BORSIG

BORSIG
GROUP

LEADING TECHNOLOGY FOR INNOVATIVE SOLUTIONS

www.borsig.de


BORSIG

CONTENT

1.

BORSIG GROUP

LEADING TECHNOLOGY **FOR INNOVATIVE SOLUTIONS**

The **BORSIG Group** offers customised process solutions for applications in the chemical and petrochemical and oil and gas industries as well as for power plants.

The successful product range comprises

→ Pressure vessels and heat exchangers
(waste heat recovery systems and transfer line exchangers)

→ Compressors
(reciprocating and integrally geared centrifugal compressors)

→ Valves
(ball valves and compressor parts)

→ Process and membrane technology
(emission control and product recovery units)

→ Power plant and industrial services

Our experience is based on more than 185 years of company history. This long-established competence enables us to successfully master all economic, technical and social challenges now and for the future. All BORSIG products are synonymous with top quality, reliability, optimum technical implementation and smooth order processing. Innovative solutions, state-of-the-art technology, excellently trained specialists and comprehensive expertise have cemented our position as a single-source supplier of leading technology.

The BORSIG Group - your competent partner for the future.

1.1

BORSIG GROUP

SITES

The BORSIG Group has five locations in Germany and two branches abroad. The company headquarters are in Berlin.

- **Berlin:** Pressure vessels, heat exchangers, valves and ball valves, power plant services and energy facility engineering
- **Gladbeck:** Process and membrane technology, industrial and power plant services, pressure vessels, heat exchangers, compressor parts, valve service and valve spare parts
- **Meerane:** Reciprocating and integrally geared centrifugal compressors, compressor service
- **Rheinfelden:** Membrane production, process and membrane technology
- **Hamburg:** Power plant services

BORSIG Group also has offices worldwide, mainly in oil and gas producing and processing countries, as well as its own offices and branches in **China** and **CIS**.

1.2

BORSIG GROUP

MANUFACTURING

The BORSIG Group looks back on more than 180 years of experience in the development and production of tailor-made components for industrial plants. We stand for quality, reliability and innovation made in Germany.

Our highly qualified engineers and technicians develop, produce and install the best possible systems and machines on site. Our products are efficient even under the harshest conditions and represent an investment in the future.

Our employees at our production sites add personal dedication to our guarantee of consistently high standards using the latest technology and innovative production processes. Each production site of the **BORSIG Group** has its own outstanding qualities.

BORSIG owns more than 16,700 m² of indoor workshop facilities in **Berlin** alone and is equipped with a 250t crane capacity. High-tech welding technology is our core competence and includes the use of a laser controlled welding seam guidance system for submerged narrow-gap welding, robot welding for the GMAW welding process in the high pressure vessel manufacture, GMAW narrow gap robot systems with integrated plasma and autogenous 3D cutter systems, TIG hot wire welding, SAW nozzle welding, RES and SAW strip weld cladding, automatic tube to tube sheet welding, including in bore welding of up to 500 mm, as well as qualified machining of all steel and nickel-based alloys.
Since 2008 the Borsig Harbour has enabled the company to transport pressure vessels and heat exchangers of any size with easy access to the national waterways system.

At its site in **Gladbeck** in North Rhine-Westphalia, BORSIG has 5,250 m² indoor workshop facilities, 32,000 m² open space and loading capacity up to approx. 100t. The manufacturing equipment comprises a UP welding system for vessels with a a diameter of up to 4000 mm for interior and exterior welding work, weld cladding with ribbon and wire, a UP welding system for welding in fittings, a gas cutting machine, a plasma cutter for material thicknesses of up to 50 mm, a vessel turning system with a load capacity of up to 100t, CNC turning machines, centre lathes, vertical cutting and boring machines and a ball grinding machine of up to 46".

1.3

BORSIG GROUP

QUALITY

Quality assurance and control activities take place independently of the manufacturing process or product lines, and guarantee that machined and handled materials, components, assemblies, products and service operations are executed in accordance with all specified requirements.

Quality assurance monitors compliance with national and international specifications, statutory and contractual provisions as well as the directives, standards and regulations stipulated by all companies of the **BORSIG Group**.

In order to ensure even better interaction between quality, work safety and environmental management, the individual management systems have been merged to form an Integrated Management System (IMS).

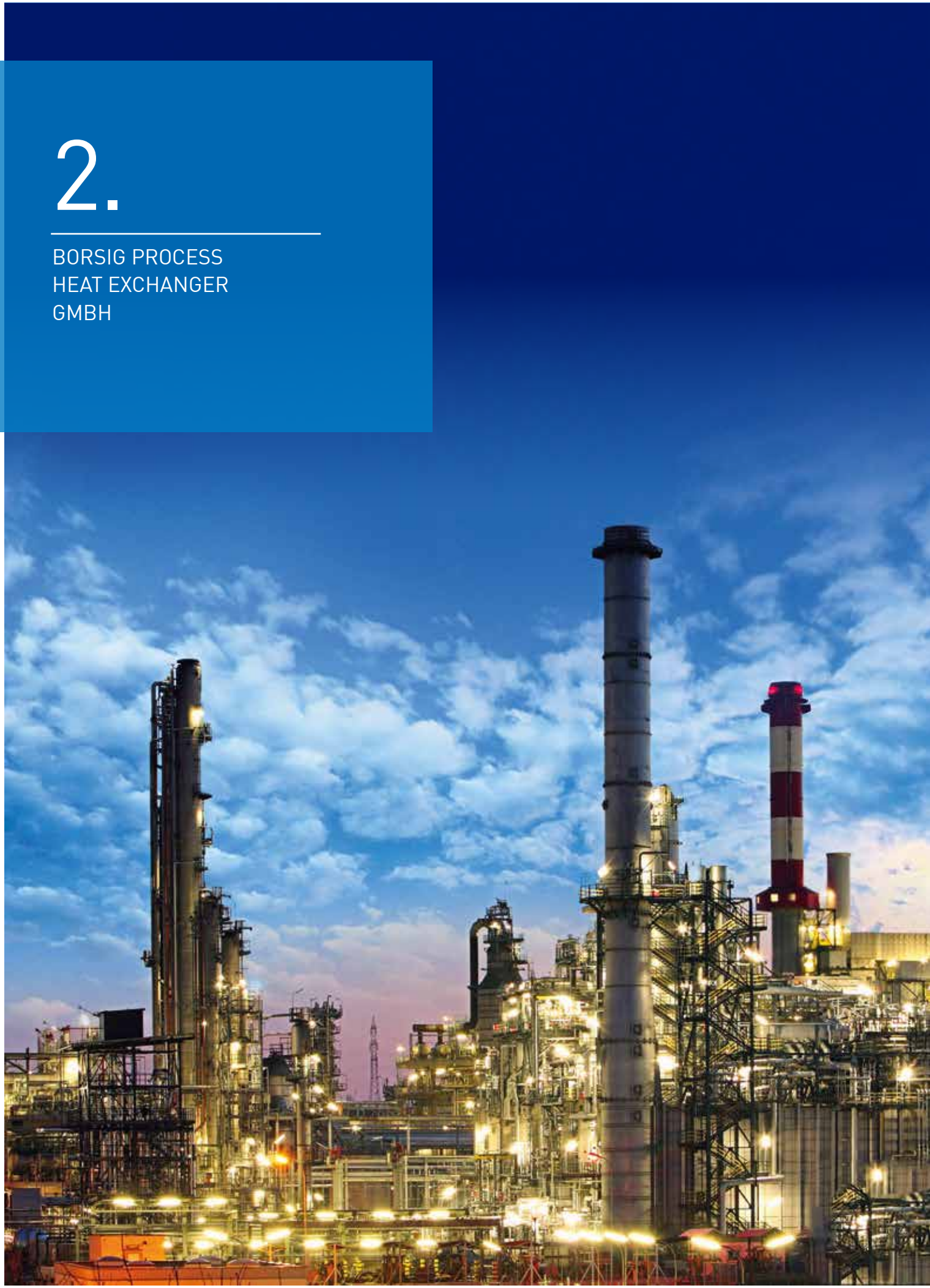
Consistent quality monitoring from the analysis of the customer needs to design, work preparation, construction, acceptance and handing over to the customer right through to after-sales services ensures that the materials used, the manufacturing, products and services adhere to applicable requirements at all times.

CERTIFICATION OF THE BORSIG GROUP (Extract)

- Quality Management
  DIN EN ISO 9001
- Environmental Management System
  DIN EN ISO 14001
- Occupational Safety SCC**
- ASME U, U2, R and S
- SQL Licence for PR China
  (Pressure vessels A1, A2)
- AD 2000 - Directives HP 0, TRD 201 and
  DIN EN ISO 3834-2 and
  EN 1090-2, EXC4
- Korean Gas Safety

2.

BORSIG PROCESS HEAT EXCHANGER GMBH



PRESSURE VESSELS, HEAT EXCHANGERS AND INDUSTRIAL SERVICES

BORSIG Process Heat Exchanger GmbH supplies pressure vessels and heat exchangers for cooling gases at very high temperatures (up to 1,500 °C) and high pressure (up to 35,000 kPa) to the chemical and petrochemical industries and offers comprehensive industrial services.

Our pressure vessels and heat exchangers are used in process stages in plants for the production of basic chemicals where they are installed directly at the downstream end of the cracking furnaces and/or reactors. BORSIG technology is also used in innovative oil gasification processes.

Design oriented towards practical application, highly qualified staff as well as state-of-the-art production and testing methods ensure that the consistent high quality of our pressure vessels and heat exchangers meet all requirements regarding stability, operational safety and long service life.

Our product and service range

- → Waste heat recovery systems
  (in ammonia plants, methanol plants, hydrogen plants, coal gasification plants, gas-to-liquid plants, partial oxidation of oil and gas, replacement boilers for nitric acid, caprolactam plants and formaldehyde plants, HP and LP preheaters as well as special equipment)
- → Transfer line exchangers in ethylene plants
- → Scraped surface exchangers for lube oil plants and special applications
- → After-sales services and industrial services

2.1

BORSIG PROCESS HEAT
EXCHANGER GMBH

PROCESS GAS WASTE HEAT RECOVERY SYSTEMS

BORSIG Process Heat Exchanger GmbH has been supplying process gas waste heat recovery systems for high temperature and high-pressure applications to the petrochemical industry for more than 50 years.

A wealth of experience, comprehensive knowledge, practically oriented design, state-of-the-art production and testing methods and highly qualified staff has made **BORSIG Process Heat Exchanger GmbH** the leading manufacturer in this field worldwide.

Every process gas waste heat recovery system is designed exactly in accordance with the customer's individual requirements and the on-site various operating conditions and applications.

Process gas waste heat recovery systems can be used for gas pressure values of up to 350 bar (35,000 kPa), incoming gas temperatures of up to 1,500 °C and steam pressure values of up to 160 bar (16,000 kPa).

BORSIG Process Heat Exchanger GmbH also produces high- and low-pressure preheaters and special equipment at its Gladbeck workshop for oil refineries, the petrochemical and chemical industries and also for power plants.

APPLICATIONS OF BORSIG PROCESS GAS WASTE HEAT RECOVERY SYSTEMS

- Ammonia plants
- Methanol plants
- Hydrogen plants
- Coal gasification plants
- Gas-to-liquid plants
- Nitric acid, caprolactam and formaldehyde plants
- Partial oxidation of oil or natural gas

ANY COMBINATION CAN BE INTEGRATED INTO A CUSTOMER-SPECIFIC PROCESS GAS WASTE HEAT RECOVERY SYSTEM

Reform gas waste heat boiler, steam superheater (one or two stages), HT SHIFT waste heat boiler, feed water preheater, gas/gas heat exchanger, steam drum, superheated steam cooler, synthesis gas waste heat boiler, quench coolers for ethylene plants, scraped surface exchangers for lube oil plants and other special applications.

2.2

BORSIG PROCESS HEAT
EXCHANGER GMBH

SYNTHESIS GAS COOLERS

downstream from partial oxidation of oil and natural gas

The non-catalytic cracking of hydrocarbons by partial oxidation of natural gas, oil etc. takes place at temperatures of up to 1,500 °C and pressures up to 8,000 kPa. In addition to the resulting components CO, CO2, H2, H2O and H2S, the process gas contains soot and ash. Depending on the type of feedstock, other impurities such as vanadium, nickel and iron can also be expected. These impurities, the high particulate burden of the gas and the hydrogen sulphide mean the waste heat boiler must be highly resistant to erosion, corrosion and fouling .

The process gas is cooled down in the waste heat boiler from about 1,400 °C to 300 °C. The heat of the gas is used to generate saturated steam with a pressure of between 3,000 and 10,000 kPa.

Waste heat boilers can be built with a gas side flow rate of up to 70,000 Nm³/h. The construction enables this to be expanded easily to a capacity of 200,000 Nm³/h.

BORSIG Process Heat Exchanger GmbH has set itself the goal of developing and manufacturing tailor-made gasification equipment that fully meets its customers´ requirements. The company has developed its own boiler design with special design features in order to achieve this goal. BORSIG Process Heat Exchanger GmbH is also an authorised designer and manufacturer of gasification equipment for the SHELL gasification processes.

2.3

BORSIG PROCESS HEAT
EXCHANGER GMBH

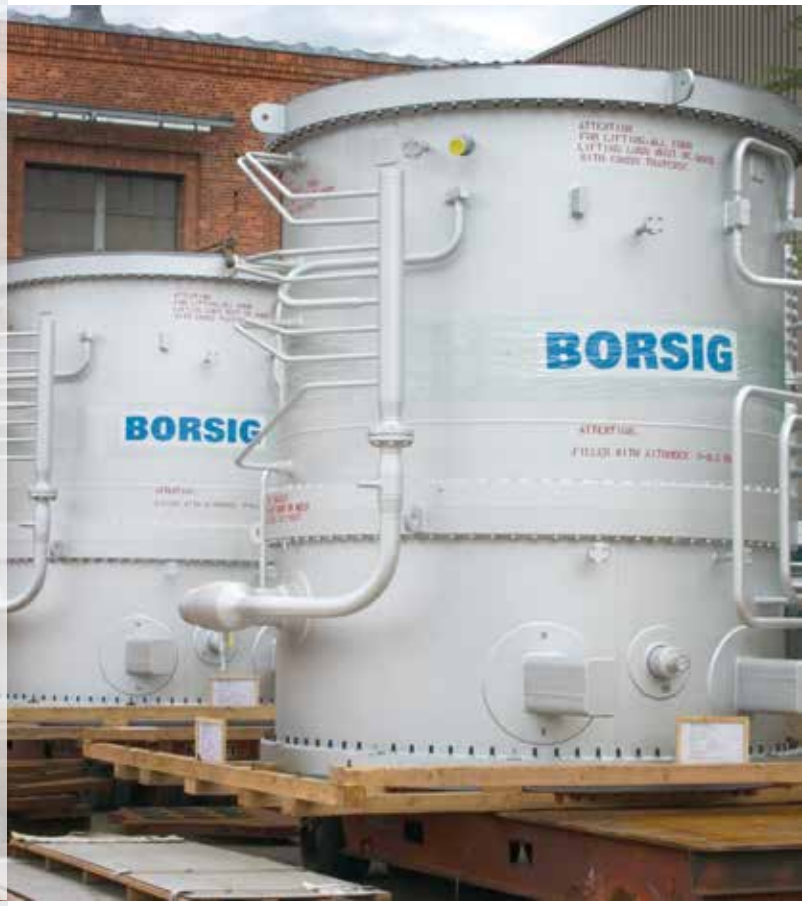
WASTE HEAT BOILERS

for nitric acid, caprolactam and formaldehyde plants -
one-to-one replacement only

Process gas coolers/waste heat boilers with direct integrated reactors are used in the production of nitric acid, caprolactam and formaldehyde.

The feed gas is transferred to the reactor and reacts at the catalyst to produce an intermediate or final product. The heat released during catalysis is recovered via the downstream heating surfaces directly under the catalyst bed by heating a coolant (e.g. water).

BORSIG Process Heat Exchanger GmbH delivers one-to-one replacement boilers for BORSIG waste heat boilers in nitric acid, caprolactam and formaldehyde plants.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2.4

BORSIG PROCESS HEAT
EXCHANGER GMBH

WASTE HEAT BOILERS

in coal gasification plants

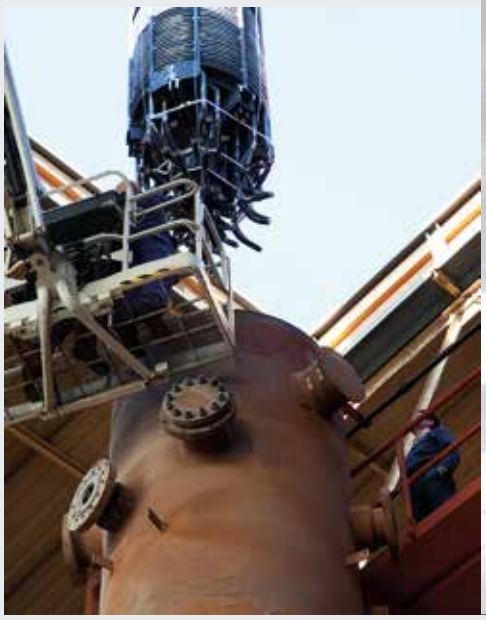
During coal gasification, solid coal is converted into a synthetic gas at high temperatures and pressures in the gasifier. This occurs by adding air or oxygen depending on the licensed process used. The synthetic gas can be used to generate combustion gas in power plants and as a basic product for the chemical industry.

BORSIG Process Heat Exchanger GmbH provides pressure vessels and heat exchangers especially developed for cooling the synthetic gas generated in the gasifier for use at these high temperatures.

This equipment is designed for the use of special materials that withstand the highly corrosive and erosive application conditions.

In coal gasification, a waste heat recovery system is usually connected downstream of the gasifier. This waste heat recovery system includes an evaporator for the cooling the synthetic gas.

Depending on the process requirements, the waste heat recovery system can be expanded by a one- or two-stage high temperature steam superheater and a one- or two-stage feed water preheater.



2.5

BORSIG PROCESS HEAT
EXCHANGER GMBH

TRANSFER LINE EXCHANGERS

in ethylene plants

Transfer Line Exchangers ("Tunnelflow" and "Linear" quench coolers) from **BORSIG Process Heat Exchanger GmbH** are used in ethylene plants as the basic material in plastics manufacturing.

Ethylene (C2H4) and other by-products such as propylene are produced by the thermal cracking of hydrocarbons in pyrolysis furnaces. This process generates so-called "cracked gas". Ethane, naphtha and other mineral oil fractions are predominantly used as feedstocks.

The cracked gas leaves the furnace at a temperature of around 850 °C (1,500 °F) and must be cooled down rapidly to 250 - 400 °C to prevent secondary reactions and to stabilise the gas composition in order to obtain the optimum product yield. The rapid cooling of the cracked gas, known as "quenching", is performed by Transfer Line Exchangers (also known as quench coolers or TLEs) in all modern ethylene processes.

The valuable high-pressure steam generated by quenching can be further used to power steam turbines in petrochemical complexes.

The quench system consists of one or more parallel TLE per furnace cell connected by riser and downcomer pipes with one common, elevated steam drum.

BORSIG Transfer Line Exchangers are the result of more than 55 years experience and thousands of units have been supplied worldwide.

The proven construction of BORSIG Transfer Line Exchangers is characterised by ease of maintenance, high reliability and long service life.

BORSIG PROCESS HEAT EXCHANGER GMBH HAS DEVELOPED TWO TYPES OF QUENCH COOLER, ACCORDING THE CUSTOMER`S PLANT CONCEPT

- → BORSIG „Linear“ Quencher (BLQ)
- → BORSIG „Tunnelflow“ Transfer Line Exchanger (TLE)

2.6

BORSIG PROCESS HEAT
EXCHANGER GMBH

SCRAPED SURFACE EXCHANGERS

for lube oil plants and special applications

BORSIG Process Heat Exchanger GmbH has been producing scraped surface exchangers for more than 90 years.

A modern, practical design, state-of-the-art manufacturing and testing methods and professional expertise all contribute to a high-quality scraped surface exchanger that fulfils all requirements in terms of stability, operating reliability and long service life.

BORSIG Process Heat Exchanger GmbH supplies scraped surface exchangers for any desired throughput and thermal capacity with inside tube diameters of six, eight, ten and twelve inches.

Scraped surface exchangers are supplied almost exclusively as compact units in order to keep installation work on site to a minimum.

BORSIG Process Heat Exchanger GmbH also supplies completely new drive systems and/or drive shafts to upgrade existing scraped surface exchangers from BORSIG and other manufacturers.

APPLICATIONS OF BORSIG SCRAPED SURFACE EXCHANGERS

- De-waxing of lube oil
- De-oiling of waxes
- Production of cellulose acetate flakes
- Manufacture of fatty acids
- Extraction of paraxylene
- Extraction of shea butter
- Continuous mixing of liquid and semi-solid products under cooling or heating
- Heat transfer when the transfer surface is heavily contaminated by products
- Heat transfer with high viscosity of the product

2.7

BORSIG PROCESS HEAT
EXCHANGER GMBH

AFTER-SALES SERVICE

Technical support and spare parts

The after-sales service and technical product support service of **BORSIG Process Heat Exchanger GmbH** offers a wide range of spare parts and services. On request we offer a complete exchange service for pressure vessels and heat exchangers.

Our main objective is to keep the downtime of your plant to an absolute minimum. Our excellent service team specialises in these operations and provides detailed engineering to work out the shortest schedule.

OUR SERVICE PORTFOLIO
TECHNICAL SUPPORT

- Installation planning and construction site supervision for new installations and repairs
- Root cause analysis at the location and by remote diagnostics
- Technical consultations in case of corrosion problems
- Evaluation of boiler operating water
- Consultations for preventive maintenance actions
- Review of customer procedures before installation starts (container cleaning, welding, chemical cleaning, non-destructive material tests, brick lining)

OUR SERVICE PORTFOLIO
SPARE PARTS

- Spare parts supply with technical order processing and delivery for maintenance or repair according to your requirements from a single source
- Delivery of spare parts

2.8

BORSIG PROCESS HEAT EXCHANGER GMBH

INDUSTRIAL SERVICES

Consulting, repair and new construction

The **BORSIG Process Heat Exchanger GmbH** Gladbeck facility offers all the necessary workshop equipment and qualified staff for the complete manufacturing of high-quality pressure vessels and heat exchangers in the chemical and petrochemical industries and for power engineering applications.

OUR INDUSTRIAL SERVICES

→ PRESSURE VESSELS AND HEAT EXCHANGERS
Manufacturing, engineering, reconditioning, maintenance for heat exchangers, waste heat boilers, collecting pipes, coolers, reactors and auxiliaries

We are able to perform repairs on your system on site or at our workshop at short notice. Our state-of-the-art manufacturing facilities allow us to overhaul your equipment quickly and efficiently. All required material tests can be carried out promptly in Gladbeck.

- INDUSTRIAL BOILERS
  Expansion, engineering, retrofitting, spare parts, repairs for process furnaces, industrial boilers, convection ovens, waste heat systems, air preheaters, flue gas ducts

- INDUSTRIAL PIPING
  Expansion, engineering, retrofitting, spare parts, repairs for piping, fittings, heat tracing

- HP AND LP PREHEATERS AS WELL AS SPECIAL VESSELS
  for oil refineries, the chemical and petrochemial industry and for power plants

3.

BORSIG ZM COMPRESSION GMBH

COMPRESSORS

BORSIG ZM Compression GmbH offers individual solutions for reciprocating and integrally geared centrifugal compressors according to customer specifications.

Our approach is characterised by integrated concepts, from planning and design to assembly and testing. BORSIG ZM Compression guarantees the highest product quality with competent engineering, state-of-the-art manufacturing processes and seamless quality assurance.

Our reciprocating compressors (API 618, API 11P / ISO 13631) and integrally geared centrifugal compressors (API 617 and 672) are designed according to customer specifications and used in refineries, the chemical and petrochemical industries, for natural gas storage and the transport of technical gases and in energy supply and power plants.

With our leading technology, high quality components and our own compressor control and a comprehensive compressor service, we set the highest standards in individual design, quality and durability under the heaviest conditions.

Our product portfolio:

→ Reciprocating compressors for process gases

→ Integrally geared centrifugal compressors for process gases

→ BORSIG BlueLine compressor control

→ Compressor services

3.1

BORSIG ZM
COMPRESSION GMBH

RECIPROCATING COMPRESSORS

for process gases

With around 160 years of expertise in the manufacture of reciprocating compressors, **BORSIG ZM Compression GmbH** offers tailor-made horizontal and vertical compressor solutions for process gases with all auxiliary equipment (turnkey solutions).

Our reciprocating compressors are developed for the heaviest continuous operation and available with lubricated or non-lubricated cylinders. They comply with the design standards of API 618 and API 11P / ISO 13631 as well as other international and manufacturing standards.

We use state-of-the-art 3D design tools that enable either a complete system or specific parts and components to be visualised and designed.

All BORSIG ZM reciprocating compressors are mechanically tested according to API 618 standards at the in-house test field.

All models boast a long service life, high wear resistance durability and low lifecycle costs.

POWER RANGES

Discharge pressure:	p = (... 1.000) bar
Capacity/flow:	V = (...115.000) m³/h
Power:	P = (... 21.000) kW
Stroke:	L = (... 500) mm

TYPICAL APPLICATIONS

- Hydrogen applications
- Petrochemical industry
- Refineries
- Gas processing
- Fertilizer industry
- Power plant industry
- Steel industry

3.2

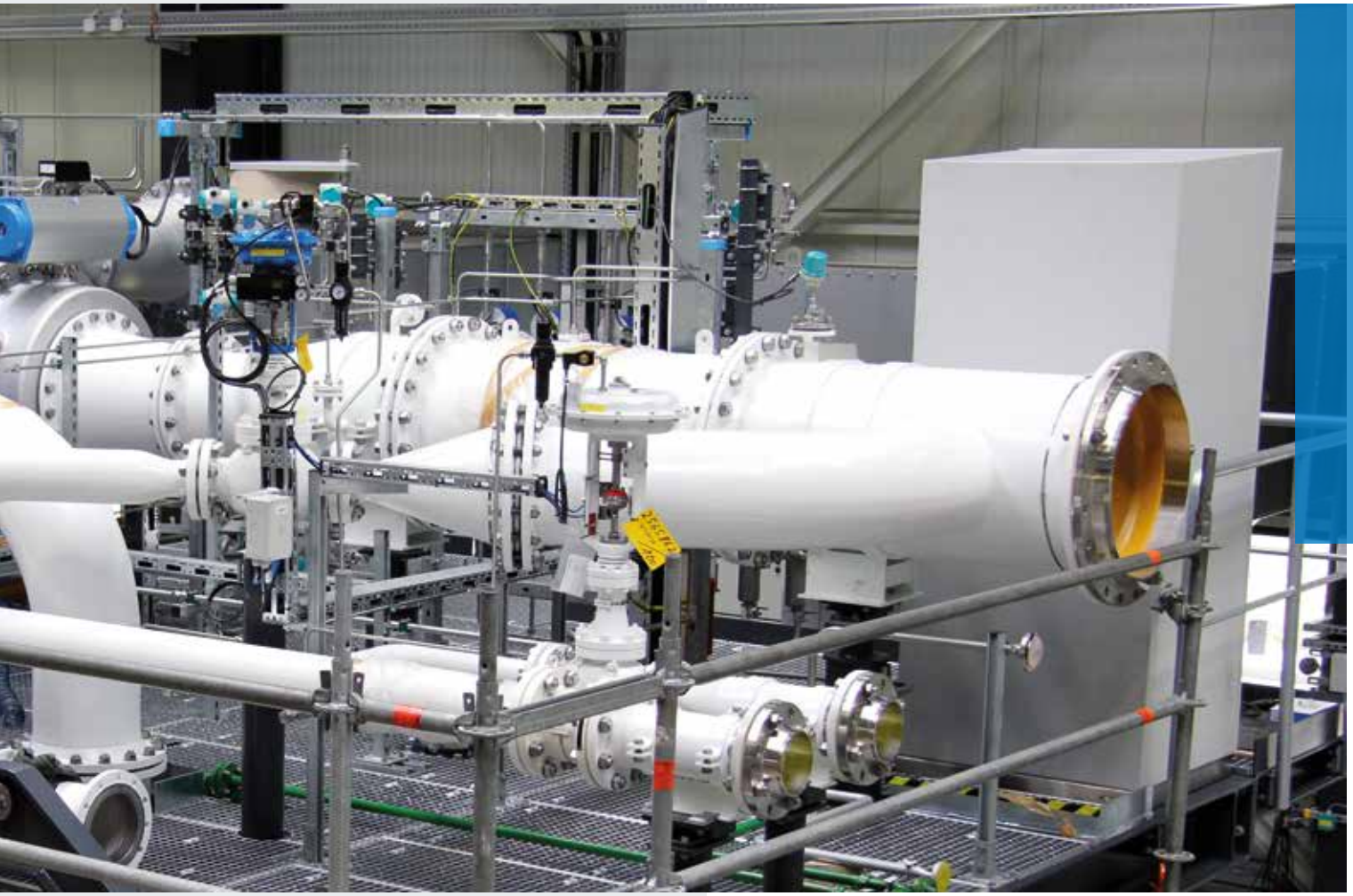
BORSIG ZM
COMPRESSION GMBH

INTEGRALLY GEARED CENTRIFUGAL COMPRESSORS

for process gases

With around 60 years of experience in turbo compressor construction, **BORSIG ZM Compression GmbH** offers integrally geared centrifugal compressors according to customer specifications as turnkey solutions with all necessary system components.
Our BTC series provides multistage geared turbo compressors with up to 8 stages, which correspond to the design standards of API 617 (3rd chapter) and API 672. The oil system is designed according to API 614 or the manufacturer's standard. The latest research results in fluid mechanics as well as gear and bearing design provide the basis of our development. High efficiency is achieved through speed variation, cooling between each stage, inlet guide vane control and axial inflow.

All integrally geared centrifugal compressors from BORSIG ZM Compression GmbH are mechanically tested according to the API 617 standards at the in-house test field.



We also offer complete performance tests according ASME PTC 10 on request.

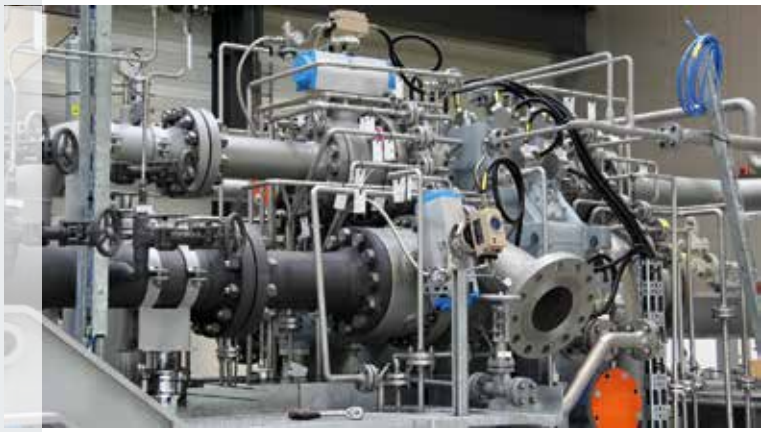
POWER RANGES

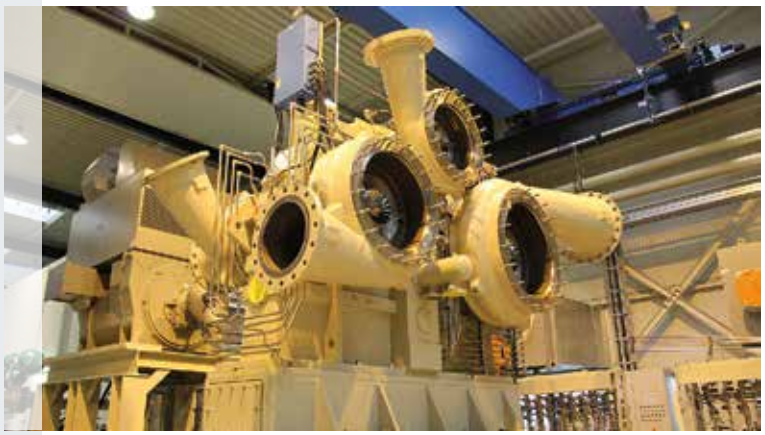
Discharge pressure:	p = (... 150) bara
Capacity/flow*:	V = (... 300.000) m³/h
Power:	P = (... 25.000) kW

* based on atmospheric conditions and air

TYPICAL APPLICATIONS

- Petrochemical industry
- Refineries
- Gas processing
- Fertilizer industry
- Power plant industry
- Steel industry





3.3

BORSIG ZM
COMPRESSION GMBH

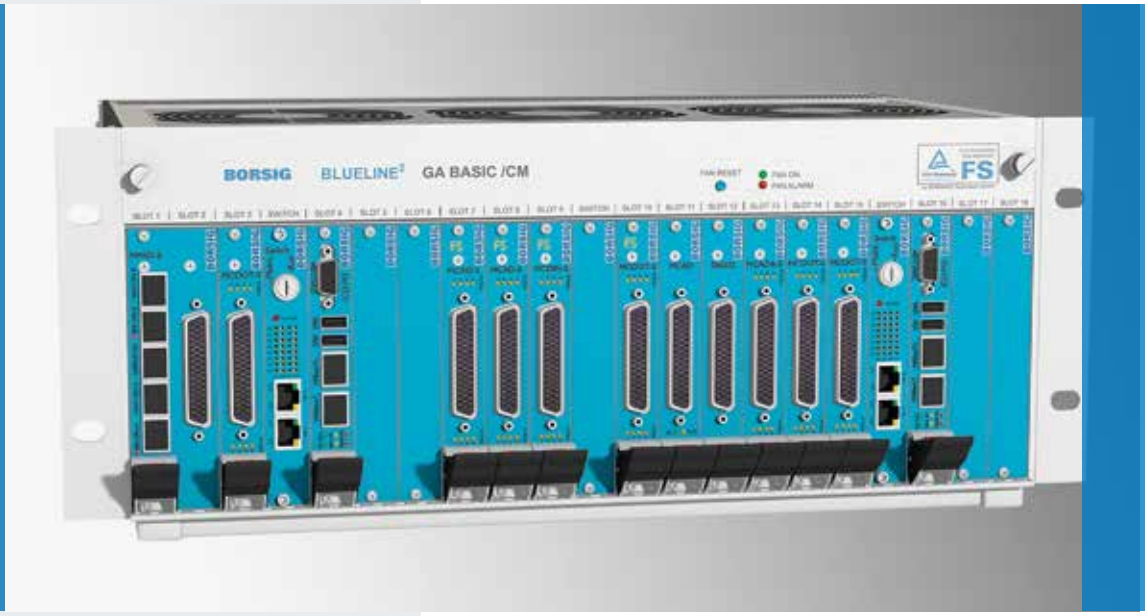
BORSIG BLUELINE COMPRESSOR CONTROL

The BORSIG BlueLine combines the compressor control (PLC), emergency shutdown (ESD) and machine protection (MPS).

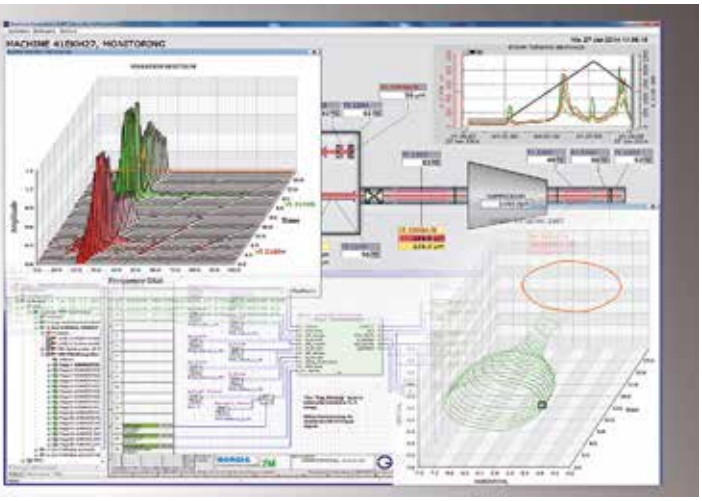
Flexible compressor control is necessary to maintain efficiency under the changing operating conditions of compressors, surrounding system processes and environmental conditions. In addition to regular automation, modern plants increasingly require certified safety functions.
The BORSIG BlueLine combines the compressor control (PLC), emergency shutdown (ESD) and machine protection (MPS) in a modular automation system. For operators of reciprocating and integrally geared centrifugal compressors from **BORSIG ZM Compression GmbH** and other manufacturers, this means a reduction in hardware, software and engineering costs, as well as considerable savings in service and training costs.
BORSIG BlueLine systems enable the mixed operation of certified safety components (up to SIL3) with standard automation systems.

FEATURES OF BORSIG BLUELINE

- Highest safety standards, certified up to SIL3 (IEC61508, IEC61511, IEC62061) and PL e and CAT 4 (ISO 13849, DIN 954) for open- and closed-loop control
- Highest system availability with up to three times the redundancy and the interchangeability of components during operation
- Mixed configuration of certified safety, measuring and control technology possible
- Integrated Machinery Monitoring System (MMS) and Machinery Protection System (MPS) (vibration monitoring)



- No strict separation of MPS, PLC and ESD necessary
- Full integration of all three systems PLC, MPS and ESD and availability as single modules
- Low space requirement and reduction of the usual interfaces
- Freely programmable with SIL3 certified function blocks
- Open communication interfaces: Open Modbus TCP, RTU Modbus and others on request
- Process visualisation system with integrated, high-resolution recording of process data and procedures



TYPICAL APPLICATIONS

- Anti-surge control, optimised for reciprocating and integrally geared centrifugal compressor systems with adaptive control line and static / dynamic final pressure limitation
- Surge detection
- Capacity and load distribution control
- Overspeed protection
- Vibration monitoring
- Simplex, Duplex and TMR systems
- Initial value alarm
- High-resolution data recording

3.4

BORSIG ZM
COMPRESSION GMBH

COMPRESSOR SERVICES

for BORSIG ZM compressors and other brands

As a leading manufacturer of compressor systems worldwide, **BORSIG ZM Compression GmbH** offers a comprehensive service package from a single source. Our flexible and efficient after-sales service provides comprehensive care of your compressor regardless of the make.

In addition to the competence and long-standing experience of our staff in compressor manufacturing, a particular strength is outstanding quality of our services in accordance with our excellent OEM quality standards.

SERVICE PORTFOLIO

- Installation and commissioning of compressor units
- Spare part management
- Revamp and modernisation
- Maintenance and overhauling
- Troubleshooting
- In-house and on-site training
- Compressor valve service

PRODUCT PORTFOLIO

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

BORSIG ZM's engineering competence provides support with the installation and commissioning of compressor units as well as 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 minimal downtime for your compressor.
Emergencies demand short reaction times. BORSIG ZM´s service staff is available to its customers worldwide, 24 hours a day, 7 days a week, 365 days of the year.

24-H-SERVICE HOTLINE
PHONE: +49 (0) 3764 5390 5120
E-MAIL: service.bzm@borsig.de

4.

BORSIG VALVETECH GMBH

VALVES AND COMPRESSOR PARTS

BORSIG ValveTech GmbH offers high-pressure control and shut-off valves for extreme operating conditions, a comprehensive valve service and complete solutions for compressor valves.

The full service range of BORSIG ValveTech GmbH includes the design, manufacture and maintenance of high-pressure control and shut-off valves and compressor valves. All our valve solutions are tailor-made for the respective applications and manufactured for extreme operating conditions by the application of duplex, super-duplex and other special materials. This innovative product range makes BORSIG one of the leading providers of high-pressure control and shut-off valves for extreme operating conditions, especially on gas compressor and storage stations.

Our compressor valves also satisfy these demands. Desired flow rates and pressures are achieved due to the optimal design.

BORSIG ValveTech GmbH stands for innovation, precision, longevity and reliability.

Our products:

→ Control Sphere® control ball valves

→ Superbloc® isolation and emergency shut-off ball valves

→ Desuperheaters

→ Compressor parts

→ Valve services and spare parts

4.1

BORSIG VALVETECH GMBH

CONTROL SPHERE® CONTROL BALL VALVES

BORSIG ValveTech GmbH offers customised control ball valves and service solutions for power generation, the oil and gas industries as well as for the chemical and petrochemical industries.

BORSIG ValveTech GmbH offers industrial control ball valves, specifically engineered and designed to control process and media applications.

Our control valve product line is engineered to suit very high differential pressure applications providing exceptionally high rangeability with the lowest possible breakaway torque values.

SIZES

NPS 1“ - 36“
DN 25 - 900

CLASS

ANSI 600 - 2500
PN 100 - 420

SEALING SYSTEM

Metal to Metal (MM)
Primary Metal Secondary Soft (PMSS)

DESIGN

- Split body
- Fully welded
- Top entry
- Trunnion mounted
- Forged or casted steel

FEATURES

- Customized control disc for linear, equal percentage or individual control flow
- Multi-pressure reduction design
- Anti-static design
- Single or double piston
- Double block and bleed
- Anti-blowout stem
- Vent and drain connection
- Emergency sealant injection
- Bi-directional
- Fire safe design
- TA-Luft (fugitive emissions)

4.2

BORSIG VALVETECH GMBH

SUPERBLOC® ISOLATION & EMERGENCY SHUT-OFF BALL VALVES

The consistent increase in efficiency combined with the highest possible plant flexibility means that operating parameters such as temperatures, pressures and load processes are becoming increasingly stringent.

To minimise downtimes and ensure maximum plant safety, **BORSIG ValveTech GmbH** offer 100% system isolation and emergency shut-off valves tested to the limit to ensure performance and integrity even under the most challenging conditions.

All of our isolation and emergency shut-off ball valves are coated for enhanced erosion and corrosion resistance according to the application and can even withstand acids or caustics.

SIZES

NPS 1“ - 36“
DN 25 - 900

CLASS

ANSI 600 - 2500
PN 100 - 420

SEALING SYSTEM

Metal to Metal (MM)
Primary Metal Secondary Soft (PMSS)
Soft Seated

FEATURES

- Safety shut-off function
- Fire safe test acc. to API 607 & ISO 10497
- Anti-static design
- Single or double piston
- Double block and bleed
- Anti-blowout stem
- Vent and drain connection
- Emergency sealant injection
- Bi-directional
- High temperature application
- Fire Safe Design
- TA-Luft (fugitive emissions)

4.3

BORSIG VALVETECH GMBH

DESUPERHEATERS

Temperature control of superheated steam

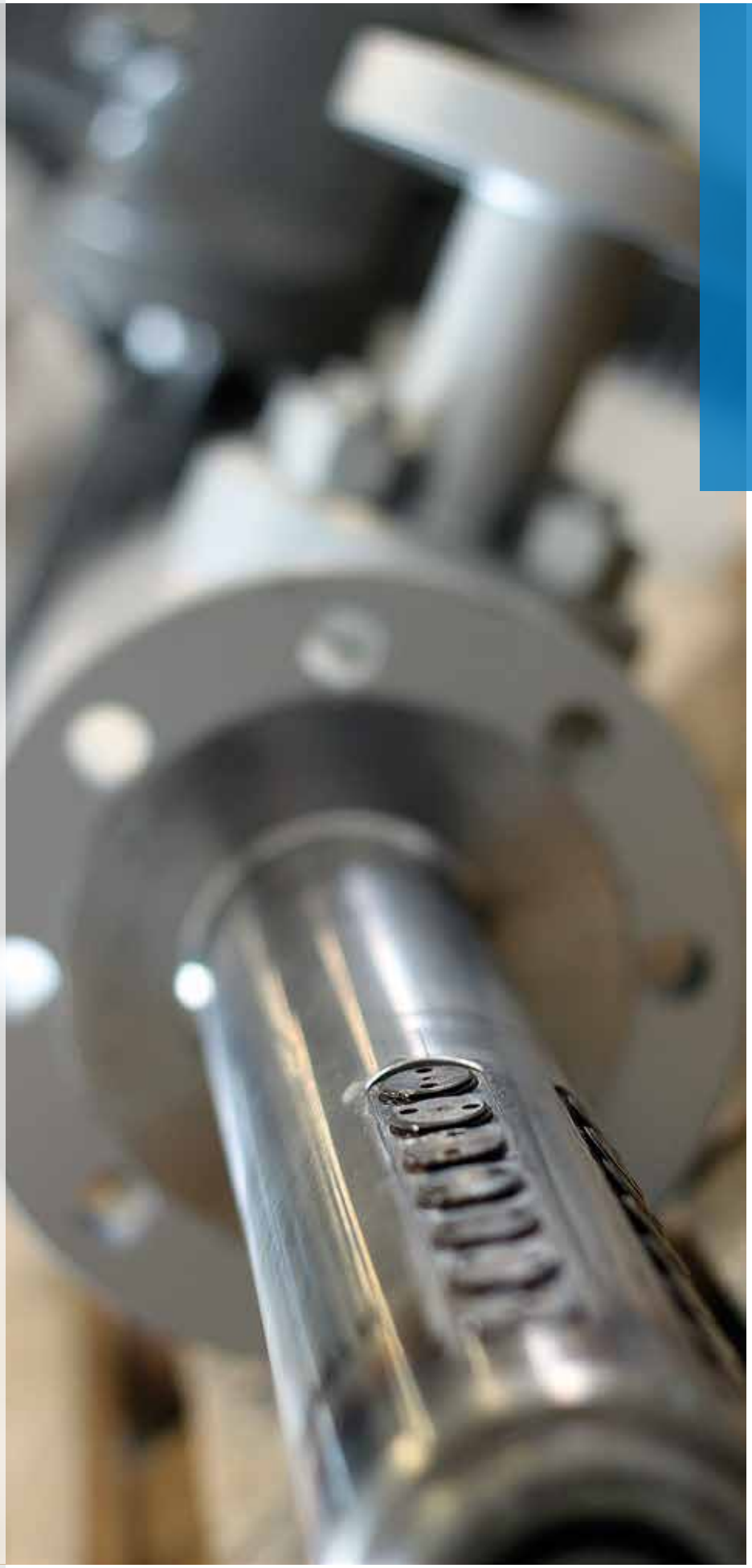
Valves for conditioning steam are an indispensable component of modern power plants and boiler systems. The desuperheater solutions from **BORSIG ValveTech GmbH** guarantee effective steam cooling with minimum evaporation distances and thus contribute significantly to the overall efficiency of the plant.

They cool superheated steam by injecting cooling water centrally into the steam flow. An integrated ball valve system guarantees 100% external impermeability, which stops water from accumulating in the piping system, thus preventing wear of steam turbine blades.

The cooling water is controlled by a unique rotational movement that guarantees optimal cooling injection across the entire load range.

FEATURES

- Shut-off function with integrated ball valve system
- Multistage pressure reduction with linear, equal percentage or individual control characteristics
- Decreased wear of sealant system due to rotating movement
- Easy maintenance and exchange of spare parts
- Single piece design for maximum mechanical integrity
- No weld joints on pressure retaining components
- No need of additional feed water regulation valve



4.4

BORSIG VALVETECH GMBH

COMPRESSOR PARTS

A small component with a big impact

BORSIG ValveTech GmbH, formerly known as BORSIG Compressor Parts GmbH and COMPART Compressor Technology GmbH, develops, manufactures, reconditions and modifies compressor valves.

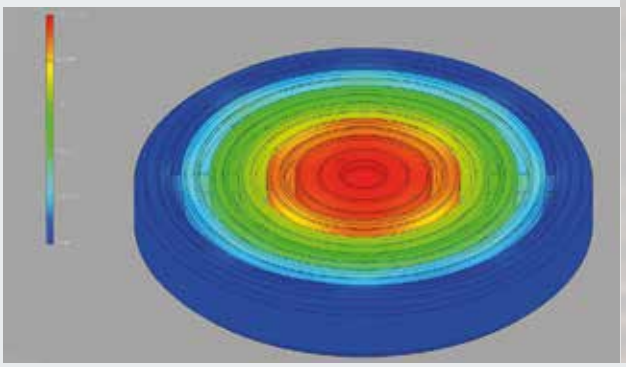
Our clients are active in the oil and gas industries, the chemical and petrochemical industries, natural gas and offshore industries and the production of process gases.

A team of experienced engineers guarantees fast service from the analysis to the right solution for the customer's needs.

With more than 2,000 items in stock, BORSIG ValveTech GmbH is always able to offer flexible and wide-ranging solutions.

OUR PRODUCTS AND SERVICES

- Plate and ring valves
- Actuators
- Oil scraper packings
- Check valves
- Piston rod seals
- Valve service and modification
- Engineering and consulting



4.5

BORSIG VALVETECH GMBH

VALVE SERVICES AND SPARE PARTS

Maintenance, repairs and conversions

BORSIG ValveTech GmbH is an independent supplier of industrial ball valve spare parts for old BORSIG ball valves as well as for other brands. In cooperation with the manufacturers of the original spare parts, we are able to guarantee a comprehensive spare parts service for the complete maintenance of fittings.

Spare parts, such as balls or seat rings, are quickly and professionally manufactured or overhauled on various machines (e.g. ball lathes and grinding machines) at our workshop. We possess decades of experience in the field of on-site assembly, maintenance and repair of ball valves with diameters from 25 to 2,600 mm (DN 1 “- 104“).

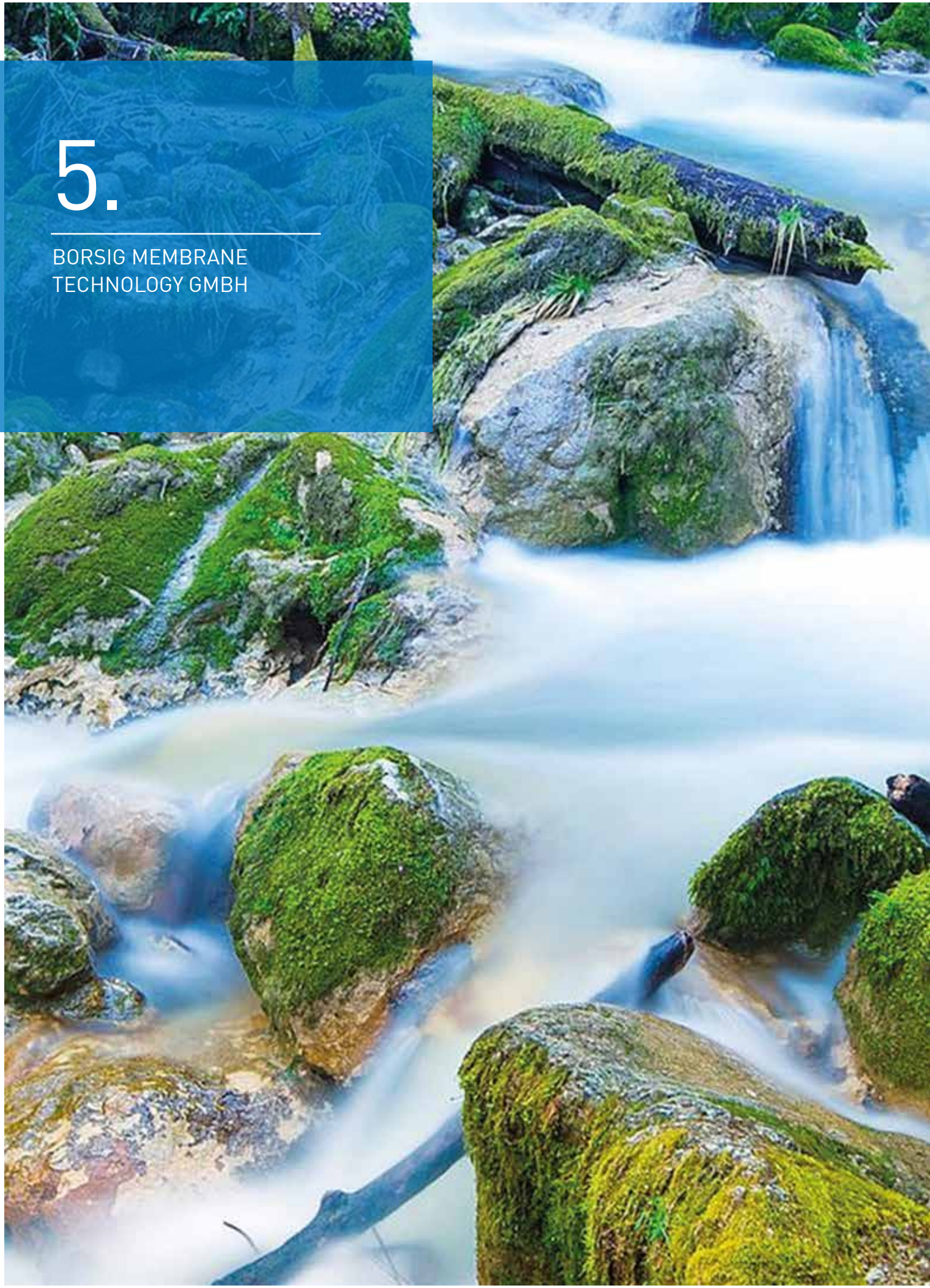
We can recondition corrosion-damaged valves with surface-layer welding and hardfacing, including PWHT, to make them qualitatively equivalent to new valves.

Our technical development includes modifications in the material (e.g. seat rings completely made of PEEK) as well as the replacement of conventional sealing rings by spring-loaded lip seals. In some cases, ball valves can be upgraded to a „fire safe design“ by modification.

Safety valves, control valves, check valves, gate/ slide valves and actuators can also be repaired and reconditioned at our workshop in Gladbeck.

5.

BORSIG MEMBRANE TECHNOLOGY GMBH



PROCESS AND MEMBRANE TECHNOLOGY

As an internationally renowned company with more than 30 years of experience, **BORSIG Membrane Technology GmbH** offers its customers leading and innovative membrane technology solutions for a wide range of industrial applications.

Our membranes, membrane modules and complete process solutions are synonymous with high quality, competence and reliability. Our product and service portfolio ranges from feasibility studies and process simulation to the delivery of complete turnkey systems and a comprehensive after-sales service.

Taking into account the highest safety and quality requirements, our process technology ensures operational safety, maximum efficiency and optimum cost effectiveness for the following applications:

- → Emission control
- → Product recovery
- → Gas separation
- → Liquid separation

5.1

BORSIG MEMBRANE
TECHNOLOGY GMBH

EMISSION CONTROL

for terminals, refineries, marine loading and car filling stations

Volatile Organic Compounds (VOC) belong to a family of hydrocarbons with high volatility and occur either naturally or are produced in many industrial processes. A wide range of industrial applications that use VOC in the oil and gas industry as well as chemical and petrochemical industries cause substantial emissions mainly due to evaporation, displacement and purge procedures.

The use, storage and distribution of solvents and petroleum products have been identified as one of the most significant sources for VOC emissions. Displacement and evaporation effect the release of organic vapours, which in most cases are mixed with air or other permanent gases.

Typical products are solvents, all types of gasoline, various additives, diesel, jet fuel, alcohols, bio fuels and crude oil.

International regulations and emission laws have been implemented to drastically minimise VOC emissions by reducing VOC consumption with the installation of emission control systems.

BORSIG Membrane Technology GmbH offers emission control solutions with maximum recovery rates of up to

99.9%, thereby enabling compliance with all customary emission standards worldwide whilst also fulfilling the highest quality, safety and reliability requirements.

OUR PRODUCT PORTFOLIO FOR EMISSION CONTROL

TERMINALS AND REFINERIES

- BORSIG ***Vapour Recovery Unit***
- BORSIG ***Aromatic Recovery Unit***
- BORSIG ***Carbon Retrofit Unit***

MARINE LOADING

- BORSIG ***Marine Vapour Recovery Unit***
- BORSIG ***Dock Safety Unit***

CAR FILLING STATIONS

- BORSIG ***Vent Recovery System***

5.2

BORSIG MEMBRANE
TECHNOLOGY GMBH

PRODUCT RECOVERY

for PE, PP, EO/EG, PVC and rubber production as well as seal gas recovery

Product recovery systems today must meet ever more stringent efficiency requirements. Economic efficiency, high productivity, improved sustainability of technological processes as well as optimum utilisation of our resources are key challenges for these types of systems.

BORSIG Membrane Technology GmbH offers optimum solutions which help to minimise losses and recover valuable input materials from exhaust or process gas streams and return them to the production cycle.

The benefits are:

- Recovery of valuable feedstock and product
- Significant reduction of waste and flare gas capacities
- Reduction of emissions caused by waste gas treatment

IMPORTANT PRODUCTS AND APPLICATIONS

- Ethylene monomer from polyethylene (HDPE, LLDPE, etc.), ethylene oxide (EO) or VAM production
- Propylene monomer from polypropylene production (PP)
- Solvent (e.g. hexane) from slurry-type HDPE production
- Alkane in polyethylene production
- 1.3 butadiene from synthetic rubber production
- Vinyl chloride monomer (VCM) from PVC production
- Fluoro and chloro hydrocarbons from any related processes
- Seal gas recovery for rotating machinery

PE PRODUCTION

- BORSIG ***Ethylene Recovery Unit***
- BORSIG ***Hydrocarbon Recovery Unit***

PP PRODUCTION

- BORSIG ***Propylene Recovery Unit***
- BORSIG ***Nitrogen Recovery Unit***

EO/EG PRODUCTION

- BORSIG ***Ethylene Recovery Unit***

PVC AND RUBBER PRODUCTION

- BORSIG ***Monomer Recovery Unit***

VAM PRODUCTION

- BORSIG ***Ethylene Recovery Unit***

SEAL GAS RECOVERY

- BORSIG ***Seal Gas Recovery Unit***

5.3

BORSIG MEMBRANE
TECHNOLOGY GMBH

GAS SEPARATION

Hydrogen separation and fuel gas conditioning

BORSIG Membrane Technology GmbH offers attractive process solutions for various gas separation applications in the fields of oil and gas production or refinery and process technology.

Membrane-based gas separation solutions can be developed as a supplement or an alternative to conventional process setups. Corresponding concepts can be effortlessly integrated into existing plants for process optimisation.

OUR PRODUCTS

→ HYDROGEN

- Hydrogen recovery from reactor purge gas (e.g. ammonia or methanol synthesis)
- Hydrogen recovery and purification from refinery process gas streams
- Synthesis gas treatment, H2/CO ratio adjustment

→ GAS CONDITIONING

for gas motors and turbines or pipeline supply
- Dew point reduction
- Adjustment of calorific value or methane number

→ GAS SEPARATION

- Treatment of raw gas streams
- Recovery and purification of valuable components
- Specific gas treatment applications

→ BORSIG ***Hydrogen Separation Unit***

→ BORSIG ***Fuel Gas Conditioning Unit***

5.4

BORSIG MEMBRANE
TECHNOLOGY GMBH

LIQUID SEPARATION

Our advanced liquid separation technologies are targeted to treat hydrocarbon-based or solvent-containing process streams and provide valuable solutions for process intensification.

While many membrane-based solutions for organic gas applications are state-of-art, organic liquid streams are typically processed by conventional thermal unit operations.

Our innovative membrane technologies offer an alternative approach. They can contribute to increasing process efficiency, reducing the use of raw materials and energy and simplifying the process steps.

BORSIG Membrane Technology GmbH offers the development of process solutions and units with the specially developed, solvent-resistant polymer membranes ***oNF-1***, ***oNF-2*** and ***oNF-3***.

These organophilic nanofiltration membranes enable the non-thermal separation of homogeneous mixtures of organic solvents and molecules ranging from 200 to 1,000 Da.

BORSIG ***Pervaporation Units*** complete the advanced liquid separation portfolio. Pervaporation is an efficient solution for separating azeotropes from solvents and water or methanol. The dehydration of ethanol, isopropanol and tetrahydrofuran by pervaporation are well-established industrial applications.

OUR PRODUCT PORTFOLIO

- → BORSIG ***Organic Solvent Nanofiltration Unit***
- → BORSIG ***Pervaporation Unit***
- → Products & services for process development

5.5

BORSIG MEMBRANE
TECHNOLOGY GMBH

PLANT AND MEMBRANE SERVICES

for all phases of your project

As a leading supplier of modern membrane process solutions, **BORSIG Membrane Technology GmbH** offers a complete range of lifecycle services covering all phases of a project. Starting with a general idea, we conduct a feasibility study, carry out engineering, installation and commissioning and provide a comprehensive after-sales service as part customer partnership which includes:

- Comprehensive process knowledge
- Data-based process simulation
- Long-standing engineering expertise in petrochemical applications and knowledge of typical codes and standards
- Lifecycle consulting services, trouble-shooting and process optimisation
- Well-trained, multidisciplinary engineers for new installations and service tasks
- Remote 24/7 service team availability

OUR LIFECYCLE SERVICE

- Consulting
- Feasibility studies
- Retrofit (process optimisation, efficiency and performance increase, TA Luft adjustments)
- Laboratory and field tests
- Basic and detailed engineering
- After-sales service

OUR SERVICE PORTFOLIO

- After-sales service, maintenance and trouble-shooting
- Plant-specific maintenance contracts and customized spare part management systems
- Maintenance and trouble-shooting of third-party vapour recovery units
- 24/7 standby duty for intervention on demand with different reaction time levels
- Remote service solution for fault analysis
- Monitoring machines by endoscopy diagnostic, vibration measurement, thermography pictures etc.
- Installation and commissioning of membrane systems such as VRU, PRU, HRU etc.
- Basic and detailed engineering
- Process control and visualisation
- Operator training
- Process development and optimisation
- Hazard and operability studies (HAZOP) of BORSIG, third party VRUs and other plants and systems, IPF analysis
- Retrofit
- Performance tests of BORSIG and third party plants and systems, including emissions and capacity measurement, gas analysis, active carbon analysis
- Official emission measurements in co-operation with authorities according to different European standards
- Emission reports for refineries and tank farms
- Pressure vessel tests in co-operation with authorities

6.

BORSIG SERVICE GMBH

POWER PLANT SERVICES AND ENERGY FACILITY ENGINEERING

BORSIG Service GmbH offers comprehensive services for the energy technology, chemical and petrochemical industries as well as for oil, gas and water supply.

From our facilities in Berlin, Gladbeck and Hamburg in Germany our excellently networked global team of engineers and technicians provides you with competent, fast and reliable support. We have decades of experience in planning, performing and implementing all kinds of assembly, manufacturing and service tasks.

We rectify malfunctions and procure any required spare parts. We support you in the planning, delivery and installation of new components in your systems, with modification and overhauls, as well as the inspection and maintenance of existing components provided by us or third parties.

In addition, we offer technically complex modifications with thermal calculations and project-specific engineering, for example, to improve the output and/or efficiency of your steam generator.

Competent, fast and close to the customer - our efficient service and installation team makes this claim a reality.

We also offer trouble-shooting as a 24-hour standby service -

YOUR SERVICE NUMBER: +49 (0) 172 4380-330.

6.1

BORSIG SERVICE GMBH

POWER PLANT SERVICES

With more than 100 years of experience in boiler engineering and plant design, BORSIG Service GmbH is a competent partner for all boiler operators.

BORSIG Service GmbH has a long tradition in tackling up-to-date technical issues such as runtime-optimised approaches, plant safety and plant flexibility. We offer our power plant customers in the ENERGY, WASTE INCINERATION and PROCESS INDUSTRIES individual solutions to individual problems as a complete package, from engineering to delivery and installation of boiler components.

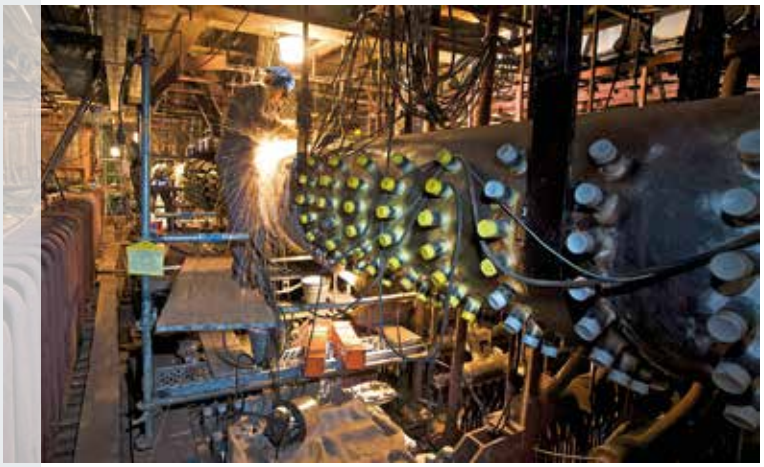
OUR POWER PLANT SERVICE PORTFOLIO

- ENGINEERING
  Consulting, layout design, construction 2D/3D, thermodynamics and flow engineering, strength calculation, basic and detail engineering, manufacturing planning and control, quality control
- BOILER SERVICE
  Repairs, maintenance, cladding, erection, assembly and disassembly, modification, spare parts supply, 24/7 standby service
- RETROFIT
  Replacement, process enhancement, raising efficiency, erosion reduction, expansion

OUR 24-H-SERVICE HOTLINE: +49 (0) 172 4380 330

COMPONENTS SERVICED

- Steam generator
- LP and HP heat exchangers
- Pressure vessels and heat exchangers
- Containers
- Pipelines
- Air and flue gas systems
- Soot blowers
- Charging / waste charging
- Ash removal / wet slag removers
- REA plants
- DENOX plants



6.2

BORSIG SERVICE GMBH

ENERGY FACILITY ENGINEERING

Optimisation of power plants - our contribution to the energy transition

As experts in conventional power plant technology, we at **BORSIG Service GmbH** will continue to help our customers optimise their power plants in the future.

Supporting the energy transition with technical solutions is the aim of our plant construction engineers.

As a full-service provider, we are able to identify and implement integrated solutions.

Professional project management guarantees the optimal implementation of our and your plant construction projects in terms of time and cost.

OUR ENERGY PLANT ENGINEERING PORTFOLIO

Engineering

→ We offer all technical planning services, from the initial concept to the basic and detailed engineering

Procurement

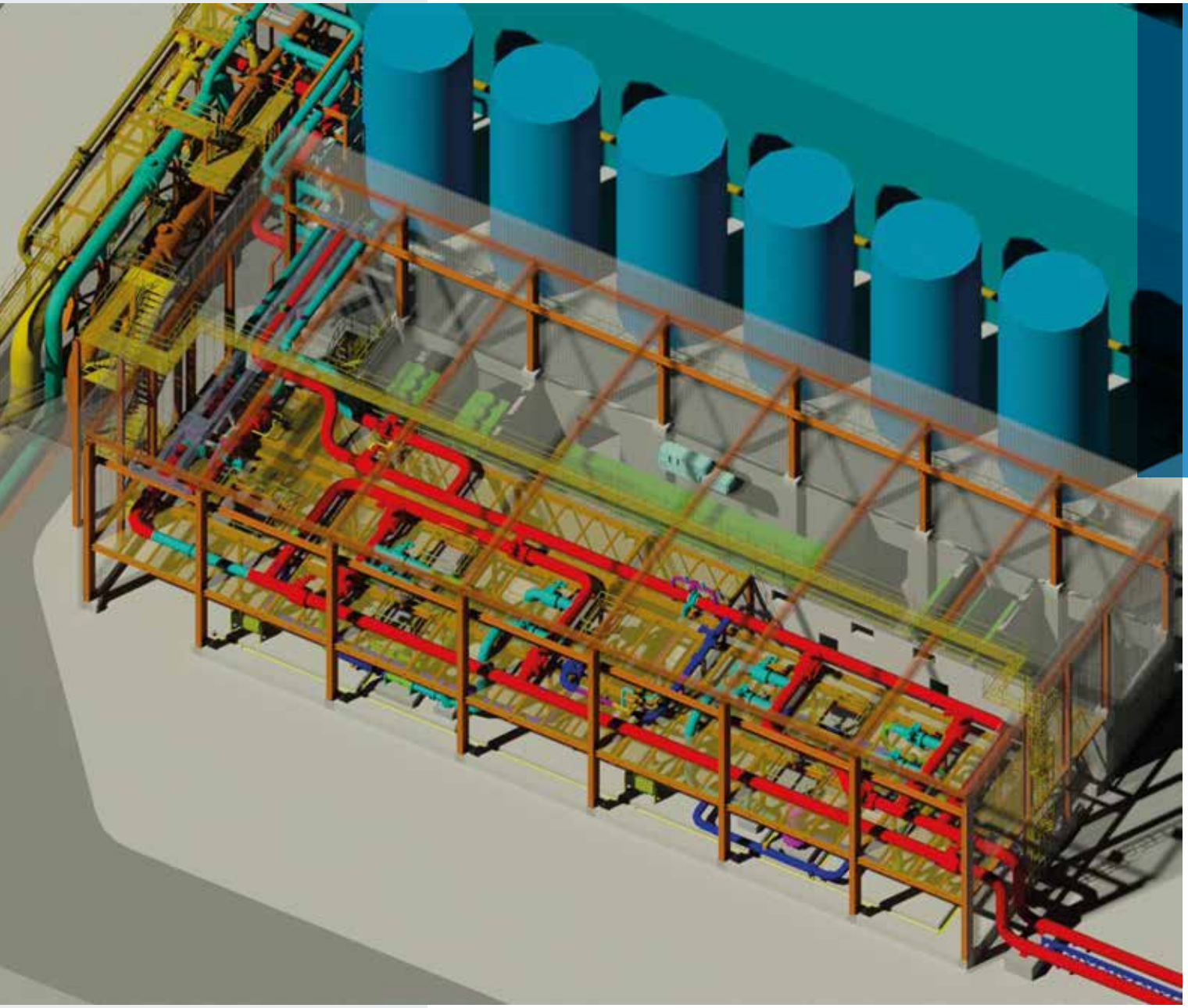
→ We optimise procurement processes, adapt logistics to the project and implement quality

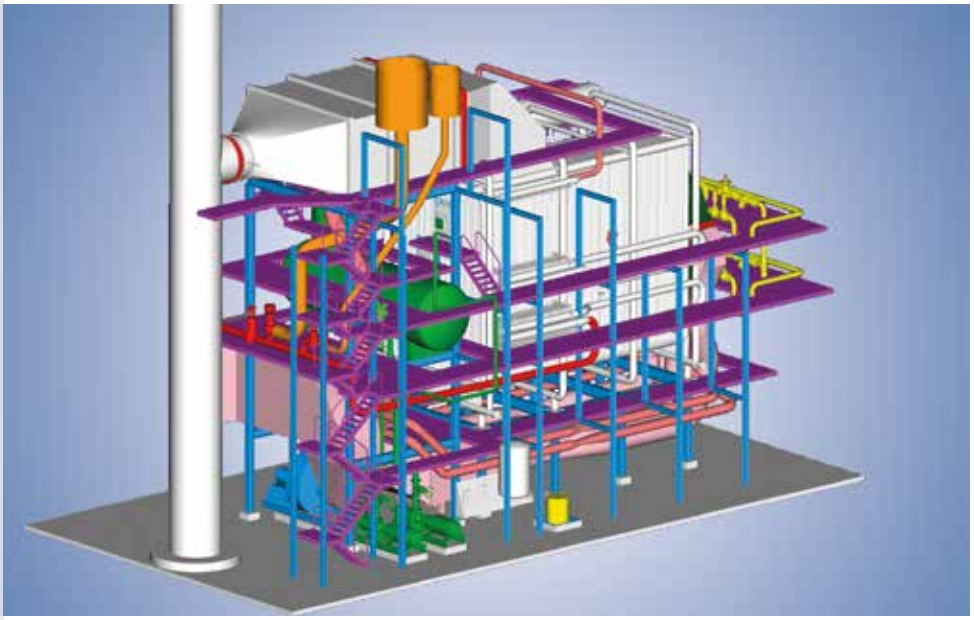
Installation

→ We assemble of all system components on the construction site

Commissioning

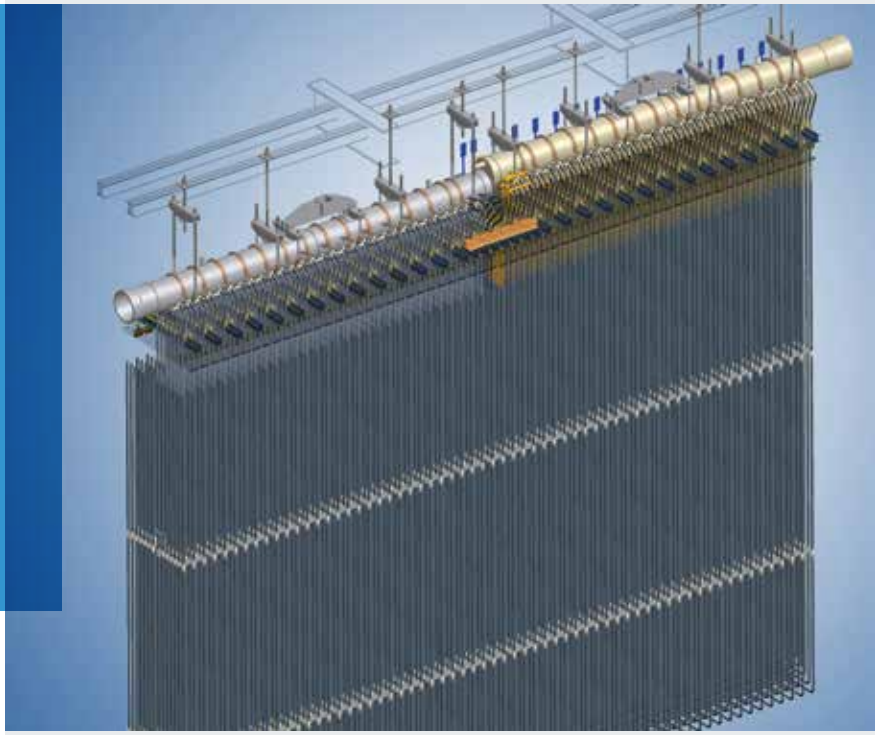
→ Planning and implementation





6.3

BORSIG SERVICE GMBH



ENGINEERING AND PIPING

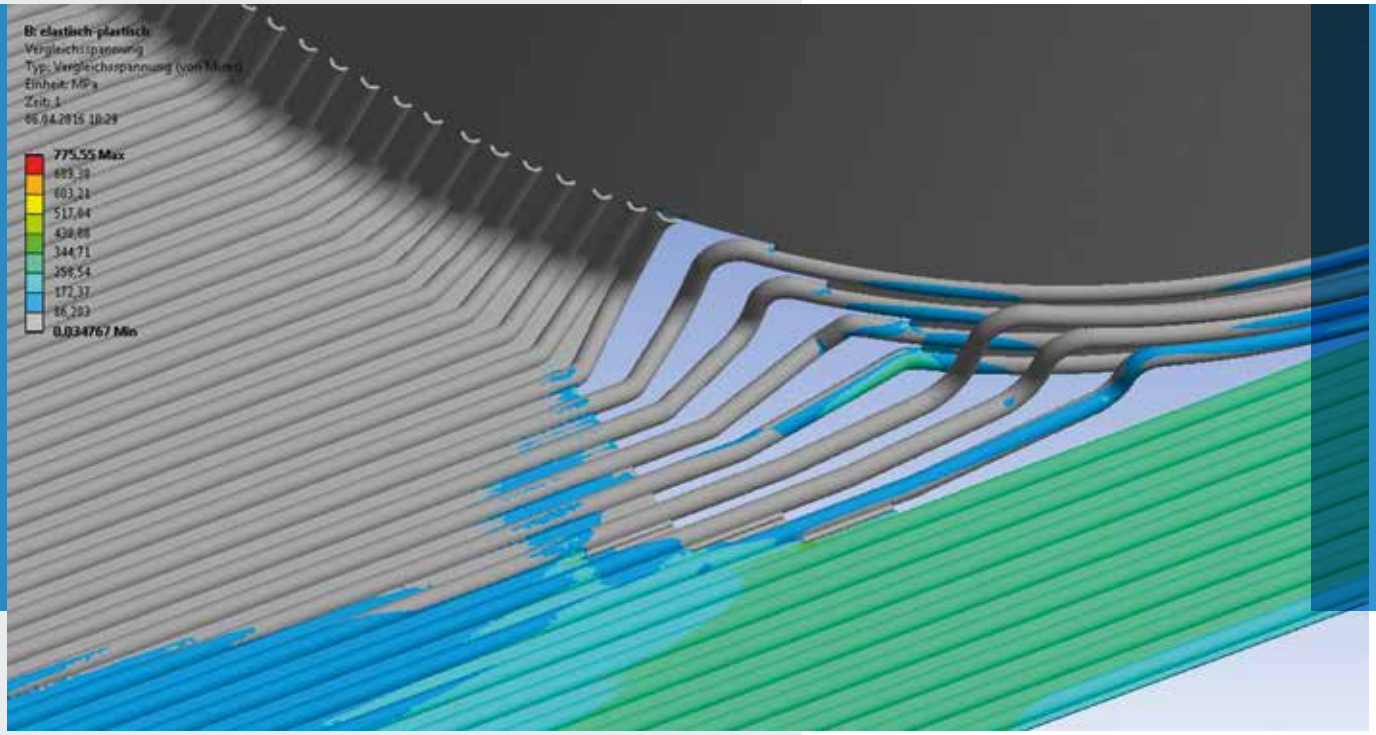
for power plants and industrial facilities

ENGINEERING

In addition to the general servicing of plants, apparatuses and boiler components, **BORSIG Service GmbH** offers a wide range of engineering services to all customers in power generation and industry. The redesign and overhaul of existing systems and components in accordance with current standards and specified customer requirements form a focal point of our work.

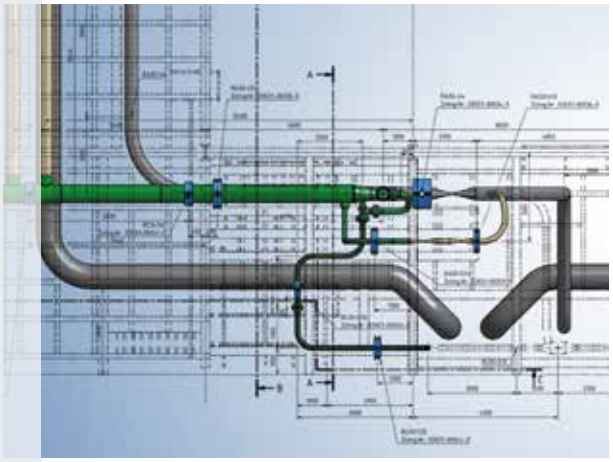
We are happy to offer our customers the benefit of our expertise in the event of damage or malfunctions. We inspect affected components, analyse patterns and determine causes of damage in order to make recommendations for improvement and conversion options. Adjoining components and systems are also included in the root cause analysis.

Our innovative assembly concepts allow us to carry out extensive disassembly and assembly work within the shortest time in an appropriate and professional manner to the complete satisfaction of our customers while complying with all necessary safety requirements.



PIPING

We service plants in the chemical and petrochemical industry as well as plants for steam and power generation worldwide. Our range of services includes repairs, dismantling and assembly of heat exchangers, steam drums, transfer line exchangers, reactors, waste heat recovery systems, collectors, coolers and special equipment, HP piping, fittings, ball valves, machines and pumps.



OUR SERVICES

- Piping design
- Strength calculations / pipe statics
- Material supply
- Prefabrication and assembly of complete piping systems including feed water lines, high-pressure steam pipes, condensate lines, gas and oil pipes
- Inspection, documentation
- Nominal sizes: DN 10 to 2,000
- Nominal pressures: PN 10 to 400

BORSIG

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