

REDURA[®] ROD SEALING SYSTEMS

**SUPERIOR DESIGNS AND MATERIALS
FOR BEST PERFORMANCE**





REDURA® ROD SEALING SYSTEMS

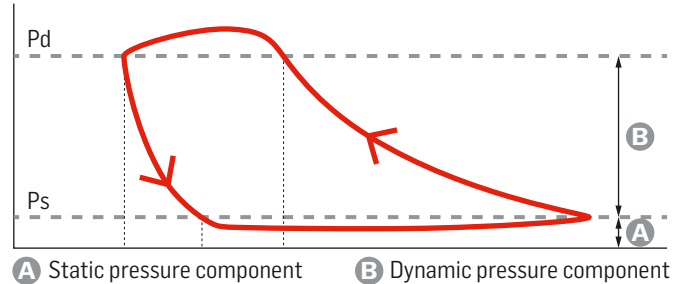
DECADES OF EXPERIENCE IN HIGH-PERFORMANCE SEALING SYSTEMS

BURCKHARDT COMPRESSION

As a compressor OEM with more than 170 years of experience, Burckhardt Compression has been setting standards for piston rod packings and packing rings for decades. Patented designs developed in-house and exhaustive material research are the perfect recipe for unique high-performance piston rod sealing systems. This vast in-house tribology and material know-how forms the basis for the comprehensive Redura® product line for rings & packings.

PACKINGS FOR EVERY APPLICATION AND DESIGN

Burckhardt Compression's sealing philosophy is based on the operational behavior of gastight friction seals. Packing rings are typically subject to a combination of static and dynamic pressure components. This has led to the design of heterogeneous sealing systems, where pressure breakers buffer the dynamic pressure component in order to enable the subsequent sealing elements to reliably seal the gas compression chamber and minimize the leakage rate, which is influenced by the static pressure. Depending on the required performance, the heterogeneous combination of pressure breakers, support rings and true seal elements is employed to provide ideal sealing performance and longest lifetime.



Burckhardt Compression provides various packing types for every application as well as packing ring designs, from enhanced classical rings to specifically in-house developed and patented rings.

REDURA® ROD PACKINGS & PACKING RINGS

With Redura® Burckhardt Compression provides a comprehensive product line of rings & packings for reciprocating compressors. It stands for reliable, durable and advanced sealing elements. The product line includes standard rings, packings as well as specifically in-house developed, designed and patented products. Redura® rings & packings are characterized by

- Longest MTBO (mean time between overhaul) at lowest leakage
- Highest availability
- Lowest life cycle costs



HIGH-PERFORMANCE SEALING SYSTEMS FOR EVERY APPLICATION

APPLICATIONS



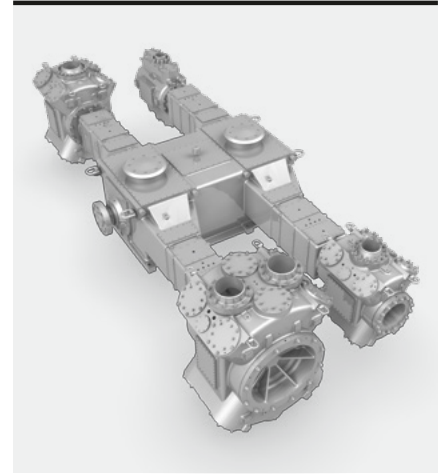
- Upstream oil & gas
- Gas transport & storage
- Refinery
- Petrochemical/Chemical industry
- Industrial gases
- Food & beverage industry
- Wood & charcoal industry
- Mining industry
- Power stations
- Hydro-electric power plants
- Nuclear power plants

GASES



- Hydrogen, nitrogen, argon, helium
- Hydrocarbons, ethylene, ethylene oxides
- Chlorine, ammonia
- Air, oxygen
- Nitrous oxides, carbon dioxide, carbon monoxide, sulfur dioxide
- Hydrogen sulphide, hydrogen chloride, sulfur hexafluorides, vinyl chlorides

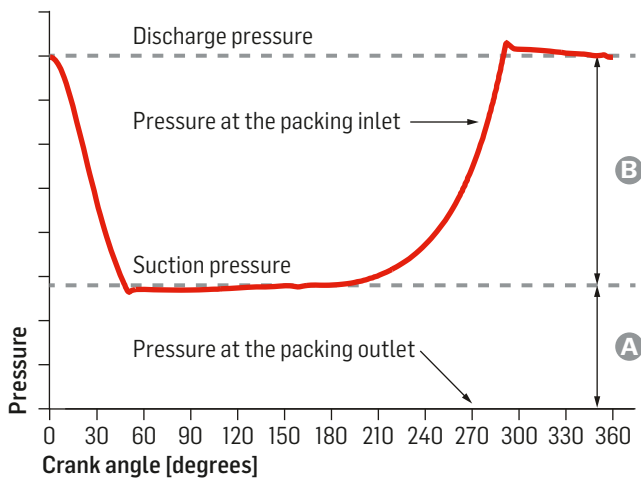
COMPRESSOR DESIGNS AND SIZES



- Lubricated and non-lubricated
- Cooled and non-cooled
- Horizontal, vertical and inclined
- Rod diameters up to 250 mm (9.84 in)

HETEROGENEOUS ROD SEALING SYSTEMS FOR BEST PERFORMANCE

Burckhardt Compression's sealing philosophy is based on the operational behaviour of gastight friction seals. Since as early as 1993 we have been constantly measuring and analysing pressure distributions of dry running packings. Packings are typically subject to a combination of static and dynamic pressure components.



A Static pressure difference **B** Dynamic pressure difference

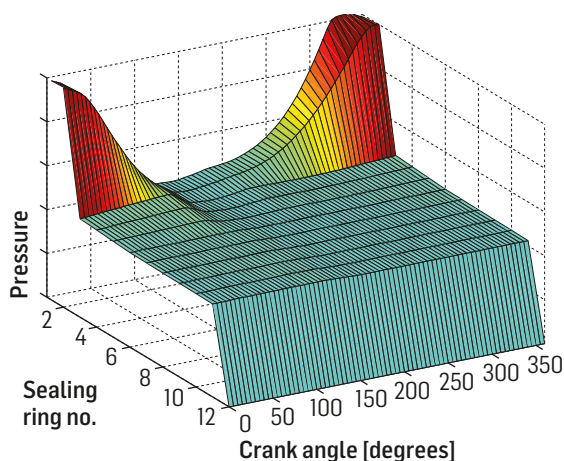
The two pressure components differ considerably in terms of their influence on the sealing system's behaviour:

- Dynamic pressure component results in a high degree of wear, failure by fracture or creep
- Static pressure difference is the primary load parameter influencing the leakage rate

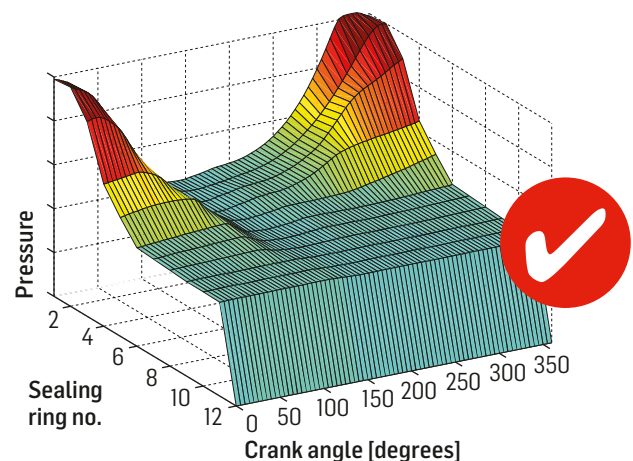
The distribution of the two pressure components among various sealing elements is used to optimize sealing systems:

- Pressure relieved or sealing elements with defined wear limit in the vicinity of the compression chamber to buffer the dynamic pressure difference.
- Subsequent gastight sealing elements are used to handle the static pressure.

Sealing systems designed by Burckhardt Compression typically consist of at least two different sealing element designs to ensure optimized pressure distribution.



Standard distribution of two pressure components among the various sealing elements



Optimized pressure distribution of a heterogeneous sealing system distributes dynamic pressure and reduces pressure difference for each element

REDURA® ROD SEALING SYSTEMS

PUSHING THE LIMITS



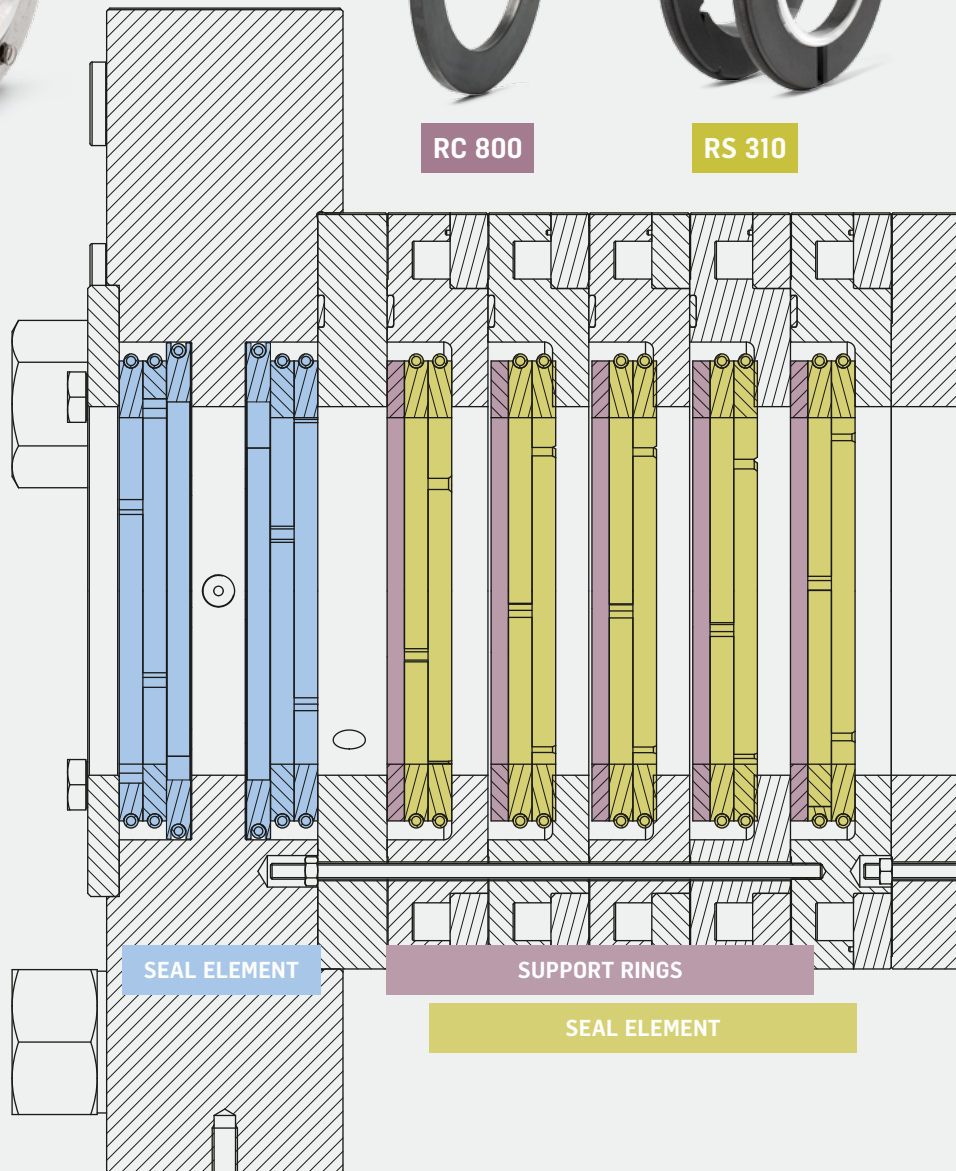
RS 900



RC 800



RS 310

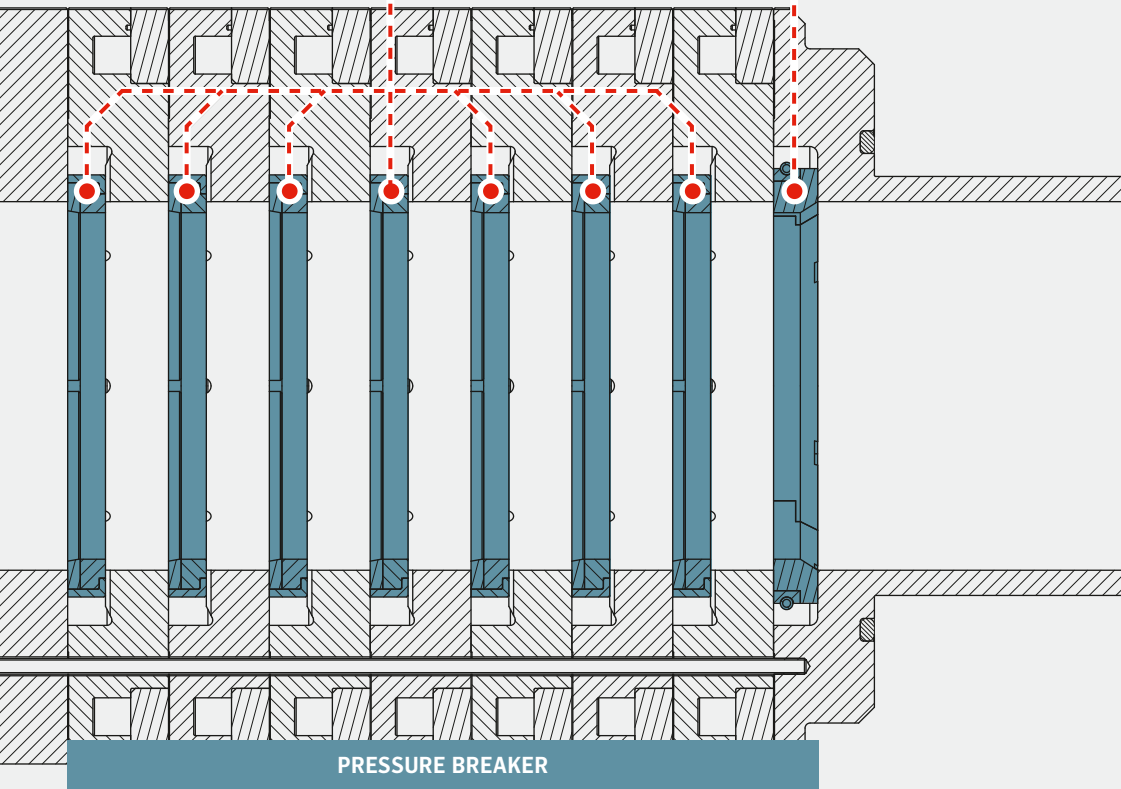




RB 200



RB 110



REDURA® PACKING RINGS

EACH ONE A CHAMPION IN ITS DISCIPLINE



PRESSURE BREAKER			
	RB 110	RB 200	RB 210
	Elaborate pressure breaker, compact and robust design for high pressure applications	High performance triple circle ring with optimized durability for dry running systems	Robust pressure breaker with optimized contact surface and defined wear limit
DESCRIPTION	<ul style="list-style-type: none"> In-house developed and patented pressure breaker (type D3) Withstands the dynamic pressure component and protects the subsequent sealing rings 	<ul style="list-style-type: none"> In-house developed triple circle ring (type EVO) Withstands the dynamic pressure component, and protects the subsequent sealing rings 	<ul style="list-style-type: none"> In-house developed crown ring Withstands the dynamic pressure component, and protects the subsequent sealing rings
DESIGN	<ul style="list-style-type: none"> 3-segment ring, step-cut joint, radial cover ring, 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter 	<ul style="list-style-type: none"> Optimized tension ring geometry and anti-rotation device Optimized profile and material Integrated support ring 30 mm–130 mm (1.18 in–5.12 in) piston rod diameter 	<ul style="list-style-type: none"> 3-segment ring, tangential to inner diameter joint, pressure relieved Optimized contact surface Defined wear limit Two phase sealing (contact seal followed by frictionless seal), No cover ring needed 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter
APPLICATION	<ul style="list-style-type: none"> Dry running systems Lubricated systems All gases Multi-purpose ring Up to 560 bara (8'120 psia; non-metallic) 	<ul style="list-style-type: none"> Highly loaded dry running systems Up to 140 bara (2'030 psia) 	<ul style="list-style-type: none"> Dry running systems up to 75 bara (1'090 psia) Lubricated systems up to 560 bara (8'120 psia; non-metallic) All gas types
SPECIFIC PROPERTIES	<ul style="list-style-type: none"> Dynamic pressure distributor Optimized running in, light tight, compact design Cooled or non-cooled packings Rigid design Combined with packing rings, i.e. Redura® RS type for optimized sealing systems 	<ul style="list-style-type: none"> Dynamic pressure distributor Cooling needed Lower running in temperatures Combined with packing rings, i.e. Redura® RS type for optimized sealing systems 	<ul style="list-style-type: none"> Dynamic pressure distributor Always support ring required Cooling needed Robust design Low friction temperatures after running in Combined with packing rings, i.e. Redura® RS type for optimized sealing systems

¹ LEAKAGE TIGHTNESS RATING Minimum: * Maximum: ****



SEALING RING

RB 410

RS 300

RS 310

Extremely compact pressure breaker, for cooled or non-cooled packings with compact cross section

Well established sealing element for lubricated systems designed to provide remarkable sealing efficiency

Very robust sealing element for dry running systems, specific design for extended life time

- In-house developed and patented twin packing ring
- Withstands the dynamic pressure component, and protects the subsequent sealing rings

- 3/6-piece classic sealing element
- Radial/tangential cut with bridge segment
- Highly efficient piston rod sealing element to handle static pressure and avoid gas leakage

- 3/3-piece classic sealing element
- Radial/penguin cut
- Highly efficient piston rod sealing element to handle static pressure and avoid gas leakage

- 1-piece ring, step-cut joint, radial cover ring
- 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter

- Sealing ring pair with 6 piece sealing ring and 3 piece cover ring
- 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter

- Sealing ring pair with 3-piece sealing ring and 3-piece cover ring
- Tangential penguin cut
- 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter

- Dry running systems
- Lubricated systems
- High molecular weight gases
- Compact cross-section (no additional cover ring needed)

- Lubricated systems
- All gases

- Dry running systems
- All gases

- Dynamic pressure distributor
- Cooled and non-cooled packings
- Combined with packing rings, i.e. Redura® RS type for optimized sealing systems

- Usually combined with support ring
- Improved by special Burckhardt Compression material combinations for high pressure application
- Outstanding sealing efficiency
- Combined with packing rings, i.e. Redura® RB type for optimized sealing systems

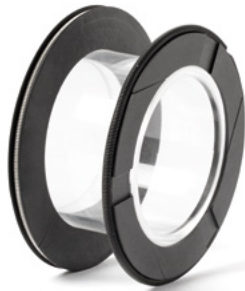
- Pressure distribution among several rings
- Usually combined with support ring
- Special Burckhardt Compression design features allow the complete wear of the segments and therefore a remarkably prolonged lifetime
- Combined with packing rings, i.e. Redura® RB type for optimized sealing systems

LEAKAGE TIGHTNESS RATING¹

Newly installed: ***
After extensive use: **

LEAKAGE TIGHTNESS RATING¹

Newly installed: **
After extensive use: *



	RS 400	SUPPORT RINGS RC 800 / 810	SEAL ELEMENT RS 900	
	Space saving sealing ring, with extremely compact cross section	High quality support rings prevent mechanical damage of packing rings	Extremely reliable sealing element with maximum sealing efficiency for low pressure differences	
	<ul style="list-style-type: none"> • Classical sealing element (TID ring) • Highly efficient piston rod sealing element to handle static pressure and avoid gas leakage 	<ul style="list-style-type: none"> • Back-up ring • Prevents the non-metallic sealing rings from extruding into the gap between the piston rod and the packing cup 	<ul style="list-style-type: none"> • Sealing element for low pressure differences • Plate activated by coil springs 	DESCRIPTION
	<ul style="list-style-type: none"> • 3-piece ring with tangential cut to the inner diameter • 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter 	<ul style="list-style-type: none"> • RC 800: endless 1-piece ring design • RC 810: multiple piece radial cut • 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter 	<ul style="list-style-type: none"> • Axially preloaded sealing ring pair with double 3-piece sealing ring • 30 mm–250 mm (1.18 in–9.84 in) piston rod diameter 	DESIGN
	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • All gases • Compact cross-section (no additional cover ring needed) space-saving 	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • All gases • Combination with pressure breaker RB 210 and several RS type sealing rings 	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • All gases 	APPLICATION
	<ul style="list-style-type: none"> • Support ring needed • Combined with packing rings, i.e.Redura® RB type for optimized sealing systems 	<ul style="list-style-type: none"> • 1-piece ring design limits the maximal packing leakage 	<ul style="list-style-type: none"> • Sealing element for low pressure difference needs an additional load to prevent them from being lifted from their sealing surface. Burckhardt Compression uses a coil springs activated plate. Practical experience has shown that this avoids self-locking of the rings • Harmonized radial and axial pre-load 	SPECIFIC PROPERTIES
	LEAKAGE TIGHTNESS RATING¹ Newly installed: **** After extensive use: **		LEAKAGE TIGHTNESS RATING¹ Newly installed: **** After extensive use: ***	



**EFFICIENCY AND
LONGEST MTBO**

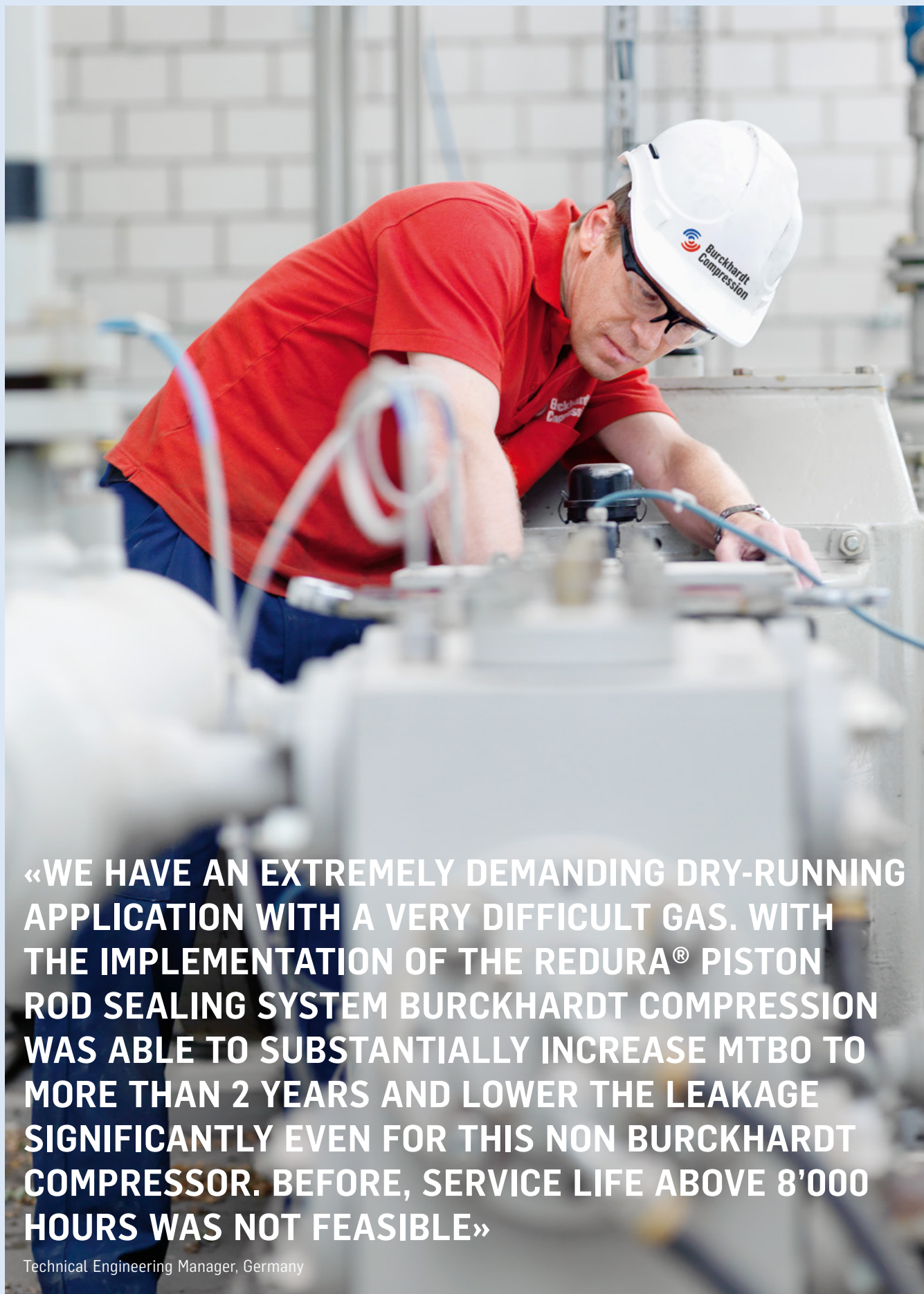


THE IDEAL COMBINATION AND HETEROGENEOUS ARRANGEMENT OF THE SPECIFIC PACKING RINGS ALLOWS OPTIMAL SEALING EFFICIENCY AND LONGEST MTBO FOR EVERY APPLICATION.

MORE TYPES



ADDITIONAL PACKING RING TYPES IN DIFFERENT DESIGNS AND CUTS ARE AVAILABLE.



«WE HAVE AN EXTREMELY DEMANDING DRY-RUNNING APPLICATION WITH A VERY DIFFICULT GAS. WITH THE IMPLEMENTATION OF THE REDURA® PISTON ROD SEALING SYSTEM BURCKHARDT COMPRESSION WAS ABLE TO SUBSTANTIALLY INCREASE MTBO TO MORE THAN 2 YEARS AND LOWER THE LEAKAGE SIGNIFICANTLY EVEN FOR THIS NON BURCKHARDT COMPRESSOR. BEFORE, SERVICE LIFE ABOVE 8'000 HOURS WAS NOT FEASIBLE»

Technical Engineering Manager, Germany

APPLICATION ENGINEERING

TAILOR-MADE SYSTEM DESIGN FOR BEST PERFORMANCE

SYSTEM DESIGN

- Complete rod sealing system design
- Design solutions for every application
- Careful concept evaluation and selection based on individual specifications
- Material selection
- In-house production capabilities for all ring designs and materials

Tailor-made solutions by experienced application engineers utilizing a proprietary, highly sophisticated software program incorporating a vast range of decisive parameters based on decades of field experience.



MATERIALS

For piston rod sealing elements, pressure breakers, anti-extrusion rings, true sealing rings and side loaded elements; the following materials are primarily used:

- PTFE-compounds (with appropriate fillers)
- High temperature polymers (e.g. PEEK, PI with appropriate fillers)
- Polymer blends (dry running applications)
- Synthetic coals
- Own developed materials
- Bronze and sintered metals

For flange and packing cups: Alloyed steel, stainless steel.



REDURA® ROD PACKING CASES

MINIMAL LEAKAGE AND LONGEST LIFETIME

REDURA® ROD PACKING CASES



The packing cases accommodate the heterogeneous combinations of piston rod sealing elements that float within precisely machined chambers to provide ideal sealing function, minimal friction and longest lifetime.

Thanks to our vast OEM in-house production capabilities the packings comply with the highest quality standards:

- Special material selection for cups and flanges
- Precision-machining of cups and flanges
- Precision-grinding and lapping of the sealing surfaces
- Designed to meet the latest API 618 standards

REDURA® COOLED ROD SEALING SYSTEMS



Plastic sealing elements are influenced by the temperature, not only in terms of physical and mechanical properties but also in terms of tribological characteristics of friction and wear. A rise in counter surface temperature directly increases the wear rate of the sealing element. Therefore effective heat removal is crucial for high sealing efficiency, low wear and longest MTBO.

- Various cooling systems are designed and manufactured:
- Enclosed cooling channels
 - Open cooling channel
 - Longitudinal cooling¹
 - Cooling jacket

¹not for sale in the US

REDURA® INTERMEDIATE PACKING



Secondary seal to prevent leakage of gas from the main packing or inert gas from the distance piece to the crankcase. For intermediate packings a combination of true sealing rings and side loaded elements is employed.

In case of toxic or explosive gas, additional purging or buffering is applied.

PACKING RECONDITIONING SERVICE

LOWEST LIFE CYCLE COSTS AND HIGHEST AVAILABILITY

To ensure lowest life cycle costs and highest availability, well maintained packings are decisive for compressor performance.

Due to our comprehensive OEM know-how and in-house packing and sealing element production facilities, Burckhardt Compression can service and repair all packing types for all brands. Packings and rings are always handled by experts.

In addition to our standard service, technology up-grade to the latest developments can be executed based on your needs.

PACKING EXCHANGE SERVICE

Upon request we provide a packing exchange service including stock-keeping of the appropriate Redura® packing rings and logistics services.

We recondition your worn packings, prepare these adequately and supply the restored packings in accordance with your compressor service intervals.



SPECIAL SERVICE

- Thorough examination
- Complete disassembly
- Inspection of individual parts
- Recording of main parts condition
- OEM engineering evaluation if required
- Thorough cleaning (glass bead blasting and/or ultrasonic cleaning if necessary)
- Repair and re-machining
- Lapping and grinding of all sealing surfaces
- Dimensional checking
- Replacement of worn and damaged parts with new Burckhardt Compression quality parts
- Careful reassembly
- Quality inspection including pressure testing and cooling jacket testing if necessary
- Corrosion protection and adequate packing



**REDURA®
RINGS & PACKINGS ARE
CHARACTERIZED BY**



LONGEST MTBO
(MEAN TIME BETWEEN
OVERHAUL) AT
LOWEST LEAKAGE



HIGHEST AVAILABILITY



LOWEST LIFE CYCLE COSTS

COMPRESSOR COMPONENTS

BEST PERFORMANCE
AND LONGEST LIFETIME

Compressor valves

Redura® rings & packings

Capacity control systems

Capital parts

Labyrinth piston compressor
components

Hyper secondary compressor
components

SERVICES

THE FULL RANGE

Burckhardt Valve Service

Spare parts logistics

Field service

Technical support

Revamps & upgrades

Component repair

Condition monitoring &
diagnostics

Training

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