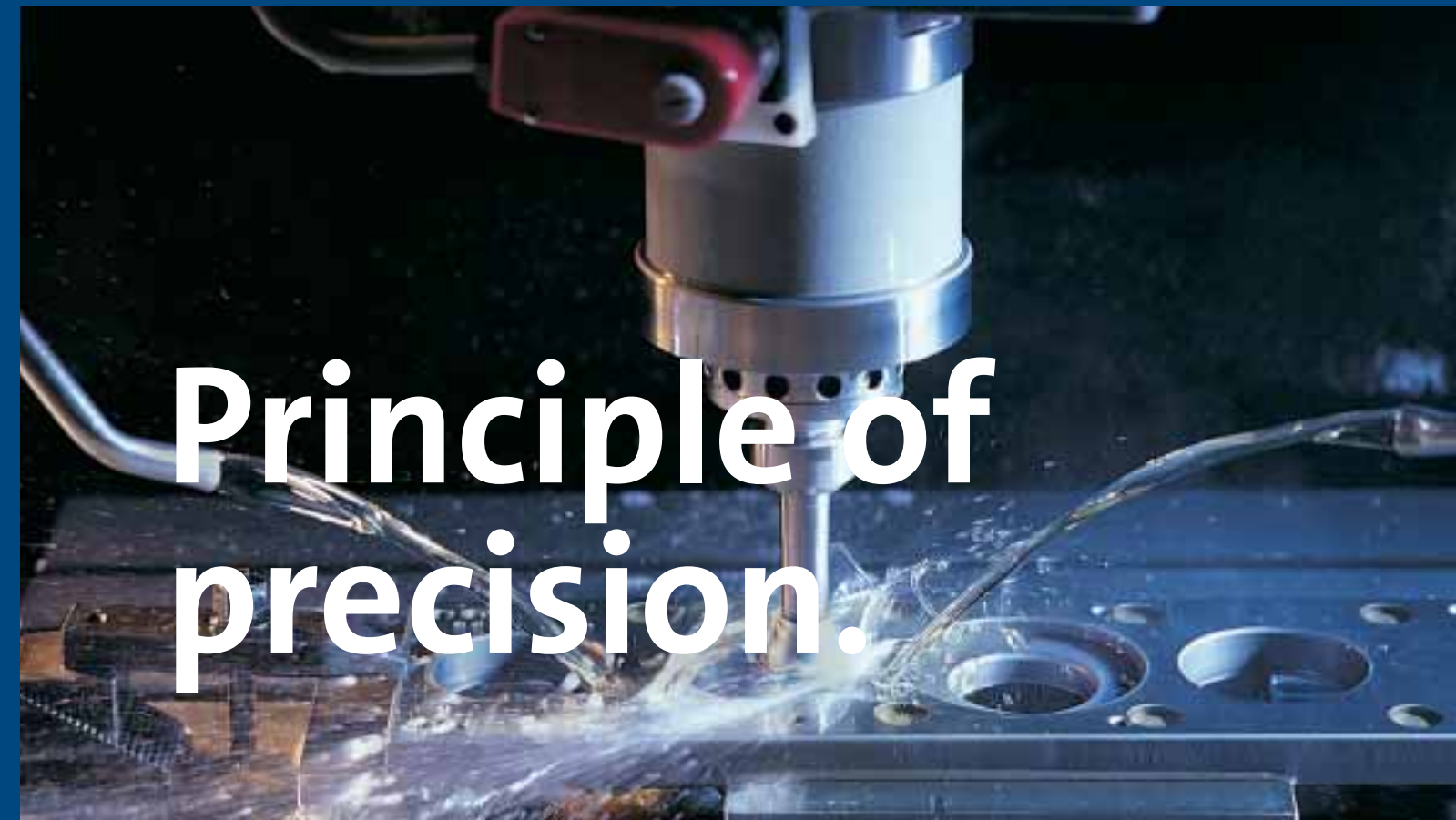




Competence in machine tool industry



96765303 0907 Theissen Druck, Germany

Principle of competence.

Competence area of machine tool industry: New structures for increased customer focus ➤

Excellentlly organised ➤ Surviving in today's competitive world and providing customers not only with outstanding products, but also with comprehensive service, require fully integrated concepts. For this reason we have set up a completely new machine tool business structure with customer service units as well as a dedicated machine tool sales force. For our discerning customers from the mechanical engineering sector, this organisation positions us as leading provider of systems and complete solutions, which are complemented by our optimal distribution and logistics structure. We also want you to benefit from the competence of a strong brand that offers everything from one source.



Varied program ➤ Grundfos immersible, norm and block pumps are suitable for almost every application in the area of mechanical engineering. The spectrum ranges from cooling and lubrication of tools and component cool-down, water treatment during production process, all the way to filtration, drilling, washing or wire eroding. Thus, it is possible to cover every requirement within the scope of industrial production, from single-part production to complete production line.



Profound experience ➤ The expertise and application skills gathered by us over decades are unparalleled on the market. In combination with the new machine tool business structure, they are the assurance that today - more than ever before - we are in a position to address the needs of your industry. With an extremely diversified, innovative product program – specifically tailored to the mechanical engineering sector – we provide you with customer-oriented systems solutions that meet highest expectations at all times.



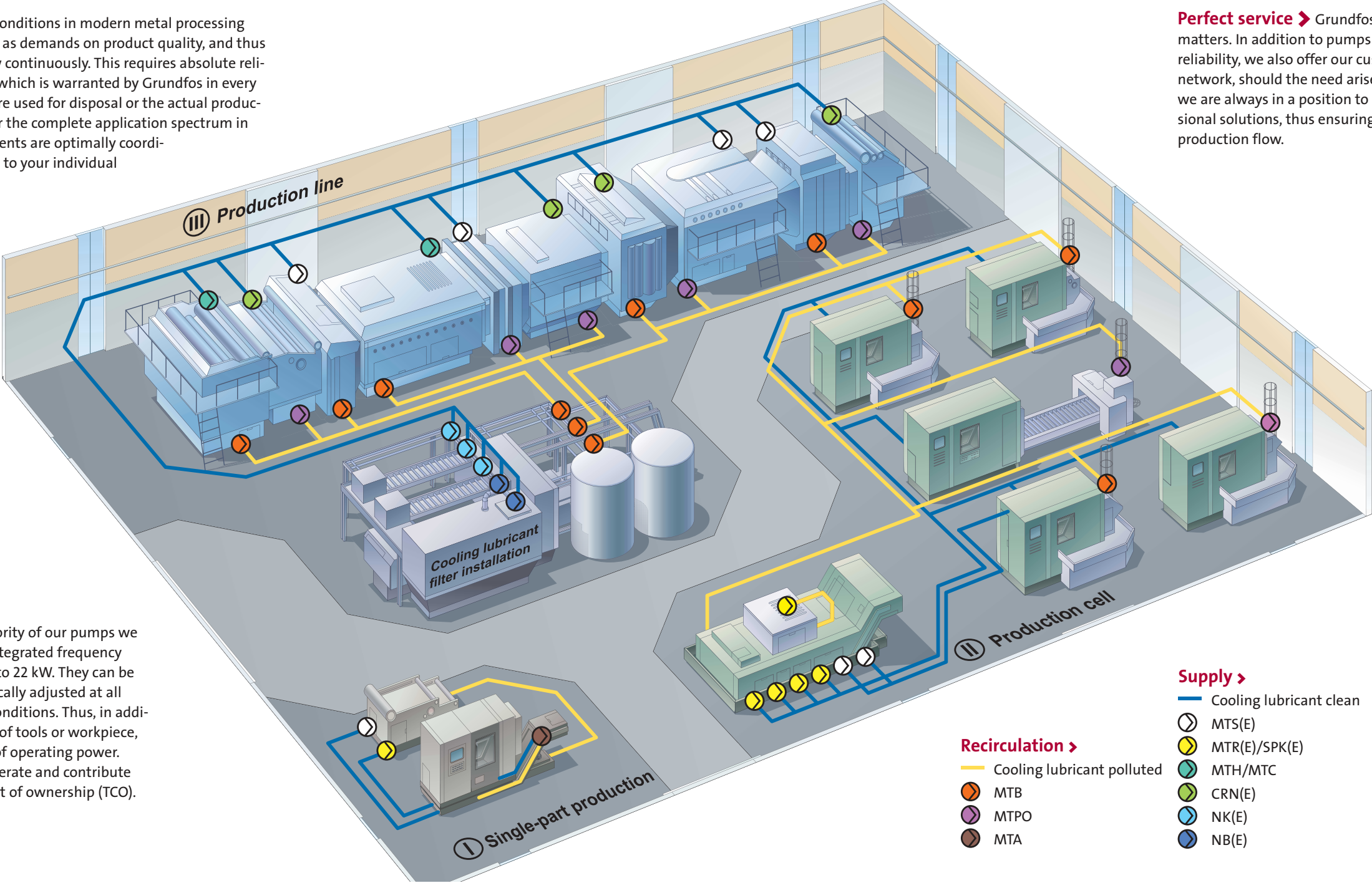


Competence area of machine tool industry:
All processes individually coordinated ➤

Maximum reliability ➤ Basic conditions in modern metal processing become increasingly more difficult, as demands on product quality, and thus the entire production process, grow continuously. This requires absolute reliability of cooling lubricant pumps, which is warranted by Grundfos in every respect. Regardless whether they are used for disposal or the actual production process, Grundfos pumps cover the complete application spectrum in production. In doing so, all components are optimally coordinated and can be precisely adapted to your individual requirements.

Perfect service ➤ Grundfos stands for competence in all matters. In addition to pumps of exemplary quality and reliability, we also offer our customers a worldwide service network, should the need arise. In case of a malfunction, we are always in a position to provide quick and professional solutions, thus ensuring a smooth uninterrupted production flow.

Flexible dynamics ➤ For a majority of our pumps we also offer electronic motors with integrated frequency converters, with a power range up to 22 kW. They can be individually controlled and dynamically adjusted at all times to the prevailing operating conditions. Thus, in addition to permanent optimal cooling of tools or workpiece, they also save an enormous share of operating power. They are particularly efficient to operate and contribute greatly to the reduction of total cost of ownership (TCO).



Principle of performance.

Competence area of machine tool industry: Customised production ➤

MTR(E), SPK(E) ➤ The MTR and SPK series offer deliveries up to 1500 l/min and pressures up to 25 bar, and are all equipped with EFF1 motor, in doing so they achieve up to 81% efficiency. Due to variable total lengths and capacity, both pump series – in addition to circulation of cooling lubricants - are also used as condensate or filter pumps, as well as in numerous industrial cleaning processes. Their cartridge-type shaft sealing can be replaced in a simple and quick manner, if necessary. Process optimisation is ensured by the design with integrated frequency converter, which provides the correct supply pressure during each processing step.



MTS(E) ➤ The newly developed MTS series for high pressure supply of machine tools proves its strengths especially during the production of filigree parts. Here, the three-spindle self-priming screw pump convinces with a delivery pressure up to 130 bar. Its high efficiency ensures a very low heat input into the cooling lubricant. In addition, the very wear-resistant system guarantees maximum reliability and minimum vibrations. This series can also be optionally supplied with integrated frequency converter.

MTH/MTC ➤ The immersible pumps of the MTH series are characterised by a very compact design, which is especially suitable for installation in flat containers. As multistage pump in segment design, it covers a very wide range of performances with delivery rates up to 130 l/min.



Supply pumps

Competence area of machine tool industry: Optimal solution for each application ➤

CR/CRN/CRNE HS ➤ The normal-priming multistage centrifugal pumps in inline-design are series equipped with EFF 1 motors, and convince by highest efficiency and unsurpassed reliability. Thanks to numerous raw material variants, like air-cooled top and MAG-drive, they have a particularly diverse application spectrum. Cooling water circuits, washing plants, industrial circulation systems, as well as general pressure increase applications belong to their application area. Furthermore this series is applicable as a filter pump for reconditioning of cooling lubricant.



NK ➤ The NK cast iron pumps perform their task in an efficient and reliable manner, especially for delivery of large quantities of water. Thus, they achieve up to 2000 m³/h at an operating pressure of max. 16 bar, making the norm pumps suitable for a number of industrial applications, like central installations for cooling lubricant reconditioning. Their specific process design permits easy removal of motor and impeller, without requiring additional work on the pump housing.



NB ➤ the single stage centrifugal pumps in close-coupled design of the NB series fulfill their task in an efficient and reliable manner. This requirement is ensured by the high hydraulic efficiency, in connection with the standard EFF 1 motors. The compact design of this series allows for use in a number of industrial applications, e.g. in parts cleaning machines, as filter pumps, or in cooling and air conditioning systems.



Supply pumps

MTA ➤ The lower performance range up to 100 l/min and delivery heights up to 10 m are attended to by immersible pumps of the MTA series. Their robust construction with open stainless steel impeller makes them suitable for media with increased viscosity and corrosiveness, as well as for high solids content. This is why the MTA series is preferred for cooling lubricant supply during lathing and parts cleaning.



MTB ➤ The single stage, normal-priming recirculation pump in closed-coupled design is equipped with a mechanical seal and is preferably applied in parts cleaning and washing systems, cooling lubricant disposal, and waste water treatment. Particle sizes up to 20 mm ball diameter can be safely delivered with the SuperVortex impeller. The maximum delivery is 1500 l/min.



MTPO ➤ Single stage, self-priming recirculation pump in closed-coupled design, with mechanical seal. Its special construction makes the MTPO suitable for delivery of highly aerated emulsions and oils. Maximum delivery is 350 l/min.



Recirculation pumps

Principle of efficiency.

Competence area of machine tool industry: Absolute minimal heat input ➤

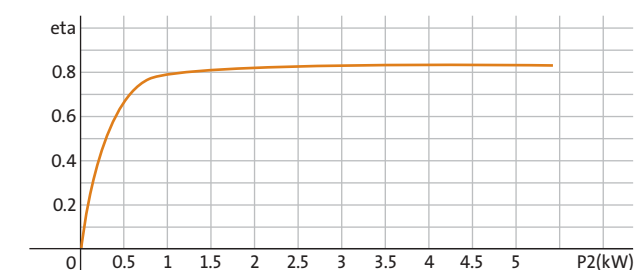
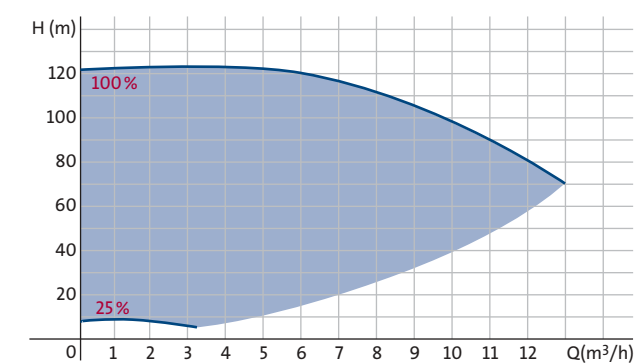
During processing, many production processes in mechanical engineering require a variety of delivery data (flow/pressure), depending on tools. To optimally meet these requirements, Grundfos supplies electronically controlled E-pumps with integrated frequency converter.

Efficient and powerful ➤ Pumps with integrated frequency converter offer additional benefits:

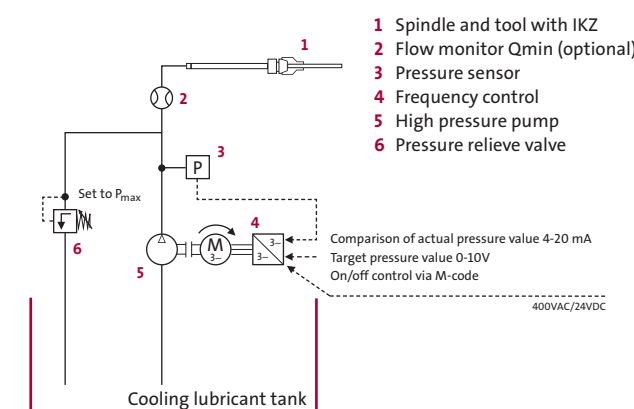
- Individual adjustment to required operating point
- Multi voltage range of 3 x 380-480 Volt; 50/60 Hz mains side
- cURus and CE certification – as a standard
- Motor connection via unique plug and play system
- Controllable through sensors for pressure, flow, temperature and the like (0-10V or 4-20 mA)
- Adjustable via remote control R100

This means specifically for the machine tool industry:

- Lower heat input into cooling lubricant
- Reduced cooling efficiency
- Increased process safety
- Lower operating costs



Intelligent application ➤ The E-pumps can be integrated into innovative production processes without any problem. The analogue and digital inputs permit individual control, e.g. depending on tool magazine assignment.



Principle of quality.

MTRI pumps are resistant against aggressive electrolytes ➤

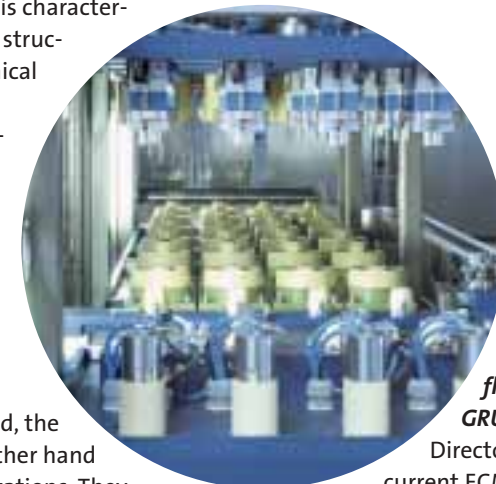
Customer: Extrude Hone VMB GmbH, Germany
Applications: DELIVERY OF ELECTROLYTE SOLUTIONS AND CLEANING AGENTS, RECIRCULATION, LOADING OF FILTER SYSTEMS

Products of Grundfos Industry:
MTRI: Immersible pumps made of stainless steel

Extrude Hone VMB GmbH specialises in the construction of machines and devices for electrolytic deburring and finishing of metallic precision parts (ECM technology). In the past, this form of 'electrolytic machining' has been used rather seldom. The high precision during deburring and edge contouring of metallic components is characteristic for this process; in doing so, the material structure is neither subject to thermal nor mechanical stress. The extremely precise ECM metal machining offers maximum component accuracy and efficiency. For instance, builders of superfine nozzles for modern common rail Diesel engines will value this precision.

The pump requirements in an ECM installation are very high: The media can be alkaline as well as acidic; stability against salts and pollutants must be ensured, and naturally, service-friendliness is in demand. On one hand, the units move the electrolytic solution; on the other hand they deliver cleaning agents in the washing stations. They return used media to the central treatment plant, load the filter systems and finally empty the tanks. In short: Everything that flows in an ECM installation is moved by pumps.

Extrude Hone VMB developed the complete systems engineering itself, including automation and washing process.



After Extrude Hone VMB has been relying on two pump suppliers in the past, meanwhile only GRUNDFOS is listed: **"In addition to the entire product range, we value the flexibility and commitment of GRUNDFOS"**, states Managing Director Markus Günther. On the current ECM installations, Extrude Hone

VMB is now changing the entire pump technology to immersion pumps of the MTRI series, which also feature a stainless steel head. Günther: "On the MTRI pumps we particularly like the easy way of exchanging the cartridge seal - this feature is also well accepted by our customers." Though all pumps are designed with speed control, the corresponding frequency converters are externally positioned, separate from the process, in a control cabinet. Reason: The effect of the not always preventable salt vapours on the integrated or attached frequency converter would be extreme.

Markus Günther is more than satisfied with the GRUNDFOS-Service: **"The reaction times to inquiries and/or problems are very good!"** Added to this is the great commitment, for instance in the event of a technical defect. "If such is the case, we receive a comprehensive analysis, together with a recommendation how such a failure can be best avoided in the future." Of particular importance is the globally available GRUNDFOS service and spare parts supply - thus Extrude Hone VMB can ensure the support for its international customer base.

On the current ECM installations, Extrude Hone VMB is now changing all pumps to immersion pumps of the MTRI series, which also feature a stainless steel head.

FETTE GmbH, Schwarzenbek, is known for highly efficient precision tools and powerful compacting presses for the pharmaceutical and chemical industry. The company is part of the Leitz association - ten industrial enterprises with subsidiaries around the globe, internationally leading in the manufacturing of precision tools and systems for processing of wood, plastic and metal.

For the production of tools, the company operates more than 600 machine tools, mainly in wet processing. The clean flow of the cooling lubricant cycle is equipped with conventional immersion pumps; they consist of several hundred units, mainly from the large Grundfos product range. In the polluted recirculation from machine tool to filter system, however, other qualities are in demand: It is not just a matter of maintaining a delivery rate; the pumps must also deliver abrasive and gas-containing parts. This concerns the abrasion of the tools to be machined, and the applied grinding discs. A particular critical point: "The grinding oils absorb a lot of air due to the high pressure of the cooling lubricant during impact onto the grinding disc", says Martin Peters, master in industrial engineering. Conventional immersion



FETTE is the leading manufacturer of precision tools, like hobs.

Delivery of abrasive, gas-containing cooling lubricants ➤

Customer: FETTE GmbH, Germany
Applications: SUPPLY AND RECIRCULATION OF COOLING LUBRICANTS

Products of Grundfos Industry:
MTPO: Self-priming centrifugal pumps
MTR: Immersible pumps



With the Pomona MTPO 23, Grundfos offers a pump for the 'dirty' part of the cooling lubricant cycle, compared to the lifting units. Pomona requires significantly less space and is more cost efficient.

centrifugal pumps have problems with this combination of liquid, solid and gaseous parts. Furthermore, during start-up of a machine tool it takes several seconds until the polluted cooling lubricant reaches the pump - and after the machine tool comes to a stop, the pump must completely discharge the cooling lubricant to filtration. Thus, the pump should survive at least a short dry running period.

For the "dirty" part of the cooling lubricant cycle, and for the particular challenge of gas-containing medium, Grundfos offers the Pomona MTPO 23 series. This is a wear-resistant and self-priming (!) centrifugal pump, with dry installation to save space. Designed as 'wastewater pump', the Pomona bearing shells are accordingly moulded. Due to special construction measures (special bearing shell contour, arrangement of guide fingers in the housing cap, scavenging port in the wear plate), the suctioned air is mixed with the pumping media. The unit is suitable for delivery of gas-containing, solid media - abrasive parts up to a particle diameter of 10 mm are no problem. The components are engineered in such a way to facilitate easy pump assembly. The replacement of wearing parts is also simple.

Martin Peters: **"The Pomona is more cost efficient than conventional specialty pumps, and significantly easier to handle than the alternatively applied lifting units. Moreover, the pump requires hardly any space, and functions reliable - it does a good job."** Consequently, the old pumps are replaced one by one with Pomona pumps, so far already 30 pumps.

Constant pressure for machine tools ➤

The **Mayfran** Company, with more than 1000 employees worldwide and production sites in the United States, Europe and Asia, is one of the leading global manufacturers of conveyor and filtration systems for the metal-working industry.

Mayfran's reputation throughout the world is evident in this current project: N3 Engine Overhaul Services (joint venture of Lufthansa Technik AG and Rolls-Royce plc) has established a plant in Arnstadt, near Erfurt, for the reconditioning of Rolls-Royce power units.

N3 assigned Mayfran with the planning and installation of a central cooling lubricant filtration system for the supply of eight machine tools with water soluble cooling lubricants. The central system (band filter installation) is located in the basement and supplies the machine tools with up to 500 l/min cooling lubricants in 3-shift operation, six days per week. Regardless how many machine tools are simultaneously running, each machine tool must be continuously supplied with cooling lubricants at a pressure of 3 bar.

To meet this requirement, the filter installation is equipped with two immersible Grundfos pumps (change in 24-hour rhythm). The units of the MTR series selected by Mayfran feature frequency controlled motors.



For the mechanical department (milling, lathing, drilling and grinding of turbine parts), Mayfran supplied a central cooling lubricant filter installation for the new plant in Arnstadt. Part of the delivery scope was also the piping to the eight machine tools. Grundfos pumps can be seen at bottom right and left of installation.

Customer: Mayfran GmbH, Netherlands
Applications: DELIVERY OF COOLANTS AND LUBRICANTS

Products of Grundfos Industry:
MTR: Immersible pumps with frequency converter



Special characteristics of this series:

- The cartridge mechanical seal can be replaced without disassembly of the pump
- Flexible immersion depth: Pump length can be adjusted to installation conditions
- A suction cycle protects the pump against dry running.
- Pump parts made of stainless steel, optimised suction chamber and impellers
- Leak channel to tank
- Energy-efficient high performance motor (EFF1).

The reason for selecting a speed-controlled variant is explained by Dipl.-Ing. Klaus Bock, who is in charge of sales support at Mayfran: **"The maximum required by all eight machine tools together lies between 400 and 500 l/min cooling lubricant. The duty pump must be designed for this. However, when for instance only two machine tools are running, the requirement decreases accordingly - and the pump automatically reduces its speed. Important: The pump still delivers the same pressure!"** This is necessary to ensure proper function, since the cooling-lubricant must be fed to each machine tool at 3 bar.

Advantage of this operation: Significant energy savings (reduced operating costs), as well as a technologically advantageous aspect: If the pump operates at reduced speed, the heat output to the cooling lubricant is also less, thus no separate cooler must be switched on.

Why the cooling lubricant must not heat up? Klaus Bock: "Especially the grinding machines are very sensitive to temperatures and require a preferably constant cooling lubricant temperature for processing a workpiece within the specified narrow tolerances.

Knapheide is a renowned manufacturer of top-quality and extremely robust hydraulic systems. With its parent company, Knapheide GmbH Hydrauliksysteme in Beckum, and diverse specialised companies for precision lathing, hydraulic hoses, hose technology, materials handling, and electrohydraulic control and process engineering, the group with its roughly 850 employees is in a position to offer everything from one source, "made in Germany".

For reasons of safe process control and tool life, Knapheide uses mainly carbide drills with interior cooling for processing of work pieces. For this purpose, a cooling lubricant with particularly high pressure might be needed. Because the smaller the tool, the tighter the cooling channels - and the greater the required pressure. Production Manager Bernhard Nauber: **"When performing deep hole drilling, an additional complication is that the chips must safely be disposed from up to 600 mm deep bore holes. Only very powerful high pressure pumps can accomplish this."**

For special applications, like deep hole drilling for high-precision turning processes, Knapheide has installed Grundfos MTS screw pumps in its Beckum plant. This pump ensures high pressures up to 130 bar, in connection with uniform delivery characteristics, long tool life, and low heat input into the cooling lubricant. MTS pumps are available in two executions: One in form of immersible pumps with shaft seal-ring (type DQ), the other as dry installed variant with mechanical seal (type D8.6). Due to their compact design, the pumps are suitable for vertical installation in or on top of tanks, or for dry installation. With seven sizes and 15 types, there is a right pump for every task.

Important performance data:
 Production flow up to 900 l/min;



The newly applied MTS pump performs a good job, as confirmed by Nauber. **"We have a 3-shift operation, thus the pump is actually continuously running. In our opinion, the pump stability is excellent."**

media temperature up to 80°C; final pump-pressure up to 130 bar; viscosity up to 2.000 mm²/s; pollution level up to 250 mg/l; filtration level up to 100 μm.

Knapheide has clearly defined the requirements for these pumps. They must deliver a 'fatter' cooling lubricant (up to 12 % emulsion level - 6 to 7 % are normal). And, most of all, they must provide such a high pressure that the chips are safely flushed out even from 600 mm deep bore holes.

Because the very expensive deep hole drills - due to their length - are less solid than conventional drills, a chip congestion would result in a broken drill within seconds - and the tight cost calculation for a hydraulic valve or a turning process would be ruined.

Deep hole drilling: Powerful chip disposal ➤

Customer: Knapheide GmbH, Germany
Applications: Delivery of cooling lubricant in the high-pressure area

Products of Grundfos Industry:
MTS: Screw pumps



On the screw pump of the MTS series, the operator can choose between different pressure stages, in order to achieve the optimal setting for cooling or chip flushing for each tool.

Competence area of machine tool industry: Tried, tested and proven ➤

Count on groundbreaking top technology and benefit from an unparalleled product quality. For the manufacture of Grundfos pumps, high-quality materials and latest procedures are used, so that they fully comply with your requirements in all application areas.

Customer-specific solutions ➤ Due to their compact design, Grundfos MT products can be integrated in the cooling lubricant tank and chip conveyor in a simple and space-saving manner, at various immersion depths. The modular design makes more than 100.000 individually configurable variants possible.



Technical top performances ➤

Each detail of our pumps contains the innovative Grundfos expertise. Our impellers, for instance, are laser welded and thus create extremely good flow behaviour and minimum friction loss. The floatingly mounted seal ring reduces the leakage loss inside the pump to an absolute minimum. The unique cartridge seal is extremely wear-resistant, and also very easy to replace.

High efficiency, low costs ➤ Due to optimal hydraulics, Grundfos pumps offer a significantly higher degree of efficiency, reducing energy consumption and heat input in the cooling lubricant by 15 to 20%. This results in a significant reduction of operating costs over the entire service life of the installation, especially when considering that 85 % of the overall costs stem from energy consumption. During actual operation, this can also cause smaller cooling requirements. Maintenance periods are reduced due to the easily replaceable cartridge seals and the application of standard tools.



Principle of partnership.

Grundfos Industry: A strong industry partner ➤

Tradition and greatness ➤ Grundfos was founded in 1945 by the visionary and inventor Poul Due Jensen. His personal values have accompanied the Grundfos success story. Today, the company is worldwide presented as full range supplier of pumps and pump systems by more than 70 companies. The corporate group, with its headquarters in Denmark, has more than 14.500 employees around the globe, which produce annually over 10 million pumps, thus generating a sales volume exceeding 2 milliard Euro.



Philosophy ➤

"Be – Think – Innovate" are our company principles in short. Our philosophy has proven itself. As world market leader in the field of cooling lubricant pumps, Grundfos offers a comprehensive range of specialised pumps. In addition to maximum product quality, our exceptional vertical integration is an important assurance of unparalleled Grundfos quality. In-house research and development centres are specifically set up to continuously expand our innovation potential. In the process, excellently trained, competent employees are our best calling card in the market.



Logistics and distribution ➤ The Grundfos logistics concept is designed for top performance. Our standard pumps are generally on hand due to high stock availability, for instance via E-Trading (EDI) or our web shop. The in-house distribution network is supported worldwide by ten logistics centres. A central, efficient spare parts supply in all European countries is ensured by the Grundfos spare parts centre in the Netherlands.

The worldwide presence of Grundfos guarantees an extensive distribution and service organization. Our customers in the machine tool sector are attended by a globally positioned network of specialists.

