THE SHARP EDGE

ISSUE 12. 2016

LATEST GRINDING EVOLUTION

Cylindrical Linear Motors Vs Ballscrew Drive Systems

TOOL MANUFACTURERS COMPARE

Featured Companies

- Myles Tool
- Element Six
- Greene Tools
- Mahe Medical

ANCA

Grind flute faces to 0.2 Ra with the FX Linear

Join the new owners achieving better surface finish than ever before

FX LINEAR

3 models – FX3 Linear / FX5 Linear / FX7 Linear

Linear motors – Unique cylindrical design rated to IP67. Improved surface finish due to smooth axis movement.

AM5000 system – Latest technology with faster processing

Full Touchscreen monitor – Customisable with Windows 8

In-machine automation – Uses less floor space

Remote pendant – Handheld for easy operator access & set-up

Enhanced Accuracy • Upgraded Technology

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From the desk of the CEO

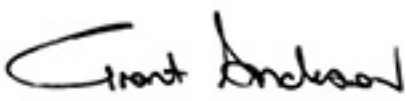
I'm pleased to be able to share that in the past year The ANCA Group has achieved all-time records in both sales and production. After the launch of our FX Linear and MX Linear machine ranges, customer feedback has been extremely positive. Our compact FX Linear range has received numerous awards, and has proven to be a popular range, particularly in the small tool market. The MX Linear range has also been a proven performer and is becoming a well-recognised machine in the high volume production mid-size tool market.

Over the last 18 months, we have been preparing for a major software upgrade in our material requirements planning systems. We engaged QAD to provide the ERP (Enterprise Resource Planning) solution to meet ANCA's requirements over the coming decade. Our aim is to improve quality, productivity and efficiency, while also gaining cost efficiencies. Our new system will also assist with the ultimate goal of improving factors such as spare parts delivery to customers. The new system went live at the end of 2015.

In June 2015, ANCA opened its new, larger European Head Office in Weinheim, Germany. The additional space allows for the increase in local staff and provides more room for the complete range of machines and spare parts.

Our next site to be redeveloped is the company Headquarters in Melbourne, Australia. The project is anticipated to be completed by the end of 2016. The new facility will provide a more welcoming front office for the many overseas customers that visit us. It will also provide additional room to expand our engineering and R&D departments, while consolidating more staff to a central location, improving communication and efficiency in a state-of-the art facility.

None of these achievements would have been possible without the support of our customers, employees and suppliers from around the world. We regard all of our stakeholders as our partners, working together to achieve successful outcomes for all. Thank you for your ongoing support over this period.



Grant Anderson
Chief Executive Officer
The ANCA Group

ANCA NEWS

A BIG YEAR FOR ANCA WITH 6 AWARDS IN 2015

Australian Exporter of the Year 2015

ANCA was announced as the Australian Exporter of the year at the 53rd Australian Export awards held in December. The company was also named the winner of the Manufacturing category for Australia on the night after winning the GOVEA (Government of Victoria Export Award) for this category earlier in 2015.

Trade and Investment Minister Mr Andrew Robb advised, "ANCA has been a leader in its field for 40 years and in that time it has significantly expanded its export markets and is on track for a record year of growth, hiring 160 new employees to meet the increasing demand for their products."

When receiving the major award founder Pat Boland thanked the team at ANCA and his co-founder Pat McCluskey. Boland said, "I get enormous satisfaction from visiting our customers around the world and seeing our products being used to make things. Being part of making things is one of the many benefits of a career in manufacturing."

Endeavour awards & PACE Zenith awards

ANCA was also the recipient of the overall 'Manufacturer of the Year' award and 'Industrial Product of the Year' award for the FX Linear range at the Endeavour Awards in Australia, and won the 'Manufacturing' category in the Australian PACE Zenith awards.

The ANCA Group plans new Global HQ building in Melbourne

After opening new head office buildings for ANCA Motion in Melbourne and the ANCA office in Germany, ANCA has commenced planning the new global headquarters for the ANCA Group. The new building will be on the existing site in Bayswater North, Melbourne and will consolidate the corporate, finance and marketing offices. It will also allow expansion of engineering, including software and manufacturing management.

New European Headquarters

ANCA Europe moved to Weinheim, Germany in June as it opened a much larger facility

ANCA formally opened a new state-of-the-art European headquarters in Weinheim, Germany on June 11, 2015. ANCA's new customer-focussed facility is close to the previous location in Mannheim, Germany and involved an investment of over 4 million euro. As Jan Langfelder, General Manager of Europe advised, "The expansion was necessary in order to keep up with our growth and to ensure we continue to offer good service and spare part deliveries in Europe. After helping set up the first German office in 1991 it is rewarding to see the continual investment and growth in this core region."

Official guests, His Excellency Mr David Ritchie, AO, the Australian Ambassador to Germany; and the Deputy Mayor of Weinheim, Dr Torsten Fetzner spoke at the event which included tours of the technology centre, demonstration room, comprehensive spare parts store and service area. Ritchie expressed his delight at the opportunity to open a facility that showed such a large Australian investment in Germany by a successful Australian company.

The day was also attended by co-founder and Chairman of the Board Pat Boland and his family, and CEO Grant Anderson. Boland told the 200 invited guests that he felt ANCA was in an important industry as the major eras of history are measured in terms of their cutting tool technology, through the stone, bronze, copper ages and today.

He shared that, "The ANCA philosophy is to push in two different directions, one being engineering excellence, with 25 PhDs working in our R&D centre and close co-operation with universities around the world. The other dimension is practical trade skills. Machine tools have to be built ruggedly, they have to be reliable and easy to use for someone with a trade background. I think that push from an academic sense and a trade sense has been one of our important cultural features."

In addition to the formal proceedings, the day included technical demonstrations, tours and lunch. An Open House was held on the following day to welcome more customers to see the new facility and machines.

WHAT IS 'SCRUM' & HOW IT CAN HELP YOUR BUSINESS

A competitive market environment means that many companies are finding that their traditional business processes do not allow them to move fast enough to keep in front. We look at what Scrum is and how it can provide faster product development.

Lisa Paterson

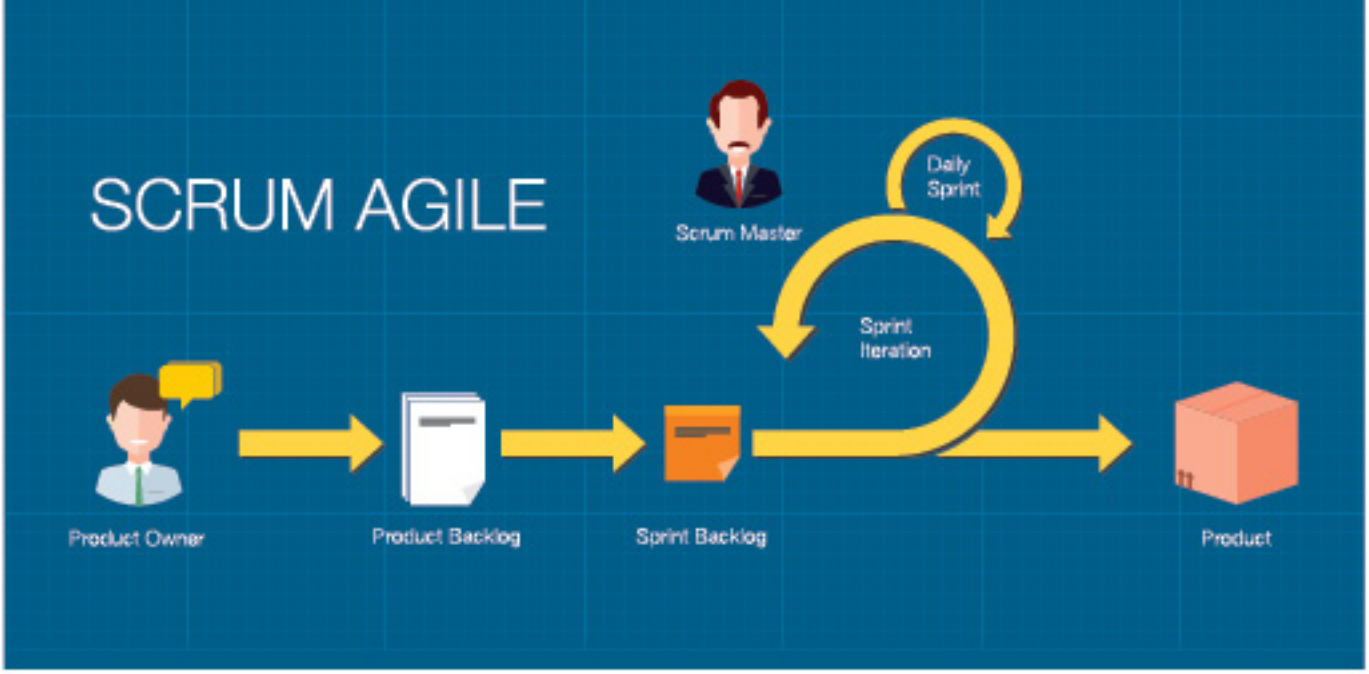
WHAT IS SCRUM?

Scrum is a process framework to manage complex product development. It is a way to keep things focused; it provides a way to build a collaborative work culture; how you can deliver the highest value to clients and how you can build customer collaboration. The term Scrum is a rugby term and it is used as it represents people working together to achieve a common goal. The rugby team moves forward in the scrum, heads down, shoulder-to-shoulder by continuously passing the ball. The central values of Scrum are continuous improvement, commitment, openness and respect. It defines a flexible product development strategy where a development team works as a unit to reach a common goal. It can be used in both large and small companies and by all industries. It is a mindset.

THE ORIGIN OF SCRUM

As outlined in the 1986 paper by Hirotaka Takeuchi and Ikujiro Nonaka 'The New New Product Development Game'; in today's competitive market speed and flexibility is as important as high quality, low cost and differentiation. Their research showed that the traditional sequential, or 'relay race' approach is now too slow and provided examples where new product development was halved in a Rugby-like method (now called Scrum) where the team goes the distance as a unit, passing the ball back and forth.

Ken Schwarber and Jeff Sutherland used Scrum in their companies in the 1990s, going on to release their first paper on scrum methodology in 1995. Their Scrum guide is available at scrum.org. Useful information is also available at www.scrumalliance.org which was originally founded by Schwarber.



Scrum is now considered an agile development method. Agile development was described in 2001 in the 'Agile Manifesto'. Agile principles allow teams to bypass traditional sequential methods and get more work done in a shorter time period. There are many Agile methods including Lean Development and Kanban, with Scrum dealing with how the project is organised and planned. The process was developed by the software industry, but the steps are relevant in any business or industry. Scrum works well for any complex, innovative scope of work.

THE SCRUM TEAM

PRODUCT OWNER

Is responsible for continuously communicating the vision and priorities to the development team and managing the Product Backlog, a current to-do list. Because Scrum values self-organisation among teams, a Product Owner must fight the urge to micro-manage.

DEVELOPMENT TEAM

Professionals who do the actual work to deliver releasable increments towards a 'Done' product at the end of each Sprint. The team is self-organising and has full control on how it works toward turning items in the Product Backlog into a functioning product increment. They are cross functional, with all the skills needed in the team to create a product increment. Ideal team size is between three to nine people.

SCRUM MASTER

Is a combination of coach, fixer and gate-keeper. They are a facilitator and do not manage the team. This person removes impediments to the Development Team's progress and helps them create high-value products. They also help the Product Owner in many ways, including finding techniques for effective Product Backlog management; and help the organisation by leading its Scrum adoption.

SCRUM PROCESS

CREATING A PRODUCT BACKLOG

An example of a Scrum process starting could be a customer wanting a product made. Maybe a medical OEM wants a surgical tool designed, some software is required, or changes to an endmill are needed. This customer and stakeholder wish list is called the Product Backlog and is managed by the Product Owner. The Development Team then estimates how long it will take to complete the highest priority items and creates a Sprint Backlog. The Product Backlog may have 40 items on it that the client would like their surgical tool to include. During Sprint Planning some of these items are selected for the next upcoming sprint.

SPRINT PLANNING & SPRINTS

The key concept in Scrum is the Sprint. The Sprint is a period of time in which work gets done to create a product increment. The Sprint length is typically short, usually between 1 to 4 weeks and once chosen stays the same. The Product Owner and the Development Team decide which jobs are highest priority. Jobs are added to the Sprint Backlog and the Team then breaks items down to smaller tasks for the next Sprint.

DAILY SCRUM

The Daily Scrum is a short meeting also known as the daily stand-up meeting. Each team member goes through what they have done since the last stand-up, what they plan to work on before the next one, and outlines any obstacles. This helps planning of work between team members.

SPRINT REVIEW MEETING

At the end of a sprint, the Scrum Team and interested stakeholders meet to inspect the product increment produced. Items that were done and not done, and any obstacles encountered are discussed. New information learned during the Sprint is fed back into the Product Backlog.

SPRINT RETROSPECTIVE MEETING

After the Sprint Review, the Scrum Master meets with the team for a retrospective meeting. In a Sprint Retrospective, the Team discusses three questions: What worked this Sprint? What didn't? What could we do better next time? And then plans and goals for improvement are made by the Team.

BENEFITS

- Leads to more satisfied customers as they are now part of the process so you can deliver products they really need faster. You can incorporate customer feedback at the end of every sprint so results are shaped by real-world use.
- There is reduced waste and cost as Teams are focused on what the customer wants.
- Results are achieved quickly and in small steps, and the adequacy of the product is tested. The feedback exposes issues faster so companies can adapt more quickly. This accelerates the overall development process and can also ensure more reliable products.
- The Scrum framework creates a more collaborative work culture where productivity is increased and workers gain satisfaction from developing features that people will actually use.

Service Tips

Get the best out of your Tool Grinder and keep it running smoothly with these tips from our service department.

Richard Shepley - Technical Support Manager

1

KEEP THE MACHINE CLEAN

- Clean inside and outside the machine weekly
- Clean the spindle taper, machine bellows and collet adapter daily
- Regularly clean the wheel arbor's contact surfaces
- Remove the bellows and clean under each axis monthly
- Adopt the 5S principles for the machine, and the machine's work area

2

KEEP ALL AXIS PROTECTION BELLOWS IN GOOD ORDER

- Remove and inspect the machine bellows for holes and wear and replace if damaged
- Remove any swarf found under the bellows and keep the drain holes clear
- Check the ballscrew / Linear shaft and bellows for wear and replace if damaged

3

MAINTAIN THE MACHINE'S COOLANT SYSTEM

- Ensure the filtration performance meets the grinding application
- Ensure the coolant system is regularly maintained
- Ensure the coolant is changed in line with the coolant manufacturer's recommendations
- Have the coolant tested for contamination
- Replace / clean the coolant filter media when required

4

4. MAINTAIN THE MACHINE'S AIR SUPPLY QUALITY

- Ensure your company air compressor is regularly serviced
- Ensure only clean, dry air is supplied to the machine
- Change the machine's pneumatic filters as per the service schedule
- Repair any air leaks that arise
- Ensure the air purge system is working correctly

5

5. REGULARLY SERVICE YOUR MACHINE

- Have an ANCA qualified service technician complete an annual inspection and condition report on your machine
- Keep a service log detailing daily, weekly, monthly service tasks
- Fix small things as they appear before they become larger problems
- Plan and budget for shutdown maintenance
- Consider having a service contract in place with ANCA
- Make sure all operators and maintenance staff are aware of maintenance and service tasks
- Fit only genuine parts

6

6. MAINTAIN WHEEL CHANGERS (MX7, MX5, MX7 LINEAR, MX5 LINEAR, GX7+, FX7 LINEAR & FX5 LINEAR)

- It is crucial to lubricate the OTT Jacob clamp unit weekly with the recommended grease. This must be done if your machine is fitted with an auto clamp spindle, please refer to the maintenance manual
- Annual inspection and replacement of wear components is critical for wheel changer operation, please refer to the maintenance manual
- It is critical that the wheel changer is checked for alignment and is commissioned when required using the commissioning arbors supplied with the machine

7

7. REGULARLY CHECK THE MACHINE COMMISSIONING

- Check the machine's commissioning as a part of regular maintenance
- Recommission the machine when required
- Check the machine's loader commissioning, and re-commission when required

8

8. KEEP YOUR MACHINE SOFTWARE UP-TO-DATE

- Keep your software up-to-date
- Ensure you are running the latest ANCA maintenance release
- Ensure you are running the latest software patch for your software release

9

9. MAKE SURE YOUR MACHINE REMAINS VIRUS FREE

- Adopt work shop policies that reduce the risk of virus infection
- Only use one USB stick on the machine
- Have your simulator networked to the machine to ensure the simulator has virus protection and the virus definitions are up-to-date
- Purchase ANCA antivirus whitelist protection (available for software releases RN31 and above)
- Do not install any antivirus product that has not been approved by ANCA

10

10. REGULARLY TEST AND INSPECT THE FIRE SYSTEM

- Have your fire system regularly checked to ensure it is operational
- If you have a Pyrogen canister type fire system replace the canister when it expires (which is every 10 years)

Richard Shepley - Technical Support Manager

Linear Motor vs Ballscrew Drive Systems

A German tool manufacturer tests and compares the ANCA MX7 Linear & MX7 tool grinders on factors such as surface finish & power consumption

Until recently ANCA had resisted using linear motors in their tool grinders. It was felt the flatbed design motors were not the best design for tool grinders, partly due to thermal issues. Last year ANCA's own range of linear motors were was released. These were named LinX Linear Motors (patent-pending) and are used on the FX Linear and MX Linear range (X & Y Axis) of CNC tool grinders.

Difference in Design

With traditional flatbed linear motors the magnets are laid out horizontally. However, on the cylindrical LinX Linear Motors the magnets are "rolled up" into a shaft rather than being laid out onto a flat bed.

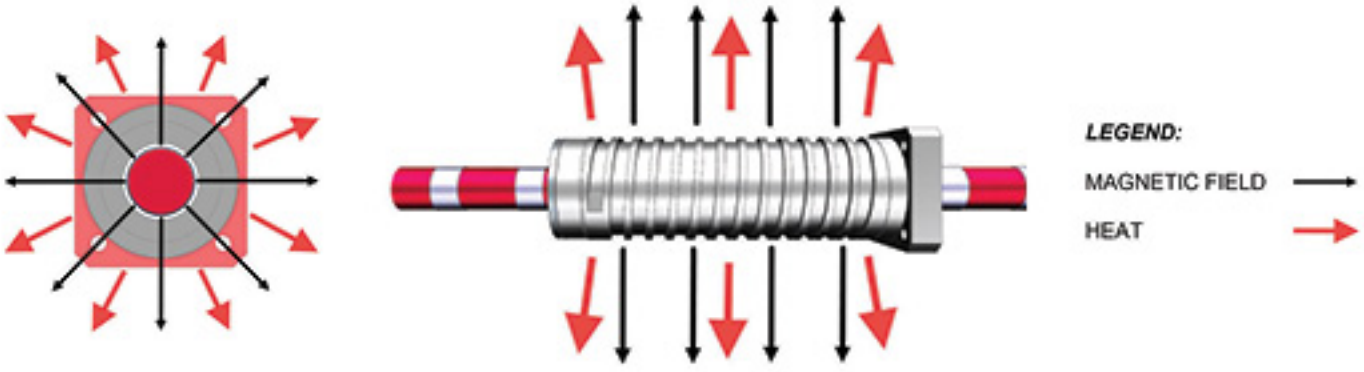
Containing just two main parts, a rod and forcer, ANCA LinX Linear Motors are a robust product rated to IP67.

Benefits of cylindrical linear motors

These are the first cylindrical linear motors on a CNC tool grinder and provide some benefits for tool grinding over flatbed linear motors and ballscrew drive systems. These include:

- No loss of preload or rigidity
- Improved accuracy
- Smoother axis motion (reduced friction and cogging)
- Reduced reversal errors and no backlash as seen on rotary ballscrew drive systems
- Improved cycle times and surface finish
- Higher acceleration and rapid traverse rates (50m/min)
- Floor space saving (no additional chiller is required to cool the linear motors)
- Less maintenance (no contacting parts so the motor does not wear out)

As the magnetic force is cylindrical there are no downward forces on the linear rails or problems with cogging (which is a jerky/uneven motion) which can occur with flatbed linear motors.



LinX cylindrical motor design showing direction of magnetic field & easy dissipation of heat

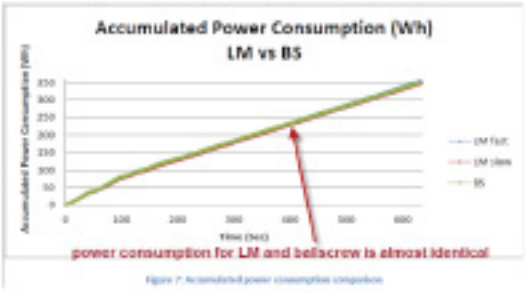
Testing conducted

Empirical testing comparing ANCA tool grinders with conventional ballscrew drive systems, to ANCA tool grinders with cylindrical linear motors follows. Factors tested included comparison of power consumption, heat generation, spindle load and surface finish.

German tool manufacturer compares surface finish

An ANCA MX7 Linear motor tool grinder was installed at a world renowned tool manufacturer located in Germany for testing. The customer wanted to compare the grinding results between the MX7 Linear and their existing MX7 ballscrew machine.

Factors such as cycle time and surface finish between both types of drive systems on the MX7 machines were tested and compared.



Power Consumption results summary for all the grinding tool cycles		
MACHINE SETTING	**GRINDING ONLY**	**EOT DIGITISE & GRINDING**
Ballscrew standard setting	0.348kWh	0.356kWh
Linear Motor with ballscrew acceleration & velocity setting	0.345kWh	0.353kWh
Linear Motor with high acceleration & velocity setting	0.352kWh	0.358kWh

Power consumption

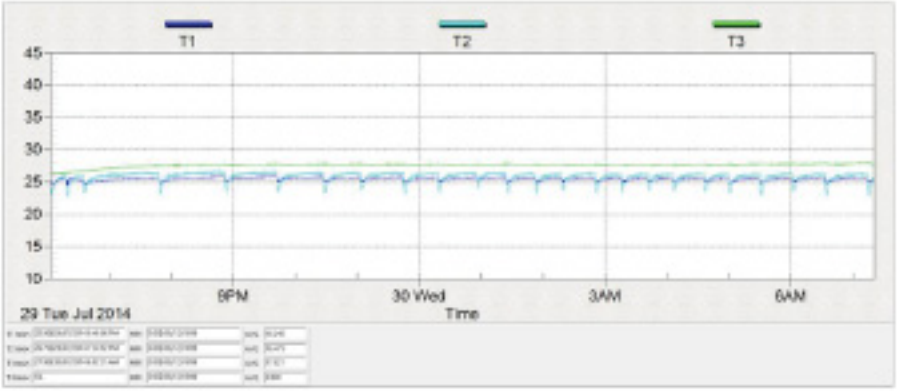
A fluke energy analyser was used to record the entire machine power consumption, voltage and current on both types of machines when grinding a 16 mm diameter ballnose tool. The results showed that the power consumption of a tool grinder driven by LinX Linear Motors and one with a ballscrew drive system is very similar.

Temperature

When using traditional flat-bed linear motors there is always a concern about the heat generated by this type of drive system. With the LinX cylindrical design there is no significant increase in temperature within the machine. Using thermal probes inside the MX7 Linear, testing showed that during thirteen hours of continuous running temperatures did not exceed 28 degrees Celsius which is acceptable when grinding. The temperature inside the machine, ambient temperature and the temperature of the coolant running back into the scavenge tank was recorded.

It is important to note that a chiller is still required on any external coolant system to stabilise the temperature of the coolant for a tool grinder with LinX Linear Motors. These linear motors have a unique design. The design acts as a cooling jacket wrapped around the motor which provides excellent heat dissipation. This ensures the motors run cooler and is the reason a separate chiller unit isn't needed. Because the LinX motor is cylindrical, it also means the magnetic field is circular and so does not affect the bed or machine rails which can cause thermal expansion of the base casting in the way a flatbed design does.

MX5 Linear - Temperature test results – 13 hours continuous running



T1 - Temperature inside the MX5 Linear machine canopy

T2 - Ambient temperature in the room

T3 - Temperature of the coolant in the scavenge tank (coolant outlet from the machine)

Cycle time & Surface finish

The cycle time for a 16 mm diameter ball nose tool using the same set up, feed/speeds and grinding wheels was almost identical. However, the most noticeable difference during the testing was the improvement in surface finish on the tool ground using an ANCA linear motor machine. The surface finish on the gash section of the tool using ballscrews was very good at 0.2 Ra (Roughness average). However, the surface finish result on the tool ground with the ANCA linear motor tool grinder was impressive, measuring at 0.08Ra. When the tool was inspected with a microscope it was clear that the surface finish is much better when ground with the ANCA MX7 Linear motor tool grinder.

As the enemy of grinding is vibration, using the extremely rigid MX7 in this case has helped both results, but the smooth axis movement of the LinX Linear Motors further assisted to keep vibration at a minimum. Tools with highly polished surfaces such as these provide better cutting edges which help ensure extended tool life and improve the finish on the machined part.

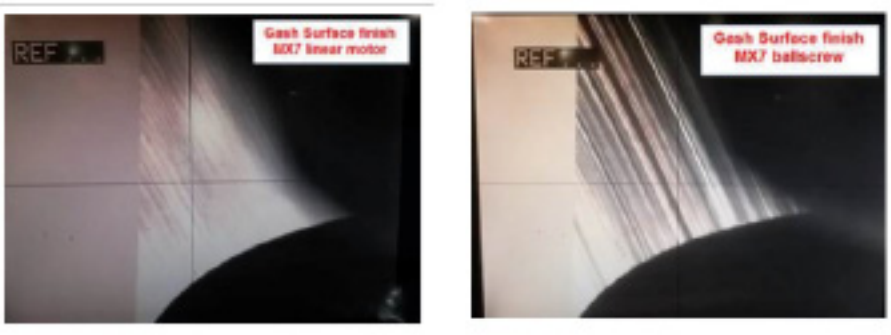
The gash surface finish was also measured using an Alicona InfiniteFocus optical 3D micro co-ordinate system for form and roughness measurement. The Alicona InfiniteFocus is capable of 3D, high resolution measurement

with a vertical resolution of up to 10 nanometers. The measurements taken using the Alicona equipment confirmed the improved surface finish results achieved on the MX7 Linear motor tool grinder when compared to the same ballscrew driven machine.

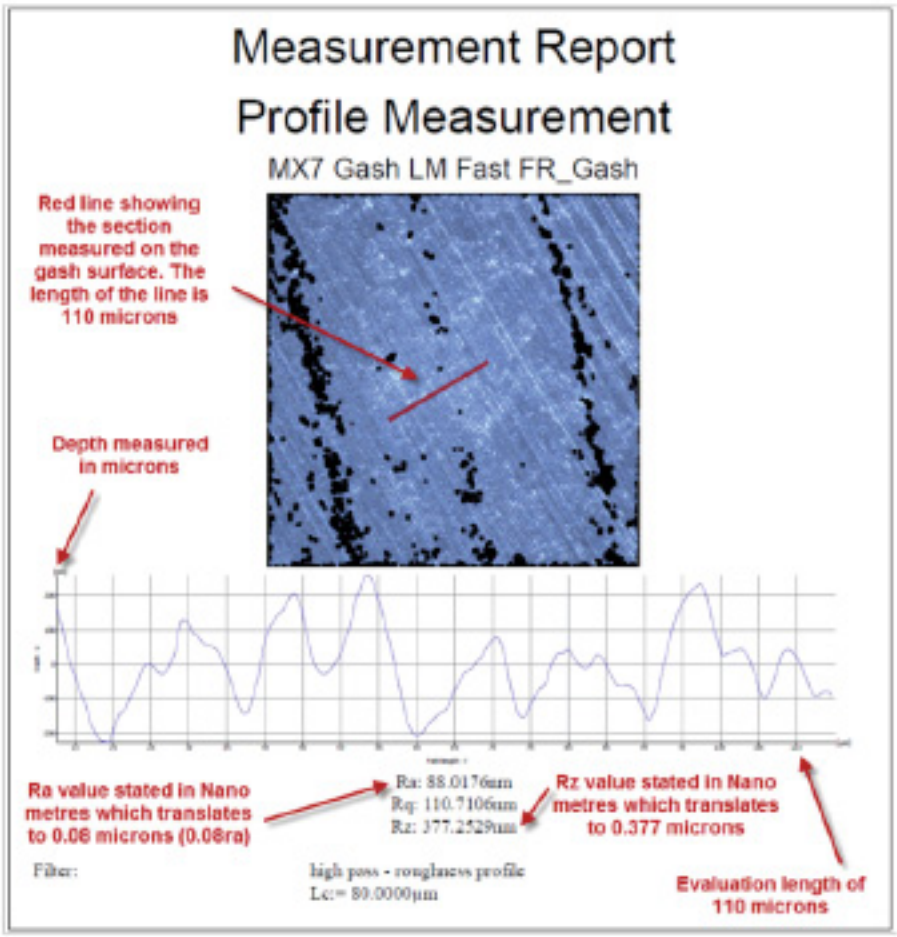
Findings

The conclusion from the testing and statements from the customer confirmed that the MX7 Linear tool grinder provided better surface finish than the MX7 ballscrew tool grinder. In addition, that the power consumption and cycle time were found to be similar on both types of machine.

Other testing, which was separately conducted at ANCA, found that the MX7 Linear did not produce excess heat over thirteen hours of continuous running. The testing demonstrated that the addition of the linear motors to the MX7 Linear model did not result in excess heat which would be detrimental to grinding results.



Tools inspected by microscope. Comparison between MX7 Linear and MX7



Alicona report showing the surface finish result of a tool ground on the MX7 Linear

MYLES TOOL

Myles Tool discusses the benefits of linear motors

Simon Richardson

Myles Tool is a company located in the hamlet of Sanborn in the state of New York. Myles Tool has been trading for thirty eight years and specialises in the manufacture of standard and special carbide cutting tools for many industries. The owner and founder of the company is Myles Barraclough, who started from his home garage in 1977 using a manual grinding machine. A combination of drive and enthusiasm rapidly grew the company into a multi-million dollar organisation that produces high quality cutting tools for the aerospace, automotive and medical sectors.

Joe believes the MX7 Linear machine is superior to a machine driven by a ballscrew, "because the transition is smoother and you don't have to deal with wear or backlash."

Myles Tool Company is now a one stop shop for standard tools, regrinds and special tools made to customer requirements. Working with his son Tim beside him, Myles has continued to grow the company by investing in new machines and high quality equipment whenever possible. Over many years, the service, support and close working relationship with ANCA Inc has also contributed to the company's success.

Myles believes that investment in the latest technology and equipment needs to be extended to people who are capable of operating the best grinding machines. Joe Adams, the Plant Manager of the grinding shop at Myles Tool, has a large amount of knowledge in cutting tools along with significant experience in using ANCA grinding machines. Myles obviously knew this when he employed Joe thirteen years ago, because he purchased an ANCA TX7 machine at the same time for Joe to operate.

A major part of the investment at the company has been with ANCA. The Myles Tool factory is home to a total of thirteen ANCA CNC tool and cutter grinding machines. Seven of these machines are the MX7 model. The latest addition to this impressive number of machines is the MX7 Linear. The MX7 Linear was delivered eight months ago and has been producing tools of exceptional quality to tight dimensional tolerances without any problems since its first day of operation.

Joe shares, "Since the MX7 Linear was installed it has worked perfectly and I am very happy with the performance of the machine." Regarding the differences between the MX7 ballscrew and linear motor machine, he commented, "When using the same grinding wheels,

tool file, feeds and speeds, I found that the surface finish is better on a tool ground on the MX7 Linear when compared to the tools ground on an MX7 ballscrew machine."

Joe believes the MX7 Linear machine is superior to a machine driven by a ballscrew, "because the transition is smoother and you don't have to deal with wear or backlash." To verify which machine had the better surface finish, the tools were checked using a profilometer (an instrument used for measuring surface finish). Joe found that the flute face from a tool ground on the MX7 ballscrew machine can be as low as 0.8 Ra (roughness average), but the flute face measured on a tool ground on the MX7 Linear measures lower at 0.2Ra. In addition to these improvements, Joe has noted a reduction in cycle time of up to 10% when grinding on the MX7 Linear machine. Joe commented, "The reduction in cycle time from the MX7 Linear machine when producing tools in batches of up to 5000 pieces is a significant saving in time and money for the company."

The MX7 Linear uses the same coolant system and chiller as the MX7 ballscrew machine. Joe confirmed that no special modifications were needed to the coolant system or the chiller unit to accommodate the MX7 Linear machine.

The linear motors used on the MX7 Linear are called LinX, and are cylindrical as opposed to a traditional flat-bed design, which require a dedicated separate chiller unit. Because the LinX motors are cylindrical there are no downward forces on the machine bed or rails, and so no heat is transferred to these components. Joe confirmed, "We have had no thermal problems with the MX7 Linear." Joe also stated that he felt that the polymer concrete base on ANCA machines contributes significantly to the thermal stability of the machine.

In Joe's experience this was not always the case with some other grinding machines where he had seen thermal issues.

To find out more about Myles Tool Company Inc visit their website www.mylestool.com.

From left, Tim Barraclough, Myles Barraclough and Joe Adams in the Myles Tool factory

RFID makes tool tracking easy

Link your TXcell with your ERP system to provide better customer service

Duncan Thompson

So you've got your tool geometries dialled in, grinding processes producing great tools and cycle time optimised so that your machine is singing. Time to relax? Not at all! Actions taken outside the machine can also have an equally important impact on giving you an edge in the market.

Receiving, processing and despatching customer orders takes time, labour and money – all for no value add. Streamlining these processes not only reduces costs, but increases your throughput and reduces lead times to your customer – particularly those ordering tools in small batch sizes.

Understanding this, ANCA has developed a Flexible Grinding Cell that links the ANCA TXcell grinding machine directly to the company's ERP system. The idea itself is simple, but the benefits are many and the resulting solution provides streamlined tool order processing outside the machine.

In the first installation of this type, a TXcell is being used for regrinding where success comes with the flexibility of the machine to switch from one tool to the next without idle time. In a study of the operations of regrind shops, several challenges were identified and solved.

"Firstly, because customer regrinds typically involve batches of tools with mixed diameter and also tool type, customers required the ability to automatically switch the collet from one size to the next," comments Duncan Thompson, TX Product Manager. "Other systems are available to change collets, but often they require one collet for each tool in the loader. This can really see machine tooling costs add up." The solution delivered by ANCA requires just one collet of each size and uses Schunk hydraulic collets, widely acknowledged as delivering excellent tool runout.

The next challenge was how to efficiently set up the loader and minimise down time. Again, looking at other systems, it was observed the operator had to spend time carefully programming each loader pocket with the correct tool and be sure no mistakes were made. During this time the machine was idle. Some efficiency in this process could be gained by sorting the tools into groups of common diameter and type, but this then required a person to re-sort them back into their original customer groups after grinding.

Duncan Thompson talks about the solution. "ANCA's Flexible Grinding Cell uses low cost RFID chips in a carrier to allow the correct program to be associated with each tool in the loader, no matter where it is placed in the pallet. Tools can be added without having to reprogram the pallet.

This is particularly useful if customers receive an urgent job. Those tools can be simply placed at the front of the queue and the machine restarted. No machine time is wasted resetting the loader schedule. After grinding, when tools in their carrier are removed from

Duncan Thompson scans a tool's RFID chip

the pallets, a quick scan of the RFID chip will tell you which tool belongs to which customer, so you can be sure customers get their original tools returned to them without errors."

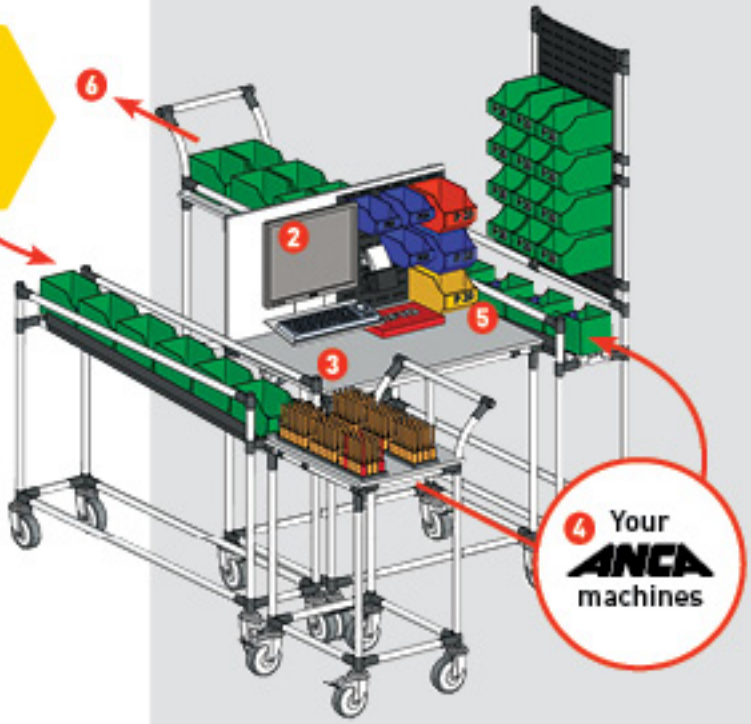
These two developments can be used on their own, and certainly add excellent flexibility to the TXcell, but working with a customer ANCA has taken things one step further. Duncan Thompson explains, "Each tool that arrives at the customer site was uniquely identified. This allowed the customer to track this tool not only through the factory, but over its entire usable life. The TXcell with its RFID carriers has been linked into this system. At a dedicated work station the operator scans the tool and instantly the correct grinding file and customer details will be recalled. This information is linked to the RFID chip, ensuring the correct file is used for grinding that tool. This system allows one operator to process more tools in less time. Ultimately the plan is to have several machines with identical tooling and wheel packs, so that any tool can be placed in any machine with spare capacity.

With these three features working together on the TXcell, Duncan Thompson comments "Customers are seeing a measurable reduction of machine idle time so we see better capital utilisation of the machine. Additionally, as well as reducing the operator time and effort in setting up the tool processing, the machine operators are being utilised for other value adding tasks. It has been a great outcome on all fronts."

Tools can be placed anywhere in the pallet

How The System Works In 6 Easy Steps...

1. Inward new order presented with job card from your ERP.
2. Scan job card to automatically create tool grind file (TOM).
3. Unground tool into carrier and update RFID chip with grind file details.
4. Tools in carrier are transported to tool grinder. Loader reads RFID to call correct grind file.
5. Rescan RFID for finished tool to return it to correct tool job box.
6. Finished tool in box with job card ready for despatch to customer.



Versatility & Understanding Equals Competitive Advantage

How Extramet Products keeps ahead of its competitors

Extramet is a world-wide manufacturer of premium tungsten carbide materials and components. The US operation, Extramet Products, is located in Latrobe, Pennsylvania, and is a value-added branch of the company. The carbide rotary tool market is extremely competitive. What sets Extramet apart from its competitors is providing ISO certified precision grinding services with unmatched customer service.

"When you choose Extramet, you choose excellence and consistency. This is the key to our success!" says Wayne Douglas, Managing Partner for Extramet Products.

Extramet supplies carbide to the Aerospace, Automotive, Medical and Oil field industries. All parts are produced according to the specifications of our most exacting customer. ANCA customers in need of precision profiled blanks for fluting operations turn to Extramet for blank preparation. To handle those challenges, Extramet relies heavily on TRU TECH Systems grinders. "Any tool that requires blank preparation can be created on our TRU TECH Revolutions. We've been using TRU TECH machines for 14 years, and the accuracy and repeatability we've been able to achieve using this equipment is nothing short of amazing," according to Don Dumnich, Operations Manager.

"Over the years TRU TECH has made a number of product improvements focusing on performance and productivity, but the set-up and ease-of-use of the machine is common across the product range. The software has always been extremely user-friendly which provides a huge benefit for training new personnel." Extramet owns seven (7) TRU TECH machines, including five (5) TRU TECH Revolution Perimetric™ grinders.

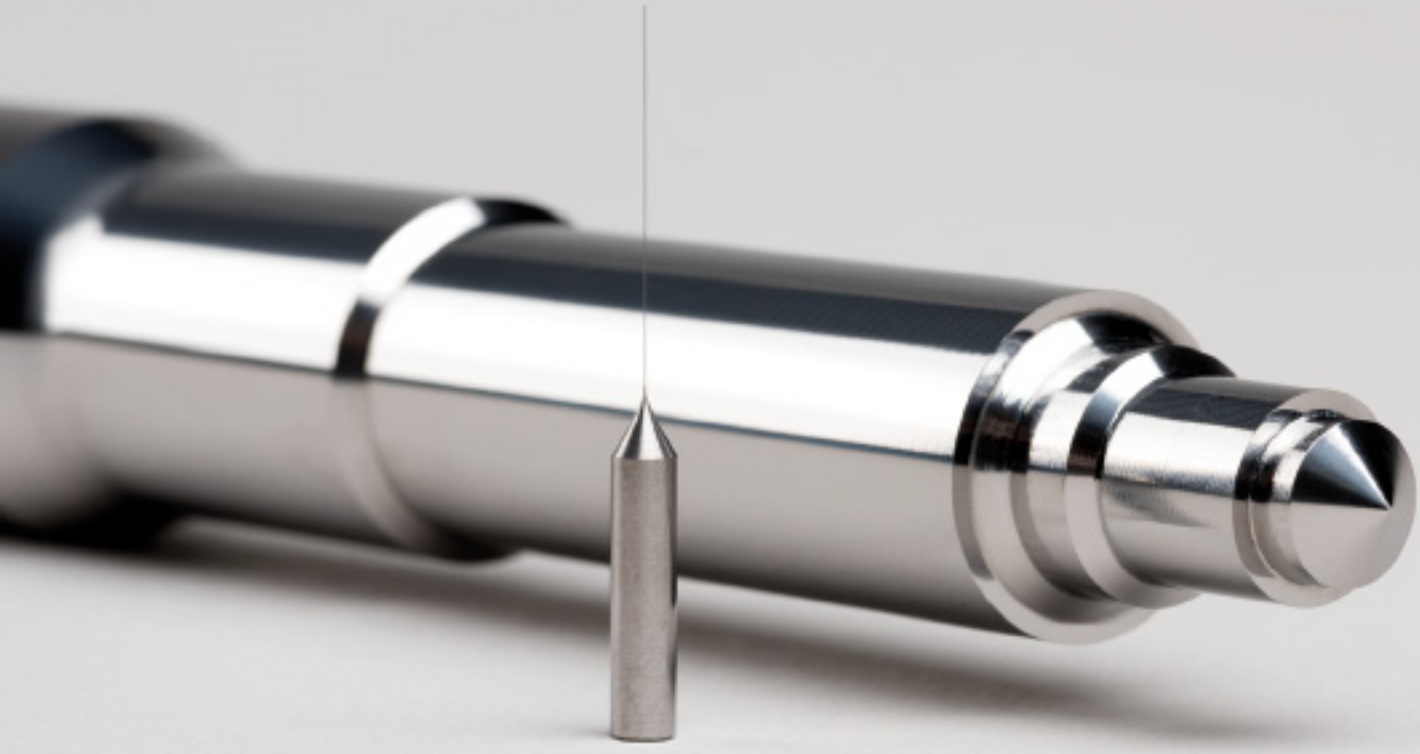
"The smallest diameter ground to date on a Revolution is 0.2 mm, the largest diameter we have ground is 50 mm. Set-up is minimal. Quick wheel changes and ease of zeroing in the machine allow an operator to be up and running with a job within 10 minutes."

The key to fast accurate set-up lies in the Revolution fixturing. The machine's unique Perimetric™ fixturing locates, rotates, and grinds each work-piece relative to its ground shank (or perimeter), rather than to a theoretical center. This means the work-piece can be loaded, (even re-loaded in the case of a regrind) without indicating, while still ensuring that each feature will have no measurable run-out to the shank of the workpiece.

"TRU TECH Revolution machines have allowed us to be very aggressive with feed rates, without sacrificing tool integrity, all while increasing our productivity."

"Fast set-up, cycle-time, and repeatability are the reasons we prefer TRU TECH equipment. We plan to continue using TRU TECH Revolution grinders in the future for performing grinding operations for our rotary tool blank customers."

VERSATILITY



Fast, Easy Setup • 1mm to 75mm

Ultra Precise • Zero Runout • Speed

Revolutionize Precision Grinding

TRU TECH

REVOLUTION

TRU TECH Systems • Mt. Clemens MI • U.S.A. • www.trutechsystems.com

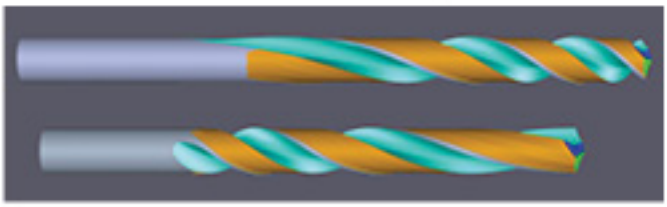
ToolRoom 2016

ANCA's latest release of ToolRoom software includes a variety of new features and enhancements that boost productivity and improve usability. Flexibility to design complex tool geometries has always been one of the strengths of ToolRoom software. New features in ToolRoom 2016 expands its ability to define and grind a wide range of custom tool geometries.

Thomson Mathew

FORMED FLUTE FROM SOLID AND FORMED FLUTE POLISH

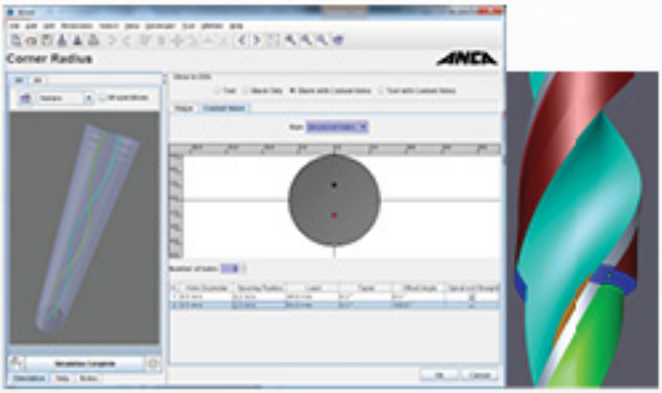
Formed flute from solid and polish operations now supports variable helix and lead/helix as spline function. In process dressing has been added for roughing and finishing passes. Enhancements have been made to achieve correct position of coolant hole offset from edge, accurate core diameter when y-offset is non zero and correct radial margin with core taper.



Picture of a variable helix drill from high helix to low and vice versa

COOLANT HOLE EDITOR

Blank editor is now used to define helical, straight and branched coolant holes. This will be displayed in the CIM3D blank during simulation.



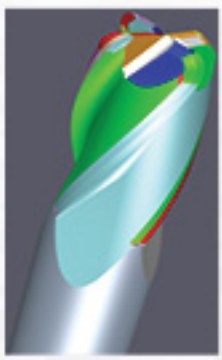
COOLANT HOLE ANALYSIS IN CIM3D TO SUPPORT TOOLROOM

Tools are available in CIM3D for automatic detection of coolant hole breaches which are colour coded for easy viewing. There is also an analysis tool which can detect minimum wall thickness with tolerance.

CORNER RADIUS

Corner radius operation has been completely redesigned and old operations made legacy.

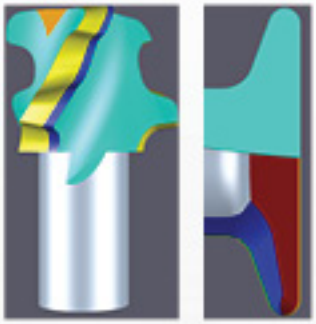
- Relief operation features:
  - Eccentric OD relief blending to facet around corner
  - Complex values for relief and land parameters
  - 4 axis grinding
  - Fixed grind point grinding
  - Unlimited reliefs
- Gash operation features:
  - Plane or curvature gash face
  - Classic or convex core profile
  - Continuous or separate grinding for corner and end



PROFILE EDITOR

ToolRoom 2016 includes a brand new profile editor with major enhancements to the already existing powerful profile software. Customers willing to keep existing profile editor will have the choice of continuing with legacy operations. Some of the major features in the new profile editor are below.

- Linear change of land width along profile
- Editor to change reliefs and land width per element
- Loop around corners to maintain a sharp external corner
- Dished sections grinding at 12 o'clock with dished cup wheel
- Addition of ellipse to the menu list
- Introduction of face style grinding with wheel contact distance
- Feedrate control per relief or global
- Roughing with wheel toroid larger than concave radii in profile
- Automatically choose both sides of 1A1 wheel when choosing 12 o'clock grinding with zero shear
- Variable Clearance + Oblique editor to grind larger number of flutes to centre with animation support
- Ability to link profile sections for eccentric after facet grinding. Additional option to trim profile from both shank end and end of tool
- Error messages are clear to the end user and actions recommended
- Profile Editor dimensioning for quick measure of profile dimensions

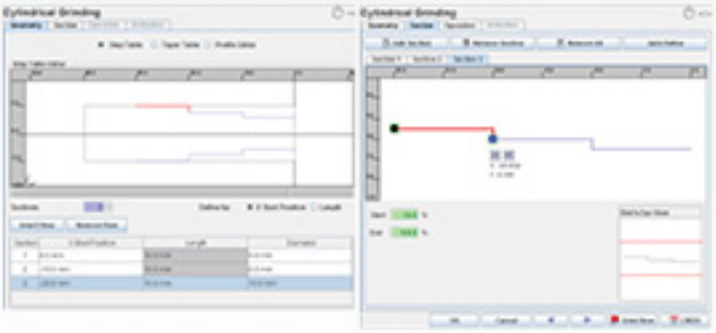


Location 4 Radial land 0.2 mm

rel #	Radial	Axial	Width
1	10.0 °	5.0 °	0.5 mm
2	20.0 °	10.0 °	0.5 mm
3	30.0 °	15.0 °	

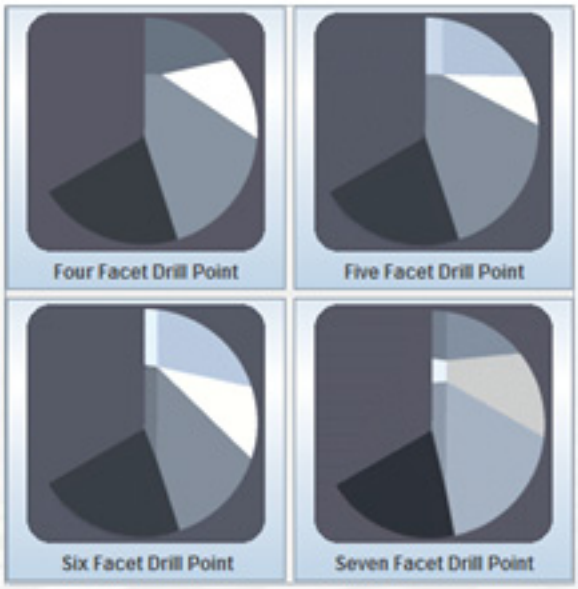
CYLINDRICAL GRINDING

Achieving complex step geometries with cylindrical grinding has also been simplified in ToolRoom 2016 with the introduction of a new cylindrical grinding operation. Focus has been on ease of use and integration with Endmill and Drill wizards. Choice of multiple geometry definitions such as step table, taper table, and profile is available, with geometry editor and grinding operations separated. Intelligent stock removal cascading from operation to operation with support for arcs with number of roughing passes is displayed depending on stock. There is provision for oscillation of the work head, or grinding spindle RPM, to avoid grind patterns. It also supports peel grinding with p-axis support for longer step sections with the option available to dress after roughing and finishing.



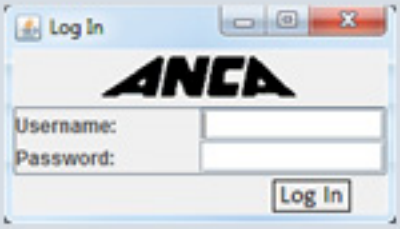
NEW TOOLTYPE IN iGRIND - GUN DRILL

A wizard style gun drill ToolType has been added to iGrind which makes gun drill manufacturing and regrinding simpler. Geometries can be saved as templates and reopened later for ease of use.



Management Suite

ToolRoom 2016 will include three new features under the banner of Management suite. All three features will require user login and account management. There will be a dropdown menu available for operator login which will also contain the machine status, production, warmup, setup and service. The three new features include:



1. PRODUCTION MONITORING

Production monitoring is a tool to provide data for analysing your production activities on ANCA machines. The system monitors production in real time and delivers up-to-date information to greatly enhance visibility and control of the manufacturing operation. This can monitor all machines on network and log cycle times, downtime on machines, set-up time, and service time etc. It can create past and present reports at the click of a button for individual machines, or all machines on the floor.

2. TOOL MANAGEMENT

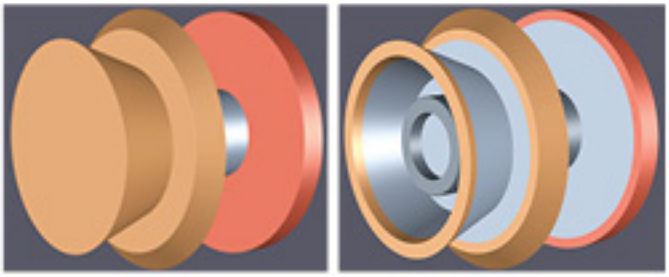
Tool management provides an option for central management of tool files by storing them on a central server. Different access rights for different levels can be managed through a login facility. There is revision control of files to view the history by comparing tool files.

3. WHEEL MANAGEMENT

Wheel management is similar to tool management for managing wheel files from a central storage. It provides a way to easily share wheel packs and qualification data between machines and has an improved search/filter facility. This clearly distinguishes between simulation and machine qualifications to provide protection from wheel packs only qualified on a simulator being used on a machine. A previous local wheel library can be used as an option if customers wish.

IMPROVED WHEEL MODELS

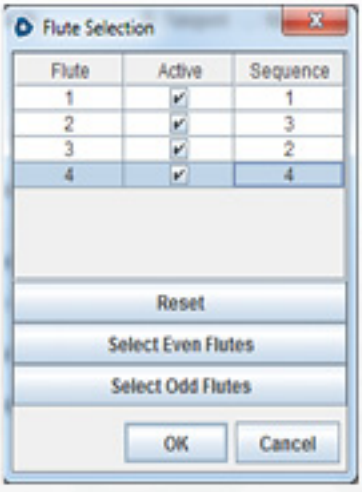
- More realistic looking wheels
- Model wheel grit and core independently

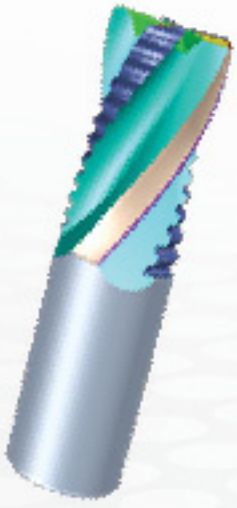


Old Wheel Model | New Wheel Model

FLUTE SELECTION AND SEQUENCING

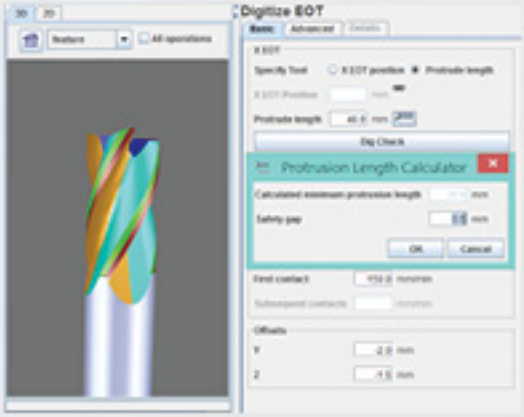
This option controls the fluting and subsequent operations on a flute by flute basis. This gives control over the order of flute grinding to balance the grinding forces.





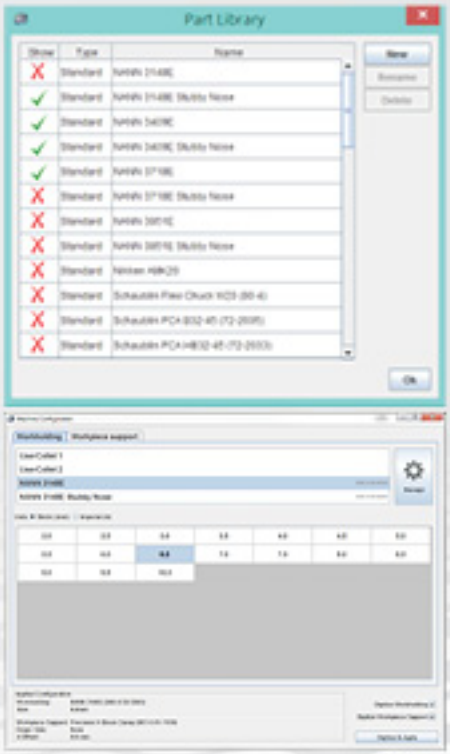
COLLISION PROTECTION

New machine options include real-time collision detection between wheel packs, collets, collet adaptor, steady rest and top clamp. Dig EOT now has a 'Protrusion length calculator' button to calculate the minimum protrusion length. Checks will be made after in process digitising to prevent wheel collet collisions and an error message will inform the user of the minimum required protrusion length to avoid collision. When running LoaderMate, tools with detected collisions will be returned to pallet.



MACHINE CONFIGURATOR

Machine configurator is a utility provided to configure the collet adaptor, collet and top clamp. A library of all ANCA supplied collet adaptors and collets are available for end user selection. The ability to import special collet adaptors of your own is also available as an option.



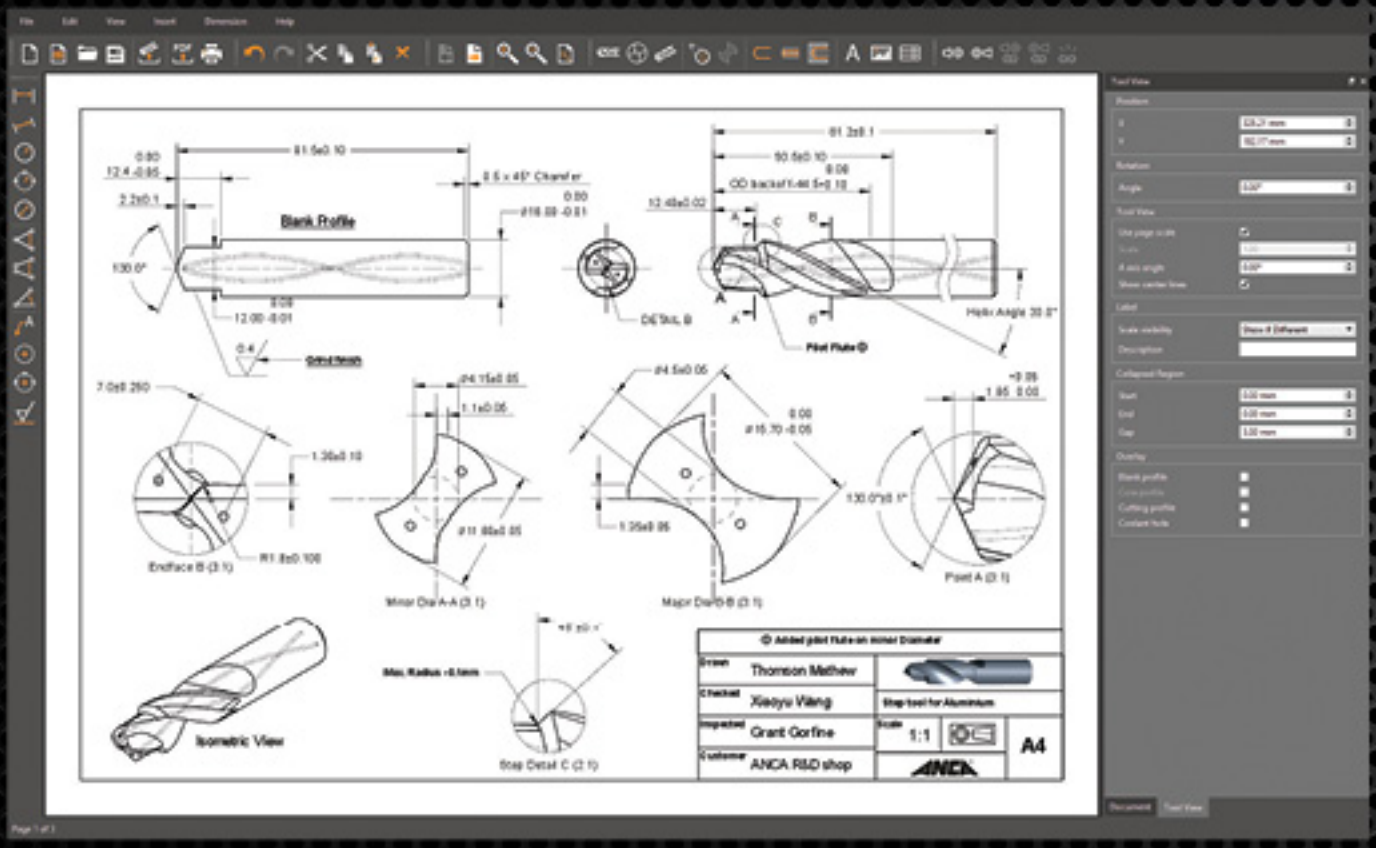
WELDON FLAT OPERATION

A new operation has been added to iGrind, iPunch and key hole punch to grind Weldon flat. It will be available from the add operations menu under utilities. The Weldon flat operation can grind one or more flats sections with the option to grind wings.

Other enhancements include:

- **RN33 is compatible with Windows 7 & 8 professional with 32 and 64 bit versions**
- It is possible to disable/enable multiple operations by swiping on touch screen
- The diameter column has been added to the user input wheel qualification menu which now also displays modified values
- Wheel editor has the functionality to display the wheel pack dimensions
- A button is available on the NC entry field to expand the entire widow for editing purposes and can be restored back to normal window
- The pilot tool segment has an offset calculator to calculate the intersection between the major and minor diameter
- The add/delete operation dialogue has been completely redesigned which will also support user defined favourite operations
- Integrated simulation graphics has been added to iPunch
- Anti-aliasing is now active (hardware dependant) with Windows 8
- Cycle time will now automatically be generated for all optimised operations in a subsequent pass
- Timeouts and memory limits can be increased for the current tool only via a button on the error window

ToolDraft Drafting



ANCA's first ToolDraft software launched for 2D tool drawings

Thomson Mathew

The first ToolDraft software package for creating 2D CAD cutting tool drawings was launched by ANCA at EMO 2015 in Milan. Quick and easy 2D tool drawings will now be able to be created straight from CIM3D or ToolRoom files, ready for your own, or your customer's requirements.

Create 2D CAD tool drawings from CIM3D

An independent product to ToolRoom and CIM3D, ToolDraft now produces 2D drawings simply by clicking on the ToolDraft icon in CIM3D (V8.1 onwards). It removes the requirement to export the 3D tool image to an external and non-tool dedicated CAD package.

Tool views

Once the tool is imported different tool views can be added to the page. Some of these views include side, endface, shank and isometric. First and third angle projection views can also be added with side and endface views linked. Other features include the ability to add core, cutting and blank profiles to the drawing.

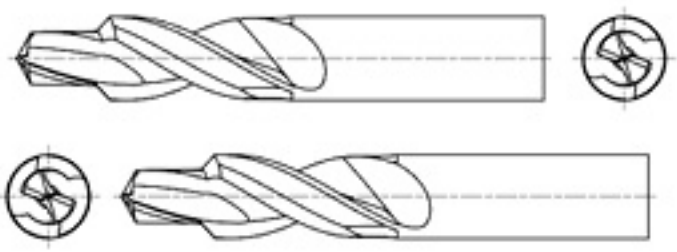
Customise the look

It is possible to display collapsed region and through coolant holes and options are also available to add

tools just got *easier*

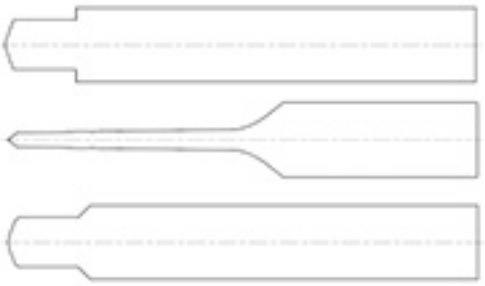
TOOL PROJECTIONS

- 1st & 3rd angle projections can be added
- They can be linked & unlinked from tool



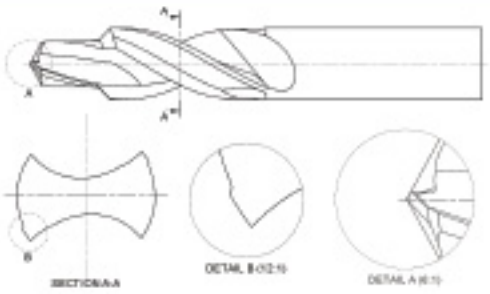
CORE, CUTTING & BLANK PROFILES

- Core profiles of the tool are completely defined
- Cutting profiles can be added to blank or core profiles
- Coolant holes can be added to blank profile



DETAIL & CROSS SECTION VIEWS

- Any number of cross section, or detail views can be added & named
- Details of detail views can be added
- Page scale or independent scaling



cross section and detail views. These views can be positioned anywhere on the page. All tool views can be scaled by page scale or individually. Leader lines, surface finish annotations and centre marks can be added to tool views. You can also change the default text, line style properties, and save templates with company title block to suit your company requirements.

Tool dimensioning

When you have positioned the tool views you require, a range of dimensions can be added. Snappable points appear on tool views for easy dimensioning and accuracy. Dimensions can have a prefix, suffix and can be overridden. Unilateral, bilateral and named tolerances can also be added to the dimensions.

A library of drafting symbols are available to add to drawings to improve their clarity.

Export to pdf, dxf, or print

When you have developed the tool drawing it can be printed, or exported to pdf or dxf directly from ToolDraft. You are then able to document your tool grinding processes, ensure quality control conformance and provide accurate information to your operator and customer. Further information on the new ToolDraft software package can be found at www.anca.com.

Small is becoming BIG

Greene Tool USA uses the FX Linear to keep up with the growing demand for smaller tools

Andrew Ritchie

Tom Greene is the owner of Greene Tool Systems, Inc., a world-class precision tool manufacturer based in Dayton, Ohio, USA. Established in 1986, Greene Tool Systems has developed a reputation for unmatched customer service, technological innovation and prototyping, and world class quality control. Greene Tool Systems also provides comprehensive re-manufacturing of carbide round cutting tools tailored to the requirements of the automotive, aerospace, and general engineering industry.

Greene Tool Systems specialise in custom tools and have a history of developing superior market technology that provides something that others don't. They developed their GTS Monroe Edge to extend tool life when they realised customers were waiting too long for overseas lead times at the time. They also provide an 'Edge of Panic' emergency consulting and fast response time when their customers really need it as they understand the costs involved in downtime, or line failure. Tom Greene brings to the company extensive experience in tool grinding which is evidenced by the tips he provides in his weekly video blog. Information includes everything from 'Tips for reaming a precision long hole' to 'How to calculate tap drill size and speeds and feeds from your smart phone'.

The new technologies of the FX Linear captured the attention of Tom immediately as he realised the advantages that the FX Linear offered. While already owning other ANCA machines, his business is under constant customer pressure to meet tighter tolerances and was receiving more requests for small diameter tools. Tom reveals, "Previously when we were getting to around Ø2 – 3 mm or smaller, it starts to become challenging. So the things we can do on these new machines is a new capability for us, because of the response of the drives and everything else, we can do small drills down to around 0.050" (1.3 mm)." Tom discloses, "One of the things we wanted to do when we got the FX Linear machines was to boost our capabilities for grinding smaller tools."

The FX Linear is also capable of grinding tools up to a diameter of 200 mm (7.8") and its best performance is for tools up to a diameter of 12 mm (1/2"). The three FX Linear models are ideal for everything from regrinding to volume production.

With tool batch runs becoming smaller and rapid delivery turnaround, the machine has been able to offset these challenges. Tom says, "We wanted the FX Linear technology to ensure that we continue to provide the quality that we're used to giving our customers. The other thing is it will help us on our lead times as a lot of our jobs are short runs. When I say short runs it could be anywhere from 2-6 pieces. So quick changeover is really important." New features such as a handheld pendant, customisable touchscreen and front tool loader door improve the ergonomics for Greene Tools operators and help increase productivity.

Tom Greene (left) and Steve Mader

Steve Mader (left) and Tom Greene using their new FX7 Linear tool grinders

A major benefit of the FX Linear range is the ANCA designed LinX Linear Motors, providing accurate axis motion. ANCA is the first to use cylindrical linear motors on a tool grinder and this is what really caught Tom's attention. Tom states, "We jumped on this technology quick. These are a new design and new machines, and I was convinced by Pat McCluskey, ANCA co-owner and designer of the FX Linear machines, that this is the way of the future."

The LinX motors in the FX provide many advantages over a flatbed style linear motor. There are no mechanical moving parts, so no loss of machine accuracy over time due to wear. Being cylindrical by design the linear motor is fully sealed (IP67) and impervious to ingress or contaminants. There are no magnetic downward forces on the rails, reducing wear and cogging, while increasing efficiency. The cylindrical motor design is energy efficient and runs a lot cooler, so a dedicated chiller unit isn't needed. The higher acceleration rates and axis speeds result in reduced cycle times, providing increased productivity. These factors are producing noticeable improvements in tool accuracy and surface finish.

Demands for improved tool accuracy and increased productivity levels are driving the development of new technologies in Tool Grinders such as the FX Linear. Time is money and tool manufacturers such as Greene Tools need to be able to set up quickly and provide fast delivery turnaround. Maintaining a high standard of tool quality, while achieving tight tolerances, requires a machine that is highly accurate and flexible. Tom says, "With the new FX machines we are finding a big advancement in the technology and it increases our capabilities for fast turnaround and easier programming."

Greene Tool U is an online learning series offering a variety of online machining instruction and tutorials by Greene Tool Systems, Inc.

To find out more about Greene Tool, and to sign up to Tom's weekly email video blog, go to www.greenetool.com.

The thread professional

»threadCheck«

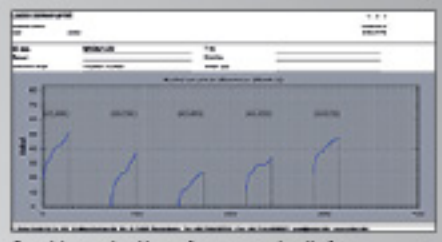
The new universal measuring machine with an extra feature takes a real step into the future. »threadCheck« does more than simply measure all metal-cutting tools such as standard shank endmills as well as tap tools to the renowned ZOLLER quality standard.

Its new feature, a sixth axis, enables thread-cutting tools with a tapered pitch to be measured without distortion. This makes this "thread professional" a universalist and a specialist at one and the same time in a single system.

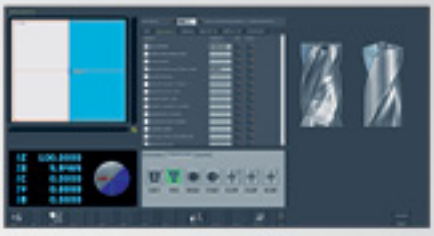
- ✓ fully automatic
- ✓ distortion-free
- ✓ universal

ZOLLER »threadCheck«

Measuring program for metric ISO threads and Whitworth pipe threads



Graphic evaluation of measured relief



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Top 10 Australian **Inventions**

We take a look at some of the most important, ground breaking inventions that we use day-to-day that people don't realise were developed in Australia.

1. COCHLEAR IMPLANT (BIONIC EAR)

After watching his father struggle with hearing loss, Professor Graeme Clark was determined to create a device that would assist people who suffered from deafness or hearing impairment. His perseverance resulted in the world's first cochlear implant operation in 1978. Its success paved the way for further developments, including a multi-channel device that includes speech processing.

2. WI-FI

One of the most used inventions of the digital age is actually the result of a failed radio astronomy experiment by Dr John O'Sullivan. While researching radio waves coming from exploding black holes, Dr O'Sullivan developed a technology that eventually became the key to fast and reliable wireless networking. His innovation is now used every day in one billion devices around the world including computers, smartphones, tablets and printers.

3. BLACK BOX FLIGHT RECORDER

The first black box prototype was built in 1958 by Dr David Warren, who was working at the Aeronautical Research Laboratory in Melbourne. While investigating a fatal plane crash that left no evidence, Dr Warren realised the value of a device that could record voices in the cockpit as well as data from flight instruments. Australia was the first country in the world to introduce mandatory flight recording.

4. ULTRASOUND SCANNER

Responding to growing concern about the effects of using X-rays to examine foetal development, Sydney doctors George Kossoff and David Robinson built the first ultrasound scanner in 1961. In the late 1960s, they achieved another technical breakthrough with grey-scale ultrasound, significantly improving the clarity and detail of images.

5. ATOMIC ABSORPTION SPECTROPHOTOMETER (AAS)

The atomic absorption spectrophotometer (AAS) was labelled as one of the most significant achievements in chemical analysis last century. It is a complex analytical instrument used in chemical analysis to determine small concentrations of elements in a wide variety of substances. The AAS is used in medicine, manufacturing, mining, environmental monitoring and laboratories globally. It was first developed by Sir Alan Walsh of the CSIRO in 1952. Virtually every analytical chemistry laboratory in the world now has one.

6. SPRAY-ON SKIN

Patented by Dr Fiona Wood in 1999, the spray-on skin technique involves taking a small patch of healthy cells from a patient and using it to grow new skin cells in a laboratory. The new cells are then sprayed onto the patient's wounds. While traditional skin grafts require 21 days to produce enough cells to cover extensive burns, this technique takes only five days. It played a key role in saving the lives of 28 burns victims during the 2002 Bali bombings.

7. POLYMER BANKNOTE

The Reserve Bank of Australia and the CSIRO embarked on a project in 1968 to create a banknote that could not be counterfeited. The first polymer banknote was issued in Australia in 1988. With its forge-proof transparent panel and embedded hologram, it was also waterproof and lasted longer than paper banknotes. Today, it is the most secure form of currency and is used in many other countries as well.

8. DISPOSABLE SYRINGE

The need for a cheap and efficient syringe became important for penicillin administration, as the antibiotic tended to clog up glass syringes. With experience in manufacturing plastic toys, Adelaide-based toymaker Charles Rothauser produced the first plastic disposable, hypodermic syringe in 1949. The use of polyethylene was later replaced with polypropylene, a more durable plastic that can be heat-sterilised.

9. MAPPING TECHNOLOGY USED BY GOOGLE MAPS

In early 2003, brothers Lars and Jens Rasmussen co-founded a Sydney-based mapping technology start-up where they worked with a team to develop the platform for Google Maps. Although originally designed as a downloadable app, the prototype was later pitched to Google as a web-based application. Google acquired the company in 2004 and Google Maps was launched in 2005.

10. EXTENDED WEAR SOFT CONTACT LENSES

In 1999 CSIRO and the University of New South Wales were part of an international research team to develop contact lenses that were safe and comfortable for wearing long term. The lenses had to be durable and thin to allow oxygen to flow through for cornea health. The invention of silicone hydrogel lenses meant that they could be worn for 30 days without being removed.

Medical Market Growth

Successful medical instrument manufacturer Mahe Medical grows their range and market

Duncan Thompson

What does it take to successfully enter a new market? Examples where one factor alone sets up an easy path for success are rare. More typically, success comes from a combination of inputs, some strategically planned, others through serendipity. Such is the case of Mahe Medical who today manufacture and sell a growing range of medical instruments.

Markus Heckmann, Mahe co-founder and Managing Director talks of some of the decisions and choices made along the way to becoming a successful supplier of medical instruments to global players in the orthopaedic industry.

"My brother and I learned tool grinding skills in my father's tool grinding factory, but made an early decision to move towards the medical tooling market. This allowed me to utilise knowledge picked up in completing my Medical Engineering degree."

Initially Markus used the facilities of his father's factory to grind medical instruments in the evenings and then in 1993, Mahe Medical was established. Markus was soon joined by his brother, Jochen and together they continue to work collaboratively in strategic, manufacturing and customer focused aspects of the business.

Markus and Jochen reflect on their decision to use ANCA grinders. "Our first ANCA purchase really came out of perfect timing for both ourselves and ANCA. The company from whom we purchased our first grinding machines was going out of business and we needed a new supplier that could guarantee ongoing support. Right at that time, the ANCA salesman was knocking on our door promoting the RGX. Other cheaper options were available, but the immediate benefits of ANCA were obvious in the Cimulator3D, which at the time was way ahead of anything else offered in the market. Combined with the machine software being so flexible

Jochen Heckmann and brother Markus Heckmann, Mahe co-founder

it was an easy choice. We found we could prepare tools that had geometries not possible on our older machines. This allowed us to work much more collaboratively with our customers to produce exactly the tools they wanted."

Markus and Jochen explain the continuing relationship with ANCA. "Our first purchase was based on the technical features of the machine and software which were clearly industry leading. But subsequent machine purchases were equally driven by the fantastic support we have received from ANCA over the years. Whether servicing existing machines, or providing technical support for new applications, ANCA has been there with us. Most recently we took the step into producing femoral hip rasps – a whole new application for us. Again, we did investigate alternative suppliers, but it was the support we received from ANCA in Germany and also Australia for this application that convinced us ANCA was committed to supporting us."

This has given Mahe Medical the confidence to branch out and establish a manufacturing site in South East Asia. Again, we know we will get excellent support in this market, with ANCA being so close by. By doing this, Mahe can now be working with and responding quickly to their customer base in that region. Today Mahe Medical has 10 ANCA machines installed across its German and Thai manufacturing facilities.

So what are the challenges today for Mahe Medical? "The medical instruments business is extremely competitive." Markus explains, "Not only do you have regulations to consider, but margins are tight. So we are constantly talking with ANCA about ways to make our manufacturing processes more efficient and lean to keep our costs down. The FastLoad automation solutions, for example, perfectly met our needs. For a small investment, we get flexible, unmanned production for the small batch sizes we must deal with. This means manufacturing in Germany can still be competitive. This in itself is a benefit, because it brings with it an implicit recognition of German quality."

And the future for Mahe? Both Markus and Jochen are optimistic and enthusiastic. "We are regularly talking with ANCA to find ways we can be more efficient with manufacturing or new applications or products that can be supported on their machines. Right now, we are closely considering other new orthopaedic implant applications. Knowing that ANCA already has experience with this application and will continue to support us, gives us much more confidence as we continue taking steps to grow our business."

Mahe Medical in Emmingen-Liptingen, Germany

The new home of ANCA Europe

WEINHEIM

The Rhine-Neckar Triangle Things to see and do

Jacey Leong

DISCOVERING RHINE-NECKAR

The Rhine-Neckar Triangle is a metropolitan region located in the southwestern German state of Baden-Württemberg. It is regarded as one of Germany's key industrial locations, specialising in sectors such as automotive, mechanical engineering, biotechnology and chemistry. Its cultural history and landscape of forests, lakes and vineyards also make it a popular holiday destination.

WEINHEIM

The historic town of Weinheim was first documented in 755 AD. Although smaller than its neighbouring cities, Weinheim is known for its relaxed vibe and friendly community. Modern developments occupy the town's west, including the new Technology Park where ANCA's European headquarters is now located. In the valley to the east is the Aldstadt (old town), a quintessential European village exuding an Old World charm.

From the town museum it is a short walk to the old town hall and St Laurentius Church in the Marktplatz. For nature lovers there is the Exoterwald, an arboretum displaying different woodland regions of the world. There are also many cafes, restaurants and pubs serving traditional fare, such as onion cake, apple wine and Woinemer Plob beer. Which is a local brew named after the sound its swing-top bottle makes when opened.

HIGHLIGHTS

The Tanners Quarter – a former leatherworkers' district with timber-framed buildings, narrow cobblestone alleys and a creek for cleaning hides. Look out for Weinheim's narrowest house which is only 2.1 meters wide!

Windeck Castle – located on a hill overlooking Weinheim, the castle was built in 1109 to protect the Lorsch monastery. Today, visitors can explore the remaining ruins, climb up the tower or have a drink in the beer garden. Some even choose to hike through Odenwald forest to Wachenburg Castle.

Wachenburg Castle – built between 1907 and 1928 as a meeting place for the Weinheim Elders Convent. Fraternities still meet once a year at the castle, dressed in traditional outfits. The impressive views of the Rhine valley from the castle's restaurant make it worth a visit.

Schlosspark – a sprawling park and home of Germany's oldest Lebanon Cedar tree. Look out for the mausoleum and the Blue Hat tower, a former prison completed in 1300 as part of the town's fortifications.

HEIDELBERG

Famously hailed as a romantic city, Heidelberg is a university town with one of Germany's oldest castles. Situated along the Neckar River, its baroque style old town provides a medieval flair to the cityscape. Germany's oldest university, Heidelberg University, was established here in 1386. With a strong student population, the city has a vibrant nightlife and music scene, with numerous restaurants and jazz clubs. Unlike other German cities, Heidelberg survived most of World War II. As a result, many original Renaissance buildings have been preserved.

Heidelberg hosts many events and festivals throughout the year. The Ball of the Vampires is a costume party where people dress up as their favourite fanged characters. It is a must for those seeking a unique experience!

HIGHLIGHTS

Hauptstraße – Europe's longest pedestrian zone includes many shops, selling everything from handcrafted souvenirs, to well-known fashion labels. Enjoy some local gelato or people watch in the Marktplatz, before visiting the town hall and the Church of the Holy Ghost.

Heidelberg Castle – is a Renaissance castle that was constructed over three centuries, starting in 1300. It has a turbulent history including enemy attacks and lightning strikes. The cellar houses the world's largest wine barrel and the gardens were once considered the 'Eighth Wonder of the World'.

The Old Bridge – built in the late 1700s, this grand nine-arch stone bridge provides beautiful views in all directions. A bronze monkey sculpture holding a mirror stands on one end of the bridge, it is believed that touching the mirror will bring you luck.

Philosophers' Walk – Heidelberg's philosophers are said to have walked along this scenic trail, seeking inspiration in the surroundings. Although strenuous in some areas, you'll be rewarded with the best views of the old town and castle.

MANNHEIM

Founded in 1606, Mannheim lies at the intersection of the Rhine and Neckar Rivers. Although it endured significant damage during World War II, Mannheim is now recognised as one of the world's most inventive cities. The first automobile was driven here by Karl Benz in 1886. In 1888, Karl's wife completed the first long distance journey by automobile, travelling 104 km from Mannheim to Pforzheim. Today, tourists can recreate the road trip by driving along the Bertha Benz Memorial Route.

The centre of Mannheim is referred to as the 'chessboard city' due to its grid layout. Instead of street names, you'll find unique addresses like 'M6, 3' in which M6 refers to the block number and 3 is the building number. Mannheim is considered the Rhine-Neckar region's shopping mecca. The Planken strip is renowned for its fashion boutiques and department stores. At the end of the Planken is the Marktplatz, where a weekly market sells fresh produce and flowers.

HIGHLIGHTS

Water Tower – known as Mannheim's landmark, it is an ideal spot for a stroll or picnic. The water fountains put on a spectacular light display each night.

Mannheim Palace – Europe's second largest baroque palace, built in 1720. Severely damaged in World War II, visitors can now explore the reconstructed rooms containing lavish décor and artwork.

Luisenpark – a sanctuary for those looking to escape the city centre with attractions including a Chinese teahouse, communications tower with rotating restaurant, gondola rides, a small zoo and an open-air stage for concerts.

Reiss-Engelhorn Museums – one of Europe's most well-known exhibition houses, with displays on archaeology, world cultures, photography, and art. Discover the town's cultural roots at the gallery on Mannheim's history.

What's New @ ANCA

Auto Height Adjustable Steady

Find out how the new Auto Height Adjustable Steady saves set up time and reduces operator error.

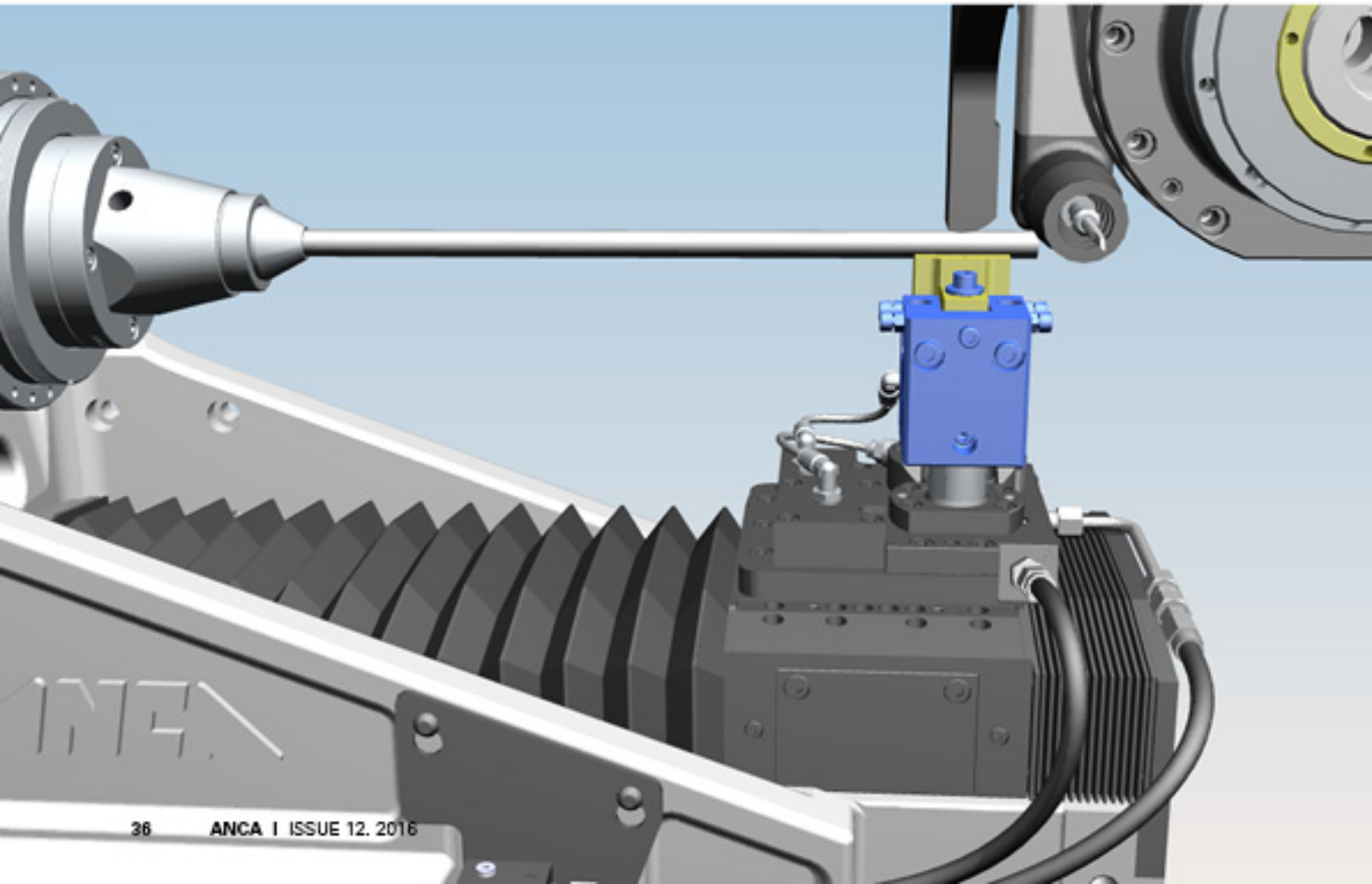
Simon Richardson

Set up time when grinding tools is time well spent in terms of obtaining the best results. However, if at the same time it can be kept to a minimum, machine downtime is also reduced.

To assist operators with this goal ANCA designed the Auto Height Adjustable Steady mounted on the P-axis for MX7 and TX7+ tool grinders. Removing the need for manual set up of the Pop Up Steady for tool support not only made the set up process faster, but also easier and less subject to possible operator error.

The Auto Height Adjustable Steady (AHAS) enables the user to set the height of the shoe (rest) by positioning

Blank supported under the datum reference block and AHAS steady

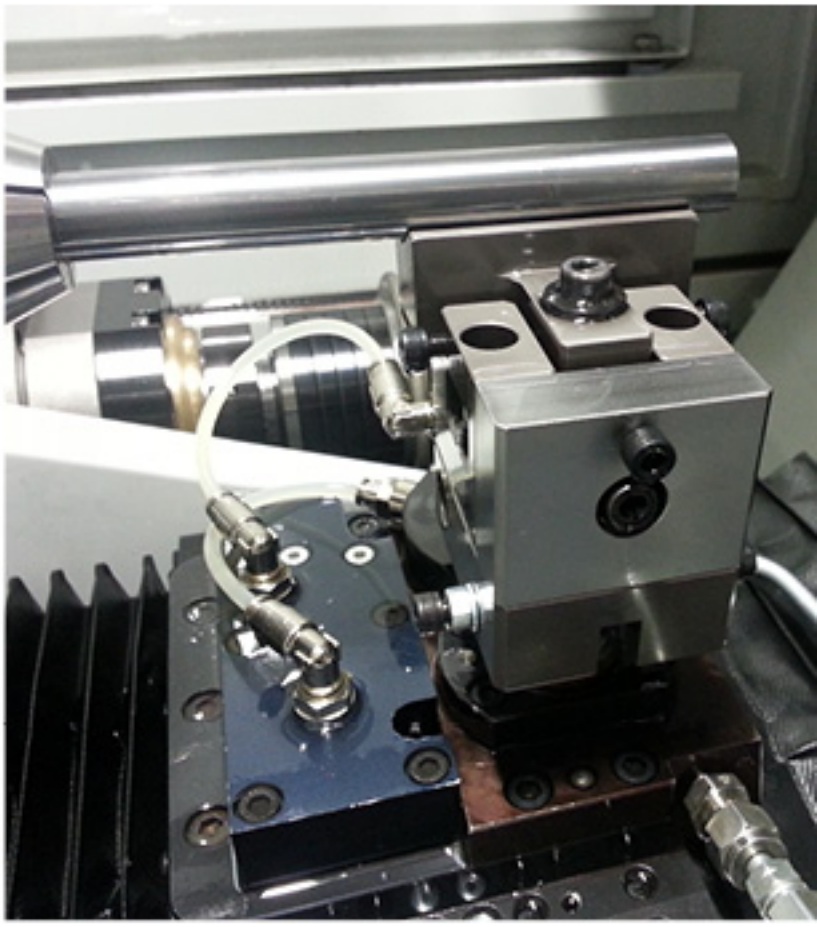


the top face of the tool (or blank) against a fixed reference (datum) surface. The steady automatically moves upwards, pushing the tool against the reference (datum) surface and stops at the height that suits the diameter of the tool. This removes the need for an operator to manually set the steady. AHAS can be used in process during a production run and in conjunction with ANCA RoboMate loader for Auto tool loading.

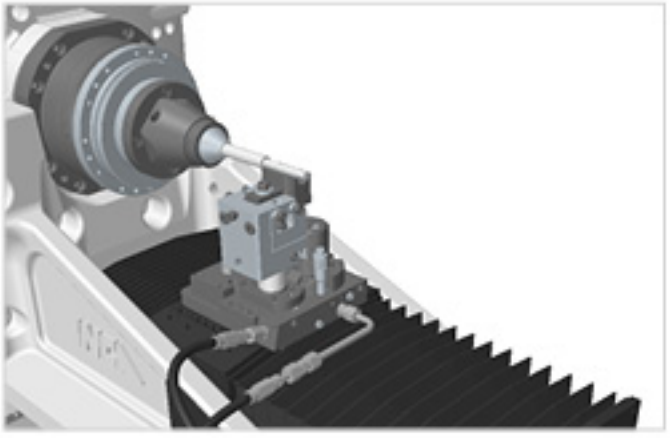
There are several differences between the AHAS and the conventional Pop-up Steady. In cycle, the AHAS can be set at different height positions depending on the section of tool being supported, and at different horizontal positions along the tool for different operations. This capability is useful for stepped tools, or if there is variation in diameters between tool groups during batch grinding. The setting of multiple heights for tools with varying diameters in cycle is also possible, further enhancing the benefits and flexibility of the product.

The automatic setting of the AHAS in process means that no operator intervention is required once the cycle starts. AHAS can be used for a wide range of tools including end mills and drills with multiple diameters, and even pre-fluted tools with back taper and stepped diameters.

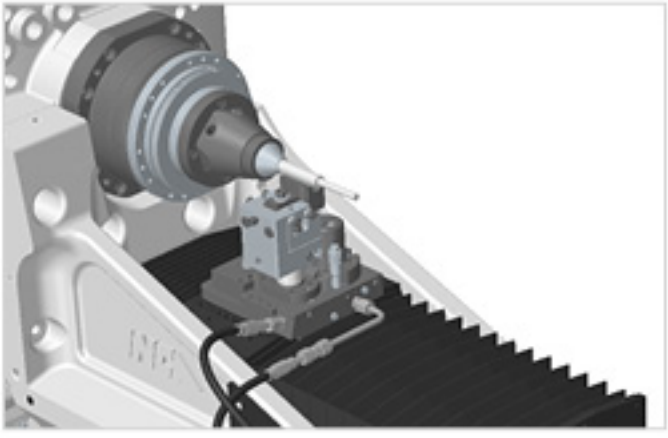
The AHAS can obtain repeatable results to 0.005 mm (0.0002"). It can accommodate a range of tools between diameters of 2-20 mm (0.078" – ¾") and lengths of on MX7, and 50-350 mm (2" - 14") on TX7+. A wide variety of V and U-shape shoes are available to support the tool. MX7 and TX7+ machines in the field can be retrofitted with the AHAS if the machine has a P-Axis already fitted. This enables the user to swap quickly between other methods of tool support, such as Arobotech and Bush systems.



The smaller the batch sizes, the bigger the time and cost savings become as an AHAS reduces downtime during set-up.



AHAS supporting smaller diameter section of blank



AHAS supporting the larger diameter section of blank

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- Reduce cycle times
- Maintain high precision
- Dress while on machine
- Greatly reduce downtime

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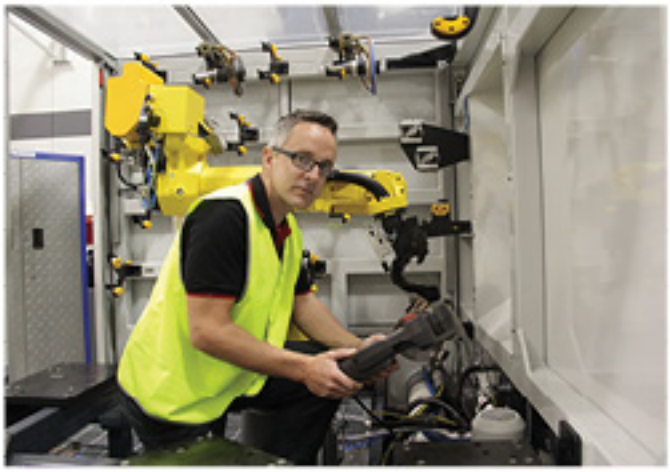
FROM CONCEPT

We talk to some of the many ANCA people



MECHANICAL ENGINEERING

Benn McGrath,
Design Engineer

Mechanical engineering at ANCA encourages you to engage in a high level of creativity during the design process. You are pushed to think outside the box, especially in the conception stage. It is important to have a balanced team consisting of big-picture thinkers and detail-oriented people.

Every project has its rewards and challenges. It is hugely satisfying to see a new machine come together through collective effort in research, design and testing.

MACHINE SHOP

Darren Tomlinson,
Senior Operator

The Dixi machines at our Australian plant are just one example of the millions of dollars in investment ANCA has made over the years to ensure that the many parts we produce internally are made to the tightest tolerances.

On the Dixi we machine parts such as castings and swing brackets. Producing high precision machine parts in our Australian factory allows us to control the quality of components. We run multiple shifts to provide enough parts to meet our orders.

SOFTWARE ENGINEERING

Alex Lee,
Applications Software Engineer

We are continually looking for ways to make our software more user friendly and versatile. We also use customer feedback to understand what features end users want.

A collaborative team environment is encouraged in our department. We have daily stand-up meetings to discuss current projects and group reviews for quality control. We keep fine-tuning until we are confident that we are delivering a high quality, high standard solution.

TO CREATION

who bring your tool grinder to life

MOULD SHOP

Mick Freeman, Paul Morrison & Garry Flint, Mould Shop Technicians

Polymer concrete sets quicker than water-based concrete, which is ideal in maximising production. All our machine bases are poured in Australia as the local climate is ideal for producing polymer concrete bases.

ANCA has been using polymer concrete bases for over 20 years due to their excellent thermal stability and vibration dampening properties. These increase a machine's rigidity, allowing it to produce tools of superior surface finish quality and accuracy.

R&D GRINDING CENTRE

Michael Galteri (left) & Rajeev Abraham, Grinding Applications Engineers

The Grinding Centre plays an important role in testing engineered developments and mechanical components. We act as the "eyes, ears and hands" of the customer, by suggesting improvements to machine and software features to further enhance user friendliness.

The customer is the focus of what we do in the Grinding Centre. The objectives of our R&D efforts are to anticipate customers' needs, and to identify new and innovative features for future developments. We also visit customers globally to assist with their application queries.

COMMISSIONING

Joel Pritchard, Senior Commissioning Technician

In Commissioning we convert a range of assembled parts into a fully functional machine. We perform user software installation and set the machine co-ordinate system, which is a range of parameters that enable a machine to operate.

Working in Commissioning teaches you a wide range of skills. It improves mechatronic skills as well as mechanical aptitude. It gives you an appreciation and understanding of the complexities involved to make a machine work.

QUALITY / SERVICE

Shaju Jacob using Co-ordinate Measuring Machine (CMM)

Component specifications are checked on the CMM to ensure compliance. Many quality systems are in place and we are certified to ISO9001. We have also implemented Lean manufacturing, 5S and Kanban. I have worked in our quality department and am currently working in our Service department as a warranty administrator.

CONTROL SYSTEMS

Steve Nicolaidis, Electrical Technician

ANCA Motion manufacture items such as the touch screens, CNC systems, remote pendants and linear motors on ANCA tool grinders. The recent FX Linear range included completely new systems. My department builds and tests the control systems.

SPINDLE ROOM

Kiran Krishnamurthy, Senior Operator

The precision parts of ANCA's tool grinders are assembled in the Spindle Room. These include grinding spindles, collet adaptors, flexichucks, NC steadies, the c-axis and the a-axis.

Most of the components are machined in ANCA's machine shop. After machining and preparation in the factory they are sent to the Spindle Room for assembly. The finished precision products are then used in the production of the different models of ANCA tool grinders.

MACHINE ASSEMBLY

Mark McKiernan, Senior Operator

ANCA tool grinders are configured to a customer's specifications and take approximately 2-3 weeks to manufacture. They undergo a series of checks and audits and then final commissioning. Most parts are made onsite. The skills required are specialised which is why we established the ANCA Apprentice Training Centre.

We make it easy to get an ANCA

ANCA Capital provides custom financing for ANCA machines and ANCA accessories at rates comparable to conventional bank financing, including 5-and 7-year terms and payment skips.*With ANCA Capital, you can conserve your bank lines for other cash flow requirements and avoid tying up fixed assets with one lender. Because of our long relationship to manufacturing, we have a much better understanding of your type of business than do banks and other lenders. Contact ANCA Capital the next time you are thinking about adding ANCA productivity. We understand.

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Element Six Global Innovation Centre

at the forefront of PCD and PCBN tool research

Element Six, the world leader in the field of synthetic diamond supermaterials, has recently began high-level research and in-depth grinding trials on PCD and PCBN tools with the use of an advanced ANCA TX7+ Tool and Cutter Grinder.

Mike Welsh

Although several alternative Grinders were considered, it was thought that ANCA's TX7+ would be ideal for delivering the precise, repeatable data needed to enable the development of a new generation of highly efficient Polycrystalline diamond (PCD) and Polycrystalline cubic boron nitride (PCBN) cutting tools at the company's Global Innovation Centre (GIC).

Element Six opened the world's largest and most sophisticated synthetic diamond research and development facility at Harwell, near Oxford, UK, in 2013. Employing over 100 scientists and technologists, the impressive £20m, 5,000m² facility consolidated Element Six's global innovation teams into one integrated centre.

GIC facilities include modeling and design, materials preparation, a high pressure, high temperature synthesis press hall, Chemical Vapour Deposition reactor synthesis labs, post-synthesis processing (e.g. polishing, cutting, shaping), materials and end application testing. The result is a physical environment which enables open collaboration and partnership with customers in support of their product development programs.

Since its launch, the GIC has witnessed the development of an impressive number of innovative synthetic diamond and related supermaterial products for customers, involved in industries such as precision machining, oil and gas drilling and electronics.

The properties of Element Six's range of synthetic diamond materials makes them ideal for a multitude of advanced industrial applications. The exceptional hardness of synthetic diamond and its very low coefficient of friction have inherent advantages in mechanical applications. These properties help to extend tool life and reduce downtime, they also drive down operating costs and help reduce carbon footprints.

Element Six, Applications Engineering Manager, Dr. Wayne Leahy, explained the reasons behind the ANCA TX7+ purchase. "As part of the De Beers Group of Companies, Element Six has a 50 year, world-leading track record of applying the extreme properties of synthetic diamond within cutting-edge abrasive and cutting applications.

"As Element Six solutions are ideal for use in areas such as cutting, grinding, drilling, shearing and polishing, a major part of my remit is to undertake research in conjunction with commercial partners. To enable high-level research to be carried out with a cutting tool partner, the need arose for a high-quality, robust tool and cutter grinder that could provide accurate, repeatable data when performing grinding trials, on PCD and PCBN tools.

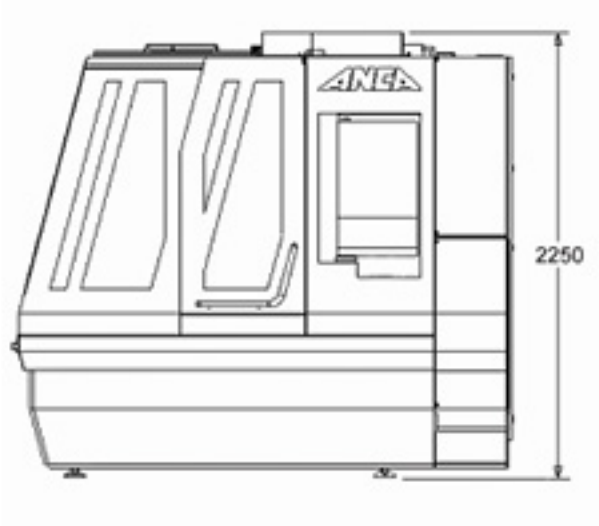
"When we were researching the available options, we were satisfied that the performance of the TX7+ would meet our needs for grinding these materials. It was also important to us that ANCA were able to adapt the grinder to meet our needs."

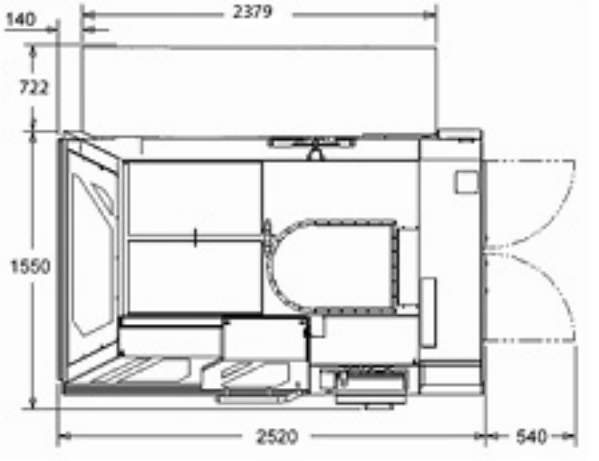
"Given the very specific nature of our unique requirements, prior to starting the project, it has helped that we received excellent help and cooperation from ANCA's technical staff. This has allowed any initial technical issues to be resolved quickly."

"In addition to the ease of use and reliability of the TX7+, the machine's diagnostic monitoring and instrumentation now provides invaluable feed-back related to the PCD and PCBN tools being ground at any given time, in addition to the condition of the overall process."

Element Six Polycrystalline Diamond (PCD) is the first choice tooling material for use on non-ferrous abrasive metalwork materials, such as aluminium silicon alloys and metal-matrix composites. Providing the ultimate wear resistance, PCD ensures unparalleled part quality over long production runs and helps to minimise machine down-time.

The company's Polycrystalline Cubic Boron Nitride (PCBN) composites are used for the production of precision cutting tools for machining ferrous materials such as hard steels, grey and hard cast irons and high-temperature superalloys. Different grades of PCBN are offered to meet specific application requirements. Low CBN materials are most commonly used for the





finishing of hardened steel components in the automotive industry, and superalloys for land and air turbine engine components. High CBN materials are used for rough and finish machining of cast irons, and for extremely abrasive powder metallurgy parts, such as automotive valve seats.

Duncan Thompson, ANCA TX & EDGe Product Manager added. "As we faced strong competition from several other leading grinding machine manufacturers, and given the challenging technical requirements of Element Six, we were pleased to be awarded this prestigious order. Although ANCA have considerable experience in the manufacture of PCD and PCBN cutting tools, the first rate co-operation we have enjoyed with the staff of Element Six since the TX7+ installation has helped our development team to better understand the demands related to these challenging materials. This knowledge will benefit future ANCA products."

The robust nature of the TX7+, combined with cleverly designed tooling and high degree of automation, provides users like Element Six with outstanding levels of productivity. Combined with ANCA's ToolRoom software suite it is able to deliver versatility for both current and all foreseeable applications.

The TX7+ is equipped with a powerful direct-drive 10,000 RPM, 37 kW (49 HP) spindle. For applications that require higher speeds a 15,000 RPM option is also available. The spindle reaches its full power at 3,500 RPM which makes it ideal for both solid carbide and HSS grinding applications.

The ANCA TX7+ is able to cover a wide range of cutting tools and precision components applications and is ideal for both heavy-duty manufacturing and the reconditioning of precision cutting and drilling tools.

The competition where everybody wins

Formula SAE-A is a 4 day student design competition where engineering students design, construct and race internal combustion, or electric race cars, of up to 600cc/80kW. Competing students are in demand by companies as they receive valuable real world experience. Competition is fierce but the benefits are many.

Lisa Paterson

Formula SAE-A (Society of Automotive Engineers – Australasia) is held in Melbourne, Australia in December, but the student teams work feverishly towards the four day competition all year. In addition to engineers the teams also include students from other faculties to provide assistance in areas such as IT, arts and business.

After the SAE International first launched the competition in the United States in 1981, Australia became the third country to launch a Formula SAE (FSAE) competition in 2000. Other members of the official Formula SAE series now include Brazil, Italy, Austria, Germany, Japan and the UK. Overseas teams regularly compete at other competitions with seven overseas teams competing at the Australia event in December 2015. Three teams attended from New Zealand, and one each from Japan, India, Malaysia and the USA in a total field of thirty.

The concept behind Formula SAE is that a fictional manufacturing company has contracted a design team to develop a small Formula-style race car for the non-professional weekend autocross racer. The cars are judged in a series of static and dynamic events, including technical inspection, cost, presentation, engineering design, solo performance trials and high performance endurance. Teams are self-funded with sponsors not only providing financial support but also valuable manufacturing support and technical advice. The cars often include the latest cutting-edge technology and the competition is all about learning, innovation and mutual support.

RMIT Electric Racing in Melbourne, Australia submitted the first fully electric car built for FSAE in 2008 with the goal of becoming as competitive as the internal combustion versions. In 2015 they repeated their 2014 success, beating all their electric competitors, finishing seventh overall and winning the efficiency award. Proving that an electric vehicle can be competitive as they finished ahead of the majority of the field.

Michael Butler, RMIT Electric team manager for 2014 and Bachelor of Engineering (Mechanical Engineering) (Honours)/Bachelor of Business (Management) student, is one of the many previous FSAE competitors ANCA has employed. "The FSAE experience provides skills that are relevant across a broad range of professions," he shared.

Specifications for new FX Linear & MX Linear ranges

FX3 LINEAR

ANCA's entry level machine for light manufacturing & sharpening.

FX5 LINEAR

ANCA's economical CNC grinding machine. Same design as FX3 Linear with more options.

FX7 LINEAR

Same design as FX5 Linear but with more spindle power & more options.

MX5 LINEAR

ANCA's most economical bi-symmetrical gantry based machine.

MX7 LINEAR

Same design as the MX5 Linear, but with more spindle power and 4 extra wheel packs.

	FX3 LINEAR	FX5 LINEAR	FX7 LINEAR	MX5 LINEAR	MX7 LINEAR
Machine Structure	Single Column	Single Column	Single Column	Bi-Symmetrical Gantry	Bi-Symmetrical Gantry
Spindle Power	9.5 kW (12.7 HP) peak 4.2 kW (5.6 HP) S1	9.5 kW (12.7 HP) peak 4.2 kW (5.6 HP) S1	19 kW (25.4 HP) peak 8.2 kW (11 HP) S1	26 kW (35 HP) peak 14 kW (19 HP) S1	38 kW (51 HP) peak 20 kW (27 HP) S1
Wheel Packs	1 x Ø 203 mm (8") max	2 x Ø 203 mm (8") max	2 x Ø 203 mm (8") max with wheelchanger: 6 x Ø 203 mm (8") max	2 x Ø 203 mm (8") max	3 x Ø 203 mm (8") max or 6 Ø x 152 mm (6") max
Tool (shank) Diameter	Productive up to Ø 12 mm (1/2")	Productive up to Ø 12 mm (1/2")	Productive up to Ø 12 mm (1/2")	Productive up to Ø 16 mm (5/8")	Productive up to Ø 25 mm (1")
Tool Length (Max)* *flute length - may vary depending on tooling	200 mm (8")	200 mm (8")	200 mm (8")	300 mm (12")	300 mm (12")
Loader Type	n/a	TBA	Robot (option) loads tools & wheels	FastLoad-MX (option) RoboMate (option)	FastLoad-MX (option) RoboMate (option)
Max. Tool Capacity (with loader)	n/a	n/a	Robot: 840 x Ø 3 mm 520 x Ø 6 mm 221 x Ø 12 mm	FastLoad-MX: 245 x Ø 3 mm 156 x Ø 6 mm 42 x Ø 16 mm RoboMate: 2520 x Ø 3mm 1560 x Ø 6 mm 462 x Ø 16 mm 189 x Ø 25 mm	FastLoad-MX: 245 x Ø 3 mm 156 x Ø 6 mm 42 x Ø 16 mm RoboMate: 2520 x Ø 3mm 1560 x Ø 6 mm 462 x Ø 16 mm 189 x Ø 25 mm
Spindle Type	Single Ended Induction	Single Ended Induction	Single Ended Induction	Single Ended Permanent Magnet	Single Ended Permanent Magnet
Drive System	Linear Motor	Linear Motor	Linear Motor	Linear Motor	Linear Motor
Linear Scales	Standard on X & Y-axes, optional on the Z-axis	Standard on X & Y-axes, optional on the Z-axis	Standard on X, Y & Z-axes	Standard	Standard
Touch Screen	Yes (Full Touchscreen)	Yes (Full Touchscreen)	Yes (Full Touchscreen)	Yes	Yes
Tool Load Time	n/a	n/a	Robot 12 sec	FastLoad-MX 24 sec RoboMate 15 sec	FastLoad-MX 24 sec RoboMate 15 sec
Travelling Steady (P-axis)	n/a	n/a	n/a	No	Option
MicroPlus	n/a	Option	Option	Option	Option
Overhead Top Clamp	n/a	Option	Option	Option	Option
Pop-up Steady	n/a	Option	Option	Option	Option
Auto-Stick	1 Stick (option)	1 Stick (option)	1 Stick (option)	1 to 4 Sticks (option)	1 to 4 Sticks (option)
Touch Probe	Yes	Yes	Yes	Yes	Yes
LaserPlus	n/a	Option	Option	Option	Option
Automatic Wheel Probe	n/a	Option	Option	Option	Option
iView (semi-automatic tool inspection)	Option	Option	Option	Option	Option
iBalance	Option	Option	Option	Option	Option
Dimensions	1930 mm (76") W 1800 mm (70") D 1810 mm (71") H	1930 mm (76") W 1800 mm (70") D 1810 mm (71") H	1930 mm (80")W 1800 mm (70") D 1810 mm (71") H	2269 mm (89")W 1446 mm (57")D 2015 mm (79")H *with RoboMate 2379 mm (94")W* 2168 mm (85")D*	2269 mm (89")W 1446 mm (57")D 2015 mm (79")H *with RoboMate 2379 mm (94")W* 2168 mm (85")D*

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