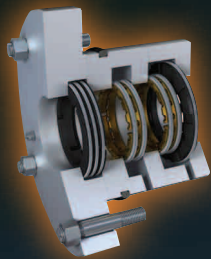
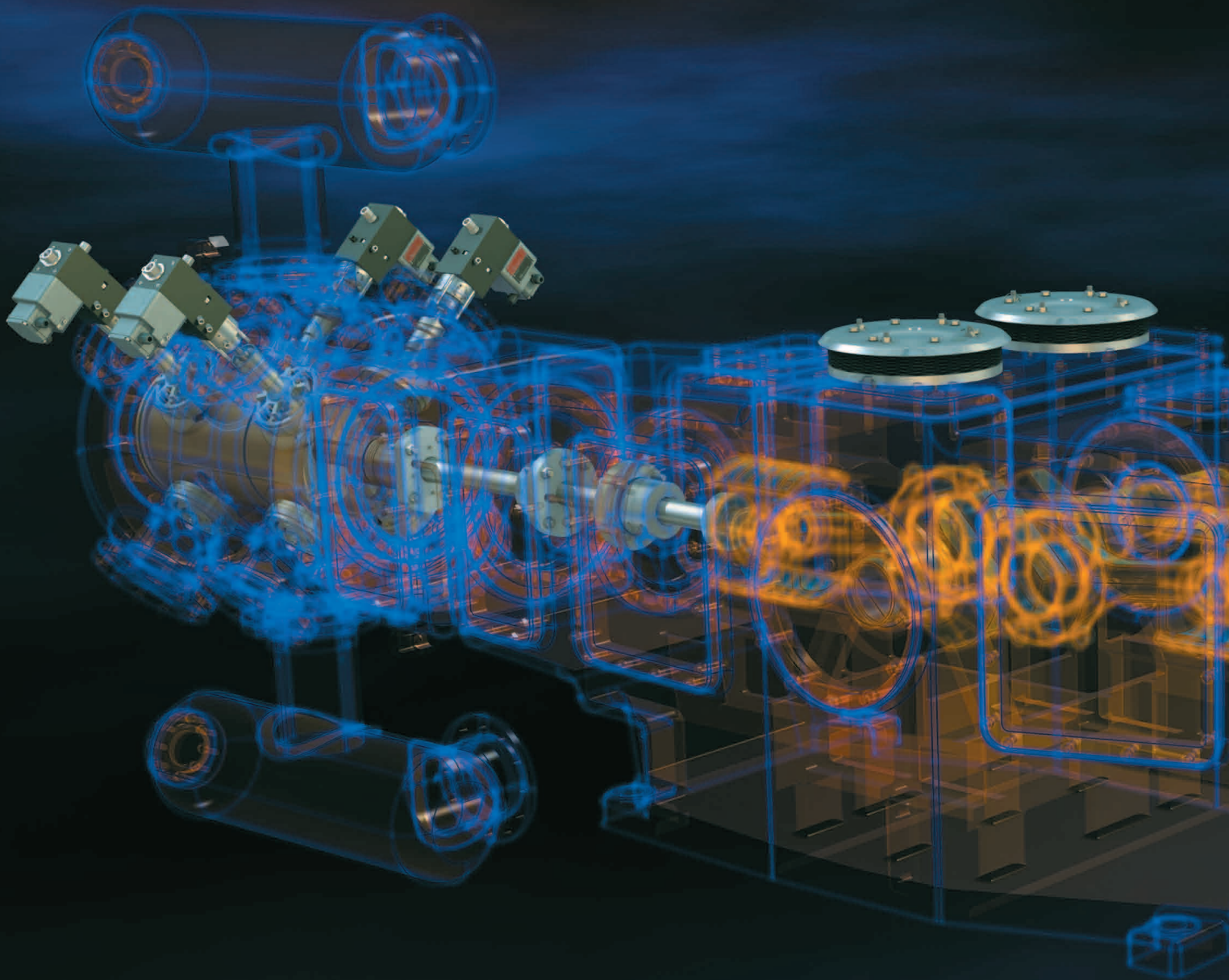


Ring and packing

Sealing systems for reciprocating compressors


HOERBIGER





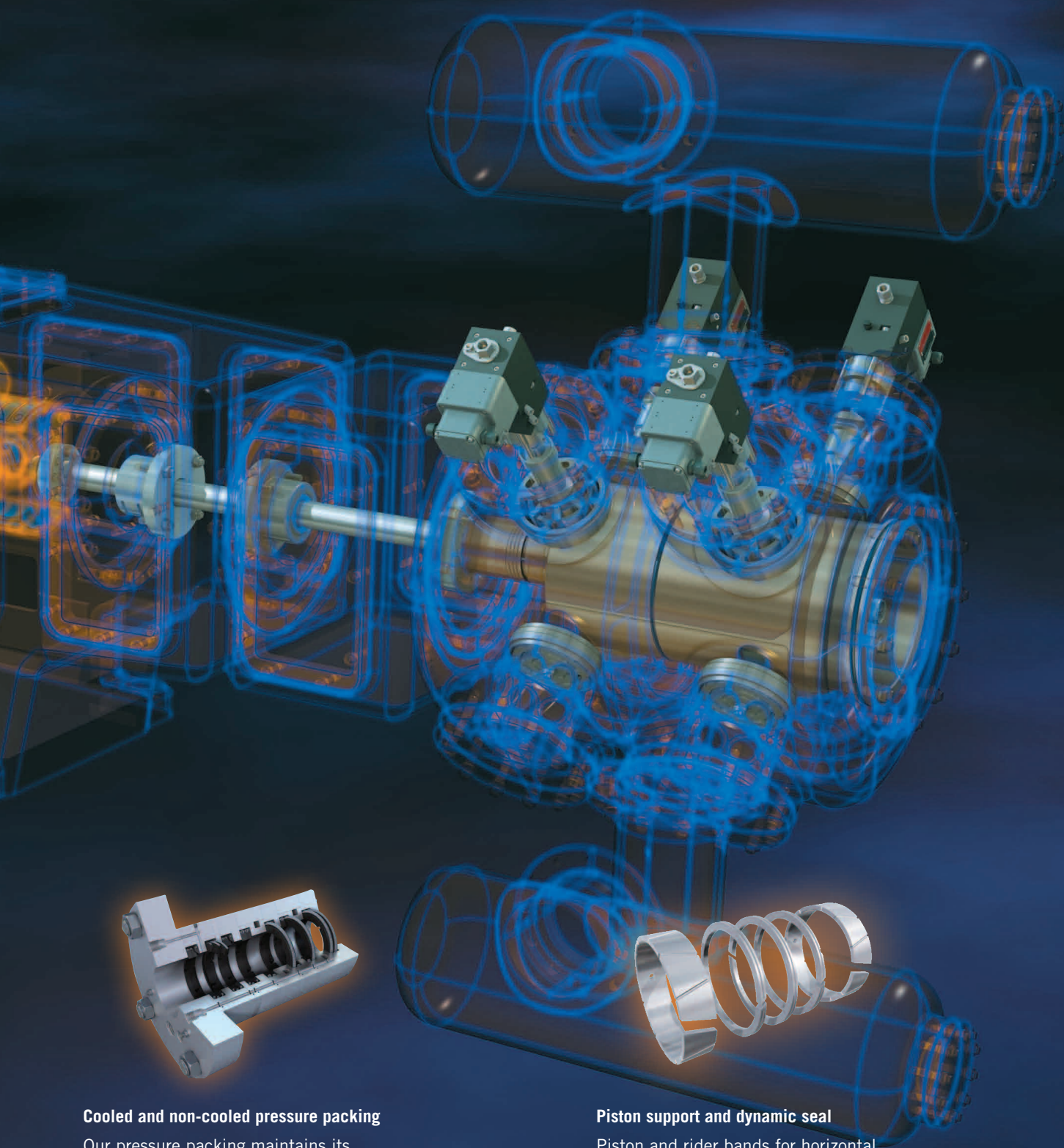
Wiper packing

Wiper rings are carefully designed for maximum wiping efficiency and economy - either using conventional wiper designs or HOERBIGER advanced designs.



Intermediate pressure packing

The intermediate packing provides a secondary seal to pressure packing to prevent residual gas leakage from outboard to inboard distance piece.



Cooled and non-cooled pressure packing

Our pressure packing maintains its seal in low pressure and high pressure conditions for any process gas. Case designs and cooling options are carefully selected for each application.

Piston support and dynamic seal

Piston and rider bands for horizontal, vertical or inclined pistons; for double- or single-acting arrangements; and for lubricated or non-lubricated compressors.



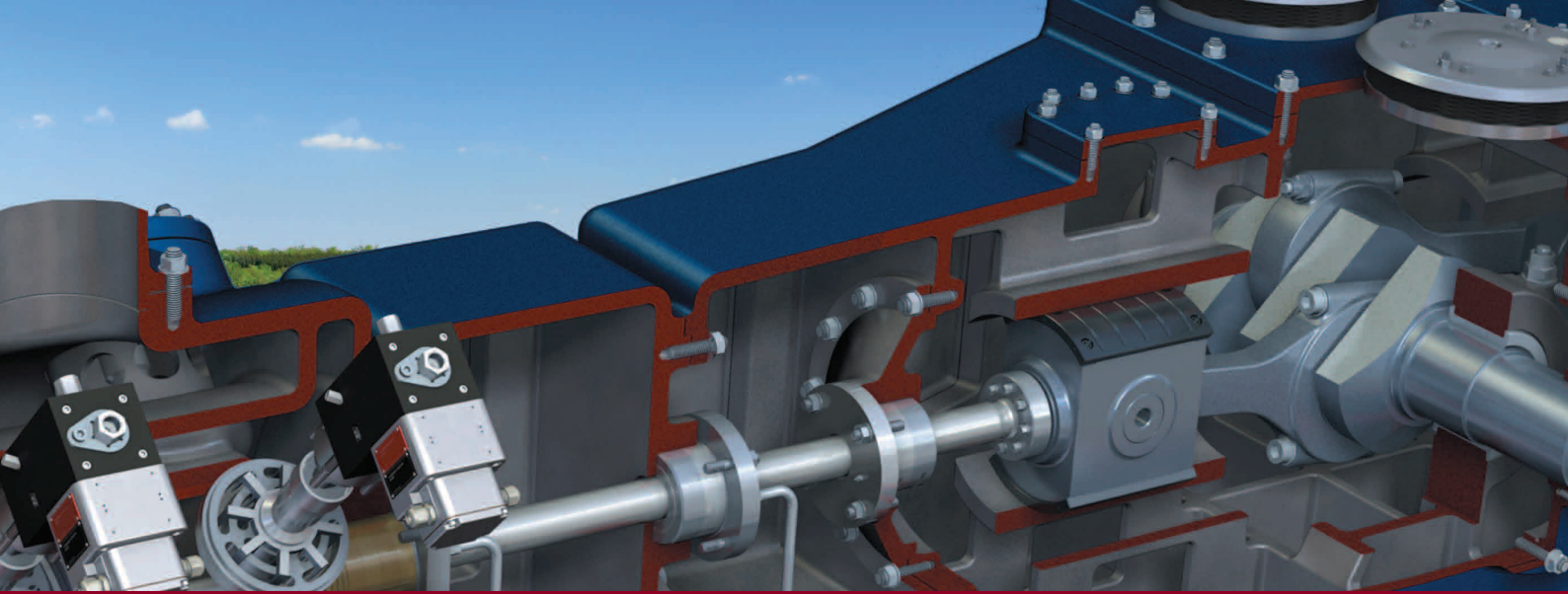
Challenging operating conditions...

HOERBIGER designs, manufactures and services pressure packing, piston rings and rider bands for original equipment manufacturers and for compressor operators. We design and test our sealing systems for the most challenging operating conditions: chemically inert to highly reactive gases, cryogenic to high operating temperatures, bone-dry to wet, vacuum to high pressures. HOERBIGER will provide a solution that optimizes sealing performance and lifetime.

We are committed to advancing the technology that makes the seals for reciprocating compressors last longer and leak less. Our solutions are based on an integrated approach that first understands the application and then overcomes problems with design, material selection, manufacturing, installation and operation.

Our ring and packing systems

- improve compressor efficiency
- provide superior sealing performance
- extend ring life expectancy
- reduce gas emissions



...call for new ideas

While HOERBIGER offers a complete line of standard ring and packing sealing systems, we continue to challenge broadly accepted theories to advance and redefine engineering and manufacturing standards of design. Our most recent result, a scientific breakthrough for developing an entirely new generation of high performance sealing systems.

Introducing HOERBIGER's latest scientific breakthrough- The Balanced Cap Design (BCD)

The BCD sealing ring makes compression safe, clean and efficient. The ring is manufactured with high-precision and its predictable and symmetric wear patterns are the result of a new one-ring design. Its slim profile means it runs cooler. The design allows for the use of PTFE at higher pressures.

Designed to last longer and leak less

- robust one-ring design in four pieces
- no pin required
- slim design for tight spaces
- high sealing efficiency
- special pressure balancing does not impair sealing efficiency
- combines high lifetime and low leakage



Polymer Research Center

AUTHORIZED PERSONNEL ONLY


HOERBIGER

Advanced materials research and development

Scientists, application engineers and production specialists at our Polymer Research Center in Houston work together to solve our customers' reciprocating compressor sealing problems for virtually all gas and operating conditions.

Our years of experience allows us to offer compressor users the most extensive material selection available today.



HOERBIGER offers the broadest range of materials for piston rings, rider bands and packing. High-performance polymers are engineered for lubricated and non-lubricated compressors in air, natural gas, air separation and petrochemical process applications. Our material selections include:

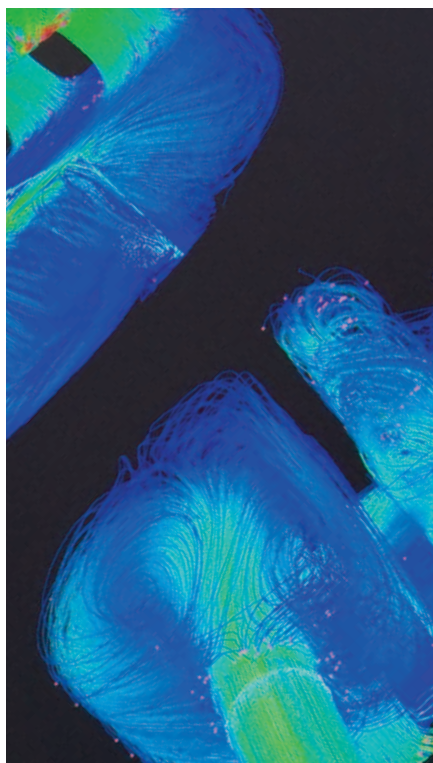
- PTFE
 - PPS
 - PEEK™
 - proprietary blends and alloyed materials which exceed traditional PEEK-based material offerings in wear and high temperature performance
 - polyimides, imadiazoles, sulphones and benzimidazoles
 - proprietary fibers and fillers for application-specific material design
- HY-grades show exceptional resistance to high pressures and temperatures, chemical reaction, corrosion and stress-cracking. The mechanical toughness and low-friction properties make them ideal for compressor sealing components. Unique filler compositions improve strength, durability, thermal and physical properties.



Total quality control from powder to product support

Research and innovation

- advanced polymer research
- mechanical component testing, FEA, stress analysis
- component design validation using comprehensive simulation tools that calculate frictional heat generation, cup pressure distribution and rod temperatures



Polymer compounding and blending

- polymer engineering
- material testing and inspection: static, creep, stress relaxation, fatigue, friction and wear
- material selection
- qualification & evaluation



Manufacturing, molding & machining technologies

- material compounding: filling, reinforcing, alloying and coloring
- injection-molding
- compression molding
- up to 60 inch diameter machining
- multi-axis and twin turret CNC lathes
- vertical mills, lappers, gapping saws





Application engineering and design

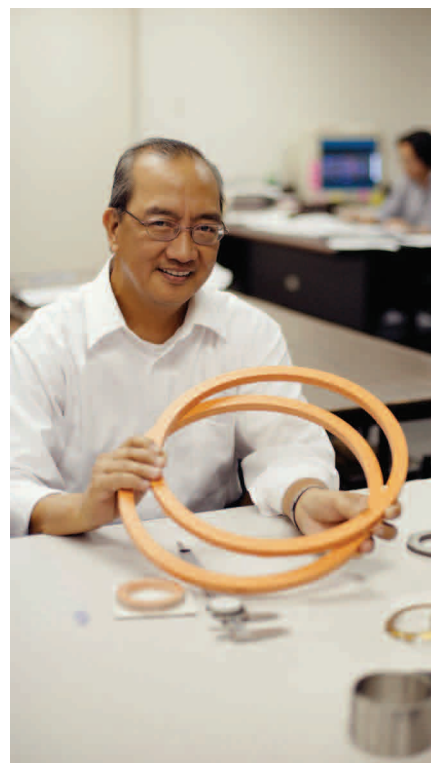
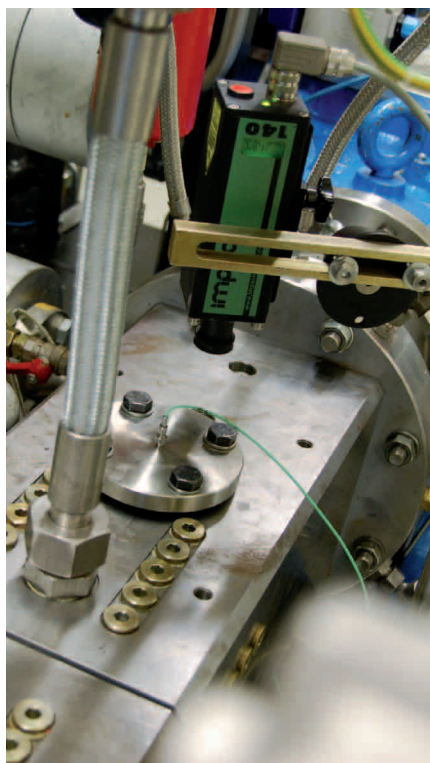
- design solutions for chemically inert to reactive gases, cryogenic to high-temperature, and vacuum to high pressure applications
- material selection
- packing system design

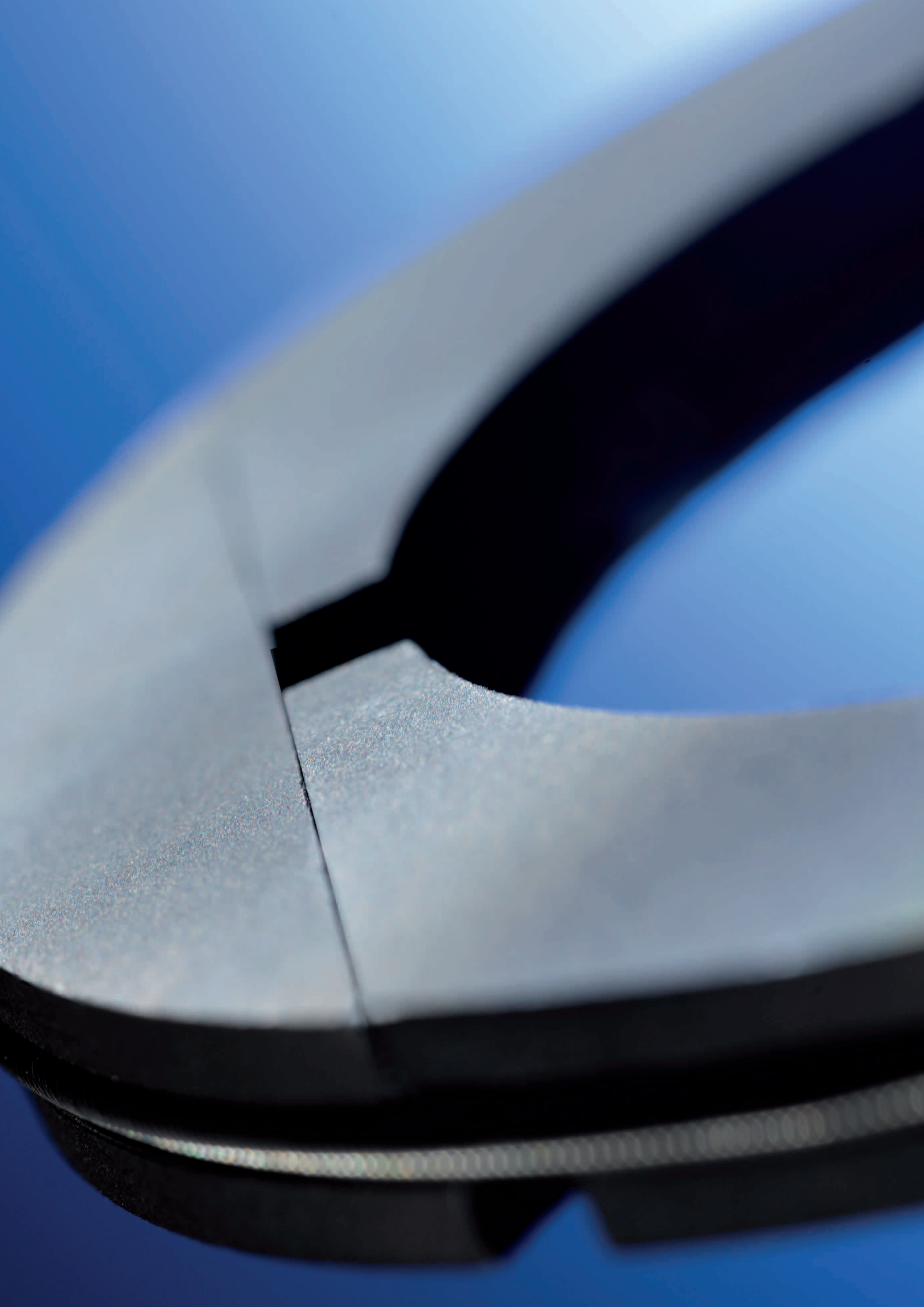
Product evaluation testing

- fully-instrumented high-speed (1400 rpm), high pressure test compressor measures cup pressure distribution, packing leakage and rod temperature distribution
- life prediction and failure analysis

Product and field support

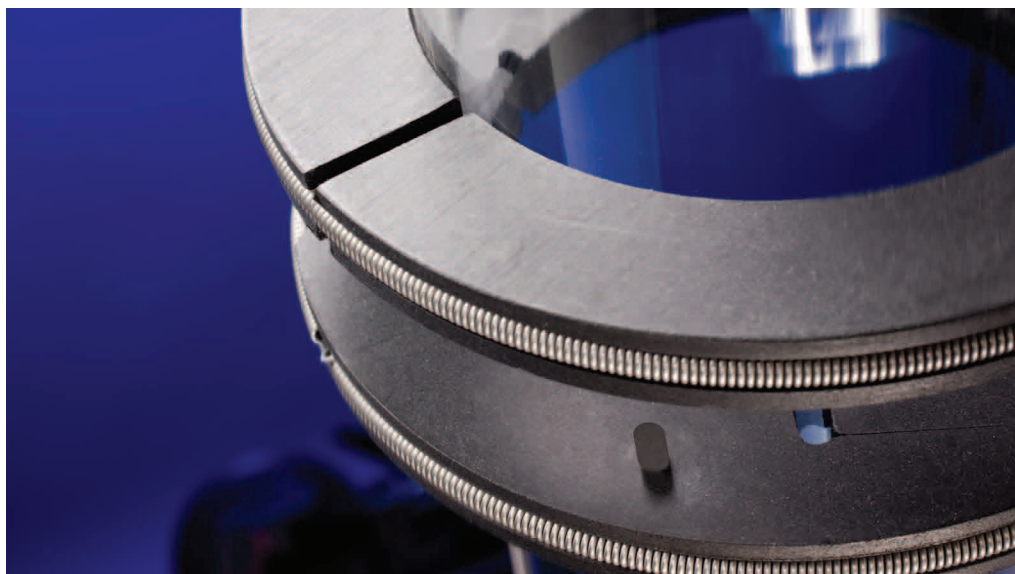
- solution design & material selection
- product upgrades
- field support and problem-solving
- conversion from lube to non-lube
- tailored training classes





Rod pressure and oil wiper packing rings

HOERBIGER is a leading supplier of rings and packing for reciprocating compressors. As a key sealing component in the compressor, customers come to us to solve a number of problems related to packing. HOERBIGER can provide design solutions to combat failures, increase the life expectancy and improve sealing function.



All segmented pressure packing rings are dynamic, pressure-actuated seals. That means, they only function with a differential pressure and with the compressor operating. Some common features of pressure packing rings:

- pressure loads the rings against the piston rod and packing cup sealing faces
- side clearance allows the rings to float within the cup as the piston rod reciprocates and gas enters and leaves the cup
- garter springs hold the ring segments in contact with the piston rod during assembly and while the compressor is shutdown
- gas leakage is blocked by ring overlap
- end gaps allow the rings to self adjust for wear during the life of the packing

This section introduces you to some of the more common designs for packing. However, different compressor duties require different packing ring designs and material selection. The gas properties, pressure differentials, compressor speed, and type of service are all used to determine the proper combination of ring style and material that will provide the optimum pressure seal and oil wiping.

Single-acting rings

Balanced-cap (BCD)

Features

- single radial cut ring in four segments
- 2 upper/lower caps bridge 2 side segments
- no rotary lock required

How it works

The sealing segments surround the rod and form radial gaps. The design produces a balanced pressure breakdown that does not impair sealing and provides a highly predictable wear pattern that optimizes material usage and increases the life of the sealing rings. The compact design produces less frictional heat, is easy to install and requires less space. The simple, one-ring design has very low leakage.

Applications

- 3rd and 4th stage PET compressors
- good for all piston speeds
- when conventional packing is not meeting required life expectancy
- high-temperature / high-load



BCD: balanced-cap ring

Radial Tangent pair (RT)

Features (from pressure side)

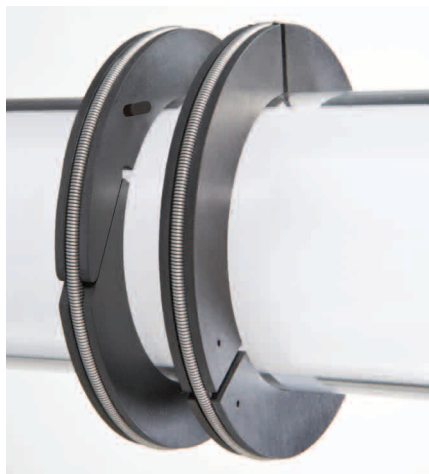
- radial cut ring and a tangent cut ring

How it works

On the discharge stroke, the pressurized gas flows through the annular clearance between the piston rod and cup and forces the radial-tangent pair against the flat face of the next packing case cup. The gas then flows through the side clearance in the cup and the gaps in the radial cut ring and out into the space above the packing rings which loads the tangent ring to the rod. The radial rings are loaded but not as heavily as the tangent cut ring. On the inlet stroke, the gas pressure reverses its flow and relieves the packing ring load on the piston rod.

Applications

- fundamental sealing element for all pressure packing
- manufactured from a wide variety of materials based on application



Radial Tangent pair

Single acting rings seal gas in one direction. The preventing pressurized gas from being trapped between the main assembly during the suction stroke.

Backup rings

Back up rings minimize non-metallic sealing rings from extruding into the space between the piston rod and packing cup. The back up does not seal on the rod; it does seal on the packing case cup face. It is bored to have a small clearance on the piston rod and has no segmental gaps when positioned. Back up rings are typically manufactured using cast iron or bronze material.



Radial Tangent pair with backup rings; cast iron (above) bronze (below)

Tangent

Features

- tangent cut ring
- gap
- the
- back

How it works

The ring, the segmental gap (rod). The gas pressure reverses its flow and relieves the packing ring load on the piston rod.

Applications

- when
- acco
- high



Tangent

by keep the packing cooler by
between the ring sets within the

vent to rod (TR)

es (from pressure side)

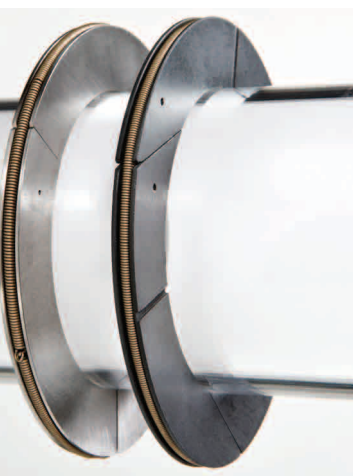
gent to rod cut ring without step
o and with relief grooves facing
pressure
ck up ring

works

g behaves like a camera lens as
ments wear (closing in on the
there is no direct leakage path for
. Slots in the front face of each
nt allow the gas to relieve from
. Double-acting tangent to rod
s do not have face slots to not
as back across the ring in the
stroke.

ations

en space is limited to
commodate conventional packing
h-speed, short-stroke applications



t to rod with cast iron backup ring

Side-loaded rings (SLP)

Features (from the pressure side)

- radial cut ring with chamfered recess
- radial cut ring with chamfered boss
- tangent cut ring

How it works

Side loaded pressure rings always maintain a seal between the tangent cut seal ring and the cup sealing face due to the inclined nature of the face of the two radial cut rings. The garter spring force on the first ring assists the radial cut ring down the inclined boss of the second radial cut ring, forcing the two radial rings apart axially. The rings do not reciprocate with the piston rod at low differential pressures. This ring set forms the necessary seal below 50 psi and slight vacuum pressures.

Applications

- low pressure end of packing
- generally behind the vent line
- to form purge chambers in main pressure packing and oil wiper packing



SLP (side loaded pressure rings)

Pressure breakers

Two common types

- grip the rod with gaps, or
- over-bored with zero gap
- cast iron, bronze, PEEK, PTFE and other high-strength non-metallics

How it works

Installed in the first cup of the packing assembly, pressure breakers face the highest pressure. The pressure breaker throttles the gas pressure pulsations—they do not seal. They can restrict the gas into the case (single-acting) or can restrict the gas in and out of the case (double-acting).

Pressure breakers are typically required for pressures over 300 psi differential pressure between suction and discharge. For most applications, a single pressure breaker is sufficient; however, two cups can use pressure breaker rings if required.



Pressure breakers; cast iron (left); PEEK (right)

Double-acting rings

Double acting rings seal gas in both directions. They are commonly used at low pressures and as vent seals.

Tangent pair

Features (from pressure side)

- two tangent rings

How it works

This is a common double acting ring configuration. This ring set consists of two tangent rings pinned to each other so that the gaps do not align. Both tangent rings form a seal against the metallic cup faces and with the piston rod.

Applications

- partition or intermediate packing
- pulsation seal in oil scraper packing
- final or vent seal in main pressure packing
- main packing at low or vacuum pressures



Tangent pair

Double side loaded pressure rings (DSLPL)

Features

- tangent cut ring
- radial cut ring with chamfered boss
- radial cut ring with chamfered recess
- radial cut ring with chamfered boss
- tangent cut ring

How it works

DSLPL ring set uses two pairs of SLP rings with the tangent cut rings facing opposite sides in a purge cup system with the purge gas acting on it.

Applications

- main and intermediate packing
- low pressure end of packing
- limited space for purge
- low emission packing



DSLPL (double side-loaded pressure rings)

Oil wiper rings

Tangent cut wiper

Features

- tangent cut ring with drainage slots

How it works

This style of wiper ring has two scraping edges in the bore, drilled internal drain holes and on the front face there are drainage slots. The ring is in three segments with the cuts being tangent to the rod so the ring acts like a camera lens, closing in on the rod as it wears. Double-acting rings have drainage slots on both faces but holes only on the front face.



Tangent cut wiper ring (single-acting)





Radial high volume wiper (HVOL)

Features

- 2 radial cut rings with milled drainage

How it works

The milled voids face the oil side. the rings are pinned together to eliminate rotation and prevent the gaps from aligning. The rings are manufactured in a variety of materials, the most common being metallic such as bronze, but can also use non-metallic materials .



Oil scraper pair (pinned together)

Three radial wiper rings

Features

- 2 or 3 radial cut rings in bronze

How it works

A radial wiper set can consist of either 2 or 3 radial wiper rings that are pinned to each other so that the gaps do not align and the set as a whole provides effective oil wiping action. The rings have 2 scraping edges on the inner diameter similar to that of the single acting tangent to rod wiper rings. They also contain drainage slots on the back face to allow the oil to drain back into the cup after it is scraped off the rod like a single-acting wiper. However, they do not contain oil drainage holes on the face like the single-acting wiper rings. They are usually made out of cast iron, bronze, or non-metallic material.



Radial wiper rings

Oil-Tight (OT) rings

Features

- non-metallic throttle ring
- 2 radial wiper pairs

How it works

The volume of oil entering the housing is minimized by the non-metallic throttle ring sticking to the front face of the wiper housing through “oil stiction”. The OT wiper rings have a much smaller radial height than conventional rings which allows the rings to conform to the piston rod, ensuring optimal wiping of the oil from the piston rod surface.

Pictured (below):

- 1 OT wiper ring and a tangent to rod ring (left)
- 2 OT wipers and a throttle ring (right)



Oil-Tight (OT) wiper packing



Packing cases

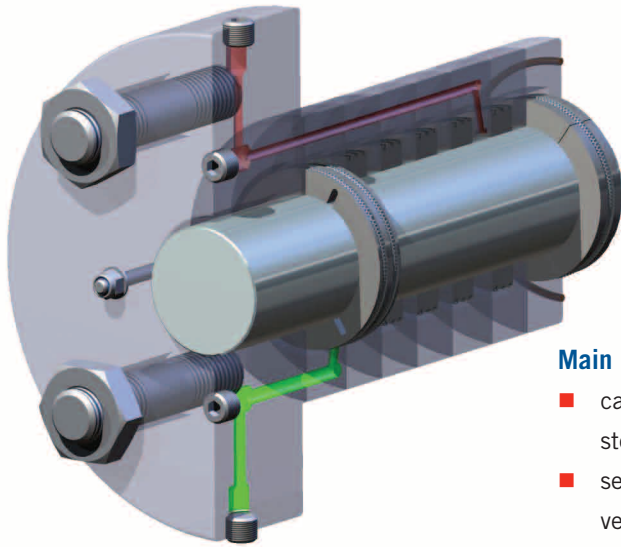
HOERBIGER provides a full line of packing case assemblies covering the vast array of applications and performance demands required of reciprocating compressors. Application specialists design the case and internal packing rings into an integrated solution to meet the application's requirements. The final design is based on many parameters: lubricated or non-lubricated, the pressure range, allowable environmental leakage limits running and stationary, gas analysis and compatibility with the case and packing ring materials, project cost limits and timing restraints, rod size, stud load requirements, gasket needs, stroke, and RPM are the major considerations.



- packing cups and flanges are precision machined from the appropriate grade of material required to meet the performance requirements: carbon steel, alloy steel, stainless steel, cast iron, nodular iron, or bronze; material selection includes proper specifications and heat treatments to meet specific demands such as API 618 and NACE MR0175 requirements.
- the design can meet the latest requirements set forth in API 618 fifth edition, one such requirement: rod encircling "O"-rings for cooled cases not allowed
- designs are specifically tailored for lubricated or non-lubricated service as well incorporating the need for cooled or non-cooled
- emission-reduction packing systems meet required environmental regulations; solutions include purged, vented and, when required, stationary gas seals
- gas control and monitoring systems provide purge control, remote alarming, and flow control
- packing case retrofits and upgrades available for all compressor models

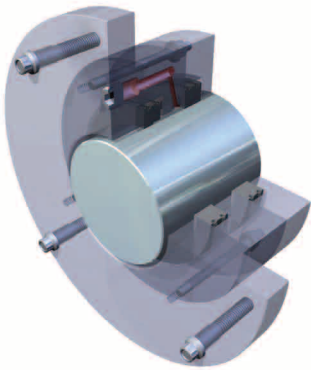
The manufacturing process is based on strict adherence to all the designer's specifications for the packing components. Control of our manufacturing process generates the quality assurance that is demanded of this precise integrated assembled product. Material specification, correct machining practices, meeting flatness and finish requirements, proper "O" -ring retained grooves, detailed assembly documents, and testing: all are precisely defined to assure the best possible seal assembly will be achieved when placed in operation.

Standard packing case systems



Main packing

- cast iron, steel, bronze or stainless steel
- service connections include cooling, venting, purging, temperature monitoring, etc.
- special designs for lube and non-lube service and pressures from vacuum to 690 bar (10,000 psi)
- can be fully lapped metallic components to ensure gas- and water-tight packing
- designed to meet API 618 Fifth Edition



Intermediate packing

- eliminates crankcase contamination
- prevents process gas leakage into second distance piece
- wide material selection ensures optimum service life
- can be lubricated or purged

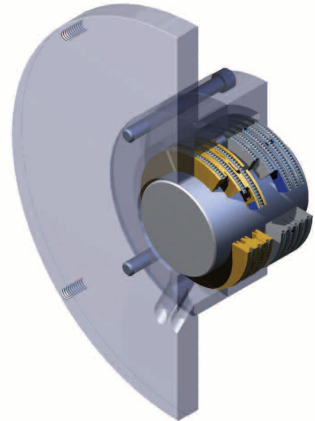
Cooled packing

- provides all the benefits of the non-cooled case plus it helps remove heat from the seals and rod by use of internal passages that permit a constant flow of coolant

Thermosleeve

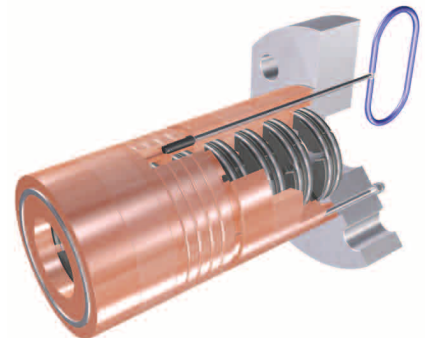
- heat-conducting pressure packing for the high temperature environments of PET blow molding applications

Standard and custom packing case systems are designed for original equipment manufacturers and for compressor operators. Material selection, ring and case designs are available for a broad range of compressor applications - from cast iron to stainless steel, cooled, non-cooled, heat conductive, purged, vented, or may include a static seal.

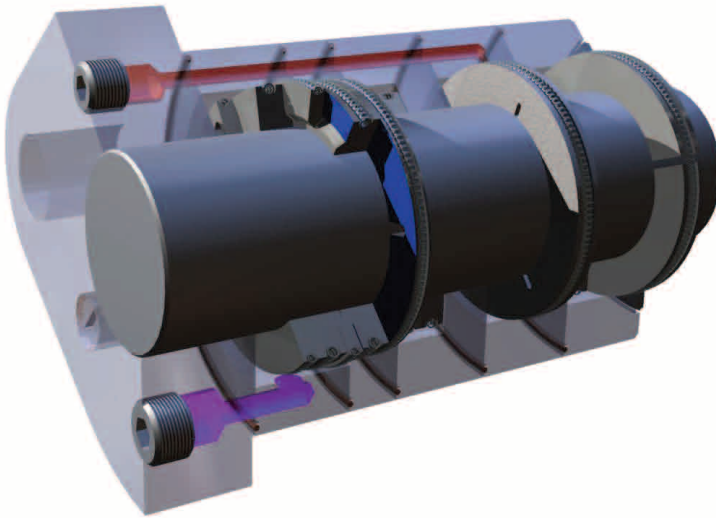


Oil wiper packing

- removes oil from the piston rod as it exits the crankcase
- provides a seal for pressure pulsations
- simple, one-cup design using an oil scraper and sealing ring set
- multiple cup designs incorporate conventional oil wiping, reverse oil wiping, pulsation sealing, and a purge chamber
- wiper rings are typically bronze, but other metallic and non-metallic materials can be applied
- SLP and DSLP rings for maximum sealing performance

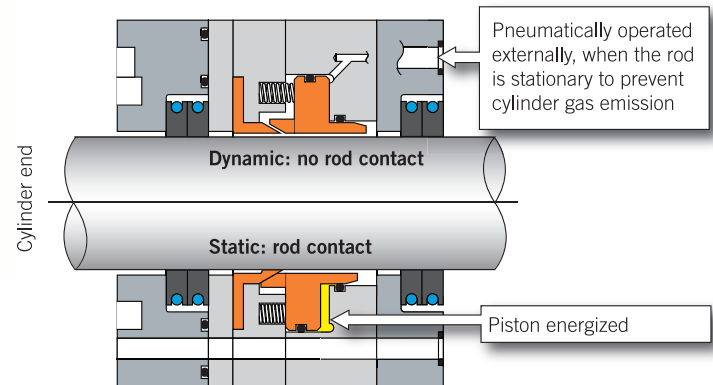


Low emission packing case systems and monitoring



Stationary gas seals

- does not seal during dynamic reciprocating action
- energizes when the compressor stops

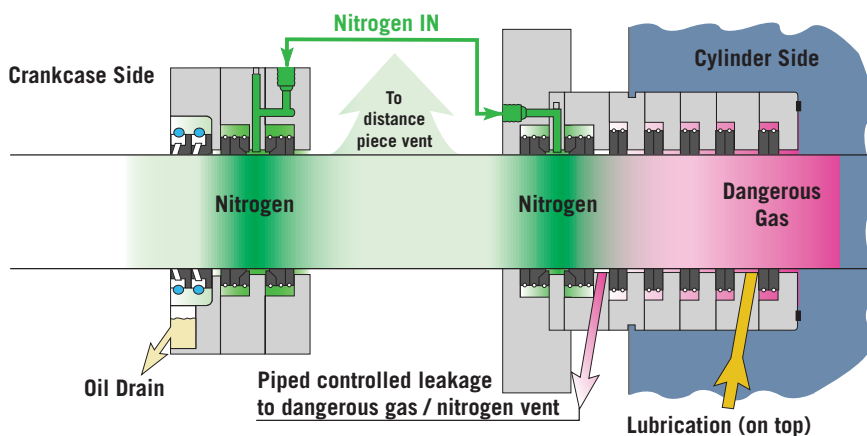


Our purged pressure packing uses SLP, DSLP or BCD rings for maximum sealing performance. Inert gas, purged into this packing case, forces process gas to the vent line, preventing it from ever entering the crankcase or atmosphere.

- SLP, DSLP and BCD rings for maximum sealing performance
- inert gas, purged into the case forces process gas to vent
- monitoring systems provide automatic purge control
- remote alarm and monitoring available
- intrinsically safe
- API 618 and NACE emission standards
- optional flow control for valve unloaders, intermediate and wiper packing
- optional static seal to control leakage during shutdown

Monitoring systems

- automatic purge control
- remote alarm and monitoring
- intrinsically safe
- satisfies API618 and NACE emission standards
- optional flow control for valve unloaders, intermediate & wiper packing





Piston rings and rider bands

Piston rings restrict the flow of gas between the piston and cylinder bore. Cylinder pressure activates the piston rings to seal. The radial clearance between the piston ring and the piston allows the piston rings to be free floating. The radial thickness of the rider band is greater than the ring groove depth so that it rides on the cylinder bore and supports the piston.



The design and construction of the piston plays an important part in cylinder ring design, upgrade and modification. With proper material selection, careful design and close tolerance machining, piston rings should provide an effective positive seal. Additional benefits of HOERBIGER designed cylinder rings include:

- excellent sealing
- extended lifetime
- active piston support
- even wear characteristics
- minimize frictional heat
- protection from temporary or sudden loss of lubrication

Piston rings

The piston rings are designed to seal the gas within the cylinder. The number and style of rings that are required depend upon the gas duty, temperatures, pressures and piston design. Most common piston rings are 1- or 2-piece angle cut but special designs are available for low to high pressures and light gases. For better sealing, L-cuts or step cuts minimise any direct leakage path. For low molecular weight gases, low differential pressures, and to support larger rings, expander springs help minimize leakage by applying an outward tension on the ring to seal it to the cylinder bore. Expanders can also be used to reduce the leak path beneath the piston ring thus improving seal efficiency. Piston rings are manufactured using tight tolerances and are available in several cuts and styles.

- angle
- step
- butt
- seal joint
- pressure balanced
- single- or multi-segment
- with expanders, flat or round wire, recessed or not

Rider bands

Rider bands support the piston and prevent metal-to-metal contact. Most common rider bands are either solid riders or angle cut with side relief.

Riders can be one piece stretch-on designs which require special fitting equipment, or they can be cut designs in one or two pieces. If a stiff material is required for the application, two-piece designs make installation easier.

Material selection is critical, especially for non-lube operation. Selecting materials with proper strain and memory ensures optimal piston support and long service life at operating temperatures and pressures. HOERBIGER's research and development, extensive testing and field experience has resulted in a complete portfolio of tribological materials designed for piston rings and rider bands.



HOERBIGER has the right sealing technology for every application

Process Industry

- oil production and refining
- chemical processing
- petrochemical processing

Natural Gas Industry

- gas exploration
- gas transport
- gas storage
- gas re-injection

Air Compressors

- PET blow molding
- industrial air

Industrial Gases

- argon, ethylene, carbon dioxide, helium, hydrogen, nitrogen, nitrous oxide, oxygen, and more...

Gas conditions

- wet, dry, and bone-dry
- temperatures up to 240°C (460°F)
- pressure from vacuum up to 690 bar (10,000 psi)
- air, oxygen, hydrogen, nitrogen, argon, helium
- chlorine, ammonia
- nitrous oxides, carbon dioxide, carbon monoxide, sulfur dioxide
- hydrocarbons, ethylene, ethylene oxides
- hydrogen sulfide, hydrogen chloride, sulfur hexafluorides, vinyl chlorides, refrigeration

Compressor designs and sizes

- lubricated and non-lubricated
- cooled and non-cooled
- single and double-acting
- crosshead/non-crosshead
- horizontal, vertical and inclined
- rod diameters to 255mm (10 inches)
- cylinder diameters to 1400 mm (55 inches)

Specialized HY-grade materials

- PTFE based
- PEEK based
- advanced polymers

www.hoerbiger.com



HOERBIGER Compression Technology is a business unit of HOERBIGER Holding AG, Zug / Switzerland. HOERBIGER is active throughout the world as a leading player in the fields of compression technology, automation technology and drive technology. In 2010, its 7,600 employees achieved sales of 950 million Euro. The focal points of its business activities include key components and services for compressors, gas engines and turbomachines, hydraulic systems and piezo technology for vehicles and machine tools, as well as components and systems for shift and clutch operations in vehicle drive trains of all kinds. Through innovations in attractive technological niche markets, the HOERBIGER Group sets standards and delivers cutting-edge solutions for the benefit of its customers.

This product brochure contains product specifications based on research and development on the one hand and on manufacturing on the other. Dependent on place of installation, operating conditions and specifications, several parameters of the described product may change. Thus, HOERBIGER assumes no liability or warranty for the accuracy and completeness of the information covered in this brochure.