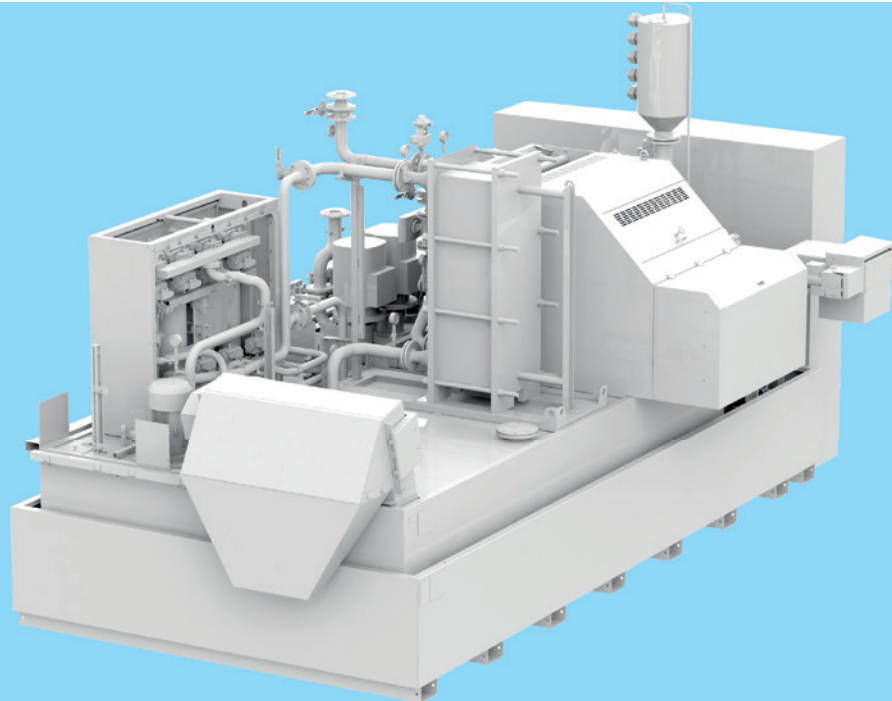


MicroPur[®] versus precoat filters

Backflushable superfine filter systems are replacing precoat filters in hard metal, HSS and cast material grinding



The modular KNOLL MicroPur[®] superfine filter can be scaled to meet virtually any requirements and used in a wide variety of systems. You can see a system with an output of 480 l/min in the image.

Companies that want to compete in the metalworking sector have to pay attention to ongoing costs. There are now powerful alternatives to conventional, expensive precoat filters for cleaning superfine particles out of grinding oils. These alternatives can achieve filter fineness less than 3 µm and do not use filter consumables. The MicroPur[®] superfine filter from KNOLL Maschinenbau is particularly efficient.

For a long time, precoat filters were the only real option for grinding oil cleaning in hard metal, HSS and cast material processing. There was no alternative to expensive filter systems that rely on auxiliary filter materials such as diatomite and cellulose. But the high levels of consumption, subsequent disposal and the amount of oil soaked up by material led to high costs. There is also the health hazard posed to employees due to fibers that can be inhaled in the form of dust.

But in recent years, other superfine filter systems have seen considerable development, such as the MicroPur[®] filter from KNOLL Maschinenbau, Bad Saulgau that does not use filter aids. Instead, it contains backflushable filter cartridges like the ones used in other areas of oil filtration. This allows it to reach a nominal filter fineness of 1 to 3 µm, which fulfills the strictest requirements. In combination with an integrated sludge concentrator, the MicroPur[®] can achieve a residual moisture down to four percent in the sludge (in HM). These types of dry chips can generally be sold as recyclables. At

the very least, you will not incur any disposal costs. Disposal costs for wet sludge often exceed EUR 200/t.

"In the near future, backflushable systems such as the MicroPur[®] will substantially reduce the use of precoat filters in grinding oil cleaning for economic reasons," says Karl-Rudolf Vogel, Team Leader of Development at KNOLL, with confidence. "This has already happened for hard metal grinding, and this process is underway for HSS. We have even seen significant success in its use for cast materials in a short period of time."

Time for a system change

There are several reasons for this changing of the guard for filter systems. The most important is the efficiency, which goes hand in hand with environmental considerations. Even acquiring a filter system that operates based on the precoat principle is more expensive than acquiring one with back-



The core element of KNOLL MicroPur[®] superfine filters is the filter cartridges that are regularly backflushed in an open-loop system. In case of wear, they can be replaced cleanly and in a very short time.

flushable filter cartridges. Handling the filter aids requires additional peripheral equipment. These requirements include the bag infeed, the automated and protected system for emptying the bags so that dust does not escape, fulfillment of legal explosion protection directives, and the required agitator for fluidization of the auxiliary medium that has to be applied as uniformly as possible to the filter cartridges. The system (complete with peripheral equipment) requires a larger installation space than a comparable system with backflushable filters.

But the incidental costs are what truly make a precoat filter expensive. This is because the auxiliary medium has to be changed up to several times each day. This type of filter system may very well require five tons of cellulose per year and per grinding machine. The costs are not limited to purchasing auxiliary material. This material also requires disposal, as do the grinding oil and chips bound together with high adhesive strength. This means that there are additional costs for disposing of the sludge and replacing any displaced oil. Separating the individual components is extremely time-consuming, expensive and can only be achieved through the use of chemicals.

Precoat filters without a constant level of clarity

Filter systems with precoat filters also have process-related disadvantages. Firstly, the flow of the auxiliary filter medium to several filter cartridges during application leads to an uneven coat, especially in large systems. Finally, the filter cake needs to be compacted by an accumulating dirt layer. Until this has happened, medium and coarse particles up to 20 µm in diameter and 300 µm long, such as chips, can slip through the filter. This type of contamination can cause significant damage to machines with oil-based spindle cooling. In such cases, an additional police filter is connected upstream. However, this also increases the system and maintenance costs. After a specific time period, the desired level of clarity is achieved, which is generally less than 2 µm (which is undeniably a good value). This is also a value that modern backflushable KNOLL filters with intelligent control technology can achieve. The main advantage of the MicroPur[®] is a much

more constant level of clarity, meaning that no police filters for spindle cooling need to be installed.

How the MicroPur[®] works

The core elements of the MicroPur[®] are its filter cartridges. Due to their star-shaped folding, these special elements have an especially large filter area with a cleaning output of approximately 60 l/min per cartridge. Generally, the cartridges are installed in a housing in pairs. Therefore, in the MicroPur[®] 480 standard filter, there are four housings, which are double-fitted. The filter cartridges can be flushed individually with cleaning oil without interrupting the filter process – a central feature of this filter. In order to achieve as effective a backflushing as possible, KNOLL uses a special flushing pump. This results in a longer service life for the filter cartridges and lower maintenance costs. The backflushing process takes less than four seconds per filter cartridge, so it does not affect the total output.

It takes a lot of time and effort to regenerate precoat filters when they need it. The respective container has to be completely removed from the system and a replacement needs to be available while the filter is being rinsed and recoated. The cleaning oil tank must be large enough to cover the cleaning oil demands of the machine during regeneration.

Filter systems in all sizes

KNOLL offers the MicroPur[®] superfine filter in different performance classes and as central systems in freely-scalable sizes. The smallest model is the MicroPur[®] Mini. It is a mobile filter column, which can be moved from machine to machine for mobile cleaning in order to satisfy cleaning requirements. However, the MicroPur[®] Mini does not have a backflushing system, but rather a one-way filter cartridge.

The current standard models of the MicroPur[®] begin with the MicroPur[®] 60, which has a backflushable filter cartridge. Accordingly, sizes 120, 180, 240, 360, 480 contain additional filter cartridges. The numbers correspond to the cleaning

KNOLL's MicroPur[®] sets standards:

- Intelligent filter control system for fulfilling the toughest requirements in microparticle separation
- A filter housing designed to create a swirling effect ensures uniform filter cake accumulation
- Effective backflushing with cleaning medium thanks to a separate pump, resulting in a long service life for the filter cartridges
- Very short backflushing times < 4 s without air, therefore great energy efficiency without filter interruption
- Display of the differential pressure on each filter housing and control panel; thus direct localization of damaged filter cartridges
- Differential pressure for regeneration can be set on each individual filter housing; this guarantees optimal filter quality
- Filter cartridges in tandem arrangement; thus less space required and fast replacement times
- Drip-free filter change < 1 min; less maintenance and cleaning work required
- Flexible, modular filter system. Filter can be installed in narrow spaces
- High-performance sludge treatment with < 4% of residual moisture in any container system

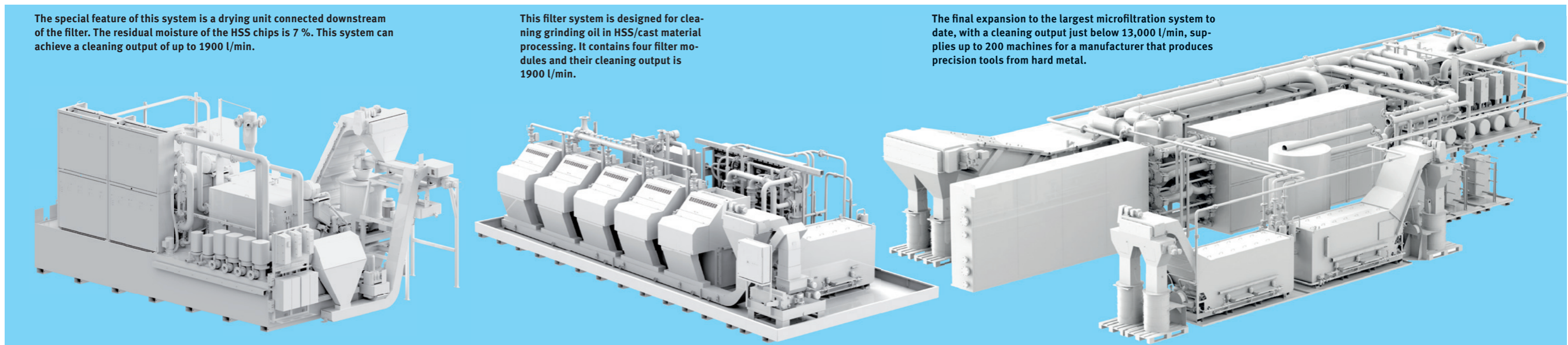
output in liters per minute. Starting at 480 l/min and above, a clever, modular system is used.

Frequently, the KNOLL MicroPur[®] filter is used in individually-configured, central filter systems for entire production areas. The largest current system is designed for a cleaning output of nearly 13,000 liters per minute. It was developed for a precision tool manufacturer, who will connect it in the final expansion stage of its milling production to up to 200 metal carbide grinding machines.

The special feature of this system is a drying unit connected downstream of the filter. The residual moisture of the HSS chips is 7%. This system can achieve a cleaning output of up to 1900 l/min.

This filter system is designed for cleaning grinding oil in HSS/cast material processing. It contains four filter modules and their cleaning output is 1900 l/min.

The final expansion to the largest microfiltration system to date, with a cleaning output just below 13,000 l/min, supplies up to 200 machines for a manufacturer that produces precision tools from hard metal.



MicroPur[®] versus precoat filters

Another strength of the MicroPur[®] is seen in large systems. The control system developed by KNOLL, complete with the required sensor technology, enables you to activate and deactivate individual filter housings (with two filter cartridges and a 120 l/min output) as needed. "This allows us to always generate the filter area required for the amount of dirt that accumulates, ensuring that the filter cake accumulation is optimum and the level of clarity is constant," explains Karl-Rudolf Vogel. In addition, each filter housing is monitored for differences in pressure. This enables operators to quickly display faults on the system control display or remotely on the computer, and to implement countermeasures.

The path to success leads from HM and HSS to cast materials

KNOLL Maschinenbau, a specialist in cooling lubricant filters and pumps, has already installed many MicroPur[®] systems for various applications over the last few years. This started with hard metal grinding, specifically for tool production. The high-efficiency of backflushable filter systems free of auxiliary materials led to the spread of this technology. As a result, KNOLL soon set its sights on oil filtration for HSS grinding. Excellent results were also achieved in the HSS sector thanks to modified filter cartridges in the MicroPur[®] superfine filter and the combination with pre-filtration using an endless filter belt that separates long-fiber chips exceeding 20 µm. The separated chips can easily be compressed, allowing most of the residual oil to be removed from them. The fine sludge that passes the filter belt is conveyed to the MicroPur[®]. This filters the oil in the filtered fluid tank. Then it is pumped back to the machines. Now there are applications with several large production systems connected to these types of central filter systems.

For a few years now, MicroPur[®] filter concepts have also covered cast material grinding. The long fibers in these materials do not pose a problem, but byproducts such as silicon and graphite do. They quickly soil the filter surface. But the available filter media have since improved. In addition, KNOLL has developed an intelligent process technology that, "binds silicon in the filter cake so that it cannot reach the filter mat," explains Team Leader Vogel. "This provides significant potential for savings in oil cleaning compared to precoat filters and using cellulose as a filter consumable." Tests, including a three-year field test in which a MicroPur[®] 480 filter was used for a rotor grinding machine, show that this technology works. The cost comparison revealed that the operator saved a five-figure sum per year (in euros). This is also due to eliminating the need for consumables, the minimized oil discharge, lower costs for changing police filters, etc.

As illustrated in the precoat filtration cost comparison, microfiltration with MicroPur[®] pays for itself in a short amount of time.

Betriebskosten auf Grundlage eines dreijährigen Feldtestes

Kosten in €/Jahr bei ca. 5,5 t Zerspanungsgewicht	Kosten Anschwemmfilter	Kosten MicroPur [®] KNOLL
9 t Anschwemmmittel (1,62 €/kg)	14.580 €	–
2,8 t verschlepptes Öl in Cellulose bei 24 % Restfeuchte (2,60 €/kg)	7.280 €	–
11,8 t Entsorgungskosten Cellulose und Öl (200 €/t)	2.360 €	–
Arbeitsaufwand Filterwechsel, Cellulosehandling	3.690 €	120 €
Filterbeutel, Filterelemente	1.800 €	2.800 €
Entsorgungskosten, Ölverschleppung Filterelemente	–	60 €
Gesamtkosten	29.710 €	2.980 €

Ersparnis durch Micro-Filtration pro Jahr: 26.730 €

Technische Daten

Werkstoff:	GJS500, GJL250
KSS:	Öl
Viskosität:	26 mm ² /s bei 22 °C
Filterleistung:	460 l/min
Filterfeinheit:	< 5 µm
Restschmutzgehalt:	< 5 mg/l



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.