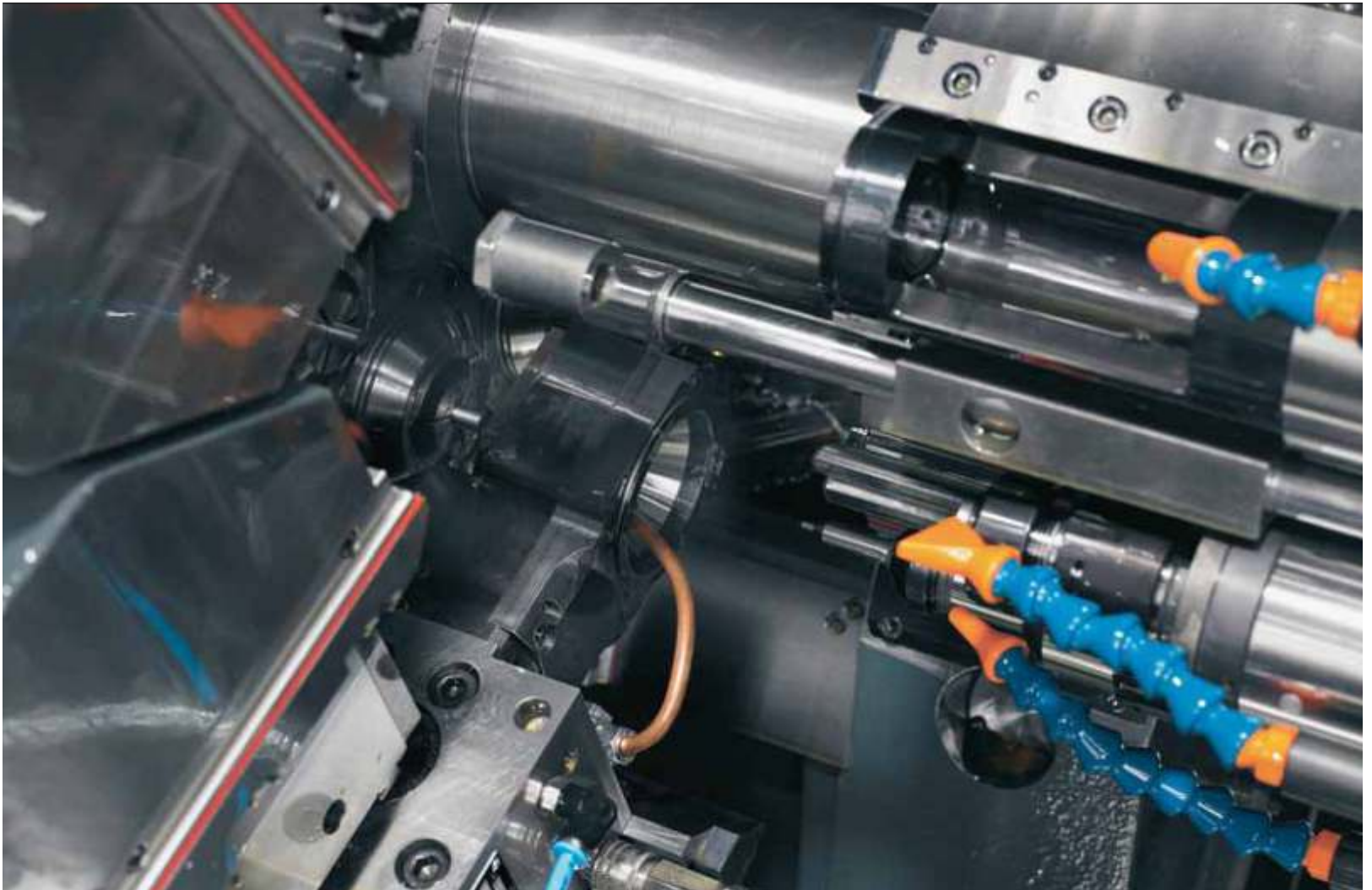




# decomagazine

THINK PARTS THINK TORNOS

54 03/10 ENGLISH



**EvoDECO 16:**  
New type  
of drive system

**More Power,**  
Flexibility, Capacity  
& Precision

**"25 years of  
Micro Precision"**

**Relaxation and  
discovery as time  
ticks by**

**UTILIS®**  
Tooling for High Technology

**WERKZEUGE FÜR DIE MEDIZINALTECHNIK**

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Two new automatic lathes with eight spindles

Hydromat Inc. in U.S. takes "Dream Team" to third IMTS this September

Precision forceps for endoscopic interventions

To be where things happen...

## IMPRESSUM

Circulation: 14'000 copies  
 Available in: English / French / German / Italian / Swedish / Spanish  
 TORNOS S.A.  
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# Medical Industry

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## THINK DONE-IN-ONE

Tornos is the singular source for productivity, Swiss precision, service, and support.



If you want to get your productivity flowing like never before, there's only one company to turn to. Since 1880, Tornos has been forging the path for the Swiss turning industry. And now, Tornos has more to offer than ever. Not only does Tornos have the finest Swiss turning machines in the world, but now, the company also offers the finest Swiss horizontal and vertical bar milling machines, high speed machining centers, and rotary transfer machines. All these diverse technologies from one source. All with Swiss-made quality and precision. And all backed by Tornos' first-class service and support.

### Why "one source"?

#### One operation: dropping parts complete.

One large benefit of a Tornos is being able to drop parts complete in one operation. One key Almac customer (a world-renown dental parts manufacturer), has experienced this first-hand. Where they used to rely on separate drilling, de-burring, and polishing stations to finish a part after it was machined; now they feed bar stock into one side of their Tornos machine and get ready-to-ship parts out the other

side. Dropping the parts complete on one machine saves time (since they no longer have to transfer parts from pre-setter to milling machine to drilling machine, and then to de-burring, cleaning and buffing stations); but they are also saving the maintenance and labor costs on those secondary machines. And they've greatly reduced the scrap that was inevitable with all that moving around. The Tornos equipment they purchased – Almac bar milling machines – had the capacity and axes of movement they needed to fit ALL the tools necessary to complete the part in a single operation. And the surface finishes achievable completely eliminated the need for separate finishing processes. Being able to drop parts complete in one operation has transformed their business to such a great extent that they have purchased 19 Tornos machines in 2 years!

#### One modular machine.

If having one machine that can perform all the processes you need on a part in a single operation is a good thing... then having one machine that can grow with your business to handle all your parts in

## Editorial

the future is like getting icecream with your cake. This is something Tornos has always done well – and it's still true with the Tornos Almac line additions. One versatile machine can carry you from initial part print to all those you encounter down the line in the future. Almac machines, like all Tornos equipment, are truly modular, single source systems. Here is an example: Let's say you've got a precision part about the size of a watch face to cut from hard steel or noble metals. You start by choosing a rigid machine – a cast iron base is ideal for reducing vibrations. You determine

your workzone so they don't affect your accuracy. So you might choose an optional integrated oil mist extractor, heating cycle, or coolant system with refrigerator. You can add these at any time in the future – without retrofitting or downtime. Finally, an optional articulated arm for parts removal lets you carefully collect your finished part so that nothing happens to mar its perfect surface finish and dimensions. For your next job, you may realize you need different tool holders and attachments – not to worry; Tornos offers an impressive selection from NC tilting head and block



Scott Kowalski, President Tornos Technologies USA

*“One Tornos customer, a large dental manufacturer, purchased 17 Almac milling machines from Tornos over the last two years. They were impressed with the machines’ Swiss precision and done-in-one capabilities. When they found out that Tornos turning centers offered the same level of precision and modularity for larger part diameters, they also purchased a Tornos Delta and Deco 20a and integrated the machines together.”*

how many axes you'll need to cut your part efficiently. Three axes will do for most parts; but those with lots of angles will need a few more axes to be able to approach the part from a direction that will conserve motion (and thus time and wear) and raw material. You'll want to make sure those axes of movement are smooth, fluid, and accurate. For this, you'll select ball screws with precision guideways – and you'll make sure those axes of movement are driven by AC brushless motors for positioning speed, and long, reliable life. You'll want to make sure the cutting spindles – the heart of the machine – are the best available: fast, powerful, and accurate. You'll make sure the control on the machine makes sense to you – that you can understand the interface and easily find the software tools you need to command the mechanical movements. All these things are standard on Tornos' Almac FB series.

Then, when you put tools in the machine to do your cutting, you'll want this to be easy to do; and, ideally, you'll want to make sure you can fit all the tools you'll need to cut your part in one setup. Again, this is SOP on the Almac FB series. When you're cutting your part; scrap material, mist, and heat will be created and you'll want those things to be carried away from

spindle for 6<sup>th</sup> face machining, to a vertical block spindle attachment with high frequency spindles.

A versatile Almac milling machine from Tornos lets you very easily grow your operations from simple (but perfect) 3-axis parts, to any 6-axis part you can imagine. And if you opt for an Almac CU 1007 vertical machining center, you don't even have to stop there. When you're incredibly successful and your customer places a large production order, a 6-axis robot that will integrate perfectly with your CU 1007 machine and give you unbeatable autonomy of movement in loading, unloading, palletizing, deburring, buffing, flipping and reloading your machine. Adding a second machine as a mirrored unit creates a cell with two machining centers flanking your robot in perfect integration. The Swiss Almac machine line will impress you from the starting blocks... but its modularity will keep you coming back for more. Got a special project that doesn't fit any of our existing products? We're flexible – our modular approach means we can build a custom Almac solution just for you!

*“Customers who have seen demos on the Almac machines are learning about the difference between high speed milling and high performance machining,”* notes Scott Kowalski, President of TTUS. *“Any*

machine can go fast in a straight line, but throw a curve or steep climb at it and you'll quickly see what high performance means. Almac high performance machines are built from the ground up to enable 80,000 rpm speeds and true 1G acceleration/deceleration – they aren't simply milling machines with high speed spindles tacked on. The kinematics of the Almacs are designed for versatility and high performance: from surface finishes to extreme tolerances, to tool life utilization. All while maximizing unattended operation."

**One global provider:  
for machines, service, and support**

The Almac product line is manufactured in La Chaux-de-Fonds, Switzerland. Its Swiss-made quality, like that of all other Swiss built Tornos machines, is evident in the machines' rigid construction and very high precision output. The complete Tornos/Almac product range includes horizontal milling machines with 3 or more axes, vertical milling machines, high speed machining centers, and rotary transfer machines. All Almac machines are backed by Tornos' global first-class service and support team.

Says Scott Kowalski: *"The Almac line is very well respected in Switzerland and enhances the Tornos product portfolio here in the U.S. and abroad. These machines are the high speed, ultra- or nano-precision solutions that many of our customers have been seeking for years.*

*"Customers like that they can drop the parts complete without secondary and tertiary operations. The 5-axis milling machine with 80K rpm has an ROI of less than 12 months! One customer purchased 17 Almacs for their dental applications in the last 2 years. They also bought two Tornos machines – a Delta and a Deco 20a – to manufacture instruments. More and more customers are looking for one source for service and support globally and they're getting it with Tornos."*

So, whether you need the best Swiss turning machine or the finest Swiss horizontal and vertical bar milling machines, high speed machining centers, and rotary transfer machines, Tornos is the source for Swiss-made quality, versatility, precision and world-class service and support.

*"The word 'singular' means 'one'," says Mr. Kowalski. "But it also means 'one-of-a-kind', 'remarkable', 'exceptional', 'unique'. That is why it is said: Tornos. The singular source for Swiss precision."*

Scott Kowalski



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**(GB)** This is the Toolholding System for a success and production encreasing workflow on Tornos MultiDeco Automatics and others.

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**(D)** Hier ist Ihr Erfolgssystem für den hochproduktiven Workflow der Tornos MultiDeco-Mehrspindel-Drehautomaten und anderer Hersteller.

Durch GWS-Werkzeughalter gehören die unproduktiven, werkzeugbezogenen Stillstandzeiten der Vergangenheit an. Sonderlösungen eröffnen Ihnen weitere, individuelle Optimierungspotenziale.

**Warten Sie nicht länger!**



## TWO NEW AUTOMATIC LATHES WITH EIGHT SPINDLES

**Tornos offers a large range of automatic multi-spindle lathes with both 6 and 8 spindles delivering solutions perfectly suited to machining small to medium diameters. Although machines with 6 spindles are perfect for machining complex parts at high output rates with diameters of 1 to 32 mm, the provision for more work stations has been limited to 24 mm - until now. With its new MultiAlpha and MultiSigma 8x28, Tornos is meeting this demand.**



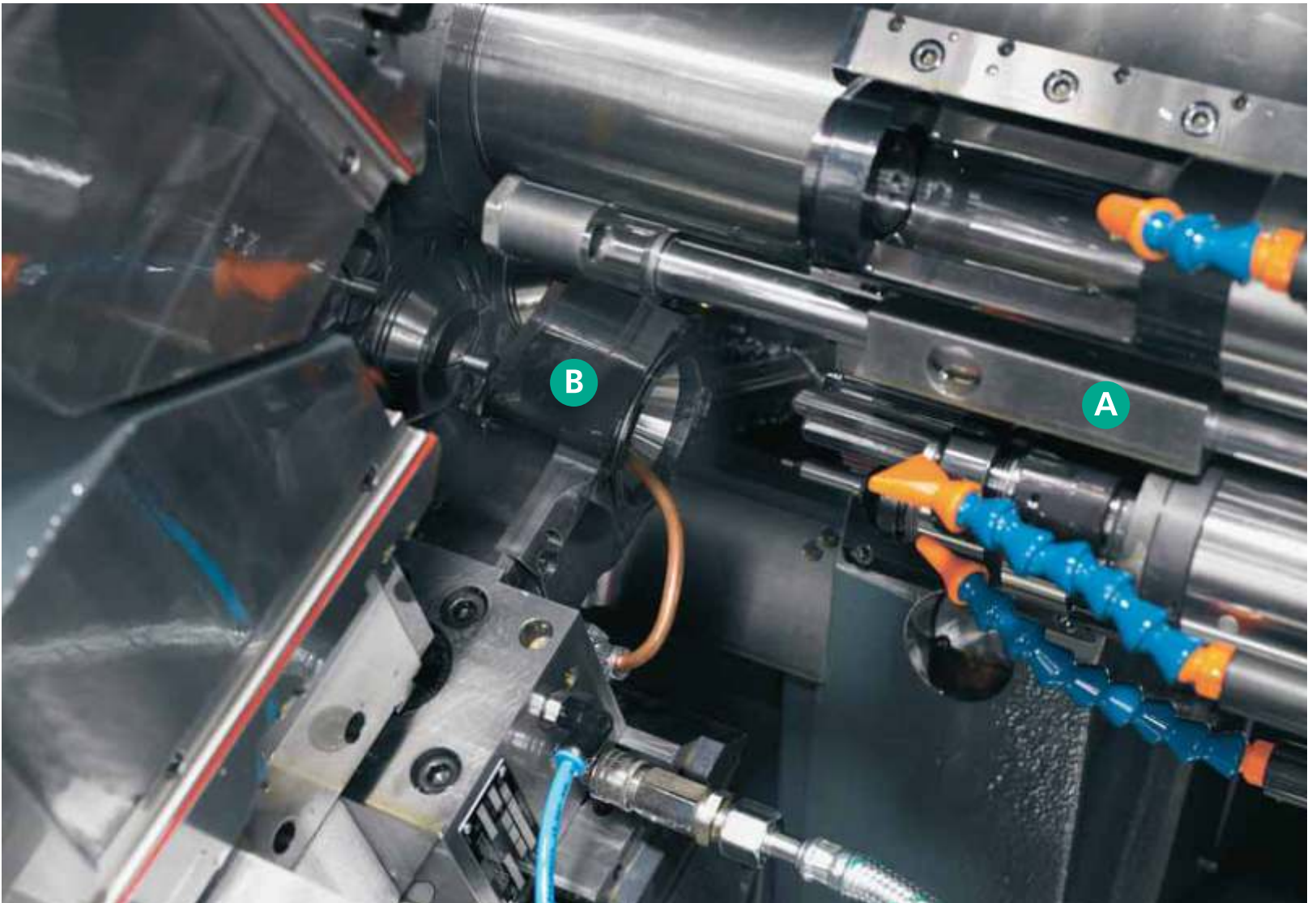
Manufacturers, from the automotive sector are increasingly interested in finishing parts on their own production equipment. The risks of loss of quality or reliability in production as well as requirements relating to cost and productivity mean that they must find highly productive and reliable production solutions. Eight machining stations enabling an increase and improvement in operations, surface finishes and productivity (especially when working 2 parts per cycle) is very welcome. From now on, depending on the requirements, the 8-spindle machine is a must. Until now, manufacturers wanting to produce complex

parts with diameters over 24 mm had to opt for a 6-spindle Tornos machine. This limited the operations that could be carried out and made designing parts more complicated (especially with the use of multiple tool holders). It also limited productivity.

### **A tried and tested solution**

Tornos has been marketing 8-spindle machines to the BS 14 standard since 1977. Based on this experience; the company launched its first MultiDeco 20/8 in 2000. Now, in order to market the most standard-

## The present

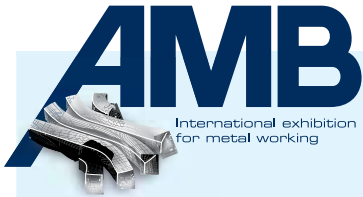


ised machines possible, the company has designed two ranges of machine on the same platform, the MultiAlpha and MultiSigma. The technological solutions employed are now widely available and therefore guarantee flawless operations.

### **From 20 to 28 mm, smooth growth**

Since its launch, the 8-spindle barrel produced by Tornos has enabled machining of diameters over 20 mm, and then over 24 mm. Aware of the market demand for an 8-spindle machine capable of handling larger diameters, Tornos stepped up to meet this challenge. Very quickly, our engineers decided

to meet this demand, working with the standard 24 mm 8-spindle machine as a basis. Finite element method design techniques showed that it was possible to switch to 28 mm bars in the barrel without changing the intrinsic qualities of the existing machine. Therefore, it became possible to use the same machine base to machine 28 mm diameter bars. Users will find that the tooling and all the peripherals remain identical and immediately available to them. The two new machines are available in 'shortened central slide' versions (A). This possibility allows the mounting of the two thread whirling devices (B) and guarantees better chip evacuation.



## AMB: AN EXHIBITION WITH EUROPEAN AND GLOBAL INFLUENCE

The AMB, International Metalworking Exhibition in Stuttgart is a very important exhibition in Germany and influential throughout Europe; 45% of German production companies are located within 200 km of Stuttgart and are responsible for 52% of production in Germany. The region of Baden-Württemberg in Germany produces more machine-tools than Switzerland and the USA combined. In 2008, the AMB show welcomed 1,284 exhibitors with over 85,000 visitors from 56 countries attending. The 2010 exhibition is set to be another huge success...

### Power, Flexibility & Performance

With a power output of 11.2 kW and an impressive torque of 17 Nm, the powered spindles on these two new machines enable you to produce all types of work, even the most challenging projects. All positions are fitted with a C-axis enabling total flexibility in the setup and providing the perfect distribution of work across all stations. On the MultiAlpha model, it is possible to fit one or two independent counter spindles on three linear axes (X/Y/Z). This concept, identical to that on the Sigma 20/32 single-spindle turning machine, provides total freedom when machining and therefore means that the machine is clearly capable of carrying out complex counter operations. Thanks to the second counter spindle, it is possible to reduce machining time on the 'other side' of the part by 50%. The counter operations on the MultiSigma turning machine are also available with one or two counter spindles, which are placed on top of the main tool slide and are fitted on two linear axes (X/Z). This enables the use of up to two tools per counter spindle (i.e. 2 x 2) compared with five on the MultiAlpha (2 x 5). Whatever the type of part to be machined, productivity is maximised.



## The present



### Simple to produce more quickly

Just-in-time production is very demanding for subcontractors - they must be able to respond quickly to their customers' every request. With the MultiAlpha and MultiSigma machines, subcontractors are perfectly equipped to handle this trend. All the tools can be preset outside the machine during concur-

rent operation time. In addition, the TB-Deco programme features many assistants and support tools that enable the user to benefit from the full power of the machine. Once a part has been machined, it is possible to reload the programme at any time directly via the Ethernet network.

With the new MultiAlpha and MultiSigma, users can use the PC integrated into the machine (optional). According to the requirements or preferences of the user, it is therefore possible to use TB-Deco directly on the machines. To date, Tornos has supplied over 550 CNC multi-spindle turning machines and depending upon the operators, the programming is simple and user-friendly.

### MULTIALPHA 8X28 UNVEILED AT THE AMB

Tornos has chosen to launch their new 28 mm capacity multi-spindle turning machines at this major exhibition. Mr Nef, Head of Sales and Marketing stated: *"The automotive market is constantly looking for new production equipment that will enable subcontractors to increase the productivity and quality of their parts. With these two new machines that now complete our range, we are offering customers a range of solutions to best respond to their needs"*. He added: *"Customers that have been able to preview these solutions have been very interested in the increase in capacity offered by these machines"*.

**Specialists from Tornos look forward to meeting you at the exhibition at the Tornos stand C14, in hall 3.**

### Why choose a Tornos CNC multi-spindle machine?

The eight powered spindles running at independent speeds provide a complete machining solution including automatic loading, unloading and palletisation (optional and according to requirements). The technological solutions applied are based on over 35 years' experience in designing 8-spindle turning machines. These solutions are provided by the most up-to-date programming system on the market, the TB Deco. Work ergonomics are optimised, as is production. To produce 'multi-spindle' parts up to 28 mm in diameter, with Tornos the customers have a tried, tested and productive solution.

## EVODECO 16: NEW TYPE OF DRIVE SYSTEM

Within a few weeks' time the first customers will be working with the new EvoDECO 16. This machine was previewed at Simodec 2010, and it is now in the market introduction phase. With the EvoDECO 16, Tornos is inaugurating a new generation of powered spindles with synchronous drive systems. This innovation represents a clean break. Indeed, besides this new product, the vast majority of industrial applications are currently equipped with asynchronous drive systems.



### So, synchronous or asynchronous?

Thanks to the simplicity of its design, use and maintenance, its robustness and low cost, the asynchronous process is at present used very widely for motors within a power range from a few hundred watts to thousands of kilowatts. This technology is still successfully fitted on most Tornos products. Particular examples are the Sigma 32 machine recently released by the Moutier workshops, as well as the Gamma 20

whose two powered spindles comprise asynchronous motors. These motors are a big hit on the market. By way of example, the Sigma 32 spindles have met with much praise in the field, and provide astonishing power. So why has Tornos opted for synchronous technology? Interview with Dr Markus Thurneysen, Head of Design at Tornos SA.

## Presentation

**decomagazine: Dr Thurneysen, why this revolution on EvoDECO 16?**

**Markus Thurneysen:** It's not a technical revolution - synchronous technology has been used for many years on our multi-spindle lathes, but it is true that very few turning machines are equipped with this technology at the moment. To my knowledge, the EvoDECO 16 is the first sliding head lathe to be equipped with it. For us it is a strategic choice, Tornos is an innovative company that intends to stay at the cutting edge of technology in order to offer its customers efficient and competitive machining solutions.

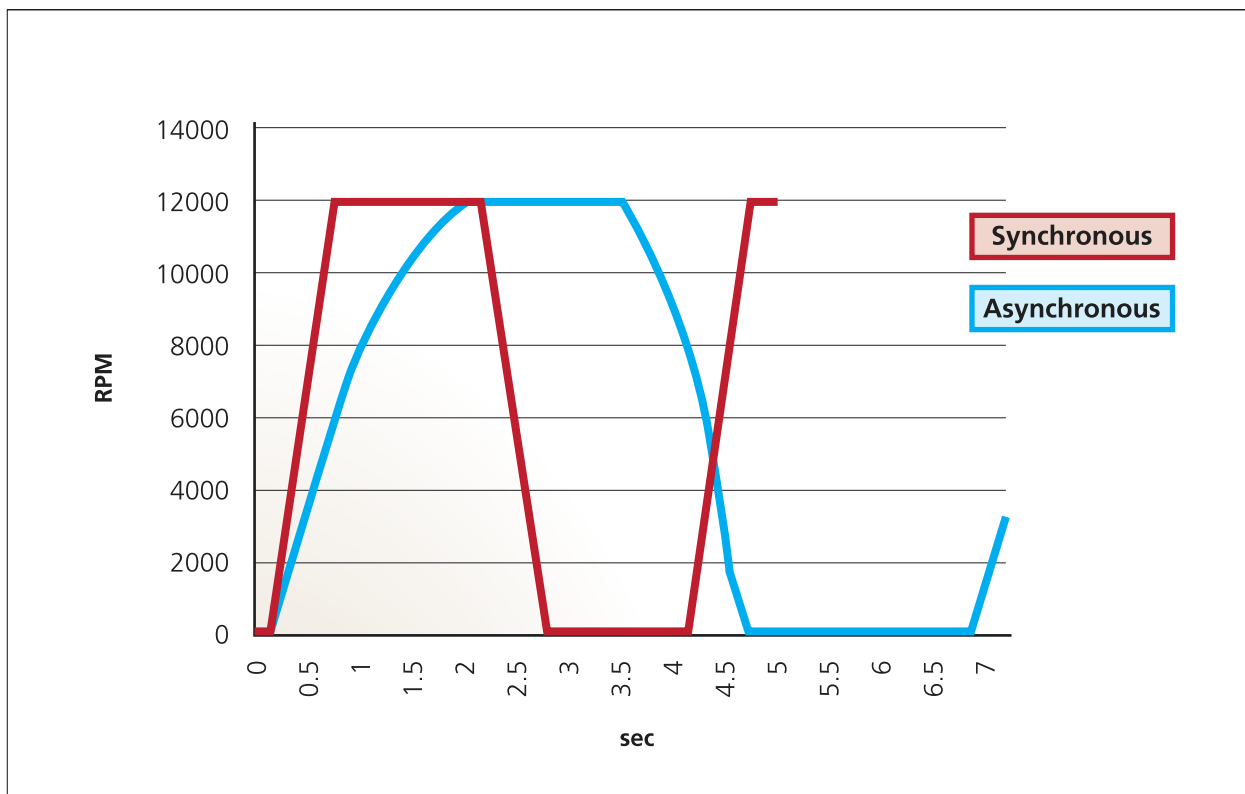
**dm: Is asynchronous technology no longer suitable?**

**MT:** No, a great many motors operate with this straightforward and robust process: but synchronous technology is the technology of the future. Synchronous motor efficiency is more than 90%, whereas asynchronous motor efficiency barely exceeds 80%. Besides efficiency, the acceleration is also greater: going from 0 to 10,000 rpm takes 0.5 secs on a synchronous motor, as opposed to 2 secs on an equivalent asynchronous motor.

**dm: What are the advantages for the customers?**

**MT:** They get acceleration and stoppage times which are 4 times shorter, with a constant torque at all speed ranges. This means that depending on the parts, the cycle times can be greatly reduced. For instance, when many milling operations require frequent stoppages.

So synchronous motor technology can produce more parts per hour. This is demonstrated by the graph, which illustrates an acceleration test from 0 to 12,000 rpm between a synchronous motor and an equivalent asynchronous motor. A machining operation is run for 1.5 seconds at 12,000 rpm, and then we brake until stoppage. The asynchronous motor has just reached 12,000 rpm, whereas the synchronous motor has finished the operation and is already starting to brake. So the synchronous motor provides significant savings in cycle time, and therefore production gains.



Comparison of acceleration times between the two technologies

**dm: The motors on the EvoDECO 16 machine are very powerful, (9.8/12 kW) for a 16 mm machine; so will it have a bigger current consumption?**

**MT:** The EvoDECO 16 is a high-end machine with cutting-edge capability in terms of rigidity and machining power. We have to be careful with power figures; this spindle will not consume any more than another machine, quite the opposite. Since the synchronous motor has better efficiency, it will consume less energy for the same use.

**dm: Besides its acceleration capacities, does the synchronous motor have other advantages for user customers?**

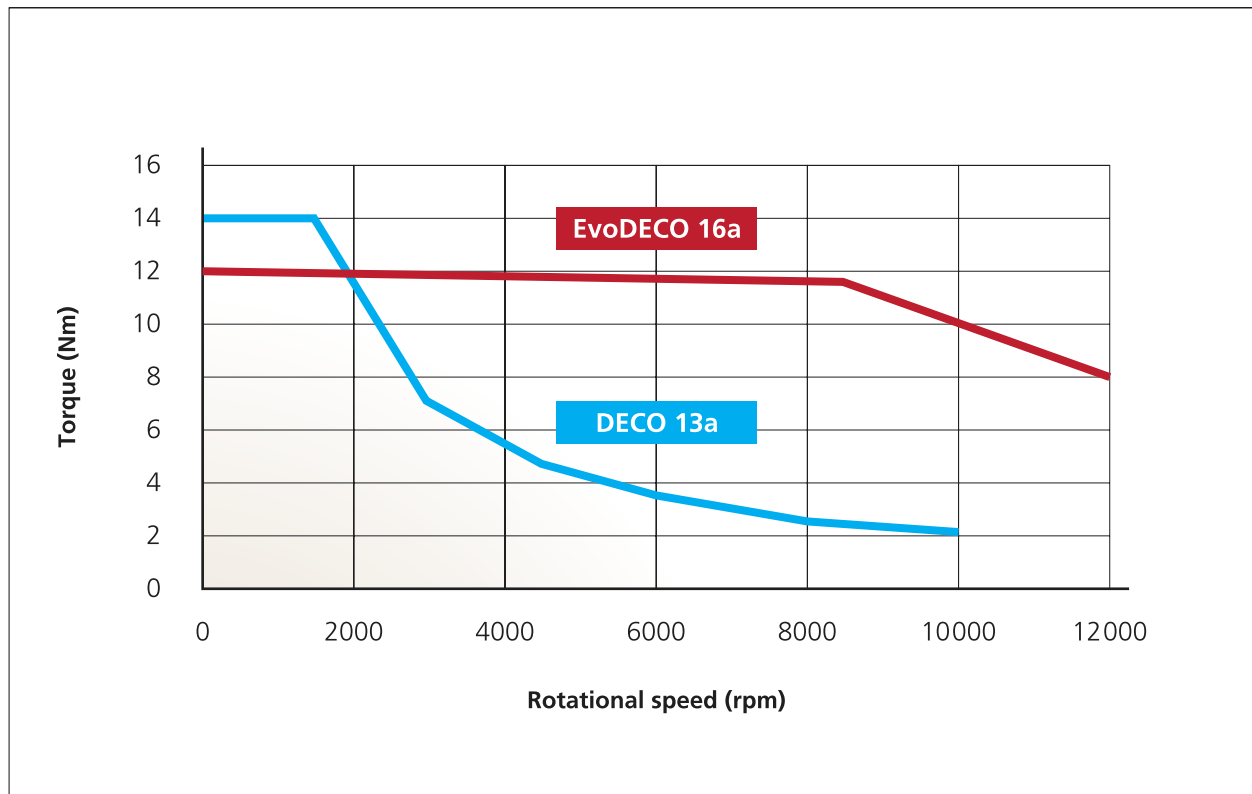
**MT:** Yes, they get near-constant torque over its entire range of use. At 8000 rpm, the motor still provides its full milling force, whereas an asynchronous motor will only have 20% of its maximum torque at this same speed. So with softer materials such as brass, you can mill off an enormous amount of material, unthinkable with an asynchronous motor using high cutting speeds.

**dm: In summary, does the synchronous motor provide only advantages?**

**MT:** For the customer, yes. For us manufacturers, it is more compact and represents 20 to 30% less space requirement, but it requires de-fluxing (amplifier compensation for disturbing current created at high speed by induction of rotor field in the stator) in order to maximise torque at high speed, and its purchase price is twice as high.

**dm: Why not extend it to the entire Tornos line?**

**MT:** Because of their prices, Sigma and Gamma machines have to compete at levels where for the moment it is impossible to achieve the market prices with a synchronous drive system. When the Deco machines were released, synchronous technology was still limited to low speeds. Now it is price that is preventing its generalisation. The synchronous motor is intended for the moment for high-tech machines such as EvoDECO 16 or our multi-spindle lathes. In future we plan to expand our range of products using synchronous motors.

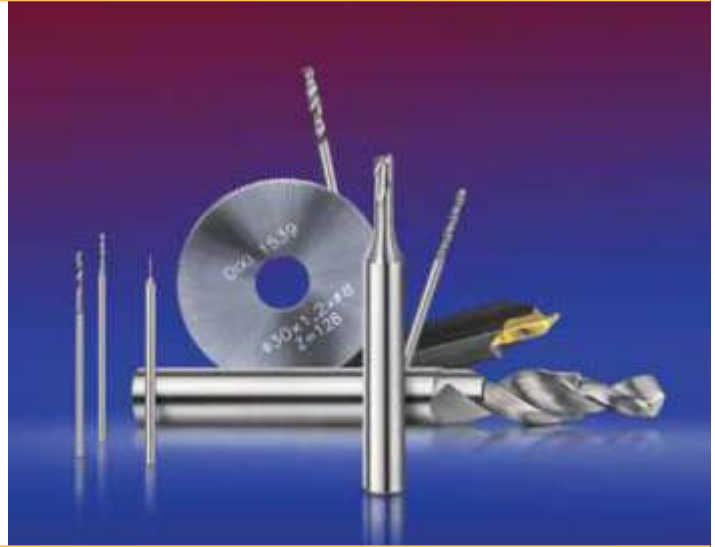
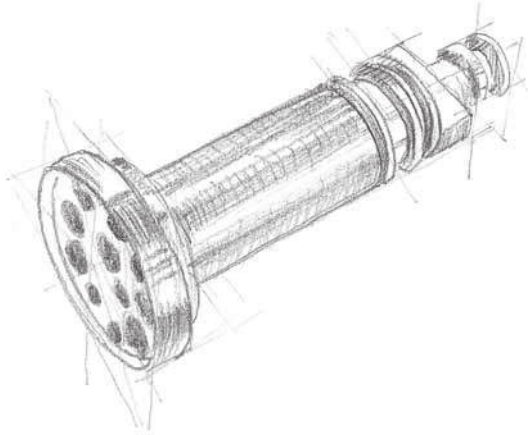


Comparison of synchronous and asynchronous motor torques

Tungsten carbide and diamond  
precision tools



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## REPLACING CAM-TYPE MACHINES...

**Who has never dreamed of finding the perfect solution for replacing their cam-type machines? Regularly, machine manufacturers release turning machines that more or less meet this aspiration. We met up with the Swiss bar-turning company Laubscher in Tuffelen, Switzerland. Manfred Laubscher, the technical director, has found the machine that is destined to replace whole collections of cam-type machines. The project was only slowed by the global credit crisis.**



The company's cam-type machine inventory is in perfect working order, however the management is thinking of the company's future. These machines will progressively be replaced with Delta machines.

Founded in 1846, Laubscher Precision SA is a business that specialises in the production of bar-turned parts in diameters from 0.3 mm to 60 mm. The company has 230 workers employed to operate nearly 500 production machines. Every year, the company uses over 1000 tonnes of material. With such a production rate, nothing is left to chance. Mr Laubscher told us: *"As opposed to a small business that only has a few means of production at its disposal; we are in a position to really select machines that are perfectly adapted to specific types of parts. In this way we have different ranges of machines dedicated to certain types of part."*

### Cam-type machines in flawless condition

The cam-type machine shops are impressive, a hall with over 100 R10, R16 and RR20 machines in perfect condition awaiting their visitor. These turning machines benefit from a permanent updating program that is carried out by internal specialists. In this way, these production tools are still 'as new' even after 40 years. But if such a collection is at your disposal, why would you want to replace these machines? Mr Laubscher told us: *"We still train bar turners on cam-type machines, but it's true to say that this specialty is dying out, there are very few young people interested in learning this, and replacement parts will not be available forever."*

## Presentation



Laubscher's workshops are unique in Switzerland. Both sides of the building are completely transparent. When the weather is fine, working at Laubscher is like working outdoors.

### LAUBSCHER PRECISION IN FIGURES

Founded:	1846, SA (plc) since 1920
Employees:	230 employees
Machine inventory:	Nearly 500 units
Manufacturing area:	20,000 m <sup>2</sup> with enough land for two extensions if necessary.
Parts manufactured:	bar-turning from 0.3 mm to 60 mm
Areas of activity:	All areas that use bar-turned parts are covered.
Geographic coverage:	To answer this question Mr Laubscher tells us: <i>"As long as there exists the means of getting parts to the customer, we can manufacture them"</i> . Global geographic coverage is therefore possible.
Training:	Over 20 apprentices are being trained.

### An extensive and detailed analysis

To replace the cam-type machines is no secret; all that is needed is to find a machine that is able to produce parts at least just as quickly and to at least the same level of quality. All of this was expected at a price that is also similar. To meet this challenge, Mr Laubscher and his team pitted several turning machines from different manufacturers against each other to fabricate 'classic' parts made at Laubscher on the cam-type machines. The cost of the machine could not be much more than a full overhaul of a cam-type machine, so certain types of 'complete' machines were eliminated from the beginning. As Mr Laubscher stated in the introduction, the machine must meet a very specific requirement: *"We were not looking to replace our Deco machines or other NC products with the machine we were looking for."*



The company has at its internal disposal, all the expertise and installations needed for heat treatment, galvanizing, trowalisation and polishing. The entire company is ISO 14001:2004 certified.

### Parts that meet the requirements perfectly

After numerous tests and comparisons, Laubscher selected the Delta 20/4 machine by Tornos. This machine was able to meet the requirements perfectly since it produced parts within the time limits and to a standard that was at least equal to that of the cam-type machines. Mr Laubscher told us: *"We do not produce very simple parts; therefore the barest of the Delta versions did not suit us at all. With the model*



Laubscher Precision SA offers a complete range of operations for all types of parts from a few tenths to 60 mm in diameter.

### OVER 1000 TONNES A YEAR!

Logistics measure up to the quantities produced. For parts of a few millimetres in diameter, that much material represents a very high number of parts that must be monitored, cleaned, checked and sometimes reworked, re-cleaned, checked etc...

The buildings are located at the centre of Tuffelen town and are on three floors with the materials shop located another two floors below in the basement. This 'storage tower' is 23 metres tall and houses nearly 300 tonnes of material in stock. The swarf processing unit is a miniature factory in itself, as is the cleaning department.

## Presentation



To guarantee the quality of its products, Laubscher can rely upon its 164 years of experience. The ISO 9001:2000 management system ensures that all the processes allow for perfect production. The quality control equipment used completes this vision of quality.

*we have chosen we are able to do all that we did previously with our cam-type machines (these were already equipped with the tailstock drill) and we will be able to take things further in terms of complexity". In terms of materials, the tests were conducted on brass, steel and stainless. Mr Laubscher notes: "We had no problems whatsoever, the machine and tool holders are very rigid and stable and therefore perform quality machining on very tough materials."*

### Measuring up to the company's reputation

If Laubscher is able to supply directly to the customer's production lines, it is because the quality of their product is flawless. A new production method should therefore have to meet and uphold these standards. Mr Laubscher told us: *"The machine is integrated in the complete process, its quality is therefore very important, as is its ergonomics and handling. On this subject, the operators who carried out the tests were unanimous in highlighting the strengths of Delta. The machine was supplied, installed there and then and immediately operational."*



# Laubscher

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After numerous tests and comparisons, Laubscher selected the Delta 20/4 machine by Tornos.

## HYDROMAT INC. IN U.S. TAKES "DREAM TEAM" TO THIRD IMTS THIS SEPTEMBER

On August 7<sup>th</sup>, 2006 an announcement was made to the precision metal cutting industry in North America that would change the way manufacturers would think about quoting their machine tool purchases.

Hydromat announced a new strategic alliance with Tornos S. A. of Switzerland. Hydromat Inc., headquartered in St. Louis, Missouri, would now represent the Tornos line of multi-spindle lathes in the United States, Canada and Mexico. How did this collaboration actually spring into life?



It all started during EMO 2005, with a casual discussion between Tornos and Hydromat. Once the ice was broken, the idea took shape. Hydromat the most renowned company for volume production would be an ideal partner for Tornos Multispindle products in the US.

Within short, a meeting was arranged between Willi Nef, head of Tornos multi-spindle products at that time, and Bruno Schmitter, President & CEO of

Hydromat Inc. When Mr Nef asked if Mr Schmitter had any ideas about how Tornos could sell more multi-spindle machines in the U.S. market, Schmitter analyzed the situation. With over 25 years in the rotary transfer production machining marketplace, and reviewing Tornos as a compatible rather than competitive product, Schmitter believed Hydromat was the logical choice to take the Tornos multi-spindle line to the next level. He then suggested Hydromat as a possible solution. It was the answer Nef wanted to hear.

## The present



IMTS 2006



IMTS 2006

The two discussed the possibility of a partnership that would benefit both companies. *"There are few requests for quotation (RFQ's) that arrive at Hydromat where the part could be put on both a rotary transfer machine or a multi. Ninety-nine percent of the time it is a good Hydromat part or it is a Tornos Multispindle application,"* stated Schmitter. *"With the addition of the Tornos Multi line we are able to recommend the perfect solution to our customers. We now also have very few 'no quotes' sent back to our customers."*

Nef agreed that Hydromat Inc. had an expansive client list in the world of high-volume precision production as well as many years of very successful sales and service to those customers, and that they could possibly bring a new dimension to the sales effort for the multi-spindle line. They shook hands and the deal was done.

Schmitter wanted to rock the industry. An announcement went out to the industry and the Metalworking Press regarding the partnership, and with only a few weeks to go, he re-arranged the Hydromat booth to include the MultiDeco 20/8b for the International Manufacturing Technology Show (IMTS). No easy feat, but it was accomplished.

Hydromat's extensive experience in the marketplace combined with their engineering excellence immediately worked well with the Tornos multi-spindle line. It now enables Hydromat to expand its offerings to always give its customers the best metal cutting solution for each specific application. The addition of "Tornos Multi-spindle by Hydromat" would add to their already impressive array of rotary transfer machines. So, the Hydromat Marketing team sent a message to the industry, the "Dream Team" was coming to IMTS.

At the Chicago show, the appearance of an 8 spindle machine on the stand that had always been the exclusive land of rotary transfer technology surprised many; *"We had to explain the new arrangement to*

*many who were very interested in the recent change,"* states Jim Otten, Vice President - Sales, Hydromat Inc. *"But, our experienced Hydromat clients knew how well we always take care of them with parts and service, so they thought that it was a good thing, and they hoped that we would do this for the multi's as well. And we have."* Hydromat's commitment to the Tornos multi-spindle operation includes sales, engineering, set-up, service, and parts stocked at their centrally located St. Louis campus.

At the same time that Hydromat made the partnership known, an announcement was made by Tornos that they had appointed Scott Kowalski as the new President of the U.S. single spindle lathe organization. The Tornos management team had already been working on a plan to expand their single-spindle exposure and service in the U.S. marketplace. A new Technology Center was on the drawing board. This facility was to be built in the Midwest, giving Tornos a more central location in the nation and a large presence in the Great Lakes, single-spindle marketplace. Tornos U.S. moved forward with the construction of the additional new Tech Center located in the greater Chicago area, allowing for a greater concentration on that section of the marketplace while maintaining a presence in Connecticut.

The alliance between Hydromat and Tornos S.A. was a leap forward for the high volume and precision machined parts industry in the United States. Hydromat's 30 years of success in the rotary transfer marketplace combined with Tornos' multi-spindle history, one dating back to 1958, created a rich synergy that has benefited both companies and the customer alike.

*"It really is a 'Dream Team', this combination of two extremely high precision machine tool lines, some applications are better produced with turning the bar stock, other applications are better 'tool turning' type parts,"* states Kevin Shults, Director of Marketing for

Hydromat Inc., "and with the engineering expertise that has been built here during the past 30 years to create the best solution for each application, this is very powerful stuff."

Hydromat's timing was excellent, Tornos was about to release two new multi-spindle products that would change the playing field. Soon after the 'Dream Team' was formed, a technological breakthrough at Tornos placed the new MultiAlpha 8x20 and 6x32 machines in the lap of the Hydromat sales organization. This gave them new ammunition to fight with in the North American multi-spindle battle. Later the MultiSigma line would follow. "I was very excited about the Tornos opportunity back in 2006, and now we are having great success with the new (MultiAlpha and MultiSigma) line up," noted Otten.

The new Tornos Multi-spindle, the MultiSigma 8x24, was to be shown for the first time in North America at IMTS 2008. Hydromat teamed with Chase Brass to feature a unique promotion. Chase's Green Dot lead-free bars would be used to create a two-part whistle, with the body of the whistle being cut on the Hydromat EPIC machine, and the mouth piece turned on the Tornos MultiSigma 8x24. This new machine was shown as possessing the highest degree of flexibility by being equipped with the latest generation of eight integrated, powerful and independent spindles featuring synchronous motors. The MultiSigma also showed the double back working operations and a lightning fast 3.7 second cycle time. The whistles were then assembled, a lanyard added and the finished 'Dream Team' gifts were given to attendees.

Presently the sales organization at Hydromat for the Tornos multi-spindle products is having great success, selling machines and consistently generating an impressive number of RFQs, meanwhile they prepare for another Chicago trip with the Tornos product line.

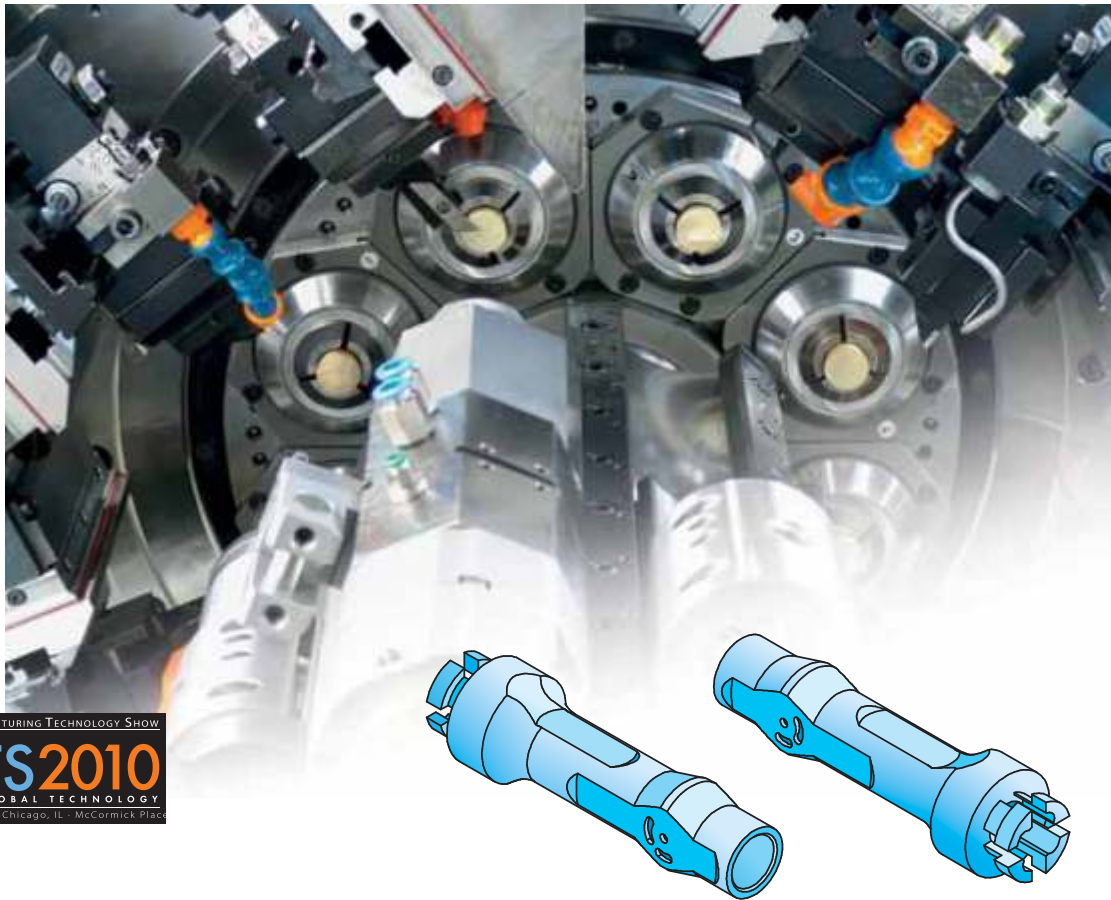
"This year we go into our third IMTS with the 'Dream Team' in our booth; a Tornos MultiAlpha 6x32 paired with the Hydromat EPIC R/T 25-12," noted Max Bebie, Vice President - Technical Sales and Services for the Tornos Multi-spindle line. "The MultiAlpha will show it's capability for the medical industry by cutting a pivot jaw assembly part for attendees to view, while the Hydromat will produce a high-pressure fuel nozzle from the automotive industry."

The Tornos MultiAlpha being shown at IMTS is the future of multi-spindle technology, featuring independent spindle speeds. Twin counter-spindles enable double back working operations simultaneously. The MultiAlpha is capable of performing unrivalled machining operations on the back of the work piece resulting in reduced production times.



IMTS 2008

## The present



The MultiAlpha features the legendary Tornos high precision, large working area for accessibility and the bar loader and chip management system to allow an overall, complete and high performing solution all in one machine. Each spindle functions independently of the others for cutting RPM, spindle stops and indexing. The spindles with independent speed settings enable the full range of cutting tools to be employed. This extends tool life and improves the quality of the components produced. With every position potentially being used as a C-axis, allowing any positioned transverse milling or drilling operation to be performed at any time and on all spindles. These spindles can be synchronized in angular fashion, meaning that positioned operations such as eccentric drilling can be performed at several different stations. The advantages to this system include; optimum speed on each position in accordance with the type of machining required, unrivalled capacity for stock removal, great flexibility – C-axis 'Transmit' function, stopping and exceptional spindle acceleration and a great combination of features for highly demanding parts.

The Tornos multi-spindle line features the powerful Fanuc control with TB Deco Programming Software for advanced machining flexibility and programming versatility. These principals combined with the Tornos machine's strength and supreme accuracy raises the bar for multi-spindle productivity. Come see us at IMTS in Chicago, IL, September 13-18, 2010 in booth S-8353 and see how bright the future will be with the Tornos MultiAlpha from Hydromat.



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# HAROLD HABEGGER

## Canons de guidage Führungsbushen Guide bushes



### Type/Typ CNC

- Canon non tournant, galets en métal dur
- Évite le grippage axial
- Nicht drehende Führungsbushen, mit Hartmetallrollen
- Vermeidet das axiale Festsitzen
- Non revolving bush, with carbide rollers
- Avoids any axial seizing-up

### Type/Typ C

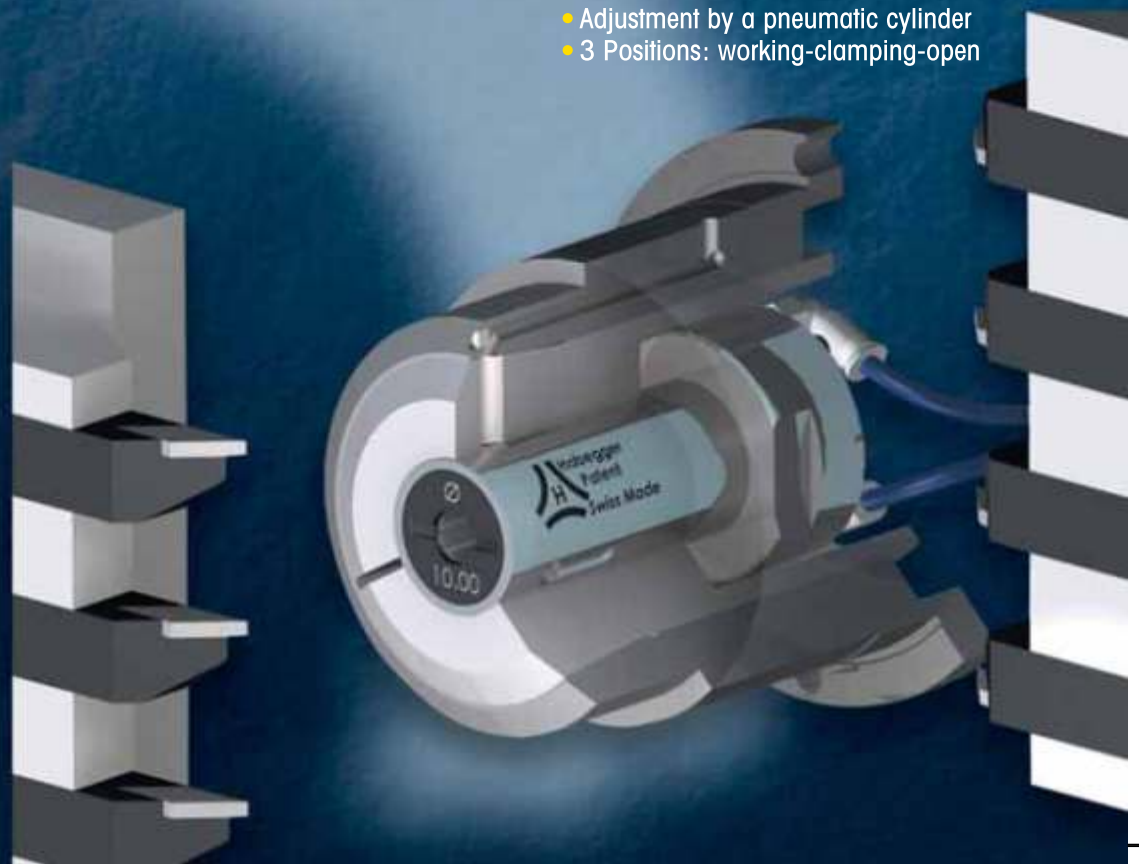
- Réglable par l'avant, version courte
- Longueur de chute réduite
- Von vorne eingestellt, kurze Version
- Verkürzte Reststücke
- Adjusted from the front side, short version
- Reduced end piece



### Type/Typ TP

- Réglage par un vérin pneumatique
- 3 positions: travail-serrage-ouverte
- Einstellung durch einen pneumatischen Zylinder
- 3 Positionen: Arbeitsposition-Spannposition-offene Position
- Adjustment by a pneumatic cylinder
- 3 Positions: working-clamping-open

➤ 1 Porte-canon: 3 types de canon Habegger!  
➤ 1 Bushholder: 3 Habegger Bushentypen!  
➤ 1 Bushholder: 3 Habegger guide bush types!



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## KEEPING THE BAR WHERE IT IS...

The automotive industry is constantly raising the bar, creating a high workload for subcontractors in this field. This means they really need to attack the material at speed. In some cases, this speed means the bar tends to actually move back, which obviously has a detrimental effect on machining. To solve this problem, there are numerous grooved or hatched grippers available; however these can damage the material. So, DecoMagazine met with Mr Alain Marchand, Director of Swisscollet SA, who introduced us to double-taper collets, a suitable solution to the issue.



The double-taper collet has been around for a very long time and it is suitable for both primary and secondary operations. It can be fitted to Tornos turning machines with no modification or restrictions. The process clamps the material in the two tapers, which are far enough apart to provide a significantly increased clamping force. This is more than doubled without affecting the quality of the surface. Can this type of collet always be used from now on?

### Fine adjustment is required

Despite being available as standard with numerous sizes, the double-taper collet is not always the best solution. Mr Marchand explains: "We have a lot of experience in clamping. Based on our customers'

*needs, we can precisely calculate the required force and offer the most suitable type of collet depending on the materials to be machined, the friction or sliding coefficients, the cutting conditions and the tools used."*

### Is there a risk of sticking in the guide bush?

Depending on the cutting conditions, working with a 'supergrip' single-taper grooved collet may prove harmful because even if the bar is held, the risk of sticking is greater when feeding into the guide bush. To avoid this problem, the bar must be clamped without its edge being deformed. In such cases, the double-taper collet must be used.

## ECS SWISSCOLLET SA IN BRIEF

Company founded:	1982
Employees:	15
Production:	100% at ECS Swisscollet, including heat treatments
Range:	Collets, guide bushes, rings and plugs, special clamping and guiding tools
Distinctive feature:	Develops made-to-measure clamping solutions 95% of turnover is from special applications
Markets:	Europe 80%, Switzerland, Asia, USA

### PRODUCTIVITY

Material: Aluminum  
Diameter: 22 mm  
Length: 54 mm  
Standard time: **87 sec**  
Sigma 32 time: **38 sec**  
Productivity gain: **56%**



### What about profiles?

As with all single-taper collets, profiled material can be used with this type of collet. As is the case with round material, if problems occur a specialist should be contacted. *"Although our catalogue contains many standard references, our expertise is in finding clamping solutions specifically tailored to our customers' problems. We are lucky enough to be able to rely on a highly experienced and innovative team,"* explained Mr Marchand.

### Steel or hard metal?

Depending on the requirements governing the bar surface finish and the collet service life, ECS Swisscollet can offer steel or hard metal collets to meet the end users needs. Again, this choice depends on the full range of parameters and may allow the customer to reach higher levels of quality, productivity, profitability and safety. In many cases, a simple, standard collet is all that is required, however choosing the right collet can open the door to many benefits.

## COMBINING OUR SKILLS

This is the philosophy adopted by a group of companies that includes ECS Swisscollet and Tornos. Using combined skills, eight companies operating in the bar turning sector aim to improve the competitiveness of bar turning plants and thus to preserve important expertise within Europe.

To go the extra mile, resources are required to enable machining processes or methods to be validated, as bar turners themselves often have neither, the time nor the money to carry out this type of research. They can rely on bar turning technical centres and companies, however even the latter do not generally have at their disposal the full range of necessary skills. The 'Combining our Skills' group allows skills to be shared with each member able to rely on the others for support.

To find out more, please download the brochure (in French) from: [http://eurotecmagazine.files.wordpress.com/2009/05/skills\\_france\\_brochure.pdf](http://eurotecmagazine.files.wordpress.com/2009/05/skills_france_brochure.pdf)

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## MORE POWER, FLEXIBILITY, CAPACITY & PRECISION

A new patented guide bush has been launched by Tornos. Exactly the same size as devices already on the market, the Tornos guide bush with three positions is compatible with bars up to 32 mm (compared to 25.4 mm) while providing the same clamping force. Interestingly, this type of guide bush is able to work with irregular bar surfaces, eliminating the need to straighten out the bars, which always proves a very time-consuming exercise.



### Option

This option has not yet been assigned a product number. If you are interested, please contact your usual Tornos dealer.

### Principles

The guide bush with three positions can guide, clamp and open automatically, according to the requirements of the user. This device rotates and features a pneumatic connection that allows the air pressure on

the closing piston to be regulated. A solenoid valve battery is placed in the machine and the assembly is controlled by M-codes. M-code functions can be defined to guide, clamp or open the guide bush. The 'set' position can be adjusted by a pressure-reducing gauge. The collet is changed at the front. This guide bush is very simple to use and very flexible. When clamping, the machine is made rigid for milling operations. This option is already used by companies operating in the medical sector. In the open position, it

is easy to load or extract the material. In the guiding position, it is able to absorb differences in the diameter of materials by up to 0.5 mm while retaining its precision. The clamping force can be adapted to suit the different machining operations to be carried out. The 50 mm clamping length is exceptional in comparison with standard guide bushes (25-30 mm) and guarantees perfectly parallel clamping.

#### Benefits

- Allows the use of h9 to h11 bars; thereby simplifying supply.
- Eliminates the need to straighten the bars.
- The pneumatic guiding position easily clamps irregular bars.
- The exceptional clamping length resolves any potential problems with scratches on the bars.
- Machining with the Y-axis is guaranteed to be vibration-free with no other potential problems arising from a guide bush that is not usually locked in place.
- When using delicate materials that tend to 'stick' in the guide bush (e.g. titanium), pneumatic clamping is the chosen solution.
- The clamping length enables the bar to be moved back (45 mm) after preparatory machining, guaranteeing it remains gripped. This special feature is particularly useful when producing bone screws.
- Feed system: It is possible to clamp and open the bar in the guide bush and move it backwards and forwards with the spindle and Z1-axis. This means that material can be fed without using a supporting tool holder.

## TECHNICAL SPECIFICATIONS

#### Bar capacity:

5 to 32 mm

#### Max. Rotational speed:

8,000 rpm

#### Collets used:

Special D inner C42 double-taper collets

#### Max. clamping force (at 5 bar):

1462N

#### Setting and programming:

Using M-code functions – open/close/set (guiding)

#### Setting the adjustment pressure:

Uses a pressure-reducing gauge from 1 to 5 bars

*This device is patented by Tornos*

#### Constraints

The guide bush must be driven.

The Z1 forward travel is reduced to 15-20 mm depending on the type of machine.

#### Compatibility

Sigma 20 / Sigma 32 / Deco 20e - 20a - 26e - 26a

#### Availability

This option is already available ex works. Installation on pre-installed machines is possible.

# Pinces et embouts · Zangen und Endstücke · Collets and end pieces

for

LNS, TRAUB, FMB, IEMCA, CUCCHI  
TORNOS, BECHLER, PETERMANN



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## ADAPTING THE PRESSURE

Depending upon the operations to be carried out, the materials to be machined or even the volume of swarf to be managed, it is necessary to adapt the use of a cutting fluid. Whether you require a significant amount to 'clean' the machining area or more directly, high pressure coolant for thread whirling or high-pressure drilling, Tornos offers a range of pumps tailored to your requirements.



HP60



HP120

### Four different pumps

Tornos machines are equipped as standard with a cutting fluid pump with a pressure of 3 bar. It is possible to add two pumps from a selection of 15, 60, 120 and 340 bar models. The only limitation is the combined power of the two pumps that must not exceed 6 kW.

### Useful examples of the different models include:

- **15 bar:** For ensuring optimum removal of swarf and useful for thread-whirling
- **60 bar:** For managing swarf in the most demanding situations and for thread-whirling with the latest generation of devices (9 or 12 blades), or for drilling large diameters with through coolant drill bits.
- **120 bar:** Principally designed for deep drilling within a range of diameters from 2 to 12 mm and for thread-whirling using a head with up to 12 blades.
- **340 bar:** Principally designed for deep drilling within a diameter range from 0.8 to 3 mm

## Technical

### Combine for greater flexibility

As detailed above, it is possible to fit two pumps in parallel on the machines. For example, one pump can be used for deep drilling and the second pump for managing swarf when thread whirling or machining difficult materials. Incidentally, several manufacturers in the medical sector use this combination as it enables them to produce drilled and thread-whirled bone screws.

### Constraints

Use of high-pressure pumps can generate heat and some degree of oil spray. Depending on the individual case, customers are recommended to work with a cooler, mist extraction device or a fire prevention system. The specialists at Tornos are happy to help you find the solution that best meets your needs.



### TECHNICAL SPECIFICATIONS

		HP15	HP60	HP120	HP 340
Max. pressure	bars	15	60	120	340
Max. flow	l/min.	25	30	25	15
Max. flow at max. pressure	l/min.	20	20	13	7
Motor output	kW	1.5	1.5	4	4
Filtration	µm	250	150	150	150
Fine filtration	µm	-	20	10	10
Container volume	l.	60	150	220	200
Operation	using M-codes for all models				



### Compatibility

- **15 bar pump:** Deco 07, Deco 10, Deco 13, Sigma20 and Sigma32. It is standard on the Deco 20/26
- **60 bar pump:** Deco 10 and 13, Sigma 20 and 32 plus the Gamma
- **120 bar pump:** All Deco's and Sigma 20 and Sigma 32
- **350 bar pump:** All Deco's

### Options

If you are interested in one or more of these solutions, please contact your Tornos dealer.

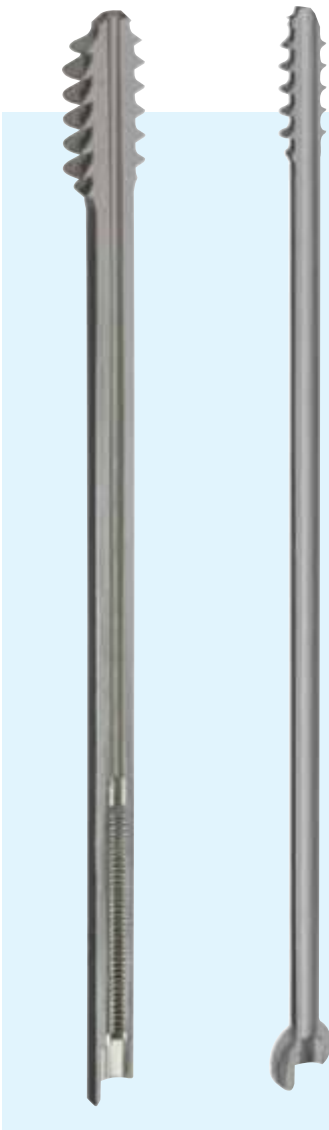
### 'Eco-friendly' pumps

Using high-pressure pumps automatically generates higher energy costs. In order to minimise the impact of this, Tornos is offering three features that are 'kind to the environment':

- The pumps feature a frequency converter that provides 'the right pressure at the right moment'
- Control using M-codes guarantees that the pumps only operate at the right moment
- The gravitational feed system eliminates the need for an additional drain pump (which is normally the case).

### Availability

These pumps are now available ex works. Installation on pre-installed machines possible.



### HIGH-PRESSURE DRILLING: SOME FACTS AND FIGURES

When deep drilling, it is important to respect the following parameters:

- Preparation of front guiding hole: Boring diameter + 0.01 mm, depth 1.5 x the diameter
- Viscosity and temperature of ISO VG oil 8 to 15 mm<sup>2</sup>/s at 40°C (120 bars)
- Viscosity and temperature of ISO VG oil 8 to 10 mm<sup>2</sup>/s at 40°C (340 bars)
- The oil flow must be constant.

### PRACTICAL TEST PERFORMED

Bored titanium material with a 3/4 boring tool, Ø 0.8 mm & depth 50 mm (62x the diameter). Speed of rotation of material, 10,000 rpm with a feed of 0.002 mm per rotation. Duration of operation: 150 seconds. The result shows an average deviation of 0.05 mm over 50 mm.

OUTILS DE PRÉCISION EN MÉTAL DUR

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### Specific equipment and accessories for lathes

TTE 10X5 18'000 rpm  
 Integrated ratio : 1 to 5

Minispindle Extensions  
 Ø5,0 mm collets Ø2,0 mm

Twin opposite spindles head  
**TIC TAC**

**OP 1**      **OP 2**      **OP 3**

Multispindle head  
 small spindle axis distance  
 4 mm  
 revolution  
 15'000 rpm

Synchronous  
 multipindles Head

### Specific equipment and accessories for TORNOS machines

Hobbing unit  
 for making gears

Polyvalent drilling and milling head  
 for heavy machining with speed-reducer  
 Usable with or without over-arm

Right angle spindle speeder  
 5 mm clamping capacity  
 15'000 rpm

Adjustable angle head  
 with range of adjustability  
 from 0 to 90°  
 5 mm clamping capacity

**ASK FOR OUR FULL RANGE CATALOGUE !**

Axial spindle speeder  
 8 mm clamping capacity  
 30'000 rpm

Whirling machine

**BMRC**  
 6 spindles multipindle head  
 Modular spindles  
 for presetting outside  
 of machine

Milling head - Spindle speeder - Angular head - Whirling machine - Drilling heads ....

## “25 YEARS OF MICRO PRECISION”

**While large corporations are currently joining in the crisis hype with good grace and laying off employees, one innovative, medium-sized manufacturer of turned parts is demonstrating social responsibility and not only safeguarding the jobs of its employees, but also employing more personnel.**

**With creative ideas, innovative production strategies and consistent focus on microprocessing, Laufer GmbH, ‘Drehteile in Mikropr zision’ (microprecision turned parts), remains on the road to success even in times such as these. A considerable factor in this success is the Swiss manufacturer of turning centers Tornos, which has supplied the majority of modern machine outfits as a competent partner. Manufacturing strategies are developed in close cooperation with Tornos, whose help has enabled Laufer to supply turned parts for the Czech Republic and even the Far East.**



Customer service is a top issue at Laufer: Thomas and Andreas Laufer now preside over the company's fortunes under the benevolent watch of their father, Gerhard Laufer (from left to right).

Five years have passed since our last visit to Laufer, and although a great deal has changed in that time, the virtues and strength that elicited admiration at that time are still present as the company continues to grow. The company celebrates its 25<sup>th</sup> anniversary this year and the two sons of company founder Gerhard Laufer, Andreas and Thomas, have now officially taken over management of the company.

This was accompanied by repositioning and a clear strategic alignment, which is expressed in the new company name “Laufer, Drehteile in Mikropr zision” (Laufer, micro-precision turned parts). The company covers a range of diameters from 1 to 42 mm, while concentrating on high-precision turned parts in the range from 1 to 10 mm, where it sets the global benchmark. This is the segment in which the company

has its roots and it is now consistently expanding these strengths. The father and company founder, Gerhard Laufer, was an automatic lathe foreman for the company Junghans until 1985. When the watchmaking industry began to decline and Junghans was looking for ways to cut costs, he took advantage of this opportunity. Nobody spoke of outsourcing in those days, but Gerhard Laufer practiced it. Together with his wife, he took over ten Tornos automatic straight-turning lathes and from that point on, manufactured watch parts for Junghans on a freelance basis. The precision and quality required by the watchmaking industry therefore shaped the company's thinking from the very start. Who can claim to have supplied only two bad parts out of a total of 32 million? Laufer can, and thus the company has continued to grow.

## Presentation



Always state-of-the-art technology: Laufer's machinery consists almost exclusively of the latest Tornos CNC single spindle and CNC multi-spindle automatic lathes.

In 1988, it moved to the current company premises in Hardt. This was also the year in which the first new machine, a Tornos MS7 with rod loading magazine, was purchased. The current managing directors, Andreas and Thomas, joined the company in the early 90s and focused on this technology at a time when CNC technology was still in its infancy.

### **A development partnership with a long tradition**

The partnership with Tornos had, thus far, proved so positive for Laufer that the company even took a chance on a Tornos machine when it introduced CNC technology in 1994. At that time, the company already had over 20 cam-controlled automatic lathes when it purchased an ENC 74 as a demonstration machine. One year later, the second machine of this type followed, since it opened up a parts spectrum to the company that had previously not been possible. In addition to watch parts, antenna parts and the smallest turned parts with complicated rear-side machining were added to the range. As one of the first customers in Germany, 'Laufer's' were informed by Tornos in confidence about the new Deco concept, and since the partnership had worked so well thus far, Laufer decided to go for it. In July 1996, the first prototype made its way to Hardt. It was the first Deco machine in Germany. In the meantime, this machine has clocked up over 100,000 operating hours, produced over ten million parts and is far from ready for the scrap heap. Gerhard Laufer was convinced by the concept from the very start - the quality was right and support from Tornos exemplary. In 1997, not least because of this machine, production was

doubled, the area of operations was expanded from 500 to 1,300m<sup>2</sup> and the second Deco was acquired in 1998. The third Deco 13, purchased in 2000 with a diameter range of up to 16 mm is predominantly used for pre-series production and provision of samples. Today, the company has 12 Tornos CNC single-spindle automatic lathes and is excellently positioned for the current situation. *"Our machine outfit with 5-11 axis machines puts us in a position to respond flexibly and operate perfectly at full capacity,"* says Thomas Laufer.

### **Entering the automotive industry**

When the watchmaking industry and the mobile phone market experienced a slump at the start of the century, Laufer looked for new sales markets. At this time, a new turbo charger generation was experiencing a downright boom, and the family council decided to give this technology a try. For this, the Laufers needed a CNC multiple-spindle automatic lathe and, in keeping with tradition, decided on a Tornos Multi-Deco 20/6b. It probably does not need to be said that this machine was, in turn, the first in Germany. In February 2002, Gerhard, Andreas and Thomas Laufer travelled to Moutier for the first turning tests. These were for a part for a turbo charger, of which 9 million were going to be produced. The requirements for this part surpassed all existing limits and together with Tornos technology, the process was fine-tuned until it could be fine-tuned no more. The material, a difficult-to-machine 1.4845 steel, varied from batch to batch, the dimensions were tiny, machining operations complex and tolerances extremely narrow. After

a nine-month test phase, the system partners Laufer and Tornos had the manufacturing process under control and had opened the door on new production technologies. This is how Laufer got its start in the automotive industry, which is currently, despite the crisis, one of the most important customer sectors for Laufer. But there is great variation within the automotive industry. There is, as there always has been, a huge demand for special parts that can only be fulfilled by very few suppliers.

### Concentration on core competency areas

In past years, Laufer has positioned itself very well strategically. The company concentrates on manufacturing high-precision turned parts in the micrometer range and has an almost uncatchable head start in this area. Investments in the machine outfit and in employees have been made with foresight and a sense of proportion. *“One also has to see, however, that we are now moving into entirely different dimensions. If, before, we were happy about 100,000 units, we are now manufacturing series in the millions. And, moreover, in a diameter range competitors will not attempt. Our strengths lay in the range from 1 to 16 mm, with 90 percent of our parts under 6 mm.”* Screws with M1 threads, M1 threaded rod with slot and tip or little buttons with a diameter of 1.3 mm - these are the parts that Laufer is supplying as far afield as the Czech Republic and China. Customers in the electronics and automotive industries have recognised that they cannot manufacture such parts on site to this kind of quality and at this price, so they come to Hardt.

### Practiced corporate responsibility

For this reason, Laufer has been spared a dramatic slump during the crisis. In fact, the effects of the global drop in demand did not stop at Laufer's doors, but instead of laying off employees or reducing working hours, the company invested in further education and quality assurance measures and recruited new people and trainees. *“We consider ourselves responsible for our employees,”* agree Andreas and Thomas Laufer. *“We would rather forego profit in poor years than complain later on about the lack of skilled labor.”* For this reason, Laufer also partners with Technolino, a project in Hardt that introduces pre-schoolers to technology at an early age, teaching them basic manual skills. As part of their systematic partnership with Tornos, they now even employ an exchange employee from Switzerland. He was not taken on by Tornos after his training and can now expand his skills at Laufer before returning to Switzerland when



Nothing works at Laufer without a magnifying glass. The company is the specialist for micro-precision. 90 percent of the parts range falls into a diameter range of less than 6 mm.

## Presentation



The Tornos specialists are often on-site: Siegfried Broghammer (left-hand image) in conversation with Thomas Laufer and Sven Martin (right-hand images) talks shop with Andreas Laufer and his team.

Tornos' orders pick up once again. This measure shows just how good the relationship between Laufer and Tornos has become over their years together. Ultimately, Laufer's attribute some of their success to these machines. With 95 percent availability, a rate of complaints in the tenths of a percent and productivity that has yet to meet its match, Tornos machines are a safe investment. In 15 to 17 shifts per week, they have produced, on average, around 80 million challenging turned parts per year over the last 25 years, with a failure rate of nearly zero. Gerhard Laufer has, therefore, good reason to smile. He knows that his life's work is in the best of hands with his sons, Andreas and Thomas. Now, despite the crisis he can celebrate at the company anniversary celebration on 18 September 2010.



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## CHIP BREAKER – THE INITIAL CUT

On the MultiAlpha and MultiSigma turning centres, the initial cut is a macro that controls all the variables, in particular the diameter and the length. This macro is therefore essential for the accurate and correct operation of the machine and it cannot simply be deleted.

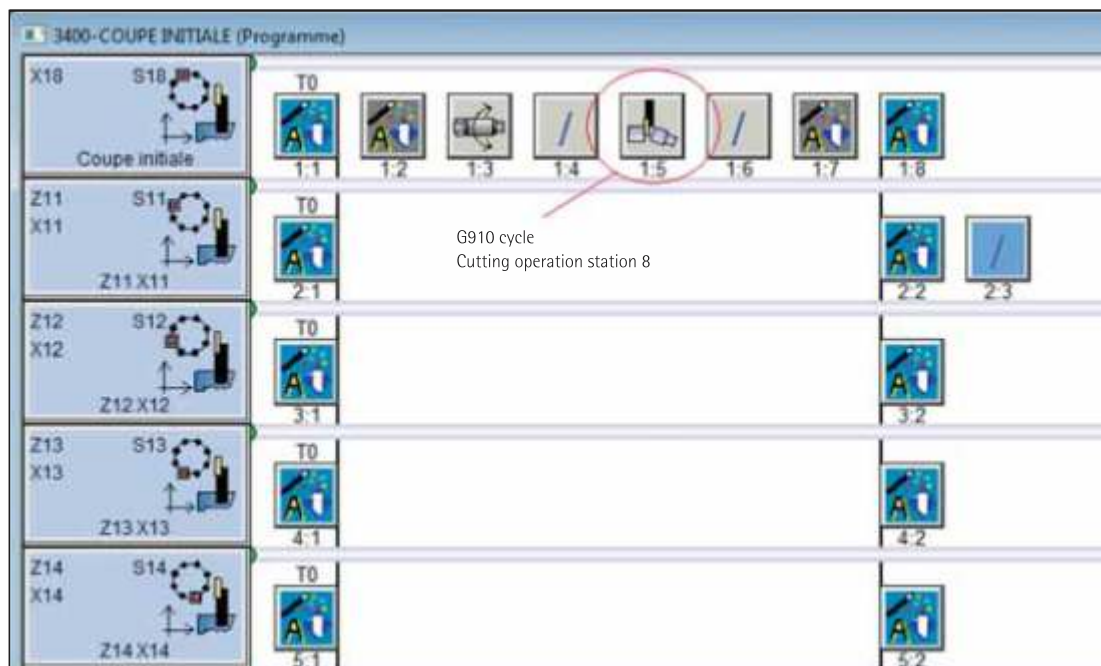
Depending on the case, (a reset for example) it may be preferable to work with the initial cut deactivated (this option is detailed in Decomag 55) or to work with a chip breaker. To do this, the operation must be neutralised and replaced with another that uses the G919 function. As the problem is not the same with the MultiAlpha and MultiSigma fitted with one or two counter spindles, this tip is detailed in two sections.

### 1) Use with a machine fitted with a single counter spindle

*Deactivation of the cutting operation (without chip breaker).*

A machine fitted with a single counter spindle includes the initial cut function in the G910 cycle. The parameter P0 enables this initial cut to be deactivated.

- Open the part
- Open the "Initial cut" program

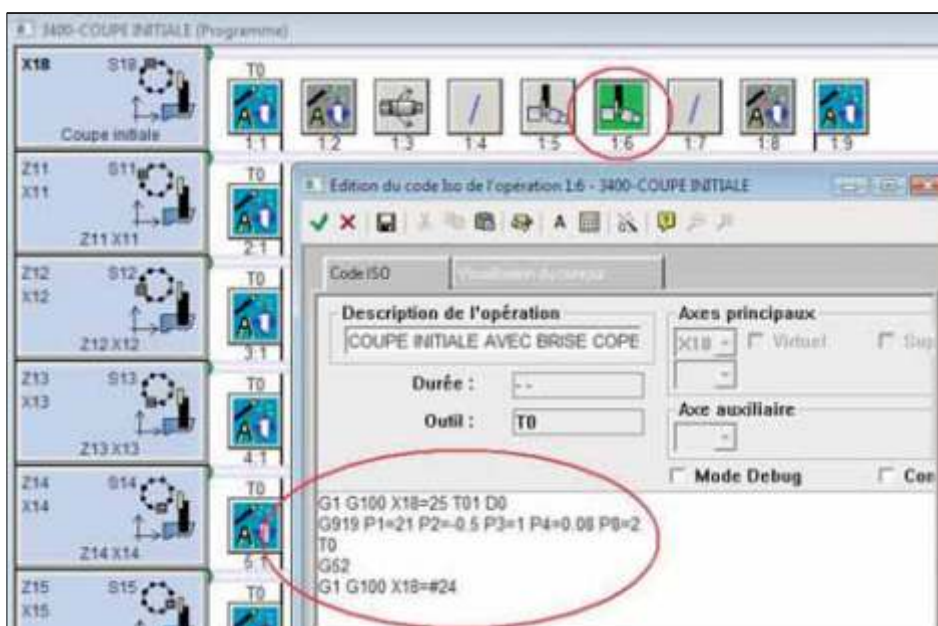


## Tricks and tips



- Enter parameter P0=1 in operation 1:5 to deactivate the cutting operation

**Comment:** This parameter (P0=) requires TB Deco software version RC-Build013\_8-2 or higher. To find out what version you are working with, see Help/About.



- Enter a new operation (1:6) between operation 1:5 and 1:7

### ISO code:

G1 G100 X18=25 T01 D0  
(Rapid approach with use of tool)

G919 P1=21 P2=-0.5 P3=1  
P4=0.08 P8=2 (Cutting cycle with chip breaker)

T0 (Cancel use of tool)

G52 (Cancel original offset)

G1 G10 X18=#24 (Reference position)



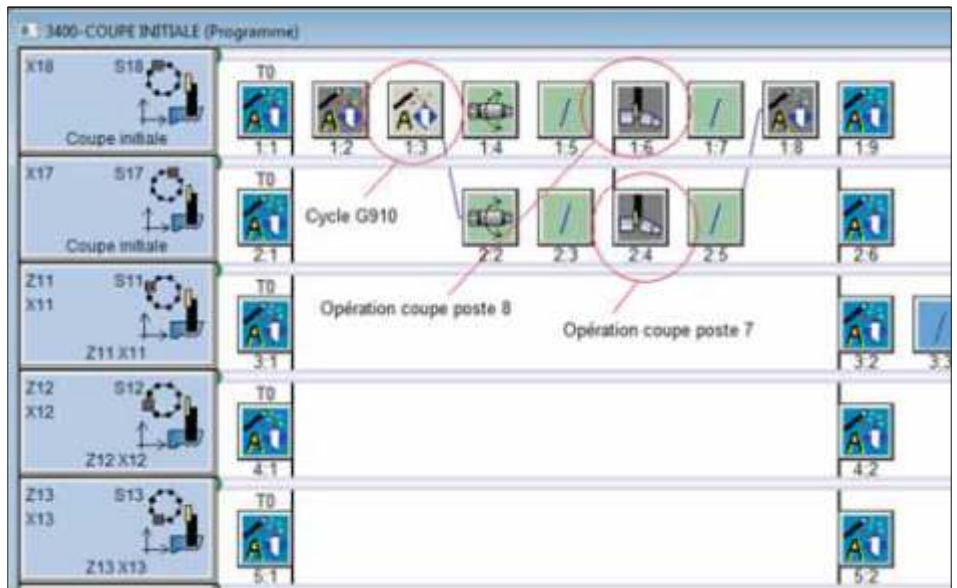
**2) For use with a machine fitted with two counter spindles**

*Deactivation of the cutting operation (without chip breaker).*

A machine fitted with two counter spindles includes one or two operations configured for the initial cut (depending on the model).

To deactivate the initial cut, simply comment out the operations concerned.

- Open the part
- Open the "Initial cut" program

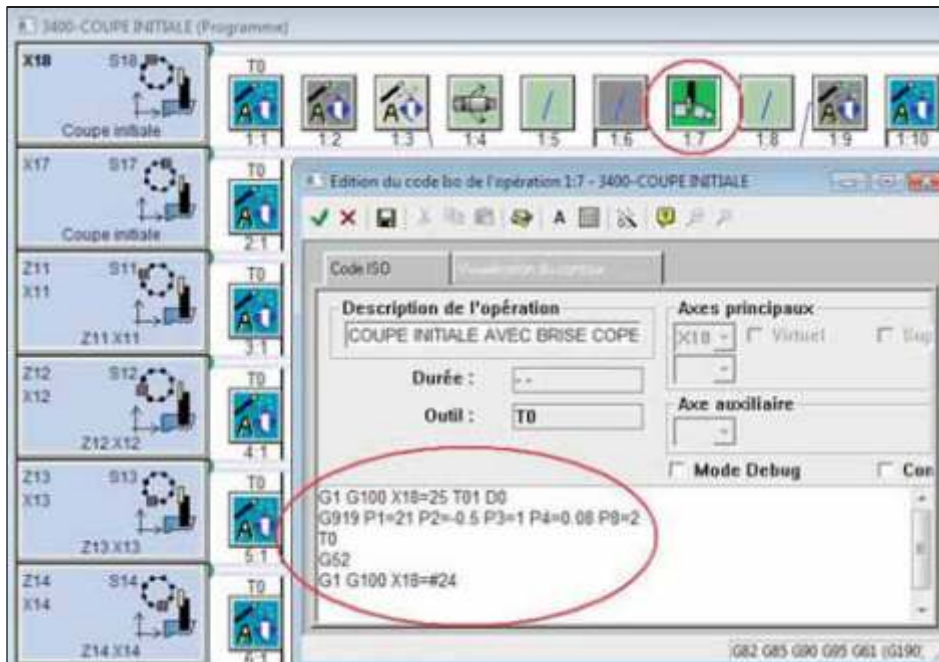


- Comment out the cutting operations (1:6 and 2:4)



**Comment:** To access the type of operation, click on the TB-DECO menu "Options/Configurations/Other" tab, then tick the **Access type of operation** box.

## Tricks and tips



- Enter a new operation (1:7) between operation 1:6 and 1:8

### ISO code:

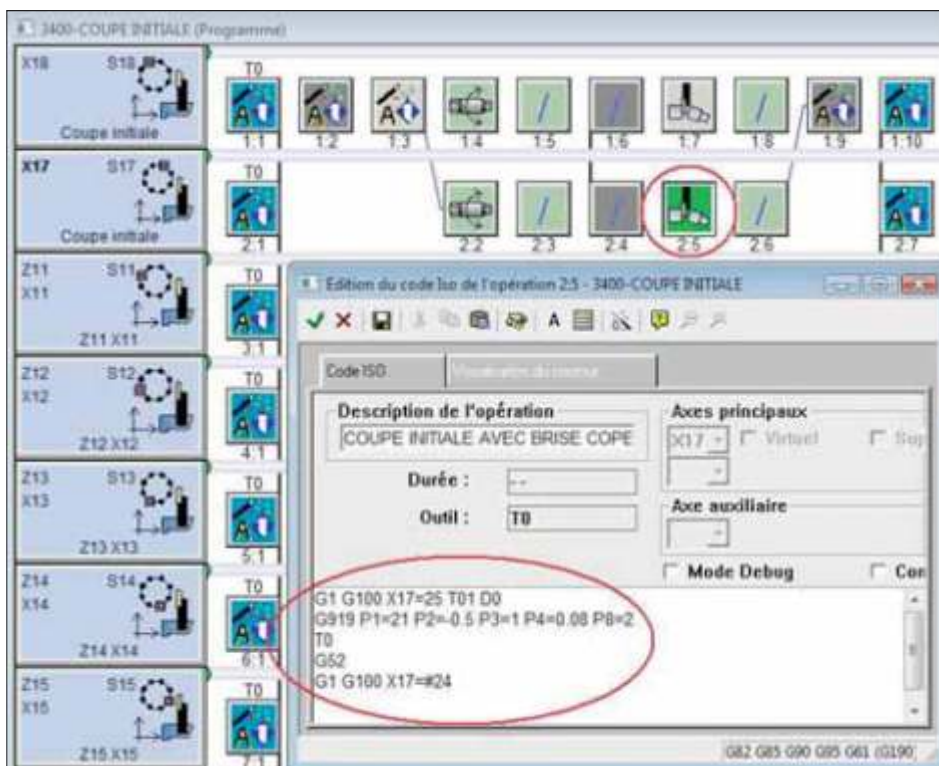
G1 G100 X18=25 T01 D0  
(Rapid approach with use of tool)

G919 P1=21 P2=-0.5 P3=1  
P4=0.08 P8=2 (Cutting cycle with chip breaker)

T0 (Cancel use of tool)

G52 (Cancel original offset)

G1 G10 X18=#24 (Reference position)



- Enter a new operation (2:5) between operation 2:4 and 2:6

### ISO code:

G1 G100 X17=25 T01 D0  
(Rapid approach with use of tool)

G919 P1=21 P2=-0.5 P3=1  
P4=0.08 P8=2 (Cutting cycle with chip breaker)

T0 (Cancel use of tool)

G52 (Cancel original offset)

G1 G10 X17=#24 (Reference position)

Depending on how difficult it is to machine the material, the initial cut without chip breaker could cause a pile of swarf to accumulate on the bar. This could break the tools. These tips will avoid this problem.

MEDICAL ENGINEERING PRODUCED WITH INNOVATION:

## PRECISION FORCEPS FOR ENDOSCOPIC INTERVENTIONS

**For a number of years, the Bacher Medizintechnik company of Tuttlingen, Germany has continuously specialised in the manufacture of alligator and biopsy forceps for use in endoscopes. Today, these surgical tools are used in a variety of interventions and are now an indispensable feature in all operating theatres.**

**To produce the mechanical masterpieces, the company has turned to Swiss technology. As a result, all turned parts are manufactured on a Tornos Micro 7 and all machining processes are carried out using the high-performance Motorex Ortho NF-X cutting oil.**



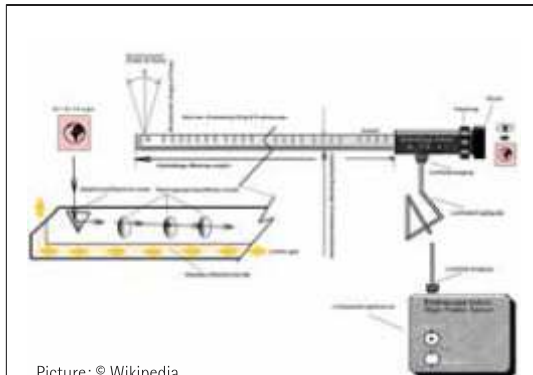
The alligator and biopsy forceps manufactured by Bacher Medizintechnik are available in diameters from 1 to 5 mm and in flexible or rigid versions in lengths up to 200 cm. They are operated via a wire in the sleeve with a separate handle (in the background of the picture).

In German-speaking countries, Tuttlingen is regarded as the heartland of medical engineering and has consequently assumed a leading role as far as production is concerned. The sector is dedicated to continuous optimisation of production processes and the development of ever more specialised materials and tools. The management at Bacher therefore approached the lubrication technology specialists Motorex to find out about optimisation options for production. After consultation with the technical customer service department and the appropriate field

representative, all production steps were examined and the production capacities in place at that time were recorded.

### **The benefit of multi-purpose cutting fluid**

Earlier, certain production steps always had to be performed on machines filled with the "right sort" of cutting oil, but the company soon found it necessary to look for cutting oil that could be used universally. It had to be universal but at the same time, nobody



Picture: © Wikipedia

The term 'endoscope' is derived from the Greek 'endon' = inside and 'skopein' = to observe. An early version of the instrument had already been invented around 1850. This device makes it possible to view not only the inside of living organisms but also cavities involved in engineering. It can be used simply for examination or even for manipulation. Endoscopes can be either rigid or flexible. Using a light source, a beam of light is directed onto the desired area. The endoscope has several channels, one or more of which can be used to introduce other required tools, such as the flexible alligator forceps shown earlier, for the removal of tissue, for example. In addition to use for diagnosis, it is therefore now also possible to perform minimally invasive surgical interventions.



The milling results with Motorex Ortho NF-X can be seen in the arms of the forceps - also the tool service life of the HSS milling cutter.



### "TECHNOLOGY HAS SURPRISED ME!"

"Motorex Ortho cutting oil has actually surprised me. I thought that it would hardly have any effect on production results, but even after the first series of tests, the full potential of this new-style cutting oil in terms of performance was obvious. A short list of what I have discovered in using Ortho NF-X:

- it allows all materials to be machined using just one cutting oil
- it guarantees maximum output in all processes, such as drilling, turning, milling, spinning, etc.
- it reaches optimal operating temperature rapidly and cools down superbly
- under a pressure of up to 120 bar, it clears away swarf without foaming
- it provides optimum lubrication
- it achieves a significant improvement in tool service life
- it can be removed effortlessly from workpieces
- it is free of undesirable, critical substances.

I am glad that we have switched to the Swiss cutting oil. It makes our day-to-day production work here noticeably easier."

*Mate Bekavac – Machine operator  
Bacher Medizintechnik,  
Tuttlingen, Germany*



The forceps consist of many classic turned parts that are turned on Tornos Micro 7 machines out of bar stock with diameters of 2 to 5 mm.

wanted to compromise on performance. Motorex's recommendation to switch to the ground-breaking high-performance Ortho NF-X cutting oil allowed the user to combine several benefits at the same time. It was possible to carry out all machining processes with one and the same cutting oil and, thanks to the integrated Vmax-Technology, production quantities were also improved, as well as the  $R_a$  surface values. The following process steps are carried out at Bacher on stainless surgical steels, such as 1.4021 and 1.4310, using Ortho NF-X:

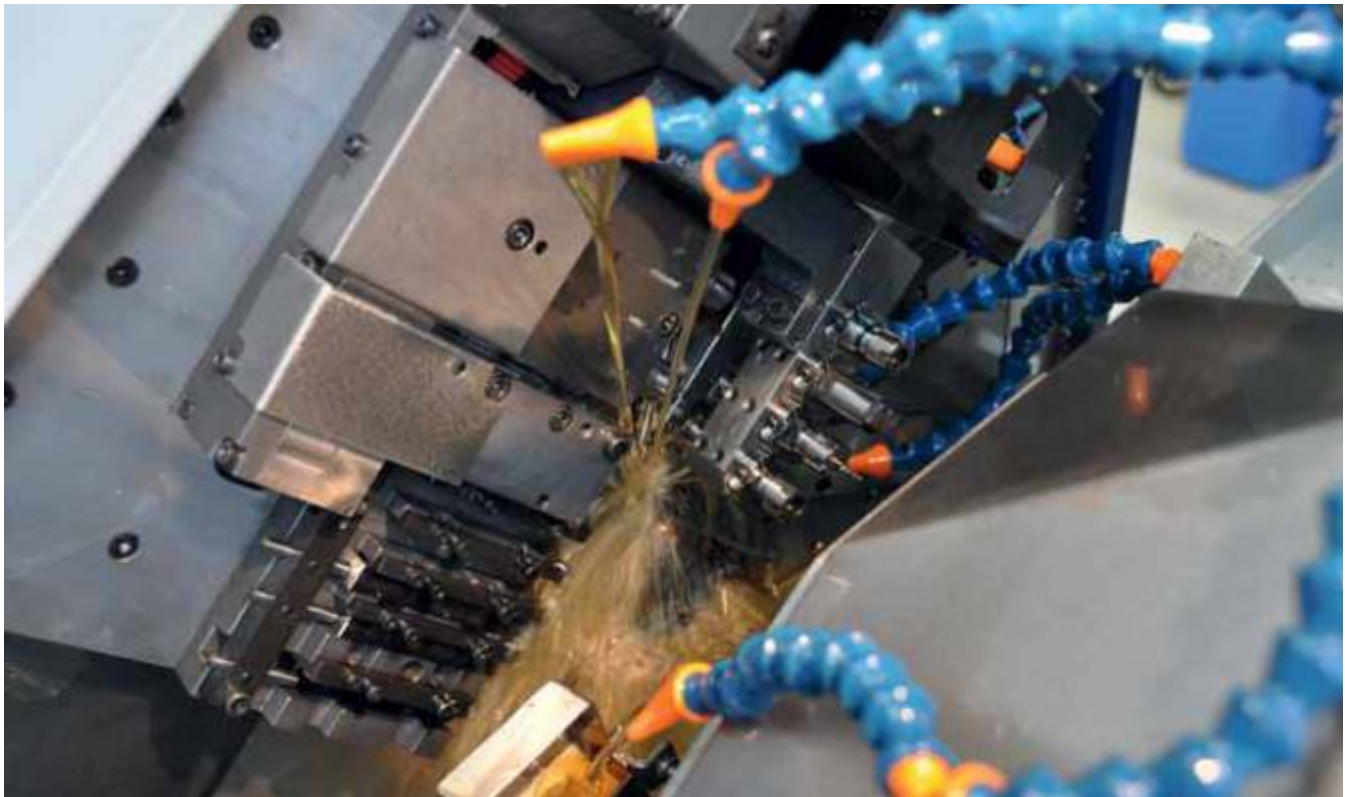
- Turning
- Drilling
- Milling
- Thread cutting

#### **Machining fluids as liquid tools**

Machining materials used in medical engineering demands an extremely high level of performance from the medium used for cooling, lubrication and

rinsing. Rinsing pressures of up to 120 bar are today no longer uncommon. On the other hand, outstanding high-pressure characteristics (EP = extreme pressure) are also required. In order that the HP properties of the fluid can absorb the extreme pressures, the lubricating film must be extraordinarily stable in terms of temperature and high pressure. With the ongoing development of the high-performance Swisscut Ortho NF-X cutting oil and Motorex Vmax-Technology, Motorex has made a significant contribution to innovation in the manufacture of parts produced in industrial medical engineering. In addition, the cutting oil contains no chlorine or heavy metals and can be easily cleaned away.

In component manufacture, it is no secret that the whole process is always only as efficient as the weakest link in the chain. As a result, the four success factors of machine, tool, machining fluid and operator must be of absolutely equal quality. It is therefore of little benefit to a company if it turns to the latest generation of machinery but seeks to make savings in the training of its staff or by using an outdated cutting oil.



As important as a powerful machining centre: The type of machining fluid used has a significant influence on the production process and costs.

### Cutting costs – protecting the environment

The facts on the machine reports demonstrate that the switch to the new-style cutting oil from Motorex has been worthwhile in terms of output, tool service life and quality demands. The current generation of Ortho products also carries no risk for people or the environment, and thus contributes towards ideal working conditions. That not only has a positive effect

on the working environment but also helps to reduce costs in respect of maintenance and disposal.

We would be delighted to provide you with information on the latest generation of machining fluids for manufacturing in medical engineering and on the optimisation possibilities for your organisation:



The jaw parts of the forceps are connected via joints with a draw piece. This is welded here by laser with a wire under magnification.

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PRECISION TOOLS

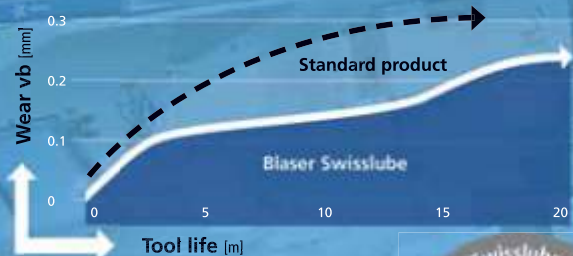
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## TO BE WHERE THINGS HAPPEN...

Canon Communication, the organizer of the famous series of Medtec shows all around the world now presents a new event in Zurich, Switzerland. Orthotec will take place on September 29<sup>th</sup> and 30<sup>th</sup>. To know the reason for the very existence of this professional show dedicated to the orthopedic market and learn a little bit more about this particular media, we've met with Mark Temple-Smith, Head of trade shows for Europe and Asia with Canon Communications.



**decomagazine:** You have organized the Medtec shows with substantial success; now you propose another show targeted at an even narrower market, why?

**M. Temple-Smith:** The orthopedic business has one of the highest growth rates in the medical business. Driven by demographic changes, this market is pushing innovation further and further. New types of orthopedic devices and material are continually brought to market, regulations are evolving and companies are in urgent need of information. We aim to create the perfect platform for these purposes.

**dm:** Wouldn't it have been easier to link it with Medtec (in another hall for instance) rather than creating another show?

**T-S:** We decided to organize this show because we are aiming at a niche market and highly targeted participants. These focused people welcome smaller more precise events. The first event will take place in Zurich with 70 specialised exhibitors.

**dm:** Why this location?

**T-S:** Switzerland has the perfect location for a Pan-European event like Orthotec. It is not far from any European country and flight connections are ideal. Moreover, the country includes factories from all the main players active in this field as well as hundreds and hundreds of smaller innovative manufacturers and sub-contractors for this industry. A lot of

innovation also comes from these small and mid-sized companies. It is then the ideal meeting point for this industry.

**dm:** You want to reach high profile people in the orthopedic industry, is it then mandatory to offer an added value event... or they wouldn't come. What is the program of the manifestation?

**T-S:** The event is planned for two days and the motto is "innovation". We will focus on every aspect including emergence of new materials, new technologies, new design, R&D, new regulations as well as green issues that cannot be ignored. It is clearly a networking event where people speaking the same "orthopedic" language will be able to draw the future of their businesses. For instance, in terms of technology, what will be used at short, middle and long term to produce parts. Will it be high precision turning, ultrasonic machining, metal or composite sintering? We will cover all these topics during the conferences or the table top exhibition.

**dm:** How can we participate?

**T-S:** As visitors, you have two options, you can go and visit the show or you can subscribe for the conferences. Obviously being a delegate at the conference also allows you to visit the show and carry on networking. We





expect 350 conference delegates and 1,500 visitors. During two days, leaders of the industry, exhibitors, delegates and visitors will be able to meet and exchange innovations regarding orthopedics.

**dm: It is not a simple exhibition but an event with conferences and companies presenting their know-how. Is this concept a new direction for Canon Communications?**

**T-S:** We organize events where there is a demand. We have clearly discovered that high profile and value adding events are requested by the market. The Orthotec show is also organized in the US.

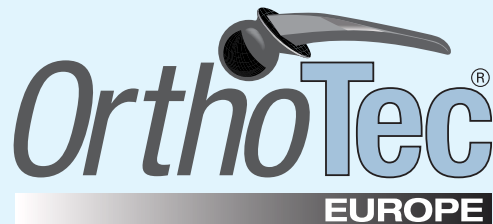
**dm: Will this event be organized in Switzerland again in the future?**

**T-S:** Yes, Orthotec is planned to take place every year in Switzerland. We are not sure of location yet, as it may alternate between Zurich and Geneva.

**dm: You told us that you saw demand for such targeted events increasing. As a specialist, merging industry and medicine specialists that are willing to go "to the heart of the action", I assume that Orthotec is not the only show of that kind you've planned, is it?**

**T-S:** This is true, we think these kinds of events have a bright future. Providing value to visitors and delegates, they also offer a non-expensive way for exhibitors to present themselves in a high quality manner. This mastered marketing effort is well appreciated. Yes, it is very likely that you will see new accurately targeted events blossom around the world.

*Thank you M. Temple-Smith for this insight into the Canon Strategy and the information regarding Orthotec Europe 2010.*



#### ORTHOTEC EUROPE 2010 KEY TARGET VISITORS AND DELEGATE GROUPS:

- Research and development
- Design engineering
- Production and manufacturing management
- Quality assurance and regulations
- Packaging engineers
- Purchasers
- Senior technical and corporate management
- Financial and legal

#### FIELDS THAT WILL BE DISCUSSED

- Joint replacement
- Spinal implants and instruments
- Fracture repair
- Soft tissues repair
- Orthobiologics
- Lean manufacturing
- Rapid prototyping
- Additive manufacturing
- Tooling and machining

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## TORNOS AT ORTHOTEC 2010 – Z RICH

The Swiss manufacturer will be part of this targeted event. To discover Tornos' approach to Orthotec, we met up with Philippe Charles, the Manager for the medical sector Market Segment at Tornos. He explained:

*"For over 20 years Tornos has been developing and providing high-performance, efficient machining solutions for producing medical hardware, in particular for the surgical sector. Some examples include orthopaedic implants, spinal applications, the dental sector, orthodontics and tools designed for surgery.*

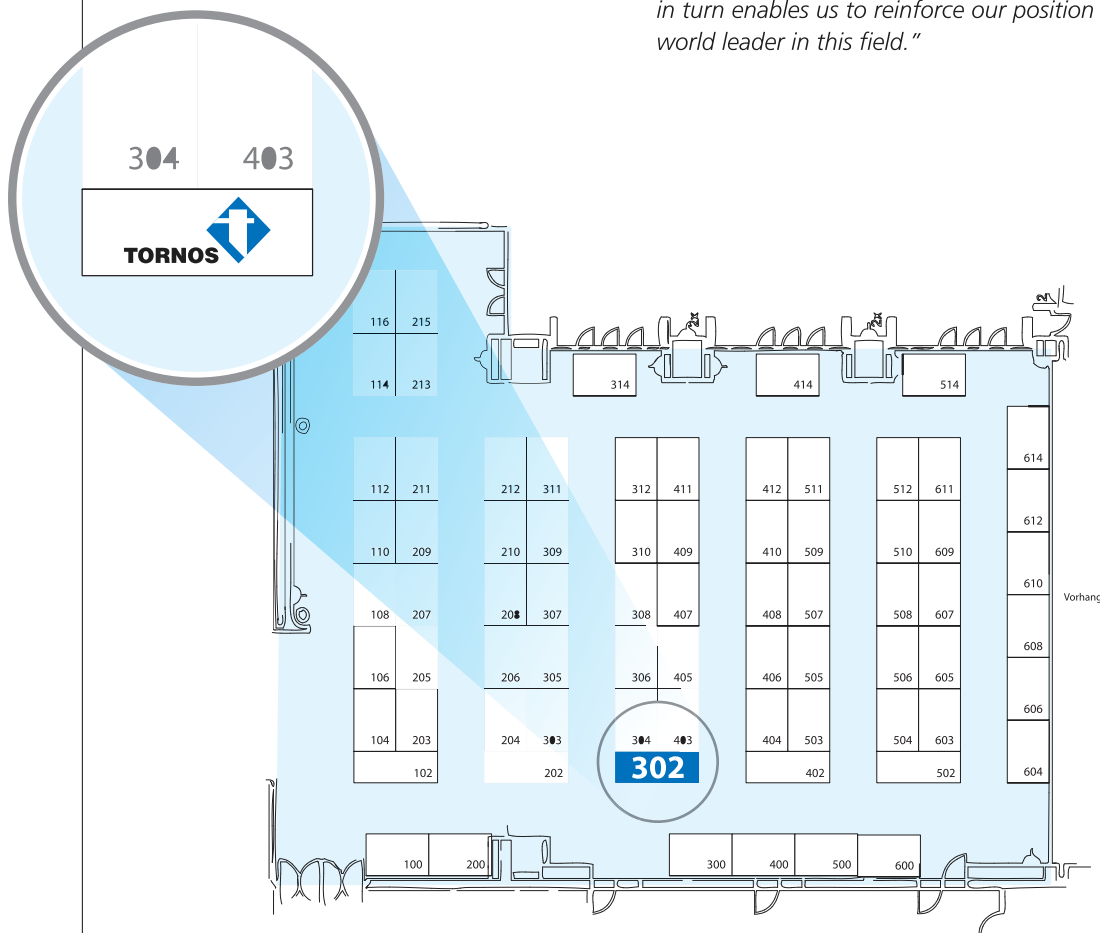
*Tornos is one of the biggest machine-tool companies to have attended the Canon organisations' Medtec exhibitions. In the USA, Europe and Asia, this has always been a success. At each show Tornos has been able to make numerous contacts with both existing and potential customers, whether OEMs or subcontractors.*

### Introducing...

*Orthotec is a part of these events, during which Tornos can demonstrate its expertise to visitors. There are many Swiss companies specialising in the medical technology field, and Tornos is convinced that these future contacts will bear fruit. It's important to note that for demographic reasons, the medical technology sector suffered the least during the 2008-09 economic downturn with annual growth indicators generally remaining positive.*

### ... and discovering

*"Orthotec is also an excellent opportunity to get to grips with how medical technology is evolving. It allows attendees to discover the latest developments and innovations in terms of R&D and the emergence of new materials. This allows us to anticipate market trends and expectations with regard to machining. We can then innovate, adapt and develop our products to respond better and more quickly to the needs of our customers. This in turn enables us to reinforce our position as the world leader in this field."*





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## RELAXATION AND DISCOVERY AS TIME TICKS BY

*Traditional watchmaking craftsmanship, workshop, assembly and manufacture are terms that still resonate throughout the mountains and valleys of the historic Jura region in Switzerland. Watchmaking is directly linked to both the local history and economy. In recognition of this fact, a small group of passionate enthusiasts established the Watchmaking Foundation some nine years ago. Collecting parts, exhibiting its findings and giving expert opinion on individual timepieces, the Foundation concerns itself with the treasures of our ancestors.*



### **Watchmaking: Inextricably linked to the region's development**

The past is undoubtedly an inexhaustible source of riches, but it also serves to help us understand our present society and envisage its future. Aware that the past has a tendency to gather dust, the Foundation's members are constantly seeking to bring watchmaking history out from the vaults and into the public arena, for those who either remember or need to understand the past. The Foundation's role today is

to effectively promote the region's heritage and to bring it to life through dynamic projects aimed at the widest possible audience.

With support from both the Republic and the Canton of Jura and the Swiss Confederation, the Watchmaking Foundation has implemented a large-scale project to appeal to historians and tourists alike. Connoisseurs and amateurs, Jurassians and foreigners can all discover the three aspects of watchmaking as they pass through the three Jura districts.

The Foundation's workshop in Porrentruy has been transformed. It will stage a presentation of semi-precious stones - a burgeoning area a few decades ago in the lovely Ajoie region. A traditional workshop will be recreated in the Franches-Montagnes district to recall the origins of watchmaking in the Jura. And finally, the Foundation will explore the themes of bar turning and machine tools in Delémont and the Birse Valley.

### Collective Project

In addition to these presentations, the institution is aiming to bring together the Canton's entire watchmaking community for the project. The industry, hotel, leisure, culture and heritage sectors will join forces to offer each visitor the most detailed picture of the Canton of Jura.

A truly innovative concept: the chance to look inside the industries and companies involved in watchmaking. For reasons of confidentiality and sometimes organisation, it is naturally not always possible to reveal specific expertise. Several organisations have chosen to participate, aware of the importance of openness and communication. Tornos is one of them.

Combined with a visit to the Automatic Lathe and History Museum, the Tornos factories are helping to confirm the historic significance of Moutier. When manual work was no longer sufficient, Schweizer,

Junker, Bechler and Petermann prepared the way for the machine, still controlled by the expert hand of the worker, thus becoming his ally rather than his enemy.

### Welcome to the Jura

In addition to this historic journey, each visitor will have the opportunity to spend some time in the Canton. Relaxing leisure activities, excellent cuisine and a night in welcoming Jurassian accommodation will be the perfect accompaniment to a truly unique watchmaking experience. This offer will be available as complete packages with the option to adapt both the length and content of the stay. Another way to discover the past and present of the Jura, just as you like.

### Watchmaking: Still a dynamic market for Tornos

The development of the company has always been linked to this area of activity. As far back as 1880, traditional watchmakers and the first manufacturers were relying on machines from Moutier to produce screws and other small parts needed to make the very first watches that would shape the reputation of Switzerland for centuries to come.

100 years after these first machines came the introduction of numerical control, allowing more complex parts to be produced. Faced with the need to produce this type of part to ever higher standards of quality and in increasingly difficult materials (gold followed



## The present



by titanium, stainless steel or even carbon steel, for example), manufacturers welcomed these machines and later the Deco generation with open arms. Almost 700 machines from the Deco range are now used for production in the watchmaking industry.

### Always more

There is a developing trend for the execution of operations in addition to the traditional turning, drilling, tapping and milling. For example, gear hobbing,

internal thread-whirling and screw thread milling is all now everyday procedures. These operations are the result of decades of historic expertise. For example, thread milling, which allows threads to be produced up to the screw head, is based on the "Piranha" system used on cam turning machines. The proposed solutions depend on the shapes of the parts but also on the run size. For example, for hobbing gears in relatively small runs (from 50 to 5,000 parts), the solution proposed by Tornos enables parts to be completely finished on the machine. Around 10%



of the Deco generation machines currently used in the watchmaking industry are equipped with a hobbing solution.

### Why Tornos?

Tornos has been closely involved in Swiss watchmaking for many years and not only for technical reasons. In technical terms, the solutions proposed by the manufacturer are dedicated to the production of parts for the movement and exterior. As watch designs become ever more sophisticated, parts must fulfil several functions in ever tighter spaces, therefore the production solutions must not only satisfy traditional watchmaking requirements, but go that much further. Tornos' extensive experience in other high-tech business sectors such as the automotive and medical industries is of obvious benefit to the watchmaking industry, which can take advantage of solutions with a proven track record in other fields.

Another reason for Tornos' close relationship with watchmaking is that it is an easily accessible service and it has the desire to provide assistance and guidance to companies developing Swiss-made watchmaking parts. The machine industry - in particular 'Swiss-type' sliding headstock machines - is intertwined with the watchmaking industry and Tornos has the resources to remain the number one partner in this business sector.

### A global solution

The integration of Almac into the Tornos Group represents a new chapter in the history of watchmaking. Tornos now offers a solution that has a bearing on all of a watches component: the movement, the exterior, the case and the bracelet.



For more information on the history:

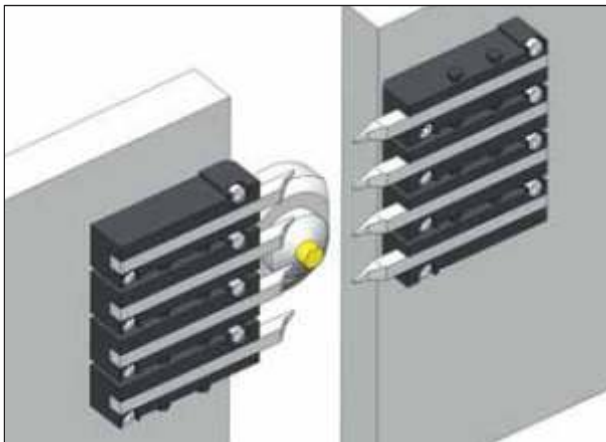
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For more information on Tornos' watchmaking solutions,  
contact your usual reseller or [contact@tornos.com](mailto:contact@tornos.com)  
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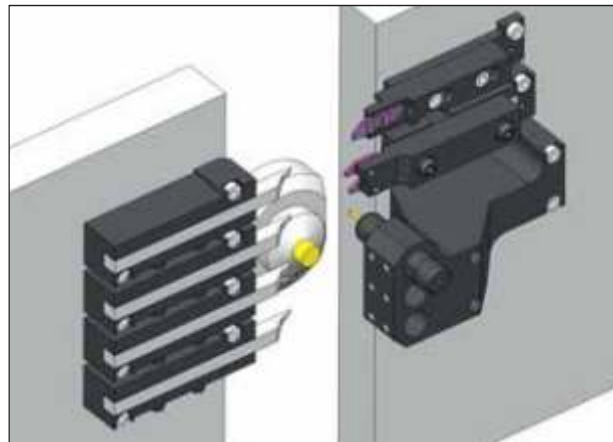


## MORE MACHINING POSSIBILITIES ON TORNOS DECO 7/10E

When machining complex parts with a Deco 7/10e machine, the lack of tool positions may become a problem. Indeed, bar turners must often cope with increasingly complex parts, which therefore require more tool positions. Aware of this, Bimu has developed several solutions which have proved their worth. The example of optimised tool configuration on the Deco 7/10e described below is a good illustration of the advantages that the combination of these products can provide.



Standard configurations



Optimised configuration

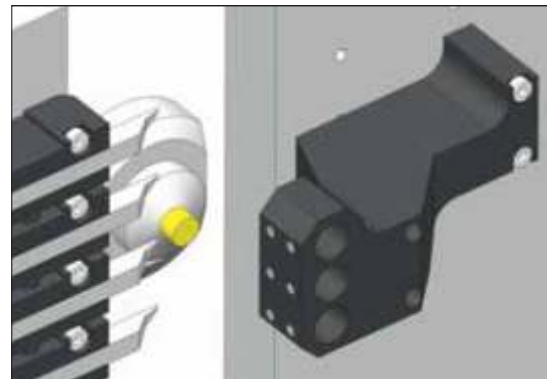
Here is a more detailed description of the tools available:

### 1. Support for using 3 drills.



Since the Deco 7/10e is primarily dedicated to turning operations, this version of the Tornos machine is not equipped with the end attachment. It may sometimes be that you need to perform drilling or boring operations. The Bimu "support for using 3 drills" offers an initial solution.

Mounted on positions T13 and T14, this support can house 3 drilling tools. Besides this useful option, an additional tool position is gained since 2 turning positions are "converted" into 3 drilling positions.



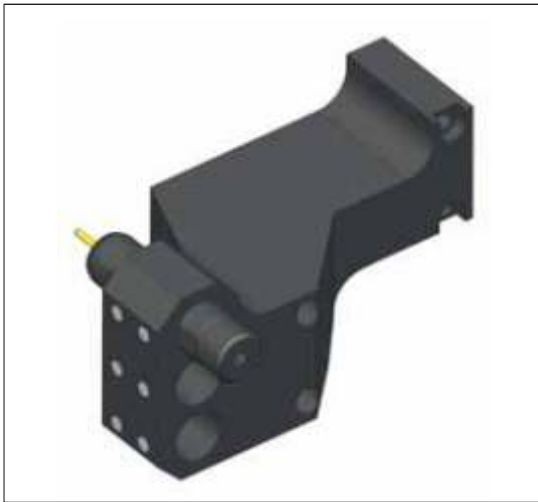
Close to the guide bush and highly rigid, this system enables precise machining of parts. Note that for machining long parts, it is possible to mount a spacer between the support and platten, in order to increase the guide bush-support distance to 60 mm, instead of the standard 40 mm.



## 2. B8 precision collet holder.



If the support above can house standard ER11 drill holders, using Bimu B8 precision collet holders offers an additional advantage.

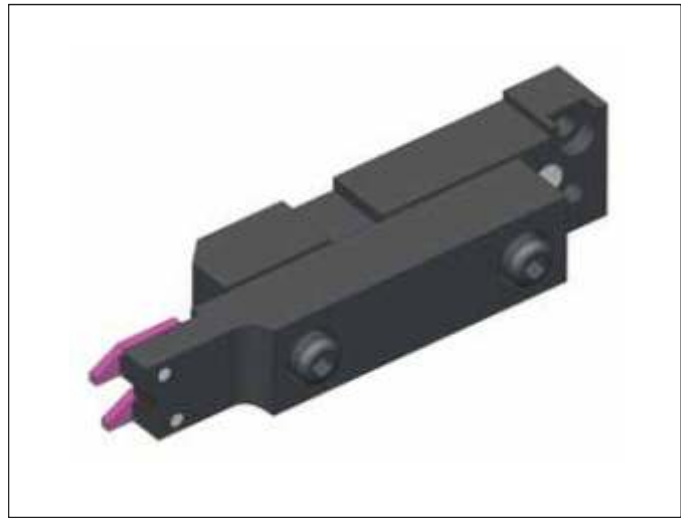


Indeed, the tightening precision of the B8 collet, combined with the great rigidity of the support, guarantee a high alignment precision and consequently an excellent drilling and boring quality.

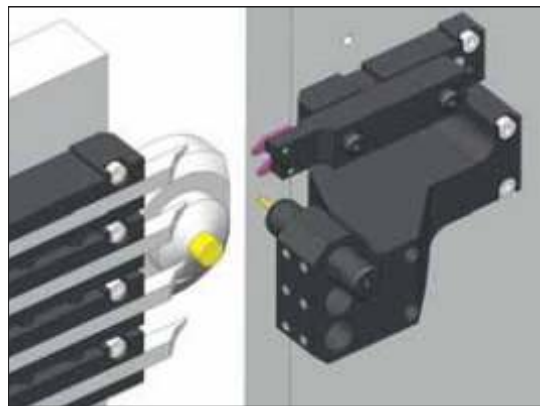
## 3. Tecko double tool holder.

When machining complex parts requiring many turning operations, or if for instance you need to make 2 roughing passes and 1 finishing pass, the number of tool positions available may quickly become limited. This is even more true if as we saw above, 2 turning positions are used for mounting the support for 3 drills.

To solve this type of problem, Bimu has developed double tool holders in its "Tecko" product line.



Thanks to these, you can have 2 tools in a single tool position, e.g. 2 inserts from Bimu's 400-line, 1 ISO insert (DC07/VC11) and one 400-line insert, or 1 VPGT insert and one 400-line insert.



Another advantage of these Tecko tool holders is their 19x15 mm cross-section, which ensures great stability and consequently a long insert service life.

### 4. "121" sectioning tool holder.



Another tool to supplement our example is the "121" sectioning tool holder. This tool's speciality lies in its cut close to the guide bush and the possibility of sectioning without an extended tip collet.

Indeed, the tool holder design enables the counter spindle to come close to short pieces to grip or support them, which provides greater sectioning precision.

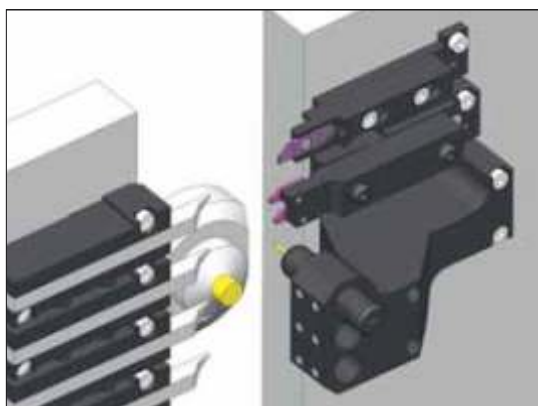
Since sectioning can be carried out with less need to remove material from the guide bush, vibrations potentially generating part or tool breakage are avoided.

This tool is available with an insert with standard clamping (type 253R) or X Centring clamping (type 853R).

You will find the complete tool documentation presented on the site [www.bimu.ch](http://www.bimu.ch). Bimu's staff are also at your disposal for any advice on these products and their applications.

*Technical Managers: Y. Meyer*

*Graphics by: A. Jeandupeux*



Another advantage is that in order to keep the same tool line after resharpening, it is possible to slide the tool holder forward to restore the initial tool geometry.



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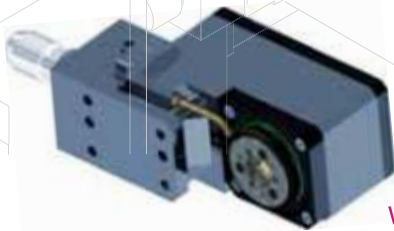


## Modular Series

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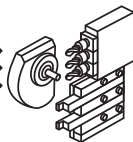
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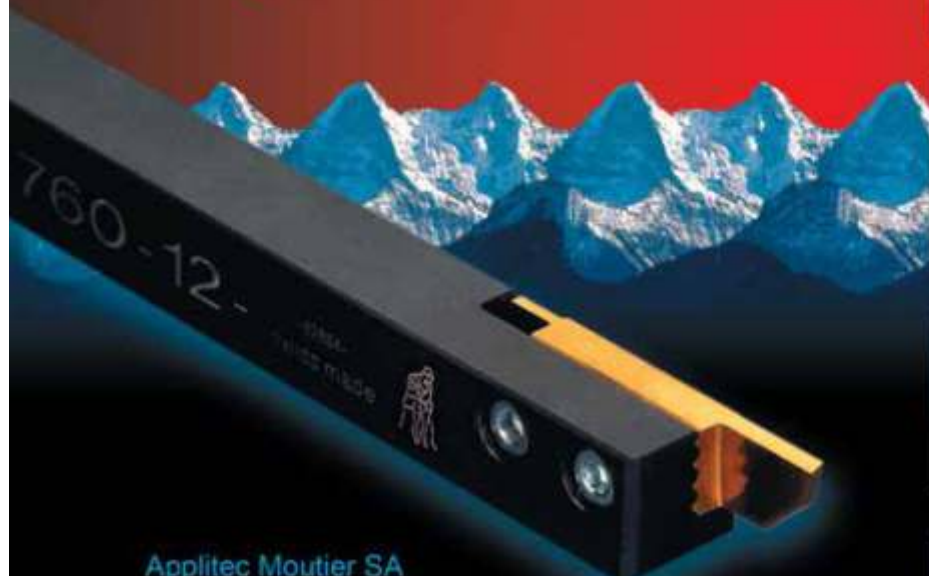
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