against the Ordering Party's liabilities, less reasonable realisation costs. The Ordering Party undertakes to handle the delivery with care.
3. The Ordering Party is authorised to process, mix or combine our products with other products in the ordinary course of business until further notice. In the event of processing, we shall be deemed to be the manufacturer and shall directly acquire (co-)ownership of the manufactured item in accordance with Section 950, (BGB). In the event of mixing or combining, we shall acquire (co-)ownership in the ratio of the value of our reserved goods to the new uniform item.
4. The Ordering Party may, upon cancellation, sell the goods delivered subject to reservation of title or the items manufactured from those in the ordinary course of business. In order to secure our claims, the Ordering Party hereby assigns to us the claims obtained through the sale to the extent that corresponds to our (co-) ownership share in the sold item. We hereby accept the assignment. The Ordering Party is entitled to collect the assigned claims as long as we have not revoked this authorisation. We shall only revoke the right to resell and collect receivables if our Ordering Party fails to properly fulfil their contractual obligations. It shall also expire without express revocation if the Ordering Party ceases to make payments.
5. At our request, the Ordering Party undertakes to provide us with a precise list of the claims to which we are entitled, including the names and addresses of the buying entity, the amount of the individual claims, invoice data, etc. and to provide us with all information necessary for the assertion of the assigned claim and to allow us to check this information and to issue us with publicly certified documents on the assignment of the claims at his expense.
6. If our securities in accordance with the above paragraphs exceed our claims by more than 20%, we shall release securities of our choice at the request of the Ordering Party.
7. As long as our retention of title exists, the Ordering Party may neither assign the reserved goods or the items manufactured from them as security nor pledge them. In the event of seizure or other interventions by third parties, the Ordering Party must inform us immediately in writing so that we can file an action in accordance with Section 771, ZPO (German Code of Civil Procedure) and provide us with all information and documents necessary to protect our rights. Enforcement officers or third parties must be informed of our ownership. If a third party is not in a position to reimburse us for the judicial and extrajudicial costs of an action pursuant to Section 771, ZPO, the Ordering Party shall be liable for the loss incurred by us, subject to the assertion of further claims due to damage, alteration or destruction of the item itself.
8. The Ordering Party hereby declares his consent that the persons commissioned by us to collect the reserved goods may enter or drive onto the property or building on or in which the reserved goods are located for this purpose to take possession of the reserved goods.
9. We are entitled to offset all counterclaims to which we are entitled against the Ordering Party against the Ordering Party's claims.

Section 10 Price and payment terms
1. As a matter of principle, our prices are in euros "ex works" (EXW) plus the VAT applicable on the day of delivery as well as customs and insurance costs. Value added tax shall be shown separately on the invoice. Special packaging is charged at cost price. The prices apply to the individual order, not retroactively or for future orders. Repeat orders are new orders. Additional costs such as packaging, freight, shipping costs, customs, assembly, insurance and bank charges will be charged separately.
2. We reserve the right to change our prices appropriately at our reasonable discretion if price-relevant cost reductions or cost increases occur after conclusion of the contract, in particular due to collective labour agreements or changes in the price of materials and energy. We shall exercise this right in particular if there are more than 4 months between the original calculation and the date of performance. In the event of cost reductions, e.g. relating to products from third-party suppliers, we shall be entitled to reduce the prices insofar as these cost reductions are not fully or partially offset by increases in other areas. We can only use price increases, e.g. relating to products from third-party suppliers, to increase costs to the extent that they are not offset by any reduced costs in other areas. In exercising our reasonable discretion, we shall select the time of a price change in such a way that cost reductions are not taken into account in accordance with standards that are less favourable to the Ordering Party than cost increases. We shall notify the Ordering Party in writing of any price change in good time before the changed prices take effect. The Ordering Party may terminate the contract in writing in the event of a subsequent price increase, but only within 2 weeks from the date on which the Ordering Party received the announcement of the price increase.
3. Payments must be made exclusively by bank transfer to the account details stated in our invoice and are due without deduction within 30 days of the invoice date. Payments by cheque or bill of exchange are not permitted and shall be deemed not to have been made. An agreed cash account is only granted on condition that all payment obligations from previous deliveries have been fulfilled. All payments are to be made free of charges.
4. If the purchase price is deferred, if instalments are granted or if the term of payment is exceeded, the Ordering Party shall be charged interest at the usual bank rate, but at least 2% above the respective base rate of the European Central Bank, even without a reminder.
5. Payments shall first be offset against costs, then against interest and then against the older primary claim. In this respect, the Ordering Party waives the right to determine how his payments are to be utilised.
6. In the event of default of payment, we may demand default interest in the amount of 10 percentage points p.a. above the respective base interest rate in accordance with Section 247, BGB. A higher damage caused by default can be proven. However, the Ordering Party is entitled to prove that no or less damage has been incurred.
7. The Ordering Party shall only be entitled to offset or withhold payments if his counterclaim is undisputed or has been legally established or is ready for judgement.
8. The assignment of claims against us requires our consent.
9. The Ordering Party shall only have a right of retention if the counterclaim is based on the same contractual relationship and is undisputed or legally established or disputed but ready for judgement or if we have materially breached our obligations arising from the same contractual relationship despite a written warning and have not offered adequate security.
10. If our performance is indisputably defective, the Ordering Party shall only be entitled to withhold payment to the extent that the amount withheld is in reasonable proportion to the defects and the anticipated costs of remedying the defects.

11. The payment deadlines shall remain in force even if delays in delivery occur through no fault of our own.
12. In order for us to be exempt from VAT in the case of intra-Community deliveries, we require a so-called confirmation of arrival from the Ordering Party. The Ordering Party, therefore, undertakes to confirm to us in writing after receipt of the subject matter of the contract that it, in the capacity of the buying entity, has received the subject matter of the contract as the object of an intra-Community delivery.
13. Insofar as VAT is not included in our invoice, in particular because we assume an "intra-Community delivery" within the meaning of Section 4 No. 1 b in conjunction with Section 6 a of German Value Added Tax Act (UStG) on the basis of information provided by the Ordering Party and we are subsequently charged with a VAT payment (§ 6 a IV UStG), the Ordering Party shall be obliged to pay us the amount with which we have been charged. This obligation exists irrespective of whether we have to subsequently pay VAT, import VAT or comparable taxes in Germany or abroad.
14. Insofar as our claim for payment appears to be jeopardised as a result of circumstances occurring after conclusion of the contract which, in our view, give rise to fears of a significant deterioration in the Ordering Party's financial position, we shall be entitled to declare outstanding claims due for immediate payment. If the Ordering Party is in arrears with payment, which in our view indicates that our claim is jeopardised, we shall also be entitled to take back products already delivered, to enter the Ordering Party's premises if necessary and to take the products away. We may also prohibit further processing of the delivered products. This shall not apply if the Ordering Party is not responsible for the payment arrears. Taking back the goods does not constitute cancellation of the contract. In both cases, we may demand advance payment for outstanding deliveries or services. The Ordering Party can avert all these legal consequences by providing security in the amount of our jeopardised payment claim. We are entitled to the usual type and scope of securities for our claims, even if they are conditional or limited in time. The statutory provisions on default of payment shall remain unaffected.

Section 11 Industrial property rights

1. We shall only be liable for infringements of industrial property rights insofar as we are responsible for them and insofar as industrial property rights which are valid in the Federal Republic of Germany and published at the time of delivery are infringed when our products are used in accordance with the contract.
2. Orders based on drawings, sketches, models, samples or other documents or information provided to us shall be executed at the risk of the Ordering Party. If, in such a case, a third party claims that we infringe an industrial property right, e.g. by manufacturing or supplying our products, we shall be entitled, without further examination and subject to our other rights, to refuse fulfilment of the contract and to cease our activities in this respect. If we infringe third party industrial property rights as a result of the fulfilment of such orders, the Ordering Party shall indemnify us against claims by third party rights holders. Any further damages and costs shall be borne by the Ordering Party.
3. The Ordering Party undertakes to inform us immediately of any risks of infringement and alleged cases of infringement of which he becomes aware.

Section 12 Returns

1. We manufacture on a made-to-order basis. The return of goods delivered by us that are free of defects is excluded. If, by way of exception, we agree to take back goods that are free of defects, a credit note will only be issued to the extent that we establish unrestricted reusability. For the costs of inspection, preparation, reworking and repackaging, the actual costs, at least 20% of the invoice amount or at least 100 euros, shall be deducted. Such a credit note shall not be issued, but shall only be used to offset future deliveries.

Section 13 Defects, warranty and limitation period

1. It is incumbent upon the Ordering Party to inspect the goods without delay after delivery in accordance with Section 377, HGB (German Commercial Code), or comparable foreign national or international provisions and to notify us in writing of any defects and damage recognised in this connection as well as later immediately after their discovery, but at the latest after 5 working days, giving a precise description of the defects. Otherwise the delivery shall be deemed to have been approved without defects. The provisions of Section 377, HGB, shall apply accordingly to services and work performances. Notification of defects must be made in writing. The Ordering Party shall make one or more parts from the affected delivery available to us without delay. The notification of defects does not release the Buyer from the fulfilment of payment obligations.
2. If the item is defective, we shall be entitled, at our discretion, to remedy the defect or make a replacement delivery (subsequent fulfilment) or issue a credit note within a reasonable period of grace to be set by the Ordering Party. Parts replaced in the course of remedying the defect shall become our property upon dismantling. If the Ordering Party has not set us a deadline for remedying the defect or has set us a deadline that is too short, he shall not be entitled to remedy the defect himself or have it remedied by a third party without our prior written consent, even in urgent cases. If rectification of defects or replacement delivery fails or cannot be carried out, e.g. because we are entitled to refuse subsequent fulfilment due to the disproportionate costs involved, the Ordering Party shall be entitled to withdraw from the contract or reduce the price at his discretion.
3. In the case of third-party products, even if they have been installed or otherwise used in our products, we shall be entitled to initially limit our liability to the assignment of the warranty claims to which we are entitled against the supplier of the third-party products, unless the settlement from the assigned right fails or the assigned claim cannot be enforced for other reasons. In this case, the Ordering Party shall again be entitled to the rights from the preceding paragraph 2.
4. Unless otherwise agreed, we reserve the right to make customary deviations (e.g. in quality, colour, thickness, weight, finish or pattern). The characteristics specified in our performance description define the properties of the delivery item comprehensively and conclusively. In particular, public statements, promotions or advertising by the seller or manufacturer or their agents or third parties do not constitute a contractual specification of quality. Our declarations in connection with this contract, e.g. descriptions of performance or reference to DIN standards, do not contain any assumption of a guarantee. Only our express written declarations regarding the assumption of a guarantee are authoritative. Information in product descriptions and product specifications does not constitute a guarantee for the quality of the item or that the item will retain a certain quality for a certain period of time, subject to their inclusion as quality specifications within the meaning of Section 434, BGB.
5. Claims for defects shall not exist in the event of only insignificant deviations from the agreed quality or in the event of only insignificant impairment of usability. The Ordering Party's warranty rights shall be excluded if the defect is due to improper use of our products or use not in accordance with the intended purpose, failure to adhere to our installation instructions in our catalogues or our website and the guidelines for storage, maintenance and cleaning of rubber products in accordance with DIN 7716, the presence of excessive stress or natural wear and tear due to their material properties, in particular in the case of parts in contact with the workpiece, improper modifications, faulty maintenance or faulty and negligent handling. In the context of repairs without legal obligation, the Ordering Party shall only be entitled to claims for defects if this has been expressly agreed.
6. The expenses required for the purpose of subsequent fulfilment shall be borne by the Ordering Party insofar as they increase because the products have been moved to another location after our delivery, unless the relocation corresponds to their intended use.
7. Recourse claims of the Ordering Party against us in accordance with Section 478 of German Civil Code (BGB) shall only exist insofar as the Ordering Party has not reached an agreement with his buying entity that goes beyond the statutory claims for defects.
8. Unless expressly agreed otherwise, the limitation period for claims and rights due to defects in our products is 1 year from delivery to the Ordering Party. We shall be liable for repairs and replacement parts to the same extent as for the delivery item, namely until the expiry of the limitation period for claims for defects applicable to the original delivery item. However, the limitation period contained in sentence 1 of this clause shall not apply in the cases of Section 438(), No. 1, BGB o German Civil Code (BGB) (defects of title in immovable objects), Section 438 para. 1 no. 2 of German Civil Code (buildings, objects for buildings), Section 479 para. 1 of German Civil Code or Section 634 a para. 1 no. 2 of German Civil Code.
9. The limitation periods in accordance with clause 8 shall also apply to all existing claims for damages against us in connection with the defect — irrespective of the legal basis of the claim. Insofar as claims for damages of any kind exist against us which are not related to a defect, the limitation period in accordance with Section 12 clause 8 sentence 1 shall apply to them.
10. The limitation periods in accordance with Section 12 clauses 8 and 9 shall not apply in the case of intent, if we have fraudulently concealed the defect or have assumed a guarantee of quality, in the case of claims for damages in cases of injury to life, body or health or freedom of a person, in the case of claims arising from the Product Liability Act, in the case of a grossly negligent breach of duty or in the case of a breach of essential contractual obligations.
11. Unless expressly stipulated otherwise, the statutory provisions on the commencement of the limitation period, suspension of expiry, suspension and recommencement of time limits shall remain unaffected.

Section 14 Liability

1. With the exception of liability under the German Product Liability Act (ProdHaftG) due to fraudulent concealment of a defect, due to a guarantee that we have assumed for the quality of the products or a service, or for damages resulting from culpable injury to life, limb or health, we shall only be liable to the Ordering Party for damages in the event of a breach of obligations arising from the contract concluded between us in accordance with the following provisions, without, however, waiving the statutory requirements for such liability.
2. We shall only be liable for the culpable breach of material contractual obligations and for the wilful or grossly negligent breach of other contractual obligations owed to the Ordering Party. The essential contractual obligations are those obligations which must be fulfilled in order for the contract to be properly executed and on the fulfilment of which the Ordering Party can and does typically count.
3. In the event of a simple negligent breach of material contractual obligations, our liability shall be limited to compensation for foreseeable, typically occurring damage.
4. Our liability shall be excluded in the event of a simple negligent breach of other, i.e. non-essential contractual obligations towards the Ordering Party.
5. The above limitations of liability shall also apply to breaches of duty by persons whose fault we are responsible for in accordance with statutory provisions.
6. A change in the burden of proof to the detriment of the Ordering Party is not associated with the above limitations.
7. The Ordering Party shall only have a right of recourse against us insofar as the Ordering Party has not reached an agreement with his buying entity that goes beyond the statutory claims for defects and damages.
8. Our liability is excluded insofar as the Ordering Party has effectively limited his liability towards his buying entity.
9. Insofar as our liability is excluded or limited, this shall also apply to the personal liability of our employees, workers, staff, representatives, vicarious agents and assistants.
10. Insofar as liability is excluded or limited in accordance with the above, the Ordering Party shall also be under obligation to indemnify us against third-party claims.

11. In all other respects, the statutory provisions shall apply.
12. The Ordering Party undertakes to inform us immediately in writing of any claims asserted by third parties and to reserve all defence measures and settlement negotiations for us.

Section 15 Cancellation
1. The Ordering Party may only withdraw from the contract within the framework of the statutory provisions if we are responsible for the breach of duty; in the case of defects, the statutory requirements shall apply. In the event of a breach of duty, the Ordering Party must declare within a reasonable period of time after being requested to do so by us whether it is cancelling the contract due to the breach of duty or insisting on delivery.
2. The right of the Ordering Party to demand compensation instead of performance in the case of a mutual contract is excluded by the cancellation.
3. In the event of a breach of duty by the Ordering Party, in particular in the event of default in payment and non-acceptance of the delivery, we shall be entitled to withdraw from the contract and to take back the service rendered and to claim damages after the unsuccessful expiry of a reasonable period of grace set for the Ordering Party. The statutory provisions on the dispensability of setting a deadline and on the assertion of further claims to which we are legally entitled remain unaffected by this.

Section 16 Confidentiality
1. If the Ordering Party comes into contact with our business secrets and/or know-how during the execution of the order, he must maintain secrecy about this and take precautions to ensure that our interests worthy of protection are not violated and that knowledge worthy of protection is only used in connection with the order or the subsequent use of the object of the order itself. In particular, the Ordering Party shall bear the burden of proof that the trade secrets and/or the know-how were already known to him beforehand or were at least obvious. The Ordering Party undertakes to treat all commercial and technical details in connection with the order as business secrets. He is obliged to keep the documents and information confidential even after completion of the respective contract. Reproduction is only permitted within the scope of operational requirements and copyright regulations. Disclosure to third parties may only be made with our written consent.

Section 17 Items provided
1. In the event of claims by the Ordering Party for damage to or destruction of items provided by the Ordering Party or handed over to us for processing, we shall only be liable for intent and gross negligence; liability for simple negligence is excluded. Normal wear and tear are excluded from liability. The Ordering Party is obliged to take out "external insurance" to the required extent for the items provided.
2. For products provided, e.g. raw materials and blanks, the Ordering Party shall be responsible for checking and guaranteeing the quality (e.g. material, dimensional accuracy, etc.); we shall only carry out an incoming goods inspection with regard to quantity, identity and a visual inspection for obvious transport damage. We are not obliged to carry out any further inspections.
3. If the materials provided prove to be unusable as a result of material defects for which the Ordering Party is responsible, we shall be reimbursed for the processing costs incurred.
4. We shall not be liable for damage caused by inaccurate labelling and marking of the materials provided by the Ordering Party.
5. The Ordering Party is obliged to compensate us for all damages, including loss of profit, which we incur as a result of the provision of material which cannot be processed and for which he is responsible.
6. We shall not provide compensation for rejects that are customary in the industry.

Section 18 Compliance
1. The Ordering Party confirms that it has no direct or indirect business or other connections to terrorists, terrorist organisations or other criminal or anti-constitutional organisations. The Ordering Party shall, in particular, adopt appropriate organisational measures to ensure the implementation of applicable embargoes, the European regulations on combating terrorism and crime applicable in the context of the supply relationship and the corresponding US or other applicable provisions as part of its business operations, in particular by means of appropriate software systems. As soon as our products have left our respective premises, the Ordering Party shall be solely responsible for compliance with the above provisions and shall indemnify us against all claims and costs incurred by us due to a corresponding breach of law by the Ordering Party, its affiliated companies or employees, representatives or vicarious agents, including reasonable lawyers' and consultants' fees or administrative fees and fines.
2. We shall comply with the provisions of the European Chemicals Regulation No. 1907/2006 ("REACH") directly applicable to us and shall be liable for this in accordance with Section 13. The Ordering Party shall be solely responsible for any negative consequences resulting from inadequate information furnished by the Ordering Party, in particular incorrect or incomplete instructions for use within the supply chain.
3. The Ordering Party undertakes to comply with foreign trade regulations, in particular the applicable German, European and US export control regulations.

Section 19 Applicable law; Miscellaneous
1. The law of the Federal Republic of Germany shall apply exclusively, excluding the conflict of laws provisions and the United Nations Convention on Contracts for the International Sale of Goods (CISG).
2. Aachen is deemed the place of jurisdiction for all legal disputes resulting from the contractual relationship, — provided the Ordering Party is a merchant —. We may also bring legal action against the Ordering Party at the competent court for its registered office.
3. In the event that a provision of these General Terms and Conditions of Sale is or becomes invalid in full or in part, this shall not affect the validity of the remaining provisions of these General Terms and Conditions of Sale. The parties agree at this point in time to replace an invalid provision with a legally permissible provision that comes closest to the economic intent of the invalid provision. This shall also apply in the event of an unintended omission in the provisions.
4. We are entitled to process data in accordance with the German Federal Data Protection Act.

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