

## Diebold-JetSleeve™ 2.0, the second revolution in CNC milling



JetSleeve™ 2.0 shrink chucks are used in high-speed machining, heavy-duty machining, general machining, mold making and micro machining. At Diebold's own production facility we use JetSleeve™ 2.0 on all machining centers, even on lathes and turning-milling machines, achieving a total of 35% better cutting performance through better tool life, better surface finish and higher workpiece accuracy. When using JetSleeve™ 2.0 you can save a lot of time and money. Adding up all the benefits of the innovative product, you can save 1 euro per minute of work, a fact that JetSleeve™ 2.0 user value, but do not like to tell.

JetSleeve™ 2.0 was won several awards in the categories innovation, environment and design.

### Milling replaces EDM

In tool and die industry, EDM works can be replaced by milling which will save a lot of money. With JetSleeve™ 2.0 shrink chucks mold contours can be milled instead of erosion and contours can be largely finished without additional polishing works.

Milling in deep cavities and holes or pocketing causes problems when the chips cannot be removed from the cavities by the common machine coolant. This often leads to early cutter wear or cutter breakage with all the resulting consequences. To solve this problem, JetSleeve™ 2.0 shrink chucks have been developed.

The Diebold designers first came up with the idea of screwing an aluminum sleeve with integrated nozzles over shrink fit holders. JetSleeve™ 1.0 was born and could automatically be loaded like a normal tool holder into the machine spindle without changes on the machine. Before Diebold produced the "medium distributor system", where a coolant distributor housing had to be attached to the spindle nose and the tool magazine hat to be modified.



Comparison JetSleeve™ 1.0 and JetSleeve™ 2.0

The ingenious Diebold designers, however, managed an even better development: the JetSleeve™ 2.0: the previous aluminum sleeve was replaced by a TiN-coated ring in the size of a wedding ring - just like a classic Diebold gold ring, as to be found on other tool holders from the Diebold tool holder range. The stroke of genius is that this ring for the shrink process no longer has to be removed, it remains firmly fixed on the holder. The ring is made of the same material as the tool holder and is as temperature resistant as the holder itself. The tiny nozzles are still incorporated at the front of the ring, spraying coolants, an oil-air mixture or air only to the tip of the cutter.



Diebold's application engineers and distribution partners assist their customers when they start using JetSleeve™ 2.0 or accompany them during the transition from EDM to milling. Together we search for the best savings potential. The JetSleeve™ 2.0 holders for the respective machine taper are available for testing. In central Europe the Diebold service mobile comes into use. The demo van is equipped with chucks of all taper types and sizes, shrink fit machines and measuring instruments for accuracy checks.



## Diebold Service-Van

### JetSleeve™ 2.0 with ATS lubrication and cryogenic cooling

The JetSleeve™ 2.0 shrink chucks work with air only, coolant or air-oil lubrication. A modified air/oil version with modified nozzle rings now makes it possible to work with ADS (aerosol dry lubrication). ADS is the improved solution of the well-known minimum quantity lubrication MMS, but works with significantly smaller aerosol particles. A real breakthrough in high-speed machining. Thanks to the specially developed inner contour of the JetSleeve™ 2.0 tool holders for ATS, minimum quantity is available at all times, even immediately after a tool change and at high speeds.



## Rother Aerosol Master 4000

Diebold supplies the innovative injection equipment from Rother for aerosol delivery and assists the user in the correct setting of these lubrication units. Another innovative step is cryogenic cooling, where liquid CO<sub>2</sub> is sprayed through JetSleeve™ chucks. When milling high-strength materials, cooling with an emulsion is usually not possible at all because the highly stressed cutting edges suffer a thermal shock and fail. This is avoided by cryogenic cooling and achieves incredible lifetime improvements at very high cutting values.

**This technique will revolutionize the machining world**

Lubricating and cooling with emulsion is becoming increasingly expensive. New legal requirements force the manufacturers of cooling lubricants to change their formulations. Many users are already aware of this because their lubrication processes no longer function as usual and often workers have skin problems. This leads to immense cost increases because coolant has to be exchanged, re-tested and cutting data changed or even tools have to be replaced. Skin problems of the workers lead to illness-related absence.

Now is the time to switch to ADS dry lubrication and cryogenic lubrication. What used to seem unsolvable is now possible to get away from the classic machine coolant. Coolant cost is an average of 7 % on the cost of the workpiece. A large part of this can be saved. Every user may calculate for himself which cost reduction per machine can be achieved.

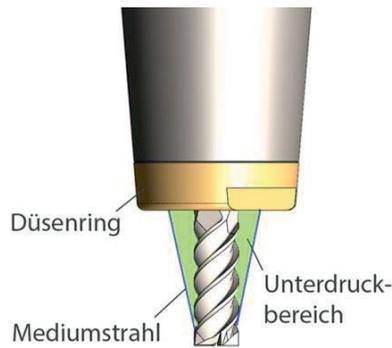
**JetSleeve™ 2.0 in mold making**

When JetSleeve™ 2.0 holders are used to machine difficult-to-access pockets, slots and cavities, there will always be lubrication and cooling at the cutting tool, and the chips are blown away at high speed by the high pressure immediately after they break. Chips will no longer be overrun by the cutter. Cutter break caused by overrunning the chips is now impossible. This increases the cutter life by 100 to 300 %. A time-consuming and problematic re-entry into the interrupted milling program due to cutter breakage or premature wear is eliminated. The unmanned production is much easier to achieve for these reasons.



JetSleeve™ 2.0 inner contour

The cooling medium is passed through the patented JetSleeve™ 2.0 shrink fit holder. Through the tiny nozzles in the jet ring the cooling medium is accelerated and sprayed with high pressure to the shaft of the milling cutter. The Venturi effect keeps the mixture at the tip of the cutter so lubrication is always available and the chips are blown away in milliseconds. The special design of the inner contour of the chuck and the close position of the bores at the center of rotation of the chuck prevent the air-oil mixture from segregating at high speeds. This well-known problem of MMS systems is solved with ADS and JetSleeve™ 2.0, because the viscosity and the mixture of lubrication remain constant at all speeds.



### JetSleeve™2.0 principle

Enthusiastic users like the company Joma Polytec from the neighborhood of Diebold report about a successful change from eroding to milling. Joma Polytec employs 480 people worldwide with a turnover of € 97 million. Joma Polytec manufactures automotive parts made of high-temperature plastics. The in-house tool shop is challenged to provide the most innovative and highly accurate molds for production. "Our toolmaking is geared to all types of thermoplastics: from Peek, PA, POM, ABS, TPE to TPU, we have to master the entire range in terms of machining technology," says toolmaker Robert Wagner. Long runtimes of the tools with faster cycles are required for shorter lead times of the production of injection molds. In detail, the geometries and surface qualities of the contouring components of the injection molding tool must be improved.



"Our approach began two years ago: not only do we want to machine soft tool steel but also hardened materials up to 62 HRC. That's why we invested and standardized," explains Robert Wagner. Firstly, we invested in the high-precision machining center High Speed Eagle V9, which OPS-Ingersoll recommends equally for machining steel parts and graphite electrodes.



Robert Wagner, Head of Toolmaking at Joma Polytec and Adrian Lücking

On the other hand, Joma Polytec standardized the tools. The toolmaker has completely changed its shrink fit chucks to JetSleeve™2.0, that are supplied by Diebold from Jungingen, 10 km away. "The benefits of these shrink chucks are the consistent length and the ADS Goldring Nozzle. The ADS aerosol supplied by the Rother lubrication unit has the charm that it is barely noticeable and above all leaves no sticky remains in the machine and on the tools," reports Robert Wagner.



Standardized tooling with JetSleeve™2.0 shrink chucks

This is ideal because Joma Polytec machines 40% steel on the OPS machine. The rest is graphite. Graphite machining is done with air only and the chips are blown away with the compressed air through the gold ring nozzles. "The ADS processing actually makes the machine even cleaner, because the chips are blown away too. The cleaning cycles and interruptions otherwise required with full-flow cooling are reduced to a necessary minimum", reports Robert Wagner.

**Good cooling, no thermal shocks, no micro-breakouts**

"We are now up to 36,000 revolutions with Jet-Sleeve™ 2.0. Thanks to the continuous good cooling, thermal shocks are prevented, as well as micro breaks on the solid carbide tools, which also allow us to use the aerosol for tools with indexable inserts," explains Robert Wagner.

Of course, Robert Wagner emphasizes the cost advantages as well: with the ADS solution from Rother and Diebold, Joma Polytec only needs 10 % of the oil quantity that a standard MMS system would require, estimates production manager Robert Wagner. This significantly lower consumption results above all from the finer aerosol particles, which are not larger than 1 µm in the ADS system. "Second advantage of the fine particles is that no segregation can occur at all. The particles are just too finely distributed and too tiny.

**Pilot Tool for Test of ATS JetSleeve Function**

What the gold ring JetSleeve™ 2.0 brings to the surface quality, however, is illustrated by Robert Wagner using a test tool from 1.2343. "The challenge was milling a spiral directly into the hard with a 1.75mm cutter to a depth of 23 mm with a glossy finish. To bring in a spiral in 52 HRC, we would have had to erode and polish the required surfaces. Now the spiral is completely milled and only adjacent parts are eroded. "The fact is, without the Jet-Sleeve™ from Diebold we would not have been able to get these surfaces with Rz 0.1 µm, says Robert Wagner. This is like polished! "The condition for this is that the ADS works without delay and the aerosol is immediately at the cutting edge at the first chip. "When milling, we also achieve much smoother surfaces than when grinding with corundum, in which the surface repeatedly has grain outliers. If possible, we mill the contour area and all external dimensions on the OPS machine," explains Robert Wagner.

**Eroding effort will be significantly reduced by milling**

With the OPS machine we achieve the necessary surface qualities. In addition, it was important for us to mill the tool almost completely in one clamping. In the future, this will save us a lot of re-clamping, multiple measuring and eroding - and in the future we will be able to run such processes all night long," says Robert Wagner, emphasizing the great potential for toolmaking at Joma-Polytec. The EDM process will be reduced to a large extent by milling the molds on the OPS Ingersoll machine. Only sharp corners need to be eroded if necessary.

**Shrinking takes only three to five seconds**

According to Robert Wagner's experience, the Diebold system also offers great advantages when shrinking the standardized tools because shrinking takes only 3 to 5 seconds. This time saving comes from the lower process temperature of only 350 to 400 °C and the shrink chucks keep their high concentricity much longer. Reason enough to introduce the Diebold system to Joma Polytec across the board: "At the moment we have about 100 standardized steel and graphite cutters in the tool management. Around 60 will be running with the JetSleeve™ 2.0 Goldring system in the future, which has proven to be absolutely worthwhile", summarizes Robert Wagner.

JetSleeve™ 2.0 has a few more advantages: Because the aluminum sleeve has been replaced by a ring, the nose part of the shrink fit chuck side has a higher wall thickness, i.e. more mass, resulting in a higher holding force for the cutter, a higher vibration dampening and less imbalance are added. For shrinking no aluminum sleeve must be removed, the shrinking is performed with the Jet Ring on the holder. The nozzle ring is made of the same material as the holder body and it is additionally TIN-coated. This makes the nozzles more resistant to abrasion by high pressure media. The nozzles do not wear out and therefore the diameters or the angle of attack do not change.

With the innovative JetSleeve™ 2.0 a workpiece can be completely milled in one operation with all difficult machining operations, replacing eroding completely.



JetSleeve™ 2.0 applications