



BORSIG

**Membrane technology
for processes and
environment.**

BORSIG Membrane
Technology GmbH

**Think.
Create.
Change.**

Membrane technology

for processes
and environment.

The foundation of a sustainable and environmentally friendly circular economy:

- The conscious and responsible use of energy and resources
- The need to conserve, recover and recycle effectively in industrial processes
- The development of new processes that are economical, environmentally friendly and sustainable



Modern membrane processes offer exceptional potential for optimising of industrial processes by enhancing resource efficiency, minimising energy consumption and reducing emissions.

The potential areas of application range from standard uses in the (petro)chemical industry and the oil and gas sector to innovative approaches for process solutions in the life sciences, food and pharmaceutical industries. BORSIG Membrane Technology GmbH (BMT) provides intelligent and innovative process solutions based on membrane separation technology.

We have a team of highly motivated and qualified engineers and technicians with extensive expertise in process technology, engineering and plant construction.

Our product portfolio includes solutions for the following applications:

- **Emission control**
- **Gas / vapour separation & recovery solutions**
- **Organic solvent nanofiltration (OSN) & pervaporation units**

Our proficiency in these areas, combined with our comprehensive range of services, makes us the partner of choice for a life cycle partnership.

One partner for all your project phases.

We support our customers in selecting or developing industrial production processes by providing expertise, system technology and complete solutions. We continue to work with them to optimise system concepts to improve environmental protection, resource conservation and energy use.

Process idea.

Innovative products and comprehensive services make BORSIG Membrane Technology GmbH the ideal partner for technologically demanding challenges. Our customers rely on our tailor-made process solutions, and we excel in finding suitable concepts even for unusual problems. Our strong reputation and numerous successful reference projects worldwide affirm this trust every day.

Feasibility.

We work with you to evaluate the technological feasibility and commercial viability of potential process concepts in advance. Laboratory tests, pilot trials and process simulations are used to assess both feasibility and any technological or commercial constraints. We explore various alternative approaches to identify the optimal solution that best meets your current and future requirements.

Engineering.

We possess extensive engineering expertise and competence across all technical disciplines for project implementation. We use state-of-the-art software and simulation tools and comply with international codes and standards as well as project specifications and norms. This process is always conducted in close consultation with the client.

Life Cycle Partnership



PROCESS
IDEA



MANUFACTURING
AND SUPPLY



ENGINEERING



FEASIBILITY



LIFE CYCLE
SERVICES



Manufacturing & supply.

Ensuring the highest standards in the manufacture of our products is our top priority, from design through to delivery, installation and commissioning on site.

Life cycle services.

We are renowned as a reliable partner for demanding projects. But BORSIG Membrane Technology GmbH offers even more; we support our customers throughout the entire product cycle, from commissioning and training to overhauls, maintenance and spare parts provision. Our framework agreements, remote service and 24/7 availability are particularly appreciated. These services are tailored to the specific product or system. We are always at your side as a strong partner for all your needs.

Membrane separation

Membrane separation is a purely pressure-driven, continuous separation process. When there is a pressure difference across a selective membrane, an incoming process stream is separated into two outlet streams with different compositions.

The availability of different polymer membranes with unique separation properties allows for the optimisation of process concepts across a wide range of applications. The specific separation properties result from the physical characteristics of the materials and their interactions with various substances.

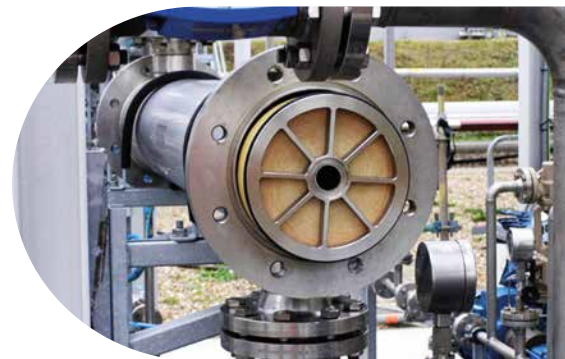
Application areas include the separation of gases and/or vapours as well as the treatment of organic liquid mixtures.

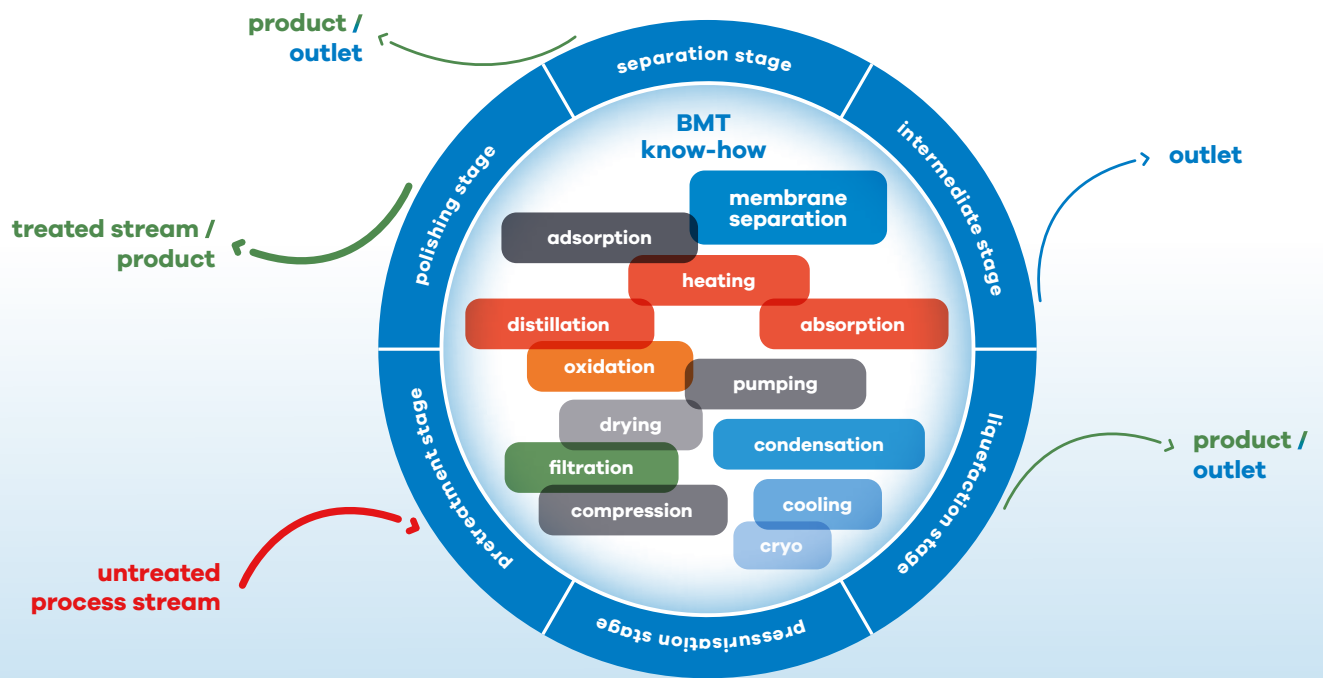
Different module concepts are available for the various applications and areas of use.

The BMT product portfolio includes spiral wound modules, plate modules, and hollow fibre modules. These can be selected, configured and customised depending on the application and specific requirements for the respective separation task.

Membrane types and their field of application – some examples:

- Hydrocarbon-selective: Solvent-resistant flat sheet membrane for applications in gas and vapour separation and organic solvent nanofiltration (OSN)
- Water- or methanol-selective: Solvent-resistant flat sheet membranes for pervaporation applications
- CO₂-selective: Flat sheet membrane for gas treatment and carbon capture applications
- Hydrogen-selective: Hollow fibre membrane for gas treatment and hydrogen recovery and enrichment





BMT has extensive expertise and knowledge based on three decades of experience in the development of process systems. This experience has given BMT a deep understanding of separation technologies, enabling the development of advanced process concepts that combine various separation and treatment technologies.

The separation and treatment technologies include, among others:

- Membrane separation – gases / vapours
 - Separation and recovery of hydrocarbons
 - Hydrogen recovery and purification
 - CO₂ separation and enrichment
- Membrane separation – organic liquid mixtures
 - Organic solvent nanofiltration (OSN)
 - Pervaporation
- Adsorption processes techniques such as pressure swing adsorption and temperature swing adsorption / drying.
- Thermal processes such as absorption and distillation.
- Condensation / liquefaction, thermal / catalytic oxidation and others.

The experts at BMT possess in-depth process and engineering expertise. This enables the implementation of the most suitable process concept, either by selecting and adapting available standardised process systems or by developing and optimising customised process solutions.

BMT's process expertise includes:

- Process integration, intensification and optimisation.
- Expertise in rotating equipment such as compressor technology, vacuum pump systems and pumps.
- Expertise in process control and automation.



Vapour recovery units

The state-of-the-art Vapour Recovery Units (VRUs) from BORSIG Membrane Technology GmbH are designed to meet the industry's highest demands, addressing both current and future challenges effectively. They reduce product loss to an absolute minimum, with the highest recovery rates of up to 99.9%. And they ensure compliance with the world's most stringent regulatory requirements.

The focus is on conserving resources, saving energy and protecting the environment. Our VRU process effectively treats gas streams containing hydrocarbons to comply with required emission limits.

Membrane separation technology offers several system-related advantages over other technologies for the treatment of explosive gas mixtures.

Our VRU's can flexibly process a wide range of products and VOC's (Volatile Organic Compounds). The proven membrane technology of BORSIG Membrane Technology GmbH is resistant to sulphur compounds (H_2S or mercaptans) during operation and is unaffected by aromatics (BTX,...). This ensures very high availability with consistent process performance and a long service life. Our VRUs meet all the requirements for safe and efficient operation in refineries, terminals and ship loading. Additionally, they address special and emerging challenges, such as systems for the storage of methanol or OLHCs (Organic Liquid Hydrogen Carriers).



Our process combines compression and absorption / condensation with vacuum-assisted membrane separation.

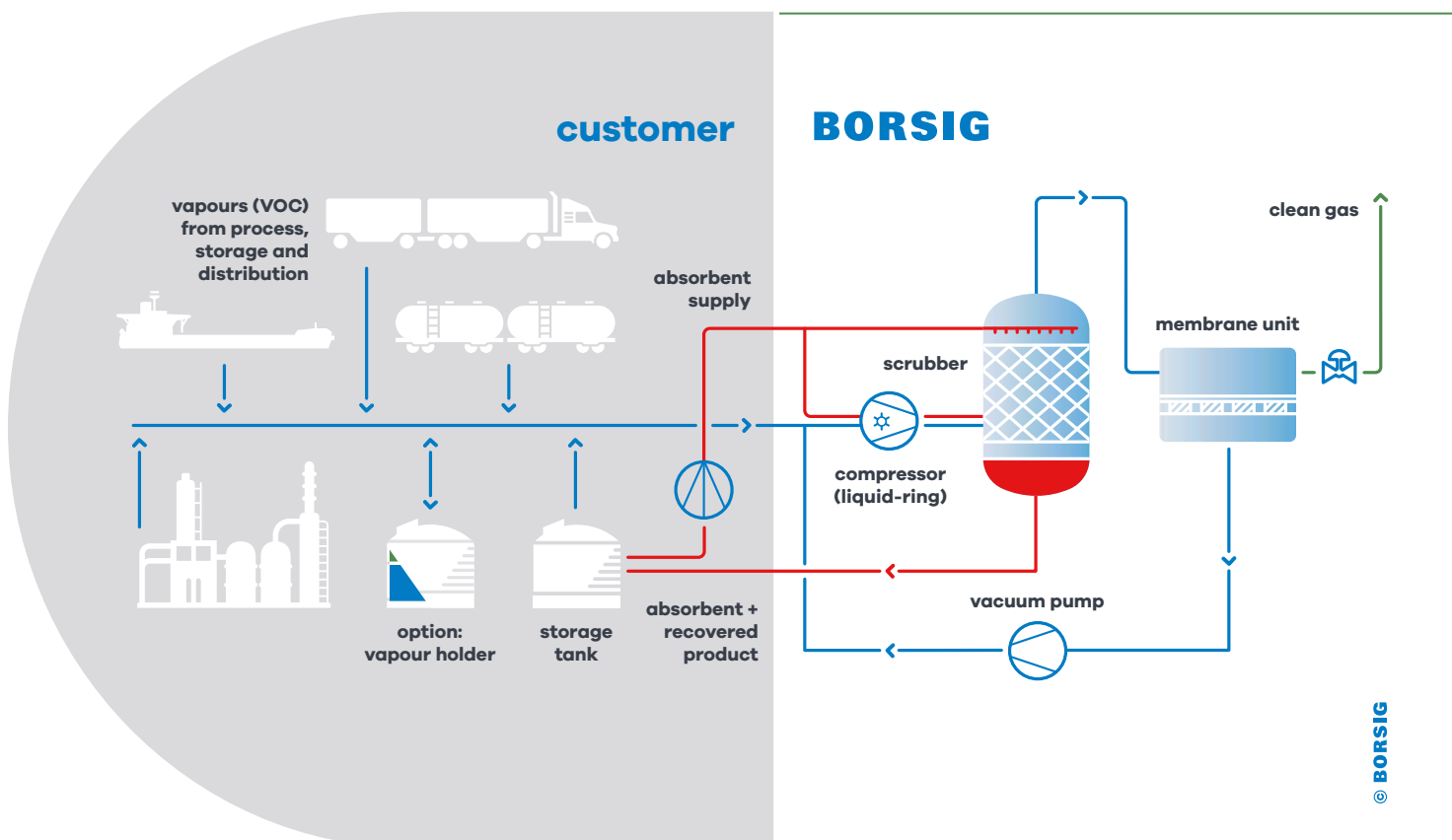
To comply with new, stricter emission limits, the system concept can be supplemented with additional process steps such as pressure swing adsorption (PSA), regenerative thermal oxidation (RTO) or other suitable technologies, depending on the product and application.

Our VRUs are designed to meet the highest refinery requirements and international standards. Only high-quality machines and materials are used in our units to ensure the highest quality and reliability. The combination of reliable instrumentation and intelligent control systems allows the unit to operate fully automatically.



Our products:

- BORSIG Vapour Recovery Units
- BORSIG Marine Vapour Recovery Units
- BORSIG Aromatic Recovery Units
- BORSIG Carbon Retrofit Units
- BORSIG Dock Safety Units
- BORSIG Vapour Buffer



Gas separation & recovery units

Modern manufacturing processes must meet increasing demands for efficiency. Cost-effectiveness, productivity, improved sustainability and optimal utilisation of resources are key challenges.

Our products:

PE production

- BORSIG Ethylene Recovery Unit
- BORSIG Hydrocarbon Recovery Unit
- BORSIG Nitrogen 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

Seal gas recovery

- BORSIG Seal Gas Recovery Unit

Methanol / ammonia-production, methan pyrolyse

- BORSIG Hydrogen Recovery Unit

(Bio-) refineries

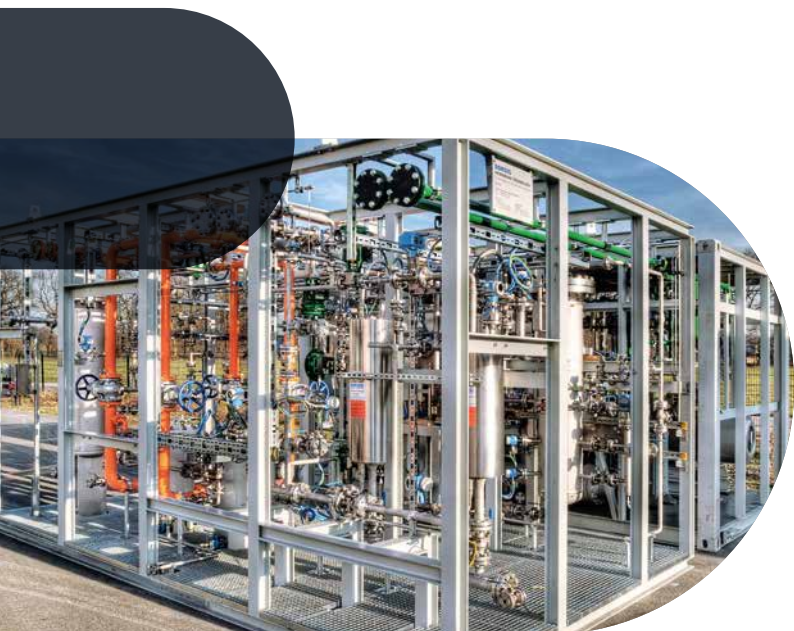
- BORSIG Hydrocarbon Recovery Unit
- BORSIG Hydrogen Recovery Unit

Methanisation

- BORSIG Hydrogen Recovery Unit
- BORSIG Carbon Capture

CO₂ recovery and separation

- BORSIG Carbon Capture





BORSIG Membrane Technology GmbH offers optimal solutions for minimising losses and recovering valuable raw materials or products from exhaust air as well as process, purge and waste gas streams and keeping them in the production process.

Our solutions enable a significant reduction in waste and flare gas capacities and associated emissions. They are suitable for both optimising conventional process concepts and retrofitting existing systems. Applications include the separation, recovery and purification of hydrogen or hydrocarbons, and CO₂ capture and enrichment.

Membrane separation technology in particular offers outstanding potential for complementing and optimising processes in new technologies for resource conservation and non-fossil-based industries. Compared to other technologies, membrane separation generally allows a significant simplification of the process concept and design. Often only a simple membrane separation stage needs to be integrated. This often results in very short payback periods.

Our approach is characterised by a customised, modular design that meets specific system conditions and local regulations. The packaged unit design makes them quick to install and easy to implement. The systems ensure safe operation, high reliability and low maintenance.

Last but not least, we have numerous references from various process licensors that underline the reliability and effectiveness of our solutions.



Organic solvent nanofiltration & pervaporation

The two innovative technologies, Organic Solvent Nanofiltration (OSN) and Pervaporation, unlock completely new potential to meet the increasing demand for sustainable process solutions in industry. BORSIG Membrane Technology GmbH already has extensive expertise and references in this field.





OSN

The system concepts from BORSIG Membrane Technology GmbH are based on new solvent-resistant polymer membranes, which are already successfully used in many industrial processes. These OSN membranes are an innovative tool for the separation and fractionation of organic mixtures and solvent-containing process streams. OSN membranes enable the separation of organic liquids under moderate operating conditions (temperature and pressure) with low energy consumption compared to purely thermal processes. OSN applications include the concentration, removal and separation of dissolved additives, impurities, valuable substances and (intermediate) products from liquid organic process streams.

Our product portfolio covers a wide range of applications:

Oil & gas industry

- (Bio-)fuel processing
- Crude oil and LNG processing
- Lube and waste oil processing

Fine chemicals

- Homogeneous catalyst recovery
- Mother liquor concentration

Life science and pharmaceutical industry

- Decolouration and purification of essential oils
- Decolouration and purification of hemp extracts
- API or protein purification

Other applications

- Solvent purification and recovery

Pervaporation

BORSIG pervaporation units use membranes with an affinity for water or methanol, providing solutions for separation processes that are independent of the vapour-liquid equilibrium. This technology is ideal for the dehydration of ethanol, bioethanol, isopropanol (IPA), organic solvents and more.

Depending on customer requirements and process conditions, either a stand-alone unit or a hybrid system can provide the optimal solution.

Applications are possible for typical solvent systems that have an azeotropic or close gas-liquid equilibrium with methanol or water, such as:

- Alcohols – C2–C5 (incl. Isomers), Cyclohexanol
- Ketones – Aceton, MEK, MIBK
- Ethers – MTBE, ETBE, THF, Dioxane
- Esters – MeAc, EtAc, BuAc
- Others – Acetonitrile, Trimethylborate

Your service partner: **BORSIG Membrane Technology GmbH**

As a leading supplier of membrane process solutions, BORSIG Membrane Technology GmbH offers a comprehensive range of services.

From consulting to after-sales service, we support customers in the oil and gas industry, refineries, tank farms and the petrochemical industry. We provide extensive process knowledge, simulation, technical expertise, life-cycle consulting, engineering services and a 24/7 remote service. Our goal is to enable our customers to focus on their core competencies while we manage the life cycle of their plants.

Our service team of experienced engineers and technicians are trained to SCC and VCA standards and support plants and installations worldwide.

We ensure the reliability, efficiency and safety of our customers' plants through our many years of experience in industrial plant maintenance and our multi-disciplinary expertise in process engineering, plant design, control, instrumentation and explosion protection.

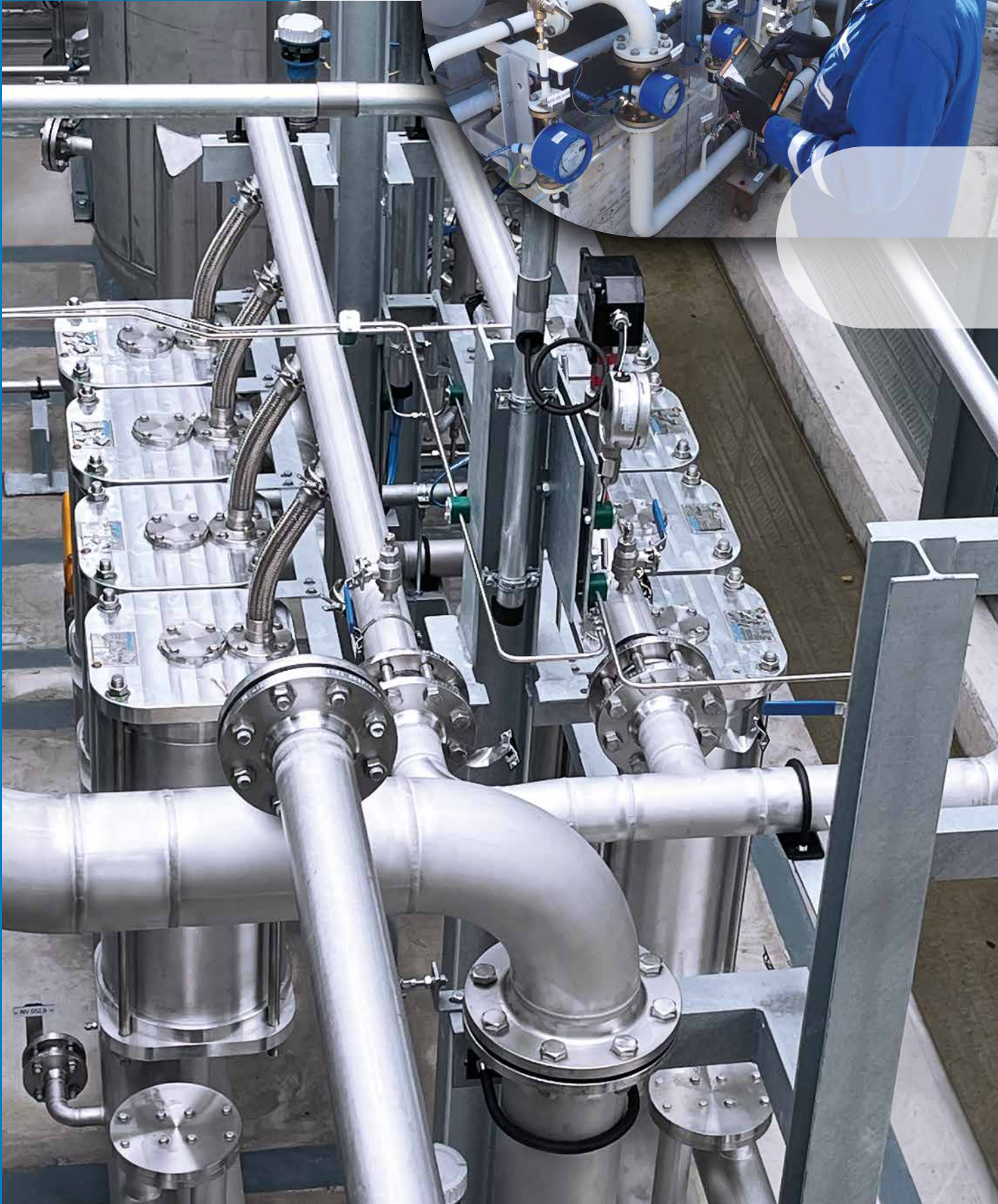
We offer a wide range of services, including after-sales service, maintenance and troubleshooting, plant-specific maintenance contracts and spare parts management systems, as well as maintenance and troubleshooting of third-party equipment.

Our 24/7 on-call service is available to our customers, as is our remote maintenance solution for fault analysis and software customisation.

We also offer services such as membrane system installation and commissioning, basic and detailed engineering, process control and visualisation, operator training, process development and optimisation, and hazard and operability studies.

We carry out performance testing of BORSIG and third-party systems, including emission and capacity measurements, as well as official emission measurements in cooperation with the authorities according to various European standards. Finally, we offer pressure vessel tests in cooperation with the authorities.

Our strengths lie in the process optimisation of existing plants and systems. This makes us your ideal partner for all your service requirements.





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