

REDURA® PISTON SEALING SYSTEMS

HETEROGENEOUS SYSTEMS
FOR LOWEST LIFE CYCLE COSTS





REDURA® PISTON 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 packings and packing rings for decades. Patented designs developed in-house and extensive material research are the perfect recipe for unique high-performance piston sealing systems. This vast in-house tribology and material know-how forms the basis for the comprehensive product line Redura® for rings and packings.

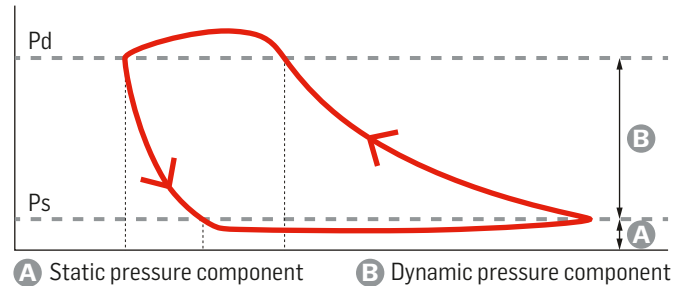
REDURA® PISTON SEALING SYSTEMS

Heterogeneous sealing system designs assure perfect sealing for every compression mode:

- Double acting
- Single acting
- Dual acting

The respective pressure components have a major influence on the design of an efficient piston sealing system.

The importance of the different pressure components and load conditions has led to the development of heterogeneous sealing systems to provide optimal sealing performance and lowest life cycle costs.

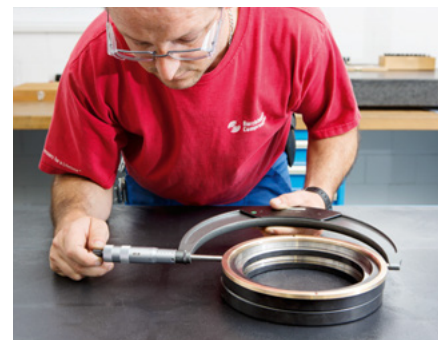


Piston sealing systems consist of an elaborate combination of different piston rings and rider rings. The meticulous combination based on the heterogeneous system approach allows each ring to fully deploy its optimum sealing efficiency while reducing wear to a minimum.

OPTIMIZED SEALING PERFORMANCE

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



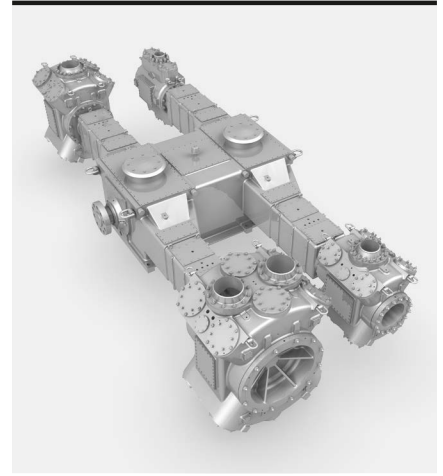
- Upstream oil & gas
- Gas transport & storage
- Refinery
- Petrochemical/Chemical industry
- Industrial gases
- Food & beverage industry
- Wood & charcoal industry
- Mining industry
- Power stations
- Hydro-electric power plants
- Nuclear power plants

GASES



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

COMPRESSOR DESIGNS AND SIZES



- Lubricated and non-lubricated
- Cooled and non-cooled
- Double acting, single acting and dual acting
- Horizontal, vertical and inclined
- Cylinder diameters up to 1'200 mm (47.24 in)

REDURA® PISTON & RIDER RING SYSTEMS

CAREFUL SELECTION, COMBINATION AND ARRANGEMENT MAKE THE DIFFERENCE

DOUBLE ACTING PISTONS



- The piston sealing elements are only subject to the dynamic pressure component varying between the suction and discharge pressure.
- The static pressure component is omitted due to the identical suction pressure at both ends of the piston.
- For challenging applications like double acting compression of hydrogen, sealing rings with improved sealing efficiency are recommended; this ensures longer life and sustained efficiency.
- Robust piston rings are used to protect the true sealing rings from high dynamic pressure.

SINGLE ACTING PISTONS



- Single acting pistons are typically subject to combinations of static and dynamic pressure components.
- The distribution of the two pressure components among various sealing elements can be used to optimize a sealing system by employment of different designs, each possessing the most favorable properties for handling a particular pressure component.
- Robust sealing elements, such as piston rings with a scarf joint or retained piston rings, in the vicinity of the compression chamber to withstand the dynamic pressure component.
- Gastight sealing rings for handling the static pressure.

DUAL ACTING PISTONS



- Dual acting pistons compress gas alternately in both compression chambers (head end and crank end), but not to the same final pressure.
- The different volumes of compression chambers may be used for realizing two different compression stages with a single piston. The lower compression stage at the head end side and the higher compression stage at the crank end side.
- The asymmetric load on either side poses challenges for the optimal ring design and arrangement on the piston. A heterogeneous sealing system based on different designs has shown best results in practice.

REDURA® PISTON SEALING SYSTEMS

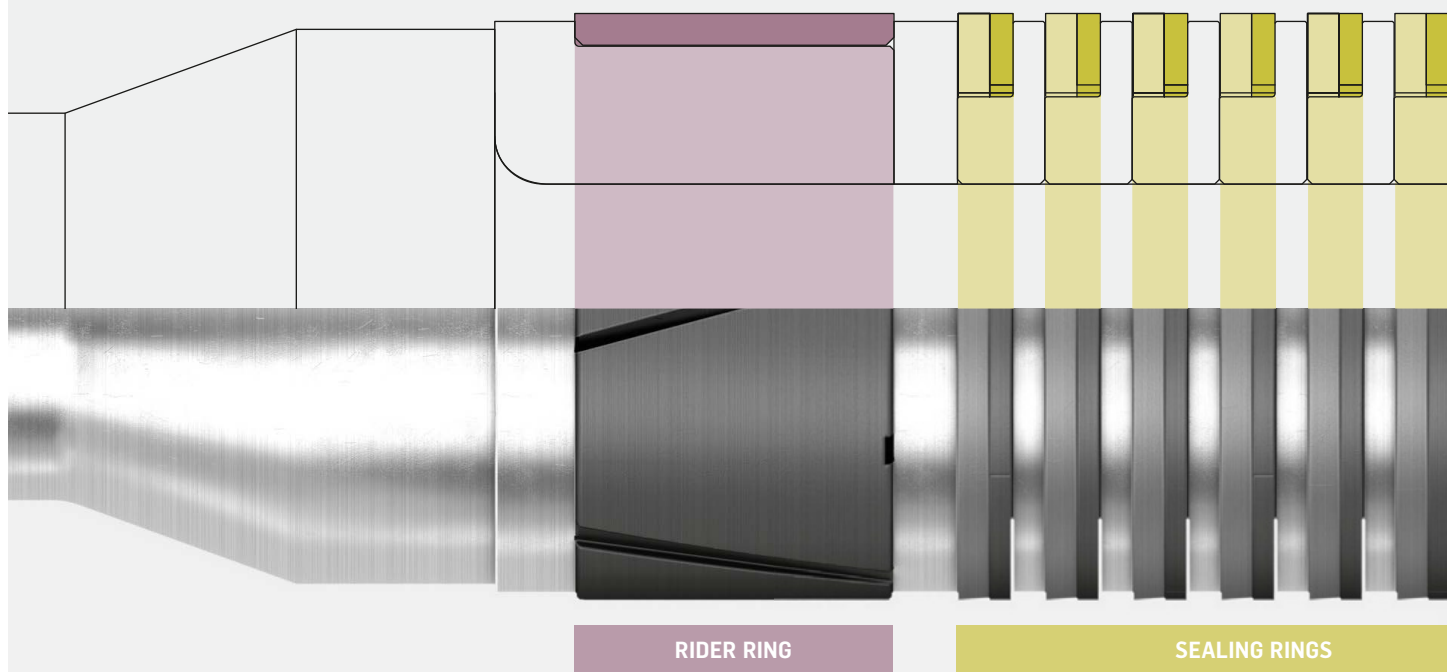
PUSHING THE LIMITS



PG 900

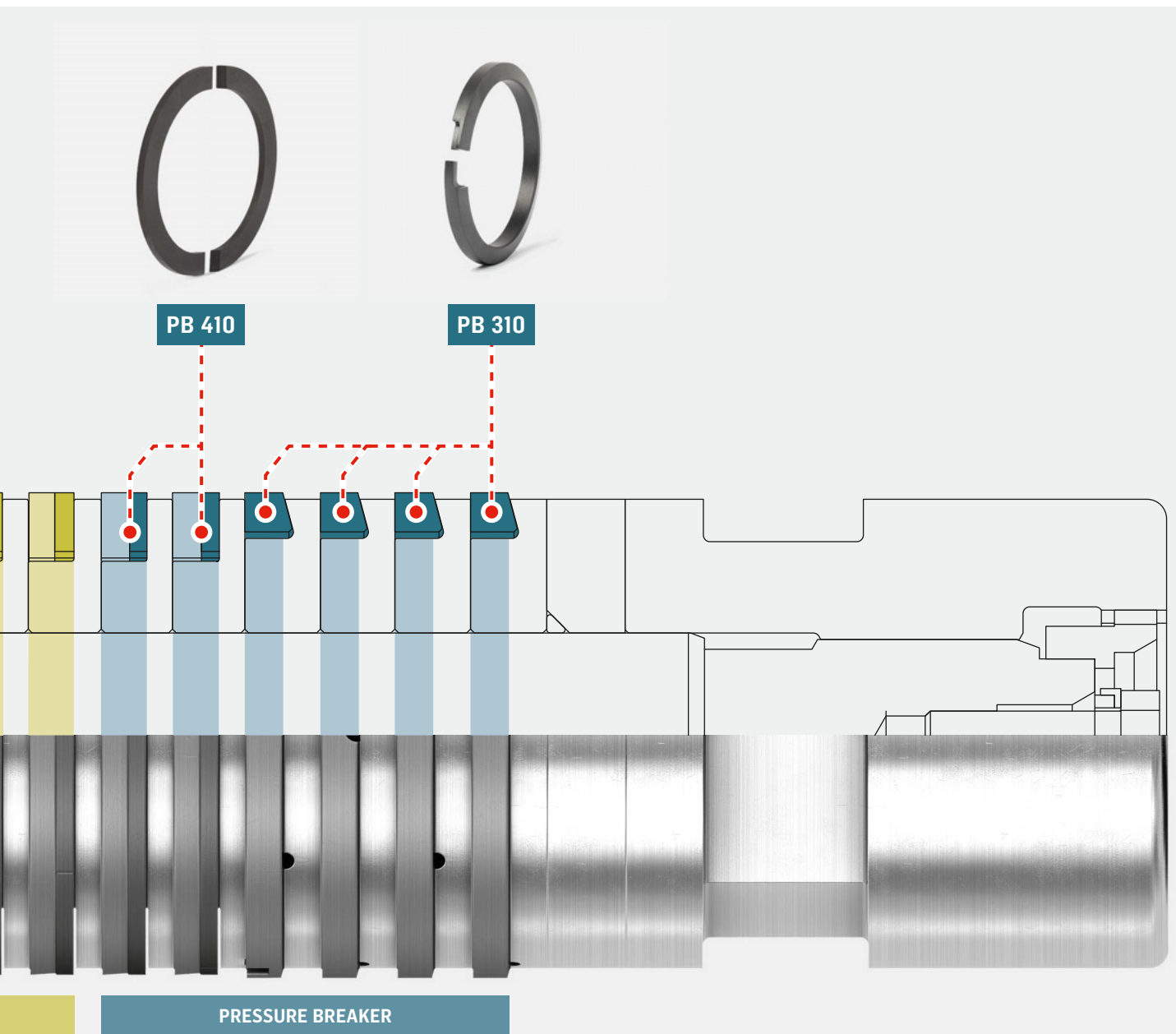


PS 420



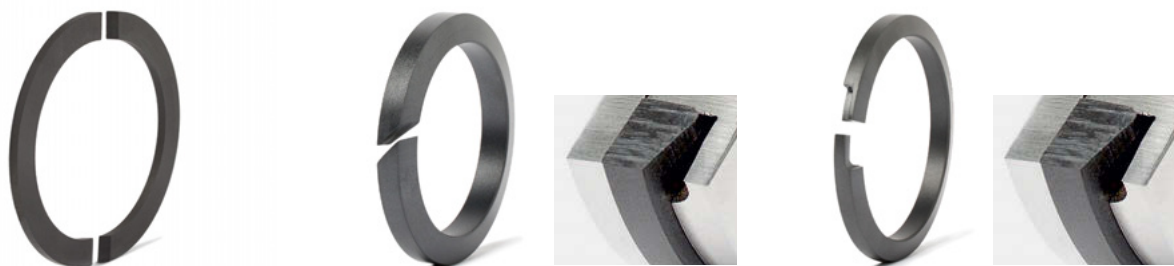
RIDER RING

SEALING RINGS



REDURA® PISTON & RIDER RINGS

FORMING THE WINNING TEAM OF RINGS



PRESSURE BREAKER				
	PB 410	PB 300	PB 310	
DESCRIPTION	Solid pressure breaker for single acting compression of gases with low molecular weight	Wear free ring design for single acting compression of gases with high molecular weight at high dynamic pressures	Wear free ring design for single acting compression of gases with low molecular weight at high dynamic pressures	
	<ul style="list-style-type: none"> In-house developed throttle ring (type D2) Withstands the dynamic pressure component, and protects the subsequent sealing rings 	<ul style="list-style-type: none"> In-house developed retained piston ring Withstands the dynamic pressure component, and protects the subsequent sealing rings 	<ul style="list-style-type: none"> In-house developed retained piston ring Withstands the dynamic pressure component, and protects the subsequent sealing rings 	
	<ul style="list-style-type: none"> 2-piece, scarf joint ring Built-up piston required Up to 250 mm (9.84 in) cylinder bore diameter Includes base ring support 	<ul style="list-style-type: none"> Slope retained ring 1-piece, scarf joint Built-up piston required Up to 250 mm (9.84 in) cylinder bore diameter 	<ul style="list-style-type: none"> Slope retained ring 1-piece, gastight joint Built-up piston required Up to 250 mm (9.84 in) cylinder bore diameter 	
	<ul style="list-style-type: none"> Dry running systems Lubricated systems Single acting compression of gases with low molecular weight (hydrogen) End pressure above 150 bara (2'180 psia) e.g. for bottle fillers 	<ul style="list-style-type: none"> Lubricated systems Dry-running systems: only vertical piston arrangement Single acting compression of gases with high molecular weight (CO₂, H₂S, C_nH_m) High loaded Max. pressure 560 bara (8'120 psia; non-metallic) 	<ul style="list-style-type: none"> Dry running systems Single acting compression of gases with low molecular weight (hydrogen): e.g. for bottle fillers High loaded 	
SPECIFIC PROPERTIES	<ul style="list-style-type: none"> Combined with retained piston rings, e.g. Redura® PB 300 for optimized sealing systems Additional sealing function 	<ul style="list-style-type: none"> Wear-free after running in Combined with true sealing elements, e.g. Redura® PS 110 for optimized sealing systems 	<ul style="list-style-type: none"> Wear-free after running-in period (only vertical piston arrangement, max. pressure 300 bara (4'350 psia)) Combined with true sealing elements, e.g. Redura® PS 420 for optimized sealing systems 	

¹ LEAKAGE TIGHTNESS RATING Minimum: ★ Maximum: ★★★★★



	PS 110	PS 120	PS 201	
	Very robust sealing element preferred for lubricated systems and gas with high molecular weight	Classical piston ring with specially designed, robust step-cut joint	Extremely robust ring design for single acting compression of gases with high molecular weight	
	<ul style="list-style-type: none"> • Classical scarf joint piston ring • Dual use: <ul style="list-style-type: none"> – As pressure breaker (to withstand the dynamic pressure component) – As piston sealing element, to handle static pressure and seal the gas within the cylinder 	<ul style="list-style-type: none"> • Piston sealing element, to handle static pressure and seal the gas within the compression chamber 	<ul style="list-style-type: none"> • Twin piston ring R-type • In-house developed • High efficient piston sealing element, to handle static pressure and seal the gas within the compression chamber 	
	<ul style="list-style-type: none"> • 1-piece, scarf joint • Up to 1'200 mm (47.24 in) cylinder bore diameter (tension rings for PTFE materials starting from 500 mm (19.69 in) cylinder bore diameter) 	<ul style="list-style-type: none"> • 1-piece, step-cut joint • Up to 1'200 mm (47.24 in) cylinder bore diameter (tension rings for PTFE materials starting from 500 mm (19.69 in) cylinder bore diameter) 	<ul style="list-style-type: none"> • Combination of sealing ring and cover ring • Up to 350 mm (13.78 in) cylinder bore diameter • Gastight 	
	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • Preferred use: lubricated systems for gas with higher molecular weight • Single and double acting • Max. pressure 560 bara (8'120 psia; non-metallic), as true sealing element 	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • Single and double acting • Gases with low molecular weight 	<ul style="list-style-type: none"> • Dry running systems • Lubricated systems • Single acting compression of gases with high molecular weight 	
	<ul style="list-style-type: none"> • Very robust • Easy to assemble • Special arrangement on piston with alternating joint orientation • Economic solution 	<ul style="list-style-type: none"> • Special shape of step-cut joint to prevent failure by fracture • Combined with pressure breaker, e.g. Redura® PS 110 for optimized sealing systems • Easy to assemble 	<ul style="list-style-type: none"> • Improved sealing efficiency and durability • Special designed cross-section of cover ring to prevent failure by fracture • Leak tightness over the whole lifetime • Combined with pressure breaker, e.g. Redura® PS 110 	
	LEAKAGE TIGHTNESS RATING¹ (as sealing ring): Newly installed: ** After extensive use: *	LEAKAGE TIGHTNESS RATING¹ Newly installed: ** After extensive use: **	LEAKAGE TIGHTNESS RATING¹ Newly installed: **** After extensive use: ***	



SEALING RINGS

	PS 210	PS 220	PS 420	
	Robust ring design for double acting compression of gases with low molecular weight	Patented ring design with improved sealing efficiency and durability for single acting compression of gases with low molecular weight	For single acting compression providing high durability and sustained leakage tightness	
	<ul style="list-style-type: none"> • Twin piston ring by-pass type • In-house developed • Highly efficient piston sealing element, to handle static pressure and seal the gas within the compression chamber 	<ul style="list-style-type: none"> • Twin piston ring coupled type • In-house developed and patented • Highly efficient piston sealing element, to handle static pressure and seal the gas within the compression chamber 	<ul style="list-style-type: none"> • Pre-tensioned multi piece sealing ring with tangential cut (TID piston ring) • In-house developed and patented • Highly efficient piston sealing element, to handle static pressure and seal the gas within the compression chamber 	
	<ul style="list-style-type: none"> • Combination of sealing ring and cover ring with by-pass grooves • Up to 350 mm (13.78 in) cylinder bore diameter 	<ul style="list-style-type: none"> • Combination of sealing ring and cover ring • Up to 350 mm (13.78 in) cylinder bore diameter • Gastight 	<ul style="list-style-type: none"> • Combination of 3 segments tangential to the inner diameter, tension ring and base ring • Up to 350 mm (13.78 in) cylinder bore diameter • Built-up piston required 	
	<ul style="list-style-type: none"> • Dry running systems (e.g. dry running pipeline compressors) • Lubricated systems • Double acting compression of gases with low molecular weight 	<ul style="list-style-type: none"> • Dry running systems (e.g. dry running pipeline compressors) • Lubricated systems • Single acting compression of gases with low molecular weight 	<ul style="list-style-type: none"> • Dry running systems only, vertical piston arrangement only, max pressure 300 bara (4'350 psia; e.g. dry running hydrogen compressors, bottle fillers) • Single acting compression of gases • High pressure differences 	
	<ul style="list-style-type: none"> • Improved sealing efficiency and durability • Fewer piston rings required than standard • By-pass groove prevents overloading and failure by fracture • Leak tightness over the whole lifetime • Pressure distribution over several rings ensures increased lifetime • Combined with pressure breaker, e.g. Redura® PS 110 	<ul style="list-style-type: none"> • Improved sealing efficiency and durability • Uniform wear behaviour of both rings, ensures long term sealing efficiency • Formation of gaps prevented through form-fit coupling between the sealing ring and cover ring • Leak tightness over the whole lifetime • Combined with pressure breaker, e.g. Redura® PS 110 	<ul style="list-style-type: none"> • Improved sealing efficiency and durability • Leak tightness over the whole lifetime • Combined with retained piston rings (PB300/PB 310) 	
	LEAKAGE TIGHTNESS RATING¹ Newly installed: *** After extensive use: ***	LEAKAGE TIGHTNESS RATING¹ Newly installed: *** After extensive use: ***	LEAKAGE TIGHTNESS RATING¹ Newly installed: *** After extensive use: ***	



RIDER RING	
	PG 900
	Advanced ring design provides reliable piston guidance, low thermal load and high durability
	<ul style="list-style-type: none">• Classical scarf joint rider ring
	<ul style="list-style-type: none">• 1-piece, scarf joint, with by-pass grooves• Up to 1'200 mm (47.24 in) cylinder bore diameter
	<ul style="list-style-type: none">• Dry running systems• Lubricated systems• Single and double acting<ul style="list-style-type: none">– Single acting: rider ring positioned after the piston rings– Double acting: rider ring positioned in between piston rings• All gas types
	<ul style="list-style-type: none">• No sealing function due to by-pass grooves allows for lower friction, heat and wear

INDIVIDUAL



DEPENDING ON THE SPECIFIC APPLICATION, AN INDIVIDUAL SELECTION OF THESE RINGS IS COMBINED TO A HETEROGENEOUS PISTON RING ARRANGEMENT DESIGNED FOR BEST PERFORMANCE AND LOWEST LIFECYCLE COSTS.

MORE TYPES



ADDITIONAL PISTON & RIDER RING TYPES IN DIFFERENT DESIGNS AND CUTS ARE AVAILABLE.

REDURA® BURCKHARDT COMPRESSION INNOVATION

FROM THE IDEA TO THE FINISHED PRODUCT

Burckhardt Compression covers the entire production process, from system engineering and material selection based on the application requirements to the final solution. We ensure highest quality at every step of the way due to our comprehensive in-house capabilities.



**IN-HOUSE
PRODUCTION****1**

ENGINEERING

2

MOLDING

3

SINTERING

4

MACHINING

5

CONTROLLING

6

FITTING





«FOR OUR HIGH PRESSURE, DRY-RUNNING APPLICATION, BURCKHARDT COMPRESSION WAS ABLE TO MORE THAN DOUBLE MTBO AND INCREASE THE SEALING EFFICIENCY SUBSTANTIALLY WITH THE TAILOR-MADE REDURA® PISTON SEALING SYSTEM»

Technical Engineering Manager, Germany

APPLICATION ENGINEERING

TAILOR-MADE SYSTEM DESIGN FOR BEST PERFORMANCE

SYSTEM DESIGN

- Complete piston 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 specifically in-house developed, highly sophisticated software program incorporating a vast range of decisive parameters based on decades of field experience.

MATERIALS

For piston sealing elements, pressure breakers, true sealing rings and rider rings, 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



**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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