VR Dichtungen

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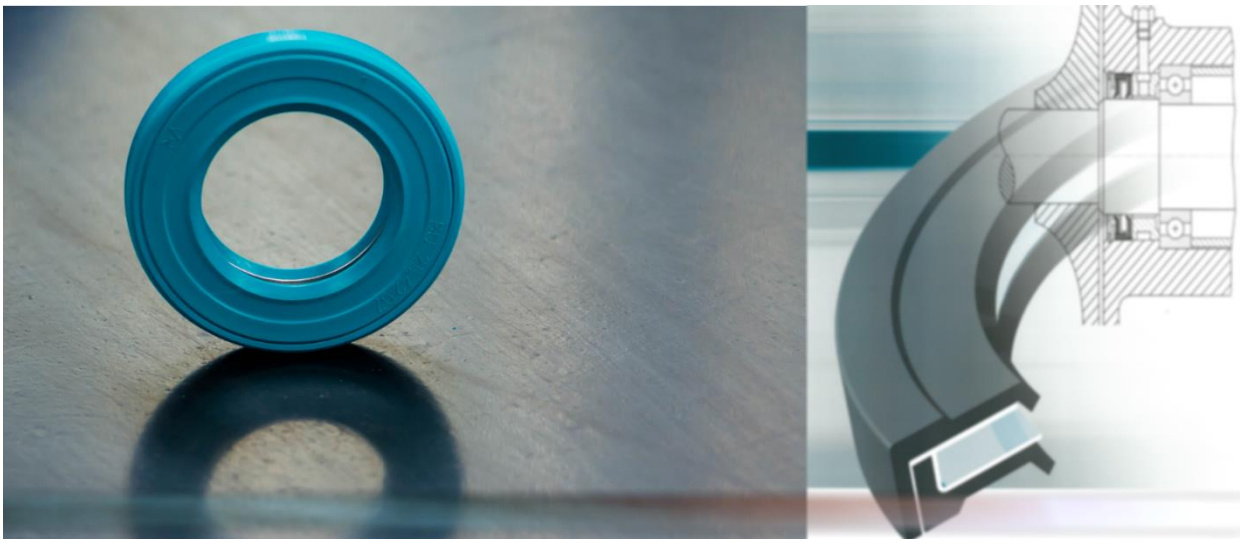

VR DICHTUNGEN

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Company presentation

VR Dichtungen

VR Dichtungen GmbH in Germany and VR Dichtungen BV in the Netherlands are development and manufacturing companies, focusing on sealing problems on a client-oriented basis with the aid of the VR sealing system. All of this particularly when high peripheral velocities, high pressure loads as well as thermal and chemical loads prevent sealing with conventional seals. VR radial shaft seals prove their power thanks to lower requirements on shaft and housing bore and consequently economic benefits in the entire system even for simple applications. The end user profits from the very low frictional power and therefore energy efficient products.

History

1988 Foundation of VR Dichtungen GmbH as member of the Vredestein group by

Dipl.–Ing. Siegmar Kreutzer

Sales office in Aachen, Germany

Production and development in the Netherlands

Number of employees: < 5

1992 Foundation of VR Dichtungen BV by Vredestein International BV, Netherlands

Production, development and sales in Wuerselen, Germany, in leased premises

Number of employees: >5

1995 Construction of a new production facility in Uebach-Palenberg, Germany

480m² production area and 180m² office space

1996 Relocation of premises from Wuerselen to Uebach-Palenberg

1999 Initial certification DIN ISO 9001:2001

2011 Expansion of the production and operating premises of VR Dichtungen GmbH by another 480m² production area and 120m² office space

2014 Recertification DIN ISO 9001:2008

2017 Recertification DIN ISO 9001:2015

2017 Number of employees in Übach-Palenberg: > 20 plus casual workers and temporary staff

Number of patents: >20

What can we do for you?

We solve sealing problems so that an optimum of safety and profitability is found. At VR the best seal is worked out as required for the user (drawing of the sealing position), taking into account a favourable housing and shaft machining, too.
Up to 10 different standard elastomer materials are available as sealing elements for the VR seals. Our portfolio includes a wide range of designs for standard applications, with very small installation space or patented seals (type SAB, SOA) for high pressure applications up to 150bar, where other radial shaft seals fail and expensive mechanical seals are used.

Depending on the application, supporting body materials can be selected from steel, stainless steel, aluminium, synthetic materials or bronze. A supplementary combination is made of turned metal parts in addition to the punched supporting bodies. These have the advantage of high concentricity and high compressive load capacity. Thousands of different seals can be assembled with this system from the combinatorics of possible types, installation dimensions and materials.
If the appropriate seal for your application is not available in our portfolio, please do not hesitate to contact us. We also develop complex new seals and test them on our test stands or in your application.

In case of the VR system it is irrelevant whether you need small / medium or large series. Seals can be manufactured for you up to 1,000,000 units at VR. These are distributed over the direct route in Germany as well as through our technically oriented trading companies and engineering companies in other European foreign countries.

Areas of application

VR seal are used in the following applications for sealing of rotating shafts:

- general mechanical engineering (e.g. spindle seals)
- electrical engineering (e.g. motors, rotary encoders)
- medical technology (e.g. very small 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. climate compressors)
- food machines (e.g. kneading machines)
- agitator and blender and liquidizer technology (e.g. bowl cutter, milk powder machines)
- household machines (e.g. blender, lye pumps, washing machines)
- shipbuilding (e.g. ship shafts)
- gear construction (e.g. high-speed transmission gearing, spur gears)
- general vehicle building (e.g. water pump seal, gearbox seal)
- rotary union (e.g. pneumatic controls)

Technical principles

The VR seal

A radial shaft seal seals a rotating shaft against a housing. VR radial shaft seals have especially been developed to withstand high peripheral velocities and high pressure loads.

Sealing mechanism of VR seals

The operating principle of this springless VR radial shaft seal is due to the fact that rubber-elastic diaphragm bodies with a precisely tuned pretension are stretched over supporting elements made of stainless steel or other metals. The oblique sealing lip, which adjoins the diaphragm body, is set outwards or inwards depending on the assembly situation and pressure direction of the medium to be sealed.

The sealing mechanism results from the radially and tangentially pretensioned diaphragm body. A spring effect of the diaphragm body to the sealing lip is produced. A radial and a tangential force of the sealing lip act against the resulting shear stresses in case of rotating axes. Vibrations and possible static and dynamic concentricity deviations are absorbed directly in the sealing lip area. A partial lifting of the sealing lip at a rotating shaft and the associated pump effect is low in this seal ring construction.

Extensive comparative measurements have shown that the VR Lip Seal requires only **1/3** to **1/4** of the radial force with the same sealing performance compared to the normal spring-supported sealing element, thus positively influencing the energy efficient requirements for modern products.

Thus, it becomes possible to allow this type of seal to run on unhardened and stainless steel shafts without destroying scoring or grooves. Even after more than a thousand running hours, only a polishing track produced by the sealing lip is visible on the shaft.

The sealing system

In addition to the already described VR ring, a complex system of mutually influencing variables acts on the sealing behaviour and the service life:

Housing (4)

- Surfaces
- Centre offset to the shaft
- Tolerances
- Material

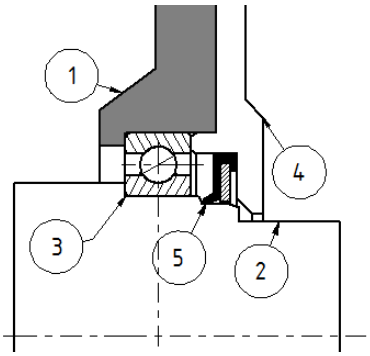


Figure 1 - sealing environment

Shaft (2)

- Diameter
- Speed
- Eccentricity
- Surface
- Axial movement
- Material

Medium

- Temperature
- Chemical effects
- Viscosity
- Lubrication
- Pressure
- Decomposition products

Environment and operating mode (1)(3)

- Temperature
- Dust and dirt
- Running and standstill periods

VR radial shaft seal

- Design and tolerances
- Radial force
- Material
  - Hardness
  - Wear resistance
  - Resistance to swelling and shrinking
  - Friction properties

VR Advantages

- save sealing, even on unhardened and stainless steel shafts
- no destroying scoring or grooves

- no need for surface follow-up treatment of the shaft, such as hardening, nitrating or hard chrome coating or additional sleeves.
- minimalized so-called pump effect due to tangential and radial pretensioning of the sealing lip
- low friction coefficient
- low loss of power – long lifetime

Construction of the VR radial shaft seal

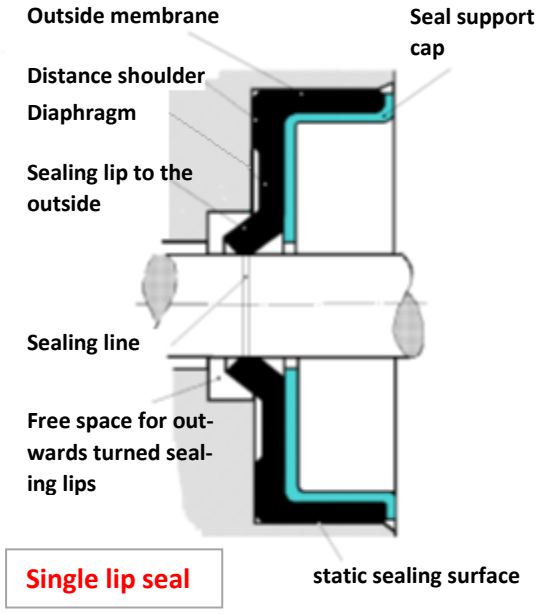


Figure 2 - Construction of the VR single lip seal

Static sealing

The static sealing of the housing is achieved by means of the outside membrane. Its task is:

- static sealing in the housing bore
- guarantee a tight fit in the bore. Small seals of types DOA and DOB should **also** be axially secured on the oil side.
- Enabling a perfect and easy installation of the seal.

When using housing materials with high thermal expansion, leakage between the drill wall and the radial shaft seal can occur at correspondingly high temperatures. When installing radial shaft seals in bearing bodies with thin walls or in bearing bodies with relatively low elasticity or strength, there is the danger that the housing will be expanded.

Constructive measures for simple assembly (see chapter "Design of the housing bore").

Dynamic sealing

The sealing lip should always be directed in the direction of the medium against which is sealed. The sealing mechanism in the contact area of the sealing lip is of decisive importance for the sealing function. It depends on:

- the structure and property of the elastomer material
- the condition of the shaft surface
- the medium to be sealed

Causes of leakage

The seal can become leaky if the complex conditions in the region of the contact zone are disturbed by:

- wrong surface quality of the shaft
- longitudinal scoring marks, porosities and other damages to shaft and seal
- impurities and decomposition products of the medium
- burning of the sealing lip due to excessively high speeds / pressure
- hardening and cracks in the sealing channel

Lubrication and friction

The sealing lip must be supplied with lubricant over the entire service life. The more intensive the lubrication, the lower the wear. Already at a standstill, due to capillary forces the medium to be sealed and simultaneously used for lubrication penetrates the unevenness of the shaft and the sealing lip. As in the case of a plain bearing, starting and subsequently increasing radial movements will lead from a condition of limited friction via mixed friction to the predominant hydrodynamic friction. The seal must in no case run dry. Therefore: Lightly grease or lubricate when mounting the shaft and seal. The medium to be sealed is not

only lubricant, but also coolant for dissipating the heat of friction generated. Already during the design phase, it should be guaranteed that sufficient lubricant is already present at the sealing edge during the first rotations (for example through drilled holes and channels). Individual designs of roller bearings, especially conical roller bearings, can exert a considerable pump effect on the medium during operation. As a result, different oil states can occur, which can endanger the lubrication of the sealing edge. Corrective actions: provide appropriate drilled holes and channels during construction. All parameters which influence the radial force and the lubrication conditions at the sealing lip have an effect on the frictional performance of the seal.

VR offers radial shaft seals made from special elastomers with self-lubricating or PTFE additives, which show certain "emergency operating features". However, their function depends on the properties of the overall system, too.

Gap extrusion

In the case of pressure each radial shaft seal is subject to extrusion in the sealing lip area on the low-pressure side, i.e. insertion of the sealing material into the ring gap between the shaft and the effective diameter Dw (distance dimension ds).

The effective diameter DW is defined either by the sealing construction (**Fehler! Verweisquelle konnte nicht gefunden werden.**) or by the construction elements straight behind the sealing lip (**Fehler! Verweisquelle konnte nicht gefunden werden.**) (housing, shell, etc.).

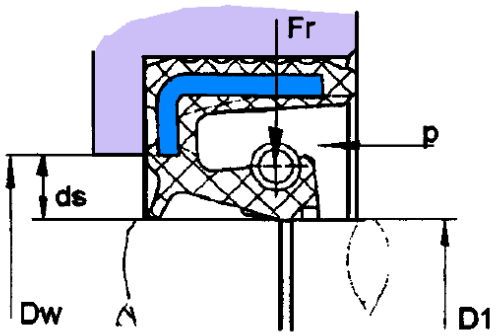


Figure 3

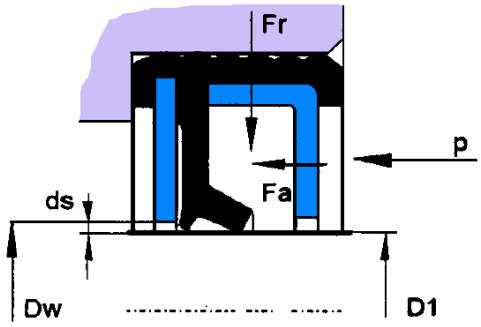


Figure 4

VR - Radial shaft seals are available with standard ds values (see also construction guidelines, ds diagram).

Chemistry

Reactions between VR materials and media

The chemical / physical effects of the media materials on the sealing materials are of decisive influence. With increasing temperature, the reactions and / or interactions are accelerated.

The materials can harden or soften under the influence of the media:

- hardening by ageing processes due to the media, especially at increased temperatures
- softening by swelling due to the influence of the media

In a chemical reaction, the elastomer reacts with the medium resulting in structural

changes (e.g. further crosslinking 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.

Boundary conditions

When several boundary conditions occur such as:

- maximum permissible peripheral speed,
- maximum permissible temperature,
- pressurisation, or
- in case of sparse lubrication or limited heat dissipation,

the application limits of the VR rings are reached and exceeded as well as the service life is limited.

Mineral oils

Low-alloyed mineral oils generally show good compatibility with the materials used for the VR radial shaft seals. Increasing demands on the mineral oils lead to higher alloyed oils and oils in new combinations. As a consequence, testing the compatibility with elastomer materials is becoming increasingly important and essential for critical applications.

Synthetic lubricants

Particularly in the area of high-power transmissions, semi-synthetic and fully synthetic lubricants are used more and more:

The base oils used possess a good compatibility with the elastomers in the overwhelming majority of cases. Aggressivity depends on the type and proportion of the additive systems contained in the lubricants. The wide range of chemical substances increases the variety of possible influences on the seal.

Note: Before new oils are introduced, the compatibility with elastomer should intensively be investigated.

Grease

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

As a remedy, limit the peripheral speed by approx. 50%. If the value is exceeded, the changeover to oil lubrication has to be checked. According to the data of the bearing manufacturer for sealing of grease-lubricated, slow-running shafts, filling the chamber with grease is recommended as far as possible.

For sealing with an insufficient supply of lubricant or against poorly lubricating media such as water and wash liquor, a separate quantity of lubricant must be provided for lubricating the sealing lip.

Here we recommend the use of VR twin-lip seals. In that case the gap should be filled with approx. 60% grease.

Impurities in the fluid

Impurities arise e.g. on rolling bearings or as decomposition products when the fluid is ageing.

These impurities will, depending on the loading, adversely affect the sealing and wear characteristics of the seals.

Note: Should the contact of the sealing lip with impurities be unavoidable, design measures such as centrifugal or collecting plates should be provided. In the case of very abrasive media, the shaft may wear out in the area of the running surface.

VR radial shaft seals with stretched membrane body

Technical specifications

Standard seals

Property	Unit	Value	Comment
V_{max}	m/s	40	Maximum value, depending on further application parameters and the elastomer used.
P_{max} max. pressure	MPa	1,5	Maximum value, depending on further application parameters. For pressures above 1.0 MPa, we recommend a consultation with our technical department.
P_{min} min. pressure	MPa	0,06	Minimum value, depending on further application parameters. For vacuum applications, we recommend a consultation with our technical department.
Temperature range (at the sealing lip) (under static conditions)	°C	-40°C to 250°C	Value, depending on further application parameters and the elastomer used.

High pressure seals

Property	Unit	Value	Comment
V_{max}	m/s	40	Maximum value, depending on further application parameters and the elastomer used.
P_{max} max. pressure	MPa	15	Maximum value, depending on further application parameters.
P_{min} min. pressure	MPa	0,04 (0,02 permanent with several SOA's)	Minimum value, depending on further application parameters.

			For vacuum applications, we recommend a consultation with our technical department.
Temperature range (at the sealing lip) (under static conditions)	°C	-40°C to 250°C	Value, depending on further application parameters and the elastomer used.

VR elastomers

Rubber is a very special material. What makes it particular is its high recovery capacity (elasticity). Thanks to their design, VR seals profit of this capability eminently.

Elastomers consist of a long chain of repeating monomers. Such a chain-like arrangement is called polymer. In the case of elastomers, this rotatability is so distinct that the molecules twist into a so-called polymer branch (rubber elasticity). This endeavour is merely the result of the rotational movement along the chain taking 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 a tensile stress, the chains as a result align themselves preferentially in the direction of the load. The elastomer is thus stretched. As soon as the tensile stress terminates, the chains begin again with the random rotary motion, in the course of which they again assume the statistically established Gaussian distribution. The chains "relax" and the elastomer contracts again.

VR Dichtungen offers you a very wide range of elastomers, from NBR for standard seals to the latest high-performance materials, appropriate for FDA / food requirements, too.

Particularly noteworthy in this context are:

- VR HNBR, excellent for applications at higher pressures, do not tend to explosive decompression*
- VR FKM with PTFE or self-lubricating additives

*specific variant, please contact us if you are interested

Influences on elastomers

Elastomeric seals can undergo structural changes in the course of use or during storage, thereby losing their elastomeric properties in whole or in part.

Rubber ageing is shown in the following forms:

Visible changes

- cracking
- becoming “tacky" of the surface

Measurable changes

- hardening or softening
- decrease in stress values

- decrease in elastic properties

Effect of contact media

Seals come into contact with a wide range of media when using, 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 into the rubber and have a

- physical activity or
- chemical activity.

Rule of thumb to select elastomers

Polar and non-polar combinations are preferable, but not always a guarantee. Please note that modern lubricating oils are to some extent fully synthetic oils with complex additive systems.

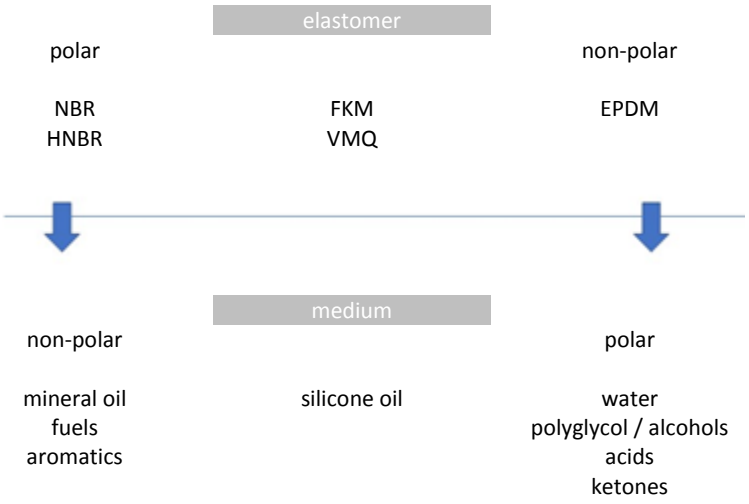


Figure 5 - combination of elastomer and medium

For ester-containing media please contact VR.

The van-'t-Hoff'sche rule, which describes the exponential behaviour of chemical reactions as a function of the temperature, should be kept in mind while evaluating the elastomer compatibility.

Material hardness sealing collar	Colour	Temperature operating range in °C	General properties	VR-No.
NBR (BFR)	black	-20°C to 100°C	A butadiene – acrylonitrile – copolymer having excellent swelling resistance to solvents based on aliphatic hydrocarbons, regular petrol and mineral oils. Good ageing resistance, low compression set. To be used with: petrol, mineral oil, fuel oil, dilute acids and alkaline solutions. Not to be used with: aromatics, chlorinated hydrocarbons, ketones, esters and ethers, as well as brake fluids based on glycol.	1
FKM	green	-12°C to 220°C	Fluor-caoutchouc Very good chemical and temperature resistance. Thermal resistance up to 250°C.	2
FKM/Food (FDA) Metal detectable	anthracite	-17°C to 220°C	To be used with: oils, flame retardant hydraulic fluids, fuels (premium petrol), aromatics, chlorinated hydrocarbons, concentrated acids and alkaline solutions. Not to be used with: amines and liquid ammonia, ketones, esters, short-chain alcohols and short-chain carboxylic acids.	B9
FKM /P	grey	-6°C to 220°C	FKM – peroxide As (2), but can also be used with hot steam and hot water, as well as with alcohols and SF mineral oils. Advanced chemical resistance.	7
FKM /PTFE(FDA)	white	-17°C to 220°C	As (2) with PTFE deposit for emergency running properties.	8
VMQ Peroxyd (FDA)	red	-50°C to 200°C	Outstanding temperature resistance. To be used with: dry heat, constant temperature up to 280°C. Resistant in mineral oils up to 150°C. Very resistant to oxygen and ozone. No hardening in hypoid oils. Food resistant.	6
HNBR Peroxyd (FDA)	brown	-40°C to 150°C	Very good resistance to hot water and hot steam, oil resistance even at high temperatures. To be used with: gasoline - also so-called sour gasoline, high-alloyed oils, cooling water, acids and alkaline solutions. Not to be used with: Synth. oils and grease, ketones, esters, ethers, aromatics, brake fluids.	5
EPDM peroxyd (BFR)	blue	-40°C to 150°C	Very good ageing resistance, high strength. To be used with: hot water, hot steam 200°C, ketones, esters, acids, hydraulic and brake fluids based on glycol. Not to be used with: petrol, mineral oils, aromatics and chlorinated hydrocarbons. Only use silicone-based greases.	3
	anthracite		As 2 and 5, however, with self-lubricating particles in the basic material. For applications without lubrication (water, gasoline, air, food etc.) extremely low friction values and loss moments due to integrated lubrication.	
HNBR-C		-40°C to 150°C		C5
FKM-C		-30°C to 220°C		C2

Mechanical properties

Property	Unit	NBR	HNBR	FKM	EPDM
Hardness	°ShA	75	69	72	69
Tensile strength	MPa	22,7	22,8	11,7	8,0
Compression set	%	14	18	20	8,0
Density	kg/m³	1280	1210	2120	1060

For all our materials more detailed data sheets are available on request. On request and for larger quantities (series), we can also adapt a material individually to the application requirements, as far as technically and chemically possible.

Summary

The following parameters are important for the selection of the seal:

- peripheral speed
- pressure
- temperature
- pollution in the fluid
- pollution / dust from the outside
- vibrations
- fluid / medium to be sealed
    - lubricating oils
    - greases
    - other media, such as coolants, cooling lubricants, etc.
- detergents used (in particular food industry)

So far, the lifetime of the often function-critical component "seal" cannot be calculated (result of a study of the Institute of Machine Elements of the University of Stuttgart), but must be tested on the test bench or in the system. By taking into account the influencing parameters, however, the designer has a considerable influence on the service lifetime of his sealing point.

Construction guidelines

Shaft / mating surface

The steels used in mechanical engineering are sufficient for the shaft surface. A follow-up treatment is not necessary due to the low contact pressure of the seal.

General requirements according to DIN 3760 and 3761:

- Rz = 1-5µm (latest publications in the area of sealing technology recommend a Rz value of 3-5µm)
- Rmax ≤ 6,3µm
- twist-free condition
- diameter tolerance h11
- roundness IT8

Recommendations for the mechanical construction of the mating surface

- According to DIN 3760 and 3761: centreless plunge grinding with complete spark-out, odd speed ratio!! (very suitable method)
- Hard turning with a very low feed rate can also be suitable. It depends, however, on the individual case, which is why we cannot recommend this without any restrictions
- Orthogonal scratches to the sealing surface are to be avoided, which is why we strongly advise against any manual follow-up treatment
- Shaft coatings can significantly increase the friction capacity of the entire system; preliminary investigations should be carried out in the case of coated waves
- Do not polish the shafts

A good conditioning of the contact surface is required in the case of thermally or mechanically highly stressed sealing points.

Please contact us so that we can work out the special case together.

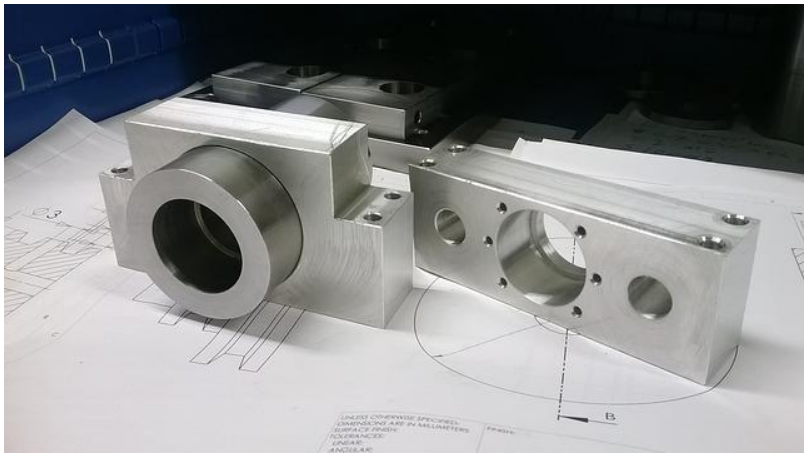


Figure 6

Housing bore

The following dimensions are required for VR shaft seals.

t1= b * 0,85 (at least)

t2= b + 0,3mm (at least)

r2= 0,7mm (maximum)

Concentricity and coaxiality according to DIN 3760

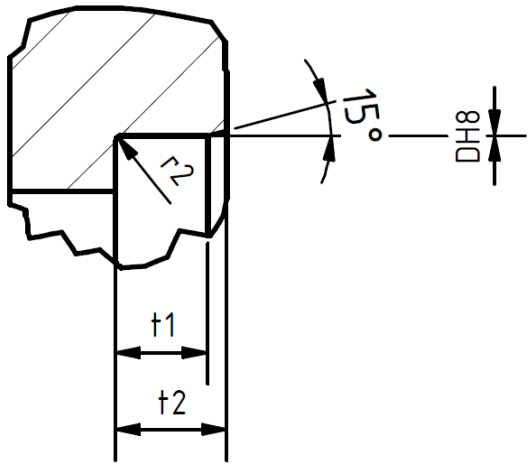


Figure 7 - housing bore

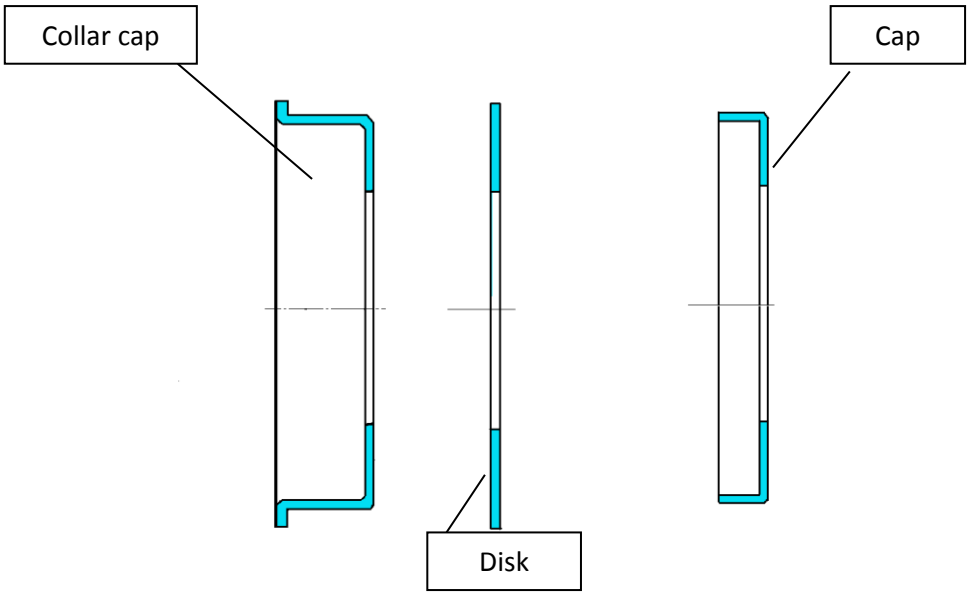
The necessary surface quality can be obtained by finish-turning.
For surface roughness apply:

- Rt ≤ 16µm (Ra ≤ 3µm)
- 4,0µm ≤ Rz ≤ 8,0µm
- bore tolerance: ISO tolerance H8

The housing bore should always have a chamfer of 15° so that the seal is installed in the housing bore and the membrane is not sheared off.

Sealing gap determination

VR RWDR (radial shaft seals) are offered with different gap dimensions ds of the support body. The purpose is the consideration of different pressure areas (see chapter gap extrusion).



With rotating shafts the sealing lip of a pressurised radial shaft seal is twisted and high shear stresses occur in the elastomer. These shear stresses are a function of the pressure, the peripheral speed, the coefficient of friction and the ring gap (distance ds - see figure 7). When the distance ds is too large, a burning of the elastomer material and a cutting of the seal lip may happen. The distance ds is thus a determining and influencing factor as to whether a seal will function or will be destroyed under the pre-determined pressure and the pre-set peripheral speed.

In the VR sealing system, this distance ds is taken into account by bore size d3 and d4 of the support body. By default, the d3 size is performed with dl + 1.0mm and d4 with dl + 0.5mm for stamped metal parts. Higher and dynamic pressures require smaller distances ds.

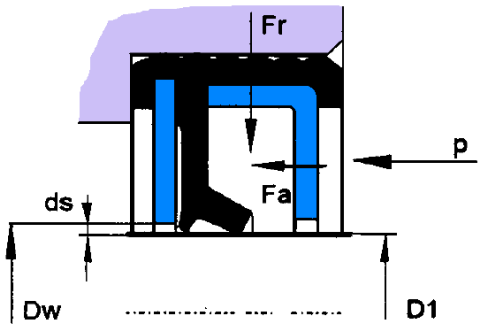


Figure 8

distance ds (mm)

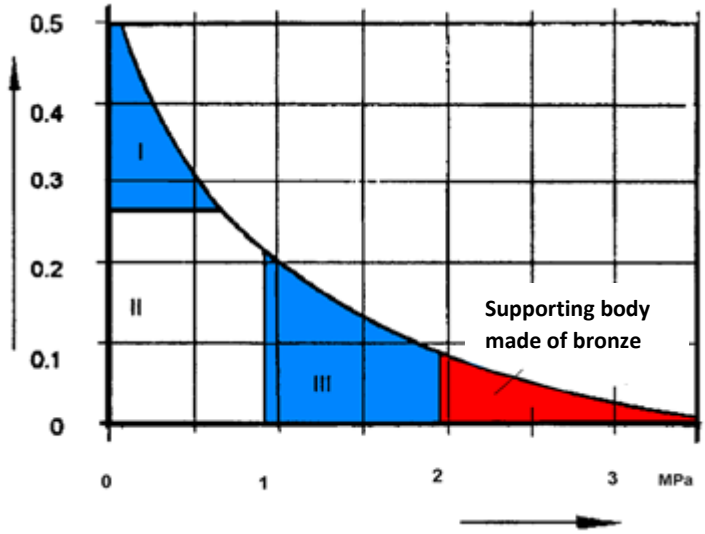


Figure 9

Please choose a gap size according to your application:

Area I: support body with size d3

Area II: support body with size d4

Area III: support body with size ds adapted to your application

Supports are available in steel and stainless steel (1.4301) or special materials. Please contact us if you have applications in area III.

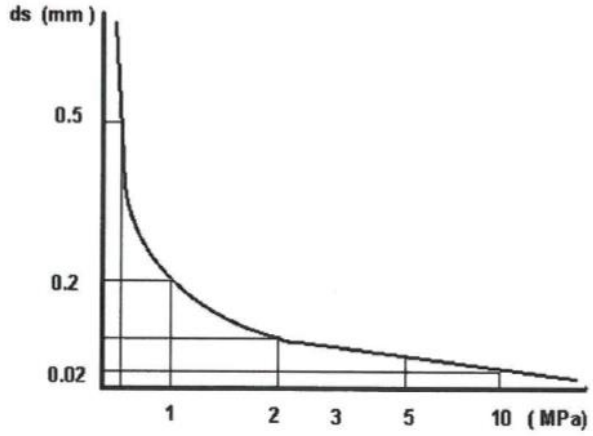
For distances ds < 0.10, we recommend to use red brass (RG7) as support to prevent shaft damages.

For higher pressure loads on seals, it is necessary to keep the gap extrusion as small as possible. For this purpose, stamped metal parts must be replaced by the one-piece, rotated support body design (design SOA).

Please contact us at an early stage in case of a design in high-pressure applications.

This support configuration allows very small ds distances to be achieved. These, on the other hand, are a measure of the maximum compressive load on the seal (**Fehler! Verweisquelle konnte nicht gefunden werden.**).
Support turned parts are available in:

- Red brass (RG7)
- Aluminium
- Stainless steel 1.4301
- Steel 1.0570



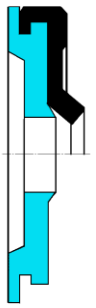


Figure 10

Selection diagrams

Speed - pressure ratio

Allowed
speed – pressure ratio

Determined values
Lubricated sealing lip without additional cooling
Pressure in quasi-steady-state condition.
The pressure values must be reduced for impact pressure.

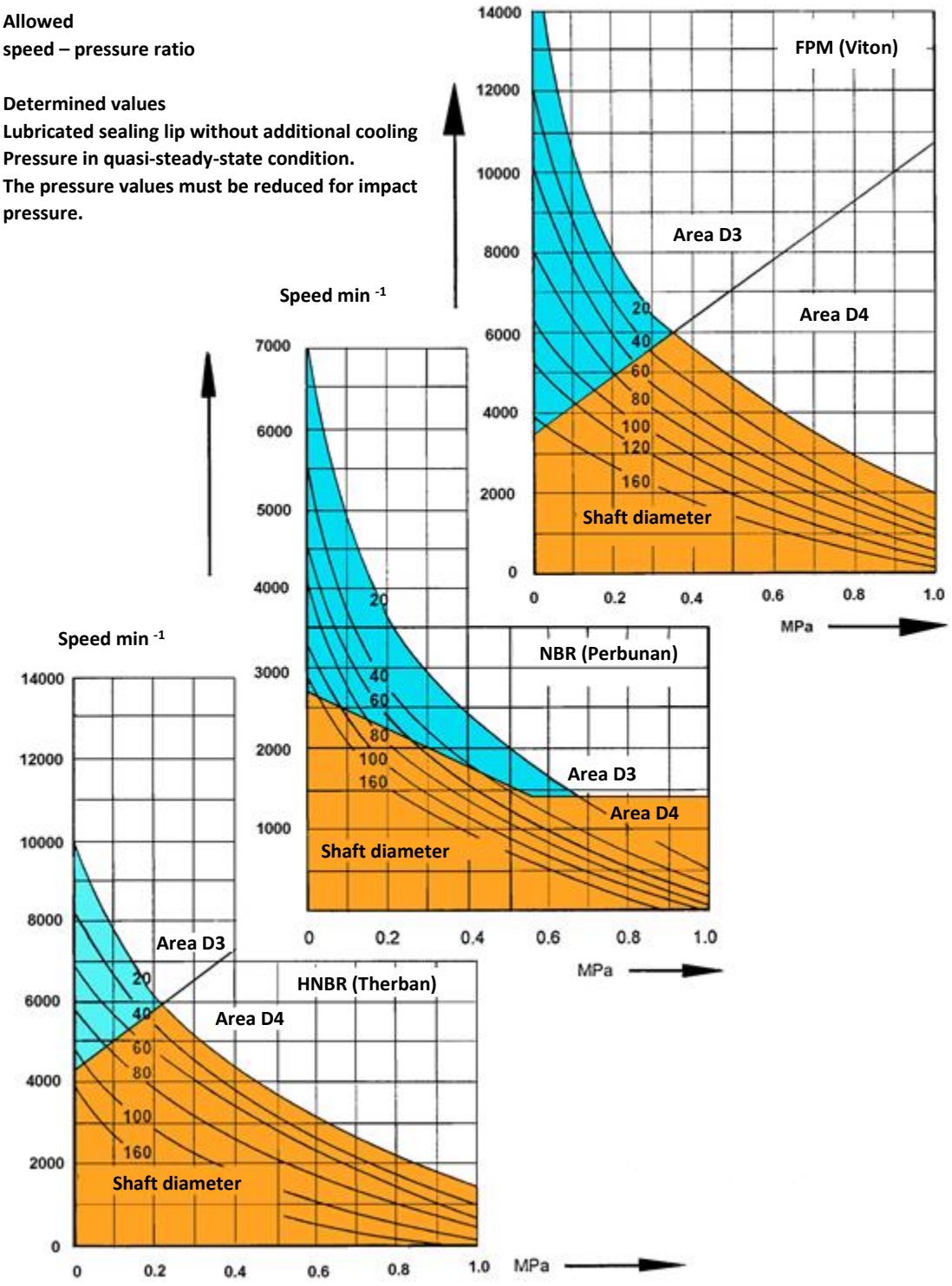


Figure 11

Tangential friction force VR shaft seals

Tangential friction force per meter circumference

Calculation of the power loss

$$p = \frac{d * \pi * p * v}{2000}$$

d = shaft diameter (mm)
v = peripheral speed (m/s)
Q = tangential friction (N/m)
P = power loss (W)
calculated values for sliding friction per sealing lip

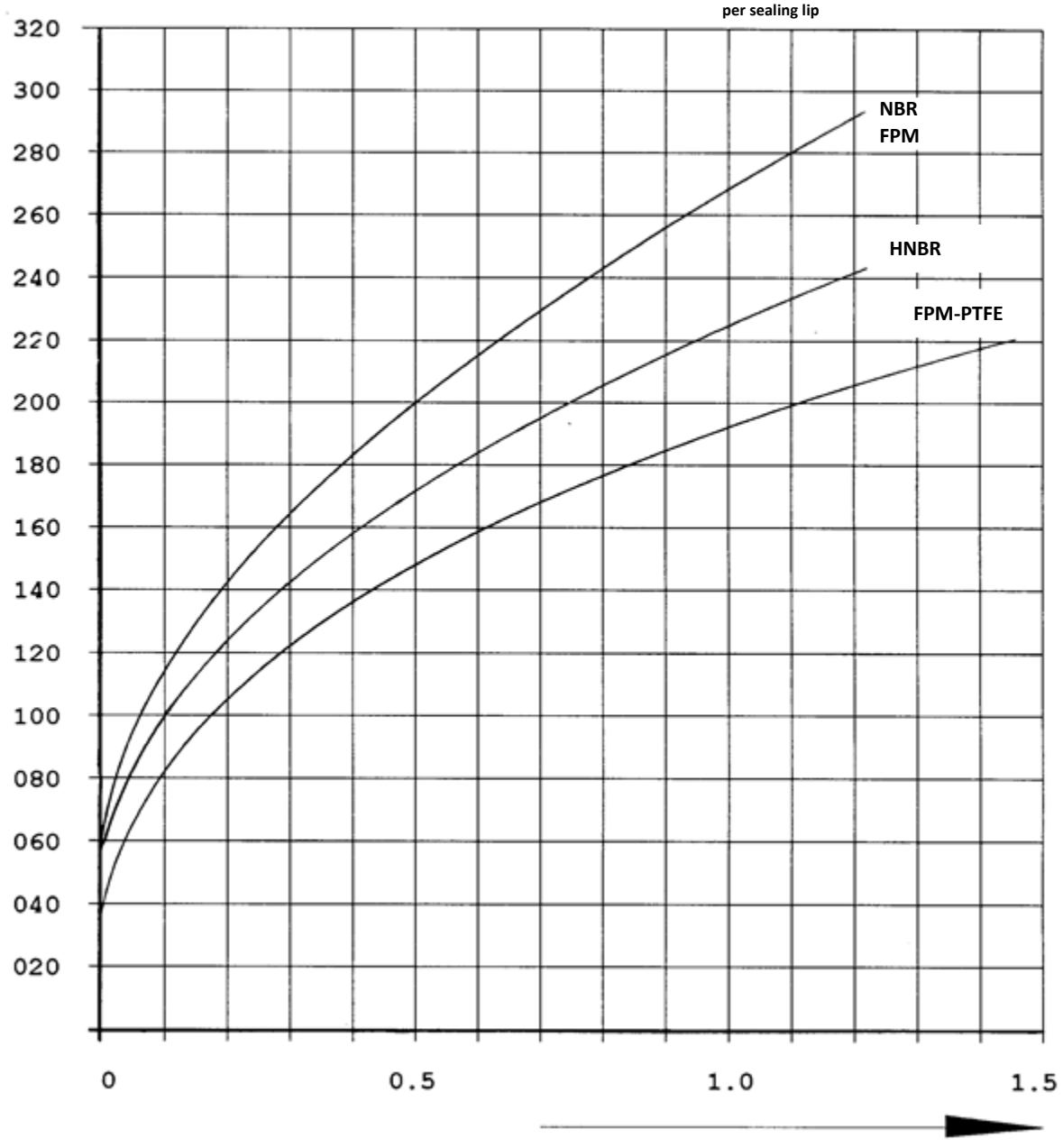


Figure 12

Formulary sealing technology (incomplete)

Descriptions

t1 = depth 1 housing bore

t2= depth 2 housing bore

b = width (total width of the seal)

Ft = tangential force (see diagram)

Construction dimensions

t1= b * 0,85 (at least)

t2= b + 0,3mm (at least)

Calculation formulas

Metre	$M = Ft\frac{1}{2}$	[Nm]
Power	$P = M * \omega$	[W]
Peripheral speed	$U = \frac{\pi * n * d}{60} = \frac{d}{2}\omega$	[m/s]

„Thumb"-formulas

Temperature increase sealing gap (pressureless)	$\Delta\vartheta = 2{,}5 * U$ U in m/s	[K]

Storage

All seals should be protected against dehydration and UV light. Please note the relevant guidelines, especially ISO 2230:2000-04 and DIN 7716:1982.

Mounting instructions

Only a professional installation guarantees the functionality and a long service lifetime of the VR radial shaft seal.

In order to avoid mounting errors, you should pay attention to the following:

- No sharp edges on tool or work piece
- No dirt
- No metal chips
- No residues of moulding sand
- No soiled mounting grease / oil
- No uncovered grooves

Mounting the seal

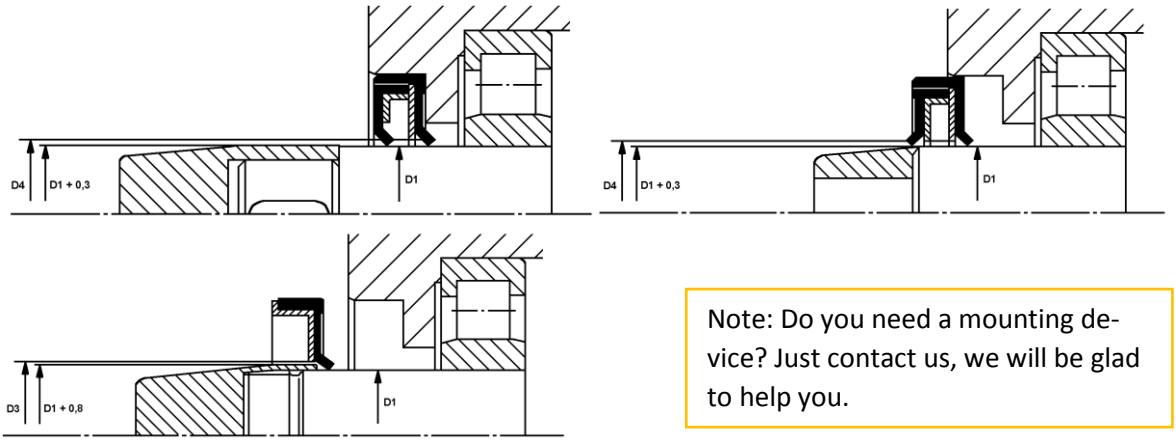
You will find illustrated instructions here.

Before mounting

Prepare seal and sealing point

Pay attention to the correct sealing lip position of the seal to the medium / space to be sealed and the mounting direction - see drawing types / mounting direction. Fill the grease chamber for the twin-lip seal to a maximum of 2/3 of the chamber volume with a suitable grease. Pay attention to the chemical compatibility. When filling, it is important to ensure that the grease pad between the membrane and the support is not too big. Remove excess grease.
Sharp edges and angles should be covered. For example grooves may be taped. Slightly grease / lubricate the shaft, spray the outer surface of the seal with isopropanol (70% solution).

For shafts with tongue-and-groove connection, the seal is fitted with a mounting hull (see drawing mounting hulls).



Note: Do you need a mounting device? Just contact us, we will be glad to help you.

Figure 13 - mounting sleeves

A fitting mandrel on a pressing device should be used for axially parallel mounting (Fehler! Verweisquelle konnte nicht gefunden werden.). Press the seal on the outer casing (not inside diameter) with a

fitting mandrel (approximately D2 - 0.5mm) straight and without tilting into the housing bore. Under no circumstances pressure should be exerted on the inside (sealing lip) of the seal.

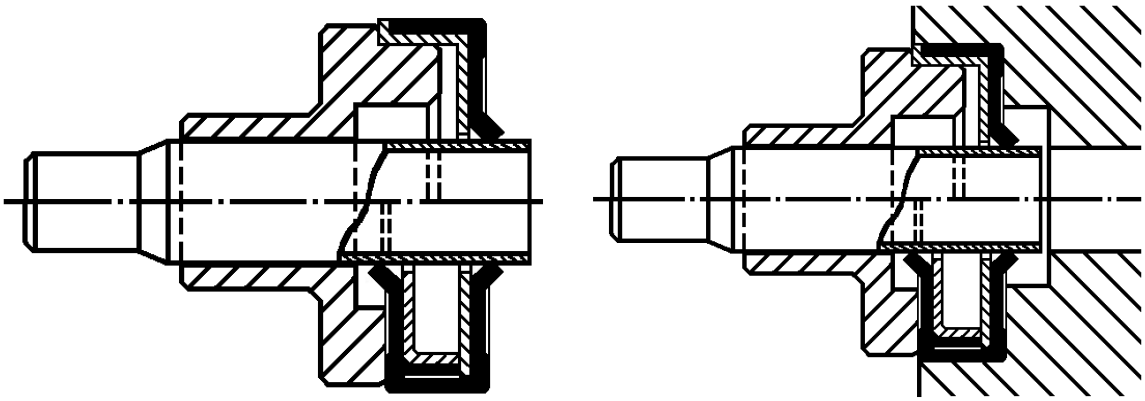


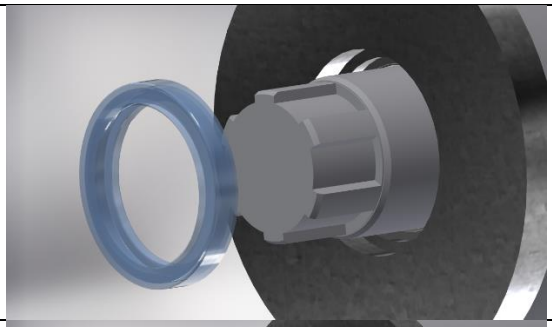
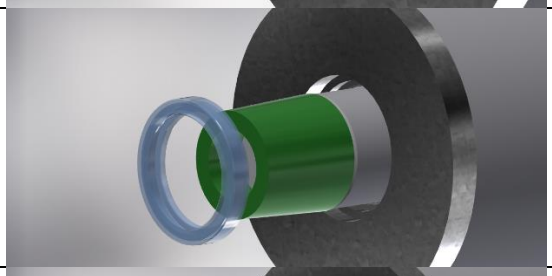
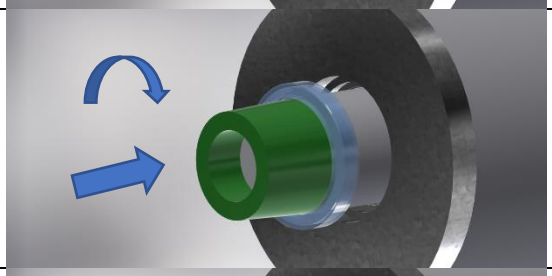
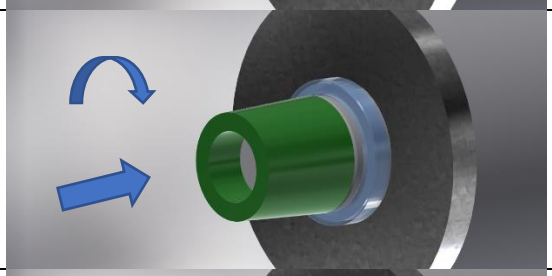
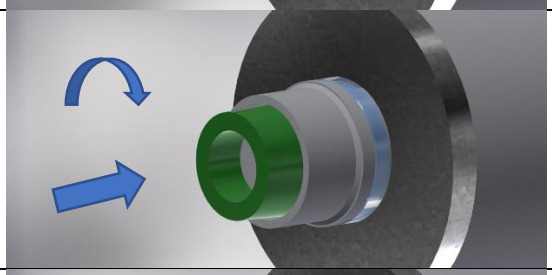
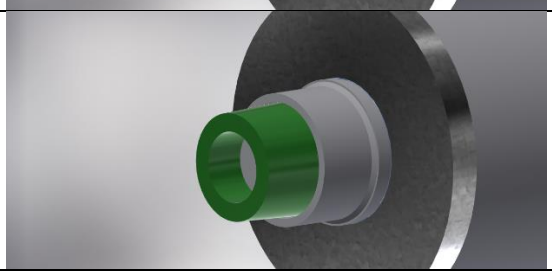
Figure 14 - mounting sleeves

Mount the shaft through the seal with a rotating movement. Do not reverse or pinch the sealing lips between the shaft and the metal ring if the sealing lips are opposite of the mounting direction. To prevent this, push the shaft back slightly with a minor rotation so that the sealing lips can rebound into the correct position (recoil). Then insert the shaft through the seal with a slight rotating movement. Pay attention to damaging the shaft by touching it with the metallic support body of the seal.

If the shaft is already mounted:
Mount the seal over the shaft rotating it slightly during mounting. Make sure that the sealing lips are not pinched or reversed. Check also, that the support bodies of the seal do not damage the shaft or the running surface. When the seal has been pushed up to the housing bore, press with a pressure ring onto the sealing edge and press the seal into the bore (see drawing pressure ring).

After mounting

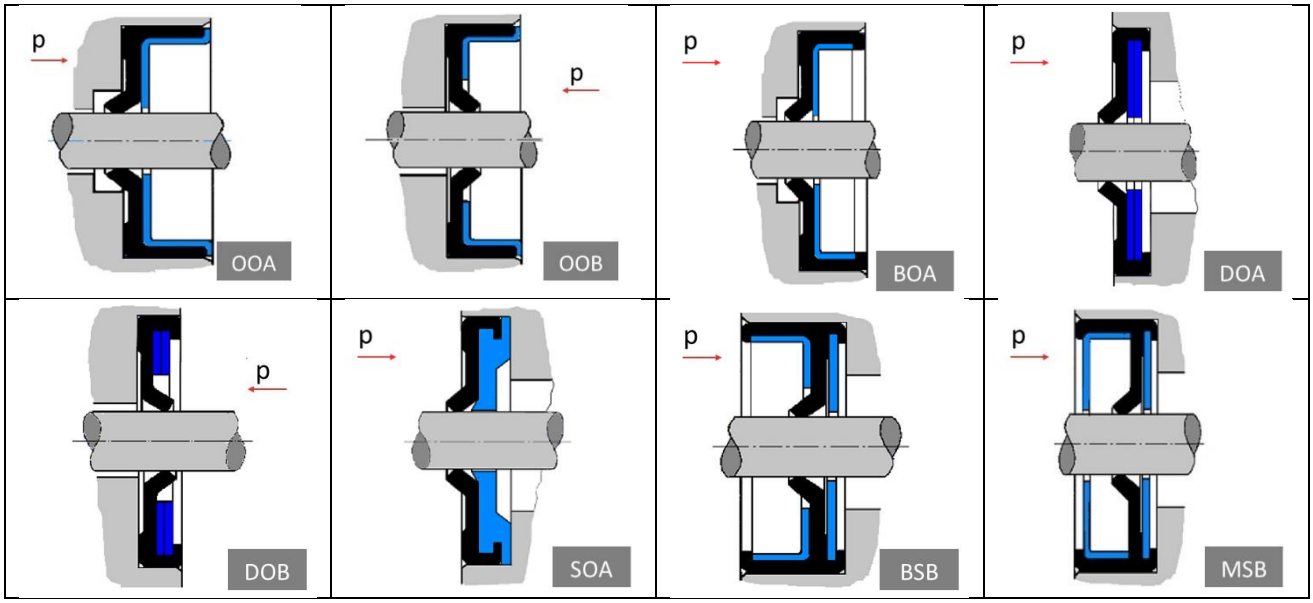
If the seal is mounted correctly (sealing lips not clenched or reversed), the shaft must be easily rotatable. Please check.

Before assembly: - Fill approx. 60% with grease - Check correct lip position - Clean housing bore - Clean shaft and oil lightly with mineral (Except EPDM) oil - Spray the seal on the outside with iso-propanol	
Eventually an additional taper adapter over the journal of the shaft	
Push seal onto the shaft under slight rotation	
Always check the sealing lip for a correct fit	
Axially parallel, by using suitable tools, press the seal into the housing bore	
Check the correct and good fit. Rotate the shaft in both directions. The shaft must be easily rotatable. Diagonally installed seals have no sealing function!	

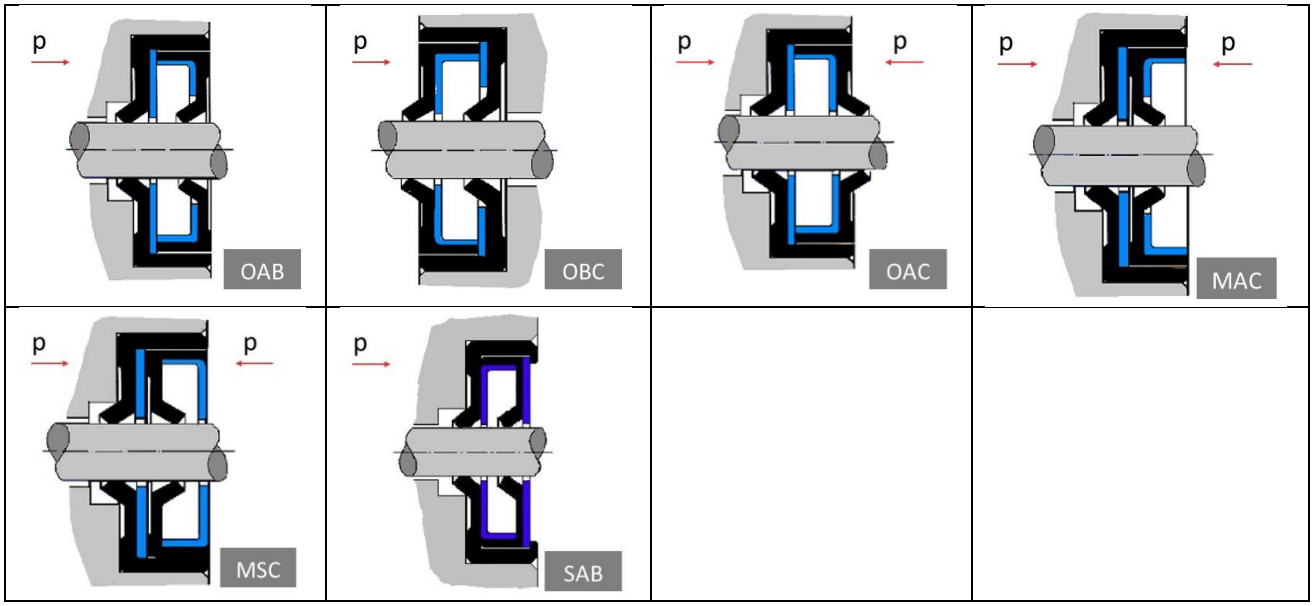
VR types

VR standard portfolio listed below

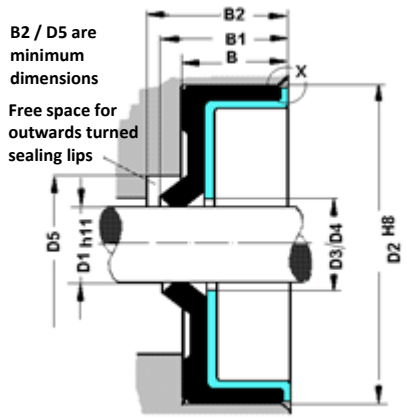
Overview one lip shaft seals



Overview two lip shaft seals



OOA



p_{max}: 1,5 MPa

Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

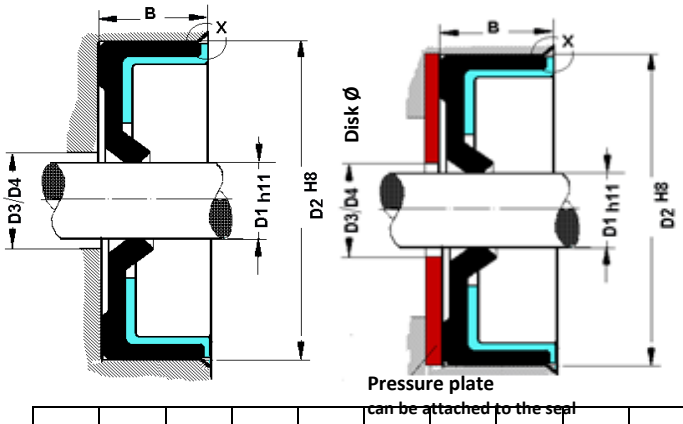
D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

Housing – diameter D5
D5 = (D1 + D2) / 2

Red marked and differing dimension on request only

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	9.0	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	8.0	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			
	26					52	9	11.0	12.0		80				130	160	12	14.5	15.5
					26	37	7	9.0	10.0		85					170			
11	22	7	8.5	9.5		42				56	70	10	12.0	13.0	135	170	12	14.5	15.5
	24					47					72				140	170	12	14.5	15.5
	26				28	40	7	9.0	10.0		80				145	175	15	17.5	18.5
12	22	7	8.5	9.5		47					85				150	180	15	17.5	18.5
	24					52	9	11.0	12.0	58	72	10	12.0	13.0	160	190	15	17.5	18.5
	28				30	40	7	9.0	10.0		80				170	200	15	17.5	18.5
	30					42				60	75	10	12.5	13.5	180	210	15	17.5	18.5
						45					80				190	220	15	17.5	18.5
14	24	7	8.5	9.5		47					85				200	230	15	18.0	19.0
	28					50					90				210	240	15	18.0	19.0
	30					52	9	11.0	12.0	62	85	10	12.5	13.5	220	250	15	18.0	19.0
	35					62	10	12.0	13.0		90				230	260	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	240	270	15	18.0	19.0
	30					47					90				250	280	15	18.0	19.0
	32					52	9	11.0	13.0	65	85	10	12.5	13.5	260	300	20	24.0	25.0
	35				35	47	7	9.0	10.0		90				280	320	20	24.0	25.0
16	28	7	8.5	9.5		50					100				300	340	20	24.0	25.0
	30					52	9	11.0	13.0	68	90	10	12.5	13.5	320	360	20	24.0	25.0
	32					62	10	12.0	14.0		100				340	380	20	24.0	25.0
	35				36	47	7	9.0	10.0	70	90	10	12.5	13.5	360	400	20	24.0	25.0
17	28	7	8.5	9.5		50					100				380	420	20	24.0	25.0
	30					52	9	11.0	13.0	72	95	10	12.5	13.5					
	32					62	10	12.0	13.0		100								
	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													

OOB



Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

p_{max}: 0,5 MPa

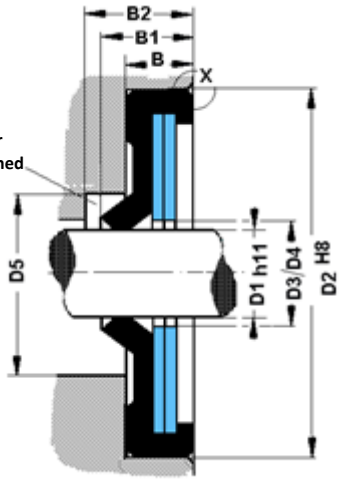
Red marked and differing dimension on request only

D1	D2	B			D1	D2	B			D1	D2	B			D1	D2	B		
					20	30	7			42	55	10			85	110	10		
						32					62					120	12		
						35					72				90	110	10		
						40				45	60	10				120	12		
						47					62				95	120	12		
6	16	7			22	32	7				65					125			
	22					35					72				100	120	12		
7	10	7				40				48	62	10				125			
	16					47					72					130			
	22				24	35	7			50	65	10			105	130	12		
8	16	7				37					68					140			
	22					40					72				110	130	12		
	24					47					80					140			
9	22	7			25	35	7			52	68	10			115	140	12		
	24					40					72					150			
	26					42				55	70	10			120	150	12		
10	22	7				47					72					160			
	24					52	9				80				130	160	12		
	26				26	37	7				85					170			
11	22	7				42				56	70	10			135	170	12		
	26					47					72				140	170	12		
					28	40	7				80				145	175	15		
12	22	7				47					85				150	180	15		
	24					52	9			58	72	10			160	190	15		
	28				30	40	7				80				170	200	15		
	30					42				60	75	10			180	210	15		
						45					80				190	220	15		
14	24	7				47					85				200	230	15		
	28					52	9				90				210	240	15		
	30					62	10			62	85	10			220	250	15		
	35										90				230	260	15		
15	26	7			32	45	7			63	85	10			240	270	15		
	30					47					90				250	280	15		
	32					52	9			65	85	10			260	300	20		
	35				35	47	7				90				280	320	20		
16	28	7				50					100				300	340	20		
	30					52	9			68	90	10			320	360	20		
	32					62	10				100				340	380	20		
	35				36	47	7			70	90	10			360	400	20		
17	28	7				50					100				380	420	20		
	30					52	9			72	95	10			400	440	20		
	32					62	10				100								
	35				38	52	9			75	95	10							
	40					55	10				100								
18	30	7				62				78	100	10							
	32				40	52	9			80	100	10							
	35					55	10				110								
	40					62													
						72													

BOA

Dimensions for the type BOA available on request

DOA



B2 / D5 are minimum dimensions

Free space for outwards turned sealing lips

p_{max}: 1,5 MPa

Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5 mm from D1 = 150mm
D4 = D1 + 1.0 mm

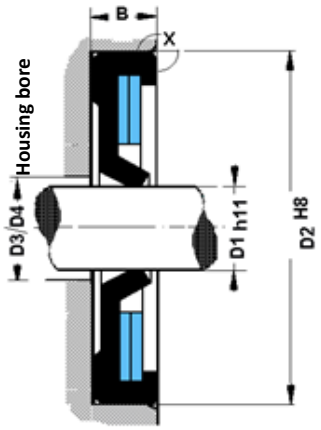
Housing – diameter D5 min.
D5 = (D1 + D2) / 2
For an axial fixation, the DOB – seal 0.5mm can be compressed by the adjacent component.
e.g. B = 3.5 becomes 3.0 mm

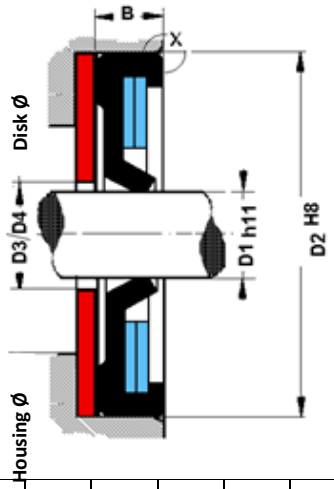
Red marked and differing dimension on request only

D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2
3	10	3,5	4,5	5,5	20	30	3,5	5,0	6,0	42	55	4,5	6,5	7,5	85	110	5,5	8,0	9,0
4	10					32					62					120	5,5	8,0	9,0
5	10					35					72				90	110	5,5	8,0	9,0
6	10					40				45	60	4,5	6,5	7,5		120	5,5	8,0	9,0
5	16	3,5	4,5	5,5		47					62				95	120	5,5	8,0	9,0
6	16	3,5	4,5	5,5	22	32	3,5	5,0	6,5		65					125			
	19					35					72				100	120	5,5	8,0	9,0
	22					40				48	62	4,5	6,5	7,5		125			
7	16	3,5	5,0	5,5		47					72					130			
	22				24	35	3,5	5,5	6,5	50	65	4,5	6,5	7,5	105	130	5,5	8,0	9,0
8	16	3,5	5,0	6,0		37					68					140			
	22					40					72				110	130	5,5	8,0	9,0
	24					47					80					140			
9	22	3,5	5,0	6,0	25	35	3,5	5,5	6,5	52	68	4,5	6,5	7,5	115	140	5,5	8,0	9,0
	24					40					72					150			
	26					42				55	70	4,5	6,5	7,5	120	150	5,5	8,0	9,0
10	22	3,5	5,0	6,0		47					72								
	24					52	4,5	6,5	7,5		80				125	150	5,5	8,0	9,0
	26				26	37	3,5	5,5	6,5		85								
11	22	3,5	5,0	6,0		42				56	70	4,5	6,5	7,5					
	26					47					72								
					28	40	3,5	5,5	6,5		80								
12	22	3,5	5,0	6,0		47					85								
	24					52	4,5	6,5	7,5	58	72	4,5	6,5	7,5					
	28				30	40	3,5	5,5	6,5		80								
	30					42				60	75	4,5	7,0	8,0					
14	24	3,5	5,0	6,0		45					80								
	26					47					85								
	28					52	4,5	6,5	7,5		90								
	30					62	4,5	6,5	7,5	62	85	4,5	7,0	8,0					
	35										90								
15	26	3,5	5,0	6,0	32	45	3,5	5,5	6,5	63	85	4,5	7,0	8,0					
	30					47					90								
	32					52	4,5	6,5	7,5	65	85	4,5	7,0	8,0					
	35				35	47	3,5	5,5	6,5		90								
16	28	3,5	5,0	6,0		50					100								
	30					52	4,5	6,5	7,5	68	90	4,5	7,0	8,0					
	32					62	4,5	6,5	7,5		100								
	35				36	47	3,5	5,5	6,5	70	90	4,5	7,0	8,0					
17	28	3,5	5,0	6,0		50					100								
	30					52	4,5	6,5	7,5	72	95	4,5	7,0	8,0					
	32					62	4,5	6,5	7,5		100								
	35				38	52	4,5	6,5	7,5	75	95	4,5	7,0	8,0					
	40					55	4,5	6,5	7,5		100								
18	30	3,5	5,0	6,0		62	4,5	6,5	7,5	78	100	4,5	7,0	8,0					
	32				40	52	4,5	6,5	7,5	80	100	4,5	7,0	8,0					
	35					55	4,5	6,5	7,5		110	5,5	8,0	9,0					
	40					62													
						72													

> 150 mm bore-Ø on request

DOB





Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm
For an axial fixation, the DOB – seal 0.5mm can be compressed by the adjacent component.
e.g. B = 3.5 becomes 3.0 mm

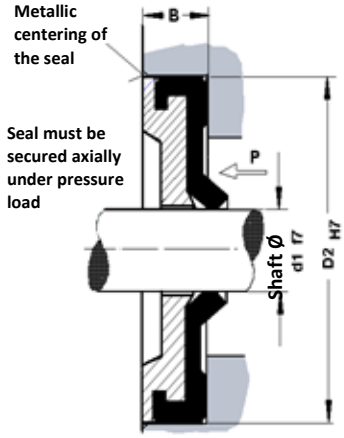
Red marked and differing dimension on request only

p_{max}: 1,0 MPa

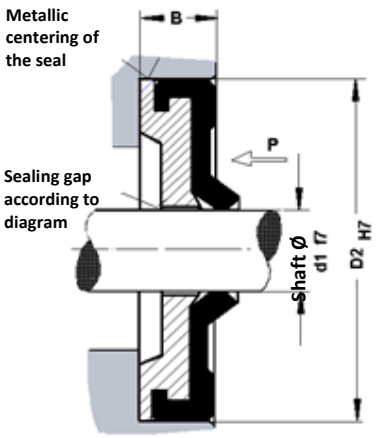
D1	D2	B			D1	D2	B			D1	D2	B			D1	D2	B		
3	10	3,5			20	30	3,5			42	55	4,5			85	110	5,5		
						32					62					120	5,5		
						35					72				90	110	5,5		
						40				45	60	4,5				120	5,5		
5	16	3,5				47					62				95	120	5,5		
6	22	3,5			22	32	3,5				65					125			
						35					72				100	120	5,5		
5	22					40				48	62	4,5				125			
7	16	3,5				47					72					130			
	22				24	35	3,5			50	65	4,5			105	130	5,5		
8	16	3,5				37					68					140			
	22					40					72				110	130	5,5		
	24					47					80					140			
9	22	3,5			25	35	3,5			52	68	4,5			115	140	5,5		
	24					40					72					150			
	26					42				55	70	4,5			120	150	5,5		
10	22	3,5				47					72								
	24					52	4,5				80				125	150	5,5		
	26				26	37	3,5				85								
11	22	3,5				42				56	70	4,5							
	26					47					72								
					28	40	3,5				80								
12	22	3,5				47					85								
	24					52	4,5			58	72	4,5							
	28				30	40	3,5				80								
	30					42				60	75	4,5							
14	24	3,5				45					80								
	26					47					85								
	28					52	4,5				90								
	30					62	4,5			62	85	4,5							
	35										90								
15	26	3,5			32	45	3,5			63	85	4,5							
	30					47					90								
	32					52	4,5			65	85	4,5							
	35				35	47	3,5				90								
16	28	3,5				50					100								
	30					52	4,5			68	90	4,5							
	32					62	4,5				100								
	35				36	47	3,5			70	90	4,5							
17	28	3,5				50					100								
	30					52	4,5			72	95	4,5							
	32					62	4,5				100								
	35				38	52	4,5			75	95	4,5							
	40					55	4,5				100								
18	30	3,5				62	4,5			78	100	4,5							
	32				40	52	4,5			80	100	4,5							
	35					55	4,5				110	5,5							
	40					62													
						72													

> 150 mm bore-Ø on request

SOA (ip protected)



Seal for high pressure loads



Seal for high pressure loads

p_{max}: 15,0 MPa

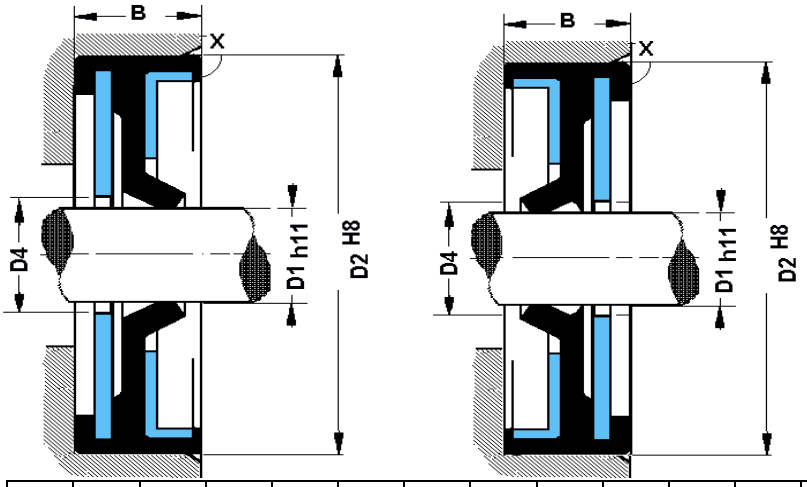
Inch dimensions on request

Red marked and differing dimension on request only

D1	D2	B			D1	D2	B			D1	D2	B			D1	D2	B		
					20	30	5,0			42	55	6,0			85	110	7,0		
						32					62					120			
5	16	5,0				35					72				90	110			
	22					40				45	60					120			
						47					62				95	120			
6	16				22	32					65					125			
	22					35					72				100	120			
						40				48	62					125			
7	16					47					72					130			
	22				24	35				50	65				105	130			
8	16					37					68					140			
	22					40					72				110	130			
	24					47					80					140			
9	22				25	35				52	68				115	140			
	24					40					72					150			
	26					42				55	70				120	150			
10	22					47					72								
	24					52	6,0				80								
	26				26	37	5,0				85								
11	22					42				56	70								
	24					47					72								
	26				28	40					80								
12	22					47					85								
	24					52	6,0			58	72								
	26				30	40	5,0				80								
	28					42				60	75								
	30					45					80								
14	24					47					85								
	28					50					90								
	30					52	6,0			62	85								
	35					62					90								
15	26				32	45	5,0			63	85								
	30					47					90								
	32					52	6,0			65	85								
	35				35	47	5,0				90								
16	28					50					100								
	30					52	6,0			68	90								
	32					62					100								
	35				36	47	5,0			70	90								
17	28					50					100								
	30					52	6,0			72	95								
	32					62					100								
	35				38	52				75	95								
	40					55					100								
18	30					62				78	100								
	32				40	52				80	100								
	35					55					110	7,0							
	40					62													
						72													

> 150 mm bore-Ø on request

BSB



Support body - diameter

D4 = D1 + 0.5mm

from D1 = 150mm
D4 = D1 + 1.0mm

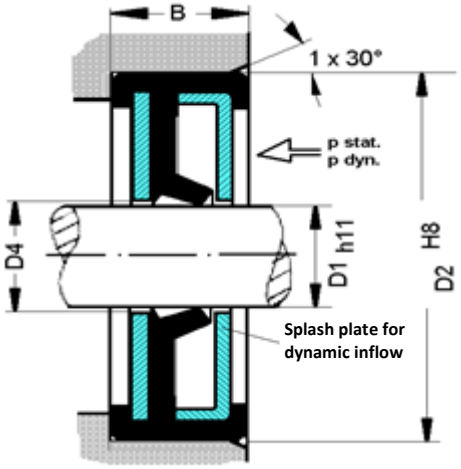
Red marked and differing dimension on request only

p_{max}: 1,0 MPa

D1	D2	B			D1	D2	B	B		D1	D2	B	B		D1	D2	B		
					20	30	7			42	55	8			85	110	12		
						32					62					120	12		
						35					72				90	110	12		
						40				45	60	8				120	12		
						47					62				95	120	12		
6	16	7			22	32	7				65					125			
	22					35					72	8	10		100	120	12		
7	10	7				40				48	62	8				125			
	16					47					72					130			
	22				24	35	7			50	65	8			105	130	12		
8	16	7				37					68								
	22					40					72	8	10		110	130	12		
	24					47					80								
9	22	7			25	35	7			52	68	8							
	24					40					72								
	26					42				55	70	8	10						
10	22	7				47					72								
	24					52	7				80	8	10						
	26				26	37	7				85								
11	22	7				42				56	70	8							
	26					47					72								
					28	40	7				80								
12	22	7				47					85								
	24					52	7			58	72	8							
	28				30	40	7				80								
	30					42				60	75	8	10						
						45					80	8	10						
14	24	7				47					85								
	28					52	7				90	8	10						
	30					62	7			62	85	10							
	35										90								
15	26	7			32	45	7			63	85	10							
	30					47					90								
	32					52	7			65	85	10							
	35				35	47	7				90								
16	28	7				50					100								
	30					52	7			68	90	10							
	32					62	7				100								
	35				36	47	7			70	90	10							
17	28	7				50					100								
	30					52	7			72	95	10							
	32					62	7				100								
	35				38	52	7			75	95	10							
	40					55	7				100								
18	30	7				62				78	100	10							
	32				40	52	7			80	100	10							
	35					55	7				110								
	40					62													
						72	7	10											

> 130 mm bore-Ø on request

MSB



p_{max}: 1,0 MPa

Support body - diameter

D4 = D1 + 0.5mm

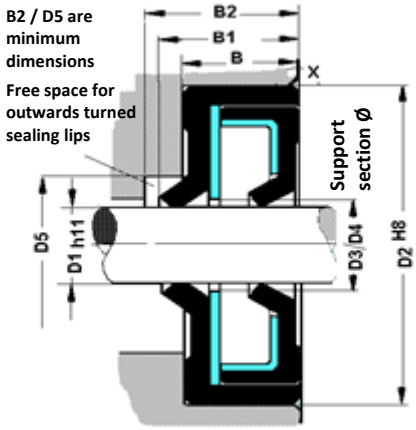
from D1 = 150mm
D4 = D1 + 1.0mm

Red marked and differing dimension on request only

D1	D2	B			D1	D2	B	B		D1	D2	B	B		D1	D2	B		
					20	30	7			42	55	8			85	110	12		
						32					62					120	12		
						35					72				90	110	12		
						40				45	60	8				120	12		
						47					62				95	120	12		
6	16	7			22	32	7				65					125			
	22					35					72	8	10		100	120	12		
7	10	7				40				48	62	8				125			
	16					47					72					130			
	22				24	35	7			50	65	8			105	130	12		
8	16	7				37					68								
	22					40					72	8	10		110	130	12		
	24					47					80								
9	22	7			25	35	7			52	68	8							
	24					40					72								
	26					42				55	70	8	10						
10	22	7				47					72								
	24					52	7				80	8	10						
	26				26	37	7				85								
11	22	7				42				56	70	8							
	26					47					72								
					28	40	7				80								
12	22	7				47					85								
	24					52	7			58	72	8							
	28				30	40	7				80								
	30					42				60	75	8	10						
						45					80	8	10						
14	24	7				47					85								
	28					52	7				90	8	10						
	30					62	7			62	85	10							
	35										90								
15	26	7			32	45	7			63	85	10							
	30					47					90								
	32					52	7			65	85	10							
	35				35	47	7				90								
16	28	7				50					100								
	30					52	7			68	90	10							
	32					62	7				100								
	35				36	47	7			70	90	10							
17	28	7				50					100								
	30					52	7			72	95	10							
	32					62	7				100								
	35				38	52	7			75	95	10							
	40					55	7				100								
18	30	7				62				78	100	10							
	32				40	52	7			80	100	10							
	35					55	7				110								
	40					62													
						72	7	10											

> 130 mm bore-Ø on request

OAB



p_{max}: 1,0 MPa

Support body- diameter

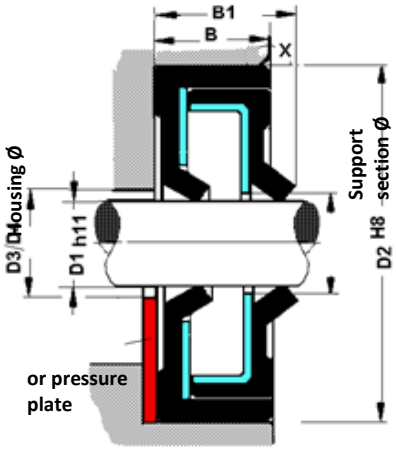
D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

Support body diameter D5
D5 = (D1 + D2) / 2

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										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													

OBC



Support body- diameter

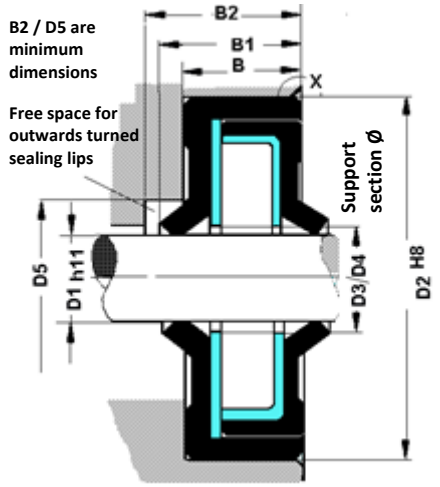
D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

p_{max}: 1,5 MPa

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

OAC



p_{max}: 1,0 MPa (disk side)

p_{max}: 1,5 MPa (cap side)

Support body- diameter

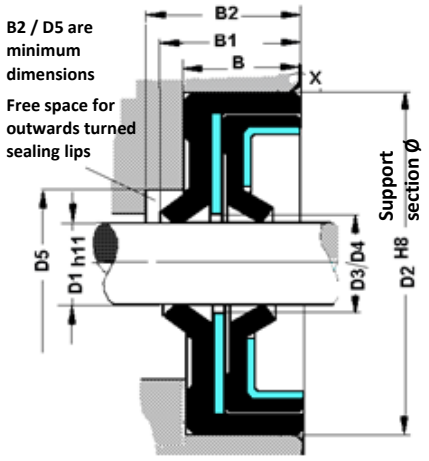
D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

Support body diameter D5
D5 = (D1 + D2) / 2

D1	D2	B	B2	B1	D1	D2	B	B2	B1	D1	D2	B	B2	B1	D1	D2	B	B2	B1
					20	30	7	11.0	8.5	42	55	10	15.0	12.0	85	110	10	16.0	12.5
						32					62					120	12	18.0	14.5
						35					72				90	110	10	16.0	12.5
						40				45	60	10	15.0	12.0		120	12	18.0	14.5
						47					62				95	120	12	18.0	14.5
6	16	7	10.0	8.0	22	32	7	11.5	8.5		65								
	22					35					72				100	120	12	18.0	14.5
						40				48	62	10	15.0	12.0		125			
7	16	7	10.5	8.5		47					72					130			
	22				24	35	7	12.0	9.0	50	65	10	15.0	12.0	105	130	12	18.0	14.5
8	16	7	11.0	8.5		37					68					140			
	22					40					72				110	130	12	18.0	14.5
	24					47					80					140			
9	22	7	11.0	8.5	25	35	7	12.0	9.0	52	68	10	15.0	12.0	115	140	12	18.0	14.5
	24					40					72					150			
	26					42				55	70	10	15.0	12.0	120	150	12	18.0	14.5
10	22	7	11.0	8.5		47					72					160			
	24					52	9	14.0	11.0		80				125	150	12	18.0	14.5
	26				26	37	7	12.0	9.0		85					160			
11	22	7	11.0	8.5		42				56	70	10	15.0	12.0	130	160	12	18.0	14.5
	26					47					72					170			
					28	40	7	12.0	9.0		80				135	170	12	18.0	14.5
12	22	7	11.0	8.5		47					85				140	170	12	18.0	14.5
	24					52	9	14.0	11.0	58	72	10	15.0	12.0	145	175	15	21.0	17.5
	26				30	40	7	12.0	9.0		80				150	180	15	21.0	17.5
	28					42				60	75	10	16.0	12.5	160	190	15	21.0	17.5
						45					80				170	200	15	21.0	17.5
14	24	7	11.0	8.5		47					85				180	210	15	21.0	17.5
	28										90				190	220	15	21.0	17.5
	30					52	9	14.0	11.0	62	85	10	16.0	12.5	200	230	15	22.0	18.0
	35					62	10	15.0	12.0		90				210	240	15	22.0	18.0
15	26	7	11.0	8.5	32	45	7	12.0	9.0	63	85	10	16.0	12.5	220	250	15	22.0	18.0
	30					47					90				230	260	15	22.0	18.0
	32					52	9	15.0	11.0	65	85	10	16.0	12.5	240	270	15	22.0	18.0
	35				35	47	7	12.0	9.0		90				250	280	15	22.0	18.0
16	28	7	11.0	8.5		50	7	12.0	9.0		100				260	300	20	29.0	24.0
	30					52	9	14.0	11.0	68	90	10	16.0	12.5	280	320	20	29.0	24.0
	32					62	10	15.0	12.0		100				300	340	20	29.0	24.0
	35				36	47	7	12.0	9.0	70	90	10	16.0	12.5	320	360	20	29.0	24.0
17	28	7	11.0	8.5		50					100				340	380	20	29.0	24.0
	30					52	9	14.0	11.0	72	95	10	16.0	12.5	360	400	20	29.0	24.0
	32					62	10	15.0	12.0		100				380	420	20	29.0	24.0
	35				38	52	9	14.0	11.0	75	95	10	16.0	12.5					
	40					55	10	15.0	12.0		100								
18	30	7	11.0	8.5		62				78	100	10	16.0	12.5					
	32				40	52	9	14.0	11.0	80	100	10	16.0	12.5					
	35					55	10	15.0	12.0		110								
	40					62													
						72													

MAC



p_{max}: 1,5 MPa

Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

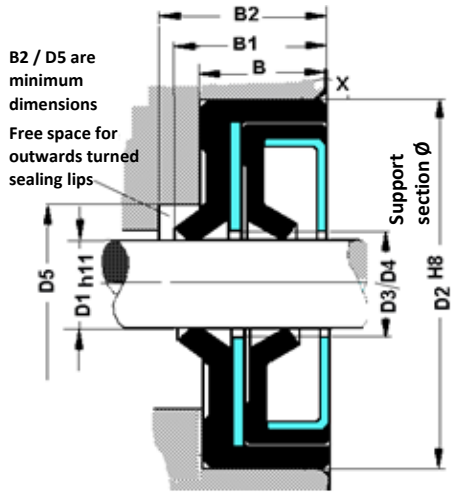
D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

Support body diameter D5
D5 = (D1 + D2) / 2

All dimensions only on request

D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2	D1	D2	B	B1	B2
					20	30	7	11.0	8.5	42	55	10	15.0	12.0	85	110	10	16.0	12.5
						32					62					120	12	18.0	14.5
						35					72				90	110	10	16.0	12.5
						40				45	60	10	15.0	12.0		120	12	18.0	14.5
						47					62				95	120	12	18.0	14.5
6	16	7	10.0	8.0	22	32	7	11.5	8.5		65								
	22					35					72				100	120	12	18.0	14.5
						40				48	62	10	15.0	12.0		125			
7	16	7	10.5	8.5		47					72					130			
	22				24	35	7	12.0	9.0	50	65	10	15.0	12.0	105	130	12	18.0	14.5
8	16	7	11.0	8.5		37					68					140			
	22					40					72				110	130	12	18.0	14.5
	24					47					80					140			
9	22	7	11.0	8.5	25	35	7	12.0	9.0	52	68	10	15.0	12.0	115	140	12	18.0	14.5
	24					40					72					150			
	26					42				55	70	10	15.0	12.0	120	150	12	18.0	14.5
10	22	7	11.0	8.5		47					72					160			
	24					52	9	14.0	11.0		80				125	150	12	18.0	14.5
	26				26	37	7	12.0	9.0		85					160			
11	22	7	11.0	8.5		42				56	70	10	15.0	12.0	130	160	12	18.0	14.5
	26					47					72					170			
					28	40	7	12.0	9.0		80				135	170	12	18.0	14.5
12	22	7	11.0	8.5		47					85				140	170	12	18.0	14.5
	24					52	9	14.0	11.0	58	72	10	15.0	12.0	145	175	15	21.0	17.5
	26				30	40	7	12.0	9.0		80				150	180	15	21.0	17.5
	28					42				60	75	10	16.0	12.5	160	190	15	21.0	17.5
						45					80				170	200	15	21.0	17.5
14	24	7	11.0	8.5		47					85				180	210	15	21.0	17.5
	28										90				190	220	15	21.0	17.5
	30					52	9	14.0	11.0	62	85	10	16.0	12.5	200	230	15	22.0	18.0
	35					62	10	15.0	12.0		90				210	240	15	22.0	18.0
15	26	7	11.0	8.5	32	45	7	12.0	9.0	63	85	10	16.0	12.5	220	250	15	22.0	18.0
	30					47					90				230	260	15	22.0	18.0
	32					52	9	15.0	11.0	65	85	10	16.0	12.5	240	270	15	22.0	18.0
	35				35	47	7	12.0	9.0		90				250	280	15	22.0	18.0
16	28	7	11.0	8.5		50	7	12.0	9.0		100				260	300	20	29.0	24.0
	30					52	9	14.0	11.0	68	90	10	16.0	12.5	280	320	20	29.0	24.0
	32					62	10	15.0	12.0		100				300	340	20	29.0	24.0
	35				36	47	7	12.0	9.0	70	90	10	16.0	12.5	320	360	20	29.0	24.0
17	28	7	11.0	8.5		50					100				340	380	20	29.0	24.0
	30					52	9	14.0	11.0	72	95	10	16.0	12.5	360	400	20	29.0	24.0
	32					62	10	15.0	12.0		100				380	420	20	29.0	24.0
	35				38	52	9	14.0	11.0	75	95	10	16.0	12.5					
	40					55	10	15.0	12.0		100								
18	30	7	11.0	8.5		62				78	100	10	16.0	12.5					
	32				40	52	9	14.0	11.0	80	100	10	16.0	12.5					
	35					55	10	15.0	12.0		110								
	40					62													
						72													

MSC



p_{max}: 1,0 MPa

Support body- diameter

D3 = D1 + 1.0mm to D1 = 145mm
D4 = D1 + 0.5mm

D3 = D1 + 1.5mm from D1 = 150mm
D4 = D1 + 1.0mm

Support body diameter D5
D5 = (D1 + D2) / 2

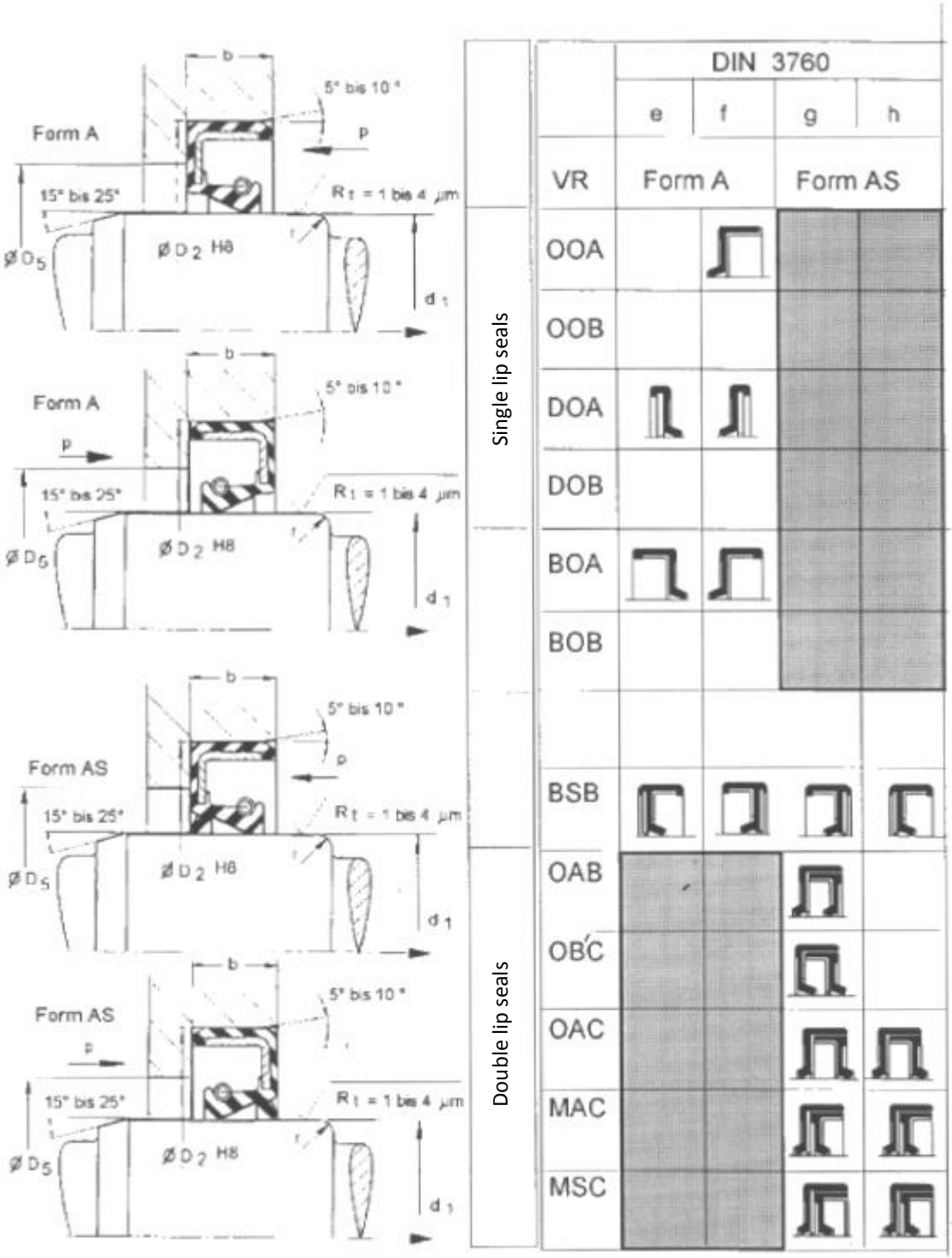
D1	D2	B	B2	B1	D1	D2	B	B2	B1	D1	D2	B	B2	B1	D1	D2	B	B2	B1
					20	30	7	11.0	8.5	42	55	10	15.0	12.0	85	110	10	16.0	12.5
						32					62					120	12	18.0	14.5
						35					72				90	110	10	16.0	12.5
						40				45	60	10	15.0	12.0		120	12	18.0	14.5
						47					62				95	120	12	18.0	14.5
6	16	7	10.0	8.0	22	32	7	11.5	8.5		65								
	22					35					72				100	120	12	18.0	14.5
						40				48	62	10	15.0	12.0		125			
7	16	7	10.5	8.5		47					72					130			
	22				24	35	7	12.0	9.0	50	65	10	15.0	12.0	105	130	12	18.0	14.5
8	16	7	11.0	8.5		37					68					140			
	22					40					72				110	130	12	18.0	14.5
	24					47					80					140			
9	22	7	11.0	8.5	25	35	7	12.0	9.0	52	68	10	15.0	12.0	115	140	12	18.0	14.5
	24					40					72					150			
	26					42				55	70	10	15.0	12.0	120	150	12	18.0	14.5
10	22	7	11.0	8.5		47					72					160			
	24					52	9	14.0	11.0		80				125	150	12	18.0	14.5
	26				26	37	7	12.0	9.0		85					160			
11	22	7	11.0	8.5		42				56	70	10	15.0	12.0	130	160	12	18.0	14.5
	26					47					72					170			
					28	40	7	12.0	9.0		80				135	170	12	18.0	14.5
12	22	7	11.0	8.5		47					85				140	170	12	18.0	14.5
	24					52	9	14.0	11.0	58	72	10	15.0	12.0	145	175	15	21.0	17.5
	26				30	40	7	12.0	9.0		80				150	180	15	21.0	17.5
	28					42				60	75	10	16.0	12.5	160	190	15	21.0	17.5
						45					80				170	200	15	21.0	17.5
14	24	7	11.0	8.5		47					85				180	210	15	21.0	17.5
	28										90				190	220	15	21.0	17.5
	30					52	9	14.0	11.0	62	85	10	16.0	12.5	200	230	15	22.0	18.0
	35					62	10	15.0	12.0		90				210	240	15	22.0	18.0
15	26	7	11.0	8.5	32	45	7	12.0	9.0	63	85	10	16.0	12.5	220	250	15	22.0	18.0
	30					47					90				230	260	15	22.0	18.0
	32					52	9	15.0	11.0	65	85	10	16.0	12.5	240	270	15	22.0	18.0
	35				35	47	7	12.0	9.0		90				250	280	15	22.0	18.0
16	28	7	11.0	8.5		50	7	12.0	9.0		100				260	300	20	29.0	24.0
	30					52	9	14.0	11.0	68	90	10	16.0	12.5	280	320	20	29.0	24.0
	32					62	10	15.0	12.0		100				300	340	20	29.0	24.0
	35				36	47	7	12.0	9.0	70	90	10	16.0	12.5	320	360	20	29.0	24.0
17	28	7	11.0	8.5		50					100				340	380	20	29.0	24.0
	30					52	9	14.0	11.0	72	95	10	16.0	12.5	360	400	20	29.0	24.0
	32					62	10	15.0	12.0		100				380	420	20	29.0	24.0
	35				38	52	9	14.0	11.0	75	95	10	16.0	12.5					
	40					55	10	15.0	12.0		100								
18	30	7	11.0	8.5		62				78	100	10	16.0	12.5					
	32				40	52	9	14.0	11.0	80	100	10	16.0	12.5					
	35					55	10	15.0	12.0		110								
	40					62													
						72													

SAB

Dimensions for the patented SAB design are available upon request.

Code conversion from DIN 3760 to VR

Do you have problems with your current seals? Here you will find a small overview for the conversion.



General terms and conditions of sale (AVB in their German abbreviation)

- For exclusive use in business transactions -

I General information

1. These terms of delivery and payment (AVB) apply exclusively to entrepreneurs, legal persons of public law or public special funds within the meaning of § 310 Paragraph 1 BGB (German Civil Code). We do not accept any other general terms and conditions - even if delivery is executed without reservations. The terms and conditions shall be considered as accepted at order placement or receipt of goods at the latest. Terms and conditions of the customer differing from our terms of sale shall only be recognized if we expressly agree to the validity in writing.
2. These general terms of delivery and payment also apply to all future business transactions with the customer, insofar as a legal transaction of similar nature is concerned.
3. Even in the case of participation in electronic platforms of the customer and the activation of selection fields to be activated according to the system, there is no legally binding acceptance of the conditions of use or other general terms and conditions.

II Consulting

Any form of advice given both written or spoken, will be provided to the best of our knowledge and on the basis of our experience. Details and information about aptitude and application of our products do not release the customer from his own tests and trials. In particular, the customer is not exempted from the necessity of testing the suitability of our products for the intended purpose. The customer is responsible for complying with the statutory and official regulations when using our products.

III Offer, acceptance and documentation

1. Orders can be accepted within 4 weeks. Our offers are subject to change if not otherwise stated in the order confirmation. Call orders shall be concluded for a maximum term of 12 months with call order dates and quantities being specified when the order is placed.
2. Orders and any telephone and verbal agreements as well as agreements with our representatives are to be confirmed by us in writing. Orders placed over the phone are executed at the customer's risk. Invoices or computer printouts, which are designated by us as binding, shall be regarded as written order confirmation. If we do not confirm the order in writing or in text form, the contract is concluded at the latest upon execution of the order.
3. We reserve title and copyright to all documents provided by us. Any disclosure or transfer to third parties shall require our written consent. In the event that the order is not fulfilled, all the documents are to be returned to us without delay on request. Documents belonging to the customer may be disclosed to third parties to whom we intend to sub-contract goods or services.

IV Prices

1. In principle, our prices are in EURO "ex delivery works" (EXW) plus value-added tax, customs and insurance costs applicable on the date of the delivery. Value added tax (VAT) is stated separately in the invoice. Special packaging shall be invoiced at cost price. The prices apply to the individual order, not backdated or for future orders. Follow-up orders shall be new orders.
2. We reserve the right to increase our prices adequately, in particular to charge the daily prices at the time of delivery if, after conclusion of the contract, there are increases in costs, in particular as a result of wage agreements, market disposable prices or material price increases. These shall be demonstrated to the customer, if so required.

V Scope of delivery, call-offs, measurement methods, data protection

1. Our order confirmation shall be decisive for the content and scope of the contract. Part consignments shall be permitted as long as they do not result in disadvantages in use. They shall be payable separately on the basis of part invoices. In the event of the customer being in default with payment for a part consignment, we shall be entitled to refuse to fulfil the remainder of the purchase order.
2. Call orders and delivery schedules are subject to written delivery agreements. In case of call orders, we are entitled to procure the material for the entire order and to produce the entire order quantity immediately.
3. For production reasons, we reserve the right to deliver quantities of a maximum of 10% above or below the ordered quantity within the limits of normal industry practice. In the case of small orders, we reserve the right to charge either for a minimum quantity or a minimum lump sum for costs.
4. It is generally not possible to return sold and non-defective goods.
5. Technical modifications shall be permitted if they are deemed to be necessary for production reasons, product update reasons, legislative requirements or other reasons. If the customer becomes aware of changes, the customer must notify us immediately if the customer regards them as unacceptable. Any change requests of the customer can thus no longer be taken into consideration after the order has been placed, unless if this has been expressly agreed.
6. The measuring methods for inspections for which specific temperatures, times and other measuring or control values apply must be agreed and accepted by both parties before the start of deliveries. If no such agreements are made, our measuring methods shall apply.
7. We shall be entitled to process data in accordance with the German Federal Data Protection Law (Bundesdatenschutzgesetz).

VI Delivery time, forces majeures, default

1. The delivery time or lead time shall commence at the earliest upon dispatch of the order confirmation. The start of the lead time specified by us shall require the prior clarification of all technical matters. Compliance with the lead time shall require the prompt receipt of all documents, permits and approvals to be provided by the customer, the prompt clarification and approval of plans, compliance with the agreed terms of payment and other obligations and the prompt supply of any items to be provided by the customer. Otherwise the lead time shall be extended within reason. The lead times we specify are approximate. Using the requisite duty of care for the conclusion of relevant supply transactions, the lead time is specified subject to the correct and prompt delivery of goods to us. Observance of our supply duties shall require the prompt and correct fulfilment of all cooperation duties on the part of the customer.
2. The lead time shall be deemed to have been met if the consignment is shipped within the lead time or notification has been given that the goods are ready for shipment. If the delivery is delayed for reasons that are the fault of the customer, the lead time shall be deemed to have been met if notification that the goods are ready for shipment is made within the agreed lead time.
3. Unless otherwise agreed for orders on call, we grant a period of 6 months from the date of the order. If this period has elapsed without a call-up being made, we are entitled to invoice the products at our option or to withdraw from the contract. In the case of call orders, the goods are to be called so that the last delivery is made at the latest one year after the receipt of the purchase order by us.
4. War, civil war, export restrictions or trade restrictions resulting from a change in the political situation as well as strikes, lock-outs, operating breakdowns, operational restrictions and similar events which make it impossible or unreasonable for us to fulfil the contract shall be deemed to be forces majeures and shall release us from our duty to deliver the goods promptly. In these cases,

we shall be entitled to either extend the lead time by the duration of the forces majeures or to cancel the contract in full or in part. The customer shall not accrue any claims for compensation for the damage suffered as a result.

5. Our liability in the event of delays caused by intent or gross negligence on the part of ourselves or our representative or agent shall be in accordance with the statutory regulations. In cases of gross negligence, however, our liability shall be limited to the typical, foreseeable damage for this type of contract. Otherwise our liability for compensation in addition to fulfilment caused by delays shall be limited to 10% of the price and for compensation instead of fulfilment to 10% of the value of the goods and/or services. Additional claims by the customer shall be excluded, even after any deadline for fulfilment has been set.
6. If the customer is in default on acceptance of the goods, we will allow a reasonable period of grace at our discretion and are then entitled to rescind the contract and claim damages if applicable. Statutory provisions on the dispensability of a period of grace and the assertion of further claims which we legally hold are not prejudiced hereby.
7. The application to start insolvency proceedings, the submission of an oath of statutory assurance in accordance with § 807 ZPO (German Code of Civil Procedure), the acquaintance of a substantial deterioration in the financial circumstances, other shortages of liquid funds and a delay in payment entitle us to suspend further deliveries up to the regulation of all invoices, to refuse the fulfilment of current contracts and to demand the return of goods that are subject to our reservation of ownership delivered by us as a precaution as well as prepayments for products to be delivered. In these cases, open claims are due for immediate payment.
8. Unless explicitly agreed otherwise, all Incoterms used by us refer to the INCOTERMS 2010 published by the International Chamber of Commerce (ICC).

VII Transfer of risk, transport and packaging

1. In principle, the agreed delivery method is “ex works”. The delivery is carried out at the risk of the customer, irrespectively of the location from which the goods are dispatched. The risk shall be transferred to the customer as soon as the consignment has been handed over to the person carrying out the transport service or has left our plant for shipment. Even if delivery included has been agreed, shipment shall be at the risk of the customer. If the shipment of the goods is delayed at the request of the customer, the risk shall be transferred to it when we give notification that the goods are ready for shipment. Unless agreed to the contrary in writing, we shall choose the means of transport and the route. In the event of the goods being damaged or lost en route, an inspection shall be carried out immediately and we are to be notified of the results.
2. If the shipment or delivery of the goods is delayed at the request of the customer and notwithstanding our right to provide evidence that our damages were higher, we shall charge storage fees of 1% of the invoice total for every month of part thereof subject to a maximum of 5% of the net total. The customer shall be entitled to provide evidence that we incurred lower damages and we shall be entitled to provide evidence that we incurred higher damages.
3. Return shipments are to be coordinated with us in each case in advance and may only be made using the forwarders engaged by us. The cheapest means of transport is to be used for this purpose, taking transport safety into account.
4. Should a specific mode of transport be prescribed by the customer, any extra charges shall also be borne by the latter.
5. Unless otherwise agreed, we determine the type and scope of packaging. The choice of packaging shall be made using the required care at our discretion. Single use packaging shall become the property of the customer.

VIII Tools and devices

1. Tools and devices manufactured by us or on our behalf by third parties shall remain our property even if the manufacturing costs are borne wholly or in part by the customer.

IX Retention of title, guarantees and set-off

1. The delivered products shall remain our property until full payment of all claims arising from the business relationship of the customer with us (for bills of exchange and checks until redemption). The customer is obliged to handle the delivery with care.
2. If the customer breaches the contract, in particular if the customer is in default with payments, we shall be entitled to retake possession of the goods. Our retaking possession or pledging the goods shall not constitute cancellation of the contract unless we expressly confirm this in writing. We shall be entitled to resell the goods and set off the proceeds of this resale against the accounts receivable from the customer, minus reasonable reselling costs. The customer undertakes to treat the goods with care.
3. The customer is entitled to process, blend or combine our products subject to retention with other products in the framework of his regular business operation until this permission is revoked. When processing, we shall be deemed to be a manufacturer and acquire directly (co-)property according to § 950 BGB (German Civil Code) of the manufactured product. In case of mixing or combining, we acquire (co-)property in the proportion of the value of our reserved goods to the new uniform item.
4. Until this permission is revoked, the customer may sell the goods subject to retention of title or the goods produced therefrom within the framework of his regular business operations. Any claims of the customer from reselling the goods subject to retention of title are herewith assigned to us. They serve as security to the same extent as the goods subject to retention of title. We accept the assignment. The customer shall be entitled to collect claims from sales until this permission is revoked by us. We will only revoke the right to resale and to claim receivables if our customer does not properly fulfill his contractual obligations. It also expires without explicit revocation, if the buyer ceases its payments.
5. The customer undertakes at our request to provide us with a precise list of the accounts receivable which are due to us, including the names and addresses of the clients, the amount of the various accounts receivable, invoice dates, etc. and to provide us with all the information required to claim the assigned account receivable and to enable us to check this information as well as to issue to us, at his expense, publicly authenticated documents on the assignment of claims.
6. If the value of the security rights accrued by us exceeds the value of all the secured claims by more than 20%, we shall release an appropriate part of the security rights at the request of the customer.
7. The customer may not pledge the goods or transfer title to them by way of security. In the event of seizures or other action by third parties, the customer must notify us immediately in writing so that we can lodge a lawsuit in accordance with § 771 ZPO (German Code of Civil Procedure) and shall also provide us with all the information and documents required by us to protect our rights. Enforcement officers and third parties are to be notified of our property. If a third party is unable to reimburse us with the court and out of court costs of a lawsuit pursuant to § ZPO (German Code of Civil Procedure), the customer shall be liable for any losses we incur, notwithstanding claims for other compensation relating to the damage, modification or destruction of the goods themselves.
8. The customer hereby declares his consent that the persons assigned by us to collect the conditional commodity for this purpose may enter the property and/or building on/in which the assigned items are located by foot or in vehicles to take possession of the conditional commodity.
9. We have the right to offset our debts against any debts of the customer with all the counterclaims which are due to us against the customer.

X Payments

1. Unless otherwise agreed, payments shall be due without deduction within 30 days after the date of the invoice. An agreed cash account is granted only under the condition that all payment obligations from previous deliveries are fulfilled. We are not obliged to accept bills of exchange, checks and other promises to pay. Their acceptance shall at all times be on account of performance. All payments are to be made free of charge for us. In case of checks and bills of exchange, the customer shall bear the discount, collection and other bank charges, even without an express agreement.
2. If the purchase price is deferred or partial payments approved or the date of payment exceeded, the customer will be charged interest at the customary bank rate but not less than 2 % p.a. above the then current basic interest rate of the European Central Bank.
3. Payments are initially charged at cost, then at interest and then to the respectively older main claim. The customer waives the right to determine how his payments are to be used.
4. In case of delayed payment, we can demand default interest of 8% p.a. above the respective base interest rate according to § 247 BGB (German Civil Code). Higher default damage can be proved. However, the customer is entitled to prove that no or less damage has occurred.
5. The customer shall only then be entitled to set off or withhold payment if his counterclaim is undisputed or legally established.

XI Industrial property rights

1. We shall be liable for the infringement of third parties' industrial property rights in connection with the sale of our goods only if we are accountable for the infringement and if such third parties' industrial property rights are valid in the Federal Republic of Germany and have been published at the time of delivery.
2. Orders based on drawings, sketches, models, samples or other documents and data provided to us will be performed at the customer's risk. If a third-party claims in such a case that we are breaching a property right, e.g. through the manufacture or supply of our products, then we shall be entitled without further inspection and subject to our other rights, to refuse the fulfilment of the contract and to discontinue our activity. If, as a result of the execution of such orders, we intervene in third-party property rights, the customer shall indemnify us from third-party claims. The buyer is responsible for further damage.
3. The customer undertakes to inform us without delay of known risks of infringement and alleged infringements.

XII Defects, warranty and limitation

1. The customer shall be responsible to immediately inspect our products after delivery for discrepancies in quality and quantity and any obvious defects, such as transportation damage, and to send us a written notice with a precise description of the defect within 10 working days from delivery, but in any case, before installation, further processing or resale. A notice of hidden defects is considered to have been submitted in due time if we receive it within 10 working days of such defects having been discovered with a precise description of the defect. The notice of defect shall not exempt the customer from its duty to comply with the payment obligations.
2. If the goods are defective, we shall be entitled at our discretion to rectify the defect or supply replacement goods (supplementary performance) or by crediting the customer within a reasonable deadline to be set by the customer. In the event of remedying the defect, we shall only assume the costs amounting to no more than the remuneration agreed for the consignment. Parts replaced in the course of the rectification of defects shall become our property. Without our prior written consent, the customer shall not be entitled to rectify the defect in his own case or to repair the goods delivered by a third party in urgent cases. If our attempts to rectify the defect or supply replacement goods fail, the customer shall be entitled at its discretion to cancel the contract or reduce the price.

3. Customary deviations (e.g. in quality, colour, strength, weight, equipment or patterning) are reserved unless otherwise agreed. The nature of the goods as defined in our specifications stipulates the features of the supplied item comprehensively and finally. In particular, public statements, extolling or advertising by the seller, manufacturer or their assistants or third parties do not constitute contractual statements on the nature of goods. Our declarations in connection with this contract, e.g. performance specifications, reference to DIN standards etc., do not imply any giving of a guarantee in cases of doubt. What are definitive are only our express written statements concerning the giving of a guarantee. No guarantee will be given of the quality of the item or that the item will retain a particular quality for a particular period of time, as a result of statements made in product descriptions, catalogues and product specifications, subject to their being included as indications of quality within the meaning of § 434 BGB (German Civil Code).
4. There will be no claims for defects in the case of only minor discrepancy from the agreed quality, in the case of only slight impairment of usability. The defect rights of the customer are excluded, as far as the defect is due to an inappropriate or improper use of our products, the failure to observe our installation instructions in our catalogues or our internet presence as well as the guidelines for storage, maintenance and cleaning of rubber products according to DIN 7716, excessive stress and/or natural wear and tear in view of their material substance, in particular with regard to parts that come into contact with workpieces, or to improper modifications, defective servicing or defective and negligent treatment. In relation to repairs made without any legal obligation, the customer will only hold defect claims if expressly agreed.
5. Costs incurred for subsequent performance will be paid by the customer if they are increased because the goods have been moved to a different location after delivery, unless such a move complies with their intended purpose.
6. Claims for recourse against us by the customer in accordance with § 478 BGB (German Civil Code) (proprietor's recourse) will only exist if the customer and his purchaser have not struck any agreements beyond the statutory claims for defects.
7. If nothing has been expressly agreed to the contrary, the period of limitation for claims and rights relating to defects in our goods is 1 year from supply to the customer. For repairs and replacements, we are liable to the same extent as for the supplied item, this being until the end of the limitation period applying to the original item for defect claims. The limitation periods according to number 7 also apply to all claims against us that are connected with the defect – irrespective of the legal basis of the claim. Insofar as there are claims for damages of any kind against us, which are not related to a defect, the statute of limitations set out in number7 sentence 1 shall apply to them.
8. The statutes of limitations set out in numbers 7 and 8 shall not apply in the event of intent if we have deliberately not mentioned the defect, for compensation claims in the event of death, injury or damage to the health or freedom of a period, for claims under the Product Liability Law, for a grossly negligent breach of duty or if we breach major contract duties.
9. Unless expressly specified to the contrary, the statutory regulations relating to the start of the statute of limitations, the suspension of the period, the suspension and the restart of the periods shall not be affected.

XIII Liability

1. Our liability in the event of intent or gross negligence on the part of ourselves or our representative or agent shall be in accordance with the statutory regulations. In addition, we shall only accept liability under the Product Liability Law in the event of death, injury or damage to the health of a person or as a result of the culpable breach of major contract duties. Claims for compensation based on a breach of major contract duties, however, shall be limited to the typical foreseeable damage for this type of contract. Even in cases of gross negligence, our liability shall be limited to the typical foreseeable damage for this type of contract unless one of the exceptions set out in sentence 2 of this number 1 applies. In determining the contract-typical foreseeable damage, we

may require that suitable consideration be given in good faith, both nature, scope and duration of the business relationship and to the value of the individual item of our products.

2. Liability for damage caused by our products on the customer's property, for example to other goods, shall be completely excluded, however. This shall not apply if intent or gross negligence applies or in the event of death, injury or health damage to a person.
3. The provisions of numbers 1 and 2 above shall extend to compensation in addition to the goods or services and compensation instead of the goods or services regardless of the legal grounds, in particular as a result of defects, breach of duties from the debt relationship or for illegal actions. It shall also apply to claims for the reimbursement of expenses paid in vain and to our liability for impossibility of performance. The liability for delay is validated by § VI Paragraph 5.
4. Possible compensation claims shall be restricted to the cover of our product liability insurance policy. This shall not apply if liability is mandatory in cases of intent, gross negligence and in cases of death, personal injury and health damage to a person or as a result of claims under the Product Liability Law.
5. If our liability for compensation is excluded or limited, this shall also apply to all claims by the customer due to culpability at the conclusion of the contract, breach of secondary duties or claims on the part of the customer on the basis of manufacturer liability pursuant to § 823 BGB (German Civil Code). The same shall apply in the event of impossibility. If our liability is excluded or limited, this shall also apply to the personal liability of our staff, workers, colleagues, representatives, agents and vicarious agents.

XIV Rescission

1. The customer can only rescind the contract in compliance with legal regulations if there has been a breach of obligations for which we are responsible; for defects, legal requirements shall apply. In the case of a breach of duty, the buyer must clarify within a time period set down by us, whether he shall withdraw from the contract due to the breach of duty or whether he insists on delivery.
2. The right of the customer to demand compensation for a mutual contract shall be excluded by such cancellation.
3. In the event of a breach of duty by the customer, particularly in the event of a delay of payment and non-acceptance of the delivery, we shall be entitled to withdraw from the contract and to cancel the service rendered and to claim compensation for damages after the expiry of a reasonable period of time set for the customer. The statutory provisions on the dispensability of setting a deadline and asserting further claims which we are legally entitled to remain unaffected.

XV Secrecy

If the customer comes into contact with business secrets and/or know-how belonging to us during execution of the order, he must maintain secrecy about them and make arrangements to ensure that our protectable interests are not damaged and protectable knowledge is only used in connection with the order or subsequent use of the item itself, which is covered by the order. In particular, the customer bears the burden of proof that the business secrets and/or know-how were already known to him beforehand or were at least obvious to him. The customer is obliged to treat as a business secret all commercial and technical details in connection with the order. He is obliged to keep secret the documents and information even after the respective contract has been completed. Duplication is only permitted in line with business requirements and copyright provisions. Disclosure to third parties is only possible with our written consent.

XVI Items supplied by the customer

If the customer submits claims due to damage to or destruction of his items supplied to us or given to us for processing, we shall only be liable in the event of intent and gross negligence; there will be no liability for ordinary negligence. Liability does not cover normal wear and tear. The customer

must take out external insurance for the necessary amount to cover the items supplied. The customer is responsible for inspecting and guaranteeing the quality (e.g. material, accuracy of measurements, etc.) of products supplied, e.g. raw material, blanks, etc.; we perform no more than an incoming-goods control of quantity and identity and a visual check for obvious transportation damage. We have no obligation to perform any further checks.

XVII Compliance

1. The customer does not have direct or indirect business or other links with terrorists, terrorist groups or other criminal or anti-constitutional organisations. The customer will in particular ensure reasonable organisational measures for the implementation of valid embargoes, the applicable European ordinances on terrorism and fight against crime, as well as the corresponding US-American or other applicable provisions within the scope of this business operation, in particular through appropriate software systems. As soon as the goods have left our respective factory, the customer is solely responsible for compliance with the above-mentioned provisions and will indemnify us from all claims and costs arising from a corresponding legal offense by the customer, its affiliates or employees, representatives or vicarious agents - attorneys' and advisor's fees or administrative fees or penalties.
2. The customer is obliged to comply with the foreign trade regulations, in particular the applicable German, European and US Export control regulations.

XVIII Applicable right

1. Any contract shall be governed solely by the law of the Federal Republic of Germany; application of Uniform UN Purchase Law CISG is excluded.

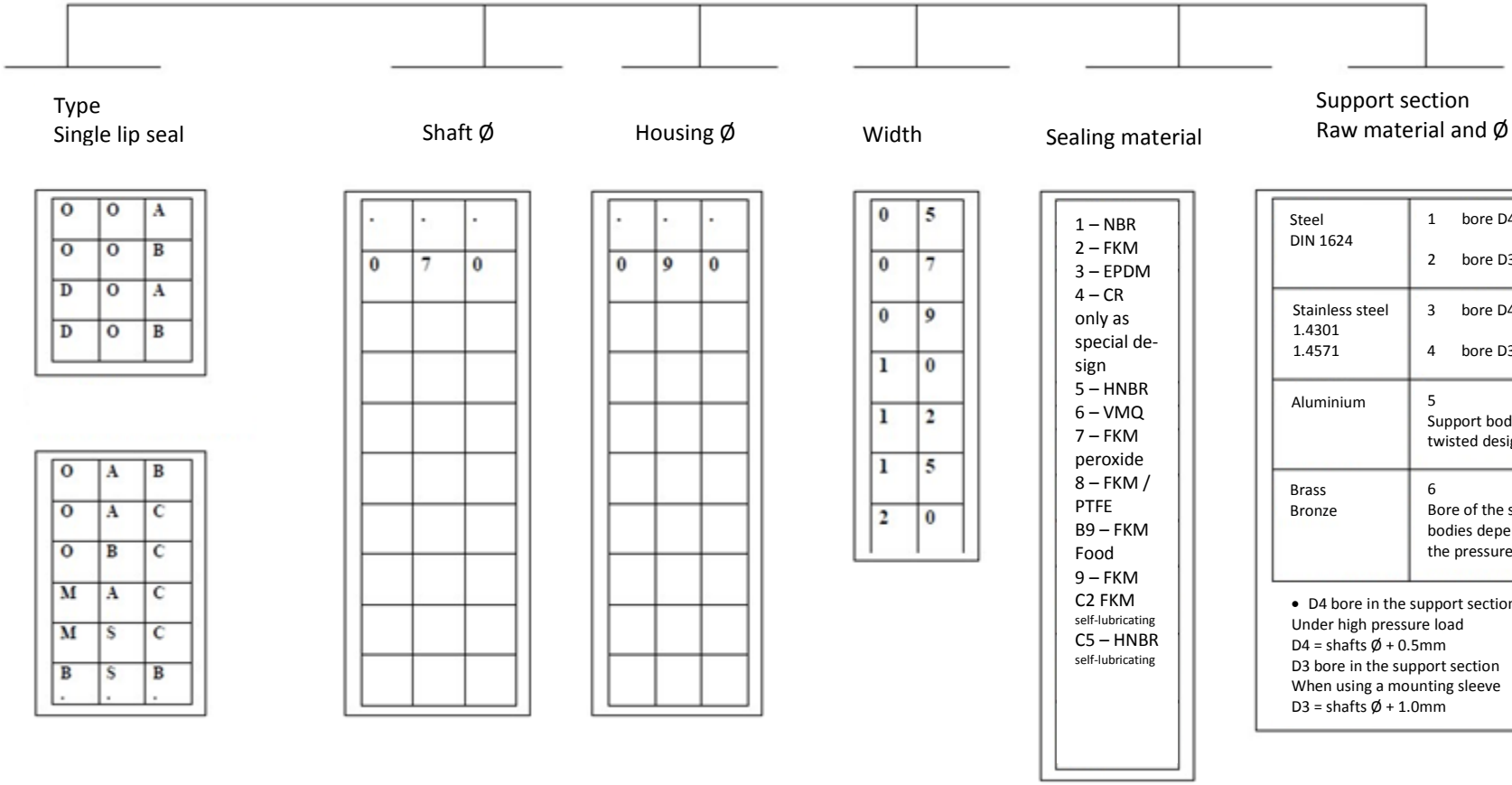
2. Unless otherwise established under contract or confirmation of order, the place of performance is also set our seat of business. The place of jurisdiction for all disputes arising hereunder shall be Aachen. We also have the right to sue the customer at the court having jurisdiction for his seat of business.

3. If the customer has its company headquarters outside the Federal Republic of Germany, we also have the right that all disputes be decided in accordance with the Rules of Arbitration of the German "Institution für Schiedsgerichtsbarkeit e.V. (DIS)" (German Institution for Arbitration) under exclusion of any state jurisdiction before the beginning of the procedure.

4. If individual provisions in these general terms of delivery should be invalid, this shall not affect the other provisions. Invalid provisions shall be reworded so that they achieve the commercial aim intended by the provision.

Latest revision: January 2017

Order scheme



** For the OOB design, the housing bore must be executed with a diameter of D4 under high pressure load, or a corresponding washer must be installed before the sealing ring.

* In case of special designs and dimensions deviating from DIN an "S" is additionally attached and fixed in the product cards.

Order example:

Double lip seal type OBC for shaft diameter 40mm and housing diameter 60mm. Raw material of the sealing material; FKM / PTFE, raw material of the support body, 1.4301 with bore D4: **OBC 40.60.10 – 83.**