

## Energy-saving pump technology

Retrofitted frequency control for cooling lubricant high-pressure pumps is worthwhile



*Ever more metal processors are discovering energy-saving potential in the cooling lubricant area, especially with uncontrolled high-pressure pumps. KNOLL Maschinenbau has developed the E-PASS, with which the savings potential can be determined in less than an hour during ongoing operation. Various companies have used this service and then decided to retrofit the high-pressure pumps of their machine tools with frequency control. In the following example, the amortization time is less than two years.*

For many companies, environmental protection plays an important role, whether with respect to environmentally-friendly final products or within the company's own production. At one of the large German automobile suppliers, for example, the people responsible for production work on keeping the company's ecological footprint as small as possible. Therefore, all of the processes are continuously monitored and optimized in terms of cost-effectiveness, energy and resource efficiency, and environmental compatibility.

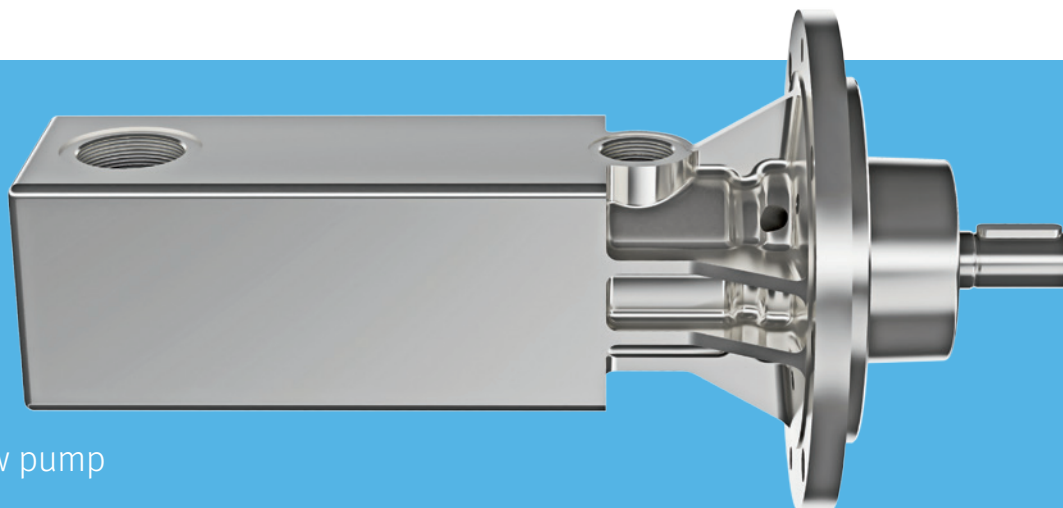
Thus a significant energy savings potential was detected in

the high-pressure supply pumps for cooling lubricant in the chipping of aluminum cast parts. Since these were previously equipped with a vario valve with different pressure stages, the company asked the question whether a retrofitting with frequency-controlled pumps would pay off.

### Quick analysis with practical values

When KNOLL Maschinenbau, a leading supplier of pumps, filters, and complete cooling lubricant systems suggested examining the energy consumption, the person responsible for the department agreed gladly, especially since the consumption measurement does not require long machine downtimes and since then clear figures can be put on the table.

Jochen Blerch, expert in energy-efficient solutions at KNOLL, explains the background of the savings potential: "The pumps with vario valve used ensure different pressure stages, however they nevertheless generate the full volumetric flow, so that the cooling lubricant that is not needed must flow off. This is associated with an energy loss, which



## KNOLL's KTS screw pump

KNOLL's KTS screw pump is a self-suctioning positive displacement pump that distinguishes itself through its low pulsation, high resistance to wear, and long life span. It is most effective with the KNOLL PQ-Tronic frequency controller.

a frequency inverter helps prevent. For it ensures need-oriented pressure regulation by adjusting the speed of the pump."

To check whether this is the case using an efficiency analysis, the cooling lubricant specialists have developed a special measuring system called the KNOLL E-PASS. This system can not only measure the power consumption of a high-pressure pump during the process; it can also determine how much power is actually required for the machining process. On the automobile supplier's premises, Jochen Blerch checked two machining centers that process typical series pieces. The machines only had to be shut down for about five minutes in order to install the appropriate measurement technology. It then measures the actual cooling lubricant flow rate to the machine during a complete machining cycle and the respective pressure. In addition, required data such as the operating hours, the current and investment costs for the retrofitting are entered into the computer.

After the measurement process, the calculation begins. The largest share of the energy savings results from the difference between the fixed speed and the actually-required speed with frequency inverter. Thanks to the frequency-controlled drive of the pump, there is also a smaller

release of heat into the cooling lubricant and the ambient air. In addition, the pump is spared by the partial load operation, which increases its service life. All of these factors are considered in the E-PASS evaluation.

### Little effort – clear result

Just a few minutes after the measurement procedure, there is a printout that provides exact figures for possible energy savings with a retrofitted frequency controller and the amortization time. Jochen Blerch points out an additional benefit of the measurement procedure: "Via the data recorded, it is possible to assess the wear state of the high-pressure pump, which can also be replaced when retrofitting the frequency controller."

The determined values were – as expected – quite convincing. For the retrofitting in the chipping of aluminum cast parts frequently pays off. The reason for this is the many tools that are required for cutting, drilling, and threading and that require high-pressure interior cooling. The required pressure and volumetric flow changes depending on the tool and machining, while the design of the pump is always oriented according to the tool that requires the highest values. Smaller tools, drills for example, can get

## PQ-Tronic speed control

The KNOLL PQ-Tronic speed control allows you to specify desired pressures within a range of 0 – 150 bar. With this system, pump performance is regulated automatically. Thanks to the frequency control of the drive motor, the speed of the pump unit is changed (up to 4500 min<sup>-1</sup>) and thus the output as well. A pressure sensor together with an electronic PID control ensures the specified pressure (target value) independent of the amount used.

Numerous advantages arise from this:

- Energy savings of up to 70%
- Variable pressure control
- Low pulsation conveyance
- Smooth starts and stops
- No power peaks during startup
- Speed adaptation to reduce noise
- Minimization of wear
- Reduced heat release into the medium

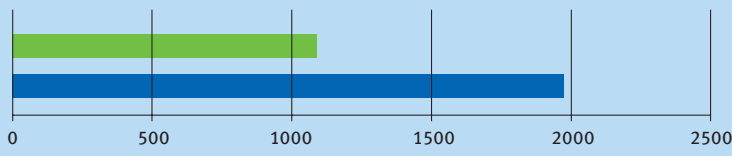
by with significantly lower cooling lubricant pump performance; that is, they can be supplied optimally at a lower speed. The frequency-controlled pump thus saves energy, for the rule of thumb applies: half the speed corresponds to half the power required. For a permanently-set pressure limiting valve, this energy is changed into heat and lost. Also for the automobile supplier's application, the complete characteristic curve field of the pump is required, sometimes higher and then lower volumetric flow up to pause times, when the pump can be shut down to 0 Hz. The energy savings potential determined with E-PASS amounted to 61%. A result that justifies the modification and the costs incurred to those responsible.

cy control system that it uses is known as PQ-Tronic, as it allows for variable pressure (P) and flow (Q) coupled with optimal speed adjustment. KNOLL regards itself as much more than a component supplier; it regards itself as a partner on the process level. Jochen Blersch explains: "Our claim is to achieve the same reaction times as before with the existing technology and a new frequency inverter and without intervention in the machine tool – even if the process demands are very high. At the automobile supplier mentioned, we undertook the complete incorporation into an existing machine tool without a KNOLL cooling lubricant system. In addition, we place great value on documentation according to the CE stand-

### Safety thanks to a reference machine

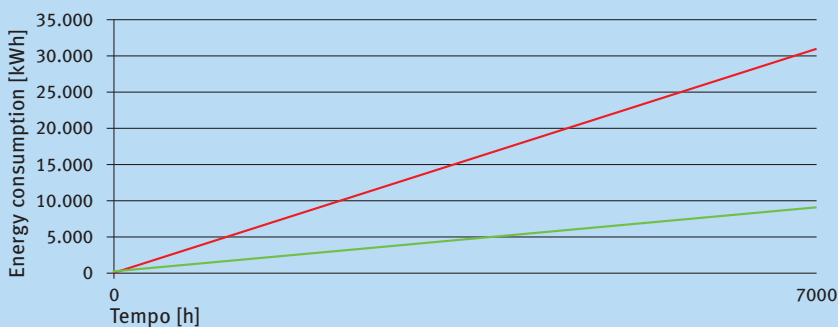
In order to verify the values calculated, they first had a machine modified to serve as a reference system. The scope of delivery did not affect the complete cooling lubricant system, but only the frequency control. KNOLL offers the screw pump for this, a self-suctioning positive displacement pump that distinguishes itself through its low pulsation, high efficiency, and long life span. At KNOLL, the frequen-

Jochen Blersch, expert in energy-efficient solutions at KNOLL: "With the E-PASS, we provide the customer with an analysis of the current situation and a calculation of the potential savings, including a calculation of the amortization period. The assessments are provided in the form of diagrams and tables."



■ Useful life of the high-pressure pump  
■ Total operating time

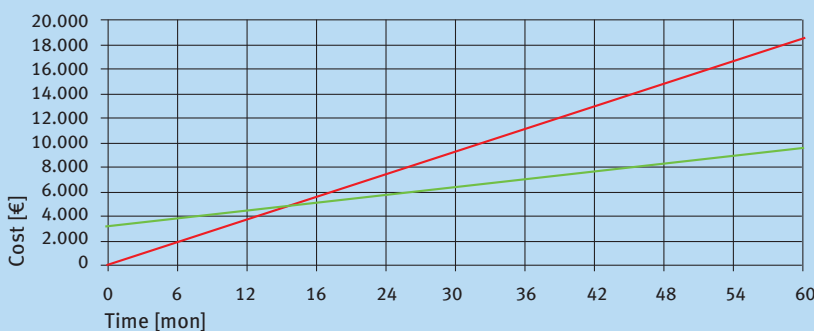
The high-pressure pump is generally not required the entire time the machine is running. Therefore, there is significant savings potential here.



— Energy consumption without regulation 100%  
— Energy consumption with regulation 28.6%

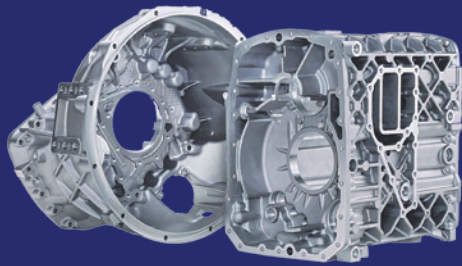
Among other things, the KNOLL E-PASS determines the energy consumption by pump and cooler in an installation with and without control.

### Amortisation (7,000 operating hours per year)



— Costs without regulation  
— Costs with regulation

From the data determined, the amortization time is calculated; in this example it is less than two years.



The retrofitting frequently pays off in the chipping of aluminum cast parts. The reason for this is the many tools that are required for cutting, drilling, and threading and that require high-pressure interior cooling.

ard, such as drawings, electrical diagram, parts list, and safety observation."

## Amortization time less than two years

The people responsible for production welcomed the chance to get everything from a single source, from KNOLL, and they rejoiced at the results: the reference system confirmed the values determined theoretically. Thus the path was cleared for optimizing additional machines. Initially KNOLL retrofitted a production line with eight machining centers, where the predicted figures once again applied. In a second step, another twelve machines were modified.

Meanwhile, KNOLL received the pleasing feedback from the customer that the measures were very successful, even overall. Before the modification, the average machine required approximately 3 kW/h. After that, consumption was only 1 kW/h. This means that the modification, especially with normal 3-shift operation, pays off in less than two years without production downtime.

Jochen Blersch points out another advantage that was not yet calculated, but that can be used in the course of operation: "If I operate a pump with frequency inverter, I can also monitor the process. I will be able to see early on, for example, when the pump is worn. For in that case, the frequency inverter regulates the speed higher in order to compensate for the wear. If you are monitoring the speed, spare parts can be ordered when a specified value is reached and a timely replacement can be prepared, which is to the benefit of process reliability."



## KNOLL Maschinenbau GmbH

KNOLL Maschinenbau ranks among the leading suppliers of systems for conveying and filtering chips and coolant in the metal machining industry. Its displacement pumps are also used in the chemicals and foodstuffs industries. Highly-flexible transport systems complete the KNOLL product portfolio. Thanks to its comprehensive product range, the company is able to implement complete systems and system solutions incorporating central or localised functions. Since 1970 the name KNOLL has been associated with innovation, progress and growth.

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