

### KNOLL cooling lubricant cleaning system provides process improvements for knife grinding



ZWILLING's chef's knives are of high quality, which relies on high-quality materials a time-consuming production process.

*Grinding and polishing processes are especially important in the production of chef's and kitchen knives. With a sophisticated cooling lubricant supply system, KNOLL was able to eliminate troublesome chip wool at the knife manufacturer ZWILLING and create ideal prerequisites for significantly improving the improved cooling lubricant quality. A desired side effect: less maintenance work and a more pleasant atmosphere in the working environment.*

The blade-city Solingen – this is the headquarters of ZWILLING, one of the world's largest, best-known knife manufacturers. Klaus Kroesen, Development Manager Production Equipment, explains the manufacturing process: "The blades are made of rust-proof chromium steel. First, strips are punched from the coil, heated up, and compressed. The rough contour is forged into the resulting bulge. After the contour is lasered, the blank is hardened, chilled to -70°C, and then tempered to approximately 250°C in order to give the steel the necessary elasticity in addition to hardness." After that, the blades go to the blade grinding shop, where they are given their typical blade shape. Next, there are cleaning, labeling, and assembly processes, as well as the final sharpening, which in knife manufacturing

is called "honing." The blade grinding shop is especially important for an economical manufacturing process. In the Solingen production plant, this shop includes nine robot-assisted processing cells with two grinding and polishing machines apiece. These machines grind the first and second sides and the dry-finishing (for this is what the professionals call polishing). In addition, there are two special grinding machines for grinding serrated knives such as bread or tomato knives, and two machines for fluted edges (indentations on the blade side).

#### Bad air, time-consuming maintenance, limited technology

These 40 machines have to be supplied with cooling lubricant. "Previously, we had installed three cooling lubricant circuits for this," explains Klaus Kroesen. "First and foremost, these were sedimentation basins from which the sludge filtered out was discharged by scraper conveyors. Great purity could not be achieved with these, and they needed a lot of maintenance work." In figures: the filter quality of the filtered fluid was approx. 150 µm, which resulted in a gravimetric dirt content of approx. 1000 mg/l.

## Here's how the KNOLL cooling lubricant cleaning system works for knife grinding and polishing machines

The largest element of the cooling lubricant system installed by KNOLL at ZWILLING is the sedimentation tank, into which the water from the grinding machines streams. The cooling lubricant is fed through a rough separator and then across three magnetic rollers, which fish out the long-fiber chips and most of the chip wool nests. The pre-cleaned medium runs back into the sedimentation tank, where the heavy (corundum) particles sediment. The cooling lubricant is fed by dry pumps to the main filtration stage, the hydrocyclone. For cleaning in the bypass, a KNOLL VL vacuum filter with endless belt is installed. Then the cooling lubricant flows into the filtered fluid tank, where the cooling (reversible flow filter and the heat exchanger) is incorporated. From there, the cooling lubricant medium is made available frequency-controlled (with variable pressure and adjusted delivery rate) to the blade grinding shop. A collecting conveyor brings the separated grinding sludge to a press, which processes it into pellets. These pellets are fed into the recycling and the cooling lubricant recovered by the presses remains in the circuit.



A key to success: the pre-separation via magnetic rollers.



The essential filter capacity is provided by four hydrocyclones (in housings due to the aerosol formation). Under these is the collecting conveyor for the sludge from the cyclones and over these, the piping for the cyclones.



Frequency-controlled clean coolant pumps with noise protection hoods.



Pipework of the cooler/plate heat exchanger.

Another disadvantage: because a lot of material is removed during grinding, the heat input in the circuits is high. "The temperature of our cooling lubricant was between 30 and 39°C," says Kroesen. "Thus, there could be no more talk of cooling lubricant." The high cooling lubricant temperature also made for a difficult atmosphere in the hall.

That's why the cooling lubricant supply was the stepchild of the production team. Added to this was the fact that the poorly cleaned medium stood in the way of further enhancements in the grinding and polishing process, as the responsible equipment development manager Kroesen explains: "With grinding, it is important to bring the cooling water to the grinding point purposefully and under high pressure. At that time, it was not possible technically for us to work with fine-stream nozzles since given the degree of contamination of our cooling lubricant, these got blocked after just a few hours."

In 2015, Kroesen and his team had enough of bad air, too much maintenance work, and limited processes – and they had approval to purchase a new cooling lubricant system for the entire blade grinding shop, one that was supposed to provide comprehensive improvement.

### Enough dirt!

Five providers were originally considered as suppliers. "After intensive conversations, we had the impression that KNOLL would be not just the least expensive, but also the most expert partner. Since this filter system is an extremely critical element in the production chain – if it doesn't work, we can't produce any knives – we selected KNOLL as our provider. In the end, our choice was perfect."

Among the specified framework conditions were the knife material chromium steel; grinding wheels of ar-



After cleaning, the grinding sludge discharged is pressed into pellets and the recovered cooling lubricant is fed back into the circuit.



The grinding and polishing processes in ZWILLING's knife production in Solingen are supported by cooling lubricant that is cleaned and tempered in a KNOLL central system featuring multi-stage filtration that requires no filter consumables and is then supplied to the machines. Sedimentation in the type SR sludge remover.

tificial resin-bonded corundum; a synthetic water-miscible cooling lubricant; and a grinding sludge mass flow of approx. 50 kg/h. Required was a filter capacity of up to 3300 l/min; a filter fineness < 50 µm; and an automatic fill level control and metering of the cooling lubricant. Furthermore, it was supposed to be possible to use a chilling unit to keep the cooling lubricant at a constant temperature of approx. 23°C.

After an analysis on-site and appropriate design, KNOLL installed a cooling lubricant supply system in August 2016, which consists essentially of a sedimentation and a filtered fluid tank, and for cleaning relies on hydrocyclone and bypass filtration. However, there were problems. KNOLL's Team Manager Design Systems, Tobias Engenhardt, explains:

"The different sized chromium steel chips from the grinding and polishing process and the artificial resin dust bind with one another – thanks to water-miscible cooling lubricant – to form a chip wool that does not discharge as expected. We hadn't experienced such behavior to the same extent in any other application and we weren't able to discern it during the initial stocktaking. The chip wool swam up in the form of nests, blocked the flows of the cyclones, and made the desired cleaning nearly impossible."

Here, KNOLL proved to be a reliable and especially, when it comes to filter technology, an experienced partner," emphasizes Klaus Kroesen. Tobias Engenhardt and his colleagues didn't hesitate to focus on making appropriate improvements, as Kroesen confirms: "We worked with KNOLL to search for a solution, formulate suggestions, agree on and then implement these."

### Two additional cleaning stages produce the desired success

While grinding operation was ongoing, the people from KNOLL modified the system in two steps. First they installed magnetic rollers to pre-separate the long-fiber chips – which works since the chromium steel is ferritic and therefore can be magnetized. To ensure the perfect function of the sensitive plate heat exchanger in the cooling system, KNOLL also added an additional filter stage with an upstream reversible flow filter.

This combination, flanked by a few other smaller measures, produced the desired success. Klaus Kroesen and his team



16,000 blades pass through the blade grinding shop every day. There, the laser-cut blanks (top) are ground and polished.

# KNOLLREPORT

## AT ZWILLING J.A. HENCKELS IN SOLINGEN



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are very satisfied with the result: "The system has run flawlessly since then and it fulfills all of our specifications. Thanks to the high quality, purity, and controlled temperature of the cooling lubricant, we can tackle the planned process improvements. We have already installed a high-pressure pump and optimized the grinding parameters with regard to higher power. Furthermore, we are testing alternative grinding wheels and a few more things for which our hands were previously tied."



Klaus Kroesen (left), Development Manager Production Equipment at ZWILLING in Solingen, praises the commitment of KNOLL Team Leader Design Systems Tobias Engenhardt and his team: "The support that we received due to start-up problems with the KNOLL cooling lubricant filter system has earned the company our greatest respect. We have never received comparable support from another supplier."

Kroesen mentions another advantage of the system: it can be run without an operator. This is possible thanks to the lack of consumables for filtration and automated refilling of the cooling lubricant when the fill level gets low. Of course regular maintenance is required nevertheless. For due to the highly abrasive grinding material corundum, the wear of individual components is unavoidable. KNOLL's Team Leader Design Engenhardt points out that his company actively works against wear by making the affected

components of highly wear-resistant steel, "but with such grinding systems, material discharge cannot be prevented. This is where service programs and contracts are recommended and when unusual problems occur, of course we're on the job." People at ZWILLING are convinced of the necessity of preventative maintenance. In the end, system availability should be as great as possible, for without filtration, there are no knives.



### KNOLL Maschinenbau GmbH

KNOLL Maschinenbau ranks among the leading suppliers of systems for conveying and filtering chips and coolant in the metal machining industry. 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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### ZWILLING – one of the world's oldest brands

ZWILLING J.A. Henckels, Solingen, is a company in the cutlery and household goods industry. Its products include, among other things, chef's knives, scissors, cooking pots, cutlery, and, starting this year, small electrical appliances. The Solingen cutler Peter Henckels entered the Zwilling trademark in the Solingen list of cutlers in 1731. Today, the internationally oriented ZWILLING Group, which has belonged to Neusser Wilh. Werhahn KG since 1970, employs 3800 people around the world.

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