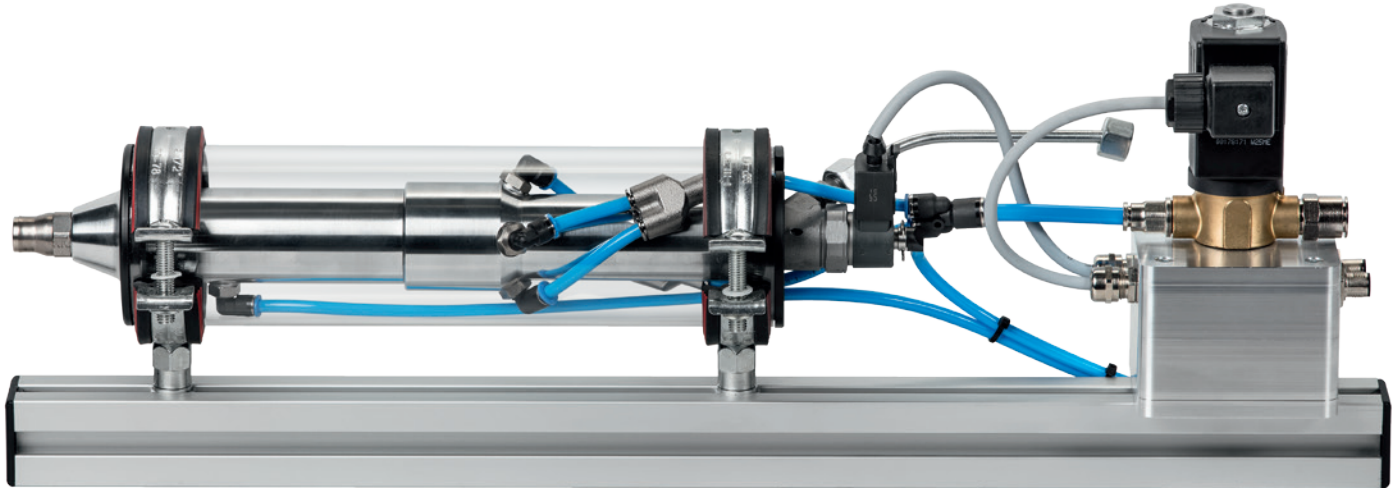


MQL-system ControLube

Working at high pressure toward process advantages
KNOLL presents MQL system with injector technology



With KNOLL's ControLube MQL system, oil and compressed air are fed separately into a mixing chamber, which is right in front of the main spindle.

The new KNOLL ControLube minimal quantity lubrication system is controlled by a microprocessor and makes use of the injector technology familiar from the automobile industry. It unites the advantages of single- and dual-channel solutions – and has even more to offer.

Cooling lubricants and systems perform many tasks during chipping: they reduce the friction, remove chips, discharge heat, and ensure an even temperature of workpiece and tool in order to be able to adhere to tight tolerances. However, the use of cooling lubricants is sometimes associated with high costs for provision, preparation, and disposal, and it pollutes the environment.

For a long while, the operators of chipping machine tools have been searching for alternatives. Minimal quantity lubrication, which represents a middle path between wet and dry processing, is becoming increasingly significant. At least if the focus is on chipping with defined cutting of materials such as aluminum, wrought and cast alloys, cast iron, steels, and even rust-free material.

MQL offers many advantages with respect to process and costs

Industries such as the aviation and automobile industries that produce workpieces of these materials in large quantities are using MQL systems more and more. For, based solely on the low quantity of lubricant required, there are many advantages. By way of comparison: the volumetric flow for MQL

is generally less than 50 ml per hour, while for wet cooling lubricants in the same period, up to 12,000 liters are used.

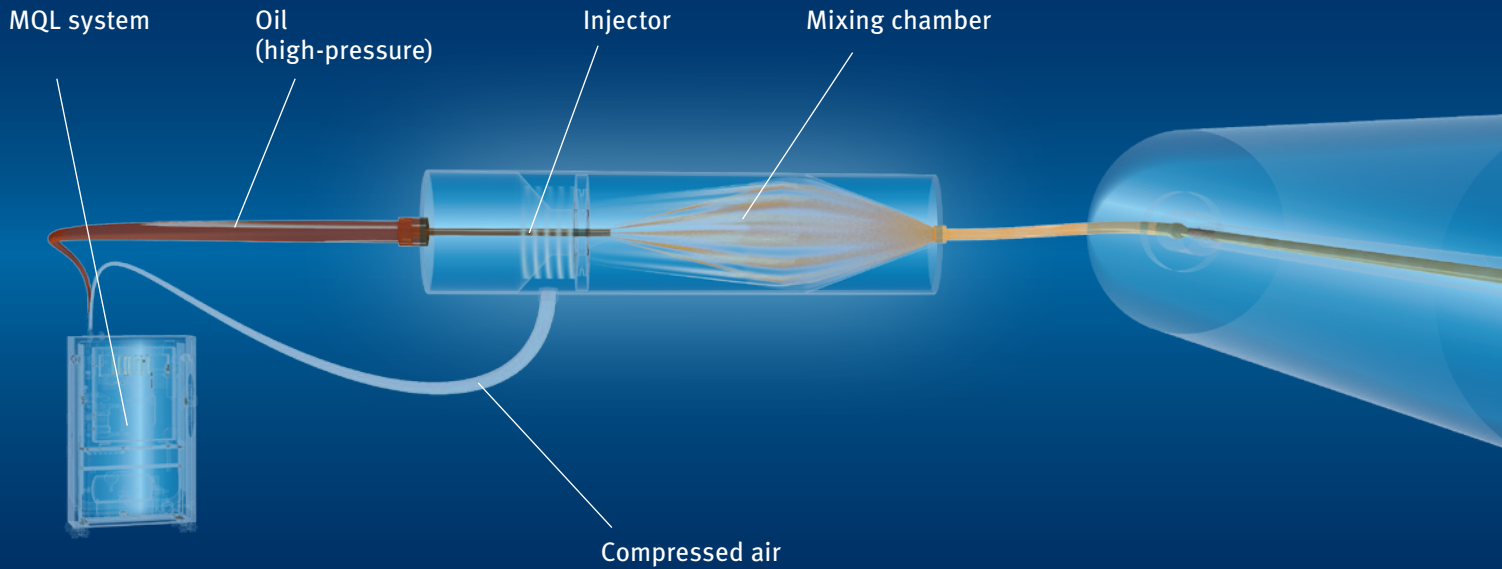
Thus the user saves both with respect to consumption and with respect to monitoring and maintenance, not to mention preparation and disposal, for the minimal quantities of lubricant evaporate almost without a trade with an optimal process. Therefore, it is less work to clean the parts to be processed.

For many applications, the process advantages due to MQL are much greater. During chipping with wet cooling lubricant, superfine particles remain in the oil and emulsion; for



KNOLL Managing Director Matthias Knoll: "There are production areas where the future clearly belongs to minimal quantity lubrication. This is why we have developed a system that works at high pressure and generates an especially fine aerosol."

Functional schematic ControLube MQL system



This is how the KNOLL ControLube MQL system works – from the MQL system to need-oriented streaming of the finest aerosol from the tool.

recycling, these compromise the surface quality and they must therefore be filtered out, a process that requires a lot of work. This is not a problem with MQL. The lubricant used is consumed completely and therefore always feeds in anew in pure quality.

In addition, the user profits from lower tool wear, which is due to the better lubrication and lower thermoshock effect (with interrupted cutting). The ideal conditions also permit faster tool feeding. Last but not least, the smaller space requirement, lower noise level, and fewer health hazards for the operator are among the positive aspects of the MQL.

Variants of minimal quantity lubrication

Now there are different MQL systems, which exhibit great variations. In particular application cases, the opportunity is taken to apply the lubricant on the tool from the outside. The device-technical effort required is low here, but unfortunately so is the desired lubrication effect. And that's not to speak of the chip discharge.

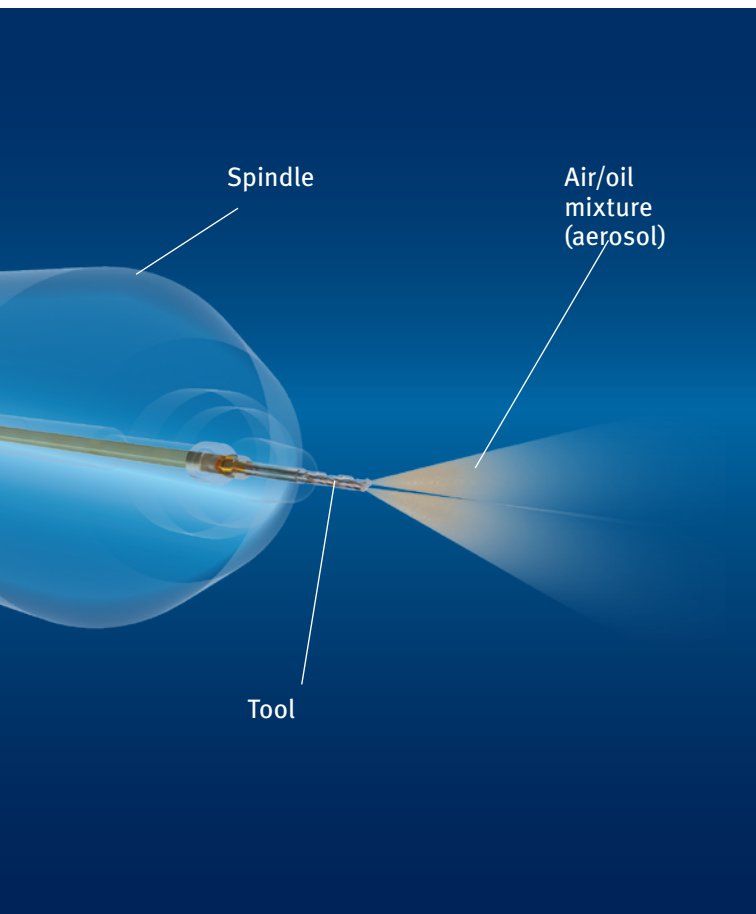
The most-used systems rely on internal feeding of the lubrication medium, that is, through spindle and tool. Here, there was previously a distinction between single-channel and multi-channel systems. While for the former the oil is added to the compressed air before the main spindle, in multi-channel systems, the mixture is made after the main spindle in the tool holder.

Both systems have their strengths and their justifications. The classic single-channel system, which goes through the spindle with a single channel, is relatively simply construct-

ed and cost-effective. It generates a relatively fine air/oil mixture (aerosol), which distributes itself evenly across all cooling channels. Therefore, even special machines can be supplied this way. Depending on the system, however, a pressure drop may be anticipated, and due to the long lines from the aerosol generation to the tool, also reaction delays. In addition, the quantity of oil that can be transported is limited.



The KNOLL ControLube MQL system includes specially-developed electronics based on microprocessor technology, which ensure short reaction times on program change and in cyclical operation, as well as offering the possibility of live monitoring.



The design of a two-channel system is much more complex. Here, oil and air channels lead separately through the spindle and the media are then mixed afterwards in the tool holder. Thanks to the separate oil lance, the oil quantity can be set regardless of the tool size and speed. However, only under optimal conditions is the mixture homogeneous.

ControLube – the best of both worlds

KNOLL Maschinenbau, Bad Saulgau, a leading supplier of conveying and filter systems for chips and cooling lubricants in the metal machining sector, has been working on minimal quantity lubrication for a while already. Managing Director Matthias Knoll argues: "There are production areas where wet cooling lubricants are on the decline and the future clearly belongs to minimal quantity lubrication. For these areas, which include cast aluminum processing in the automobile industry, we have developed a system that works at high pressure and generates an especially fine aerosol. We thus achieve improved process conditions that result in shorter processing times and lower costs for the user."

With KNOLL's ControLube MQL system, oil and compressed air are fed separately into a mixing chamber, which is right in front of the main spindle. This mixing chamber is the heart of the ControLube MQL system. For here, oil is fed into an injector, a method that has been proven over many years in the injection technology used in passenger cars. It sprays the oil into the mixing chamber under high pressure, where it is mixed with the air fed in to form an extremely fine aerosol. The extremely compressed air/oil mixture is then fed through one channel through the spindle to the tool.

Jochen Blersch, MQL Product Manager at KNOLL, explains: "Even if our ControLube system is in principle still a sin-

The strengths of the KNOLL ControLube MQL system:

- Great process security thanks to microprocessor technology with live monitoring
- Quick and precise dosing
- No recalibration necessary
- Air pressure and oil quantity can be controlled separately, also need-based
- Integrated air pressure increase up to 20 bar
- Direct machine connection via ProfiNet
- Quick and variable NC programming
- No special oil required, emulsion oil can be used

gle-channel system, thanks to the mixing chambers with their high-pressure injection and special electronics, properties are achieved that were previously associated only with two-channel systems. For example, the independent regulation of the oil and air mixture, as well as the very short reaction times." Thanks to the calibrated high-pressure injection technology, the lubrication medium is dosed quickly and precisely, and the finest oil particles are generated, which have proven themselves especially at high speeds.

Microprocessor takes over system control

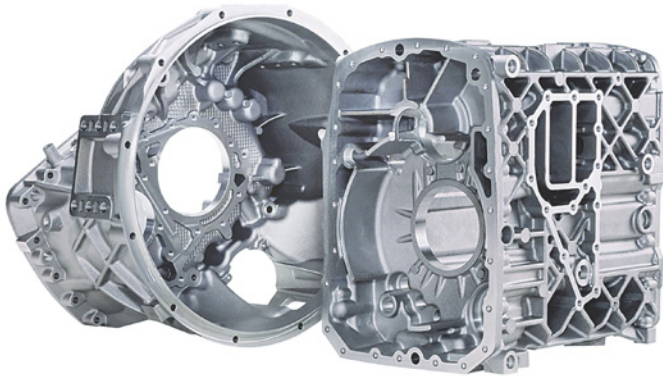
A significant component of the new KNOLL ControLube MQL system is the specially-developed electronics based on microprocessor technology, which ensures short reaction times on program change and in cyclical operation, as well as offering the possibility of live monitoring. It is connected directly to the CNC machine tool via ProfiNet or another bus system.

ControLube can be programmed variably via the CNC. For the pressure and oil quantity, it is either possible to specify fixed values or variables that depend on the tools used. Need-based regulation is also possible; it ensures a constant air supply during the processing operation (ideal, e.g. for drilling deep holes). Jochen Blersch points out that "Previous systems could only be controlled in steps. Our ControLube offers the opportunity to control the air pressure almost steplessly in the decimal range up to 20 bar and to control the oil quantity up to 400 ml/h, which also contributes to the sparing of resources."

And another strength: a KNOLL ControLube system can supply several machines or several spindles. For this, for example, a mixing chamber is mounted in front of each spindle; the MQL system communicates with these.



MQL Product Manager Jochen Blersch: "The KNOLL ControLube offers the opportunity to control the air pressure up to 20 bar almost steplessly in the decimal range and to control the oil quantity up to 400 ml/h independently of this."



The use of minimum quantity lubrication systems promises advantages above all in series manufacturing, where the processes can be attuned and adjusted optimally. Therefore, the share of MQL systems is growing especially fast in the automobile industry, for example in cast aluminum processing.

The environment makes the difference

In order to introduce minimal quantity lubrication so that it is successful from the process-technical and economic points of view, it is important, in addition to selecting the appropriate MQL system, to note various building blocks: the kind of processing, the machine tool, tool, and peripherals, and last but not least the personnel.. Preparations and qualifications for minimal quantity lubrication should be made in advance. For the employees must be in a position to adjust the process optimally and to monitor it with respect to process sequence, planning, and strategies.

The machine tool should have a diagonal and steeply-attached workspace covering as well as surfaces that are as smooth and unlacquered as possible, e.g. made of stainless steel, in order to guarantee optimal sliding of the chips. To be avoided are pipes, corners, and horizontal surfaces where chips and dust can accumulate. Careful sealing of the workspace is necessary so that no dust reaches sensitive parts such as drive and guide elements of the machine. Important also is the thermal uncoupling of the interior covering from the machine frame, so that no heat bridges form.

With minimal quantity lubrication, the heat arising due to the chipping process is not discharged via the cooling lubricant, but rather via the chips. In order to prevent a heating up of workpiece and tool, the chips should be removed as quickly as possible. MQL-optimized tools are therefore advisable, whose cutting materials, coatings, and geometries support chip breaking and chip flow, thus preventing an overheating. Jochen Blersch emphasizes the significance of short chips for the successful use of minimal quantity lubrication: "Then our ControLube MQL system can reveal its full capacity. For the air pressure increased to up to 20 bar expands it sharply at the outlet point. This creates a high streaming speed, so that the short chips are literally catapulted out through the grooves. Precisely with small tools, this is a great advantage."



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.

KNOLL Maschinenbau GmbH
Schwarzachstraße 20
D-88348 Bad Saulgau
Tel.: +49 (0) 7581/2008-0
Fax: +49 (0) 7581/2008-140
info.itworks@knoll-mb.de
www.knoll-mb.de