ENGINEERING & REVAMP PROJECTS, COMPRESSOR MODERNIZATIONS
FOR RECIPROCATING COMPRESSORS, COMPRESSOR SYSTEMS AND AUXILIARY EQUIPMENT

Compressors for a Lifetime®
DECADES OF EXPERIENCE IN RECIPROCATING COMPRESSOR SYSTEMS ENABLE US TO PROVIDE SUPERIOR SOLUTIONS FOR LOWEST LIFE CYCLE COSTS OF YOUR EQUIPMENT.
RELIABLE SOLUTIONS FOR NEW OPERATING CONDITIONS
YOUR COMPRESSOR SYSTEM ADJUSTED TO THE EVER CHANGING REQUIREMENTS

COMPRESSORS FOR A LIFETIME

Burckhardt Compression is one of the market leaders in the field of reciprocating compressors and the only manufacturer that offers a complete range of Process Gas Compressors API 618, Laby® (labyrinth piston), Laby®-GI and Hyper Compressors. As a compressor OEM with more than 170 years of experience, we are committed to innovative solutions for highest reliability and lowest life cycle costs for new or modified compressor systems. Burckhardt Compression is predestined to support you in any adjustments to changing requirements.

Compressor systems are an integral part of the surrounding production process. Throughout the entire lifetime the requirements a compressor system must meet keep changing. We make sure your compressor meets the latest requirements guaranteed.

CHANGING REQUIREMENTS – SUPERIOR SOLUTIONS

Decades of expert knowledge in a wide range of compressor applications enable us to provide:
– Comprehensive expertise
– Profound review of the requirements
– Thorough planning including proficient feasibility studies

Our dedicated team approaches every revamp project with the support of our in-house experts for design and manufacturing of new compressors. We incorporate up-to-date technologies where appropriate and provide a guarantee on our solutions.

MARKETS & SEGMENTS SERVED

– 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
RECIProCATING COMPRESSOR SYSTEMS
OEM WITH MORE THAN 170 YEARS OF EXPERIENCE IN DESIGNING AND MANUFACTURING COMPRESSOR SYSTEMS

MORE THAN JUST COMPRESSORS

Any kind of modification of a compressor system or parts of it requires the comprehensive evaluation of the entire system and processes including auxiliary equipment.

Depending on the new or changing requirements, the condition of your equipment and security and environmental regulations, we start the process with an extensive assessment of the situation.

Precise project planning in close cooperation with customers and with a focus on cost and time efficient completion is the basis for reliable execution.

Incorporating state of technology material, design and manufacturing improvements, reliability, availability and efficiency can be increased.

The aim of our activities is a comprehensive system solution that meets all customer requirements, incorporating lifetime extension, reduction of the maintenance costs of the renewed equipment, the on time finalization of the project and continuation of the plant production.

OUR INNOVATIVE SOLUTIONS WILL PROVIDE A SECOND LIFE FOR YOUR WELL ESTABLISHED EQUIPMENT

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<th>COMPRESSOR COMPONENTS</th>
<th>AUXILIARY VALVES</th>
<th>MONITORING &amp; DIAGNOSTICS SYSTEMS</th>
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<tr>
<td>Wear and capital parts</td>
<td>Safety valves</td>
<td>Compressor control systems</td>
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<td>Compressor valves</td>
<td>Control valves</td>
<td>Monitoring and diagnostics safety systems</td>
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<td>Redura® rings and packings</td>
<td>Process valves</td>
<td>Machinery protection systems</td>
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<tr>
<td>Capacity control systems</td>
<td>Manual valves</td>
<td>Early warnings and trend analysis</td>
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<tr>
<td>Bearings</td>
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<td>High pressure equipment</td>
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<tr>
<td>VESSELS AND STEELWORK</td>
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<tr>
<td>Dampers/separators</td>
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<td>Absorbers/drain systems</td>
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<tr>
<td>Coolers/heat exchangers</td>
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<tr>
<td>Piping (pre-fabricated/loose)</td>
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<tr>
<td>Tubing</td>
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<td>Filters/strainers</td>
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<td>Pipe supports</td>
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<tr>
<td>Platforms</td>
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<tr>
<td>SKID UNITS</td>
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<tr>
<td>Oil supply units</td>
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<tr>
<td>Cooling water units</td>
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<td>High pressure lubrication pump units</td>
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<tr>
<td>Skid packaging</td>
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| DRIVE SYSTEMS                        |                                       |                                            |
| Electric motors (high voltage/low voltage) | Frequency converters | Compressor control systems                |
| Gear boxes                           | Belt drive systems                   | Monitoring and diagnostics safety systems  |
| Coupling systems                     |                                         | Machinery protection systems              |
|                                       |                                         | Early warnings and trend analysis         |

ELECTICAL, INSTRUMENTATION & CONTROL

| Control cabinets                     | Local instrument boards               |                                            |
| Instrumentation/hook-ups             | Software                               |                                            |
| Cabling                              | Pressure, temperature, flow, level and vibration indication |                                            |
| PLC programming                      |                                         |                                            |

MONITORING & DIAGNOSTICS SYSTEMS

| Compressor control systems          | Monitoring and diagnostics safety systems |
| Monitoring and diagnostics safety systems | Machinery protection systems       |
| Early warnings and trend analysis   |                                            |

ON-SITE SERVICES

| Site coordination                   | Technical and electrical supervision  |
| Technical and electrical supervision| Special tools                        |
| Special tools                       | Back-office support                  |
| Back-office support                 | Turn-key projects                    |
| Turn-key projects                   | Reciprocating compressor specialists  |
ENGINEERING & REVAMP PROJECTS, COMPRESSOR MODERNIZATIONS

- COMPREHENSIVE REQUIREMENTS REVIEW AND PROJECT PLANNING UTILIZING SOPHISTICATED ANALYSIS AND SIZING TOOLS
- EFFICIENT EXECUTION – PROFESSIONAL PROJECT MANAGEMENT
- ON SCHEDULE
- PROJECT FINALIZATION – ENSURING DEPENDABLE CONTINUATION OF PLANT PRODUCTION
STANDARD PROCESSES
OUR WELL ESTABLISHED METHODS FOR MEETING YOUR REQUIREMENTS

CUSTOMER

REQUIREMENTS
- PROCESS IMPROVEMENT
- AVAILABILITY, RELIABILITY, SAFETY
- PROCESS CONDITIONS
- ENVIRONMENTAL IMPROVEMENTS
- ECONOMICAL IMPROVEMENTS
- TECHNOLOGICAL UPGRADE
- OPERATIONAL CHANGES
- LOCATION CHANGE
- LEGAL COMPLIANCE

BURCKHARDT COMPRESSION

EVALUATION
- BASIC ENGINEERING
- FEASIBILITY STUDIES
- PERFORMANCE CALCULATIONS

ENGINEERING
- PROJECT ENGINEERING
- ANALYTICAL ENGINEERING
- DETAIL ENGINEERING
- QUALITY & DOCUMENTATION

A SOLID FOUNDATION FOR SUCCESSFUL PROJECTS
CONSTANT INTERACTION ADDS TRUST BETWEEN CUSTOMER AND BURCKHARDT COMPRESSION
A SOLID FOUNDATION FOR SUCCESSFUL PROJECTS

CONSTANT INTERACTION ADDS TRUST BETWEEN CUSTOMER AND BURCKHARDT COMPRESSION

PRODUCTS AND SERVICES

- COMPRESSOR COMPONENTS
- AUXILIARY EQUIPMENT
- CAPACITY CONTROL & MONITORING SYSTEMS
- DIAGNOSTICS & SAFETY SYSTEMS
- ELECTRIC, INSTRUMENTATION, CONTROL
- SKID MOUNTED UNITS
- WEAR & CAPITAL PARTS
- MAINTENANCE TOOLS
- DRIVE SYSTEMS

SITE ACTIVITIES

- COMMISSIONING
- INSTALLATION & DE-INSTALLATION
- QUALITY PROCEDURES
- FIELD SERVICE

PERFECT OPERATING COMPRESSOR SYSTEM ACCORDING TO DEFINED SPECIFICATIONS

- IMPROVED RELIABILITY AND AVAILABILITY
- INCREASED PERFORMANCE AND LIFETIME
- ENHANCED EFFICIENCY AND COMPLIANCE
In order to provide optimally engineered solutions to meet the new system requirements, skilled reciprocating compressor professionals use our vast in-house expertise as a leading compressor OEM to provide highest planning reliability.

In close collaboration with clients we draw up detailed, customized solutions based on the plant production planning and scheduling to ensure efficient execution and on-time project completion.

EVALUATION PROCEDURES

- Feasibility check of new demands (incl. risk analysis)
- Compressor and plant assessments
- Failure analysis
- Material tests and analysis
- Oil test (pump ability)
- Proposals for suitable modification, upgrade and technical improvement options for: auxiliary equipment, drive system, control systems, monitoring systems, compressor components and technology
- Project and quality evaluation
COMPREHENSIVE ENGINEERING SERVICES
IN-HOUSE SIZING AND ANALYSIS COMPETENCE FOR ANY RECIPROCATING COMPRESSOR

Burckhardt Compression has over 40 years of in-house experience in the field of structural analysis. With our latest in-house developed sophisticated sizing and analysis tools, we are able to provide mechanical and structural analysis of components as well as of entire compressor systems, particularly if operating conditions change or an increase in capacity is planned.

OUR IN-HOUSE COMPETENCE

DETAI ENGINEERING
– P&I diagrams/isometric drawings
– General arrangements/foundation drawings
– Circuit diagrams, terminal diagrams, interface diagrams, logic diagrams, connecting diagrams, hardwired lists
– Instrument lists
– 3D modelling (plant, compressor)
– IOM (instructions and operational manual)
– Document management
– Project schedule

ANALYTICAL ENGINEERING
– Compressor performance calculations with RecipCalc™ (thermodynamic)
– Valve performance optimization
– Impact on foundation (forces and moments)
– Torsional analysis
– Pulsation and vibration studies
– Finite element analysis (FEA) studies
Changes to a compressor and/or compressor system for operational, technological, economical or environmental reasons, which can combine activities such as:
- Debottlenecking
- Capacity change
- Reapplications
- Modernizations

**REVAMP**

**REJUVENATE OR TUNE YOUR COMPRESSOR SYSTEM**

**DEBOTTLENECKING**
Changes to a compressor and/or compressor system to fit to new design or operation parameters and eliminate compressor system limitations; work performed includes theoretical calculations, size simulations and feasibility check/studies.

**CAPACITY CHANGE**
Changes to a compressor and/or compressor system to increase or decrease the output of an existing product/machine.

**REAPPLICATION**
Changes to a compressor and/or compressor system to meet revised process parameters.
CASE

Compressor type: Hyper Compressor (10 Cylinder)

Application: Low-density polyethylene production

Year of installation: 1978

SITUATION/CUSTOMER REQUIREMENTS
- Original foundation (provided by 3rd party) without oil resistant protection. Movement of the system led to damage of foundation
- Replacement of the damaged foundation and a complete revamp of the compressor system was required

SCOPE OF SUPPLY AND SERVICE
- Complete disassembling of compressor and connections
- Removal of old foundation and replacement with new, state of the art foundation
- Local refurbishment of entire compressor, motor and auxiliaries
- Concurrent coordination of all necessary suppliers and services

TECHNICAL HIGHLIGHTS
- Heavy duty equipment combined with high precision execution
- Highly accurate machining of large parts (e.g. crankcase)
MODERNIZATION
NEW LIFE – ENHANCED RELIABILITY

Upgrade, optimization, adjustment and/or modification of a compressor and/or a compressor system to state-of-the-technology for both software and hardware.

<table>
<thead>
<tr>
<th>UPGRADE</th>
<th>ADJUSTMENT</th>
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<tbody>
<tr>
<td>Exchange of components or system for a state-of-the-art solution.</td>
<td>Adjustment to a compressor and/or compressor system to meet legal requirements and regulations.</td>
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<th>MODIFICATION</th>
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<td>Quality and/or design improvement for compressor and/or compressor system parts.</td>
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</table>
CASE

Compressor type: Process Gas Compressor (2 cranks)

Application: Hydrogen in refinery

Year of installation: 1982

SITUATION/CUSTOMER REQUIREMENTS
– Increase reliability and availability of plant, which requires a modernization of old compressors

SCOPE OF SUPPLY AND SERVICE
– Service provided in immediate action
– Reconstruction work based on old, intensively used parts
– Complete dismantling of compressor, inspection (incl. NDT), cleaning, sand blasting and repair of the used parts
– Provided state-of-the-art components such as: bearings, cross heads & pins, additional distance pieces and crankshaft, complete cylinders incl. rings & packings, liners, valves etc.
– Reassembly of the complete compressor, incl. all new, modernized parts, piping on the compressor, painting and mechanical test run
– All engineering activities (including project management, design & manufacturing, documentation, quality services etc.)

TECHNICAL HIGHLIGHTS
– Successful combination of refurbished parts and new state-of-the-art components
– Complete modernized system solution
RETROFIT/REVERSE ENGINEERING
PERFECTLY ADAPTED COMPONENTS – IMPROVED QUALITY

Replication and substitution of existing components with components of original design and latest quality standards.

CASE

Compressor type: Process Gas Compressor, Non-Burckhardt Compression model

Application: Low-density polyethylene production

Year of installation: 1974

SITUATION/CUSTOMER REQUIREMENTS
– Fretting of bearing shell of connecting rod
– Investigate cause of fretting
– Provide appropriate solution

SCOPE OF SUPPLY AND SERVICE
– Scanning of existing parts without any documentation
– Redraw the complete connecting rod based on available information and on measurements
– Finite element study resulted in increased tightening to provide the correct pretension
– Material analysis and recommendations for improvements
– Specification of manufacturing and testing procedures
– Engineering, manufacturing and delivery of connecting rods

TECHNICAL HIGHLIGHTS
– Capital part manufacturing without existing original drawings
– Original part had to be measured to obtain the missing dimensions
– Complete modernized system solution
RELOCATION
A NEW LOCATION FOR YOUR WELL ESTABLISHED EQUIPMENT

Move and fit a compressor and/or a compressor system to a new location.

CASE
Compressor type: Laby® Compressor (3 cranks)
Application: Linear low-density polyethylene production
Year of installation: 2012

SITUATION/CUSTOMER REQUIREMENTS
– Move an existing compressor system to a different location
– In addition, evaluate and provide necessary changes to meet higher working pressure

SCOPE OF SUPPLY AND SERVICE
– Recalculation and exchange of equipment according to process parameters
– Revision and exchange of electrical components incl. new main motor
– Relocation of the entire equipment

TECHNICAL HIGHLIGHTS
– Foundation planning with new and old equipment
– Meet new legal requirements with old machine (CE, PED, ATEX)
REPLACEMENT
NEW TECHNOLOGIES – IMPROVED LIFETIME

Exchange of compressor and/or compressor system with state-of-the-art solutions.

CASE

Compressor type: Laby® Compressor (4 cranks)
Application: Boil-off-gas handling
Year of installation: 1988

SITUATION/CUSTOMER REQUIREMENTS
– Replacement of old, purged control panels while ensuring dependable continuation of plant availability

SCOPE OF SUPPLY AND SERVICE
– Engineering of hardware and software
– 4 new installed compressor panels (including software package)
– 1 new installed cooling water panel (two old water panels combined in one)
– Panels nitrogen purged
– Complete set of documentation and quality certificates

TECHNICAL HIGHLIGHTS
– Successful on-site installation with short time slots between loading and unloading phases
TURN-KEY PROJECT
ONE SOURCE FOR YOUR COMPLETE SOLUTION

Solutions provided with sole responsibility for the complete execution of the contractually specified scope of works from the planning to the commissioning activities.

CASE

**Compressor type:** 3x Hyper Compressor (6 cylinder), Non-Burckhardt Compression model

**Application:** Low-density polyethylene production

**Year of installation:** 1978

**SITUATION/CUSTOMER REQUIREMENTS**
- Increase reliability and availability of compressors
- Turn-key solution for three lines of non-BC Hyper Compressors

**SCOPE OF SUPPLY AND SERVICE**
- Calculation and adaption of the system to new process parameters
- Engineering of new installed and revised components
- Dismantling, revision, reassembly and commissioning of the compressor lines according to local regulations
- Partial replacement of components by new state-of-the-art technology
- Site installations in three steps (slot of 24 days for each compressor)
- Transport, storage and conservation of materials
- Coordination of local sub-suppliers and flexible planning of manpower, infrastructure and logistics

**TECHNICAL HIGHLIGHTS**
- Heavy duty equipment combined with high precision execution
- Flexible process adaptation to situation on site
# ENGINEERING & REVAMP PROJECTS

**WELL-DEFINED ACTION PLANS FOR SUPERIOR SOLUTIONS**

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<tr>
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<th>MODERNIZATION</th>
<th>RELOCATION</th>
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<tr>
<td>UPGRADE</td>
<td>Move and fit a compressor and/or a compressor system to a new location.</td>
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<tr>
<td>OPTIMIZATION</td>
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<th>TURN-KEY PROJECT</th>
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<td>Exchange of compressor and/or compressor system with state-of-the-art solutions.</td>
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WITH OUR WELL ESTABLISHED PROCESSES WE ACCOMPLISH OPTIMIZED REVAMP SOLUTIONS ACCORDING TO DEFINED SPECIFICATIONS PROVIDING:

– IMPROVED RELIABILITY AND AVAILABILITY
– INCREASED PERFORMANCE AND LIFETIME
– ENHANCED EFFICIENCY AND COMPLIANCE
WITH OUR IN-HOUSE EXPERTISE WE KEEP ANY COMPRESSOR RUNNING ENDLESSLY

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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