



BORSIG 7M
COMPRESSION ZM

**RECIPROCATING COMPRESSORS
FOR PROCESS GASES**



About BORSIG ZM Compression GmbH

BORSIG ZM Compression GmbH is a member of the BORSIG Group and manufactures reciprocating and integrally geared centrifugal compressor units. The company additionally offers compressor valves, the BORSIG BlueLine system and a comprehensive compressor service.

BORSIG ZM Compression GmbH is situated in Meerane at the centre of Leipzig, Chemnitz and Zwickau economic area. Zwickau is the birthplace of the composer Robert Schumann and the automobile industry in Saxony, and has continued to develop into a modern and efficient business location over the past few years adding to the federal state's industrial reputation.

Our competence is based on a 180-year company history including more than 160 years of manufacturing expertise in reciprocating compressors, which enables us to successfully

meet economic, technical and social challenges both now and in the future.

At BORSIG ZM Compression GmbH innovative solutions, state-of-the-art technology, highly trained specialists and comprehensive expertise provide the basis for our position as a single source supplier of leading technology.

BORSIG ZM Compression GmbH – your reliable partner for the future.

Reciprocating Compressors for Process Gases



BORSIG ZM Compression GmbH offers horizontal and vertical reciprocating compressor solutions for process gases with all auxiliary equipment (turn-key solutions).

Our compressors are driven either by electric motors, gas engines or steam turbines and comply with API 618 design standards as well as other international and manufacturing standards. The series has been developed for heavy continuous operation with lubricated or non-lubricated cylinders.

The latest BORSIG ZM reciprocating compressor series covers the following power ranges:

Discharge pressure ... 1,000 bar
 Flow rate ... 115,000 m³/h
 Coupling power ... 16,000 kW

Our service also includes:

- Assembly and commissioning of the reciprocating compressors at site
- Conversion and modernisation of reciprocating compressors
- Upgrading of control systems

Typical application fields of the BORSIG ZM reciprocating compressors for process gases are:

- Chemical and petrochemical industries
- Oil and gas industry
- Crude oil recovery
- Natural gas recovery and processing, transport and storage
- Refinery technology
- Power plants
- Low-temperature engineering
- Gas liquefaction, e.g. LPG, LNG
- Gas gathering and injection
- Various industrial processes

Performance Range

Overview of frames / main data

Reciprocating compressors - horizontal design - Types Bx

Frame size		15	22	32	40	45	50
Max. stroke	mm	150	220	320	400	450	500
Max. speed *	rpm	1000	681	469	375	375	300
Max. number of axes		4	4	6	6	6	6

Reciprocating compressors - vertical design - Types PV

Frame size		90	110	140	180	220
Max. stroke	mm	90	110	140	180	220
Max. speed *	rpm	1500	1200	900	750	600
Max. number of axes		3	3	3	4	4

* lubricated machine

HORIZONTAL

Example

Bx50

Technical data:

Non-lube and lubricated
number of cylinder axes:

max. 6 axes

Discharge pressure:

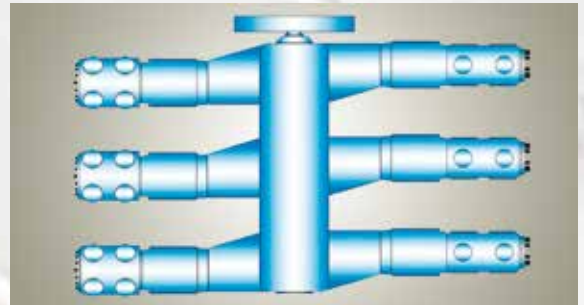
max. 1,000 bara

Power (lubricated):

max. 16,000 kW

Compressor capacity:

max. 115,000 m³/h



VERTICAL

Example

PV422

Technical data:

Non-lube and lubricated
number of cylinder axes:

max. 4 axes

Discharge pressure:

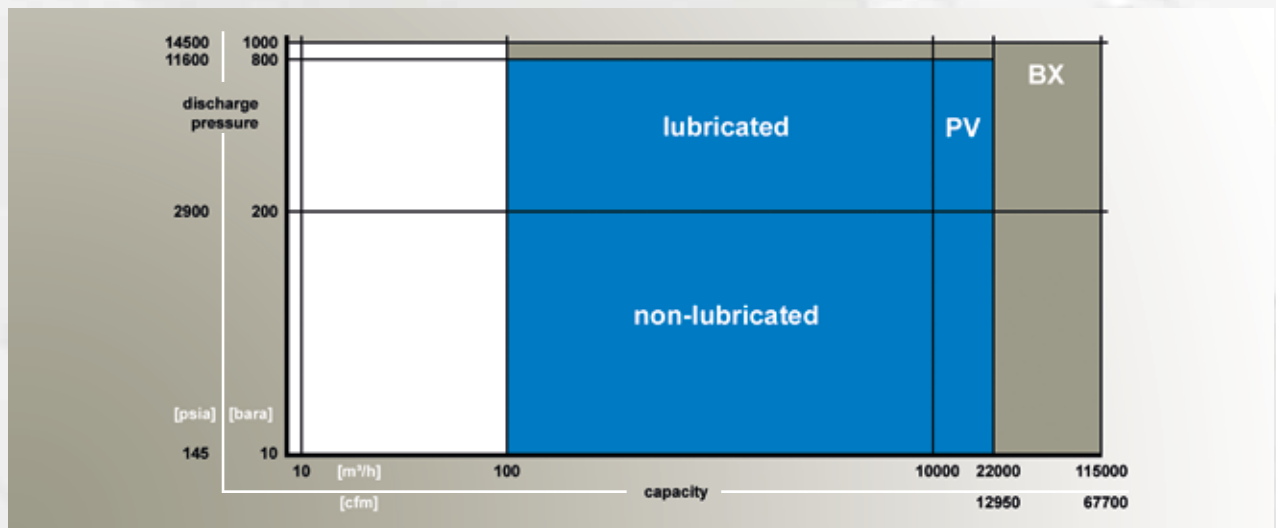
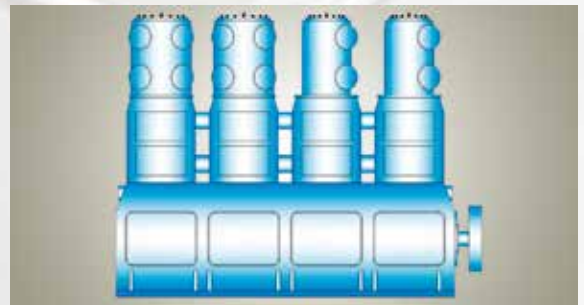
max. 800 bara

Power (lubricated):

max. 3,000 kW

Compressor capacity:

max. 22,000 m³/h



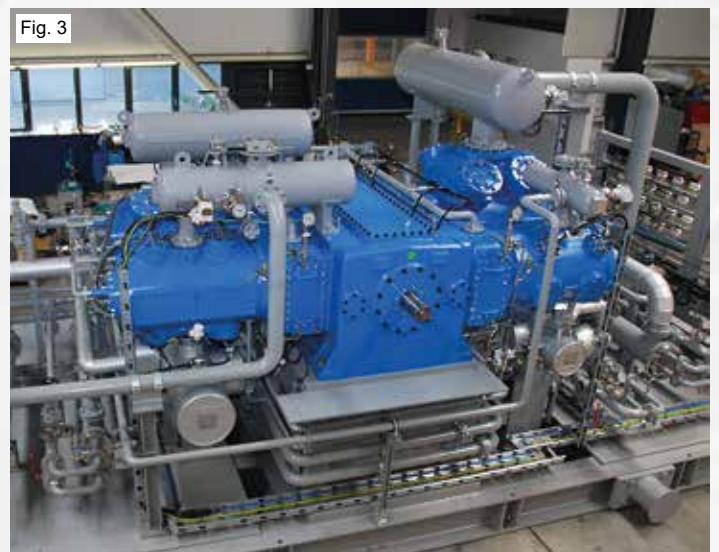
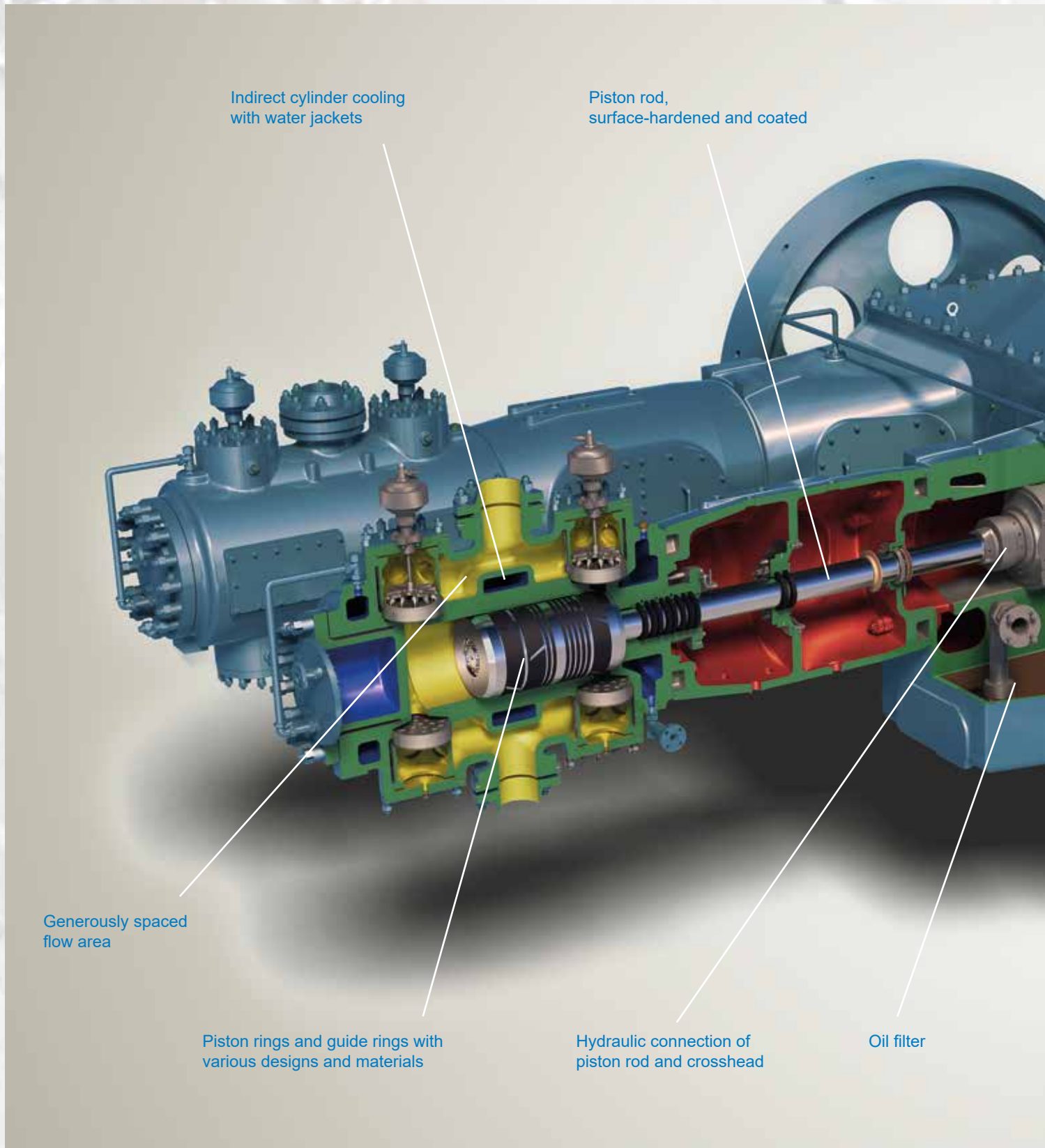


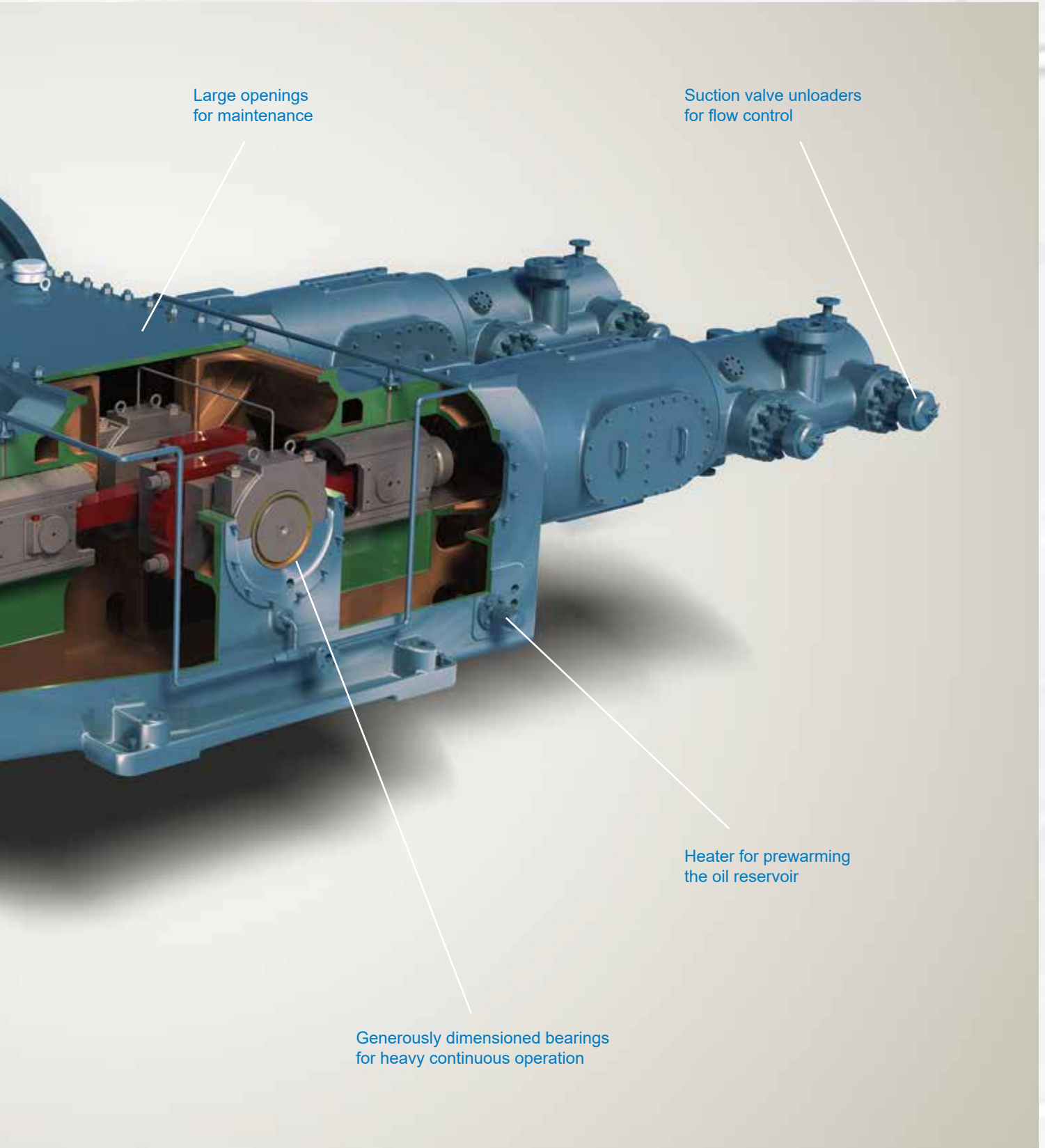
Fig. 1: H₂ import compressor unit, type Bx45, 6 cranks, 43,000 Nm³/h

Fig. 2: Hydrogen compressor unit for H₂ liquefaction plant, type PV422, 4 cranks, 21,100 Nm³/h

Fig. 3: Nitrogen high pressure compressor unit, type PH414, 4 cranks, 1,400 Nm³/h

Design and Engineering





Large openings for maintenance

Suction valve unloaders for flow control

Heater for prewarming the oil reservoir

Generously dimensioned bearings for heavy continuous operation

Design and Engineering

Thanks to the high level of vertical integration in the manufacturing of compressor components, **BORSIG ZM Compression GmbH** can transfer and closely monitor the high demand placed on the parts directly from the design into the manufacturing process.

Our experienced and competent design engineers are able to respond directly our customers' requirements and develop the compressor in close cooperation to meet the given specifications.

Our customers are able to follow the development of the compressor throughout the design process until completion. Whether a foundation or a skid construction, ease of service and easily accessible components for maintenance is a paramount consideration. Our partners and experience have taught us that these details are too often disregarded or inadequately taken into consideration.

Should the available space onsite make a particular solution unworkable i.e. due to the space requirements of secondary equipment, the BORSIG ZM 3D scan technique can be used to create a complete image of the working area. The available space can thus be optimally utilised and the risk of the compressor system not fitting into its surroundings is eliminated.

We use state-of-the-art 3D design tools that enable complete system visualisation and design as well as the specific design and construction of the components using FEM software.

Particular attention is paid here to the values obtained in relation to durability, strength and stiffness. The benefits of this engineering are passed on directly to the customer in the form of longer life, higher wear resistance and thus lower lifecycle costs.

Fig. 1: FEM analysis of compressor frame

Fig. 2: Natural gas storage compressor unit, type Bx45, 4 cranks, 35,000 Nm³/h

Fig. 3: Boil off gas compressor unit, type PH418, 4 cranks, 2,900 Nm³/h

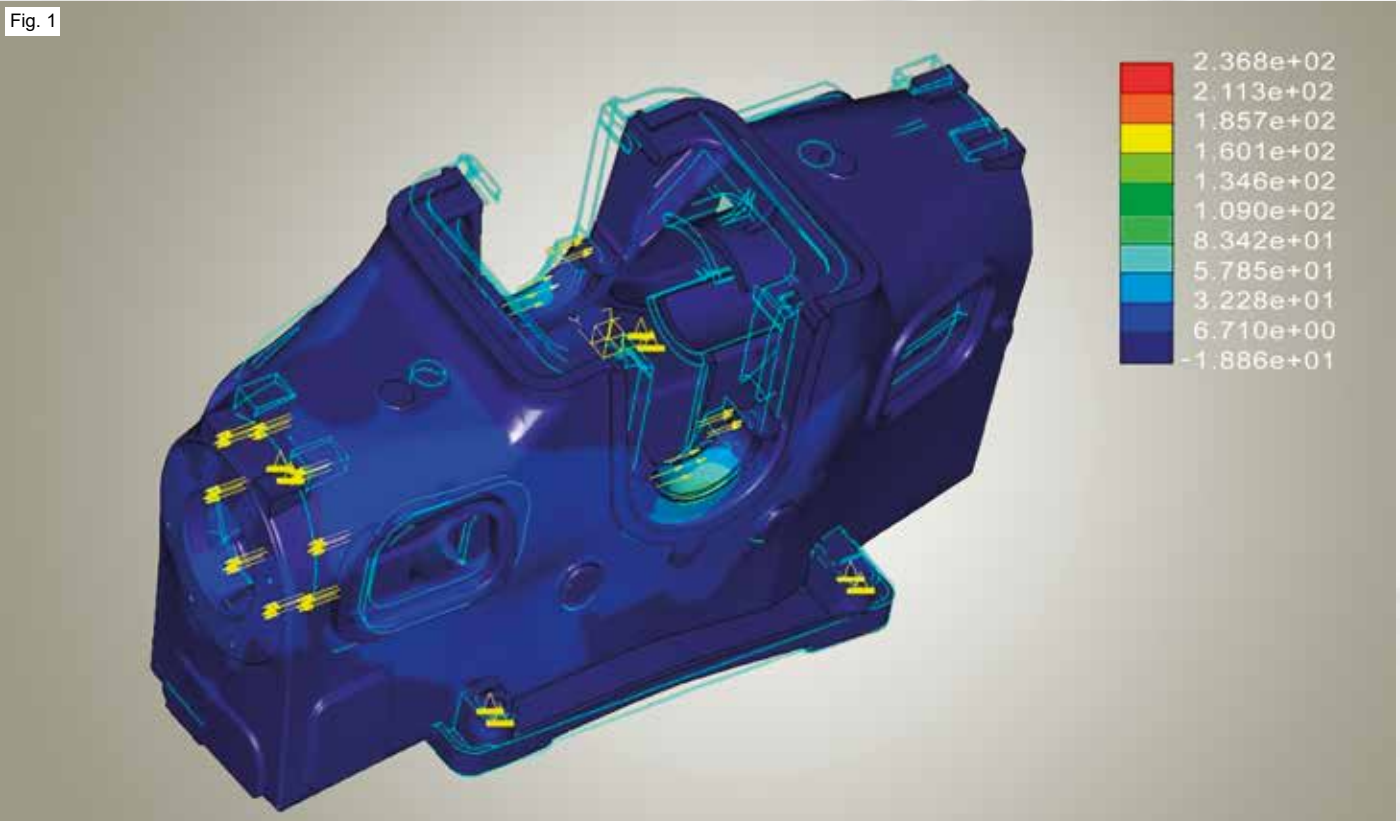


Fig. 2



Fig. 3



Flow Control

Flow control means the adaption of the compressor capacity to the actual requirements. This can either be a stepless solution with energy saving benefits or a step-by-step solution with higher power requirements.

Stepless control

- (1) **Speed control**
is economical and driven by internal combustion engines. Electric motors require a frequency converter.
- (2) **Back flow control**
with the suction valves temporarily kept open during the discharge stroke. Usually designed with hydraulic valve control.
- (3) **Variable clearance pockets**
enable the stepless extension of the clearance volume. They are manually or pneumatically operated, with high expenditure.

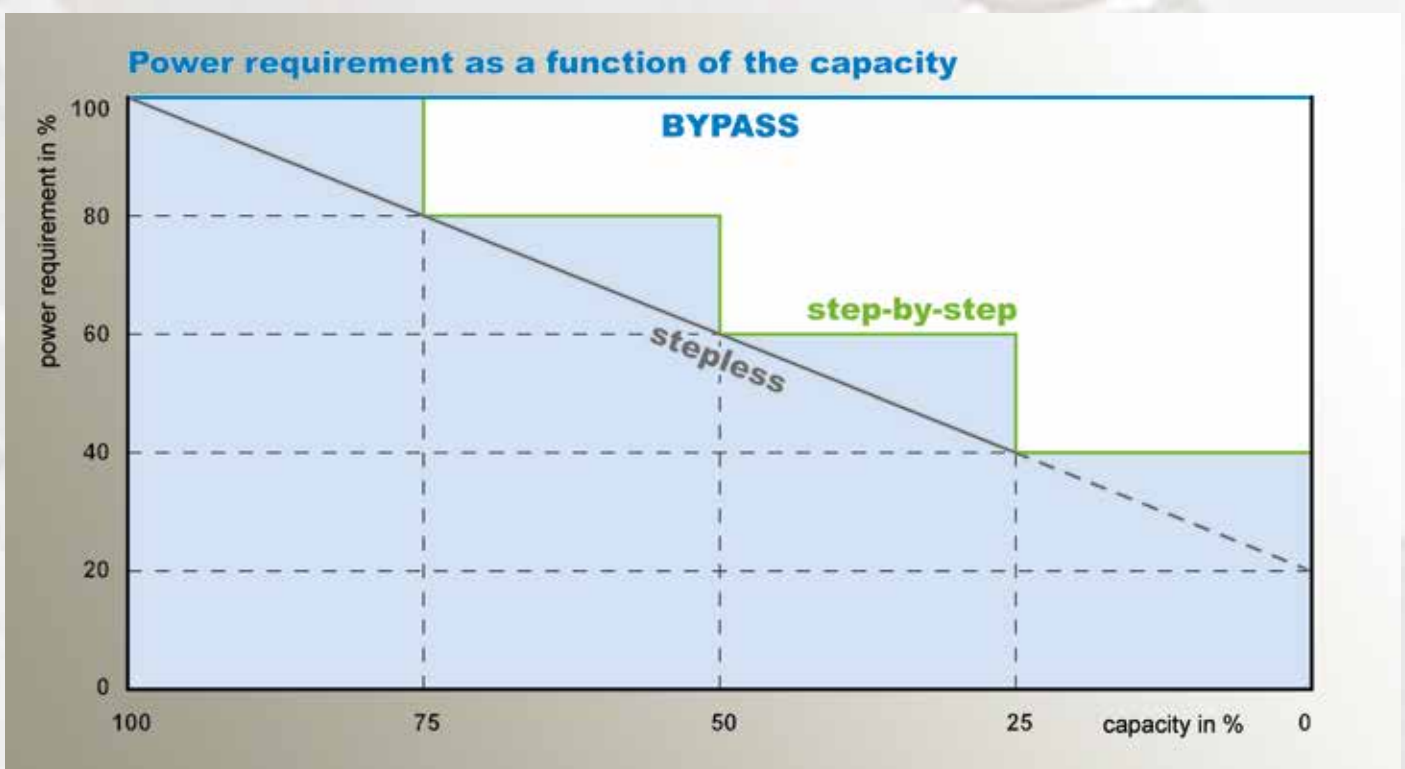
Step-by-step control

- (4) **Fixed clearance pockets**
extend the clearance volume step by step with moderate costs.
- (5) **Unloading of individual cylinder sides** (valve lift)
is relatively easy with the suction valve constantly kept open during the compression stroke. As with (4), it is not suitable for exact control.

Bypass control

- (6) **Heavy-loss back expansion**
recycling of a previously compressed partial flow often used in combination with the control methods (4) and (5) or around the first stage of compression.

In each individual case the most appropriate control system is selected depending on the specific operating conditions.



Instrumentation and Controls / BORSIG BlueLine

BORSIG ZM provides state-of-the-art solutions for instrumentation according to customers' requirements as well as national and international standards.

The instrumentation is manufactured to high safety standards using high quality techniques to comply with advanced international standards. These requirements are continuously monitored and adapted according to customer demands and new developments in the technical fields.

BORSIG ZM offers a high-availability BORSIG BlueLine automation system with scalable redundancy and up to SIL3 (safety integrity level) for industrial use.

The system combines a control system, emergency shutdown, machine protection and machine monitoring for BORSIG ZM's reciprocating compressors.

The BORSIG BlueLine system range is the basis for integrated SIL3 automation. Safety-related communication and processing with, if required, multiple redundancies enable the efficient distribution of complex applications and the integration of several systems.

In addition to regular automation, modern plants increasingly require certified safety functions. BORSIG BlueLine systems enable the mixed operation of certified safety components (up to SIL3) with standard automation systems in one system.

Fig. 1: Concept of BORSIG BlueLine

Fig. 2: BORSIG BlueLine GA BASIC / CM

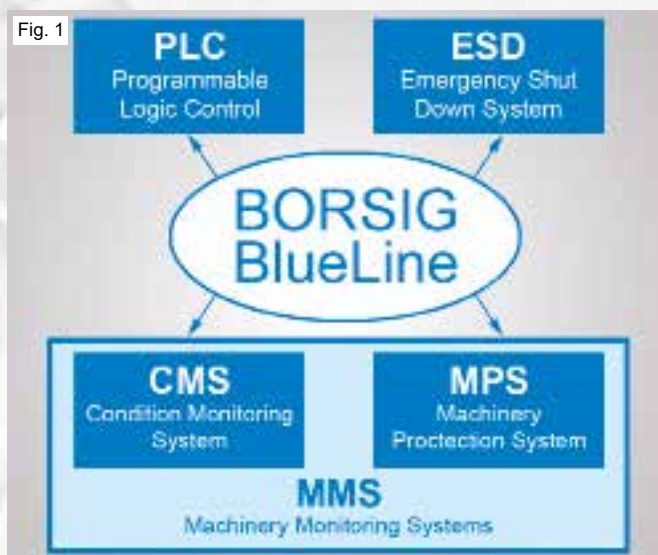
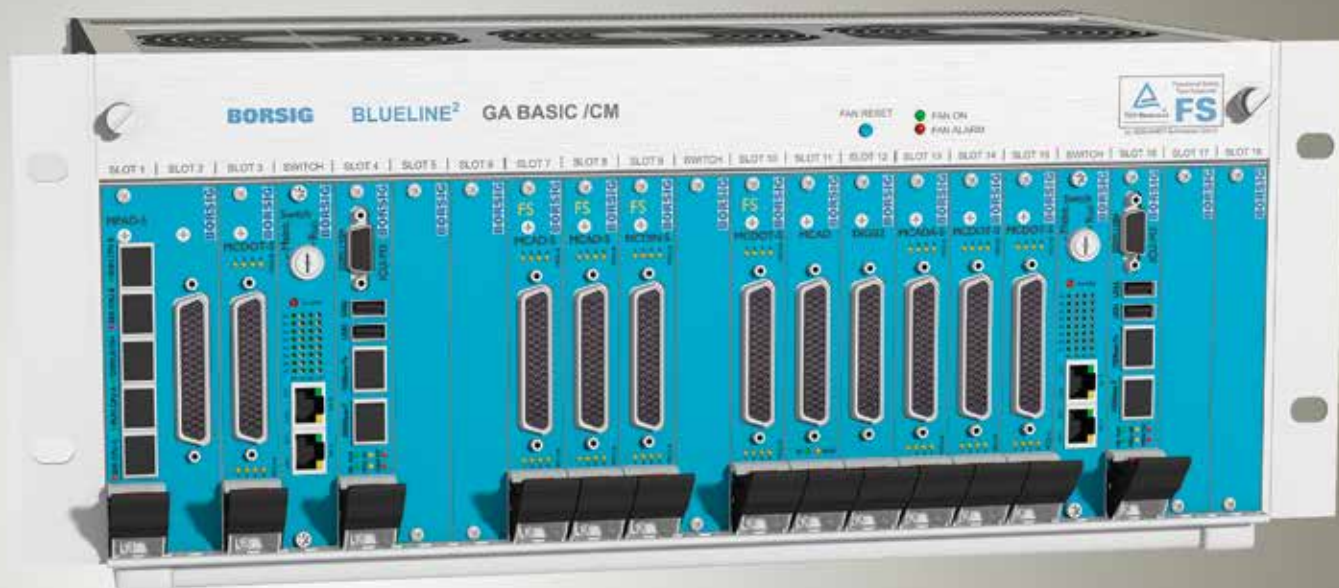


Fig. 2



Manufacturing

The **BORSIG ZM Compression GmbH** plant in Meerane, Saxony has a 10,000 m² production area with up to 100 tonnes crane capacity.

At the heart of the plant are two CNC boring and milling machines with a maximum travel path of 14 m and a piece weight of up to 40 tonnes. The extensive CNC machinery is linked to a modern programming system for the simulation of complex machining tasks and error-free processing. BORSIG ZM is thus able to machine cylinders, impellers and other components for compressors in-house. The machining of forged components, cast steel, modular graphite cast-iron and stainless steel is part of our daily routine.

All compressor units are carefully assembled and prepared for the contractual test runs.

A high degree of vertical integration, a sophisticated machine outfit and well-trained permanent staff are guarantors of BORSIG ZM's high quality production standards.

Quality assurance and timely delivery are fundamental elements of the BORSIG ethos.

Fig. 1: Plant in Meerane

Fig. 2: Machining of crank shaft tunnel for the 6-crank case of the Bx series



Fig. 1



Fig. 2

Quality



Fig. 1

The **BORSIG ZM Compression GmbH** Quality Management System is certified according to DIN EN ISO 9001:2008.

Our quality standards are also verified according to additional certifications such as the DIN EN ISO 14001 Environmental Management System and the SCC** certificate (Safety Certificate Contractors).

Competent engineering, state-of-the-art production processes and comprehensive quality management guarantee the high standards of our products. BORSIG ZM applies modern portable measurement techniques such as laser trackers, scanners, index arms etc.

The Quality Assurance Team works according to appropriate testing schedules, measurement equipment administration and is linked to the production planning and control system (PPS).

The Quality Assurance Team at BORSIG ZM runs tests independently of manufacturing and production control. It guarantees the compliance of processed material, manufactured components, equipment, products and services with national and international standards, regulatory and contractual requirements and BORSIG's internal rules and policies.

We have our own test field with 1,700 m², 8 work stations and a power input of up to 5 MW to carry out function and packaged unit tests of our reciprocating compressors as well as any other machinery with high current or even mean voltage.



Fig. 2

Fig. 1: Mechanical test run according API of 6-crank reciprocating compressor

Fig. 2: Axis measurement at crank case with laser tracker

Compressor Services

As a leading manufacturer of compressors, **BORSIG ZM Compression GmbH** offers a comprehensive service from one source. Our after sales service responds flexibly and efficiently to inquiries to provide comprehensive care of BORSIG ZM products as well as compressors supplied by other manufacturers.

Competence based on our long-standing expertise in the field of compressors and the high quality of our services makes us the partner you can rely on.

Portfolio of services

- Installation and commissioning of compressor units
- Spare part management
- Revamp and refurbishment engineering
- Feasibility and pulsation studies
- Maintenance and overhauling
- In-house and onsite training
- Compressor valve service and engineering

Portfolio of products

- Reciprocating compressors for process gases
- Centrifugal compressors for process gases

Based on its own engineering, BORSIG ZM provides support from the installation and commissioning of compressor units to their revamp, modification and modernisation.

We provide a comprehensive maintenance service to keep systems available and running at an optimal level.

A wide range of constantly available spare parts together with short manufacturing times and high quality standards guarantee a minimal downtime of your compressor.

In emergency cases short reaction times are required. BORSIG ZM's service staff is available for its customers worldwide, 24 hours a day, 7 days a week, 365 days of the year.

24-hour service hotline

Phone: +49 3764 5390 5120

E-mail: service@zm.borsig.de



Fig. 1: Installed reciprocating compressor unit

Fig. 2: Mechanical cylinder processing

Fig. 3: Re-engineering and modernisation of reciprocating compressor unit

Fig. 4: Practical onsite training

Fig. 5: Quality control



Fig. 3

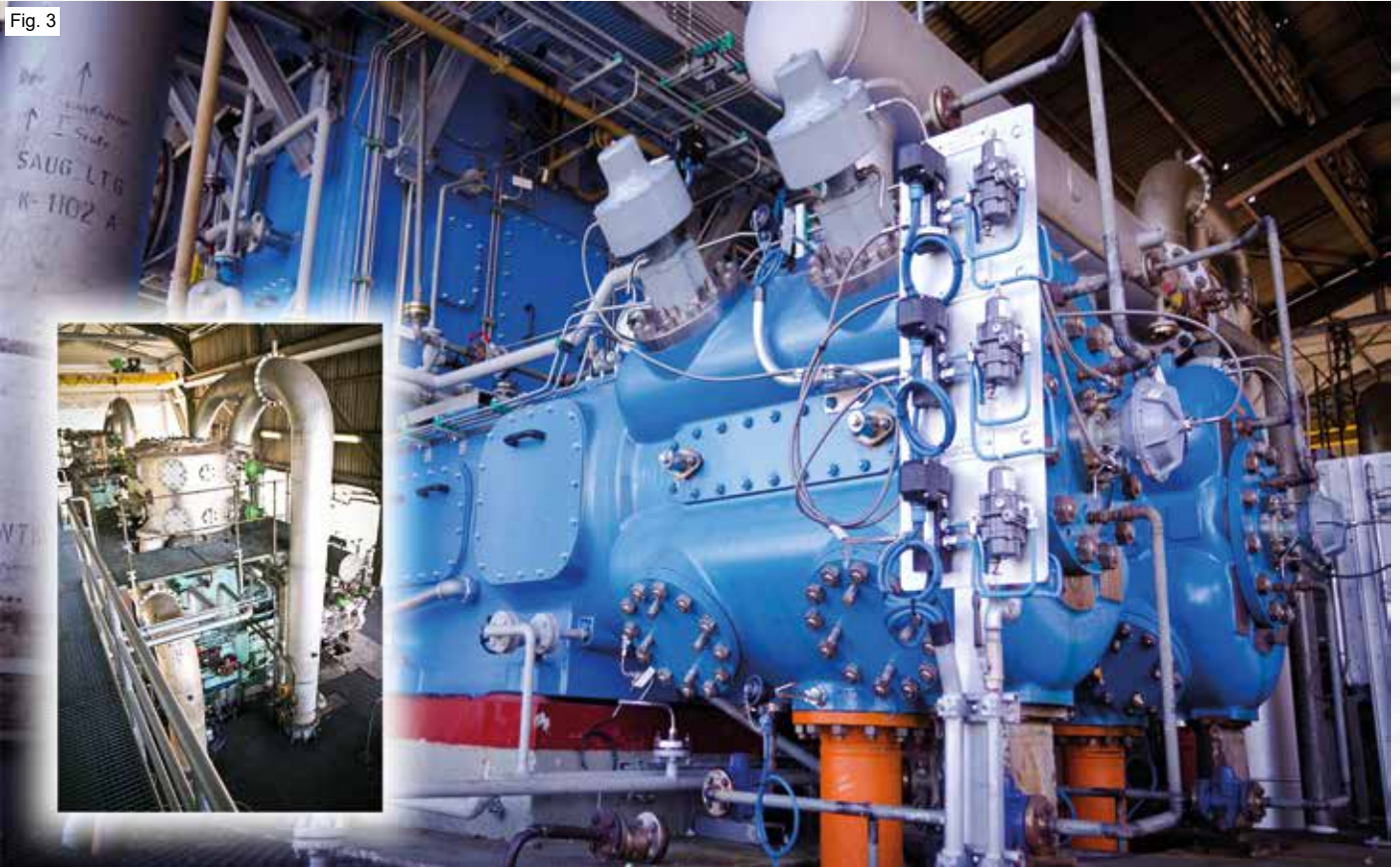
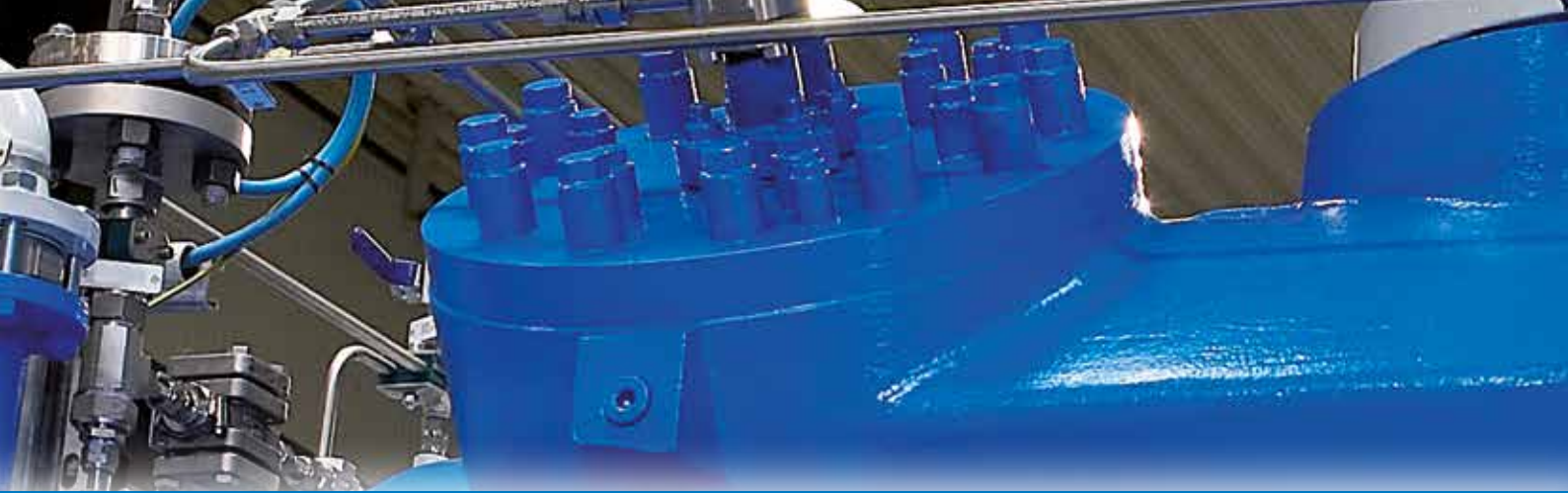


Fig. 4



Fig. 5





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