

# Compressor valves for better reliability, higher efficiency and safety

  
**HOERBIGER**



# Experience and know-how: basis for profitability and reliability

**Compressor valves are among the most excessively stressed parts of reciprocating compressors and are vital to their availability, efficiency and safety.**

The working principle of HOERBIGER compressor valves is fully automatic and highly efficient. The valves have a long service life and guarantee ideal flow behaviour.

Many different valve designs are available for numerous fields of application, e.g. for the compression of air, hydrogen, natural gas, industrial gases or refrigerants, for lubricated or non-lubricated compressors in high and low pressure ranges.

## Crude oil industry

- Oil production and refineries (fuels)

## Petrochemical and chemical industry

- Lubricants
- Polymers
- Chemical products

## Natural gas applications

- Gas gathering
- Gas transport
- Gas storage
- CNG

## Air applications

- PET-bottle blowing
- Air and compressed air supply

## Technical gases

- Production of oxygen, nitrogen, hydrogen, argon, helium etc.

## Industrial cooling

- Refrigerated storage buildings, refrigerator trucks, container cooling

## Automotive industry

- Air brake compressors for utility vehicles
- Air condition for buses and drivers' cabins

## Railway

- Air brake compressors

## Shipbuilding

- Starting air compressors
- Explosion relief valves for engine crank cases

## Plant construction

- Explosion relief valves for compressor crank cases



# Innovation is tradition with HOERBIGER

For more than a century design solutions and materials improving the efficiency and working time of compressors have been developed by HOERBIGER.

Be it standard applications or special requirements: each single solution contains all the expertise of HOERBIGER concerning the complex relationships within the compressor, as well as the pertinent international directives.

Our experience enables us to meet the requirements of our markets. We can support compressor manufacturers at an early stage of development work. A combination of customer experience and our expertise with valve development provides means and possibilities to build more efficient compressors, with maximum performance. Machine users on the other hand are given our support in optimising their machines and rendering them fit for the decades to come.

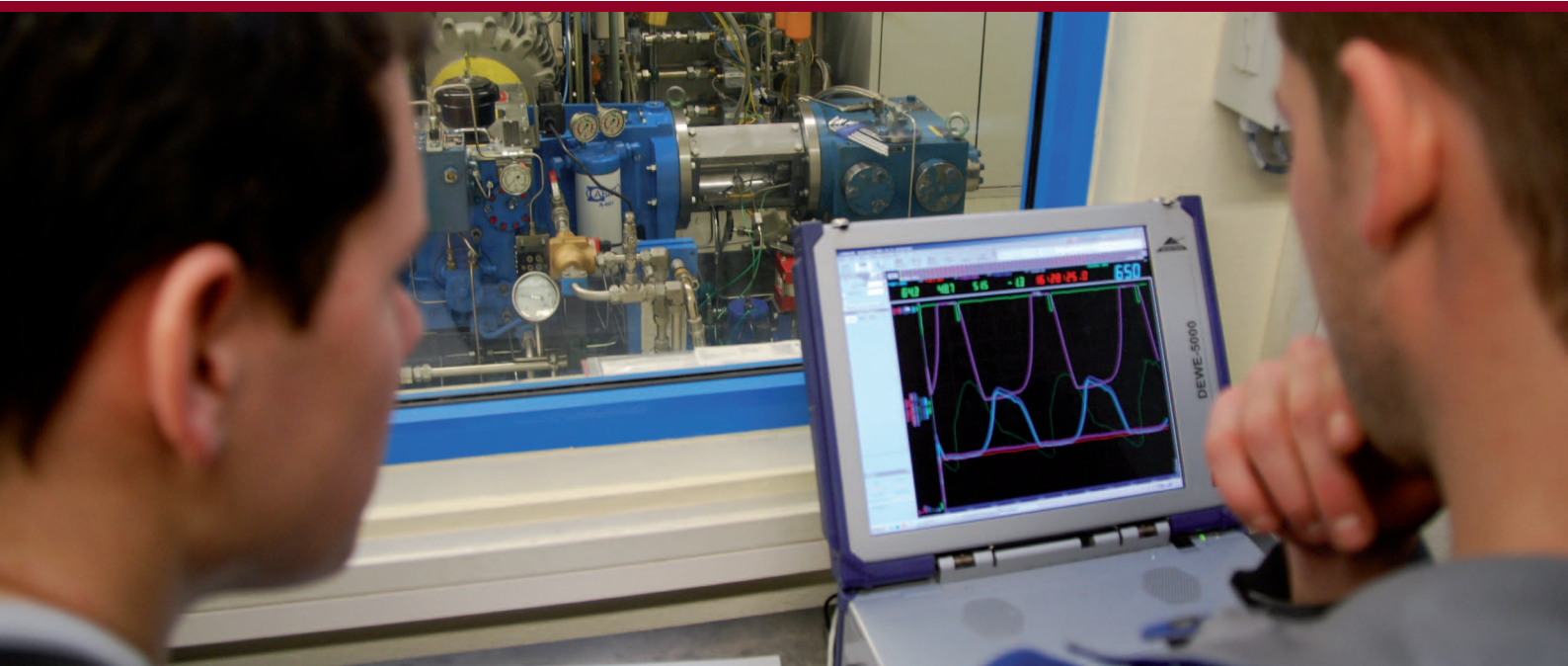
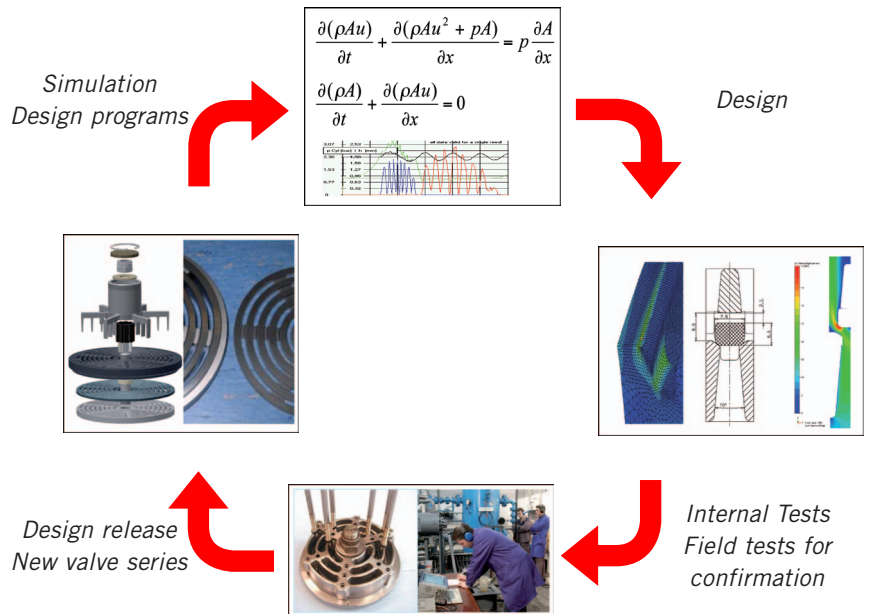
## HOERBIGER standard in product development

In order to meet the high industrial standards of our customers we develop our products according to the principle of the so called design box.

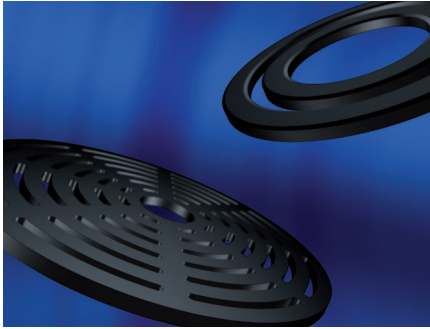
Design box is an internal HOERBIGER quality standard which has been developed over decades. It describes and monitors all development processes.

## Design box consists of four essential elements:

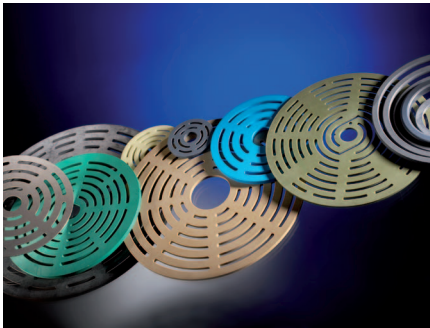
- Systematic examination of fundamental chemical-physical relationships
- The development of materials and products based on the above
- Tests at our own test compressors and in our laboratories
- Intensive field test phase together with selected customers



# The optimal material for each application



*The new HP material: superior with corrosive gases and extreme temperatures*



*The new HTCX material: optimal impact resistance for maximal life time*

Since the lifetime of a reciprocating compressor depends essentially on the life time of the wear parts, the selection of optimal materials and the development of innovative materials is one of our core competences.

Materials for the production of plastic rings and plates of HOERBIGER compressor valves have to meet special requirements. Some of them are:

- resistance to very high and low temperatures
- pressure resistance
- resistance against corrosive gases
- damping properties
- extremely high impact resistance
- use under variable operating conditions

Rings and plates meeting these requirements increase service life of valves and dramatically reduce maintenance cost of a plant.

HOERBIGER makes quality its highest goal and produces plastic materials to our own high specifications. This leads to Continuous high valve quality as a result.

HOERBIGER specifications are based on intensive basic research and development, and our long term experience in tribology and materials sciences. This know-how is invested in joint development together with selected material producers.

Integration of all the individual processes guarantees high process safety over the whole production procedure. From blending the basic materials, to the production of plastic plates and rings in our own plants, to the finished product.

Our most recent developments have already been successfully established in the market:

- **HP:** a chemically high resistant material especially developed for extremely low temperatures
- **HTCX:** a plate and ring material optimized in impact resistance and life time



# The best valve service now on your doorstep

**State-of-the art compressors equipped with HOERBIGER valves require only a minimum of valve maintenance. Nevertheless, compressor reliability and safety depend on carrying out this limited maintenance thoroughly.**

## Visual checking

First of all, our specialists examine each valve carefully to spot any problems – and their possible causes – for the final repair report. They decide whether the valve can be repaired economically, and if so, they give it a preliminary clean in preparation for dismantling.

## Washing and shot-peening

All the valve components are cleaned with the help of a shot-peening machine, which removes even the most persistent layers of contamination.

## Crack checking

Next, each component is inspected for signs of fatigue, cracks and breakage. Deep tears or breaks in the seat or guard require the valve to be replaced. On the whole, the valve will

need replacing if the valve seat shows a minimum thickness after being reworked several times.

## Seat machining

Seat surface quality is critical to valve tightness. We use high-precision machine tools to turn and grind valve seats to agreed standards.

## Assembly

Due to the highly specific and individual nature of each compressor valve, assembly requires as much care and accuracy as dismantling. Our specialists use only HOERBIGER spare parts when they replace plates, rings and springs. They take care to tighten the central nut to the exact torque required, whilst ensuring that the valve plates have free movement and the correct lift.

## Leak testing and conditioning

Finally, the valve is checked thoroughly on a dedicated test rig. We insist on the same stringent tightness standards for reconditioned valves as for new valves. All valves are documented on a certificate that is included with the analysis report. The valve is wrapped in special paper for long-term storage.



## Process Gas

### Refinery, chemical applications and technical gases

The field of technical gases comprises production, bottling, and sales of pure & technically clean gases. Compressors used for this purpose are often of considerably smaller size than with process gas applications, and therefore have to be equipped with smaller valves. Both, reciprocating and diaphragm compressors are used. The chemical industry processes technical gases, for instance in the Haber(-Bosch) process during ammonia synthesis. Also polymer production for producing plastics is counted among the (petro)chemical applications. Desulphurization of oil or production of fuels and lubricants are examples for refinery applications.

#### Applications:

##### Refinery:

- Hydrogen production
- Crude oil distillation
- Hydro cracking
- Reforming
- Hydrogen desulphuration (HDS)

##### Chemistry:

- Production of different polymers (e.g. PP, LDPE, HDPE)
- Fertilizers
- Chlor-alkali

##### Technical gases:

- Air separation
- Gas bottling for transport
- End user applications in medicine technology, pharmaceutical industry, space technology, chemistry and electronics

#### Requirements and features:

Compressors for process gas are frequently lubricated, slow running, and in accordance with API and can achieve powers of up to 15 MW. Compressors for technical gases are often non-lubricated and compress at high pressure ratios. As is the case of the chemical industry where operating conditions are highly demanding for compressor valves:

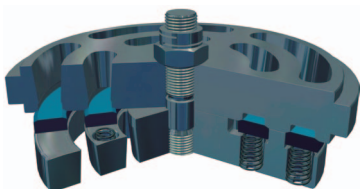
- Chemical reactions of gases (e.g. polymerisation)
- Different gas properties (e.g. corrosive, explosive, toxic, inert)
- Different gas densities (from nitrogen to carbon dioxide)
- Humid as well as bone dry gases
- High temperature ranges (air applications)
- Reciprocating compressors with and without cylinder lubrication and diaphragm compressors
- Foreign particles in the gas (e.g. by catalyst wear)

#### Recommended HOERBIGER valves:

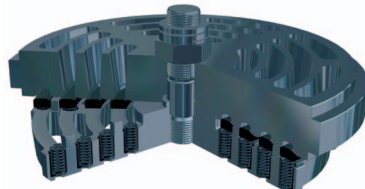
Depending on the individual application we recommend solutions from modern ring valves, to proven simple constructed plate valves. The individual case depends on the right valve selection.

- CX valve: the robust ring valve mainly for low molar weight (pure hydrogen applications)
- CE valve: the ring valve for demanding (petro)chemical applications
- CS valve: the plate valve for low pressures and heavy gases
- CM valve: the ring valve with synchronous plate for highest efficiency at high speeds and pressures
- CP valve: the profiled plate valve for minimal performance losses
- HPV valve: the special valve for highest final pressures in diaphragm and reciprocating compressors with small cylinder diameters

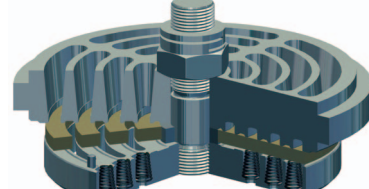
CX valve



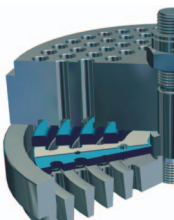
CE valve



CS valve



CM valve



# From the application case to the right valve

Being a valve manufacturer with a tradition of more than 100 years' experience, we have computed, constructed and manufactured valves for almost every application case possible. As many of our customers trust in our service we can also gain insight into wear behaviour and service life under most different operating conditions. Taught by experience we have systemized valve selection and design step by step.

## Natural gas

Gas processes are the most diverse applications such as natural gas gathering, transport and storage.

### Applications:

#### Natural gas:

- Gas transport
- Gas processing
- Gas storage
- Gas re-injection
- LNG

### Requirements and features:

Compressors for natural gas applications are frequently high speed compressors with high power density.

Operating conditions that are characteristic for gas processes render requirements even more difficult:

- Saturated, humid gases
- Gathering of liquids
- Corrosive components in the gas (H<sub>2</sub>S, CO<sub>2</sub>)
- Foreign particles in the gas
- Combination of heavy gases and oil lubricated compressors (oil sticktion)

### Recommended HOERBIGER valves:

When selecting compressor valves for the gas industry the right balance between efficiency and life time has to be found.

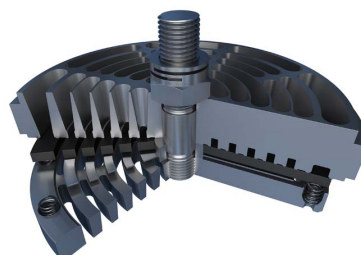
The flow properties of the new generation of profiled plate valves, the CP valve, make them highly efficient and durable (no oil sticktion, especially resistant materials for high impact speeds):

- CP valve: the high performance valve for high speed compressors - typically for small pocket - with a profiled valve plate for minimal performance losses, robustness and efficiency
- CM valve: the ring valve with synchronous plate for highest efficiency at high speeds and pressures - specifically for gas storage and gas re-injection
- CT valve: reliable and high performance valve for high speed compressores - a workhorse of the gas compression industry
- HDS valve: the proven double-damped plate valve for highest pressures and speeds

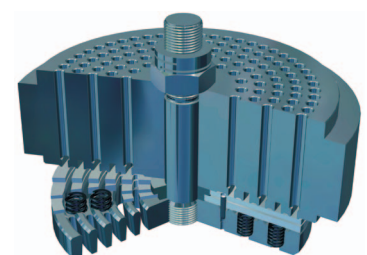
CP valve for small pocket



CT valve



HDS valve



CP valve



# Ive design - HOERBIGER design standards

The different requirements are of course taken into consideration, as each process owns other crucial features that have to be observed for valve selection. Depending on place and type of compressor use, there is a specific portfolio of valve types which can be chosen. It is the single application case which individually defines the valve type to be selected.

## Industrial air

### PET, CNG and refrigeration applications of serial compressors

Serial compressors are characterized by compact construction, a high degree of standardisation and high numbers. The media to be compressed are mainly air, natural gas and refrigerants. The industrial field covers a wide range from PET bottle blowing to natural gas fuel stations.

#### Applications:

- Air supply
- PET-bottle blowing
- Starting air for big diesel engines
- Air brakes for railways and trucks
- CNG fuel stations
- Air conditioning and refrigeration

#### Requirements and features:

The compressors used are mostly dry running with medium to high speeds. In spite of their small construction, valves for such applications have to offer long service life and high efficiency. Modern materials and new valve types help meet these requirements:

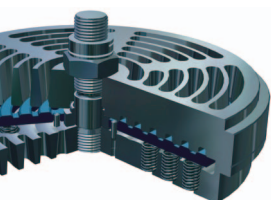
- Flexible operating hours (frequent switching on and off)
- Compact construction
- High performance compressors (high temperatures)
- Many of them dry-running
- Low maintenance expense required

#### Recommended HOERBIGER valves:

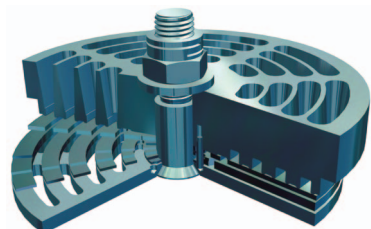
Valves for such compressors have to be adapted to the geometrical conditions of the compressor. They excel by low clearance volume and an economic design. At the same time they have to excel in efficiency and service life.

- CP valve: the profiled plate valve for minimal performance losses
- R valve: the proven steel plate valve for high speed and low pressure
- Concentric valve: the compact suction and discharge valve for serial compressors
- HPV valve: the high performance valve with high temperature plastic ring, especially for high discharge pressures

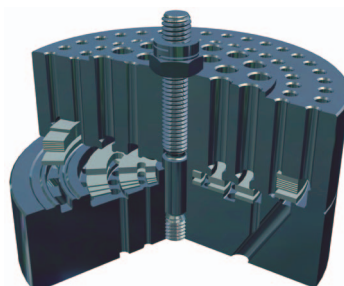
for large pocket



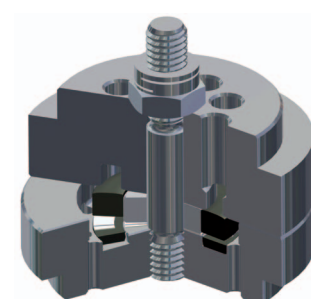
R valve



Concentric valve



HPV valve





**Based on the HOERBIGER valve design standards we can provide a valve design which is optimized for reliability and efficiency. Our valves are precisely adjusted to the required properties for a process.**

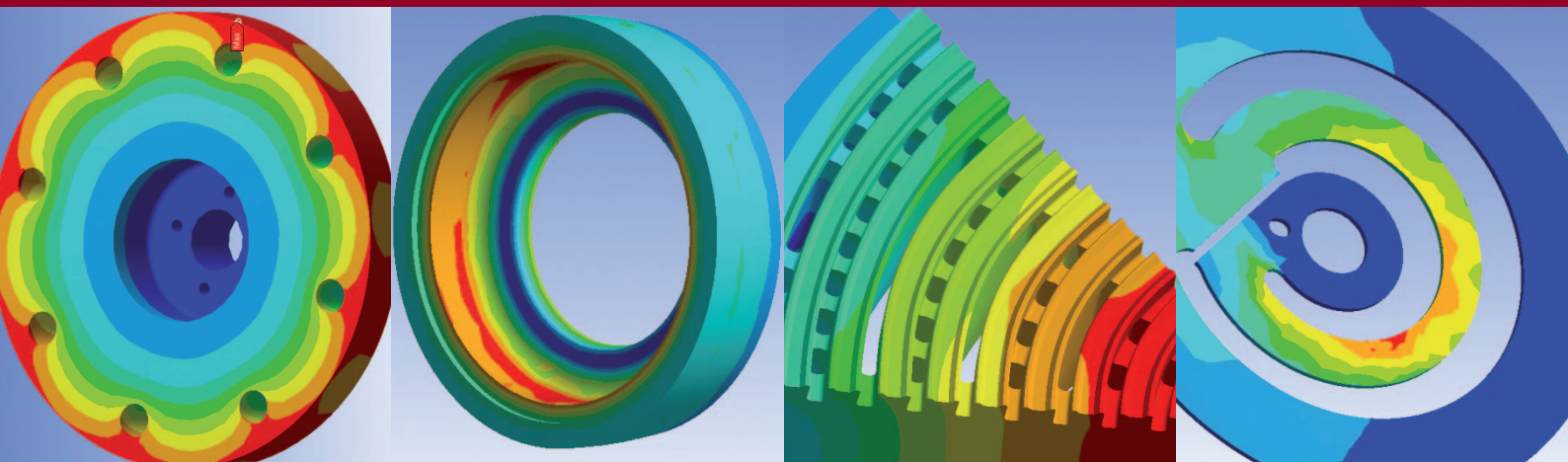
Each of our compressor valves are submitted to very individual operating conditions. A variety of different plant processes requires a variety of configuration possibilities for our valves. That is why it is our duty to select “the“correct valve for individual applications and design it exactly to your needs. You can trust our expertise and knowledge of the industry for this tailor made selection.

Apart from the activities of our R&D department, it is the long term experience of our product managers and design engineers which is decisive for the engineering process. This experience and the cooperation of our internationally active organisation have contributed to the development of HOERBIGER valve design standards. These design standards combine our knowledge on processes and their operating conditions, as well as the compressor and valve properties derived from them. Thus we can provide a valve design which is optimized for reliability and efficiency and can generate worldwide customer benefit by our standard design criteria.

The structure of the design standards are both simple and convincing, special valve types being attributed to each single application.

These valves are precisely adjusted to the required properties for a process. After pre-selection features like suction and discharge valve motion, pressure and performance losses, gas speeds etc, they are optimized for efficiency and service life.

For this purpose specially developed computation programs and simulation tools are used. In addition to the valve dynamic studies our valve seats and guards are computed with the aid of state-of-the-art FEM analysis.



# HOERBIGER control systems for higher efficiency, better process control and lower operating costs

Efficient performance control is required in many applications of reciprocating compressors. Most of these systems are, however, slow, inaccurate and waste energy. Control systems by HOERBIGER react quickly and reduce costs by energy savings.

## HydroCOM:

The most efficient continuous control for reciprocating compressors

- Maximum energy saving
- Stepless control range
- Utmost control dynamics
- Complete automation

## Why invest in HydroCOM?

HydroCOM is a quick and precise control system for safe and energy saving operation of a reciprocating compressor. This continuous control results in high energy savings, as only the actually required volume of gas is compressed. Furthermore HydroCOM renders starting and switching off of engineering processes easier.

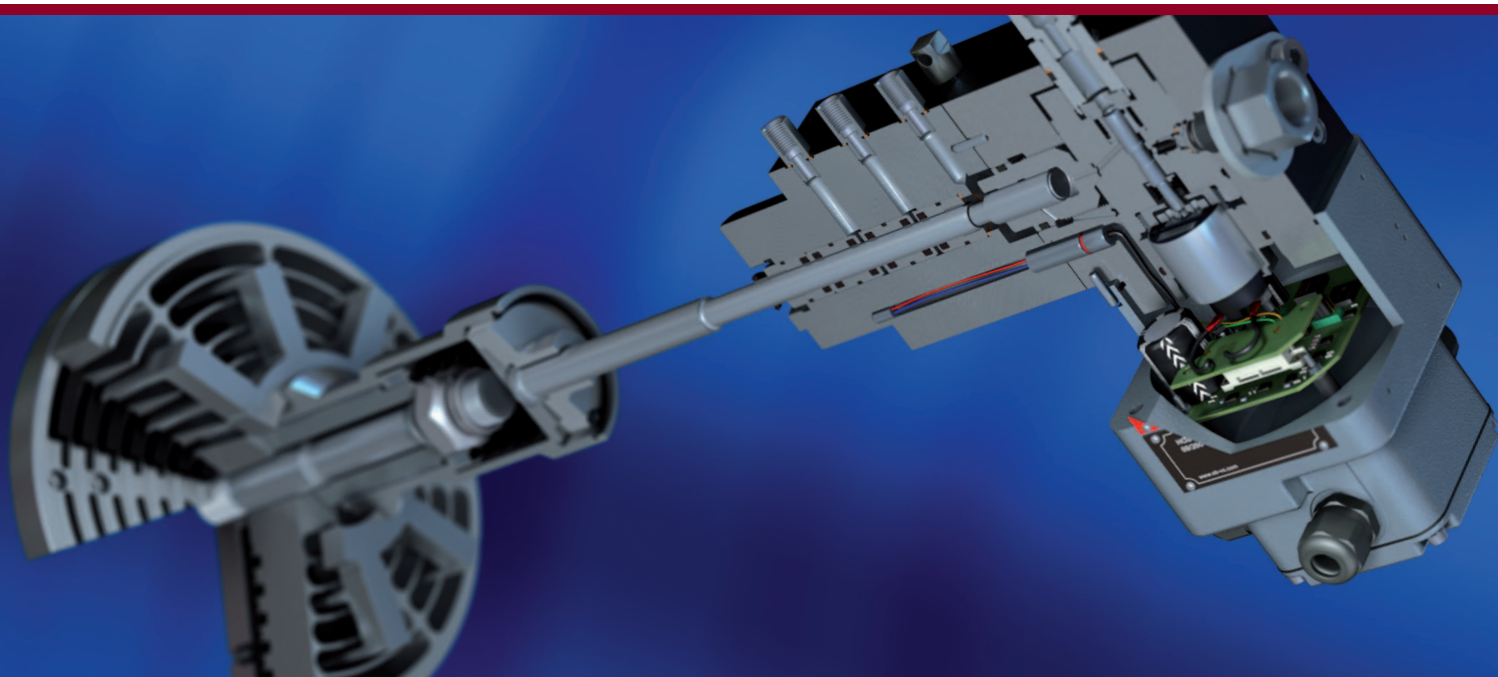
The operator can quickly adapt the compressor to varying process conditions with HydroCOM, fluctuations arising can automatically be balanced and thus the performance of the whole plant can be optimized.

## The basic principle of HydroCOM

Normally gas is compressed in the compression cycle. The actuator controlled unloader of HydroCOM keeps the suction valve open over the compression cycle, until a defined gas volume is pushed back into the suction chamber again. Only then the suction valve closes and only the gas volume remaining in the cylinder is compressed.

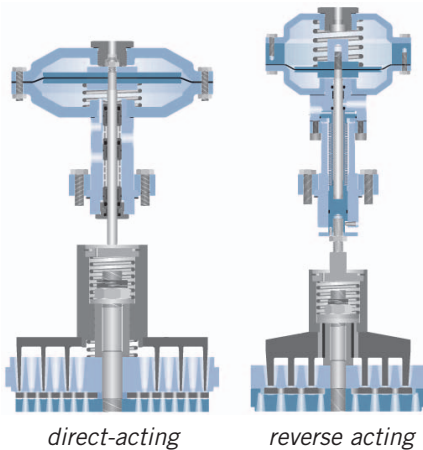
## HydroCOM supports complete system integration

Clear interfaces permit simple integration of HydroCOM into new as well as existing compressor plants.



# Solutions to get the best from your valves

To back up its proven valve designs HOERBIGER offers a safe, leak-free mounting system and a simple yet effective method of capacity control.



HOERBIGER diaphragm cylinders act in conjunction with valve unloaders to provide stepwise control of compressors.

## Diaphragm cylinder for stepwise control: The simplest way to save energy

The advantages compared to other unloader systems are:

- Perfect system solution by exact adjustment of valve, unloader and diaphragm cylinder
- No leakage
- Essentially lower consumption of control media
- Nearly no stick-slip effect
- Lower life cycle costs

## Universally applicable and flexible

As only corrosion proof material is used, HOERBIGER diaphragm cylinders are suitable for all process applications.

## Service friendly

The high-quality sealing system is virtually maintenance free. Pre-assembled and tested seal carrier assemblies facilitate maintenance.

## Safe and environmentally friendly

HOERBIGER diaphragm cylinders are serially equipped with an inert gas connection. The optionally available version with a bellows guarantees absolute gas tightness.



# The advantages of HOERBIGER valves at one glimpse

- Full material and design competence from material development via layout to production
- Comprehensive product line with carefully designed valves
- Proven quality of materials by complete control of all production processes
- Well founded knowledge of tribology for less wear
- Intensive research and development for improved materials and products
- Materials for standard applications as well as special application ranges
- Innovative new materials like material HP and 3X
- Innovative new products:
  - CM valve
  - CP valve
  - HPV valve
- Worldwide network of more than 60 service companies – always close to you.

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**HOERBIGER**  
*because performance counts*

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 6,700 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.