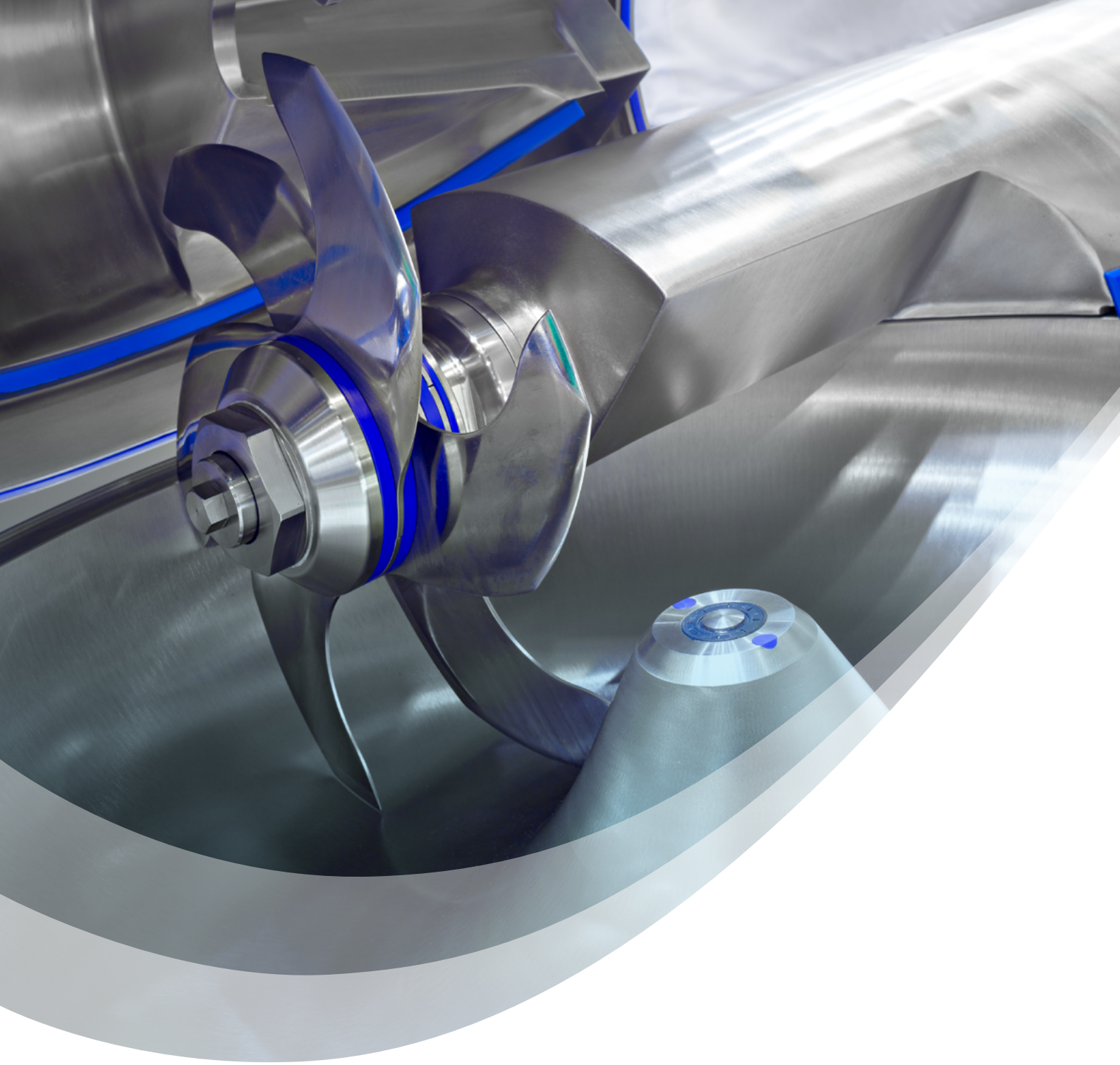


SEALING SOLUTIONS FOR DRIVE SHAFTS IN THE PROCESS INDUSTRY

FREUDENBERG
SEALING TECHNOLOGIES

FREUDENBERG
INNOVATING TOGETHER

TABLE OF CONTENTS

CHALLENGES FOR SEALING SYSTEMS FOR DRIVE SHAFTS IN THE PROCESS INDUSTRY

In our everyday life, we take it for granted that food and beverages are free of germs and have an unadulterated taste. When we use detergents and body care products or take medications, we simply assume that we are holding a high-purity product in our hands. These standards, which are commonplace for us, must be guaranteed for a system manufacturer and operator in the process industry every single day. Due to the many different and often unique features of the systems and processes in the pharmaceutical, food and chemical industries, a sealing system with drive shafts can be challenging. The next page will provide you with an overview. Freudenberg Sealing Technologies has risen to these challenges and developed appropriate sealing solutions that are innovative, functional, and durable.

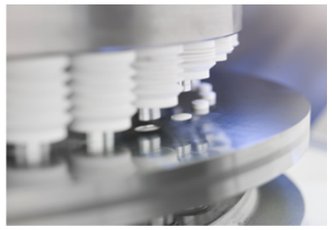
FOOD & BEVERAGE INDUSTRY

The wide variety of different applications in the food and beverage industry, such as bottling plants or mixers, place different demands on the right sealing solution. Radial shaft seals made of specially developed materials such as 70 EPDM 291, 75 Fluoroprene® XP 45 or the high-performance PTFE Y002 conform to the relevant industry-specific standards and can withstand even severe temperature fluctuations and aggressive media. Innovative product designs comply with the Hygienic Design Standards and ensure reliable sealing free of dead space even under extreme application conditions.

THE CHALLENGES AT A GLANCE:

- Prevention of flavor transfer
- Conformity according to Hygienic Design
- Temperature variations
- Media that contain grease
- Abrasion
- Aggressive CIP/SIP media
- Compliance with food-specific approvals, such as EU (Reg.) 1935/2004, EU (Reg.) 10/2011, FDA §177.2600, NSF 51, GB 4806 and GB 9685

PHARMACEUTICAL INDUSTRY



The purity requirements for the product and the process are extremely high in the pharmaceutical industry. During the synthesis of pharmaceuticals, no germs are allowed to enter the product and no undesirable by-products are allowed to form. Pharma specific applications require radial shaft seals for tablet presses, coaters and filling machines to prevent any contamination. Freudenberg Sealing Technologies has developed radial shaft seals specifically for the pharmaceutical industry that conform to Hygienic Design standards and have pharma-specific approvals.

THE CHALLENGES AT A GLANCE:

- High temperatures and pressures
- Powdery media
- Chemical resistance to various educts and solvents
- Conformity according to Hygienic Design
- Aggressive CIP/SIP media
- Compliance with pharma-specific approvals such as USP Class VI and other relevant approvals such as EU (Reg.) 1935/2004, EU (Reg.) 10/2011, FDA §177.2600, NSF 51, GB 4806 and GB 9685

CHEMICAL INDUSTRY

The chemical industry also relies on a wide variety of different processes, plants and substances. During chemical processing it is important that no harmful substances can escape from the machines. In addition, the sealing materials must be resistant to particularly aggressive, sometimes toxic chemicals and high pressures. For this purpose, Freudenberg Sealing Technologies has developed customized radial shaft seals made of robust and chemically resistant materials that can withstand these challenges.

THE CHALLENGES AT A GLANCE:

- Aggressive and toxic chemicals
- High pressures, temperatures and temperature peaks
- The use of solvents
- Compliance with emission values according to the TA Luft regulation

EVERYTHING FROM A SINGLE SOURCE – YOUR BENEFITS

MATERIAL EXPERTISE

- Extensive expertise in the area of premium quality elastomer and plastic materials
- In-house development and production of high-performance materials with all relevant approvals
- Own accredited test laboratory for analyses
- Extractables and Leachables studies

DESIGN EXPERTISE

- Development and calculation based on the Finite Element Method (FEM)
- Customer-specific solutions according to Hygienic Design

OUR KNOW-HOW on sealing solutions for drive shafts in the process industry

MANUFACTURING EXPERTISE

- Own production sites worldwide
- Production of prototypes without tool costs. Short-term requirements can be met and small series can be made available from original materials by the Freudenberg Xpress® Service

CONSULTING AND SERVICE EXPERTISE

- Expertise on the selection of materials and the hygienic design of sealing solutions
- Application consulting through countless tests (CIP/SIP database) and cooperation with cleaning agent manufacturers
- Global stocking program allows for fast delivery
- Laser marking
- Individual packaging concepts (individual and kit packaging, customer-specific packaging bags)

CHOOSING THE RIGHT SEALING SYSTEM

SELECTION GUIDE ON THE BASIS OF TECHNICAL DETAILS

The values in the table are empirical values and may vary in individual cases.

PRODUCT FAMILY	PRESSURE	SPEED	LOW FRICTION	TEMPERATURE	WITHOUT TOOLING COSTS	HYGIENIC DESIGN VARIANT AVAILABLE	SUITED FOR CIP/SIP PROCESSES	DRY RUNNING PROPERTIES
Simmerring® (See page 8)	Standard version up to 0.5 bar Special design on request	Standard version up to 10 m/s Special design on request	Good	Depending on the material -40 °C to +200 °C / -40 °F to +392 °F Special design on request	Check tool availability in individual cases	—	✓	Good
Simmerring® B2PT (See page 10)	up to 10 bar	up to 30 m/s	Special design	-60 °C to +200 °C / -76 °F to +392 °F	✓	✓	✓	Very good
Simmerring® BlueSeal (See page 12)	Standard version up to 0.3 bar With a support ring up to 2 bar	up to 40 m/s	Excellent	-60 °C to +200 °C / -76 °F to +392 °F	—	✓	✓	Excellent
Simmerring® MSS3 (See page 14)	Standard version up to 0.5 bar Special design on request	Standard version up to 10 m/s Special design on request	Good	Depending on the material -40 °C to +160 °C / -40 °F to +320 °F Special design on request	Check tool availability in individual cases	✓	✓	Relatively good
Radiamatic® HTS II (See page 16)	up to 6 bar	up to 25 m/s	Excellent	-80 °C to +200 °C / -112 °F to +392 °F	✓	✓	✓	Excellent
Gerromatic (See page 18)	up to 10 bar	up to 25 m/s	Very good	-80 °C to +200 °C / -112 °F to +392 °F	✓	✓	✓	Relatively good

Excellent · Good · Yes
Very good · Relatively good · No

Sealing Solutions for Drive Shafts in the Process Industry

CHOOSING THE RIGHT SEALING SYSTEM

SELECTION GUIDE BASED ON AVAILABLE MATERIALS

MATERIAL			PRODUCT FAMILY						CONFORMITIES / APPROVALS									
									FOOD & BEVERAGE INDUSTRY								PHARMA	
MATERIAL NAME	COLOR	CROSS-LINKING / FILLER	SIMMERRING®	SIMMERRING® B2PT	SIMMERRING® BLUESEAL	SIMMERRING® MSS3	RADIAMATIC® HTS II	GERROMATIC	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
70 EPDM 291	black	peroxide	●			●			●	●		●	●	●	●		●	●
70 EPDM 335	black	peroxide	●			●			●	●		●		●	●			
70 NBR 438	black	peroxide	●			●			●	●		●		●	●			
75 Fluoroprene® XP 45	light blue	peroxide	●			●			●	●		●		●	●			
PTFE E202	beige	Ekonol					●	●		●	●	●			●			
PTFE G223	white	Glass					●	●		●	●	●			●	●		
PTFE Y002	beige	Special					●	●		●	●	●		●	●	●	●	●
PTFE G116	white	Glass					●	●		●	●	●			●			
PTFE G224	blue	Special					●	●		●	●	●			●			
Quantum® PTFE F18245	brown	Special		●	●					●	●	●			●			
Quantum® PTFE F53722	white-opaque	Glass		●	●					●	●	●			●			

PRODUCT PORTFOLIO

SIMMERRING®

Our customers appreciate the Simmerring® as a flexible, highly resilient and reliable radial shaft seal. It is available in special designs made of elastomer materials for use in the process industry that have been developed and certified for direct contact with foods and pharmaceuticals.

BENEFITS AT A GLANCE:

- High media resistance
- Many tools available in standard dimensions
- Adaptable to customer-specific requirements

DESIGN FORMS

BAUM

Friction-optimized standard design with a rubberized outer sleeve

BAUMSL

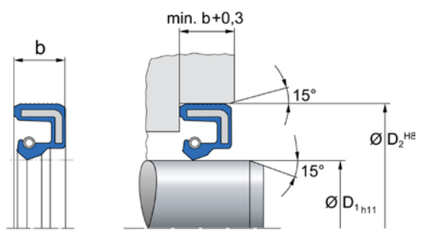
BAUM with a protective lip for heavily soiled environments

BAC

Partially or fully encapsulated Simmerring® for even higher hygiene requirements

INSTALLATION SPACE

Schematic diagram – valid for all Simmerring® designs



AVAILABLE MATERIALS

MATERIAL						CONFORMITIES / APPROVALS								
						FOOD & BEVERAGE INDUSTRY								PHARMA
MATERIAL NAME	COLOR	CROSS-LINKING	TEMPERATURE	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
70 EPDM 291	black	peroxide	-40 °C to +150 °C / -40 °F to +302 °F	• Suited for CIP/SIP • Outstanding durability in contact with water and aqueous systems	✓	●	●		●	●	●	●		●	●
70 EPDM 335	black	peroxide	-40 °C to +150 °C / -40 °F to +302 °F		✓	●	●		●		●	●			
70 NBR 438	black	peroxide	-25 °C to +100 °C / -13 °F to +212 °F	• Suited for CIP/SIP • Very good wear properties	✓	●	●		●		●	●			
75 Fluoroprene® XP 45	light blue	peroxide	-15 °C to +200 °C / +5 °F to +392 °F	• Suited for CIP/SIP • Excellent resistance at higher temperatures and/or with greasy contents	✓	●	●		●		●	●			

SIMMERRING® B2PT

The Simmerring® B2PT PTFE radial shaft seal was developed for higher pressures and can be used under extreme thermal and chemical loads, in dry running, inadequate lubrication or stick-slip free operations. The metal housing is made of 1.4571 (V4A) stainless steel and the sealing lip is made of a high-performance PTFE compound. The design and PTFE compound can be adapted to meet customer-specific requirements.

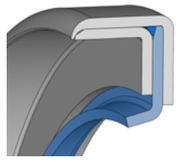
BENEFITS AT A GLANCE:

- Very good thermal and chemical resistance
- Adaptable to customer-specific requirements

DESIGN FORMS

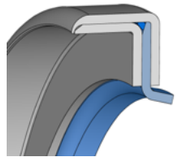
B2PT

Designed for extreme thermal and chemical loads



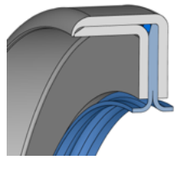
B2PT Hygienic

For increased hygiene requirements



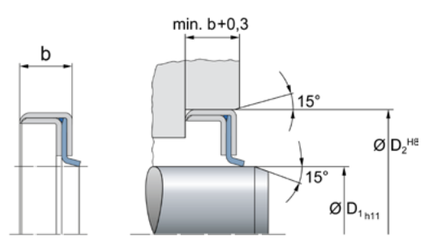
B2PT Split

Comes with an additional dust lip



INSTALLATION SPACE

Schematic diagram – valid for all Simmerring® B2PT designs



AVAILABLE MATERIALS

MATERIAL						CONFORMITIES / APPROVALS								
						FOOD & BEVERAGE INDUSTRY							PHARMA	
MATERIAL NAME	COLOR	FILLER	TEMPERATURE	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
Quantum® PTFE F18245	brown	Special	-60 °C to +260 °C / -76 °F to +500 °F	Suited for CIP/SIP	✓		●	●	●			●			
Quantum® PTFE F53722	white-opaque	Glass	-150 °C to +260 °C / -238 °F to +500 °F	• Suited for CIP/SIP • Excellent wear properties	✓		●	●	●			●			

SIMMERRING® BLUESEAL

The Simmerring® BlueSeal is particularly well suited for applications with low lubrication, high speeds, extreme temperature conditions or aggressive media. The design and PTFE compound can be adapted specifically to the conditions in the customer's application.

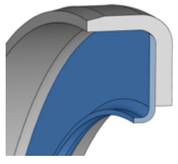
BENEFITS AT A GLANCE:

- High thermal and chemical resistance
- Friction optimized PTFE lip design
- Adaptable to customer-specific requirements

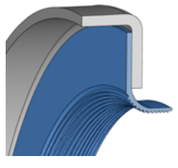
DESIGN FORMS

BlueSeal BA
Standard version

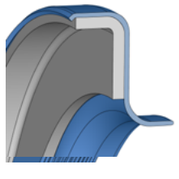
BlueSeal B1
Standard version with a metallic adhesive part



BlueSeal B1 Reverse
With a metallic outer sheath

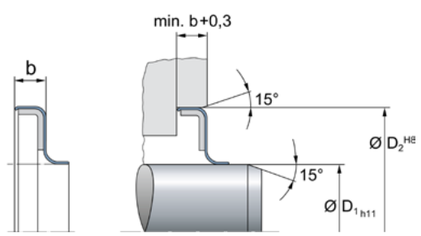


BlueSeal BA Reverse Hygienic Design
Version with a PTFE outer sheath in "Reverse Lip Design"



INSTALLATION SPACE

Schematic diagram – valid for all Simmerring® BlueSeal designs



AVAILABLE MATERIALS

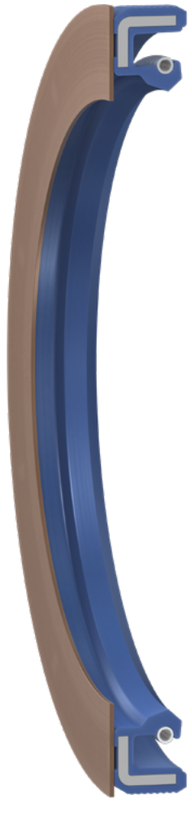
MATERIAL						CONFORMITIES / APPROVALS								
						FOOD & BEVERAGE INDUSTRY							PHARMA	
MATERIAL NAME	COLOR	FILLER	TEMPERATURE	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
Quantum® PTFE F18245	brown	Special	-60 °C to +260 °C / -76 °F to +500 °F	Suited for CIP/SIP	✓		●	●	●			●			
Quantum® PTFE F53722	white-opaque	Glass	-150 °C to +260 °C / -238 °F to +500 °F	• Suited for CIP/SIP • Excellent wear properties	✓		●	●	●			●			

SIMMERRING® MSS3

The Simmerring® MSS3 is based on the design of the proven standard Simmerring® and is available with or without a dust lip. The additional PTFE lip provides protection against aggressive media and is suited for direct contact with food and pharmaceuticals using Freudenberg food contact approved PTFE compounds.

BENEFITS AT A GLANCE:

- Combination of non-food & beverage standard catalog articles with a food grade PTFE lip
- Available very quickly
- Adaptable to customer-specific requirements
- Many tools available in standard dimensions



DESIGN FORMS

MSS3

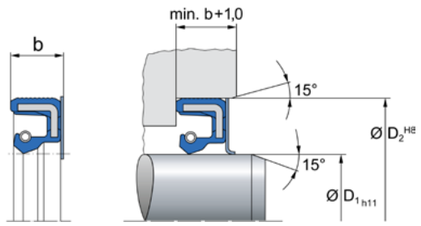
Modified standard design BA with a special fleece glued on or a PTFE disk as a protective lip for the finest dirt accumulation

MSS3 Hygienic Design

A PTFE disk covers the Simmerring® hygienically without any dead space

INSTALLATION SPACE

Schematic diagram – valid for all Simmerring® MSS3 designs



AVAILABLE MATERIALS

MATERIAL						APPROVALS / CONFORMITIES								
						FOOD & BEVERAGE INDUSTRY								PHARMA
MATERIAL NAME	COLOR	CROSS-LINKING / FILLER	TEMPERATURE (operating temperatures depend on the elastomer)	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A) (Catalog product available in DC04 steel)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
70 EPDM 291	black	peroxide	-40 °C to +150 °C / -40 °F to +302 °F	• Suited for CIP/SIP • Outstanding resistance to water and aqueous systems	✓	●	●		●	●	●	●		●	●
70 EPDM 335	black	peroxide	-40 °C to +150 °C / -40 °F to +302 °F		✓	●	●		●		●	●			
70 NBR 438	black	peroxide	-25 °C to +100 °C / -13 °F to +212 °F	• Suited for CIP/SIP • Very good wear properties	✓	●	●		●		●	●			
75 Fluoroprene® XP 45	light blue	peroxide	-15 °C to +200 °C / +5 °F to +392 °F	• Suited for CIP/SIP • Excellent resistance at higher temperatures and/or with greasy contents	✓	●	●		●		●	●			
Quantum® PTFE F18245	brown	Special	-60 °C to +260 °C / -76 °F to +500 °F	Suited for CIP/SIP	✓		●	●	●			●			
Quantum® PTFE F53722	white-opaque	Glass	-150 °C to +260 °C / -238 °F to +500 °F	• Suited for CIP/SIP • Very good wear properties	✓		●	●	●			●			

RADIAMATIC® HTS II

The Radiamatic® HTS II is a high-performance radial shaft seal made of PTFE that was developed specifically for the process industry. In addition to its high resistance, it is characterized by low friction and contact pressure forces of the lip on the shaft. The contact pressure is generated by the back-forming forces in the sealing lip joint in conjunction with the plastic memory effect of PTFE. This arrangement minimizes friction and at the same time provides excellent sealing. All versions with two sealing lips are also available as Hygienic Design versions.

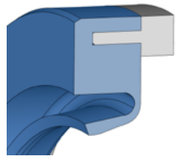
BENEFITS AT A GLANCE:

- Low contact forces of the sealing lip ensure low friction and therefore low heat input
- Anti-adhesive
- The media only comes into contact with food-grade PTFE compounds
- High media and temperature resistance
- Secure fit through clamping ring technology

DESIGN FORMS

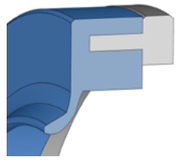
HTS II 9535

With standard lip for a variety of applications



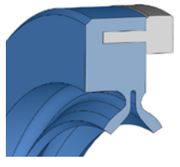
HTS II 9539 VL

Hygienic Design – dead space free version due to a protruding sealing lip



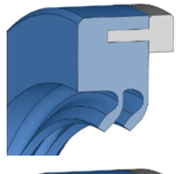
HTS II 9536 SL

With an additional dust lip for heavily soiled environments or alternating pressure-vacuum operation



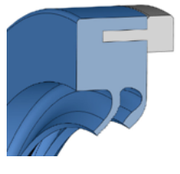
HTS II 9538 DL

Double lip version to meet the highest demands on tightness



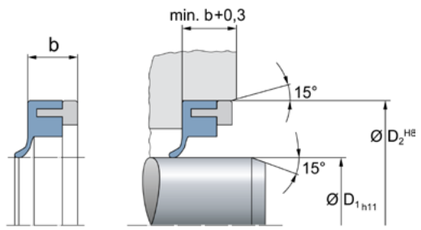
HTS II 9541 with a twist

With dynamic return capability for increased demands on tightness



INSTALLATION SPACE

Schematic diagram – valid for all Radiamatic® HTS II designs



AVAILABLE MATERIALS

MATERIAL						APPROVALS / CONFORMITIES									
						FOOD & BEVERAGE INDUSTRY								PHARMA	
MATERIAL NAME	COLOR	FILLER	TEMPERATURE	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A) (special materials available on request)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
PTFE Y002	beige	Special	-80 °C to +200 °C / -112 °F to +392 °F	• Good dry running properties • For soft mating surfaces • Conditionally suitable for water	✓		●	●	●		●	●	●	●	●
PTFE G224	blue	Special	-80 °C to +200 °C / -112 °F to +392 °F	• Needs hard mating surfaces • Suited for use with water	✓		●	●	●			●			
PTFE G223	white	Glass	-80 °C to +200 °C / -112 °F to +392 °F	• Needs hard mating surfaces • Suited for use with water	✓		●	●	●			●	●		
PTFE G116	white	Glass	-80 °C to +200 °C / -112 °F to +392 °F	For soft mating surfaces	✓		●	●	●			●			
PTFE E202	beige	Ekonol	-80 °C to +200 °C / -112 °F to +392 °F	• Good dry running properties • For soft mating surfaces	✓		●	●	●			●			

GERROMATIC

The development of the PTFE radial shaft seal Gerromatic combines analogies from nature with the precision of today's manufacturing processes. Like a water strider, the wave-shaped sealing lip is capable of distributing even high pressure in such a way that the structure is maintained. The seemingly effortless gliding of a water runner with minimal effort and friction can be transferred to a certain extent to the hard contact of the sealing lip with the shaft. The result is minimal heat generation and therefore minimal influence on the process material.

BENEFITS AT A GLANCE:

- Highest tightness for wet running
- High operating pressure up to 10 bar possible
- Excellent wear behavior
- Gentle to the process due to low frictional heat of the seal
- High media and temperature resistance
- Flexible adaptation to the installation space without any tool costs
- Secure, self-retaining fit in the housing

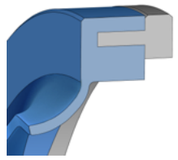
DESIGN FORMS

Gerromatic G61

Standard version for pressurized applications

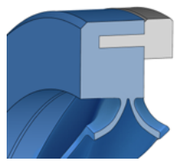
Gerromatic G69 VL

Hygienic Design – dead space free version due to a protruding sealing lip



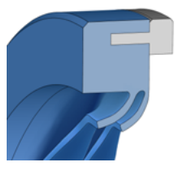
Gerromatic G62 SL

Comes with an additional dust lip for heavily soiled environments or alternating pressure-vacuum operation



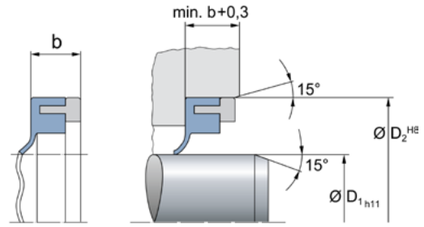
Gerromatic G68

Comes with a double sealing lip for high safety requirements



INSTALLATION SPACE

Schematic diagram – valid for all Gerromatic designs



AVAILABLE MATERIALS

MATERIAL						APPROVALS / CONFORMITIES									
						FOOD & BEVERAGE INDUSTRY								PHARMA	
MATERIAL NAME	COLOR	FILLER	TEMPERATURE	PROPERTIES	METAL MATERIAL STAINLESS STEEL 1.4571 (V4A) (special materials available on request)	EU (REG.) 1935/2004	EU (REG.) 2023/2006	EU (REG.) 10/2011	FDA	NSF 51	3-A® SANITARY STANDARDS	ADI FREE	GB 4806 / GB 9685	USP CLASS VI CH. 88 (IN VIVO)	USP CHAPTER 87 (IN VITRO)
PTFE Y002	beige	Special	-80 °C to +200 °C / -112 °F to +392 °F	• Good dry running properties • For soft mating surfaces • Conditionally suitable for water	✓		●	●	●		●	●	●	●	●
PTFE G224	blue	Special	-80 °C to +200 °C / -112 °F to +392 °F	• Needs hard mating surfaces • Suited for use with water	✓		●	●	●			●			
PTFE G223	white	Glass	-80 °C to +200 °C / -112 °F to +392 °F	• Needs hard mating surfaces • Suited for use with water	✓		●	●	●			●	●		
PTFE G116	white	Glass	-80 °C to +200 °C / -112 °F to +392 °F	For soft mating surfaces	✓		●	●	●			●			
PTFE E202	beige	Ekonol	-80 °C to +200 °C / -112 °F to +392 °F	• Good dry running properties • For soft mating surfaces	✓		●	●	●			●			

Editorial Information

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2020

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