



High pressure solutions

The plunger pump: The heart of all applications

Plunger pumps function in principle like a heart: A chamber increases in volume when fluid is sucked in and then it decreases in volume when the fluid is pressed out – a simple and effective system. In the case of a plunger pump the chamber is actually a cylinder and the variation in volume is effected by a piston, called a plunger, driven by a shaft. The direction of flow is governed by check valves, allowing the cylinder to be filled and emptied.

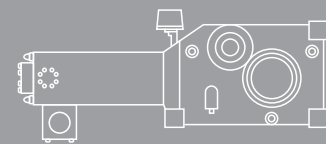
Plunger pumps are of low-complex design and require a minimum of space; nevertheless they achieve high rates of efficiency. Just like a heart, plunger pumps have to perform reliably und perpetually. The modular design allows material selection to suit the particular application and the pump performance characteristics. Comparable to the beat of a heart, our pumps pulsate in an exact rhythm. Further advantages of this type of pump are simplicity in operation and easy maintenance so that even semi-skilled workers can handle the pump system confidently after a short training period.



Applications

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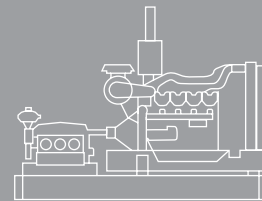
Complex variety



High pressure pumps

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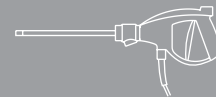
Reliable power



Units

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Safety and variety



KAMAT worldwide

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Service and technical support

Finding individual high pressure solutions

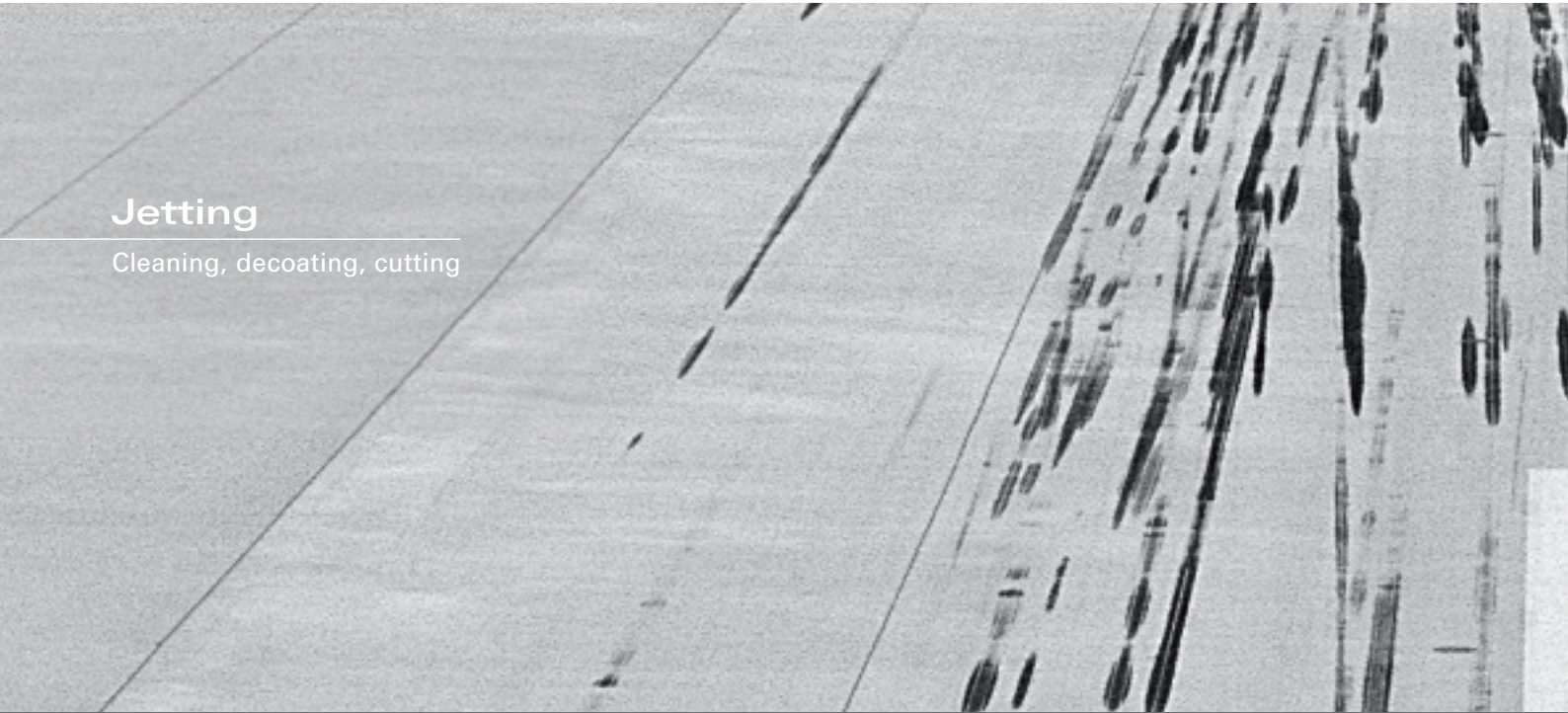
Competence in high pressure technology is our main target: KAMAT has built up its reputation over decades as being a leading international supplier of high pressure technology systems for pumping fluids. But that is no reason for us to rest on our laurels! Success stories of yesterday are not the message our customers want to hear – our job is to meet the new market requirements of today and tomorrow. We are keen to accept the challenge and prove our strength by assessing the task to be performed, developing ideas and then implementing the solution at full blast – that means with high pressure.

What does “high pressure” mean? There are two answers to that question: First of all, high pressure is the technology of generating pressures up to 4000 bar for even the most difficult application. In a figurative sense it also represents the way we tackle every new challenge, with energy and enthusiasm. How do we ensure such “high pressure performance” in every case? By listening to what our customer has to say. A proper understanding of the customer’s problem is the basis for finding the perfect solution. The heart of each solution is a powerful high pressure pump, selected from a wide range of possible performances. Flexibility is just one of our strong points: The types of machine available range from high pressure units for cleaning jobs to individually designed machines for special applications in a variety of industries worldwide.

Our company headquarters are located in Witten, a town in the centre of the Ruhr area. Our highly qualified and motivated engineers and production staff take pride in designing and manufacturing high-quality products which our customers can fully rely on. Such quality is not left to chance: Our Quality Management system is certified according to EN ISO 9001:2008 in all aspects such as development, construction, manufacturing, sales and distribution.

Jetting

Cleaning, decoating, cutting



Targeted use of water as a powerful tool

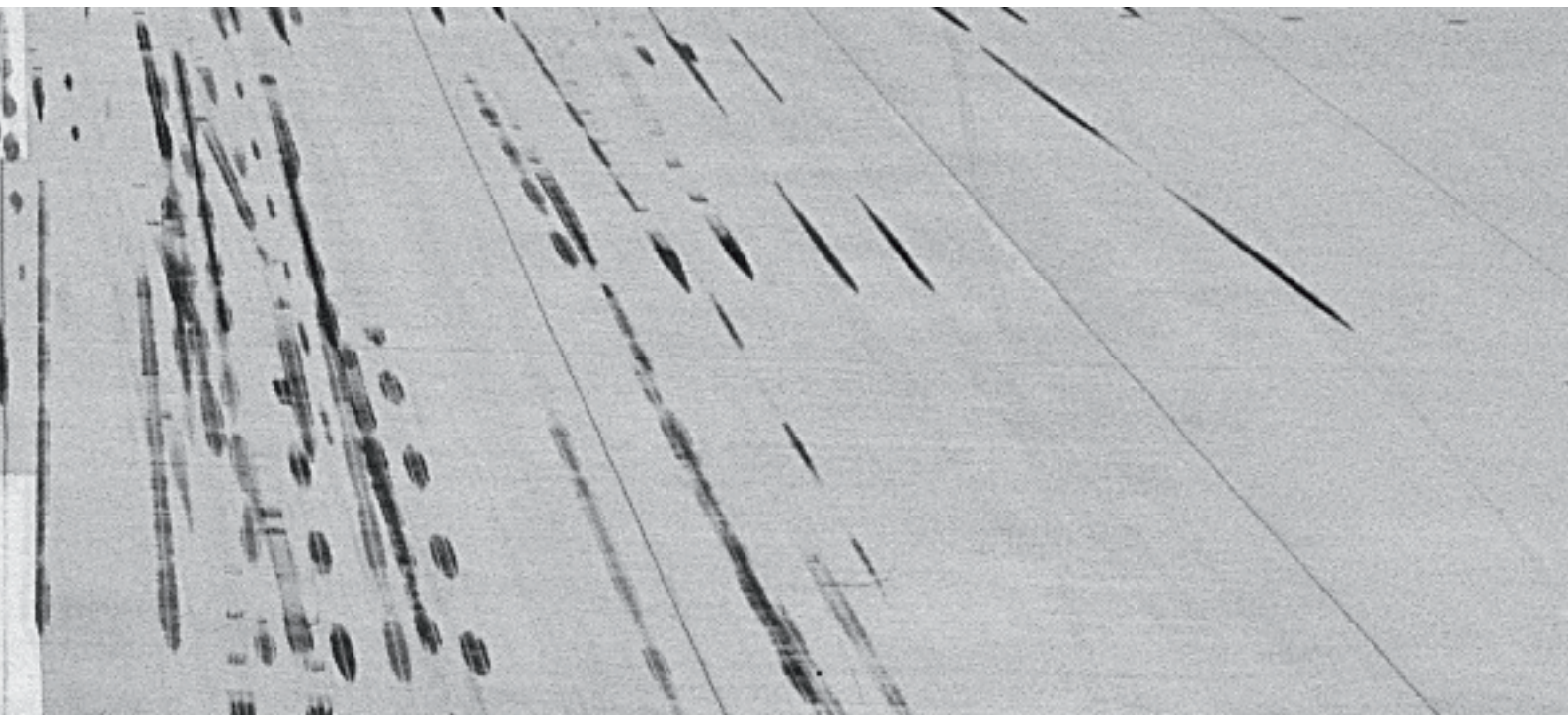
“Constant dripping wears away the stone” – we have “accelerated” the idea behind this old proverb and developed it to perfection. The result: Jetting; a modern term for an intelligent method of utilising water as a work tool. The KAMAT high pressure technology forms the basis of this exact swift, selective and ecologically-friendly process. By pressurising water at high speed, a water jet is generated which, on impact, can be used to clean surfaces, to remove layers or deposits or to cut a wide variety of materials.

The pressure selected depends on the job to be done. For simple surface cleaning very often a pressure of 300 bar is sufficient for good results. On the other hand, for jobs such as stubborn paint removal a pressure of 2000 bar will be necessary. The flow rate is the decisive factor in determining how long it takes to do the job. Thanks to a modular component system and flexibility in design features, KAMAT is always able to provide the right pump for each and every jetting application.



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Waterjet technology: Definitely clean

Whether the problem is hard incrustations or tough accumulations, with a water jet anything can be removed completely without damaging the surface. Provided the right high pressure system is used, even hard deposits can be removed from soft surfaces, without causing any damage. The technology can equally be applied for paint and rust removal from large surface areas; again, the structure is not affected or damaged.

New fields of application are arising every day: One of the latest jobs to be successfully performed is the effective runway cleaning of international airports. Here, the rubber debris which accumulates when a jet lands on the runway is taken off using the high pressure water technology. We install a KAMAT high pressure pump with a performance of up to 29 l/min at 2500 bar in a special-purpose vehicle.

Using a cleaning tool specifically designed for the job, the rubber layers are completely removed and sucked into a dirty-water tank. Just a further example to show how KAMAT plays an important role in improving safety standards, this time in air traffic.

Here are some typical jetting applications:

- Paint removal
- Rust removal
- Removal of rubber
- Runway cleaning
- Removal of road markings
- Heat exchanger cleaning
- Drain cleaning
- Cold cutting
- Concrete renovation
- Deburring
- Decoring

| 1 *Runway cleaner*

| 2 *Surface cleaner with vacuum device*

Jetting

Perfectly suitable for every surface



Achieving a surface finish of WJ-1 at 3500 bar

But this is not the end to the story: KAMAT high pressure technology is the answer to many cleaning problems which arise in industrial manufacturing processes. For example, cleaning casting moulds, removing casting residues from work pieces, or burrs remaining after machining, even in areas difficult to reach. For many years, the technology has been successfully implemented in the marine industry, where rust, paint and maritime growth are removed from ship surfaces. Using pressures of up to 3500 bar, it is possible to achieve the cleaning grade of WJ-1, today's highest internationally-recognised standard for surface preparation.





Taking care of material and environment

Special care needs to be taken when working in various branches of industry, for instance in the construction industry. The jetting technology is vibration-free and without any negative thermal effects. Deteriorated concrete can be removed from the surface of buildings while derusting the reinforcement bars at the same time, without inducing vibrations which might damage the structure itself.

Just how flexible the technology can be is shown in the method of pipe cleaning by high pressure water. Even cleaning round bends and elbows in fully blocked pipes is unproblematic.

There is never any dust hazard to burden the environment. And polluted water can simply be recycled, thus reducing the amount of water to be disposed of and keeping down the costs of the technique.

The range of possible applications for the KAMAT water jet technology is virtually unlimited. You, the customer, dictate the requirements. We, KAMAT, supply a custom-built system to match your individual needs.

A small selection of shipyards where the KAMAT high pressure technology is employed:

- Genoa
- Naples
- Malta
- Great Yarmouth
- Piraeus
- Stavanger
- Bergen
- Constanta
- Aalborg
- Sharjah
- Dubai
- Singapore
- Rio de Janeiro

- | 1 *Semiautomatic shiphull cleaning*
- | 2 *Manual paint removal*
- | 3 *Bauxite incrustations*
- | 4 *Pipe cleaning*

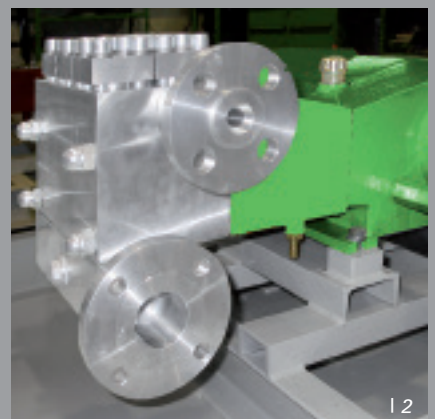
Process technology

Continuous Precision

Safe pumping of corrosive, abrasive and volatile fluids

Our customer confronts us with his problem: He needs to pump 23 lpm of a high viscosity fluid, at a pressure of 2000 bar in a particular process application 24h per day, 365 days per year. KAMAT can provide the answer: Our process pumps are high-performance, volumetrically exact feed pumps and a typical field of use is in the chemical and petrochemical industries. Apart from reaching high pressure rates they offer the added advantage of being able to safely pump many different types of fluids. Not only corrosive, abrasive, hot and cold fluids can be pumped – even volatile and multiphase media can be handled, as well as fluids of a high viscosity. KAMAT engineers design such pumps of modular design and these are manufactured to a high extent in in-house production to highest quality standards.

Whether designed and built as a package solution or as a single pump, the KAMAT pump fulfils the demands of the industry. Our modular design system for process pumps makes it easy to provide specific features such as liquid sealing, leakage monitoring, cooling circuits and heating devices.





Unique solutions

One more advantage of plunger pumps for chemical applications is cost-effective material selection for the parts of the pump in contact with the medium. Almost all components are manufactured on our flexible CNC machines and even „one-off“ manufacturing is possible. Our design department cooperates closely with the client, aiming to find individual, economical alternatives to existing methods or even to find solutions for tasks which previously were not possible at all. Whenever it is not absolutely essential to achieve hermetical sealing, the KAMAT plunger pump provides a sensible alternative. In many cases KAMAT pumps are the sole solution: Should the requirement be for an ultra-high pressure pump to meet Clean-in-Place standards (automatic feed of cleaning agent through the unit) KAMAT can

provide a suitable pump for a pressure range of up to 3500 bar. Above all, in the field of reverse osmosis, the KAMAT pump with its high rate of energetic efficiency and compact design offers considerable advantages.

Application examples in the chemical industry:

- High pressure homogenisation up to 3500 bar
- Methanol injection
- Glycol injection
- Reverse osmosis
- Gas washing plants
- Polyol pressing
- Crude oil injection
- Fuel injection

| 1 *Chemical laboratory*

| 2 *Process pump*

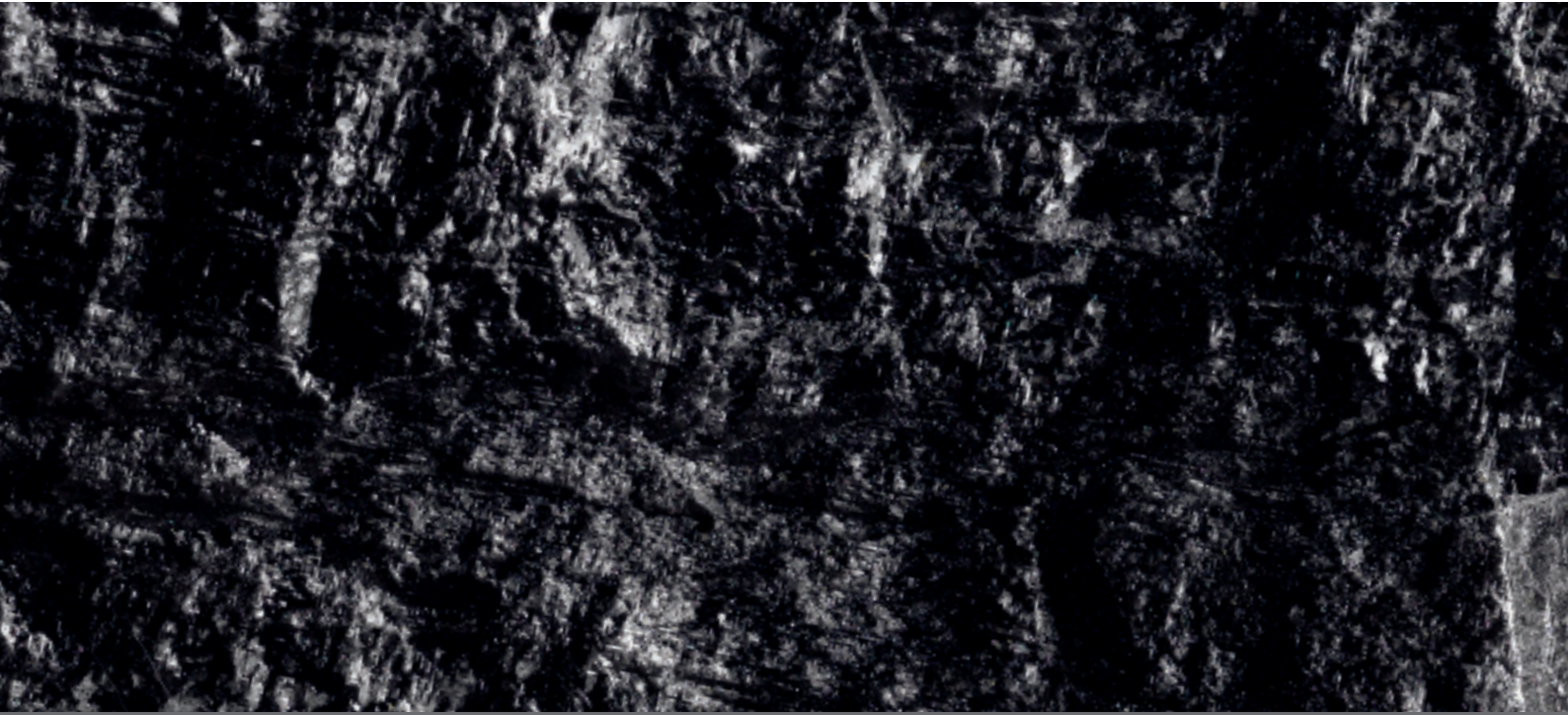
Hydraulics

Energy for power and movement

High power and precise impact

Flexibility is one of our strong points: KAMAT is equally at home in the market of hydraulics. Our system solutions for hydraulic applications generate power and transfer it via piping to the exact location where it is needed. Many of these industrial applications are oil hydraulic installations. KAMAT high pressure pump systems are employed at pressures up to 3500 bar, for instance for plain bearings in rolling mills.





Water power to rely on

KAMAT is a specialist when it comes to developing water-hydraulic systems for many industries where ecological and safety aspects are of major priority. The power of water is effectively applied in numerous areas to protect both persons and the environment. Canal locks and lifting bridges are application areas where KAMAT high pressure systems are well-proven in the protection of inshore waters. Probably the biggest market for water hydraulics constitute underground coal mines; apart from the ecological aspects, high pressure systems are often put to use here since the safety of the mine workers is of utmost importance. In a similar manner, such systems are used in the metal-working industry – for instance on hydraulic presses and forges – as the danger of explosion or fire is considerably reduced. In the process of hot descaling, the KAMAT pump is

an indispensable asset in order to fulfil today's quality requirements with regard to rolling mills.

Our highly-specialised engineers are continually developing the components required for such systems, to ensure long-term reliability and top performance. A special feature, designed and developed by KAMAT specifically for the requirements of the water hydraulics industry, is a sealing system without oil lubrication. Highest possible engineering standards, combined with unmatched quality make KAMAT a leader in the segment of mining technology.

Here are just some reference locations where KAMAT hydraulic pumps are in service:

- Shenhua International / China
- BHP Billiton / Australia
- Consol Energy / USA
- Jim Walter Resources / USA
- Foundation Coal / USA
- DSK / Germany
- Park Termik / Turkey
- Voestalpine Grobblech / Austria
- Voestalpine Schiene / Austria
- Welspun / India
- Servercorr / USA
- Bhilai Steel / India

| 1 Hydraulic press

| 2 Descaling

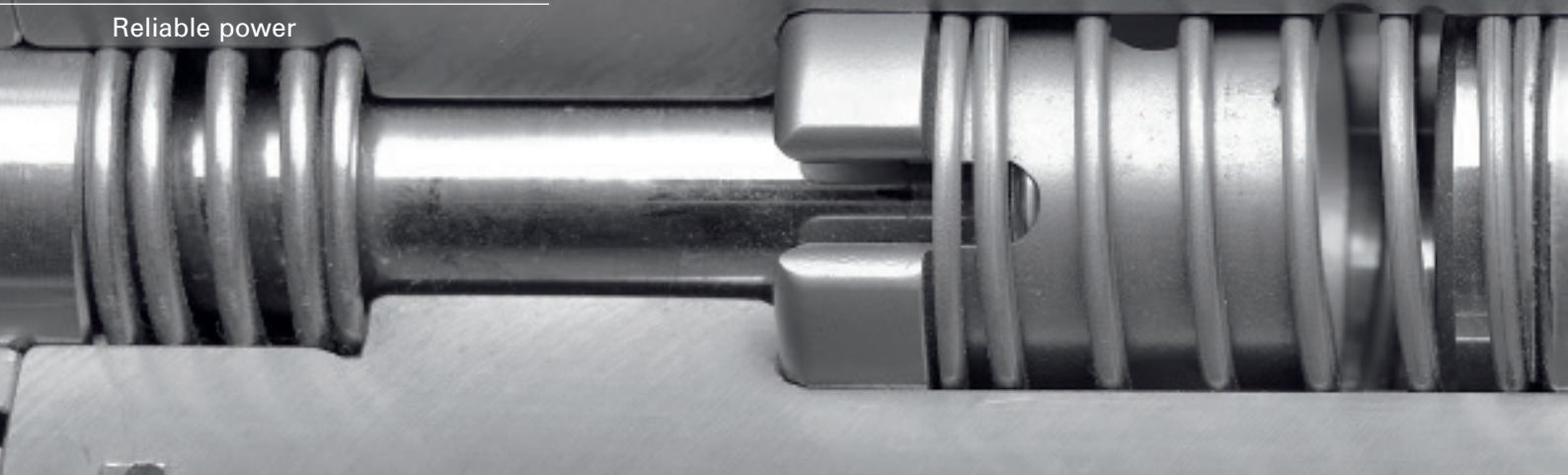
| 3 Mining pump

| 4 Coal production

(Photo: Deutsche Steinkohle AG,
www.deutsche-steinkohle.de)

High pressure pumps

Reliable power

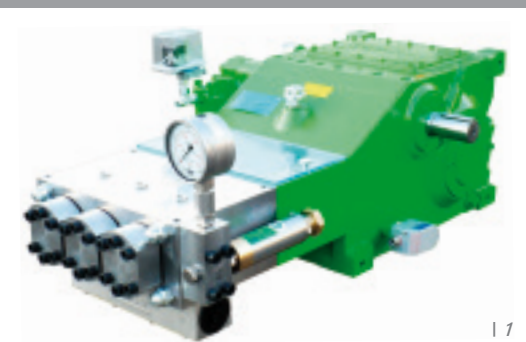


Modular construction for optimal products

KAMAT plunger pumps with integrated gear reductions generate pressure for the KAMAT high pressure systems. Such pressure pumps are of simple design and require a minimum of space. They build up the high pressure required to ensure the systems function reliably and continually. With an impressive rate of efficiency of above 90%, the KAMAT pump is outstanding in its class.

Production in small numbers, even down to as low as one, is achievable, due to a high degree of modularity. A particular advantage when it comes to manufacturing components for special applications where the media or thermal properties need to be taken into consideration. KAMAT pumps are simple to operate and easy to maintain.

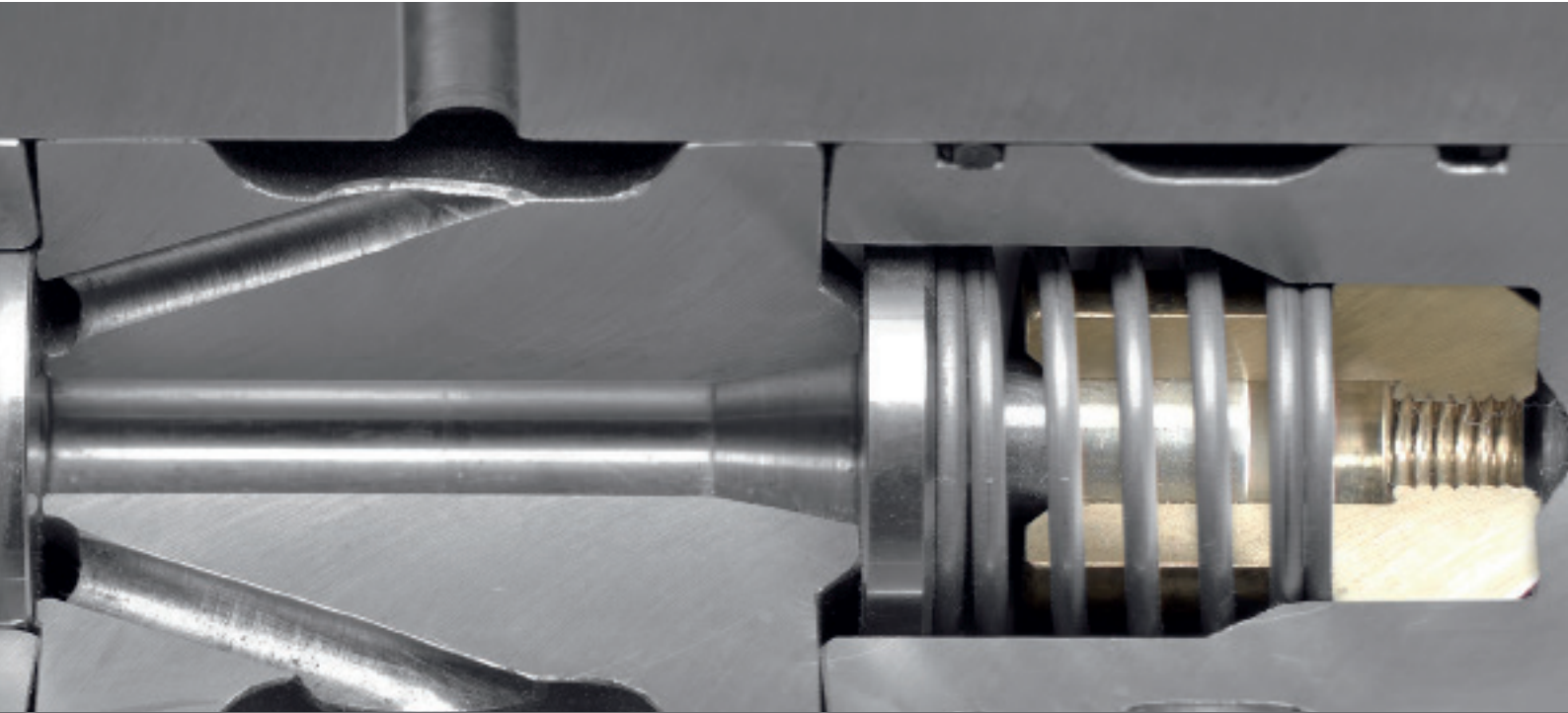
Simply by exchanging the plunger conversion kit, the pump operating data and flow-to-pressure ratio can be converted over a wide range without changing the pump head. This feature allows a high degree of flexibility – the exchange of the kit is neither time consuming nor difficult. The KAMAT gear is of rugged design and equipped with a reliable lubrication system. All pumps can be supplied according to national and international regulations, like ATEX.



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Rugged design up to 800 kW for continuous duty

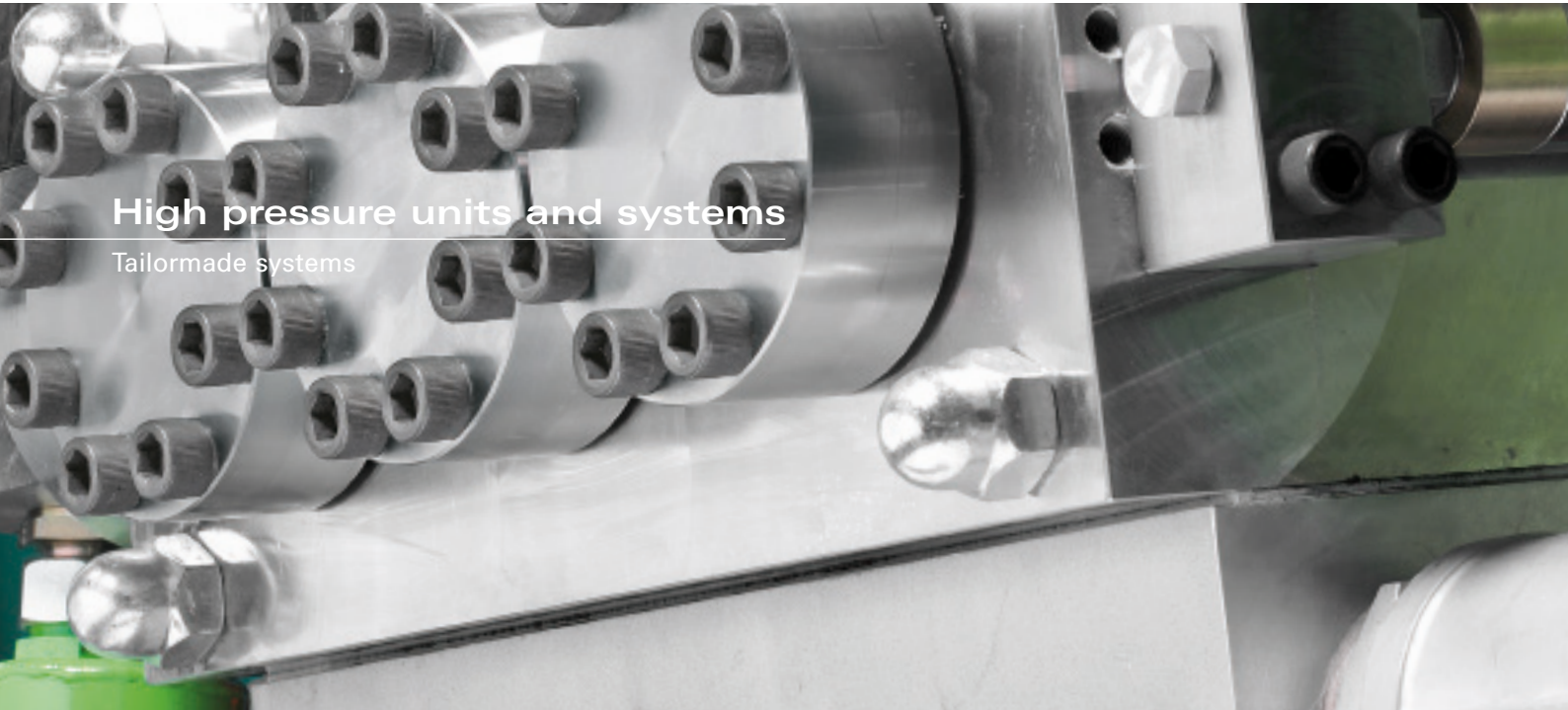
KAMAT can supply pumps for every possible requirement. The input power rating ranges from 15 kW to 800 kW; the operating pressure can be selected from anywhere between 0 and 3500 bar. Our pumps can handle a wide range of media: The spectrum includes liquids with a high viscosity, dilutions, media with solids and media of high or low temperature.

Regardless of the demands, the KAMAT pump will always meet the requirements. Pumps for continuous duty are available which conform to all current norms (e.g. API 674), whereby the gear ratio and drive speeds can be configured to suit customer specifications.

Pump type	p max. kW	Q max. l/min.	p max. bar
K 100	15	6.8	2000
K 4500	45	232	2100
K 8000-3G	75	283	2950
K 9000-3G	90	283	3100
K 10000-3G	130	449	3500
K 11000-3G	110	454	1500
K 13000-3G	130	496	1500
K 16000-3G	160	522	1500
K 20000-3G	200	957	2800
K 25000-3G	250	1148	3200
K 35000-3G	350	1310	3500
K 40000-3G	400	1310	3500
K 50000-5G	530	1913	3500
K 80000-5G	800	2182	3500

| 1 UHP pump type A

| 2 Medium pressure pump type M



High pressure units and systems

Tailormade systems

From the first idea to the ready-to-operate system

We set our own high standards: Only the best solution for each client is good enough. The emphasis is on the word „solution“ - but what does that mean in practice? It means supplying complete custom-built solutions, each one configured specifically for the individual requirements. At the heart of each high pressure system there is the KAMAT high pressure pump. Our engineering expertise is not limited to the high pressure pump itself. Our customers benefit from our comprehensive technical knowledge: The scope of supply supplementary to the high pressure pump includes different types of drive systems, power transmissions, PLC controls, monitoring devices, data transfer, remote-control, pneumatic or electric valve control, mobile assemblies and sound-proof installations. From the very beginning, we accompany our customer through all stages of

implementing the project, right up to the final ready-to-operate system.

Complete KAMAT systems are supplied for many applications, including cleaning technology, pressure testing, longwall mining and water hydraulics. All systems are individually designed to meet customer specifications. Whether for special fluids or exceptional locations, KAMAT engineers can provide the answer. Units are available for operation in hazardous locations such as underground mining and offshore applications. Individual software and project-oriented control systems are also provided by KAMAT.



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Filter technology – high performance components for a clean environment

KAMAT is also strong in new technologies – we have developed our own range of special filters. Why does a pump manufacturer get involved in filter technology? The answer is simple: The high pressure cleaning technology using water as an environmentally-friendly medium calls for a high grade of filtration and recycling. Since such sophisticated filters were not readily available in the market, KAMAT decided to design its own range of filters in response to individual requests and we can now supply filters which withstand pressures of up to 4000 bar, as well as filters for water recycling systems in cleaning technology. If required, we can take over the installation and start-up on site.

| 1 *Mobile diesel driven unit*

| 2 *Stationary electrically driven pump unit*

Accessories

Safety and variety



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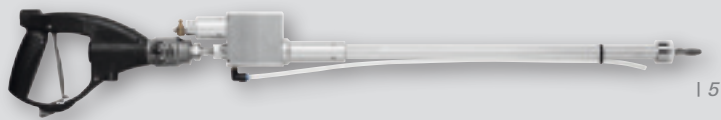
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Valves for every purpose

To run reliably long-term, a plunger pump must be protected by intact and efficient valves. KAMAT engineers have designed and continue to develop a wide range of valve types for all performance ranges and these valves are manufactured in-house to highest production standards. Such valves can be controlled pneumatically, hydraulically or electrically, and allow for independent operation of pumps in automated and remote-controlled processes. As an option, KAMAT can also supply springloaded pressure limiting valves and safety valves. Our solenoid valves for operating pressures of up to 3500 bar are unparalleled.

Special valves for complex processes

Whatever type of valve the customer may need for a special application – KAMAT can supply it. For instance, KAMAT has designed a valve particularly for the process of pipeline testing in the petrochemical industry. In this process, the high pressure pipes are extremely large and thin walled: This calls for a suitable valve which can guarantee smooth-running, safe operation. Special valves are also available for testing gas tanks strengthened with carbon fibres, commonly found in the automotive industry.



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Water tools – high pressure accessories for surface preparation

In order to achieve best results with water when treating surfaces, the water jet must be precisely guided and this can best be done using specially-designed accessories. KAMAT has an extensive range of devices of our own manufacture, including high pressure guns with mechanical function or electrical operation. Our own rotating nozzles produce coherent jets that can be directed at large surfaces precisely and speedily. We also supply externally-driven rotating tools that utilise the hydraulic energy to an optimum and clean the surface perfectly.

Vacuum-supported solutions

Sometimes an O.E.M. requires high pressure accessories to supplement his own equipment. A typical innovation is a special system developed by KAMAT for vacuum suction of debris removed in the process of cleaning large areas.

The used water is recycled and returned to the system after filtration. Solutions of this nature are planned and implemented in close liaison with the client. In many cases, the major component of such a special tool is a high pressure rotating joint; this component can also be supplied on its own.

- | 1 *Electro hydraulic unloading valve*
- | 2 *Electro hydraulic 2/2-way valve
DN8 max. 3000 bar*
- | 3 *Pneumatic 2/2-way valve
max. 3500 bar*
- | 4 *Pneumatic pressure regulator*
- | 5 *UHP gun with pneumatically
driven lance*
- | 6 *UHP gun with Remote Control*
- | 7 *Pneumatically driven Rotary Nozzle*
- | 8 *Rotary Nozzle*

KAMAT worldwide

Service and Technical Support

KAMAT sells its products and services all over the world, with 80% export turnover. Apart from the European markets, international markets account for a large share of export business. In nearly all countries where customers are using KAMAT products there are local representatives or dealers who provide a comprehensive service and who are responsible for important matters like after-sales service, technical support and prompt spare parts supply.

Whenever more intensive support for special projects is required, KAMAT engineers from the main location in Germany provide additional assistance and support to our local agents, to ensure that the end user benefits from the best possible service. Training programmes can be carried out locally or at the company premises in Witten. KAMAT considers it as essential that sales distribution and service are upheld at a high level.



| 1 KAMAT premises, Witten

| 2 Modern CNC machines for
highest manufacturing quality



Our sales organisation – service and technical support on a worldwide basis

Argentina	Denmark	Kuwait	Saudi Arabia
Australia	Finland	Macedonia	Serbia
Austria	France	Malaysia	Singapore
Bahrain	Great Britain	Mexico	Slovenia
Belarus	Hong Kong	Montenegro	South Africa
Belgium	Hungary	Netherlands	Spain
Bosnia & Herzegovina	India	Norway	Sweden
Brazil	Indonesia	Oman	Taiwan
Canada	Israel	Pakistan	Turkey
Chile	Italy	Poland	U.A.E.
China	Japan	Qatar	Ukraine
Croatia	Kazakhstan	Romania	USA
Czechia	Korea	Russia	Vietnam

We cooperate closely with many companies on an international basis that are engaged in building equipment of their own and who use KAMAT products to complement their own high pressure units. In many cases, such companies are appointed as KAMAT representatives and they are reliable partners who promote the name of KAMAT in their local markets.



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