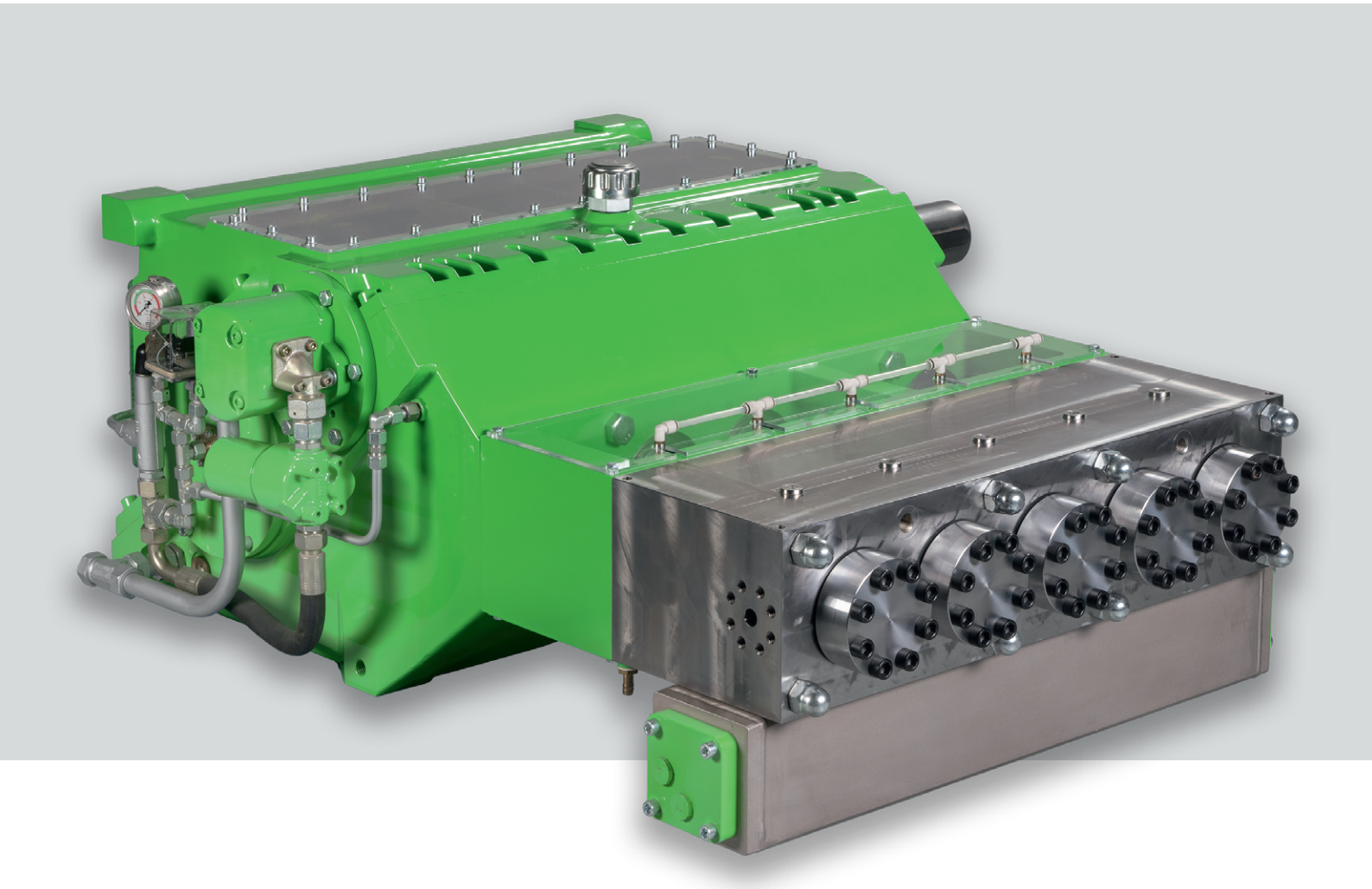
KAMAT

since 1974



KAMAT HIGH-PRESSURE TECHNOLOGY

TECHNOLOGY FOR A SUSTAINABLE FUTURE

Efficiency and Reliability in Renewable Energies

EFFICIENCY AND RELIABILITY

At a time when the shift to sustainable energy sources and greener industrial processes is inevitable, KAMAT is a key driver of this development. As a leading supplier of high-pressure technology, KAMAT is committed to future-proofing the industry with innovative and environmentally friendly solutions.

Our high-pressure technologies are not only designed for maximum efficiency and performance, but also actively contribute to reducing the ecological footprint. Our products are critical to progress towards a greener future – whether in renewable energy generation, carbon dioxide storage, or the transportation and injection of sustainable fuels (E-fuels).

ABOUT KAMAT

KAMAT GmbH & Co KG is a leading supplier of high-pressure technologies used in various industrial applications worldwide. Since our founding, we have specialized in the design and manufacture of high-pressure plunger pumps and systems known for their reliability, efficiency and durability. Our headquarters in Witten, Germany, stands for quality „Made in Germany“, supported by a high level of vertical integration, local sourcing and strict quality control.

MISSION STATEMENT: INNOVATION, QUALITY, SUSTAINABILITY

Innovation:

KAMAT is committed to continuous innovation and technological excellence. We continually invest in research and development to find new solutions to industry challenges and expand our product range.

Quality:

Our high-pressure pumps and systems are manufactured using the highest quality materials and state-of-the-art production techniques. We rely exclusively on application-resistant materials and do not use coated components to ensure maximum reliability and durability.

Sustainability:

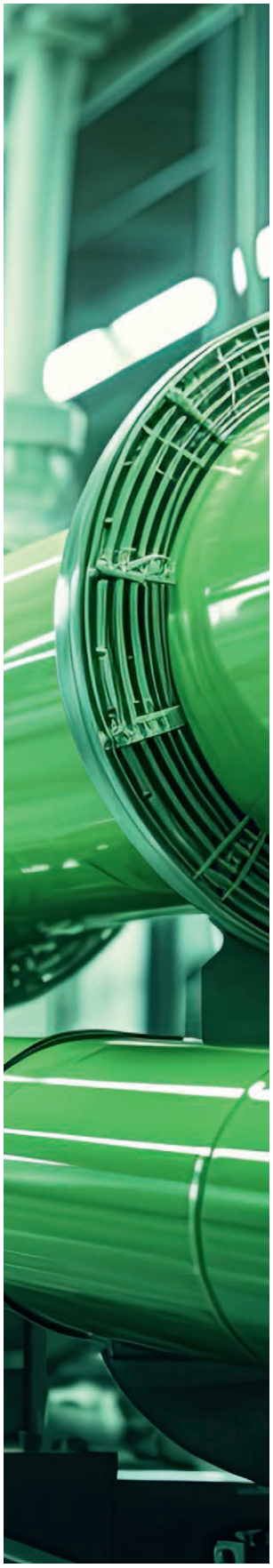
Sustainability is central to our corporate philosophy. We strive to develop environmentally friendly products that help reduce emissions and conserve resources. We manufacture to strict environmental standards and source our materials locally to minimize transportation and associated emissions.

HIGH-PRESSURE TECHNOLOGIES AND THEIR SIGNIFICANCE FOR RENEWABLE ENERGIES

With an increasing focus on sustainable energy solutions, high-pressure technology plays a crucial role in various areas of renewable energy. KAMAT offers customized high-pressure solutions to meet the specific needs of these industries:

- **Pressure testing of pressure vessels and pipelines:** Our high-pressure pumps enable accurate and safe pressure testing to ensure the integrity and safety of pressure vessels and pipelines. Our technologies ensure that leaks and material weaknesses are reliably detected and can be repaired.
- **Carbon dioxide capture and storage (CCS):** High-pressure technology is critical to the capture and injection of CO_2. Our pumps support safe storage in geological formations, making a significant contribution to reducing greenhouse gas emissions.
- **Transport and injection of e-fuels:** Efficient and reliable high-pressure pumps are essential for the transport and the injection of synthetic fuels. Our systems are adaptable to different fuel types and transport requirements and feature high material resistance to aggressive media.

KAMAT is your reliable partner for high-pressure technologies in the renewable energy industry. With our innovative solutions, uncompromising quality and strong commitment to sustainability, we support you in the efficient and successful implementation of your projects.



PRESSURE TESTING WITH KAMAT HIGH-PRESSURE TECHNOLOGY

In many industries, pipelines and pressure vessels that contain or transport fluids at sometimes high pressures are an important part of the required infrastructure. Particularly in hydrogen technology, the requirements for flow rates and test pressures for pressure test systems are becoming increasingly stringent. In order to ensure the reliability of pressure vessels, it is extremely important to regularly check their load capacity and long-term stability.

A pressure test is performed on components designed to store or transfer fluids. The goal is to verify that the components are sufficiently strong and sealed.

KAMAT has the perfect solution. We develop and produce tried and tested, high-performance complete systems, including proven pump and valve technology for this area of application. With pressures of up to 3500 bar, burst tests, load cycle tests and pressure retention tests can be carried out with ease.

Because our high-pressure pressure testing technology is used in a wide variety of industries, its design is also variable. These systems can be powered by diesel, electric or gasoline engines and can be controlled mechanically, electrically or pneumatically.

KAMAT offers proven concepts for pump and valve technology that are specially tailored to these applications. This combination of versatile pressure test units and specially designed pumps ensures that your pressure vessels meet the highest industry standards.

AT A GLANCE:

KAMAT High-Pressure Technology for Pressure Testing of Pressure Vessels and Pipelines

- Use of state-of-the-art high-pressure pumps for leak and strength testing
- High precision and safety through optimized pressure control
- Efficient and fast execution of pressure tests

DISCOVER THE MANY BENEFITS OF PRESSURE TESTING WITH KAMAT HIGH-PRESSURE TECHNOLOGY:

- **Various fluids** possible
- Simplify pressure testing with **easy-to-use processes**
- **Robustness of pressure testing** equipment ensures durability and reliability
- Perform pressure tests **up to 3,500 bar capacity**
- **Manual valve control option** for increased control
- Implement complex automated control systems with **software solutions** for optimized processes
- Maximize the convenience of pressure testing with **advanced technologies**
- **Custom design of units** for specific application requirements
- Versatility of the pressure testing system with different drive options: **electric, manual or internal combustion engin**
- **Specific valve and control technology** tailored to the application
- Completely **self-contained units**
- **Complete consulting** for your project
- Testing according to ECE R134, ISO 17519:2019 A7 G CGA C-1 and others possible

KAMAT SCOPE OF DELIVERY: COMPLETE SYSTEM OR INDIVIDUAL COMPONENTS

- Fluid tank including cooling unit
- Base frame for the pump unit
- Booster pump if needed
- Inlet filter
- High-pressure plunger pump
- Drive system
- Sensors
- Motor starters or Converters
- Control unit
- Measurement technology
- Hydraulic valves
  - Safety valve
  - Pressure limiting valve
  - Shut off valve
  - Unloader valves
  - No return valves
- Manual or automated throttle

KAMAT Control Throttle

A control throttle specially developed by KAMAT for this application allows the pressure build-up and release of the pressure vessel to be controlled. Special attention is paid to maintaining the required minimum pressures and the precise start of the test pressure. This newly developed control throttle optimises the overall cycle time and energy consumption in pressure testing systems. It also allows pressure test curves to be modulated for special requirements.

CARBON DIOXIDE-SEPARATION AND -STORAGE (CCS)

The use of KAMAT high-pressure pumps for CO_2 separation and injection is an ideal solution. The high-pressure pumps operate at high inlet pressures to keep the CO_2 in the liquid phase. This creates a high volume flow, which is essential for the efficiency of carbon storage. Liquid volumes in excess of 9 m^3/min can be achieved, which is equivalent to more than 400 tons per hour.

Safe transport and storage of CO_2 in geological formations:

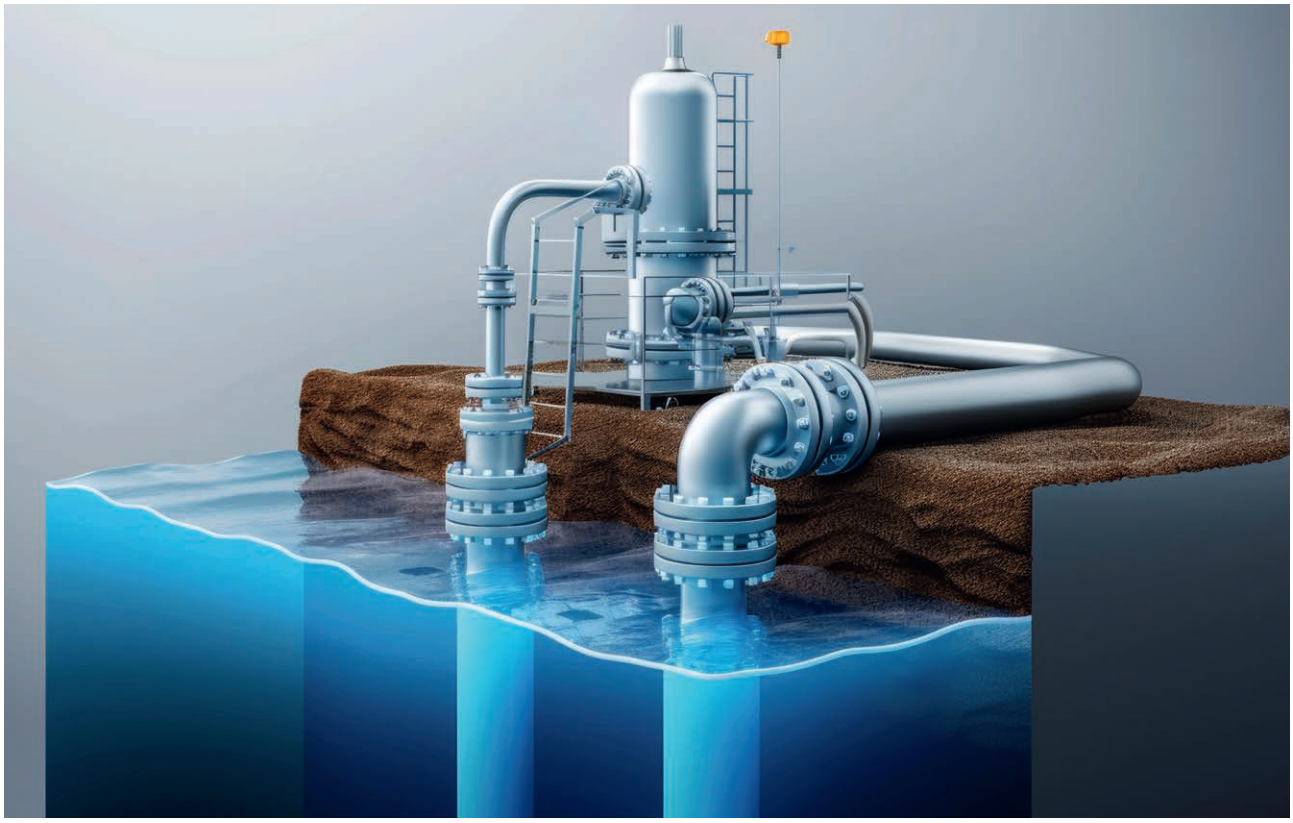
Underground storage of CO_2 is a long-term solution for CO_2 removal. Once stored in geological formations, the CO_2 remains there for thousands of years and is effectively isolated from the atmosphere. This method is particularly beneficial for industries where complete decarbonization is difficult to achieve in the short term.

Contributing to the reduction of greenhouse gas emissions:

Underground storage of CO_2 ensures that this greenhouse gas is not released into the atmosphere and therefore does not contribute to the greenhouse effect. This results in a significant reduction in climate change. Numerous industrial processes, including power generation and cement production, release significant amounts of CO_2; underground storage helps prevent these emissions from entering the atmosphere.

Carbon offsetting and enhanced oil recovery:

Some companies invest in carbon offset projects that remove CO_2 from the atmosphere and store it underground to offset their own emissions and meet carbon neutrality targets. CO_2 can also be used for enhanced oil recovery (EOR). By injecting CO_2 into oil reservoirs, additional oil can be extracted by increasing the pressure in the cavern, which also helps to reduce CO_2 in the atmosphere.



THE HIGH-PRESSURE PLUNGER PUMPS FROM KAMAT ARE THE PERFECT CHOICE FOR PUMPING CO_2

- KAMAT pumps:
  - operate at **high inlet pressures.** To keep the CO_2 in the liquid phase, it must be subjected to high inlet pressures.
  - deliver a **high volume flow**, which is essential for carbon storage efficiency. Liquid volumes in excess of 9 m^3/min are possible, equivalent to more than 400 tonnes per hour.
  - very **low maintenance** and can be left in place for service. Seals can be changed quickly without dismantling major components.
  - operate over a **wide temperature range** (-50 to 200°C) if required.
  - have **ceramic pistons**. They are perfectly matched to an aramid carbon fibre packing sealing system. Secondary seals are provided to make the pump virtually hermetic and to detect any leakage over time.
  - can be **driven by any type of drive**. For areas without a suitable power supply, low-emission industrial diesel engines are suitable.
  - are very **energy efficient.**
- KAMAT pump heads are made of **forged stainless steel**, the internal parts are **not coated**, all components are made of solid material.

KAMAT SCOPE OF DELIVERY

- KAMAT high-pressure plunger pump
- Stainless steel suction line for high-pressure
- Suction flow stabilizer
- Drive system (hydraulic, electric, engine)
- Flexible coupling, easy separatable with protective cover
- Pump control
- Motor starter
- Frequency inverter
- Baseframe with damping feet
- Pressure limiting valve with bypass against suction pressure

AT A GLANCE:

KAMAT High-Pressure Technology for CO_2 Capture and Storage

- High-pressure technology for CO_2 injection
- Scalable high efficiency solutions for small and large plants
- Safe transport and storage of CO_2 in geological formations
- Contribution to the reduction of greenhouse gases

KAMAT Pressure Limiting Valves

KAMAT pressure limiting valves are specially designed for use with high-pressure plunger pumps. They ensure that the optimum working pressure is maintained at all times. This is particularly important for the safe and efficient operation of the system.

KAMAT's pressure limiting valves offer a high degree of flexibility by allowing the pressure to be regulated pneumatically by remote control. This is particularly useful in applications where pressure may vary or precise control is required.

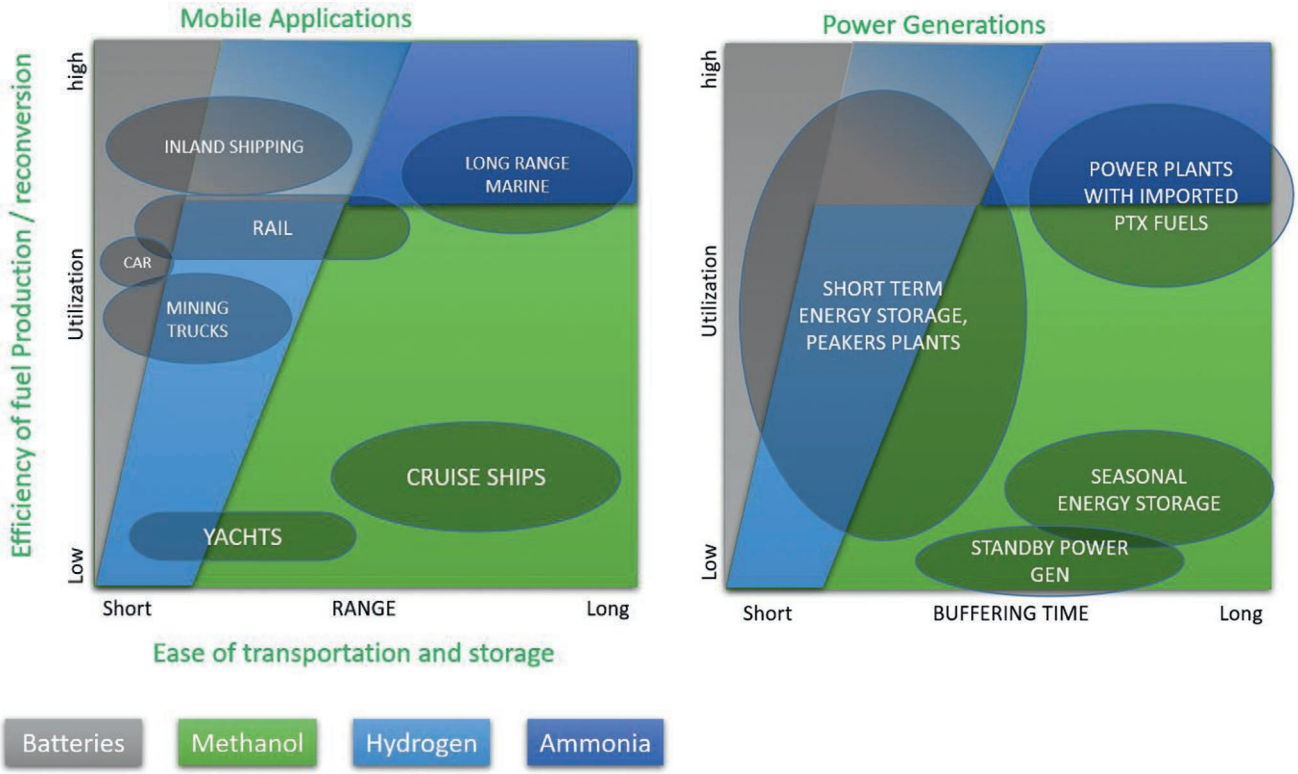
With their high precision and reliability, Our pressure limiting valves are an ideal solution for applications where accurate and constant pressure is required. They ensure smooth system operation and help to extend component life.

TRANSPORTATION AND INJECTION OF SUSTAINABLE FUELS

The transition to renewable energy is critical to a sustainable future. E-fuels play a central role. These synthetic fuels, made from renewable energy, carbon dioxide and water, are a promising alternative to fossil fuels. E-fuels can be used in existing internal combustion engines, making them attractive to industries such as shipping, where a rapid transition to new technologies is difficult. In addition, e-fuels are carbon neutral and help reduce greenhouse gas emissions.

Efficient transport logistics for e-fuels

The transport of e-fuels requires the use of high-pressure pumps designed for the efficient transport of liquids over long distances. KAMAT's advanced high-pressure pumps, often equipped with variable frequency drives (VFDs), enable precise control of liquid flow and optimum pressure regulation. This technology ensures the safe and energy-efficient transport of e-fuels.



Hydrogen:

No emissions: Burns cleanly, producing only water.

Production: Produced by electrolysis using renewable energy.

Energy Efficiency: High energy density, ideal for storage.

Ammonia:

Fuel: Direct combustion or use as hydrogen carrier.

Production: Carbon neutral by electrolysis of hydrogen.

Storage: Easier to store than hydrogen.

Methanol and Ethanol:

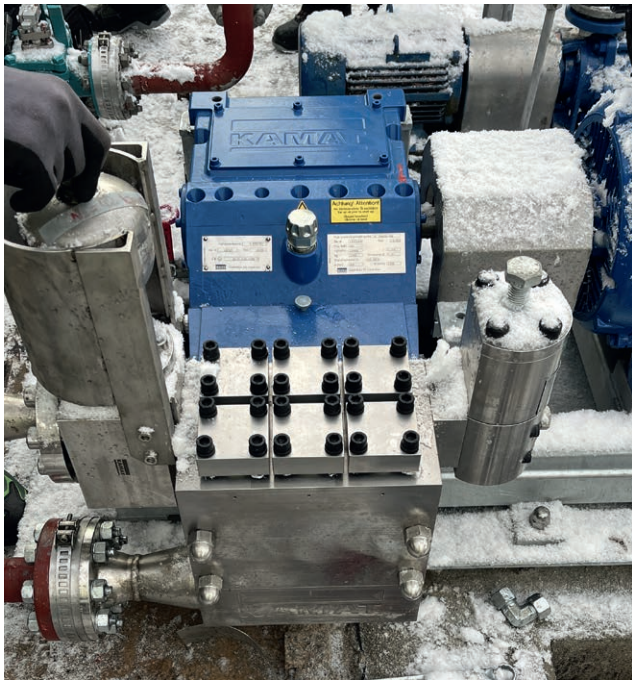
Production: Both can be synthesized from biomass or CO_2 and green hydrogen.

Use: Can be used as liquid fuels for existing infrastructure.

CO_2: Potentially carbon neutral (ethanol), methanol carbon neutral through CO_2 synthesis.

Customized solutions from KAMAT

Our high-pressure pumps offer high efficiency and reliability for the transportation and injection of e-fuels such as ammonia and methanol. They are adaptable and can be easily integrated into existing infrastructures. They therefore play an important role in the transition to e-fuels, ensuring that the specific temperature and pressure requirements are optimally met. This enables the safe and efficient use of e-fuels.



KAMAT SCOPE OF DELIVERY

- High-pressure plunger pump with special sealing system for E-fuels
- Aluminum or stainless steel intake manifold
- Suction flow stabilizer: Provides constant flow
- Drive system: Hydraulic, electric or internal combustion engine
- Flexible coupling: Easily disconnectable with protective cover
- Pump Control: Includes motor starter and speed controller
- Base frame with shock absorbing feet: For stable operation
- Pressure pulsation damper
- Pressure relief valve
- Shut-off valves
- Flow Control Valves

The K9000M-3G high-pressure plunger pump bridges the distance of 60 km between two operating points by pumping fuel.

AT A GLANCE:

KAMAT High-Pressure Technology for Transportation and Injection of E-Fuels:

- Efficient high-pressure pumps for safe and reliable transport of synthetic fuels
- Customizable pump systems for different fuel types and transport requirements
- High material resistance to aggressive fluids

INNOVATIONS THAT MAKE THE DIFFERENCE

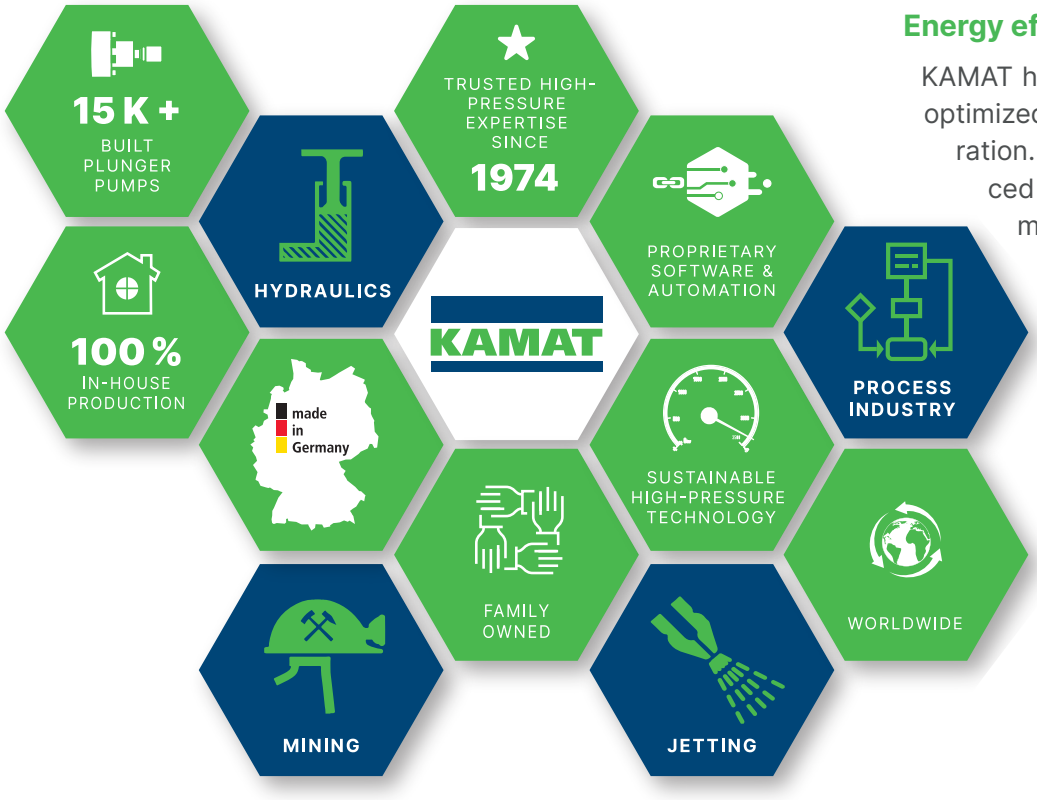
Our Strengths Your Advantage – Everything at a Glance

Diversity through modular building block system:

KAMAT offers a flexible modular system that enables a wide range of configuration options. By using standardized modules, our high-pressure systems can be quickly and efficiently adapted to specific customer requirements. This flexibility ensures that our solutions are suitable for a wide range of applications and meet the individual needs of our customers.

High quality:

Unsere Our high-pressure pumps and systems are manufactured in-house from high quality materials such as corrosion resistant stainless steels. The choice of materials ensures a high level of resistance to corrosion and wear, which significantly increases the service life and reliability of our products. We deliberately avoid the use of coated components to maximize the integrity and performance of our systems.



Energy efficiency:

KAMAT high-pressure systems are optimized for energy efficient operation. They incorporate advanced technologies that minimize energy consumption while maximizing performance. Our pumps are specially designed to operate with variable frequency drives, which provide precise pressure control and reduce wear. This efficiency results in lower operating costs and a smaller environmental footprint.

Custom design:

Our high-pressure solutions are custom designed to meet the specific needs of our customers. By working closely with our customers, we develop customized systems that are precisely tailored to their needs. From consulting and planning to implementation and maintenance, we provide comprehensive support to ensure that our solutions are optimally integrated into our customers‘ operations

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Easy maintenance:

At KAMAT, we take great care to make our high-pressure pumps as easy to maintain as possible. All pumps can be disassembled, serviced, reassembled and parts replaced on site without the need for heavy equipment such as hoists or special tools. In addition, all designs are based on a modular system that allows us to supply spare parts quickly and cost-effectively when needed. This ease of maintenance significantly reduces downtime and operating costs and ensures trouble-free operation.

ENVIRONMENTALLY FRIENDLY

SUSTAINABLE

SUSTAINABILITY AND ENVIRONMENTAL PROTECTION

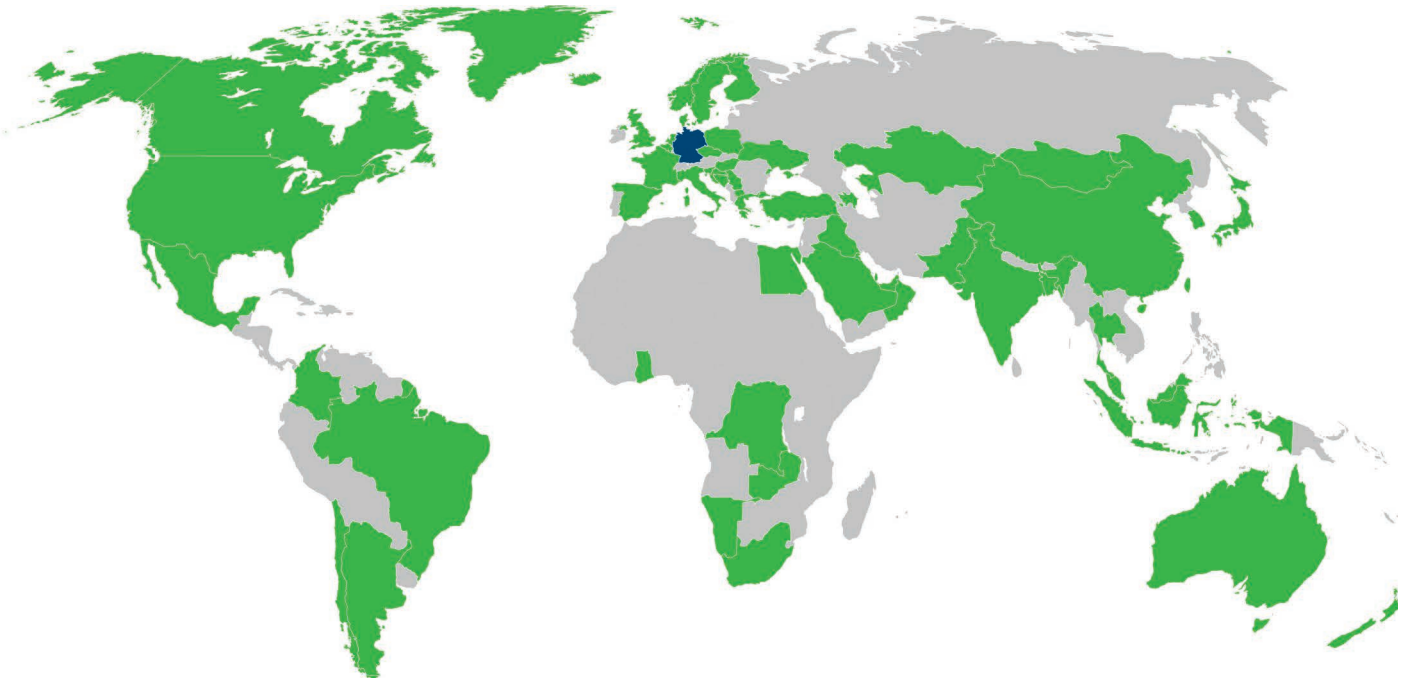
Resource-efficient production:

Sustainability is central to our business philosophy. We rely on resource-efficient production methods and local sourcing of materials to reduce transportation and associated carbon emissions. Our manufacturing operations adhere to strict environmental standards that ensure we minimize our environmental impact while maintaining the highest quality standards.

Long life and low maintenance costs:

KAMAT‘s robust and durable high-pressure systems are designed for long life. By using high quality materials and integrating advanced technology, our systems are low maintenance and reliable. This results in reduced operating costs and downtime, further increa'sing the efficiency and sustainability of our customers‘ systems.

KAMAT WORLDWIDE



Official Partner:

We invite you to contact us for a personalized consultation. Our experts are ready to discuss your specific requirements and develop customized solutions to meet your needs. Take advantage of our expertise to make your projects efficient and successful.

made in Germany

QUALITY SYSTEM CERTIFICATION DNV ISO 9001

SUSTAINABLE & ENERGY EFFICIENT

BLUEcoMPETENCE Alliance Member
Partner of the Engineering Industry Sustainability Initiative

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