QUAD-RING® Seal

Contents

The information in this brochure is based on many decades of experience in the manufacture and application of sealing and bearing systems. However, unknown parameters and conditions may restrict general statements during usage. It is vital that customers satisfy themselves as to the suitability of individual products through adequate testing. For this reason, and due to the wide range of applications of our products, Busak + Shamban can accept no liability as to the suitability or correctness of our recommendations in individual cases.

The application limits for pressure, temperature and speed given in this catalogue are maximum values determined in the laboratory. During practical applications it should be remembered that due to the interaction of the operating parameters, the maximum values must be set correspondingly lower. For exceptional operating conditions, please contact your Busak+Shamban representative.

This edition supersedes all previous brochures.

Description

Original QUAD-RING®Seals are four lipped seals with a specially developed sealing profile.

A wide range of elastomer materials for both standard and special applications allows practically all liquid and gaseous media to be sealed.

QUAD-RING®Seals are vulcanized as a continuous ring. They are characterized by their annular form with a four lipped profile. Their dimensions are specified with the inside diameter d_1 and the cross-section W (Figure 1).

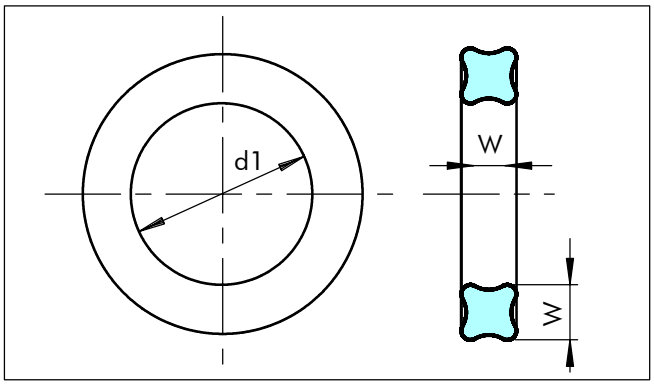


Figure 1 QUAD-RING®Seal dimensioning

QUAD-RING®Seals are supplied to the American Standard AS 568 A.

Advantages

In contrast to the O-ring, QUAD-RING®Seal has a double sealing function. It requires a lower initial squeeze, which results in reduced friction during dynamic applications.

Furthermore, it has a number of other advantages over the O-ring:

- Avoids twisting in the groove. Due to its special profile, the seal does not tend to roll in the groove during reciprocating movement.
- Low friction. QUAD-RING®Seal requires less radial squeeze than a comparable O-ring. Less squeeze mean less friction, less wear, and thus a longer service life.
- Very good sealing efficiency. Due to an improved pressure profile over QUAD-RING®Seal cross-section, a high sealing effect is achieved.
- A lubricant reservoir formed between the sealing lips improves start up.
- Unlike an O-Ring, the mould line flash lies in the trough, between and away from the critical sealing lips.

Method of Operation

QUAD-RING®Seals are self energizing double-acting sealing elements. The forces acting in radial or axial direction due to the installation give QUAD-RING®Seal its initial leak-tightness (initial squeeze). These forces are superimposed by the system pressure.

An overall sealing force is created which increases with increasing system pressure (Figure 2). Under pressure, the seal behaves in a similar way to a fluid with high surface tension and the pressure is transmitted uniformly to all sides.

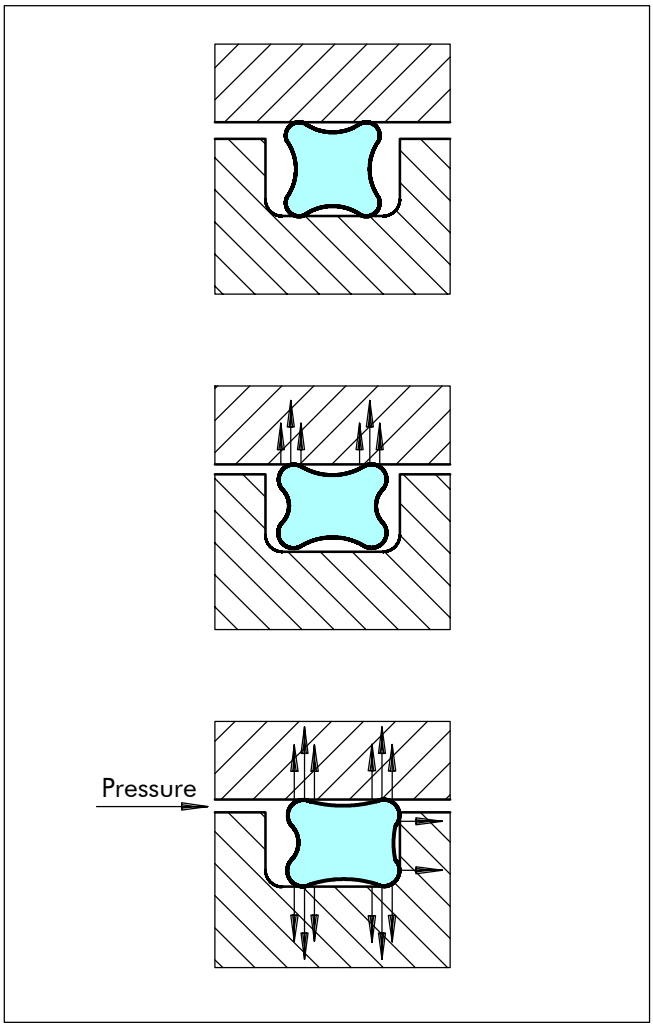


Figure 2 QUAD-RING®Seal squeeze with and without system pressure

Applications

Fields of Application

QUAD-RING®Seals can be used for a wide range of different applications.

QUAD-RING®Seal is used predominantly for dynamic sealing functions. It's use is always limited by the pressure to be sealed and the velocity.

Dynamic Applications

- For sealing of reciprocating pistons, rods, plungers, etc.
- For sealing oscillating, rotating or spiral movements on shafts, spindles, rotary transmission leadthroughs, etc.

Static Applications

- As a radial-static seal, e.g. for bushings, covers, pipes, etc.
- As an axial-static seal, e.g. for flanges, plates, caps, etc.
- As a energizer element for elastomer energized hydraulic seals where there is a risk of the O-ring twisting.

Technical Data

QUAD-RING®Seals can be used for a wide range of applications. The choice of a suitable material is determined by the temperature, pressure and media. In order to assess the suitability of QUAD-RING®Seal as a sealing element for a given application, the interaction of all the operating parameters have to be taken into consideration.

Working Pressure:

Dynamic Application:

Reciprocating
up to 5 MPa (50 bar) without Back-up Ring
up to 30 MPa (300 bar) with Back-up Ring

Rotating
up to 15 MPa (150 bar) with Back-up Ring

Static Application

up to 5 MPa (50 bar) without Back-up Ring
up to 40 MPa (400 bar) with Back-up Ring

Please note the permissible extrusion gaps on page 9, Table III.

Speed:

Reciprocating:		up to 0.5 m/s
Rotating:	briefly	up to 2.0 m/s

Temperature:

depending on material and media resistance, for:

General Applications:	-30 °C to + 110 °C
Special Compounds:	-60 °C to + 200 °C
Rotating Applications:	-30 °C to + 80 °C

When assessing the application criteria, the transient peak and continuous operating temperature and the cyclic duration factor must be taken into consideration. For rotating applications, the increases in temperature due to frictional heat must be taken into account.

Media:

With the large range of materials, each with different properties, which are now available, it is possible to seal against practically all liquids, gases and chemicals. Please note when selecting the most suitable material the information in the resistance lists on pages 16, Table VI.

Materials

The available elastomer materials are shown in the materials list, Table VI on page 16.

If no particular specifications are given for the material, NBR (Acrylonitrile Butadiene Elastomer) in 70 Shore A will be supplied.

The hardness is one of the most important and most frequently quoted properties of elastomer materials. Nevertheless, the values can be very misleading. Hardness cannot be regarded as a genuine measure of the rigidity. Hardness measurements are measurements of minor deformations at the surface.

Rigidity measurements, on the other hand, involve large deformations of the mass as a whole. For this reason, no correlation can be drawn between hardness and rigidity.

Furthermore the measured property, namely the impression at the surface, is seldom a measure of the serviceability of the sealing element or the elastomer article.

The hardness values and their tolerances are always based on the measurement in accordance with DIN 53505/ASTM D 2214 on a flat test specimen and are expressed in Shore A. Hardness measurements on finished products are performed using the IRHD (International Rubber Hardness Durometer). Measurements on cross sections < 2 mm produce inaccurate results and are therefore not permissible. In view of the different measuring instruments used, Shore A and IRHD values may differ from one another.

This manifests itself, particularly when measurements have to be performed on curved surfaces.

Design Instructions

Choice of QUAD-RING®Seal size

The chosen cross section W should be in an appropriate ratio to the inside diameter d_1. For static applications, QUAD-RING®Seals with smaller cross sections may be used.

Elongation - Compression

With a radial sealing configuration, QUAD-RING®Seal in an internal groove - "external sealing" - should be stretched over the root of the groove. The maximum elongation in the installed state is 6 %.

With external grooves - "internal sealing" applications - QUAD-RING®Seal is installed in compressed state. The maximum compression in the installed state is 3 %.

Exceeding these values will result in an unallowable increase or decrease in QUAD-RING®Seal cross section. As a rule of thumb: a 1% increase in the inside diameter corresponds to a reduction in the cord diameter of approx. 0.5 %.

Initial Squeeze

An initial sqeeze of QUAD-RING®Seal in the groove is essential to ensure its function as a primary or secondary sealing element (Figure 3). It serves to:

- Achieve the initial sealing capability
- Bridge production-dependent tolerances
- Assure defined frictional forces
- Compensate for compression set
- Compensate for wear.

Depending on the application, the following values apply for the initial squeeze:
Dynamic Applications: 6 to 18 %
Static Applications: 8 to 25 %

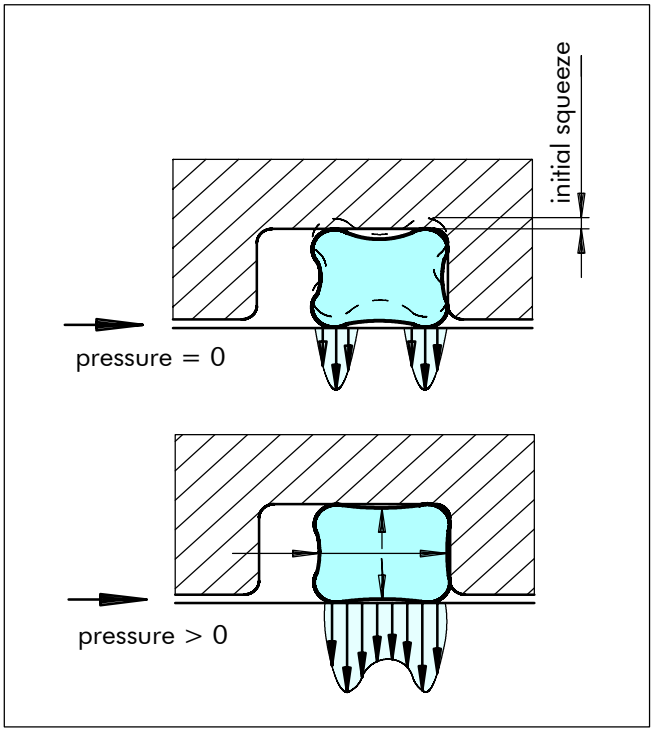


Figure 3 Sealing force with and without system pressure

Methods of Installation of QUAD-RING®Seals

QUAD-RING®Seals can be used in components in a wide variety of ways.

At the design stage, the subsequent installation situation should be taken into consideration. To avoid damage during installation it is not recommended to assemble the QUAD-RING®Seal over edges or bores. Where long sliding movements are involved, the seal seat should be recessed, if possible, or the sealing elements arranged so they only have to travel short distances during installation.

Radial Installation (static and dynamic)

Internal sealing
QUAD-RING®Seal size should be selected so that the inside diameter d_1 has the smallest possible deviation from the diameter to be sealed d_5 (Figure 4).

External sealing
QUAD-RING®Seal size should be selected so that the inside diameter d_1 is equal to or smaller than the groove root diameter d_3.

Axial-static Installation

During axial-static installation, the direction of the pressure should be taken into consideration when choosing QUAD-RING®Seal size (Figure 5).

With internal pressure, QUAD-RING® Seal outside diameter should be chosen approx. 1 to 2 % larger than the groove outside diameter.

With external pressure, QUAD-RING®Seal is chosen approx. 1 to 3 % smaller than the groove inside diameter.

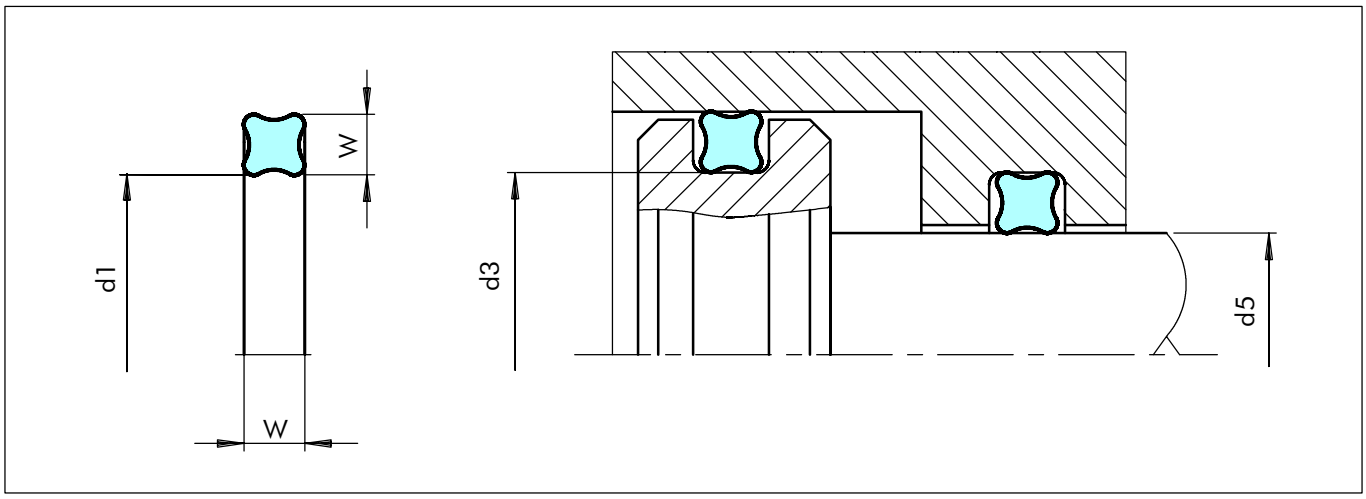


Figure 4 Radial installation, static and dynamic

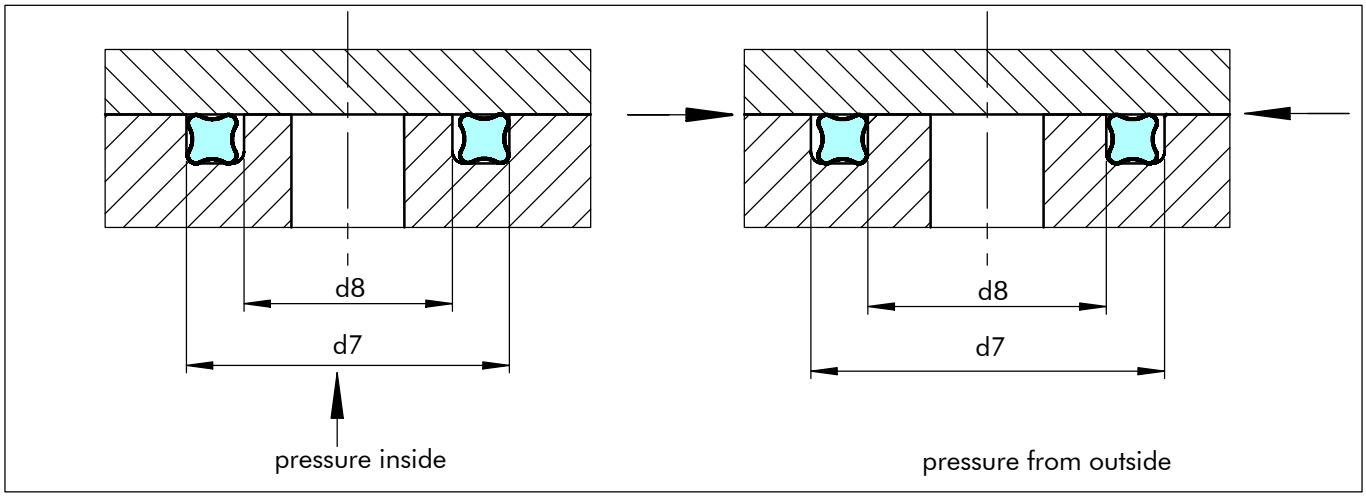


Figure 5 Axial installation, static

QUAD-RING®Seal for Rotary Application

In applications with small cyclic periods of activity, QUAD-RING®Seal can also be used for sealing rotating shafts. In this case, the following points should be observed:

In order to function as a rotary seal, QUAD-RING®Seal must be installed in accordance with specific guidelines, the rotary seal principle.

The rotary seal principle is based on the fact that an elongated elastomer ring (O-Ring or QUAD-RING®Seal) contracts when warm (Joule effect). With the normal method of installation (inside diameter d_1 < shaft diameter), the frictional heat would cause the ring to contract even further. This results in a higher pressure on the rotating shaft so that a lubricant film is prevented from forming under the seal and even higher friction occurs. The result would be increased wear and a premature failure of the seal.

Using the rotary seal principle, this is prevented by the seal ring being selected so that its inside diameter is approx. 2 to 5 % larger than the shaft diameter to be sealed. The installation in the groove means that the seal ring is compressed radially and is pressed against the shaft by the groove root. The seal ring is thus slightly corrugated in the groove, which helps to improve the lubrication.

The rotary seal principle can be neglected at peripheral speeds of less than 0.5 m/s.

X-sel® QUAD-RING® Seals

A special QUAD-RING®Seal, Type X-sel®, is recommended for rotary seal applications. X-sel®QUAD-RING®Seals have a special, thin and highly wear-resistant plastic coating. This blue coating reduces friction by absorbing lubricant in its porous surface and thus increasing the abrasion resistance.

For installation dimensions for a preferred series with and without back-up ring, see Table IX, page 23 - 24.

Groove Design

Rectangular Groove

QUAD-RING®Seals are installed in rectangular grooves. Designs with bevelled groove flanks up to 5° are permissible. If back-up rings are used, straight groove flanks are necessary (Figure 6). The groove widths specified in our recommendations already take into account a limited swelling of the seals.

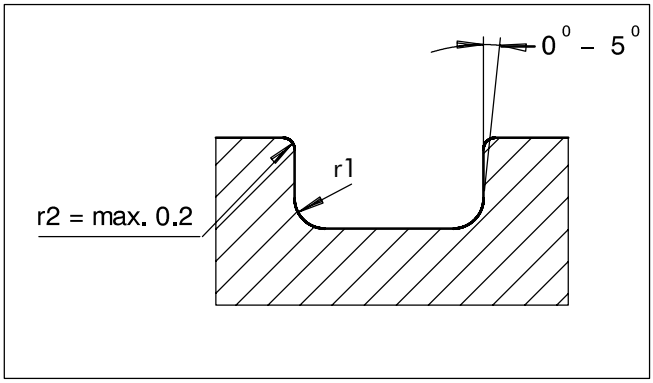


Figure 6 Groove design

Surfaces

Under pressure, elastomers adapt to irregular surfaces. For gas or liquid-tight joints, however, certain minimum demands must be made on the surface quality of the surfaces to be sealed.

Fundamentally grooves, scratches, pit marks, concentric or spiral machining scores, etc. are not permissible. Higher demands must be placed on the surface quality of dynamic mating surfaces than on static sealing surfaces.

At present, no uniform definitions exist for describing the mating surfaces. In practice, the specification of the R_a value is not sufficient to permit an assessment of the surface quality. Our recommendations therefore contain various terms and definitions in accordance with DIN 4768/1 and ISO 1302 (Table I).

Table I Surface Finish

Type of Load	Surface	R_{max} [µm]	R_z [µm]	R_a [µm]
Radial-dynamic	Mating surface* (bore, rod, shaft)	1,0 - 2,5	0,63 - 1,6	0,1 - 0,4
	Groove surface (groove root, groove flanks)	≤ 10,0	≤ 6,3	≤ 1,6
Radial-static Axial-static	Mating surface Groove surface (groove root, groove flanks)	≤ 10,0 ≤ 16,0	≤ 6,3 ≤ 10,0	≤ 1,6 ≤ 3,2
	For pulsating pressures: Mating surface Groove surface (groove root, groove flanks)	≤ 6,3 ≤ 10,0	≤ 4,0 ≤ 6,3	≤ 0,8 ≤ 1,6

*ground without spirals

Lead-in Chamfers

Bearing in mind the subsequent installation requirements during the design of QUAD-RING®Seal can help to eliminate possible sources of damage and seal failure from the outset.

Since QUAD-RING®Seals are always fitted oversize, lead-in chamfers and rounded edges must be provided (Figures 7 and 8).

The lengths of the Lead-in Chamfers are specified in Table II.

The permissible surface roughness of the Lead-in Chamfer is defined as follows:

$R_{max} < 2.5\ \mu m\ R_z < 1.6\ \mu m\ R_a < 0.4\ \mu m$

Table II Lead-in chamfers

Lead-in Chamfers	QUAD-RING®Seal
Length z min.	Cord Diameter W
1,1	1,78
1,5	2,62
1,8	3,53
2,7	5,33
3,6	7,00

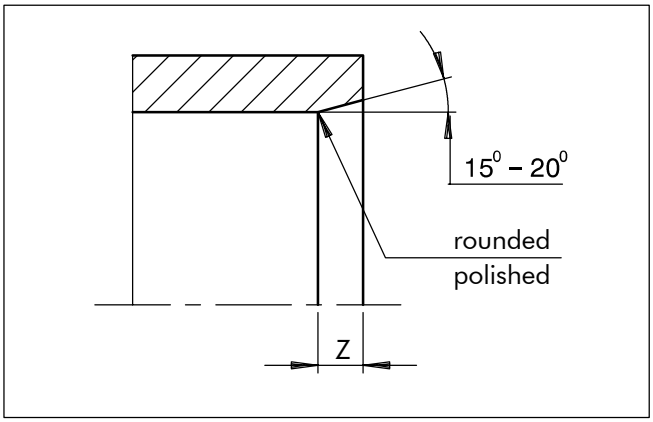


Figure 7 Lead-in chamfer for bores, tubes

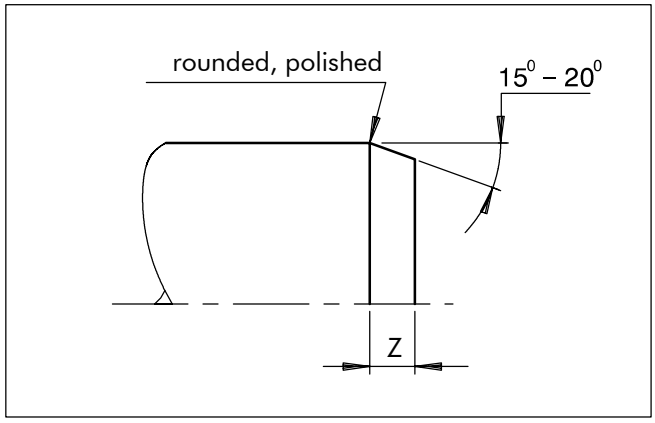


Figure 8 Lead-in chamfer for rods, shafts

Sealing Gaps

The tolerances and permissible gap Dimensions S given in the installation Tables on page 9 must be maintained.

If the extrusion gap is too large, there is a risk of seal extrusion which can result in the destruction of the QUAD-RING®Seal (Figure 9).

The permissible gap S between the parts to be sealed depends on the system pressure, the cross section and the shore hardness of the QUAD-RING®Seal.

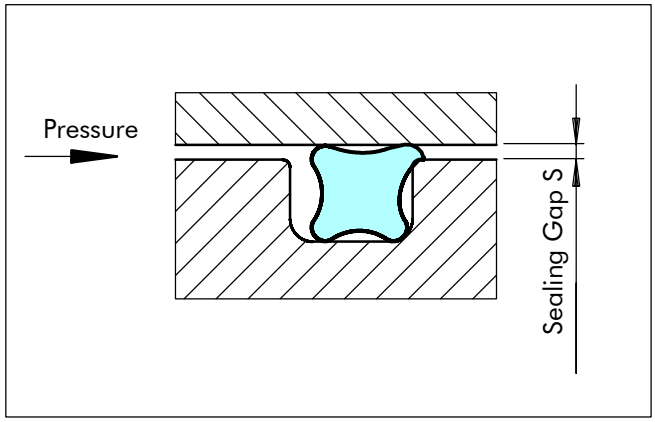


Figure 9 Extrusion gap

Installation of QUAD-RING®Seals with Back-up Rings

Another possible method of protecting QUAD-RING®Seal from extrusion into the gap is the additional installation of Back-up Rings.

The installation of Back-up Rings is generally recommended when at least one of the following conditions exists:

- High pressures - above approx. 5 MPa (50 bar)
- Large tolerances or gaps between the parts to be sealed
- High temperatures or temperature fluctuations during expansion of the parts under pressure
- High degree of contaminants in the system.

Where the pressure acts from only one side, it is sufficient to install a Back-up Ring on the side away from the pressure. Where the pressure acts from both sides, two back-up rings - one on each side of QUAD-RING® Seal - are necessary.

A complete summary of our back-up ring product range can be found in the catalogue "Back-up Rings".
The following tables offer the designer the preferred series. They permit easy selection and the assignment of the Back-up Rings to QUAD-RING®Seal sizes and groove dimensions.

"External" sealing installation, Table VII, page 17 - 18.

"Internal" sealing installation, Table VIII, page 20 - 21.

Rotary seal installation, Table IX, page 23 - 24.

The selection series contains two Back-up Ring types:

- Split, spiral-type design, preferred for both external and internal sealing applications (bore and shaft)
- One-piece design, preferably for internal sealing applications (shaft) under radially-dynamic loads.

The standard material for the Back-up Ring is virgin PTFE. Special materials, e.g. for injection moulded Back-up Rings, on request.

■ Installation Instructions

General Instructions

Before starting installation, check the following points:

- Lead-in Chamfers made according to drawing?
- Internal bores deburred and edges rounded?
- Machining residues, e.g. chips, dirt and foreign particles, removed?
- Screw thread tips covered?
- Seals and components greased or oiled before installation. Ensure media compatibility with the elastomer material.
- Do not use lubricants with solid additives, e.g. molybdenum disulphide or zinc sulphide.

Installation by Hand

- Use no sharp tools!
- Use installation aids wherever possible
- Do not overstretch QUAD-RING®Seal.

Automatic Installation

Automatic QUAD-RING®Seal installation requires good preparation. The surfaces of QUAD-RING®Seals are frequently treated by molycoating, graphitizing, powdering with talcum or coated with PTFE. This offers a number of benefits during installation by

- Reducing the installation forces required
- Non-stick effects, easy removal.

The handling and installation of dimensionally unstable components requires a great deal of experience. Reliable automated installation thus demands special handling and packing of QUAD-RING®Seal.

Talk to our specialists - we would be only too glad to help you.

Installation Recommendations

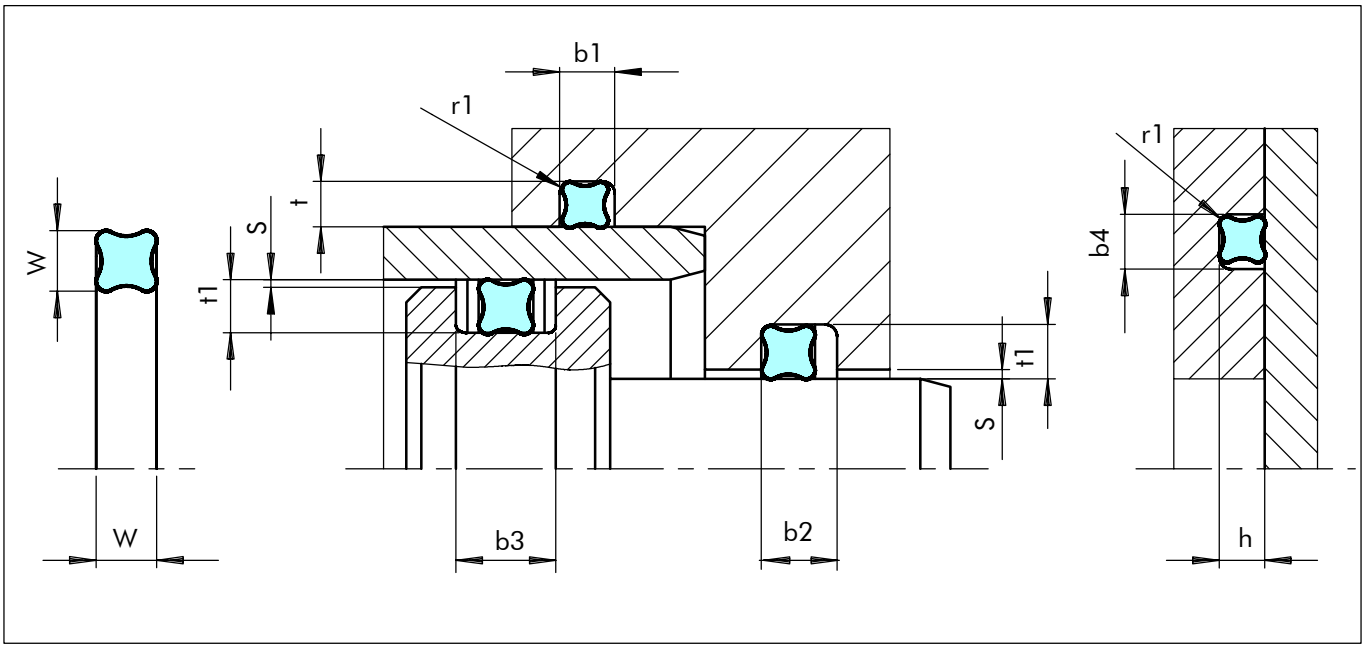


Figure 10 Installation drawing

Table III Installation Dimensions

Cord Diameter W	Radial Initial Squeeze *		Groove Dimensions					Radius	Radial Gap
			Groove Depth ** 1)		Groove Width ***				
	Dynamic max. min.	Static max. min.	Dynamic t_1 +0,05	Static t/h +0,05	b_1, b_4 +0,2	b_2 +0,2	b_3 +0,2	r_1	$S_{max.}$
1,02	0,300 0,115	0,350 0,165	0,80	0,75	1,20	-	-	0,10	0,03
1,27	0,330 0,145	0,430 0,245	1,00	0,90	1,40	-	-	0,10	0,03
1,52	0,350 0,165	0,450 0,265	1,25	1,15	1,70	-	-	0,22	0,04
1,78	0,360 0,175	0,460 0,275	1,50	1,40	2,00	3,40	4,80	0,22	0,05
2,62	0,400 0,215	0,450 0,265	2,30	2,25	3,00	4,40	5,80	0,30	0,08
3,53	0,430 0,205	0,530 0,305	3,20	3,10	4,00	5,40	6,80	0,40	0,08
5,33	0,560 0,250	0,710 0,400	4,90	4,75	6,00	7,70	9,40	0,40	0,10
7,00	0,700 0,350	0,950 0,600	6,40	6,20	8,00	10,50	13,00	0,60	0,10

Explanation for *, **, ***, see page 10.
1) Also O-Ring grooves can be generally used. Friction may be higher at dynamic application. Back-up Rings must be adapted.

General Notes

*Max. or min. values for the radial compression, taking into consideration the permissible tolerances of cord cross-section and groove depth. Max. radial squeeze produces a good sealing effect but increases the friction. Min. radial squeeze reduces the sealing effect and improves friction.

** The values quoted for groove depth are average values and apply under medium load conditions in hydraulic applications. For eccentric piston positions or bending of the rod and in vacuum and low-pressure applications, the groove depth should be reduced and/or the initial squeeze increased.

*** If a greater swelling of the seal material is anticipated, the groove width can be increased by up to approx. 20%.

The installation dimensions (Table III, page 9) apply to QUAD-RING®Seals of NBR. For elastomers with larger shrinkage behaviour at processing, such as VMQ or FKM, the groove depth must be reduced (see Table IV). The inside diameter and cross-section may differ slightly.

Table IV Groove Depth for QUAD-RING®Seals of FKM (Fluoroelastomer)

Cord Diameter	Groove Depth*	
	Dynamic	Static
W	$\mathbf{t_1}$ ±0,05	**t/h** ±0,05
1,02	0,80	0,75
1,27	1,00	0,90
1,52	1,25	1,15
1,78	1,45	1,35
2,62	2,25	2,20
3,53	3,15	3,00
5,33	4,75	4,50
7,00	6,20	6,00

* The specified groove depth applies only to QUAD-RING®Seals of FKM (fluoroelastomer)

■ QUAD-RING® Seal Dimensions According to American Standard AS 568 A

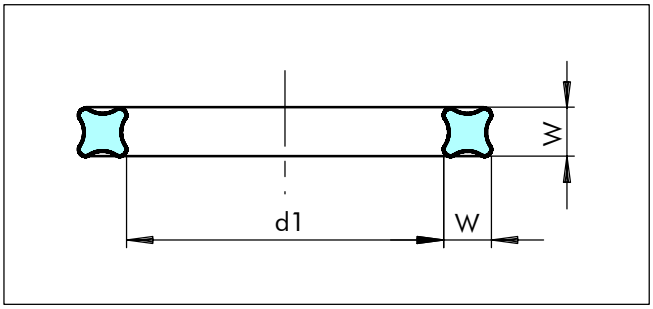


Figure11 QUAD-RING®Seal

Table V Part Numbers / Dimensions

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04001	0,74	0,10	1,02	0,08
QRAR04002	1,07	0,10	1,27	0,08
QRAR04003	1,42	0,10	1,52	0,08
QRAR4003H	1,78	0,13	1,02	0,08
QRAR04004	1,78	0,13	1,78	0,08
QRAR4005A	2,00	0,13	1,50	0,08
QRAR04005	2,57	0,13	1,78	0,08
QRAR04006	2,90	0,13	1,78	0,08
QRAR04007	3,68	0,13	1,78	0,08
QRAR04008	4,47	0,13	1,78	0,08
QRAR04009	5,28	0,13	1,78	0,08
QRAR04010	6,07	0,13	1,78	0,08
QRAR04011	7,65	0,13	1,78	0,08
QRAR4012A	8,20	0,13	1,78	0,08
QRAR04012	9,25	0,13	1,78	0,08
QRAR04013	10,82	0,13	1,78	0,08
QRAR04014	12,42	0,13	1,78	0,08
QRAR04015	14,00	0,18	1,78	0,08
QRAR04016	15,60	0,23	1,78	0,08
QRAR04017	17,17	0,23	1,78	0,08
QRAR04018	18,77	0,23	1,78	0,08
QRAR04019	20,35	0,23	1,78	0,08
QRAR04020	21,95	0,23	1,78	0,08
QRAR04021	23,52	0,23	1,78	0,08
QRAR04022	25,12	0,25	1,78	0,08
QRAR04023	26,70	0,25	1,78	0,08
QRAR04024	28,30	0,25	1,78	0,08
QRAR04025	29,87	0,28	1,78	0,08
QRAR04026	31,47	0,28	1,78	0,08
QRAR04027	33,05	0,28	1,78	0,08

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04028	34,65	0,33	1,78	0,08
QRAR04029	37,82	0,33	1,78	0,08
QRAR04030	41,00	0,33	1,78	0,08
QRAR04031	44,17	0,38	1,78	0,08
QRAR04032	47,35	0,38	1,78	0,08
QRAR04033	50,52	0,46	1,78	0,08
QRAR04034	53,70	0,46	1,78	0,08
QRAR04035	56,87	0,46	1,78	0,08
QRAR04036	60,05	0,46	1,78	0,08
QRAR04037	63,22	0,46	1,78	0,08
QRAR04038	66,40	0,51	1,78	0,08
QRAR04039	69,57	0,51	1,78	0,08
QRAR04040	72,75	0,51	1,78	0,08
QRAR04041	75,92	0,61	1,78	0,08
QRAR04042	82,27	0,61	1,78	0,08
QRAR04043	88,62	0,61	1,78	0,08
QRAR04044	94,97	0,69	1,78	0,08
QRAR04045	101,32	0,69	1,78	0,08
QRAR04046	107,67	0,76	1,78	0,08
QRAR04047	114,02	0,76	1,78	0,08
QRAR04048	120,37	0,76	1,78	0,08
QRAR04049	126,72	0,94	1,78	0,08
QRAR04050	133,07	0,94	1,78	0,08
QRAR04102	1,24	0,10	2,62	0,08
QRAR04103	2,06	0,10	2,62	0,08
QRAR04104	2,84	0,13	2,62	0,08
QRAR04105	3,63	0,13	2,62	0,08
QRAR04106	4,42	0,13	2,62	0,08
QRAR04107	5,23	0,13	2,62	0,08
QRAR04108	6,02	0,13	2,62	0,08

QUAD-RING® Seal

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04109	7,59	0,13	2,62	0,08
QRAR04110	9,19	0,13	2,62	0,08
QRAR4111A	10,20	0,13	2,62	0,08
QRAR04111	10,77	0,13	2,62	0,08
QRAR04112	12,37	0,13	2,62	0,08
QRAR04113	13,94	0,18	2,62	0,08
QRAR4114A	14,70	0,23	2,62	0,08
QRAR4114B	14,80	0,23	2,62	0,10
QRAR04114	15,54	0,23	2,62	0,08
QRAR4115A	16,20	0,23	2,62	0,08
QRAR04115	17,12	0,23	2,62	0,08
QRAR04116	18,72	0,23	2,62	0,08
QRAR04117	20,29	0,25	2,62	0,08
QRAR04118	21,89	0,25	2,62	0,08
QRAR04119	23,47	0,25	2,62	0,08
QRAR04120	25,07	0,25	2,62	0,08
QRAR04121	26,64	0,25	2,62	0,08
QRAR04122	28,24	0,25	2,62	0,08
QRAR04123	29,82	0,30	2,62	0,08
QRAR04124	31,42	0,30	2,62	0,08
QRAR04125	32,99	0,30	2,62	0,08
QRAR04126	34,59	0,30	2,62	0,08
QRAR04127	36,17	0,30	2,62	0,08
QRAR04128	37,77	0,30	2,62	0,08
QRAR04129	39,34	0,38	2,62	0,08
QRAR04130	40,94	0,38	2,62	0,08
QRAR04131	42,52	0,38	2,62	0,08
QRAR04132	44,12	0,38	2,62	0,08
QRAR04133	45,69	0,38	2,62	0,08
QRAR04134	47,29	0,38	2,62	0,08
QRAR04135	48,90	0,43	2,62	0,08
QRAR04136	50,47	0,43	2,62	0,08
QRAR04137	52,07	0,43	2,62	0,08
QRAR04138	53,64	0,43	2,62	0,08
QRAR04139	55,25	0,43	2,62	0,08
QRAR04140	56,82	0,43	2,62	0,08
QRAR04141	58,42	0,51	2,62	0,08
QRAR04142	59,99	0,51	2,62	0,08
QRAR04143	61,60	0,51	2,62	0,08
QRAR04144	63,17	0,51	2,62	0,08
QRAR04145	64,77	0,51	2,62	0,08
QRAR04146	66,34	0,51	2,62	0,08

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04147	67,95	0,56	2,62	0,08
QRAR04148	69,52	0,56	2,62	0,08
QRAR04149	71,12	0,56	2,62	0,08
QRAR04150	72,69	0,56	2,62	0,08
QRAR04151	75,87	0,61	2,62	0,08
QRAR04152	82,22	0,61	2,62	0,08
QRAR04153	88,57	0,61	2,62	0,08
QRAR04154	94,92	0,71	2,62	0,08
QRAR04155	101,27	0,71	2,62	0,08
QRAR04156	107,62	0,76	2,62	0,08
QRAR04157	113,97	0,76	2,62	0,08
QRAR04158	120,32	0,76	2,62	0,08
QRAR04159	126,67	0,89	2,62	0,08
QRAR04160	133,02	0,89	2,62	0,08
QRAR04161	139,37	0,89	2,62	0,08
QRAR04162	145,72	0,89	2,62	0,08
QRAR04163	152,07	0,89	2,62	0,08
QRAR04164	158,42	1,02	2,62	0,08
QRAR04165	164,77	1,02	2,62	0,08
QRAR04166	171,12	1,02	2,62	0,08
QRAR04167	177,47	1,02	2,62	0,08
QRAR04168	183,82	1,14	2,62	0,08
QRAR04169	190,17	1,14	2,62	0,08
QRAR04170	196,52	1,14	2,62	0,08
QRAR04171	202,87	1,14	2,62	0,08
QRAR04172	209,22	1,27	2,62	0,08
QRAR04173	215,57	1,27	2,62	0,08
QRAR04174	221,92	1,27	2,62	0,08
QRAR04175	228,27	1,27	2,62	0,08
QRAR04176	234,62	1,40	2,62	0,08
QRAR04177	240,97	1,40	2,62	0,08
QRAR04178	247,32	1,40	2,62	0,08
QRAR04201	4,34	0,13	3,53	0,10
QRAR04202	5,94	0,13	3,53	0,10
QRAR04203	7,52	0,13	3,53	0,10
QRAR04204	9,12	0,13	3,53	0,10
QRAR04205	10,69	0,13	3,53	0,10
QRAR04206	12,29	0,13	3,53	0,10
QRAR04207	13,87	0,18	3,53	0,10
QRAR04208	15,47	0,23	3,53	0,10
QRAR04209	17,04	0,23	3,53	0,10
QRAR4210A	18,20	0,25	3,53	0,10

QUAD-RING® Seal

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04210	18,64	0,25	3,53	0,10
QRAR04211	20,22	0,25	3,53	0,10
QRAR04212	21,82	0,25	3,53	0,10
QRAR04213	23,39	0,25	3,53	0,10
QRAR04214	24,99	0,25	3,53	0,10
QRAR04215	26,57	0,25	3,53	0,10
QRAR04216	28,17	0,30	3,53	0,10
QRAR04217	29,74	0,30	3,53	0,10
QRAR04218	31,34	0,30	3,53	0,10
QRAR04219	32,92	0,30	3,53	0,10
QRAR04220	34,52	0,30	3,53	0,10
QRAR04221	36,09	0,30	3,53	0,10
QRAR04222	37,69	0,38	3,53	0,10
QRAR04223	40,87	0,38	3,53	0,10
QRAR04224	44,04	0,38	3,53	0,10
QRAR04225	47,22	0,46	3,53	0,10
QRAR04226	50,39	0,46	3,53	0,10
QRAR04227	53,57	0,46	3,53	0,10
QRAR04228	56,74	0,51	3,53	0,10
QRAR04229	59,92	0,51	3,53	0,10
QRAR04230	63,09	0,51	3,53	0,10
QRAR04231	66,27	0,51	3,53	0,10
QRAR04232	69,44	0,61	3,53	0,10
QRAR04233	72,62	0,61	3,53	0,10
QRAR04234	75,79	0,61	3,53	0,10
QRAR04235	78,97	0,61	3,53	0,10
QRAR04236	82,14	0,61	3,53	0,10
QRAR04237	85,32	0,61	3,53	0,10
QRAR04238	88,49	0,61	3,53	0,10
QRAR04239	91,67	0,71	3,53	0,10
QRAR04240	94,84	0,71	3,53	0,10
QRAR04241	98,02	0,71	3,53	0,10
QRAR04242	101,19	0,71	3,53	0,10
QRAR04243	104,37	0,71	3,53	0,10
QRAR04244	107,54	0,76	3,53	0,10
QRAR04245	110,72	0,76	3,53	0,10
QRAR04246	113,89	0,76	3,53	0,10
QRAR04247	117,07	0,76	3,53	0,10
QRAR04248	120,24	0,76	3,53	0,10
QRAR04249	123,42	0,84	3,53	0,10
QRAR04250	126,59	0,84	3,53	0,10
QRAR04251	129,77	0,84	3,53	0,10

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04252	132,94	0,89	3,53	0,10
QRAR04253	136,12	0,89	3,53	0,10
QRAR04254	139,29	0,89	3,53	0,10
QRAR04255	142,47	0,89	3,53	0,10
QRAR04256	145,64	0,89	3,53	0,10
QRAR04257	148,82	0,89	3,53	0,10
QRAR04258	151,99	0,89	3,53	0,10
QRAR04259	158,34	1,02	3,53	0,10
QRAR04260	164,69	1,02	3,53	0,10
QRAR04261	171,04	1,02	3,53	0,10
QRAR04262	177,39	1,02	3,53	0,10
QRAR04263	183,74	1,14	3,53	0,10
QRAR04264	190,09	1,14	3,53	0,10
QRAR04265	196,44	1,14	3,53	0,10
QRAR04266	202,79	1,14	3,53	0,10
QRAR04267	209,14	1,27	3,53	0,10
QRAR04268	215,49	1,27	3,53	0,10
QRAR04269	221,84	1,27	3,53	0,10
QRAR04270	228,19	1,27	3,53	0,10
QRAR04271	234,54	1,40	3,53	0,10
QRAR04272	240,89	1,40	3,53	0,10
QRAR04273	247,24	1,40	3,53	0,10
QRAR04274	253,59	1,40	3,53	0,10
QRAR04275	266,29	1,40	3,53	0,10
QRAR04276	278,99	1,65	3,53	0,10
QRAR04277	291,69	1,65	3,53	0,10
QRAR04278	304,39	1,65	3,53	0,10
QRAR04279	329,79	1,65	3,53	0,10
QRAR04280	355,19	1,65	3,53	0,10
QRAR04281	380,59	1,65	3,53	0,10
QRAR04282	405,26	1,90	3,53	0,10
QRAR04283	430,66	2,16	3,53	0,10
QRAR04284	456,06	2,42	3,53	0,10
QRAR04309	10,46	0,13	5,33	0,13
QRAR04310	12,07	0,13	5,33	0,13
QRAR04311	13,64	0,18	5,33	0,13
QRAR04312	15,24	0,23	5,33	0,13
QRAR04313	16,81	0,23	5,33	0,13
QRAR04314	18,42	0,25	5,33	0,13
QRAR04315	19,99	0,25	5,33	0,13
QRAR04316	21,59	0,25	5,33	0,13
QRAR04317	23,16	0,25	5,33	0,13

QUAD-RING® Seal

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04318	24,77	0,25	5,33	0,13
QRAR04319	26,34	0,25	5,33	0,13
QRAR04320	27,94	0,30	5,33	0,13
QRAR04321	29,51	0,30	5,33	0,13
QRAR04322	31,12	0,30	5,33	0,13
QRAR04323	32,69	0,30	5,33	0,13
QRAR04324	34,29	0,30	5,33	0,13
QRAR04325	37,47	0,38	5,33	0,13
QRAR4326A	39,20	0,38	5,33	0,13
QRAR04326	40,64	0,38	5,33	0,13
QRAR04327	43,82	0,38	5,33	0,13
QRAR4328A	45,20	0,38	5,33	0,13
QRAR04328	46,99	0,38	5,33	0,13
QRAR04329	50,17	0,46	5,33	0,13
QRAR04330	53,34	0,46	5,33	0,13
QRAR04331	56,52	0,46	5,33	0,13
QRAR04332	59,69	0,46	5,33	0,13
QRAR04333	62,87	0,51	5,33	0,13
QRAR04334	66,04	0,51	5,33	0,13
QRAR04335	69,22	0,51	5,33	0,13
QRAR04336	72,39	0,51	5,33	0,13
QRAR04337	75,57	0,61	5,33	0,13
QRAR04338	78,74	0,61	5,33	0,13
QRAR04339	81,92	0,61	5,33	0,13
QRAR04340	85,09	0,61	5,33	0,13
QRAR04341	88,27	0,61	5,33	0,13
QRAR04342	91,44	0,71	5,33	0,13
QRAR04343	94,62	0,71	5,33	0,13
QRAR04344	97,79	0,71	5,33	0,13
QRAR04345	100,97	0,71	5,33	0,13
QRAR04346	104,14	0,71	5,33	0,13
QRAR04347	107,32	0,76	5,33	0,13
QRAR04348	110,49	0,76	5,33	0,13
QRAR04349	113,67	0,76	5,33	0,13
QRAR04350	116,84	0,76	5,33	0,13
QRAR04351	120,02	0,76	5,33	0,13
QRAR04352	123,19	0,76	5,33	0,13
QRAR04353	126,37	0,94	5,33	0,13
QRAR04354	129,54	0,94	5,33	0,13
QRAR04355	132,72	0,94	5,33	0,13
QRAR04356	135,89	0,94	5,33	0,13
QRAR04357	139,07	0,94	5,33	0,13

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04358	142,24	0,94	5,33	0,13
QRAR04359	145,42	0,94	5,33	0,13
QRAR04360	148,49	0,94	5,33	0,13
QRAR04361	151,77	0,94	5,33	0,13
QRAR04362	158,12	1,02	5,33	0,13
QRAR04363	164,47	1,02	5,33	0,13
QRAR04364	170,82	1,02	5,33	0,13
QRAR04365	177,17	1,02	5,33	0,13
QRAR04366	183,52	1,14	5,33	0,13
QRAR04367	189,87	1,14	5,33	0,13
QRAR04368	196,22	1,14	5,33	0,13
QRAR04369	202,57	1,14	5,33	0,13
QRAR04370	208,92	1,27	5,33	0,13
QRAR04371	215,27	1,27	5,33	0,13
QRAR04372	221,62	1,27	5,33	0,13
QRAR04373	227,97	1,27	5,33	0,13
QRAR04374	234,32	1,40	5,33	0,13
QRAR04375	240,67	1,40	5,33	0,13
QRAR04376	247,02	1,40	5,33	0,13
QRAR04377	253,37	1,40	5,33	0,13
QRAR04378	266,07	1,52	5,33	0,13
QRAR04379	278,77	1,52	5,33	0,13
QRAR04380	291,47	1,65	5,33	0,13
QRAR04381	304,17	1,65	5,33	0,13
QRAR04382	329,57	1,65	5,33	0,13
QRAR04383	354,97	1,78	5,33	0,13
QRAR04384	380,37	1,78	5,33	0,13
QRAR04385	405,26	1,91	5,33	0,13
QRAR04386	430,66	2,03	5,33	0,13
QRAR04387	456,06	2,15	5,33	0,13
QRAR04388	481,41	2,25	5,33	0,13
QRAR04389	506,81	2,41	5,33	0,13
QRAR04390	532,21	2,41	5,33	0,13
QRAR04391	557,61	2,54	5,33	0,13
QRAR04392	582,68	2,67	5,33	0,13
QRAR04393	608,08	2,79	5,33	0,13
QRAR04394	633,48	2,92	5,33	0,13
QRAR04395	658,88	3,05	5,33	0,13
QRAR04425	113,67	0,84	7,00	0,15
QRAR04426	116,84	0,84	7,00	0,15
QRAR04427	120,02	0,84	7,00	0,15
QRAR04428	123,19	0,84	7,00	0,15

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04429	126,37	0,94	7,00	0,15
QRAR04430	129,54	0,94	7,00	0,15
QRAR04431	132,72	0,94	7,00	0,15
QRAR04432	135,89	0,94	7,00	0,15
QRAR04433	139,07	0,94	7,00	0,15
QRAR04434	142,24	0,94	7,00	0,15
QRAR04435	145,42	0,94	7,00	0,15
QRAR04436	148,59	0,94	7,00	0,15
QRAR04437	151,77	0,94	7,00	0,15
QRAR04438	158,12	1,02	7,00	0,15
QRAR4439A	160,50	1,02	7,00	0,15
QRAR04439	164,47	1,02	7,00	0,15
QRAR04440	170,82	1,02	7,00	0,15
QRAR04441	177,17	1,02	7,00	0,15
QRAR04442	183,52	1,14	7,00	0,15
QRAR04443	189,87	1,14	7,00	0,15
QRAR04444	196,22	1,14	7,00	0,15
QRAR04445	202,57	1,14	7,00	0,15
QRAR04446	215,27	1,40	7,00	0,15
QRAR04447	227,97	1,40	7,00	0,15
QRAR04448	240,67	1,40	7,00	0,15
QRAR04449	253,37	1,40	7,00	0,15
QRAR04450	266,07	1,52	7,00	0,15
QRAR04451	278,77	1,52	7,00	0,15
QRAR04452	291,47	1,52	7,00	0,15
QRAR04453	304,17	1,52	7,00	0,15
QRAR04454	316,87	1,52	7,00	0,15
QRAR04455	329,57	1,52	7,00	0,15
QRAR04456	342,27	1,79	7,00	0,15
QRAR04457	354,97	1,79	7,00	0,15
QRAR04458	367,67	1,79	7,00	0,15
QRAR04459	380,37	1,79	7,00	0,15
QRAR04460	393,07	1,79	7,00	0,15
QRAR04461	405,26	1,90	7,00	0,15
QRAR04462	417,96	1,90	7,00	0,15
QRAR04463	430,66	2,05	7,00	0,15
QRAR04464	443,36	2,15	7,00	0,15
QRAR04465	456,06	2,15	7,00	0,15
QRAR04466	468,76	2,15	7,00	0,15

Part No.	Inside-Ø		Cord Diameter	
	d1	±	W	±
QRAR04467	481,46	2,29	7,00	0,15
QRAR04468	494,16	2,29	7,00	0,15
QRAR04469	506,86	2,41	7,00	0,15
QRAR04470	532,26	2,41	7,00	0,15
QRAR04471	557,66	2,55	7,00	0,15
QRAR04472	582,68	2,65	7,00	0,15
QRAR04473	608,08	2,80	7,00	0,15
QRAR04474	633,48	2,90	7,00	0,15
QRAR04475	658,87	3,05	7,00	0,15

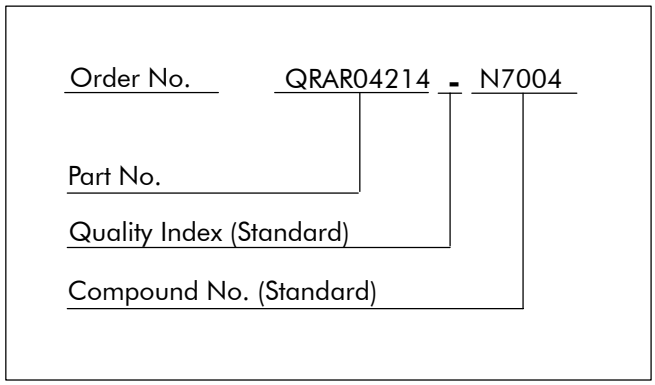
The specified tolerances for d_1 and W apply only to QUAD-RING® Seals made from the material Acrylonitrile Butadiene Elastomer NBR (N7004) with a hardness of 70 Shore A. With other elastomer qualities and hardnesses, slight deviations from the values in the tables are possible due to the different shrinkage behaviour.

Ordering Example

QUAD-RING® Seal No. 4214 (in accordance with AS 568 A)

Dimensions: Inside diameter d_1 = 24,99 mm
Cord diameter W = 3,53 mm

Material: NBR 70 (Acrylonitrile Butadiene Elastomer, 70 Shore A)



QUAD-RING® Seal dimensions and Part No., see Table V, page 11 - 15.
Material No., see Table VI, page 16.
Installation Dimensions, see Table III, page 9.

As well as the above method, you may continue to order using old part numbers or by dimensions showing material and shore hardness details.

Table VI Material list valid for QUAD-RING® Seals According to American Standard AS 568 A

Basic-Elastomer	Compound No.	Hardness * Shore A/ IRHD Tol. ±/-5	Colour	Temperature Range °C **	Field of Application, Special Features
NBR Acrylonitrile Butadiene Elastomer	N7004 (366Y)	70	black	- 30 / + 110	Standard material for hydraulics and pneumatics. Mineral oil-based hydraulic fluids, animal and vegetable oils and fats, aliphatic hydrocarbons (propane, butane, petrol), Silicone oils and greases, water up to + 80 °C.
	N8004 (446A)	80	black	- 30 / + 110	
	N7203 (523A)	70	black	- 50 / + 100	Resistant to low temperatures, applications as standard NBR, but lower heat resistance.
HNBR Highly saturated Nitrile	H7690 (574BF)	70	black	- 35 / + 150	Fills the gap left by NBR and FKM elastomers, when high temperature conditions require high tensile strength while maintaining excellent resistances to motor oils, ATF's, sour gas, amine, oil mixtures, oxidized fuels, lubricating oils.
CR Chlorbutadiene Elastomer	WC703 (486CT)	70	black	- 40 / + 120	Resistant to refrigerants, ammonia, carbon dioxide, freon (R12, R13, R21, R22, R113, R114, R115). Silicone oils, oxygen, ozone, caustic soda, low resistance to mineral oils.
EPDM Ethylene-Propylene-Elastomer	E7509 (559N)	70	black	- 50 / + 130	Peroxide-cured. Hot water, steam, detergents, alcohols, ketones, esters, motor vehicle coolants, organic and inorganic acids and bases, not resistant to mineral oils!
	E7690 (560ND)	70	black	- 45 / + 140	Brake fluids
VMQ Silicone	S70R6 (71117C)	70	red	- 70 / + 230	Hot air, oxygen, ozone, inert gases at high temperatures, aliphatic engine and transmission oils, UV radiation, good dielectric properties. For static applications only!
FVMQ Fluorsilicone	F70L2 (70157)	70	black	- 70 / + 230	Similar properties to VMQ, but with poorer resistance to low temperatures. Mineral oils, fuels, diester-based lubricants, hot air.
FKM Fluoroelastomer	V7002 (514AD)	70	black	- 20 / + 260	Mineral oils and greases, flame retardant liquids, aliphatic, aromatic and chlorinated hydrocarbons, petrol, 99 octane petrol, diesel fuels, silicone oils and greases.
	V8005 (514AQ)	80	black	- 20 / + 260	
	V9002 (514J)	90	black	- 20 / + 260	Suitable for use in high-vacuum applications!

The material numbers in (...) indicate the earlier designation!

* The hardness ranges of the elastomer types listed are given in Shore A hardness units in accordance with DIN 53505. The specified hardness refers to the test specimen described in the DIN standard,

** The specified temperatures are working temperatures which must always be considered in conjunction with the medium to be sealed and the working pressure. The max. values can vary according to application conditions and duration.

Installation Recommendation
QUAD-RING®Seal with Back-up Ring (Spiral) for Radial-Dynamic Application (Reciprocating) - "External Sealing" -

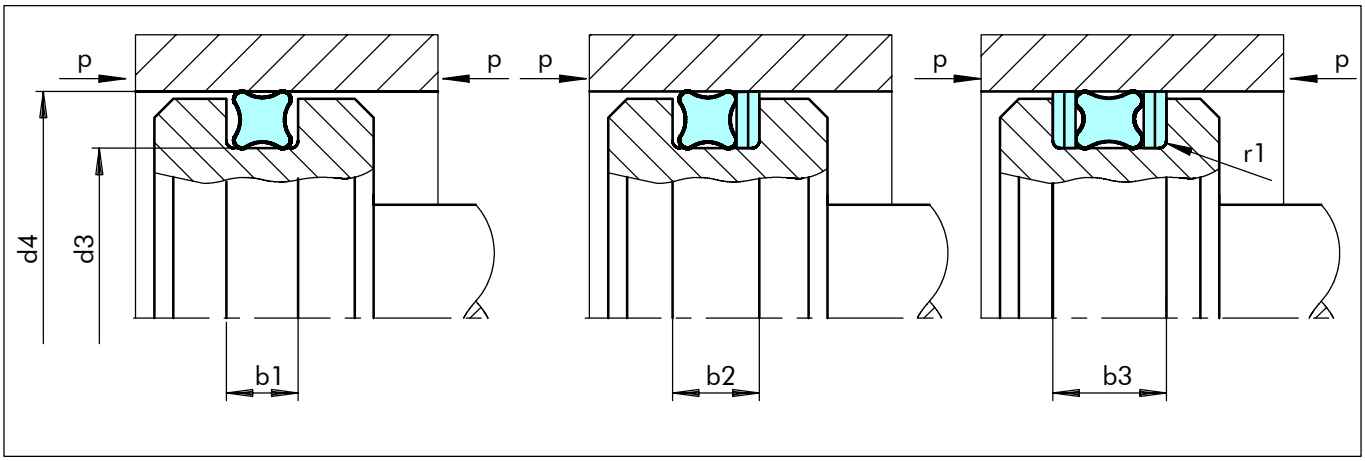


Figure12 Installation drawing

Table VII Part Numbers / Installation Dimensions

Bore	QUAD-RING®Seal		Back-up Ring, Spiral	Groove-∅	Groove Width			Radius
d_4 H8	Part No.	Dimensions	Part No.	d_3 h9	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
6,0	QRAR04005	2,57x1,78	BP1500030	3,0	2,0	3,4	4,8	0,2
8,0	QRAR04008	4,47x1,78	BP1500050	5,0	2,0	3,4	4,8	0,2
10,0	QRAR04010	6,07x1,78	BP1500070	7,0	2,0	3,4	4,8	0,2
12,0	QRAR4012A	8,20x1,78	BP1500090	9,0	2,0	3,4	4,8	0,2
14,0	QRAR04013	10,82x1,78	BP1500110	11,0	2,0	3,4	4,8	0,2
15,0	QRAR4111A	10,20x2,62	BP2300104	10,4	3,0	4,4	5,8	0,3
16,0	QRAR04111	10,77x2,62	BP2300114	11,4	3,0	4,4	5,8	0,3
18,0	QRAR04112	12,37x2,62	BP2300134	13,4	3,0	4,4	5,8	0,3
20,0	QRAR4114A	14,70x2,62	BP2300154	15,4	3,0	4,4	5,8	0,3
22,0	QRAR4115A	16,20x2,62	BP2300174	17,4	3,0	4,4	5,8	0,3
25,0	QRAR4210A	18,20x3,53	BP3200186	18,6	4,0	5,4	6,8	0,4
28,0	QRAR04212	21,82x3,53	BP3200216	21,6	4,0	5,4	6,8	0,4
30,0	QRAR04213	23,39x3,53	BP3200236	23,6	4,0	5,4	6,8	0,4
32,0	QRAR04214	24,99x3,53	BP3200256	25,6	4,0	5,4	6,8	0,4
35,0	QRAR04216	28,17x3,53	BP3200286	28,6	4,0	5,4	6,8	0,4
40,0	QRAR04219	32,92x3,53	BP3200336	33,6	4,0	5,4	6,8	0,4
42,0	QRAR04220	34,52x3,53	BP3200356	35,6	4,0	5,4	6,8	0,4
45,0	QRAR04222	37,69x3,53	BP3200386	38,6	4,0	5,4	6,8	0,4
48,0	QRAR04325	37,46x5,33	BP4900382	38,2	6,0	7,7	9,4	0,4
50,0	QRAR4326A	39,20x5,33	BP4900402	40,2	6,0	7,7	9,4	0,4
52,0	QRAR04326	40,64x5,33	BP4900422	42,2	6,0	7,7	9,4	0,4

QUAD-RING® Seal

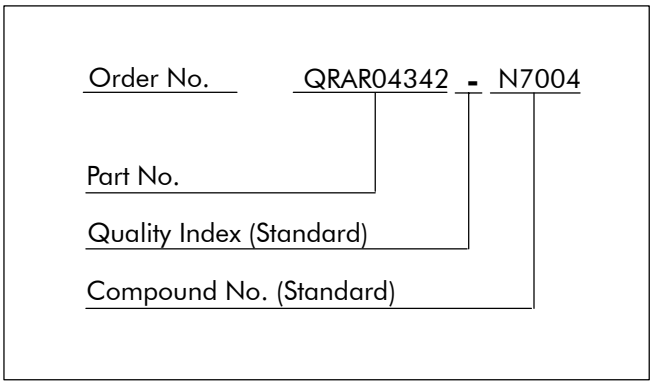
Bore	QUAD-RING® Seal		Back-up Ring, Spiral	Groove-∅	Groove Width			Radius
d_4 H8	Part No.	Dimensions	Part No.	d_3 h9	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
55,0	QRAR04327	43,82x5,33	BP4900452	45,2	6,0	7,7	9,4	0,4
60,0	QRAR04329	50,17x5,33	BP4900502	50,2	6,0	7,7	9,4	0,4
63,0	QRAR04330	53,34x5,33	BP4900532	53,2	6,0	7,7	9,4	0,4
65,0	QRAR04330	53,34x5,33	BP4900552	55,2	6,0	7,7	9,4	0,4
70,0	QRAR04332	59,69x5,33	BP4900602	60,2	6,0	7,7	9,4	0,4
75,0	QRAR04333	62,87x5,33	BP4900652	65,2	6,0	7,7	9,4	0,4
80,0	QRAR04335	69,22x5,33	BP4900702	70,2	6,0	7,7	9,4	0,4
85,0	QRAR04337	75,57x5,33	BP4900752	75,2	6,0	7,7	9,4	0,4
90,0	QRAR04338	78,74x5,33	BP4900802	80,2	6,0	7,7	9,4	0,4
95,0	QRAR04340	85,09x5,33	BP4900852	85,2	6,0	7,7	9,4	0,4
100,0	QRAR04342	91,44x5,33	BP4900902	90,2	6,0	7,7	9,4	0,4
105,0	QRAR04343	94,62x5,33	BP4900952	95,2	6,0	7,7	9,4	0,4
110,0	QRAR04345	100,97x5,33	BP4901002	100,2	6,0	7,7	9,4	0,4
115,0	QRAR04346	104,14x5,33	BP4901052	105,2	6,0	7,7	9,4	0,4
120,0	QRAR04348	110,49x5,33	BP4901102	110,2	6,0	7,7	9,4	0,4
125,0	QRAR04349	113,67x5,33	BP4901152	115,2	6,0	7,7	9,4	0,4
130,0	QRAR04351	120,02x5,33	BP4901202	120,2	6,0	7,7	9,4	0,4
135,0	QRAR04427	120,02x7,00	BP6401222	122,2	8,0	10,5	13,0	0,6
140,0	QRAR04429	126,37x7,00	BP6401272	127,2	8,0	10,5	13,0	0,6
150,0	QRAR04432	135,89x7,00	BP6401372	137,2	8,0	10,5	13,0	0,6
160,0	QRAR04435	145,42x7,00	BP6401472	147,2	8,0	10,5	13,0	0,6
170,0	QRAR04438	158,12x7,00	BP6401572	157,2	8,0	10,5	13,0	0,6
180,0	QRAR04439	164,47x7,00	BP6401672	167,2	8,0	10,5	13,0	0,6
190,0	QRAR04441	177,17x7,00	BP6401772	177,2	8,0	10,5	13,0	0,6
200,0	QRAR04442	183,52x7,00	BP6401872	187,2	8,0	10,5	13,0	0,6
210,0	QRAR04444	196,22x7,00	BP6401972	197,2	8,0	10,5	13,0	0,6
220,0	QRAR04445	202,57x7,00	BP6402072	207,2	8,0	10,5	13,0	0,6
230,0	QRAR04446	215,27x7,00	BP6402172	217,2	8,0	10,5	13,0	0,6
240,0	QRAR04447	227,97x7,00	BP6402272	227,2	8,0	10,5	13,0	0,6
250,0	QRAR04447	227,97x7,00	BP6402372	237,2	8,0	10,5	13,0	0,6
280,0	QRAR04450	266,07x7,00	BP6402672	267,2	8,0	10,5	13,0	0,6
300,0	QRAR04451	278,77x7,00	BP6402872	287,2	8,0	10,5	13,0	0,6
320,0	QRAR04453	304,17x7,00	BP6403072	307,2	8,0	10,5	13,0	0,6
350,0	QRAR04455	329,57x7,00	BP6403372	337,2	8,0	10,5	13,0	0,6
400,0	QRAR04459	380,37x7,00	BP6403872	387,2	8,0	10,5	13,0	0,6
420,0	QRAR04461	405,26x7,00	BP6404072	407,2	8,0	10,5	13,0	0,6
450,0	QRAR04463	430,66x7,00	BP6404372	437,2	8,0	10,5	13,0	0,6
480,0	QRAR04465	456,06x7,00	BP6404672	467,2	8,0	10,5	13,0	0,6
500,0	QRAR04467	481,46x7,00	BP6404872	487,2	8,0	10,5	13,0	0,6

Further sizes on request!
Materials for QUAD-RING® Seals, for rotary applications see ordering example on page 25.

Ordering Example

QUAD-RING®Seal and Back-up Ring for
bore diameter d_4 = 100,0 mm
Application: radial-dynamic, external sealing

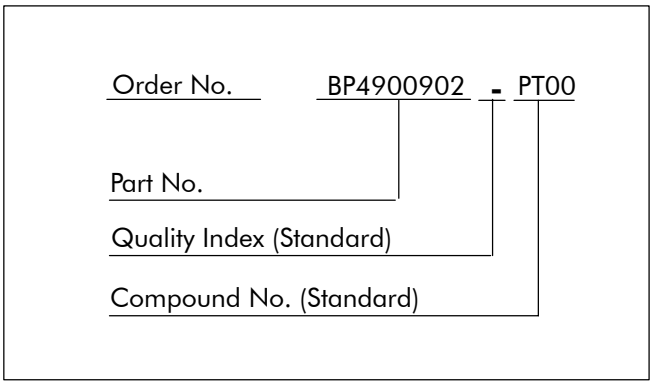
QUAD-RING®Seal according to AS 568A
Dimensions: Inside diameter d_1 = 91,45 mm
Cord diameter W = 5,33 mm
Compound: NBR 70
(Acrylonitrile Butadiene Elastomer,
70 Shore A)



Part No., QUAD-RING®Seal dimensions and installation dimensions see Table VII, page 17 - 18.

Compounds see Table VI, page 16.

Back-up Ring, type BP (spiral) fitted for
QUAD-RING®Seal cord diameter W = 5,33 mm and
bore diameter d_4 = 100,0 mm
Compound: PTFE (Polytetrafluoroethylene)



Part No. and installation dimensions see Table VII, page 17 - 18.
Standard compound PTFE.
Further indications about Back-up Rings see catalogue "Back-up Rings".

As well as the above method, you may continue to order using old part numbers or by dimension showing material and shore hardness details.

Installation Recommendations
QUAD-RING®Seal with Back-up Ring (Spiral) for Radial-Dynamic Application (Reciprocating) - "Internal Sealing" -

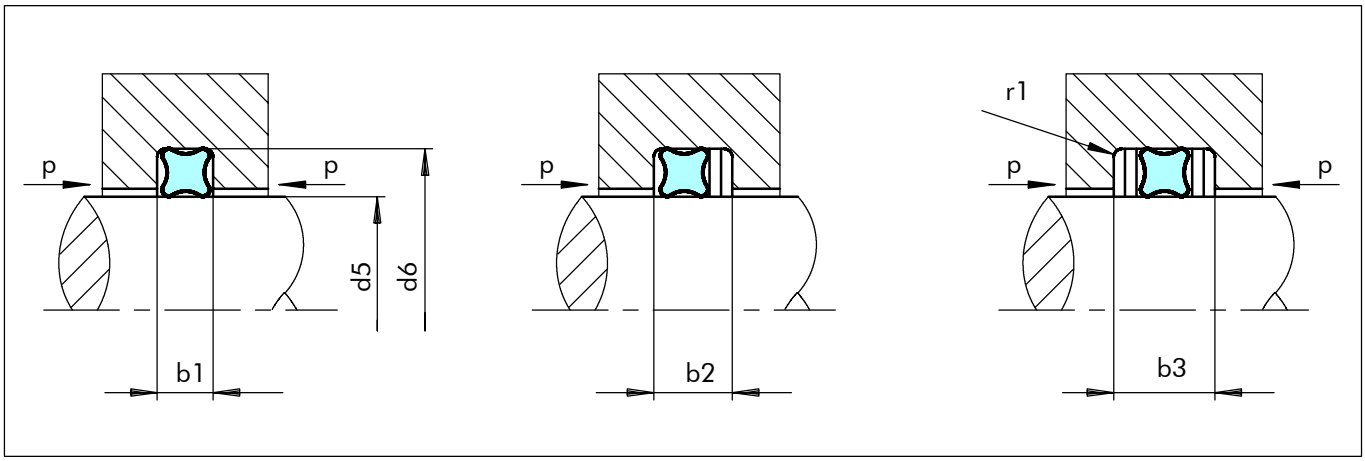


Figure13 Installation drawing

Table VIII Part Numbers / Installation Dimensions

Rod	QUAD-RING®Seal		Back-up Ring, Spiral	Groove-∅	Groove Width			Radius
d_5 f7	Part No.	Dimensions	Part No.	d_6 H9	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
4,0	QRAR04008	4,47x1,78	BP1500040	7,0	2,0	3,4	4,8	0,2
5,0	QRAR04009	5,28x1,78	BP1500050	8,0	2,0	3,4	4,8	0,2
6,0	QRAR04010	6,07x1,78	BP1500060	9,0	2,0	3,4	4,8	0,2
8,0	QRAR4012A	8,20x1,78	BP1500080	11,0	2,0	3,4	4,8	0,2
10,0	QRAR4111A	10,20x2,62	BP2300100	14,6	3,0	4,4	5,8	0,3
12,0	QRAR04112	12,37x2,62	BP2300120	16,6	3,0	4,4	5,8	0,3
14,0	QRAR04113	13,94x2,62	BP2300140	18,6	3,0	4,4	5,8	0,3
15,0	QRAR4114A	14,70x2,62	BP2300150	19,6	3,0	4,4	5,8	0,3
16,0	QRAR4115A	16,20x2,62	BP2300160	20,6	3,0	4,4	5,8	0,3
18,0	QRAR4210A	18,20x3,53	BP3200180	24,4	4,0	5,4	6,8	0,4
20,0	QRAR04211	20,22x3,53	BP3200200	26,4	4,0	5,4	6,8	0,4
22,0	QRAR04212	21,83x3,53	BP3200220	28,4	4,0	5,4	6,8	0,4
25,0	QRAR04214	24,99x3,53	BP3200250	31,4	4,0	5,4	6,8	0,4
28,0	QRAR04216	28,17x3,53	BP3200280	34,4	4,0	5,4	6,8	0,4
30,0	QRAR04217	29,74x3,53	BP3200300	36,4	4,0	5,4	6,8	0,4
32,0	QRAR04218	31,34x3,53	BP3200320	38,4	4,0	5,4	6,8	0,4
35,0	QRAR04220	34,52x3,53	BP3200350	41,4	4,0	5,4	6,8	0,4
36,0	QRAR04221	36,09x3,53	BP3200360	42,4	4,0	5,4	6,8	0,4
40,0	QRAR04326	40,64x5,33	BP4900400	49,8	6,0	7,7	9,4	0,4
42,0	QRAR04326	40,64x5,33	BP4900420	51,8	6,0	7,7	9,4	0,4
45,0	QRAR4328A	45,20x5,33	BP4900450	54,8	6,0	7,7	9,4	0,4

QUAD-RING® Seal

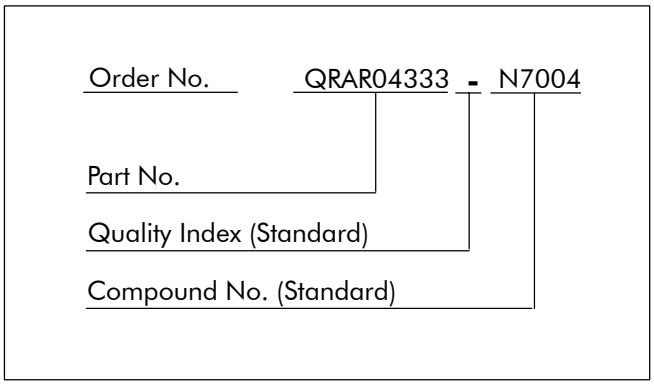
Rod	QUAD-RING®Seal		Back-up Ring, Spiral	Groove-∅	Groove Width			Radius
d_5 f7	Part No.	Dimensions	Part No.	d_6 H9	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
48,0	QRAR04328	46,99x5,33	BP4900480	57,8	6,0	7,7	9,4	0,4
50,0	QRAR04329	50,17x5,33	BP4900500	59,8	6,0	7,7	9,4	0,4
52,0	QRAR04329	50,17x5,33	BP4900520	61,8	6,0	7,7	9,4	0,4
55,0	QRAR04330	53,34x5,33	BP4900550	64,8	6,0	7,7	9,4	0,4
56,0	QRAR04331	56,52x5,33	BP4900560	65,8	6,0	7,7	9,4	0,4
60,0	QRAR04332	59,69x5,33	BP4900600	69,8	6,0	7,7	9,4	0,4
63,0	QRAR04333	62,87x5,33	BP4900630	72,8	6,0	7,7	9,4	0,4
65,0	QRAR04334	66,04x5,33	BP4900650	74,8	6,0	7,7	9,4	0,4
70,0	QRAR04335	69,22x5,33	BP4900700	79,8	6,0	7,7	9,4	0,4
75,0	QRAR04337	75,57x5,33	BP4900750	84,8	6,0	7,7	9,4	0,4
80,0	QRAR04338	78,74x5,33	BP4900800	89,8	6,0	7,7	9,4	0,4
85,0	QRAR04340	85,09x5,33	BP4900850	94,8	6,0	7,7	9,4	0,4
90,0	QRAR04342	91,44x5,33	BP4900900	99,8	6,0	7,7	9,4	0,4
100,0	QRAR04345	100,97x5,33	BP4901000	109,8	6,0	7,7	9,4	0,4
105,0	QRAR04346	104,14x5,33	BP4901050	114,8	6,0	7,7	9,4	0,4
110,0	QRAR04348	110,49x5,33	BP4901100	119,8	6,0	7,7	9,4	0,4
115,0	QRAR04426	116,84x7,00	BP6401150	127,8	8,0	10,5	13,0	0,6
120,0	QRAR04427	120,02x7,00	BP6401200	132,8	8,0	10,5	13,0	0,6
125,0	QRAR04429	126,37x7,00	BP6401250	137,8	8,0	10,5	13,0	0,6
130,0	QRAR04430	129,54x7,00	BP6401300	142,8	8,0	10,5	13,0	0,6
135,0	QRAR04432	135,89x7,00	BP6401350	147,8	8,0	10,5	13,0	0,6
140,0	QRAR04433	139,07x7,00	BP6401400	152,8	8,0	10,5	13,0	0,6
150,0	QRAR04436	148,59x7,00	BP6401500	162,8	8,0	10,5	13,0	0,6
160,0	QRAR4439A	160,50x7,00	BP6401600	172,8	8,0	10,5	13,0	0,6
170,0	QRAR04440	170,82x7,00	BP6401700	182,8	8,0	10,5	13,0	0,6
180,0	QRAR04441	177,17x7,00	BP6401800	192,8	8,0	10,5	13,0	0,6
190,0	QRAR04443	189,87x7,00	BP6401900	202,8	8,0	10,5	13,0	0,6
200,0	QRAR04445	202,57x7,00	BP6402000	212,8	8,0	10,5	13,0	0,6
210,0	QRAR04446	215,27x7,00	BP6402100	222,8	8,0	10,5	13,0	0,6
220,0	QRAR04446	215,27x7,00	BP6402200	232,8	8,0	10,5	13,0	0,6
230,0	QRAR04447	227,97x7,00	BP6402300	242,8	8,0	10,5	13,0	0,6
240,0	QRAR04448	240,67x7,00	BP6402400	252,8	8,0	10,5	13,0	0,6
250,0	QRAR04449	253,37x7,00	BP6402500	262,8	8,0	10,5	13,0	0,6
280,0	QRAR04451	278,77x7,00	BP6402800	292,8	8,0	10,5	13,0	0,6
300,0	QRAR04453	304,17x7,00	BP6403000	312,8	8,0	10,5	13,0	0,6
320,0	QRAR04454	316,87x7,00	BP6403200	332,8	8,0	10,5	13,0	0,6
350,0	QRAR04457	354,97x7,00	BP6403500	362,8	8,0	10,5	13,0	0,6
360,0	QRAR04457	354,97x7,00	BP6403600	372,8	8,0	10,5	13,0	0,6
400,0	QRAR04461	405,26x7,00	BP6404000	412,8	8,0	10,5	13,0	0,6

Further sizes on request!
Materials for QUAD-RING® Seals, for rotary applications see ordering example on page 25.

Ordering Example

QUAD-RING®Seal and Back-up Ring for
rod diameter d_5 = 63,0 mm
Application: radial-dynamic, internal sealing

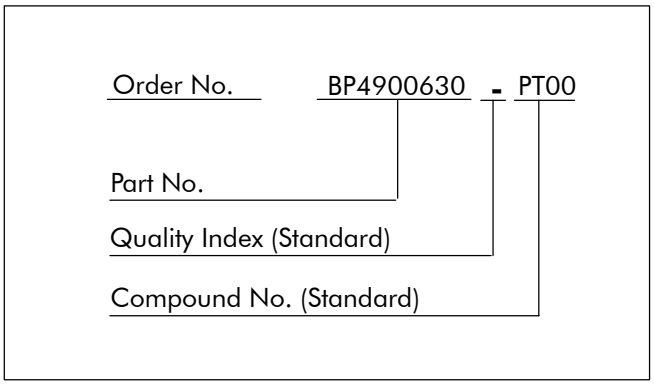
QUAD-RING®Seal according to AS 568 A
Dimensions: Inside diameter d_1 = 62,86 mm
Cord diameter W = 5,33 mm
Compound: NBR 70
(Acrylonitrile Butadiene Elastomer,
70 Shore A)



Part No., QUAD-RING®Seal dimensions and installation dimensions see Table VIII, page 20 - 21.

Compounds see Table VI, page 16.

Back-up Ring, type BP (spiral) fitted for
QUAD-RING®Seal cord diameter W = 5,33 mm and
rod diameter d_5 = 63,0 mm
Compound: PTFE (Polytetrafluoroethylene)



Part No. and installation dimensions see Table VIII, page 20 - 21.
Standard compound PTFE.
Further indications about Back-up Rings see catalogue "Back-up Rings".

As well as the above method, you may continue to order using old part numbers or by dimension showing material and shore hardness details.

Installation Instructions
X-sel® QUAD-RING®Seal and Back-up Ring (Uncut) for Rotary Application - "Internal Sealing" -

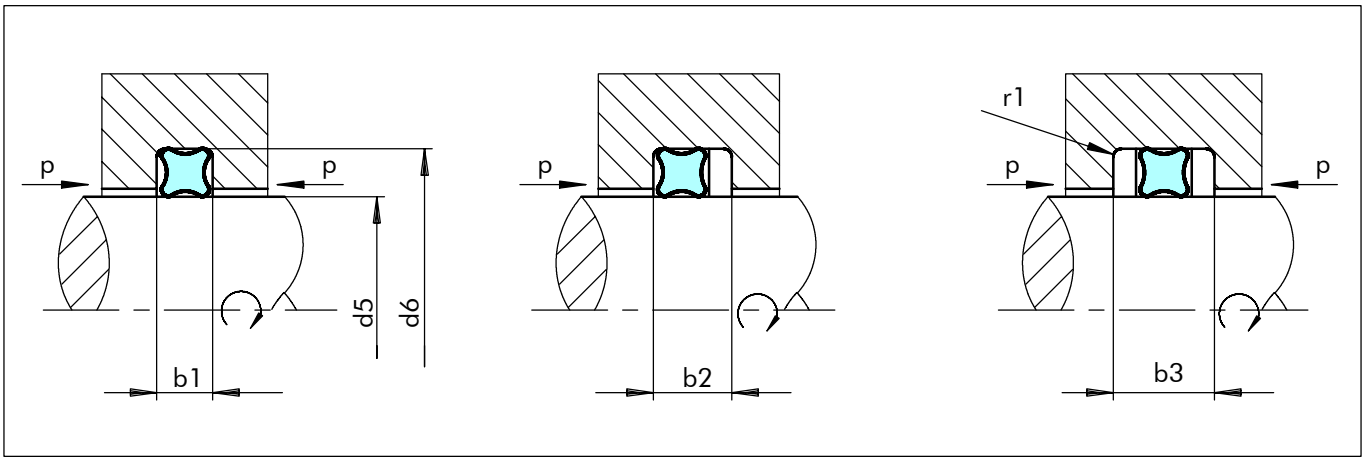


Figure14 Installation drawing

Table IX Part Numbers / Installation Dimensions

Rod	QUAD-RING®Seal		Back-up Ring, Uncut	Groove-∅	Groove Width			Radius
d_5 f7	Part-No	Dimensions	Part-No	d_6 H8	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
4,0	QBAR04008	4,47x1,78	BU16J0040	7,2	2,0	3,2	4,4	0,2
5,0	QBAR04009	5,28x1,78	BU16J0050	8,2	2,0	3,2	4,4	0,2
8,0	QBAR4012A	8,20x1,78	BU16J0080	11,2	2,0	3,2	4,4	0,2
10,0	QBAR4111A	10,20x2,62	BU24J0100	14,8	2,8	4,0	5,2	0,3
12,0	QBAR04112	12,37x2,62	BU24J0120	16,8	2,8	4,0	5,2	0,3
15,0	QBAR04114	15,54x2,62	BU24J0150	19,8	2,8	4,0	5,2	0,3
16,0	QBAR04115	17,12x2,62	BU24J0160	20,8	2,8	4,0	5,2	0,3
18,0	QBAR04116	18,72x2,62	BU24J0180	22,8	2,8	4,0	5,2	0,3
20,0	QBAR04211	20,22x3,53	BU33N0200	26,7	3,8	5,4	7,0	0,4
22,0	QBAR04213	23,39x3,53	BU33N0220	28,7	3,8	5,4	7,0	0,4
25,0	QBAR04215	26,57x3,53	BU33N0250	31,7	3,8	5,4	7,0	0,4
28,0	QBAR04217	29,74x3,53	BU33N0280	34,7	3,8	5,4	7,0	0,4
30,0	QBAR04218	31,34x3,53	BU33N0300	36,7	3,8	5,4	7,0	0,4
32,0	QBAR04219	32,92x3,53	BU33N0320	38,7	3,8	5,4	7,0	0,4
35,0	QBAR04221	36,09x3,53	BU33N0350	41,7	3,8	5,4	7,0	0,4
36,0	QBAR04222	37,69x3,53	BU33N0360	42,7	3,8	5,4	7,0	0,4
40,0	QBAR04326	40,64x5,33	BU49R0400	49,9	6,0	8,0	10,0	0,4
42,0	QBAR04327	43,82x5,33	BU49R0420	51,9	6,0	8,0	10,0	0,4
45,0	QBAR04328	46,99x5,33	BU49R0450	54,9	6,0	8,0	10,0	0,4
48,0	QBAR04329	50,17x5,33	BU49R0480	57,9	6,0	8,0	10,0	0,4
50,0	QBAR04330	53,34x5,33	BU49R0500	59,9	6,0	8,0	10,0	0,4

QUAD-RING® Seal

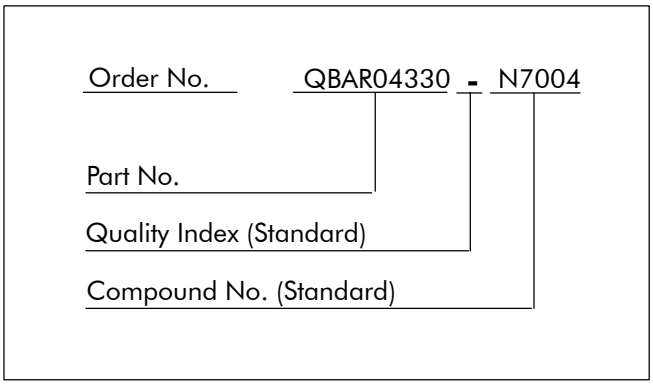
Rod	QUAD-RING® Seal		Back-up Ring, Uncut	Groove-∅	Groove Width			Radius
d_5 f7	Part-No	Dimensions	Part-No	d_6 H8	b_1 +0,2	b_2 +0,2	b_3 +0,2	r_1
52,0	QBAR04330	53,34x5,33	BU49R0520	61,9	6,0	8,0	10,0	0,4
55,0	QBAR04331	56,52x5,33	BU49R0550	64,9	6,0	8,0	10,0	0,4
56,0	QBAR04331	56,52x5,33	BU49R0560	65,9	6,0	8,0	10,0	0,4
60,0	QBAR04333	62,87x5,33	BU49R0600	69,9	6,0	8,0	10,0	0,4
63,0	QBAR04334	66,04x5,33	BU49R0630	72,9	6,0	8,0	10,0	0,4
65,0	QBAR04334	66,04x5,33	BU49R0650	74,9	6,0	8,0	10,0	0,4
70,0	QBAR04336	72,39x5,33	BU49R0700	79,9	6,0	8,0	10,0	0,4
75,0	QBAR04338	78,74x5,33	BU49R0750	84,9	6,0	8,0	10,0	0,4
80,0	QBAR04339	81,92x5,33	BU49R0800	89,9	6,0	8,0	10,0	0,4
85,0	QBAR04341	88,27x5,33	BU49R0850	94,9	6,0	8,0	10,0	0,4
90,0	QBAR04343	94,62x5,33	BU49R0900	99,9	6,0	8,0	10,0	0,4
95,0	QBAR04344	97,79x5,33	BU49R0950	104,9	6,0	8,0	10,0	0,4
100,0	QBAR04346	104,14x5,33	BU49R1000	109,9	6,0	8,0	10,0	0,4
105,0	QBAR04348	110,49x5,33	BU49R1050	114,9	6,0	8,0	10,0	0,4
110,0	QBAR04426	116,84x7,00	BU66T1100	123,3	7,7	10,2	12,7	0,6
115,0	QBAR04427	120,02x7,00	BU66T1150	128,3	7,7	10,2	12,7	0,6
120,0	QBAR04428	123,19x7,00	BU66T1200	133,3	7,7	10,2	12,7	0,6
125,0	QBAR04430	129,54x7,00	BU66T1250	138,3	7,7	10,2	12,7	0,6
130,0	QBAR04432	135,89x7,00	BU66T1300	143,3	7,7	10,2	12,7	0,6
140,0	QBAR04435	145,42x7,00	BU66T1400	153,3	7,7	10,2	12,7	0,6
150,0	QBAR04438	158,12x7,00	BU66T1500	163,3	7,7	10,2	12,7	0,6
160,0	QBAR04439	164,47x7,00	BU66T1600	173,3	7,7	10,2	12,7	0,6
180,0	QBAR04442	183,52x7,00	BU66T1800	193,3	7,7	10,2	12,7	0,6
200,0	QBAR04445	202,57x7,00	BU66T2000	213,3	7,7	10,2	12,7	0,6

Further sizes on request!
Materials for QUAD-RING® Seals, for rotary applications see ordering example on page 25.

Ordering Example

X-sel® QUAD-RING®Seal and Back-up Ring for rod diameter d_5 = 50,0 mm
Application: Rotary installation (rotating)

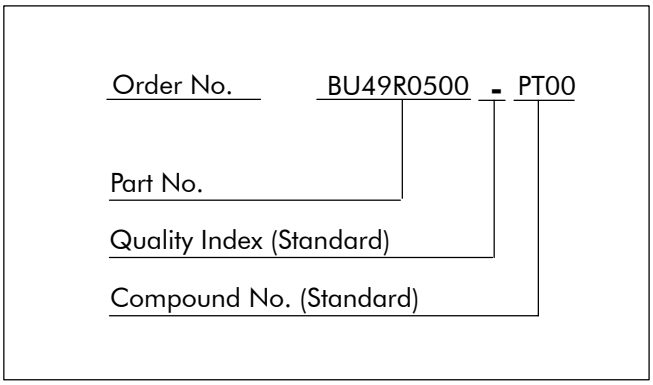
QUAD-RING®Seal according to AS 568 A
Dimensions: Inside diameter d_1 = 53,34 mm
Cord diameter W = 5,33 mm
Compound: NBR 70
(Acrylonitrile Butadiene Elastomer, 70 Shore A)



Order No., QUAD-RING®Seal dimensions and installation dimensions see Table IX, page 23 - 24.
Standard compound NBR with X-sel® coating.
Further indications about rotary installation see page 6.

The X-sel® coating is indicated by letter B in the second position of Order No.

Back-up Ring, type BU (uncut) fitted for QUAD-RING®Seal cord diameter W = 5,33 mm and rod diameter d_5 = 50,0 mm
Compound: PTFE (Polytetrafluoroethylene)



Order No. and installation dimensions see Table IX, page 23 - 24.
Standard compound PTFE.
Further indications about Back-up Rings see catalogue "Back-up Rings".

As well as the above method, you may continue to order using old part numbers or by dimension showing material and shore hardness details.

Storage

(The notes in *italics* only apply to elastomeric sealing materials)

Seals and bearings are often stored as spare parts for prolonged periods. With a few simple precautions, the shelf life of these products can be considerably lengthened.
Seals and bearings should be stored where they are safe from damage by external influences. Deformation, in particular, should be avoided during storage.

Under the influence of various external factors e.g. heat, moisture, light, oxygen, ozone and as a result of contact with liquid media, the properties of certain materials may change. For example, deformation, ageing and weathering can cause deterioration of the original mechanical and physical properties, depending on the material and shape of the parts.

Fundamental instructions on storage, cleaning and maintenance of elastomer seal elements are described in international standards, such as:

Storage of rubber products: *DIN 7716/BS 3F68:1977*

Maximum age limitation: *MIL-HDBK-695C or MIL-STD-1523A or DIN 9088*

The individual guidelines give several recommendations for the shelf life of elastomers, depending on the material classes.

The following guidelines should be observed to maintain the optimum physical and chemical properties of the parts:

Heat

The ideal temperature for storage is between +5°C/41°F and +25°C/77°F. Direct contact with heaters should be avoided.

Moisture

Parts may be stored dry under normal atmospheric conditions (65% rel. moisture ±10).

Weathering

To protect them against damage, seals and bearings should be kept in the original sealed packaging.

Ozone

Destruction of certain elastomeric sealing materials due to ozone can be caused by the following machines and equipment:

– Mercury discharge lamps

– High voltage equipment

– Electric motors

– Electric spark sources or discharges.

Quality criteria

The cost-effective use of seals and bearings is highly influenced by the quality criteria applied in production. Seals and bearings manufactured by Busak + Shamban are continuously monitored according to strict quality standards from material acquisition through to delivery.

Certification of our production plants in accordance with international standards EN ISO 9000 meets the specific requirements for quality control and management of purchasing, production and marketing functions.

Our quality policy is consistently controlled by strict procedures and guidelines which are implemented within all strategic areas of the company.

All testing of materials and products is performed in accordance with accepted test standards and specifications, e.g. random sample testing in accordance with DIN ISO 2859 part 1/ANSI/ASQC Z 1.4-1993/ MIL-STD- 105 E. Inspection specifications correspond to standards applicable to individual product groups (e.g. for O-Rings: ISO 3601/DIN 3771).

All tests on materials and seal elements are performed according to the relevant international standards and test regulations, such as e.g. the random sample testing in accordance with ISO/DIN 2859 Part 1/MIL-STD-105E or the test of O-Rings to ISO 3601 (DIN 3771).

Our sealing materials are produced free of chlorofluorinated hydrocarbons and carcinogenic elements.

The tenth digit of our part number defines the quality characteristics of the part. A hyphen indicates compliance with standard quality criteria outlined in this catalogue. Customer-specific requirements are indicated by a different symbol in this position. Customers who require special quality criteria should contact their local Busak + Shamban sales office for assistance. We have experience in meeting all Customer quality requirements.