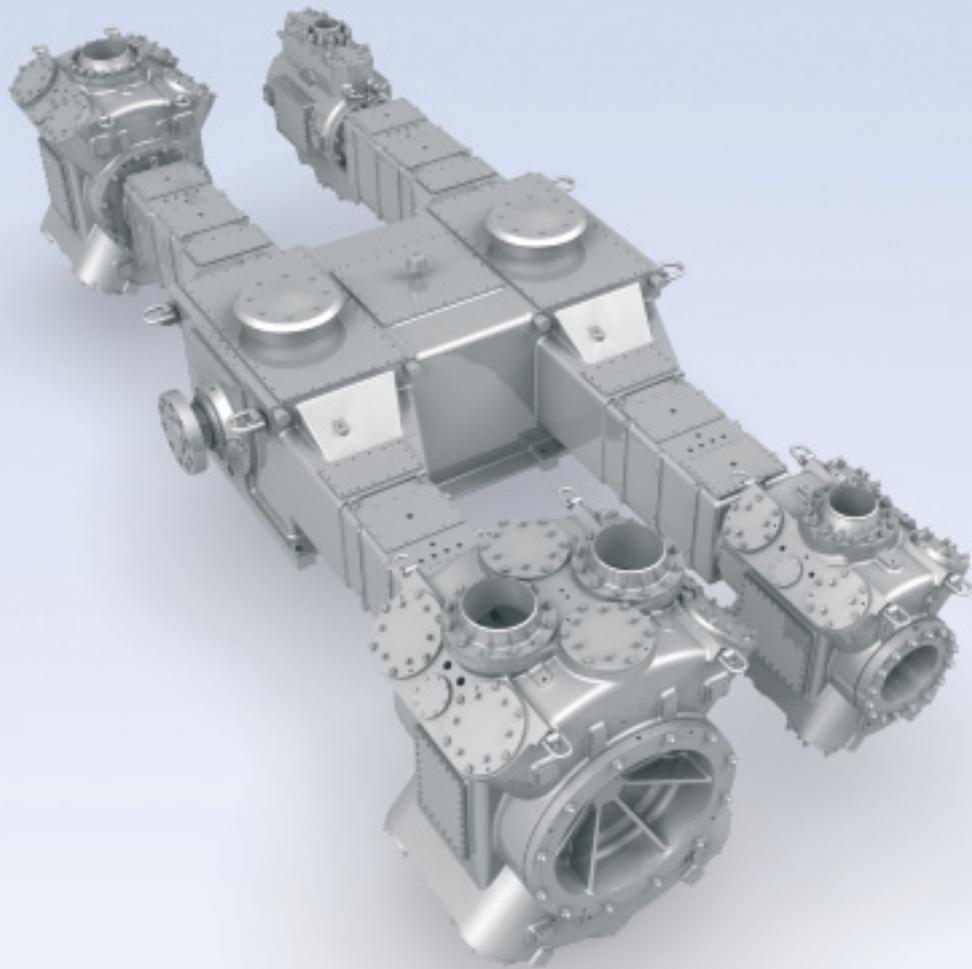


PROCESS GAS COMPRESSORS

API 618 – DESIGNED FOR LOWEST LIFE CYCLE COSTS



BURCKHARDT COMPRESSION

MANUFACTURER OF THE WORLD'S MOST POWERFUL RECIPROCATING COMPRESSOR

Burckhardt Compression is recognized as the global technology leader in the reciprocating compressor world. As an OEM with over 160 years of in-house experience in developing, engineering and manufacturing compressors, we are committed to highest reliability and best quality.

WE PROVIDE TAILORED SOLUTIONS FOR:

- Any given process gas application
- Very high pressures up to 3'500 bar
- Applications handling cryogenic, abrasive, corrosive, toxic or explosive gases

MOST POWERFUL AND CHALLENGING COMPRESSOR TYPE

Since 1951, Burckhardt Compression is the number one manufacturer of large horizontal opposed reciprocating compressors for highest discharge pressure (Hyper Compressors). In 2007, Burckhardt Compression delivered the world's most powerful single frame compressor with 27'500 kW to Saudi Arabia.

This type of compressor is used in the LDPE production process (low density polyethylene) as a secondary compressor in combination with a Process Gas Compressor used as a booster/primary compressor.

Ethylene needs to be compressed up to 3'500 bar with a flow of more than 160 tons per hour without having any stand-by compressors as back-up. These compressors are installed in the main production line. For this reason highest availability and maximum reliability are a must while meeting the highest safety requirements.

TECHNICAL DATA OF BURCKHARDT COMPRESSION'S LARGEST RECIPROCATING COMPRESSOR:

Design power	32.5 MW/44'200 hp
Pressure	3'500 bar abs/50'760 psi a
Rod load	3'500 kN/787'500 lbs
Capacity	100'000 Nm ³ /h/59'000 scfm
Weight	> 300 t



LDPE compressor train: Process Gas Compressor and Hyper Compressor at 3'100 bar by Burckhardt Compression – the global technology leader in the reciprocating compressor world

EXTRACT OF OUR WORLDWIDE REFERENCES



1

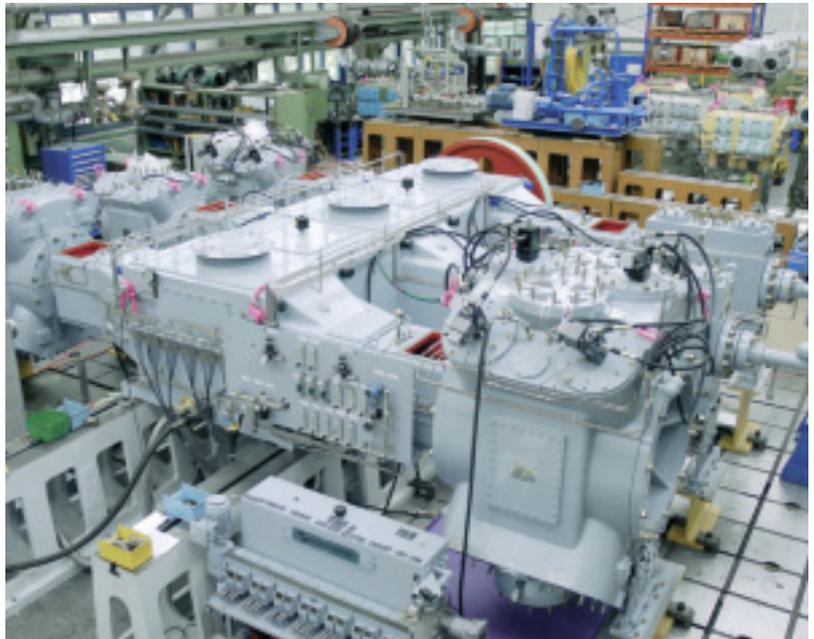
1 Hydrogen, discharge pressure 120 bar, non lubricated 12'000 h operation without maintenance



2

2 Carbon dioxide, discharge pressure 235 bar. Transcritical compression cycle

3 Ethylene, discharge pressure 288 bar. Main stream Process Gas Compressor without a stand-by compressor due to its high availability



3

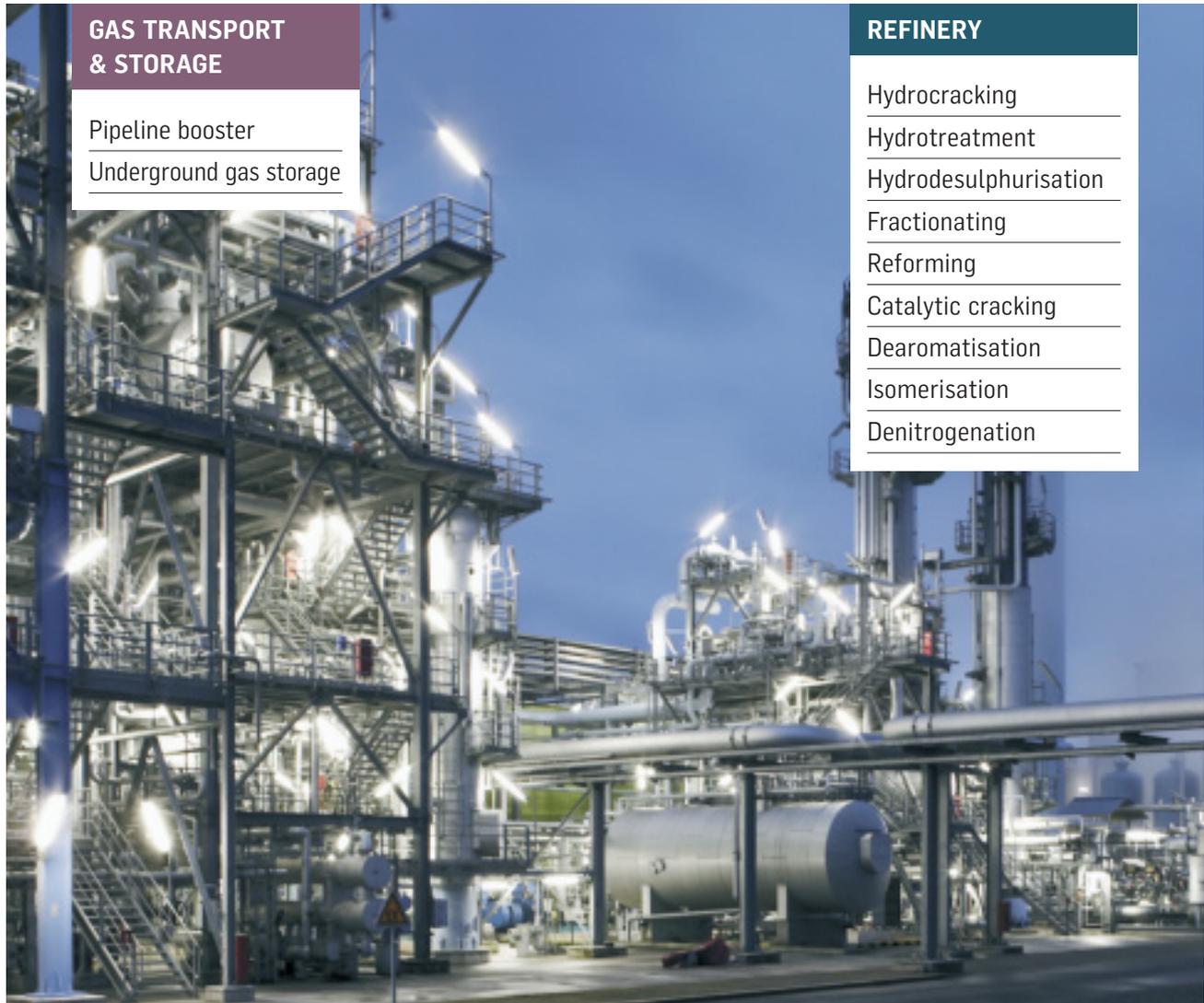
Guan Xinchun, Mechanical Maintenance Manager, CTM LDPE BASF-YPC Company Limited, Luhe District, Nanjing, China

"At our plant in Nanjing, we operate a Process Gas Compressor as booster/primary compressor with a piston diameter close to one meter, and a horizontal opposed reciprocating compressor (Hyper Compressor). Both units are crucial for the operation of our LDPE production plant. Safety, availability and reliability are the most important equipment requirements since the

compressors are used within the main production line and we don't have any stand-by units. We rely on Burckhardt Compression due to their high quality standards and their long-term experience in designing and manufacturing large reciprocating compressors".

MARKETS AND APPLICATIONS

FROM NATURAL GAS TO PROCESSING APPLICATIONS AND INDUSTRIAL GASES



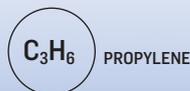
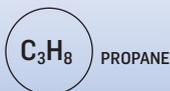
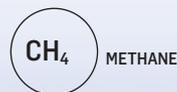
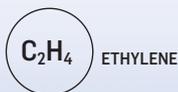
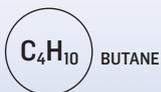
GAS TRANSPORT & STORAGE

- Pipeline booster
- Underground gas storage

REFINERY

- Hydrocracking
- Hydrotreatment
- Hydrodesulphurisation
- Fractionating
- Reforming
- Catalytic cracking
- Dearomatisation
- Isomerisation
- Denitrogenation

GASES HANDLED (INCLUDING CORROSIVE, EXPLOSIVE AND TOXIC COMPOSITIONS)





**PETROCHEMICAL/
CHEMICAL INDUSTRY**

Polyolefins

Aromatics/BTX

Alcohols

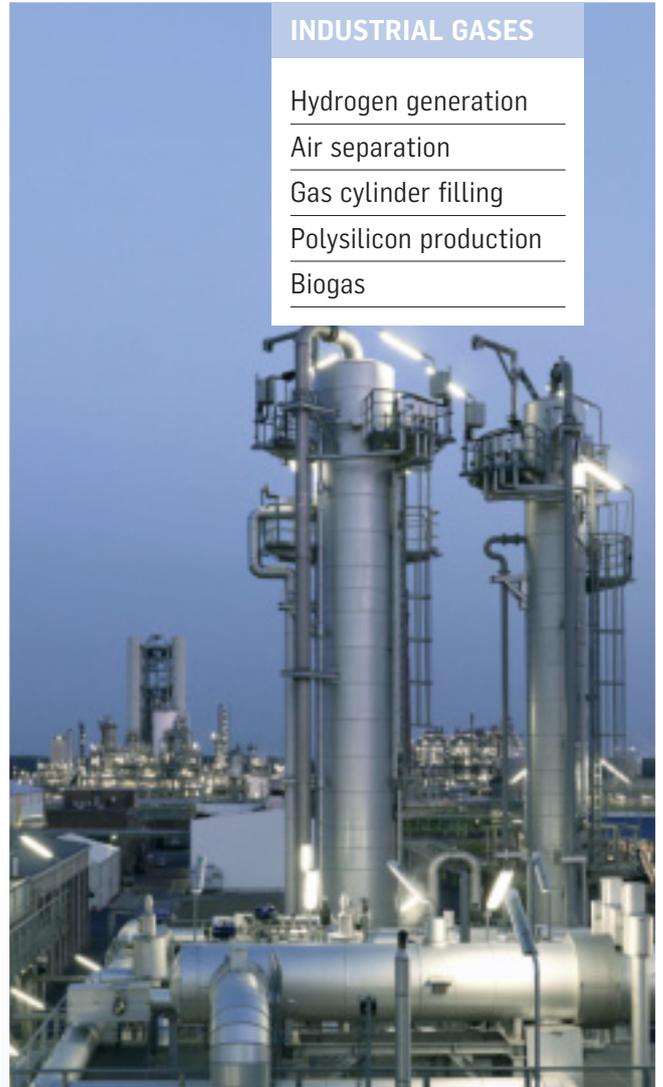
Ammonia

Urea

Polyethylene

Ethylene oxide

Ethylene glycol



INDUSTRIAL GASES

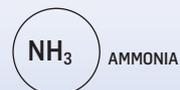
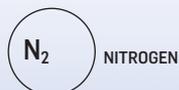
Hydrogen generation

Air separation

Gas cylinder filling

Polysilicon production

Biogas



SAFETY AND AVAILABILITY

FULL CONFORMITY TO API 618 5TH EDITION GUIDELINES*

KEY COMPRESSOR COMPONENTS – FOR BEST PERFORMANCE AND LONGEST LIFETIME

GUIDE RINGS

- According to API 618
- Pressure relieved
- Very long lifetime
- Optimized mounting position

PISTON RINGS

- Decades of lubricated and non-lubricated experience
- Various own designs and materials for – maximum durability
- Optimized wear compensation

PISTON ROD PACKINGS

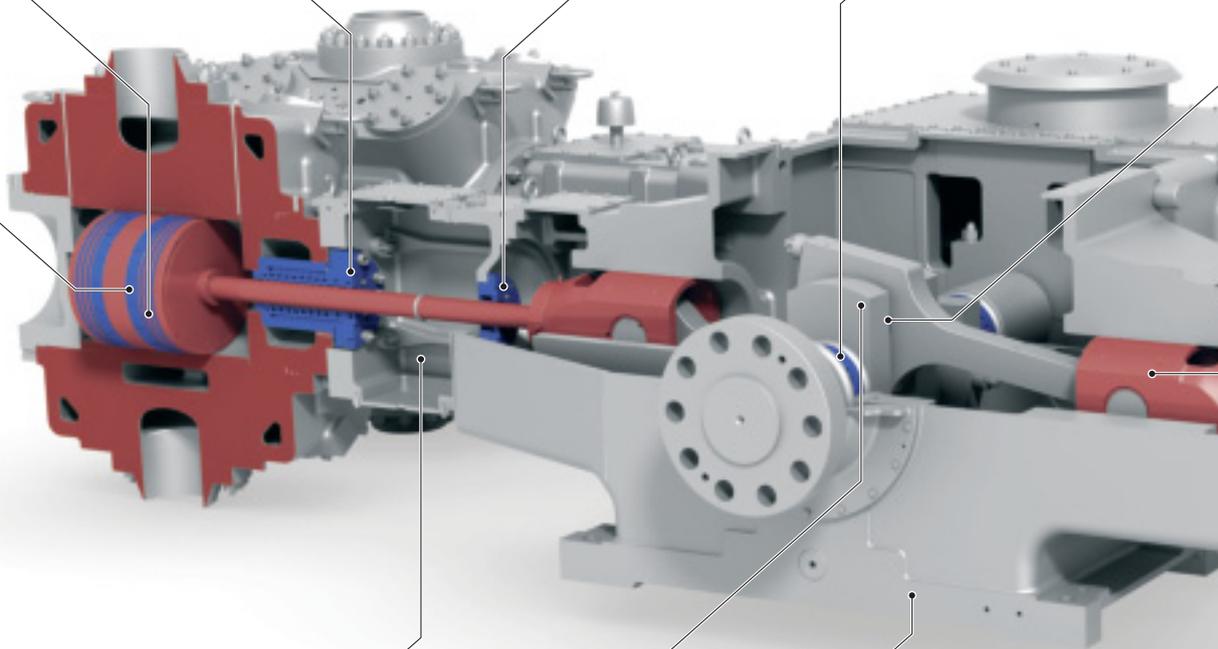
- Applied technology based on decades of experience
- Heterogeneous systems allowing high pressure non-lubricated services
- Extremely high sealing efficiency and lifetime

OIL SCRAPERS

- Highly efficient oil removal
- Material selection according to specific application
- Long lasting design for minimum lube-oil consumption

MAIN BEARINGS

- Interchangeable with big-end bearings



RUGGED DESIGN – FOR DURABILITY

LUBRICATION SYSTEM (NOT ILLUSTRATED)

- According to API 618/614 or to customer requirements

DISTANCE PIECES

- Single- or two-compartment
- Vented
- Purged
- Pressurized

CRANKSHAFT

- Forged

FRAME

- Robust
- FEM optimized

BIG-END BEARINGS

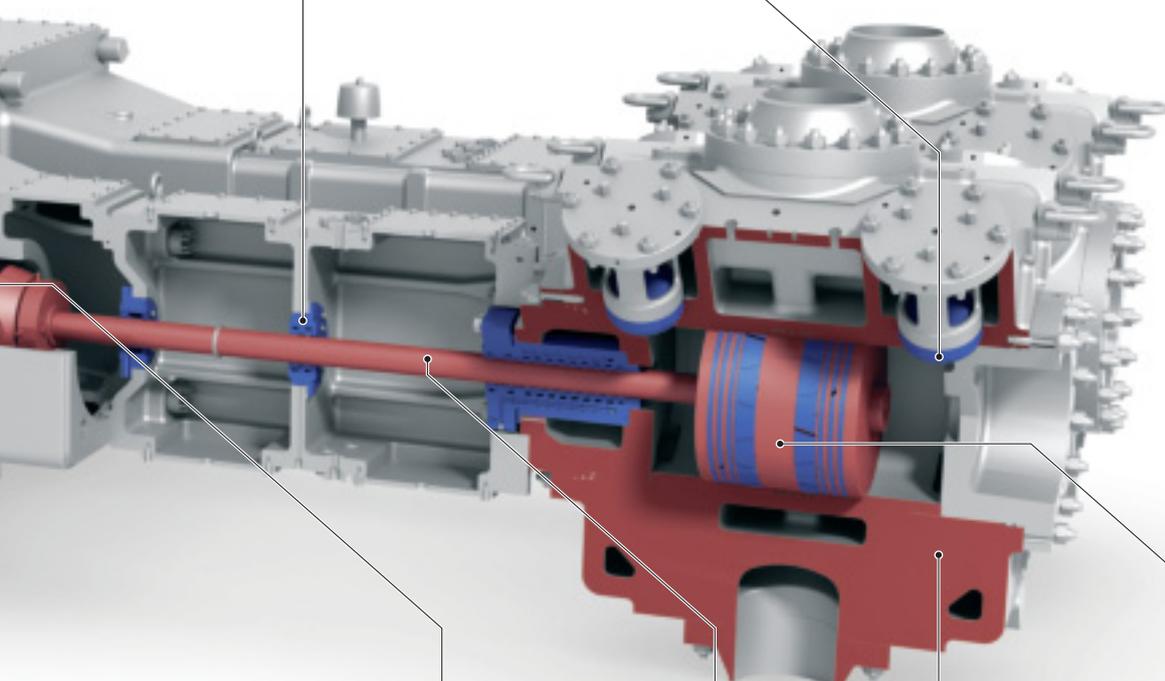
- Interchangeable with main bearings

INTERMEDIATE PACKINGS

- Separates two-piece distance piece
- Purging and buffering

COMPRESSOR VALVES

- Burckhardt Plate Valve™
- Burckhardt Poppet Valve™
- Manley® Valve, licensed by Burckhardt Compression
- Over 120 years of experience in design, manufacturing and service
- Selection and custom engineering according to application requirements
- Maximum durability due to in-house valve technology



IN-HOUSE DESIGNED AND MANUFACTURED MAIN PARTS – FOR RELIABILITY

CROSSHEADS

- One piece or with replaceable shoes

PISTON RODS

- Hardened
- Coated

CYLINDERS

- Various designs and materials
- Replaceable liners

PISTONS

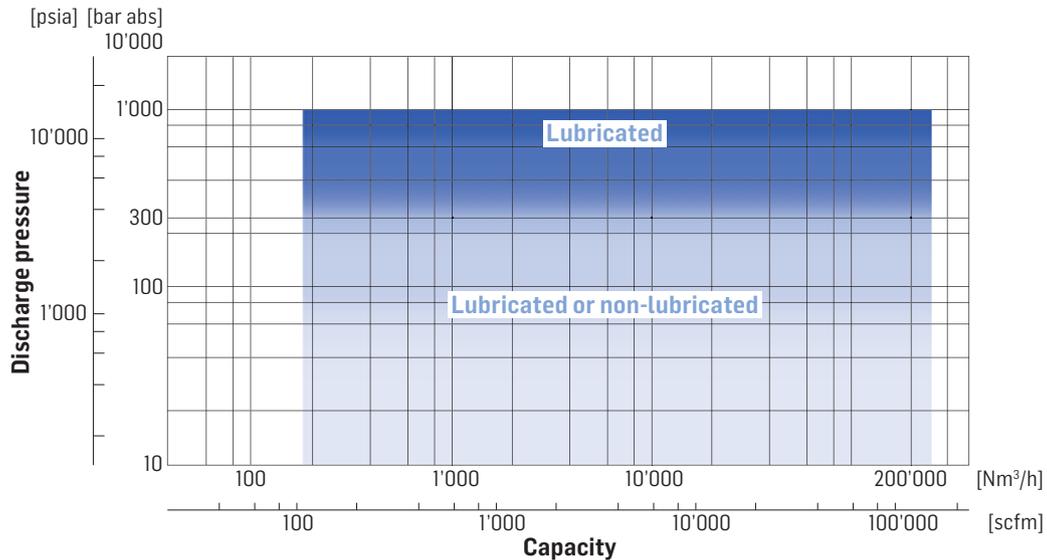
- Wide range of designs and materials

* We also offer optional customization

TECHNICAL DATA

A WIDE PORTFOLIO FOR ALL YOUR APPLICATIONS

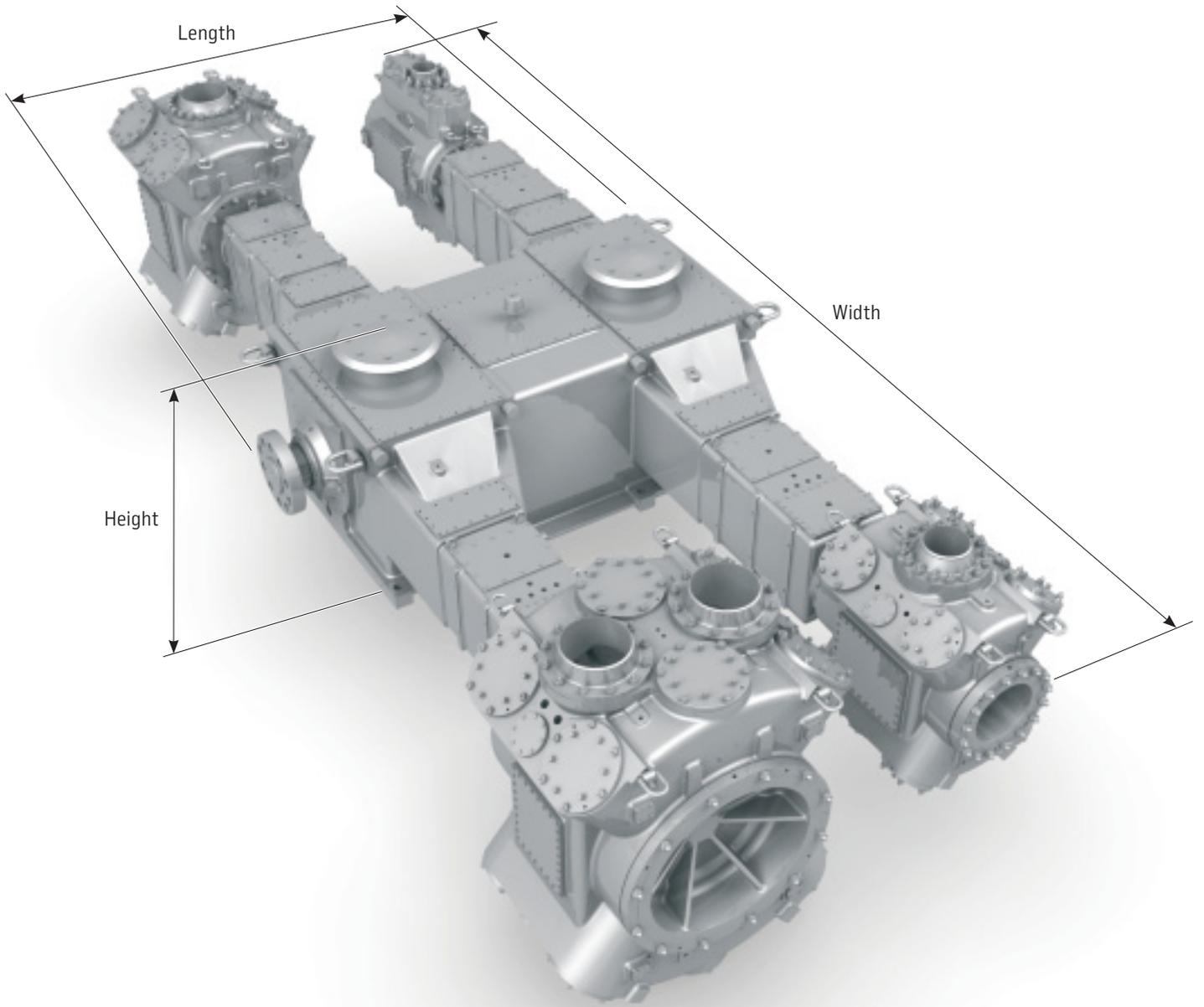
PERFORMANCE RANGE



DIMENSIONS

Type	Max. Speed [rpm]	Rated Power [kW]/[hp]	Max. Rod Load [kN]/[lbs]	Width [mm]/[in]	Height [mm]/[in]	Length [mm]/[in]	Cranks
BY	850	800/1'000	90/20'000	4'400/173	1'100/43	900/35	2
						1'500/59	4
BS	600	2'400/3'200	200/44'500	5'600/220	1'200/47	1'000/40	2
						2'150/84	4
						3'350/131	6
BX	520	5'400/7'200	350/79'000	7'750/305	1'390/54	890/35	2
						2'150/84	4
						3'390/133	6
BA	500	9'500/12'700	550/124'000	8'000/314	1'390/54	1'000/40	2
						2'800/110	4
						4'600/181	6
						6'400/251	8
BC	450	16'000/21'700	900/200'000	9'500/374	1'600/63	1'500/59	2
						3'500/138	4
						5'500/216	6
						7'500/295	8
BE	429	31'000/42'100	1'500/335'000	11'500/453	1'900/75	1'800/70	2
						4'000/158	4
						6'200/244	6
						8'800/347	8

Vertical 1, 2, 3 and 4 crank BY and BS compressors are also available.



STATE-OF-THE-ART COMPRESSOR DEVELOPMENT AND DESIGN

FOR HIGHEST AVAILABILITY AND LONGEST LIFETIME

PRODUCT INNOVATION

Burckhardt Compression's product innovation and development are based on a stage-gate process ensuring that the customer requirements and market needs are implemented. The innovation process starts with the product idea and screening phase and continues during the initial evaluation of product feasibility and market attractiveness followed by the elaboration of a product development plan including a market analysis and strategy. It ends with the actual development and subsequent launch of the product.

STATE-OF-THE-ART ANALYSIS AND ENGINEERING TOOLS

An important part of the company's certified design process are the in-house analysis tools which guarantee that the compressors fully fulfill customer's project requirements. Compressor systems, compressor components and entire compressor plants are verified in terms of strength, stiffness and stability.

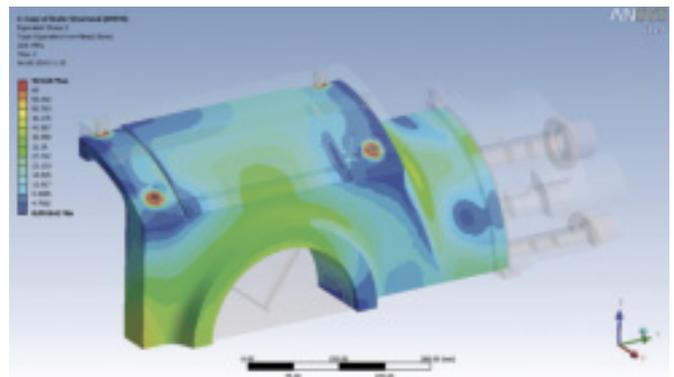
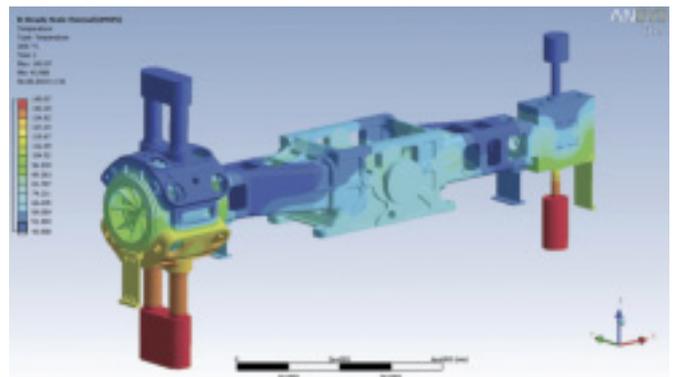
In order to achieve the most precise results, up-to-date software tools customized by Burckhardt Compression are used by our in-house specialists:

- Finite element analysis
- Pulsation vibration analysis
- Computational fluid dynamics

Optimized durability and performance is only one result. Meeting market demands in regards of cost is another important outcome.

Selection and sizing of compressors are carried out by using in-house developed proprietary software, such as RecipFinder® and RecipCalc™. Pulsation and vibration studies are made according to API 618 guidelines with advanced software tools.

Seismic stress, noise or thermal studies are conducted for complete compressor plants to ensure smooth operation.



RELIABLE DATA TRANSFER

Thanks to the use of CAM (Computer Aided Manufacturing) a high degree of precision can be achieved. Process reliability starts in the design department where computer generated design is fed directly into the manufacturing system and ends with the quality inspection.

By using a sophisticated production planning and control system, Burckhardt Compression reaches a maximum delivery performance.

IN-HOUSE PLANT ENGINEERING FOR LESS INTERFACE COORDINATION

In-house plant engineering is one of Burckhardt Compression's strength. Customers get the entire compressor package out of one hand according to their specific process requirements and specifications: from auxiliaries to the electrical motor.

Dedicated expert engineers have a broad knowledge and are able to handle large and complex contracts.



YOUR BENEFITS HAVING BURCKHARDT COMPRESSION AS A PARTNER:

- Stringent project management to achieve the agreed goals within time and cost restrains
- Highly skilled project managers and CAD plant design engineers for best expert advices
- Planning of compressor skids in 3D
- Regular status reporting including the submission of the latest drawings
- Comprehensive project management for less coordination time and effort
- Careful selection of electrical instruments for highest safety and reliability within the reciprocating compressor installation
- In-house programming of PLC control systems
- Tailor-made manuals in local language, covering all drawings, the compressor, the auxiliaries, the electrical equipment and if required the engineering reports
- Field support during commissioning

KEY COMPRESSOR COMPONENTS

LATEST TECHNOLOGY FOR BEST PERFORMANCE AND LONGEST LIFETIME



Top quality crossheads, connecting rods, bearings and crankshafts for highest reliability

Always having the best MTBO (meantime between overhaul) and lowest life cycle costs in mind, we develop, design and manufacture a wide range of top quality compressor components. We select the technology and materials and engineer all compressor components according to your application specific requirements and operating conditions.

We supply our compressor components for all your reciprocating compressors.

COMPRESSOR VALVES

We offer all three types of compressor valve technologies:

- Burckhardt Poppet Valve™
- Burckhardt Plate Valve™
- Manley® valve, licensed by Burckhardt Compression



In-house engineered valve technology

SEALING AND GUIDING TECHNOLOGY



Custom engineered and long-term tested sealing elements

- Piston rings: various patented designs and materials
- Guide rings: pressure relieved
- Piston rod packings: application specific systems



Piston and cylinder liners in high quality

- Packing rings: tribology research and laboratory tests
- Oil scrapers: application specific material selection

RESEARCH & DEVELOPMENT

Since the 1990s our dedicated specialists conduct in-house tribology research on our own test compressors in up-to-date laboratories using cutting-edge equipment. New materials and different design types are in-house long-term tested. By selecting the optimal material and design the lifetime of compressor components and complete compressor systems will be extended.



New materials and different design types are in-house long-term tested

BURCKHARDT COMPRESSION'S KEY COMPRESSOR COMPONENTS STAND FOR:

Longest meantime between overhaul and operation time

Shortest downtimes

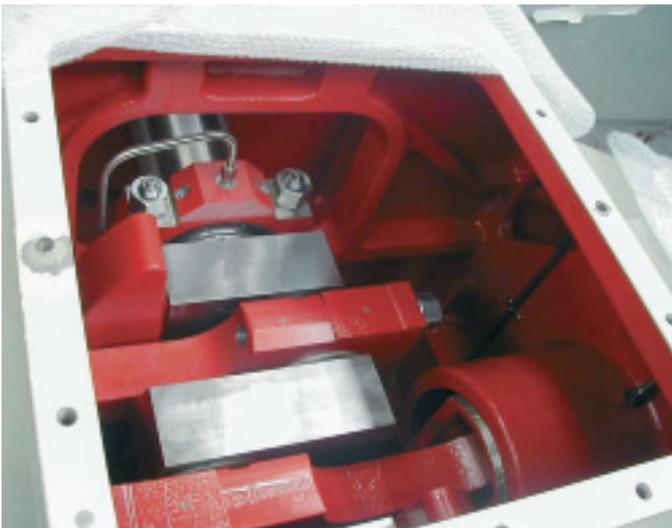
Less operating cost

EASE OF MAINTENANCE

SUBSTANTIAL ADDED VALUE

Burckhardt Compression designs all compressors for cost effective performance of preventive and predictive maintenance. We focus on service-ability by ensuring that all relevant parts can be maintained easily:

- Easy access to wear parts
- Attractive spare parts prices
- Burckhardt e-Shop™ – the easy spare parts identification and ordering system
- Professional spare parts logistics
- 24 hours technical support in case of an emergency



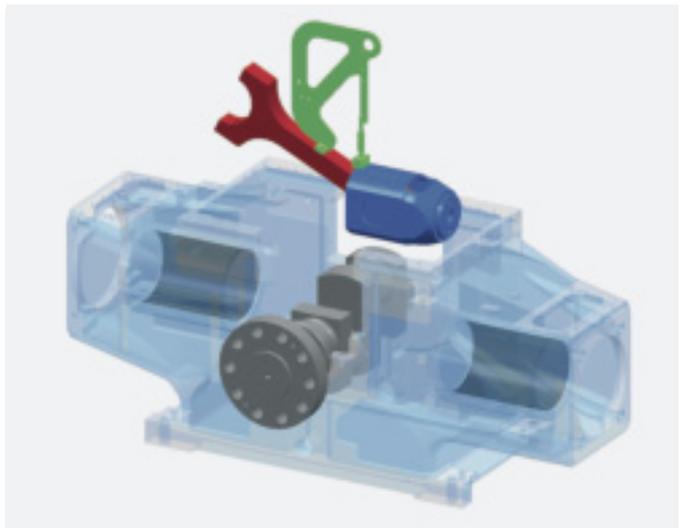
Large openings – for easy access



Easy access to piston and cylinder liner



Ease of maintenance



One assembly of crosshead and connecting rod

MAINTENANCE CONTRACTS – FOR CAREFREE OPERATION



Today's market environment demands the highest availability of a plant in order to maximize output and increase profitability. Reciprocating compressors play a key role within a process and therefore require long meantime between overhaul.

Tailor-made maintenance contracts to suit specific client needs are available for carefree operation.

COMPRESSOR TRAINING – FOR MINIMUM DOWNTIME



Our modern and fully equipped Training Center in Switzerland features the complete range of Process Gas Compressor service parts and components. The workshop and assembly hall are located next door. Compressor operation can be trained and optimized within a professional environment.

OPTIONS FOR BOLTED CONNECTIONS



Superbolt®

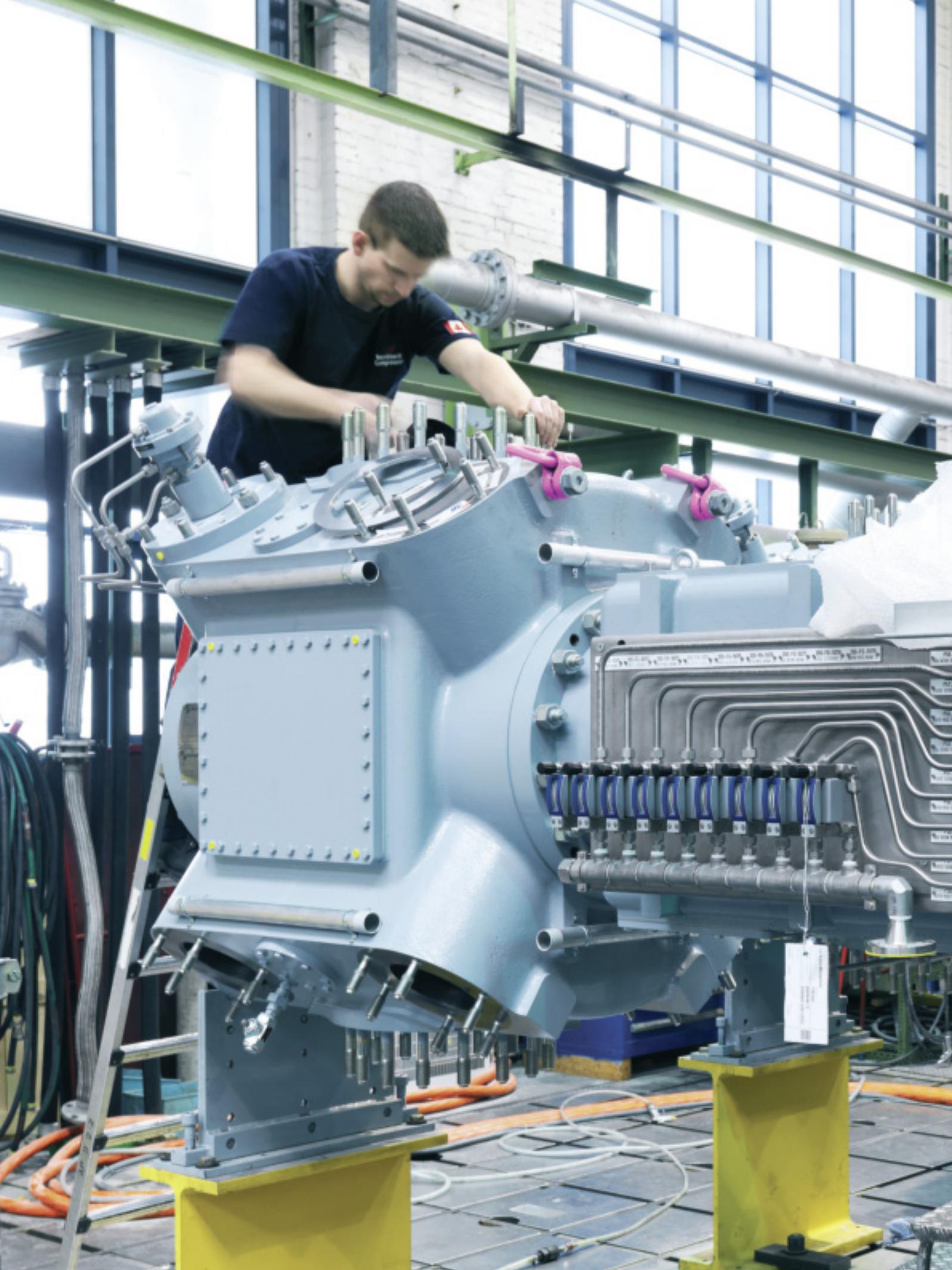


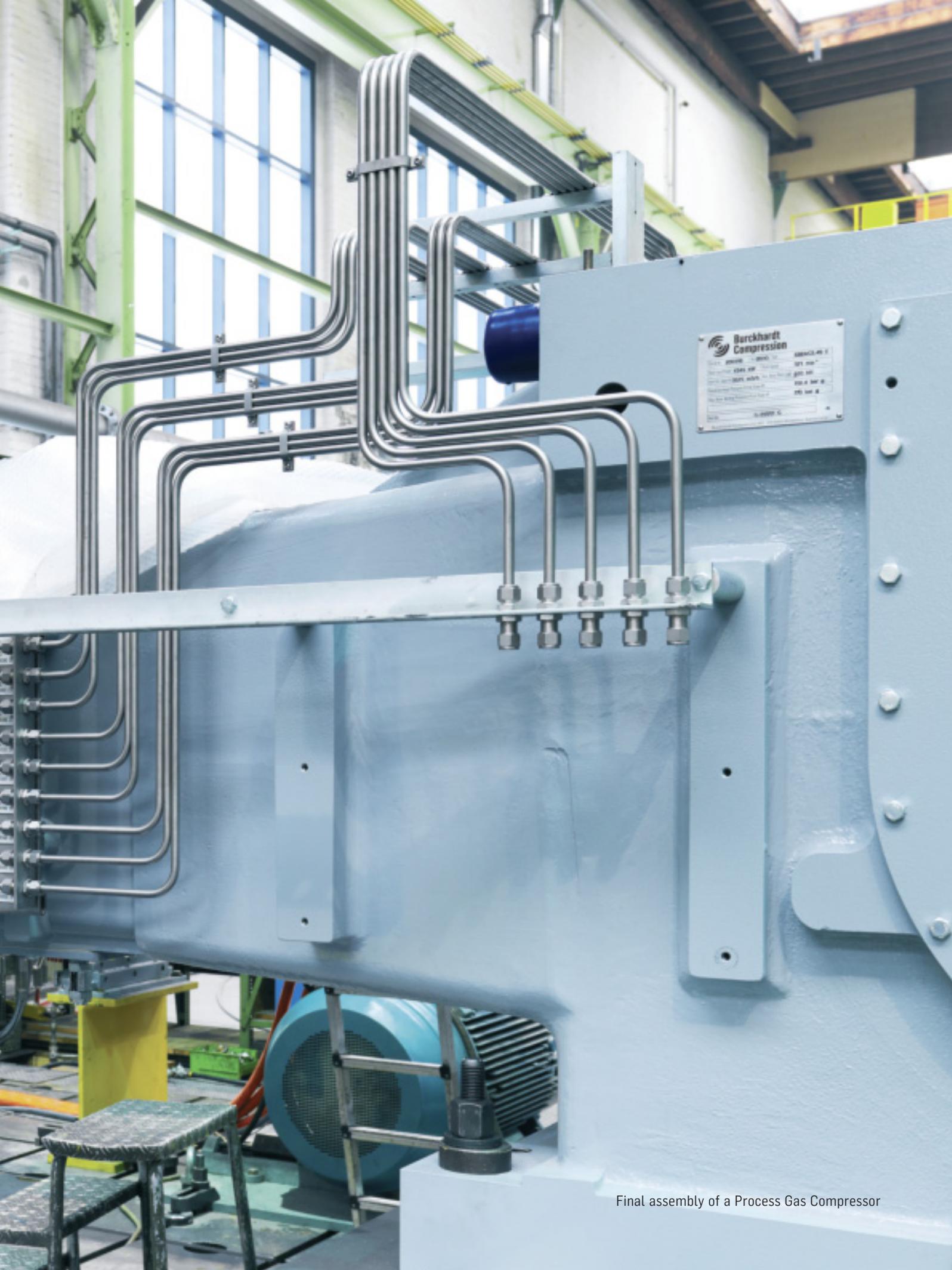
Hydraulic tightening device

“PROGNOST® READY” – PRE-FABRICATED MECHANICAL INTERFACES BY BURCKHARDT COMPRESSION

Extend MTBO, increase plant safety and avoid unplanned shutdowns by using an online condition monitoring and diagnostics system.







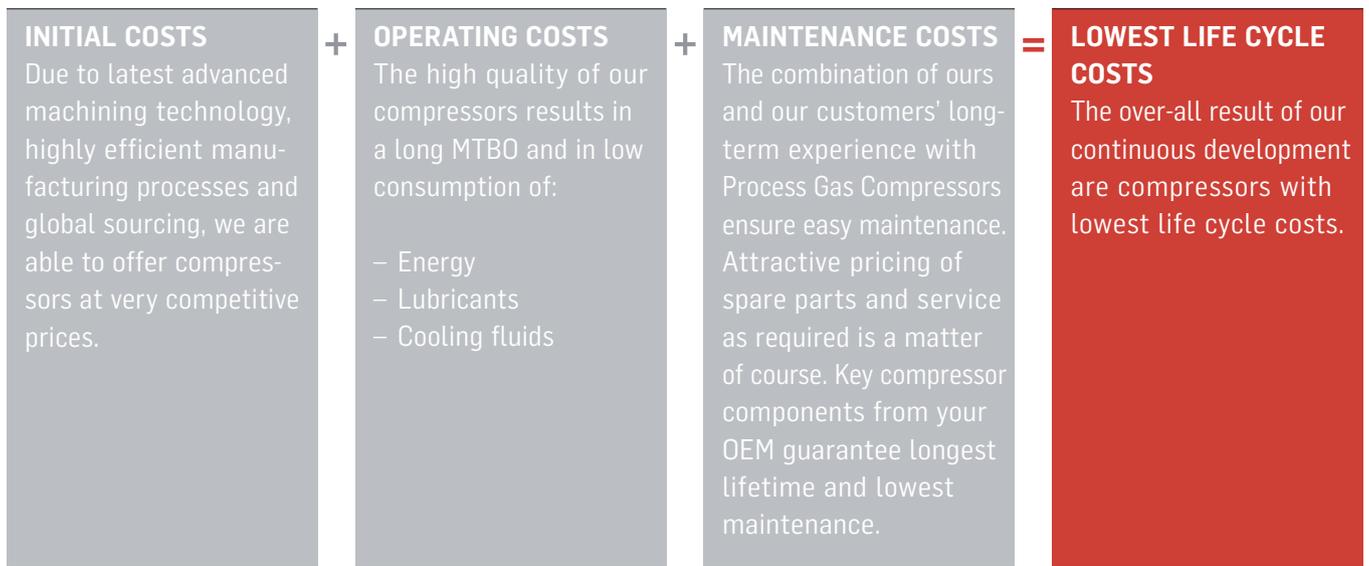
**Borchardt
Compression**

Model	2000	Capacity	2000 m ³ /h
Pressure	10 bar	Power	150 kW
Speed	1500 rpm	Weight	1500 kg
Dimensions	1000 x 1000 x 1000 mm	Material	Stainless Steel
Manufacturer	Borchardt Compression	Country	Germany

Final assembly of a Process Gas Compressor

LEADING COMPRESSOR TECHNOLOGY FOR LOWEST LIFE CYCLE COSTS

The Process Gas Compressors are the result of the broad experience gained by Burckhardt Compression over many decades. The second to none design has been accomplished in close collaboration with our customers throughout the world. Based on their needs, Burckhardt Compression provides a robust and reliable compressor of Swiss design and manufacture. Certified Swiss manufacturing, quality management and committed workforce ensure a constant high quality level.



Plant: Industriepark Höchst

Duty: Industrial Gas

Country: Germany

"We of Infracore Höchst, formerly part of the biggest chemical and pharmaceutical concern Hoechst AG, have confided in Burckhardt Compression since the fifties. Compressors of Burckhardt Compression set the standard in quality, availability, economy and safety. Thanks to the compressors' ease of maintenance as well as the reliable and wide customer support

service of Burckhardt Compression our satisfaction has increased over the years. The company's broad experience and their technical competence convinced us that we have chosen the right reciprocating compressor manufacturer."

Dr. Heinrich Lienkamp
Department Head Process Engineering
Business Unit Energies and Utilities
Infracore GmbH & Co. Höchst KG



MANUFACTURING

WITH STATE-OF-THE-ART MACHINING TECHNOLOGY



Cutting-edge 3D CNC Measurement Machine for quality inspection



Dörries Scharmann, Heavyspeed CNC Milling Machine
Centric table load: 23'000 kg, spindle stroke: 1'000 mm



Okuma MacTurn550, CNC Multitasking Center.
One of the 10 machining centers



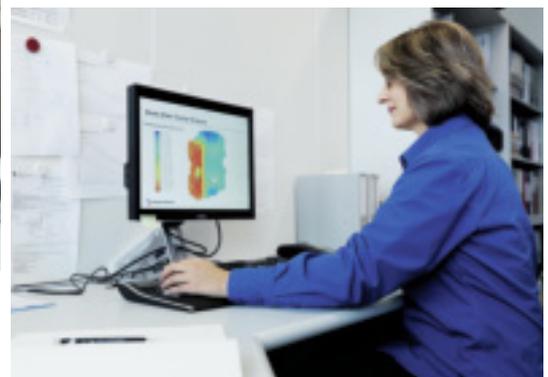
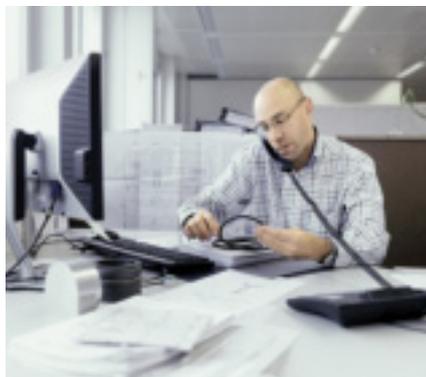
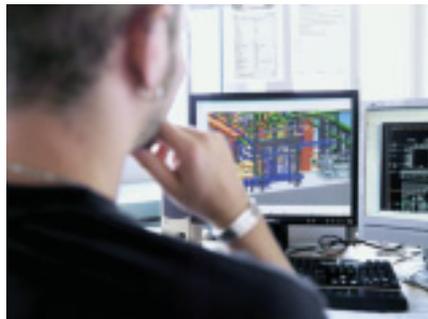
Okuma MacTurn350, Multitasking
Center. Fully automatic parts feeding



Dörries Scharmann, CNC Boring Mill
4 tables, spindle stroke: 600 mm

BURCKHARDT COMPRESSION

THE RECIPROCATING COMPRESSOR COMPANY
WITH THOROUGH IN-HOUSE EXPERTISE ...



... ENSURING COMPREHENSIVE SUPPORT BOTH FOR EPC CONTRACTORS AND PLANT OPERATORS

RESEARCH & DEVELOPMENT

- Tribology incl. test beds
- Finite element analysis
- Mechatronics

CUSTOMER SUPPORT SERVICE

- Engineering services
- Spare parts logistics
- Revamps
- Field service
- Valve service
- Component repair
- Technical support
- Monitoring and diagnostics
- Training

COMPRESSOR DESIGN

COMPRESSOR DESIGN

- Instationary fluid dynamics
- Pre-sales support, incl. detailed documentation
- Engineering analysis
- Feasibility study
- Selection and sizing
- Pulsation and vibration studies
- 3D CAD
- Compressor valves
- Rings and packings

PLANT ENGINEERING

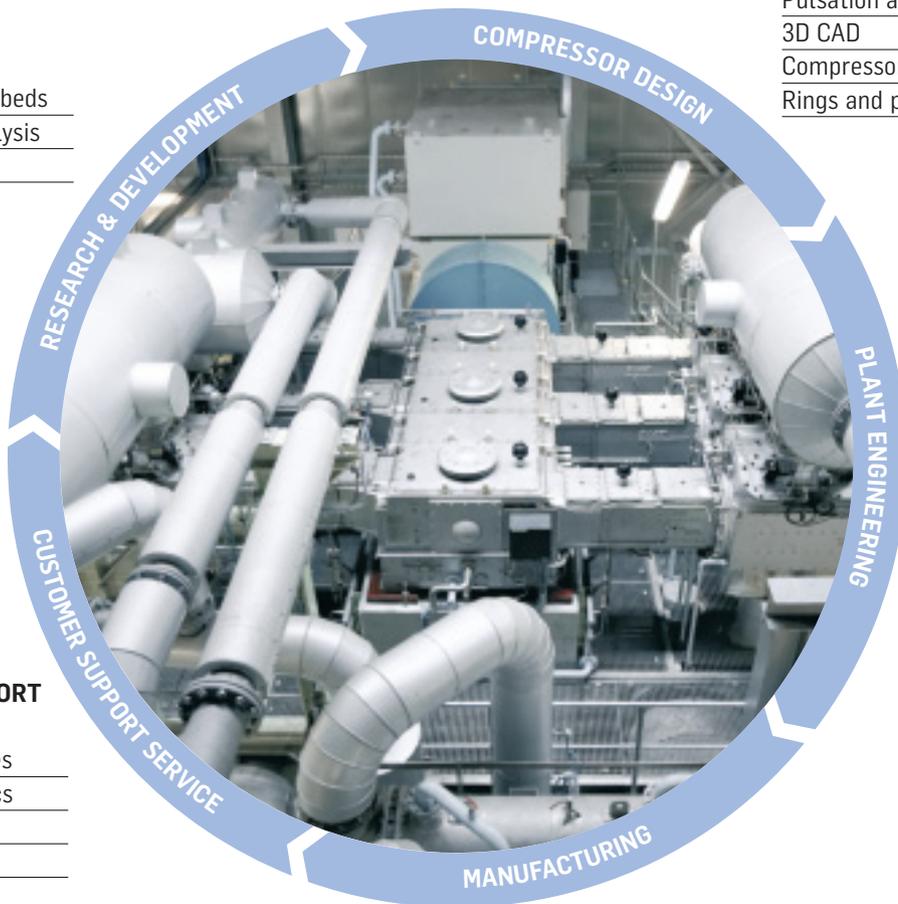
PLANT ENGINEERING

- Contracting
- Customer and standard specifications
- Compressor and auxiliaries on modules
- Cooling water system
- Instrument and control, motors
- PLC programming
- Turn-key projects

MANUFACTURING

MANUFACTURING

- State-of-the-art machining technology
- CAM in-house machining
- Purchasing
- Assembly
- Test beds
- Quality assurance



CUSTOMER SUPPORT SERVICE

ENHANCE YOUR MAINTENANCE

BURCKHARDT VALVE SERVICE

FAST VALVE SERVICE WITH EXTENSIVE GUARANTEE

- Analysis of valve condition
- Tracking of valve history
- OEM valve engineering
- Valve cleaning and overhauls
- Complete quality inspection
- State-of-the-art leak test
- Root cause analysis
- Corrosion protection

SPARE PARTS LOGISTICS

OEM GUARANTEE AND BEST LIFE CYCLE COSTS

- Original spare parts with OEM guarantee
- Spare parts frame agreements
- Stock recommendations
- Express service for emergencies
- Over 16'000 parts on stock
- 12 month guarantee
- Save time and money: use the Burckhardt e-Shop™ – the easy spare parts identification and ordering system

FIELD SERVICE

ONSHORE AND OFFSHORE: BENEFIT FROM OUR SKILLED RECIP EXPERTS

- On-site assembly and installation
- Erection/commissioning
- High safety standards – SCC and HUET certified
- Turn-key installations
- Start-up support
- Service contracts/preventive maintenance
- Plant overhaul/revision
- 12 month guarantee

TECHNICAL SUPPORT

PROFESSIONAL SUPPORT FROM OUR WELL TRAINED AND EXPERIENCED SPECIALISTS

- Performance analysis for optimized and efficient compressor operation
- Start-up support
- Troubleshooting
- Root cause analysis
- Emergency availability 24/7
- On-site failure analysis
- Online diagnostic support
- Consulting

COMPONENT REPAIR

SAVE MONEY AND GET "AS NEW" GUARANTEE

- Condition analysis
- Recommendations concerning which parts can be repaired or need to be replaced
- Incorporation of the latest technology where possible
- 12 month guarantee
- Repair of crossheads, piston rods, cylinder liners, bearings, pistons

ENGINEERING SERVICES

SOPHISTICATED IN-HOUSE SIZING AND ANALYSIS TOOLS

- State-of-the-art pulsation and vibration analysis
- Finite element analysis
- Unique analysis models for high pressure application up to 3'500 bar
- Reverse engineering and reengineering for own as well as for other brand compressor systems
- Dynamic analysis for any compressor parts

REVAMPS

REJUVENATE OR TUNE YOUR COMPRESSOR

- Modernizing
- Upgrades/retrofits
- Relocation of machines
- Debottlenecking
- Operation mode studies

- for own as well as for other brand compressor systems
- Conversion from lubricated to non-lubricated conversions
- Turn-key installations

MONITORING AND DIAGNOSTICS

EXTEND MEANTIME BETWEEN OVERHAUL

- Support for system evaluation
- Comprehensive customized service from diagnostic service to predictive maintenance
- Full service agreements for maximum availability
- Online diagnostic services

- Broad experience through compressor installations in various processes

Burckhardt Compression recommends  **PROGNOST**

TRAINING

HAVE YOUR OWN COMPRESSOR SPECIALISTS

- Theoretical and practical training from our compressor experts
- Training center with full size equipment (Laby®, Process Gas and Hyper Compressor)

- Standard trainings, customer specific programs on request

SERVICE CENTERS WORLDWIDE

- Service Center and field engineer base
- Burckhardt Compression Authorized Service Center

24 hours emergency:
+41 (0)52 262 53 53



RECIPROCATING COMPRESSORS

LEADING TECHNOLOGY FOR
LOWEST LIFE CYCLE COSTS

**Laby®
Compressors**
Contactless
and oil-free



**Laby®-GI
Compressors**
Fully balanced



**Process Gas
Compressors**
API 618 –
full compliant



**Hyper
Compressors**
Safe and reliable
up to 3'500 bar



COMPRESSOR COMPONENTS

BEST PERFORMANCE
AND LONGEST LIFETIME

Valves:

- Burckhardt Poppet Valve™
- Burckhardt Plate Valve™
- Manley® valve, licensed by
Burckhardt Compression

Piston rings

Guide rings

Piston rod packings

Packing rings

Oil scrapers

Hyper/secondary
compressor parts

CUSTOMER SUPPORT SERVICE

THE FULL RANGE OF SERVICES

Burckhardt Valve Service

Spare parts logistics

Field service

Technical support

Component repair

Engineering services

Revamps

Condition monitoring
& diagnostics

Training

FOR ALL YOUR RECIPROCATING COMPRESSORS

Burckhardt Compression AG

CH-8404 Winterthur

Switzerland

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Fax: +41 (0)52 262 00 51

24 hours emergency Tel.: +41 (0)52 262 53 53

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