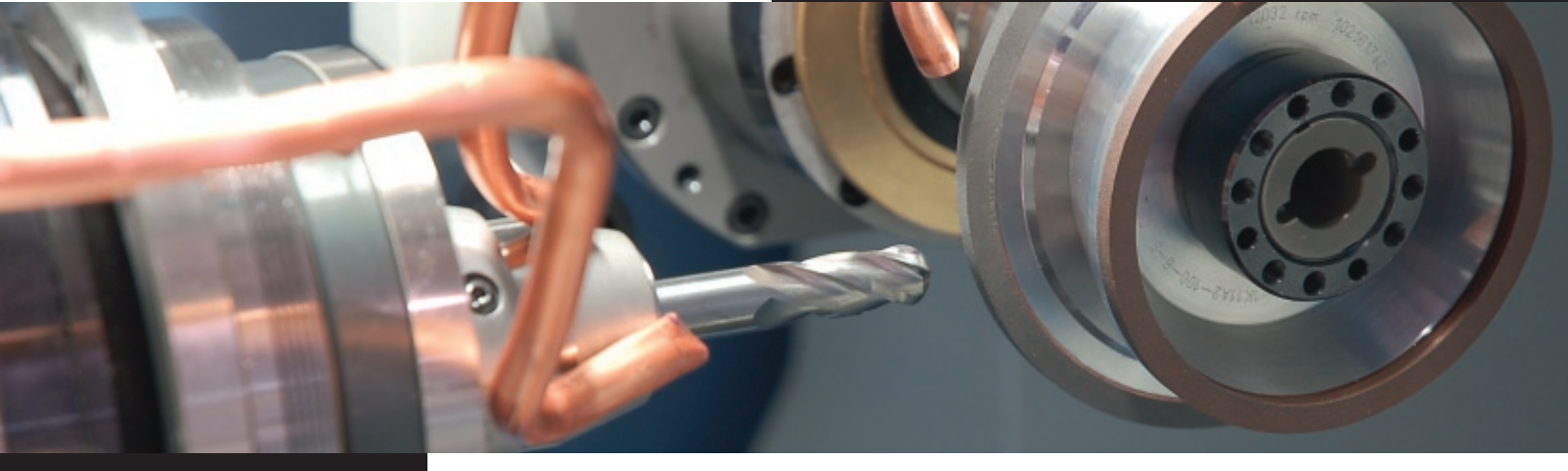


7 HOT TIPS

To Accelerate

Your Carbide Tool Production



Are you serious about carbide tool production? At ANCA, we certainly are! After 24 years designing and building advanced CNC tool and cutter grinders, we've mastered a few tricks to get the most out of your tool grinder to produce high quality carbide cutting tools all day, everyday.

Here're our 7 hot tips to help you notch up your production rates and profitability.

- Tip 1:** The wheel is the world's greatest invention, make it work overtime for you
- Tip 2:** Get your coolant clean and mean
- Tip 3:** Give your tools the support they need
- Tip 4:** Invest minutes in optimization to save hours in production
- Tip 5:** Deploy your anchor to avoid drift
- Tip 6:** Turn off the lights to save the planet
- Tip 7:** Rinse and repeat

TIP 1

The wheel is the world's greatest invention, make it work overtime for you

To extract the most from your tool and cutter grinder for carbide tool production, it's vital that you are using the right wheels, that they are perfectly balanced and qualified and that you keep them in top condition throughout a complete batch.

So it all starts with wheel selection. Which wheels you select for each operation, can have a significant impact on tool quality, cycle time and the cost of your consumables. So choose your wheels carefully. Work closely with your wheel supplier to match wheel technologies to your application.

There are four basic criteria for selecting the perfect wheels for your application:

- Wheel size and shape
- Grit size
- Grit material
- Grit bonding method

Your wheel's size and shape will be largely determined by your application requirements and the physical constraints of your tool grinder and process.

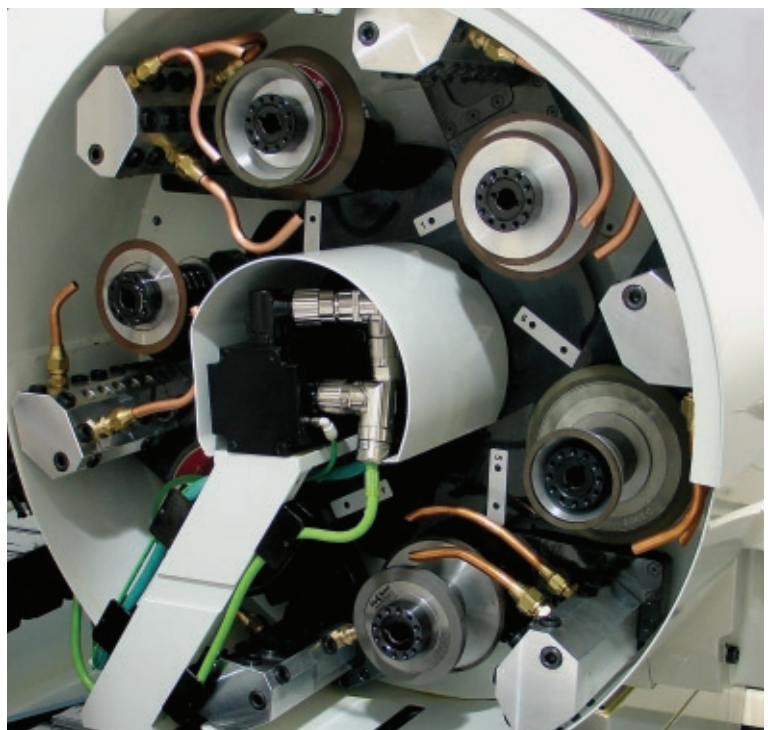
Choosing a grit size is relatively straight forward. Use coarser grit size for heavier applications such as fluting; a medium grit size for more general grinding and roughing operations such as back off grinding, some point grinding, gashing and some profiling. Select a finer grit wheel for finish grinding, profiling and smaller tools.

There are three grit materials commonly used in tool grinding. The hardest of these (Diamond) is the only grit type typically recommended for carbide grinding. The other common grit materials used in production grinding are Cubic Boron Nitride (CBN); which is often recommended for precision grinding of steels and Aluminium Oxide; which is softer than CBN but is easily dressed in process.

The three most common grit bonding systems are resin bond, metal bond and vitrified bond. Each bond has its advantages and disadvantages. Resin bonds are most common and are also the most flexible. They can provide a good balance between form holding and wheel breakdown. Metal bonds tend to be much harder, making in-process dressing more difficult, and are best used in profiling operations as they provide the best wheel shape retention. Vitrified bonds can be a lot softer and can lose wheel shape much easier, though this type of bond is the easiest to dress both in and out of process. Recent grinding wheel technology has produced wheels with hybrid bonds. These wheels are best used for fluting as they provide much better wheel shape retention and thrive on deeper cuts with higher feedrates.

Preparing the wheel for grinding is very important when manufacturing carbide tools. Most wheels should be dressed from new once mounted on your wheel arbor. Dressing the wheel on the arbor you intend to use is best practice. This ensures concentricity, helps with wheel balance and will be a contributing factor towards tool finish, wheel life and ultimately efficient carbide tool production.

Once dressed, the wheel pack should be balanced. A balanced wheel pack avoids vibration and can contribute not only to improved tool finish, but also to extended wheel life, ultimately adding to your bottom line. Make sure you balance the wheel pack in the state it will be used on the machine. There are many methods which can be used to



TIP 1

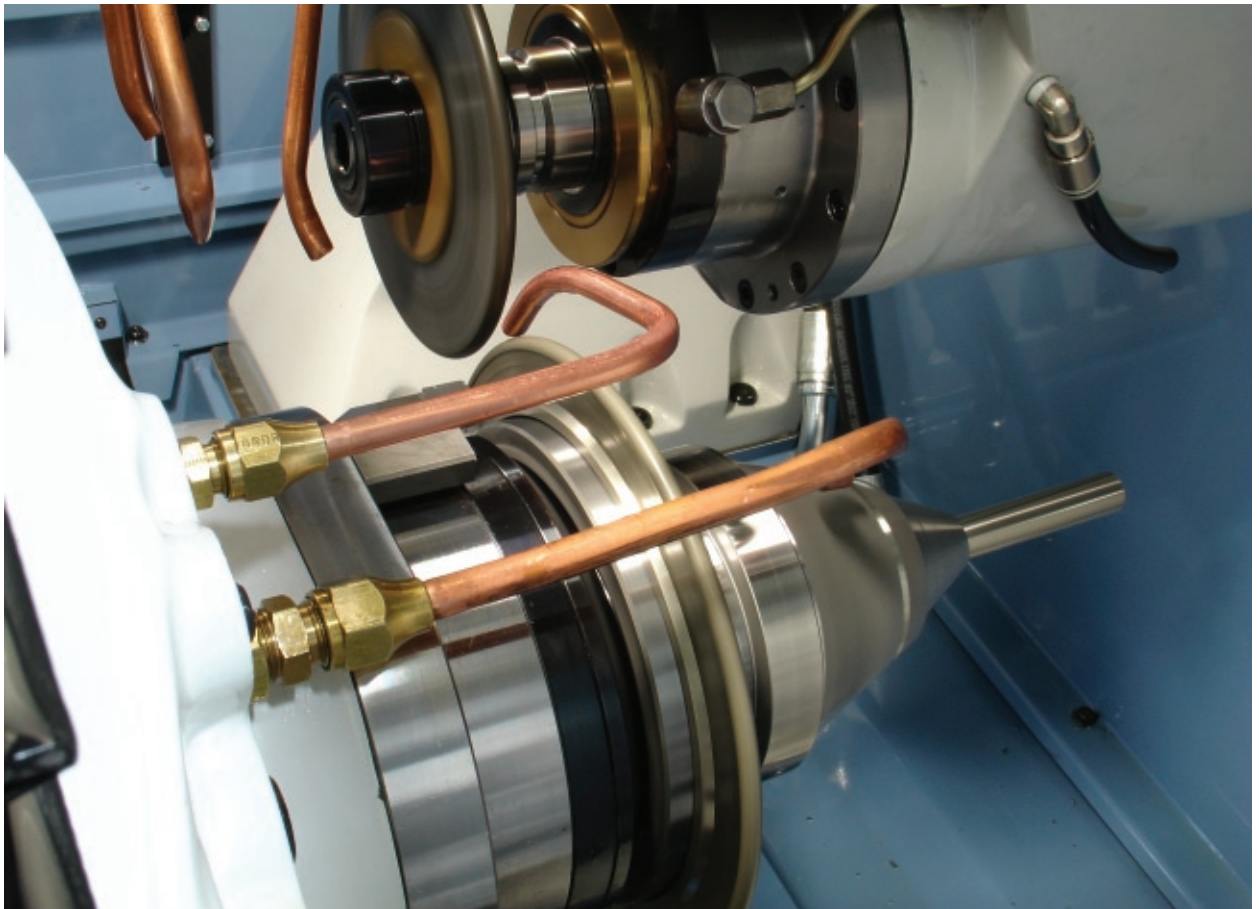
balance your wheel packs, however, the most accurate technique is to utilize balancing assist software built directly into some advanced tool grinders. This type of software detects vibration patterns in a spinning spindle and tells you exactly where to install your balancing weights.

Conditioning your wheel (also commonly known as white sticking) clears out accumulated debris built-up between the grits. White sticking your wheel in-between tools helps to reduce the load on your wheel. You want to keep your wheel cutting your tool, not just heating it up. So white sticking helps your wheel stay efficient in-between dressing cycles. This means that you can run with a higher feedrate and really load up your wheel, knowing that it is cutting true to form. Keep an eye on your spindle load meter for several tools so you can get a feel of how often to white stick your wheel. If your tool grinder has an automatic white sticking option, make sure you schedule this into the process periodically to keep your wheel cutting strong.

Depending on the type of wheel you have chosen, you may need to dress the wheel again during a batch if it dulls off too much or starts to lose shape. Advanced tool and cutter grinders often include in-process dressing abilities and you should schedule a dressing cycle after an appropriate number of tools if your wheel is of a dressable design. Ideally, your CNC tool grinder will automatically compensate for the slight change to the wheel diameter introduced by the dressing cycle.

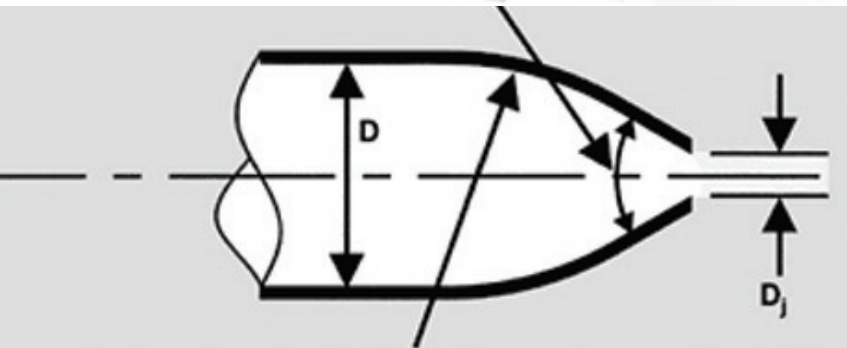
Your wheel supplier should be able to give you the correct wheel speed for your wheel in RPM or surface speed. Feed rates will vary between different tools and operations. Optimal feed rate is a balance between wheel wear, spindle load, tool rigidity, finish, accuracy and cycle time. Your wheel supplier should be able to give you a starting point but you can gain significant improvements in cycle time or accuracy by optimizing your feedrate to suit your specific application.

So to sum up, the wheels you choose for your job, what speeds and feed you run and how well you setup and maintain your wheels before and during the job all have a huge impact on your ability to crank out quality tool after quality tool at a profitable rate.



TIP 2 Get your coolant clean and mean

Your coolant has two primary jobs; lubrication and heat dissipation. The goal in coolant delivery is to inject the coolant as far as possible into the cut zone so that each wheel grit is lubricated throughout its entire contact run. This is not as easy as it looks though. You need to ensure your coolant system has sufficient pressure to obtain the required velocity needed for the particular operation at hand. At the same time, having the proper flow rate and temperature control will help dissipate heat away from the cut zone. Laminar (also called coherent-jet) nozzles can improve the effectiveness of both the pressure and flow that the coolant pump is supplying. Delivery of coolant into the cut zone as a laminar flow reduces the amount of turbulent air that is induced into the coolant stream. Air in the cut zone will decrease the cooling and lubricating efficiency of your coolant so it pays to get your flow as laminar as possible. Laminar nozzles are also more forgiving in terms of the distance your grind point can drift from the nozzle orifice allowing you more flexibility in your setup. If you also grind HSS, coolant delivery and flow to the cut zone are even more critical than for carbide grinding.



To keep sufficient coolant flowing into the cut zone, make sure your coolant nozzles are mounted relative to each wheel pack, ensuring your coolant nozzles are directed at the cut zone whilst remembering that the cut zone relative to the wheel can alter during the course of an operation and can differ for each operation you perform on the tool.

In some cases, you might find that directing one coolant jet tangential to the wheel, just in front of the cut zone "drags" coolant into the zone more effectively than directing the jet straight at the cut zone.

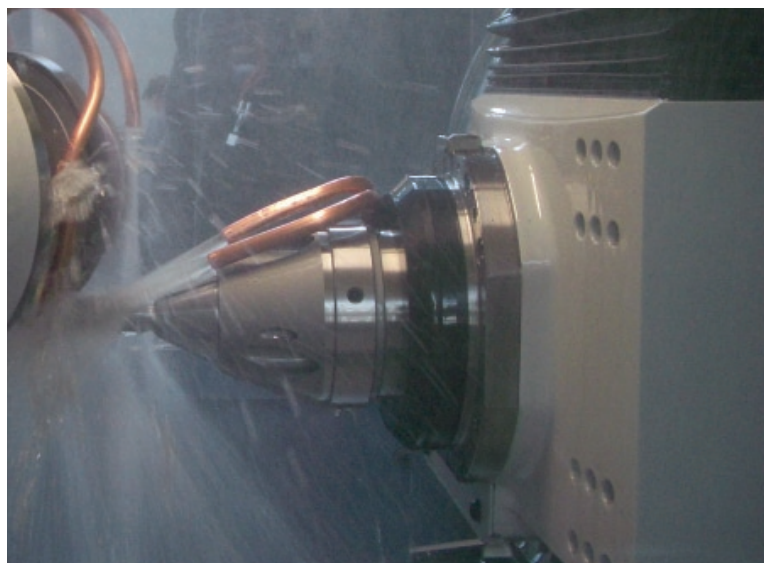
Keeping these factors in mind can benefit the grinding process by

- Reducing dressing frequency
- Reducing wheel load
- Producing less thermal damage to the work piece
- Less coolant jet deflection caused by the vapor barrier surrounding the wheel

An often overlooked factor is the cleanliness of your coolant. If your coolant gets contaminated, it adds friction to your process and you'll find you need to slow your feedrate down, the surface finish of your tools will degrade and your wheels will wear quicker. Dirty coolant cannot efficiently carry grinding swarf away from the cut zone therefore causing the grinding wheel to load up sooner than expected.

Micro sized tools are a good example where clean, temperature controlled coolant delivery are of the utmost importance. The high surface finish and tolerance requirements typically demanded in small tool manufacturing require the wheel to remain very free and sharp in its cutting action to avoid unwanted tool deflection. A good filtration system will help maintain your coolant in pristine condition.

In short, you want to keep your coolant injected deep into the cut zone and whether your grinding process requires heavy stock removal or the fussiest surface finish, good coolant filtration is a major contributor to efficient carbide tool production so keep your coolant clean and mean.



TIP 3

Give your tools the support they need

When it comes to work-holding for carbide tool production, you are often faced with the question of whether to include additional support for the tool or simply rely on the collet clamping mechanism to provide that support and grind the tool "free-ended".

It's true that a tool support system like a pop-up steady or a tailstock can, in some cases increase the setup time for a job, but you need to trade that off against the potential improvements you can gain in cycle-time. Often thought of as an aid to tighter tolerances, the humble steady rest can also be used as a production rate amplifier. By supporting the tool, you can ramp up the feedrate without suffering tool deflection. And in the last few tools prior to an automated wheel dress, a steady rest can help maintain your tolerances and avoid breakages, even as the wheel starts to dull off.

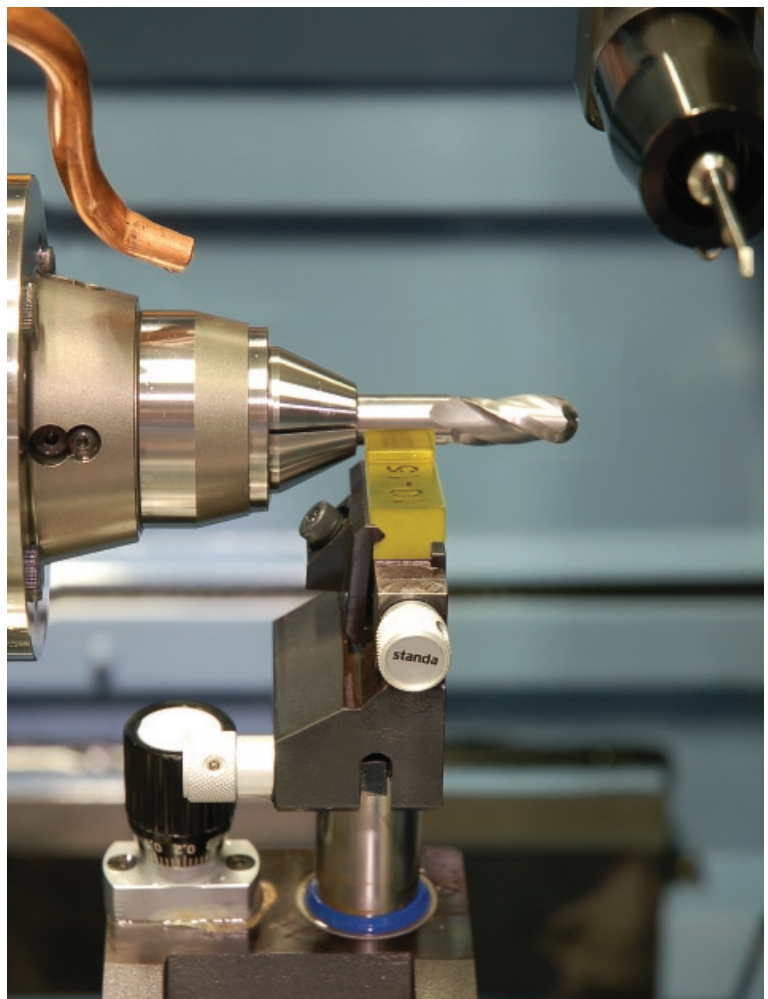
Since no one support system suits all applications, manufacturers of modern tool and cutter grinders usually provide a choice of tool support systems from manually adjusted steady rests, right through to fully automatic, self centering, multi-diameter, multi-point clamping supports and tailstocks on programmable axes that move in perfect synchronization with the grinding wheel to always provide support where it is needed most. In the case of an automatic tailstock, it is even possible with an advanced system, to program the force that the tailstock will exert on the center, allowing you back it off for some operations like cylindrical grinding.

As we've mentioned, the main reason to support your tool is to reduce deflection of the tool during grinding. Reduced deflection will improve your tolerances, run-out and surface finish. These characteristics feed directly into a higher quality, longer lasting tool that you should be able to charge a higher price for. But also, don't forget to crank up your feedrate once you start supporting your tools, particularly during fluting, normally the slowest cycle in the production process. The increased support will in many cases allow you to chew through more carbide per minute without sacrificing tool quality or wheel life, further increasing your efficiency and adding incremental gains to your profitability.

Even though you might expect to wear out your grinding wheels faster using a tool support system due to your faster feedrates, supporting your tool can in some cases actually extend the life of your wheels. The vibration that can be induced by grinding an unsupported tool can lead to chipping and wear along the edge of the wheel which can dramatically shorten the useful life of your wheel. You can minimize this undesirable effect by utilizing good tool support.

It also pays to utilize a tool support system because you can in some cases, reduce the overall length of your tools because with good tool support, you might need less shank length in the collet to clamp on which means a shorter blank for the same fluted length, so you get valuable saving on your raw carbide costs.

So give your tools the support they need, so you can crank up your profits by increasing your feedrates at the same time that you are improving the quality of your finished carbide tools.



TIP 4

Invest minutes in optimization to save hours in production

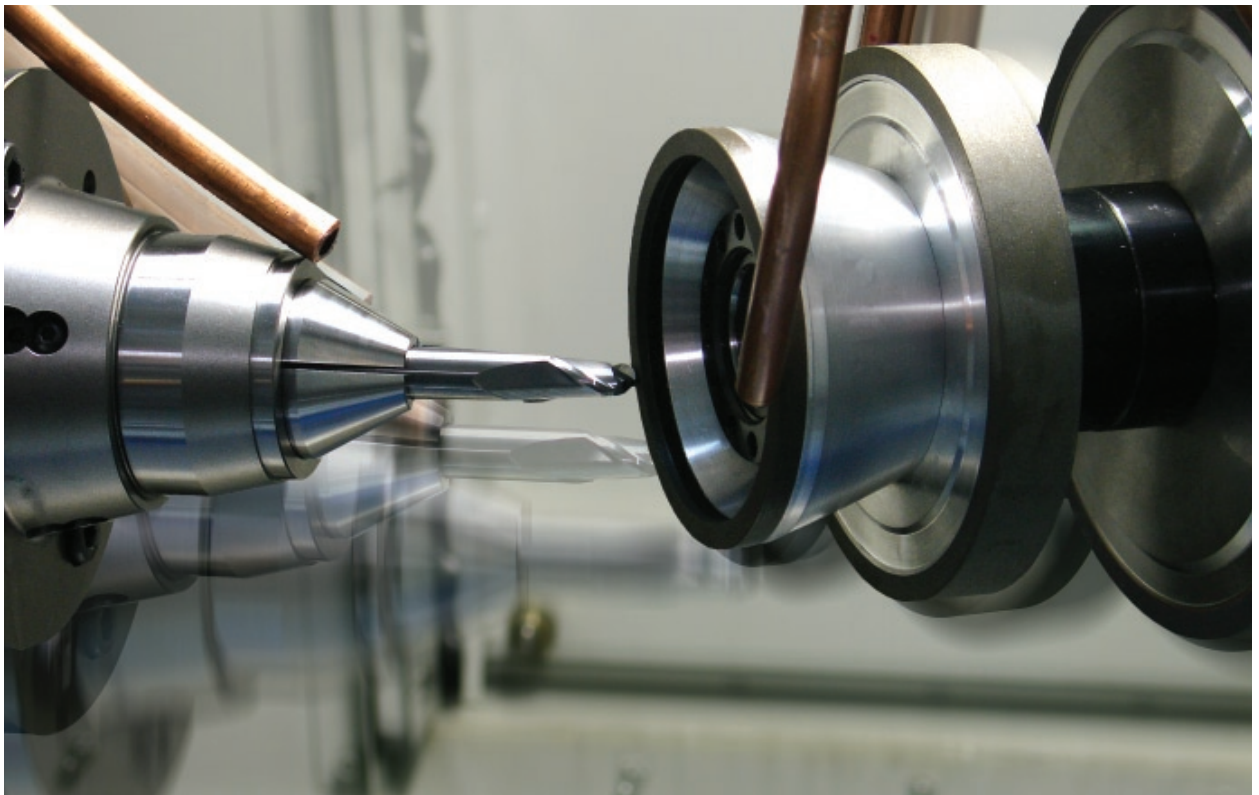
There is an age old saying that's goes "Do it once. Do it right". This holds true for production grinding too. You can save valuable time and money by taking a few minutes to set up and tune your carbide tool grinding process. A modern CNC tool and cutter grinder will have the capability to be finely tuned to maximize the efficiency of your production runs.



Optimization begins with good setup. We've already discussed the physical aspects of setting up your tool grinder for carbide tool production; the importance of good wheel selection, coolant quality and flow, and the benefits of tool support. But what about the setup of the programs that will run your batch? A huge time waster can be configuring the software of your CNC tool grinder to actually grind exactly what you want to produce. The software installed on the CNC of your modern tool grinder should have user friendly screens to guide you through the setup process. If you are grinding very complex or unusual tools, you might need to ensure your CNC is running high end or specialist software options that help you to easily configure the geometry of these tools or you could waste hours or even days, trying to setup a tool that the software was never designed to cater for.

One very effective way to quickly prove out a new tool design that could save you a big chunk of non-production down-time on your machine is "Dry Run" mode. When you have entered all the data describing your tool and the grinding cycles you want to run, switch on your CNC's "dry run" mode and give the cycle a quick run through to check that all the machine

motion looks reasonable. Better yet, perform your dry run using your CNC's MPG feed feature if it has one. This ingenious invention lets you prove out a complete tool program by simply winding the hand-wheel. This leaves you in complete control at all times and eliminates any surprises you might otherwise get if you accidentally put the decimal point in the wrong place for one of your parameters!



TIP 4

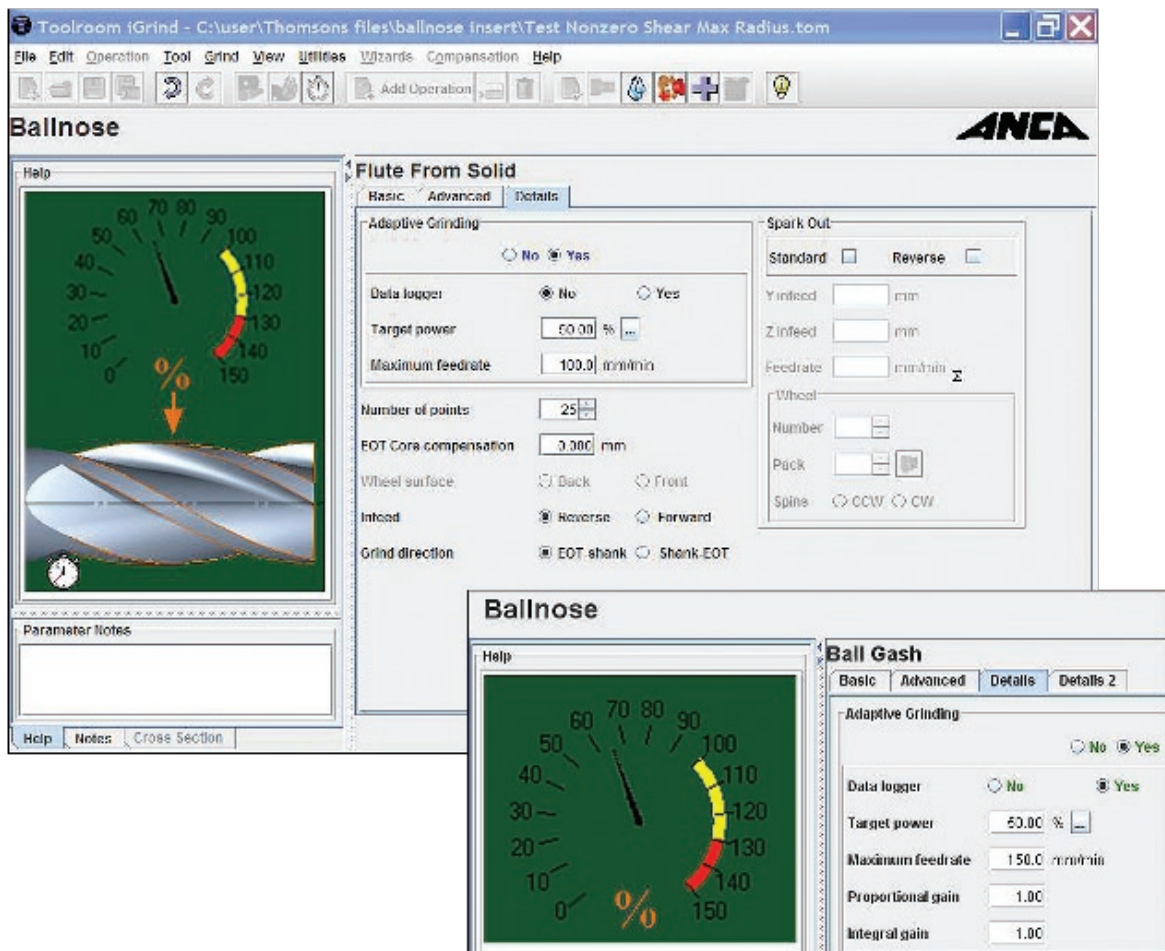
Dry running your program is effective and can save you lots of time and scrap tools, but by far the best time saving you can get for program setup is to go "offline". Invest in a PC loaded with an identical copy of your CNC's software and preferably 3D simulation software for the grinding process. You can then setup your next tool while the machine is busy producing the current batch. 3D simulation has revolutionized the CNC tool grinding industry and if you don't have it in your shop, you will be losing out big time to your competitors who are using it. With 3D simulation, you can see exactly how the tool will look like and verify and measure the actual geometry, then make as many design changes you like, all without interrupting your machine tool from its very important job of making money for you.

As well as selecting efficient spindle speeds and feedrates, there are other simple things you can do to maximize your production rates; some as simple as flicking a switch. The first thing to do is to switch on adaptive feedrate control on your CNC if it supports this feature. Adaptive control will alter the feedrate depending on the spindle load so you can go faster over the shallow cuts and the CNC will automatically slow the feedrate down during deep cuts. This translates immediately into faster grind times and maximum use of your expensive machine. Before switching on adaptive control, you should check your wheel specs first. Some wheels, such as hybrid bond diamond wheels, must be loaded up aggressively to keep them sharp.

It also pays to experiment. By monitoring the spindle load meter, you will sometimes find that you can lower the spindle speed and increase the feedrate for an aggressive cycle time improvement.

Remember, the bigger the batch or the more times you anticipate running the same batch, the more it pays to spend some time in optimizing your process. You can even get to the point of optimizing the distance of approach, retract and gap movements between cycles to reduce cycle times, although you will find that on current releases of modern tool and cutter grinder software, that the software is often smart enough to make these adjustments for you automatically so your machine spends more time cutting metal and less time unproductively grinding fresh air.

Remember, each optimization you make can be automatically reapplied the next time you run the same batch so it's definitely time well spent, and when setting up "Do it once. Do it right!"



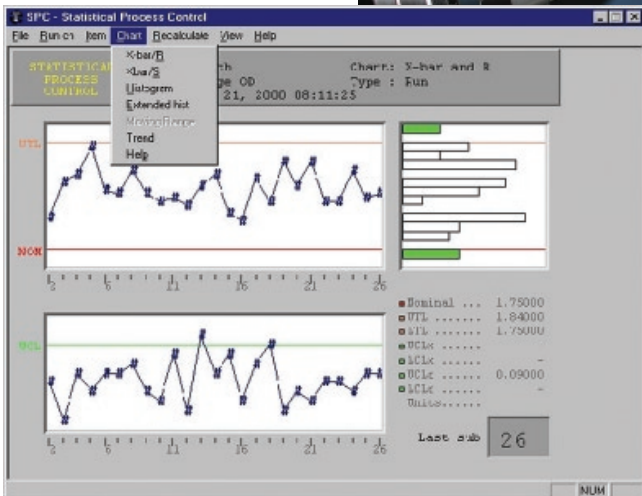
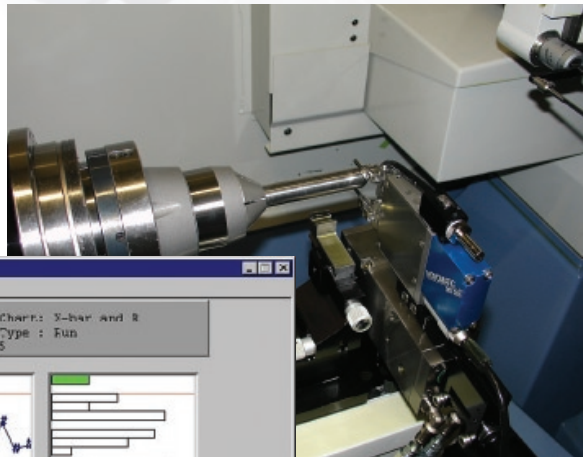
TIP 5

Deploy your anchor to avoid drift

There's nothing more frustrating and costly than an unmanned production batch gone wrong half way through. Your tool grinder should have a number of features to help you monitor and control your process from the first tool in the pallet to the very last.

If you've optimized your process properly, machine and tool accuracy should be very stable throughout an entire batch. However, due to wheel wear and possibly machine accuracy changes due to temperature shifts, you might experience slight inaccuracies creeping into your process during the grinding of a batch, which, if unmonitored, might result in part of your batch being ground out of spec.

Statistical Process Control (SPC) is a statistical technique for monitoring and controlling a process to ensure it remains within desired boundaries. If your CNC includes in-built SPC software, then you can switch this on and it will use the touch probe to monitor small samples of tools, usually by measuring the OD size or flute depth and will then feed adjustments back to the CNC to ensure the process stays within spec for the whole batch. Your SPC software will also chart the progress of your batch and report on your capability index so you have immediate feedback on the quality of the tools you are producing.



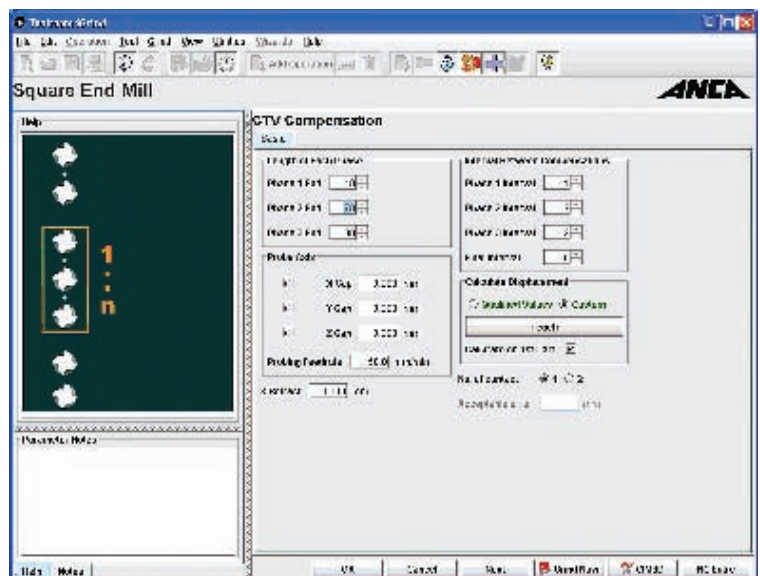
Although modern Tool Grinders are built to minimize the effects that changes in temperature can have on tool accuracy, today's tight tolerance requirements mean that in some cases, you'll need to make

adjustments to the process as the ambient temperature of the process changes. If you have a coolant chiller and good ambient air conditioning, this effect will be minimal, but not everyone has the luxury of a tightly controlled thermal environment and some people run to such tight tolerances that even slight changes in temperature can adversely affect tool quality.

This is where Coolant Temperature Variation (CTV) Compensation can help. If your tool grinder is equipped with CTV, then at periodic intervals during a large batch of tools, the machine

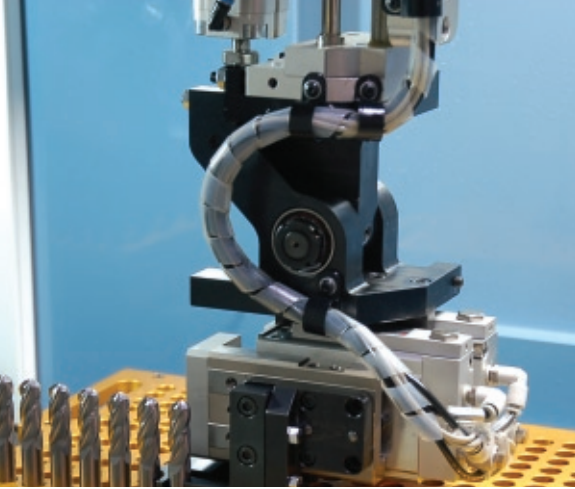
can use the touch probe to reference a known surface, re-calibrating the machine axes on the fly. The sample frequency can be increased at the start of the batch while the machine temperature stabilizes. The compensation can be scheduled at any point in the operating sequence to ensure the compensation occurs as near as possible to the most critical grinding operation. CTV can help you achieve very tight tolerances throughout an entire production run.

So make sure you utilize good process monitoring and control techniques and take full advantages of your tool grinder's automatic measurement and compensation features.



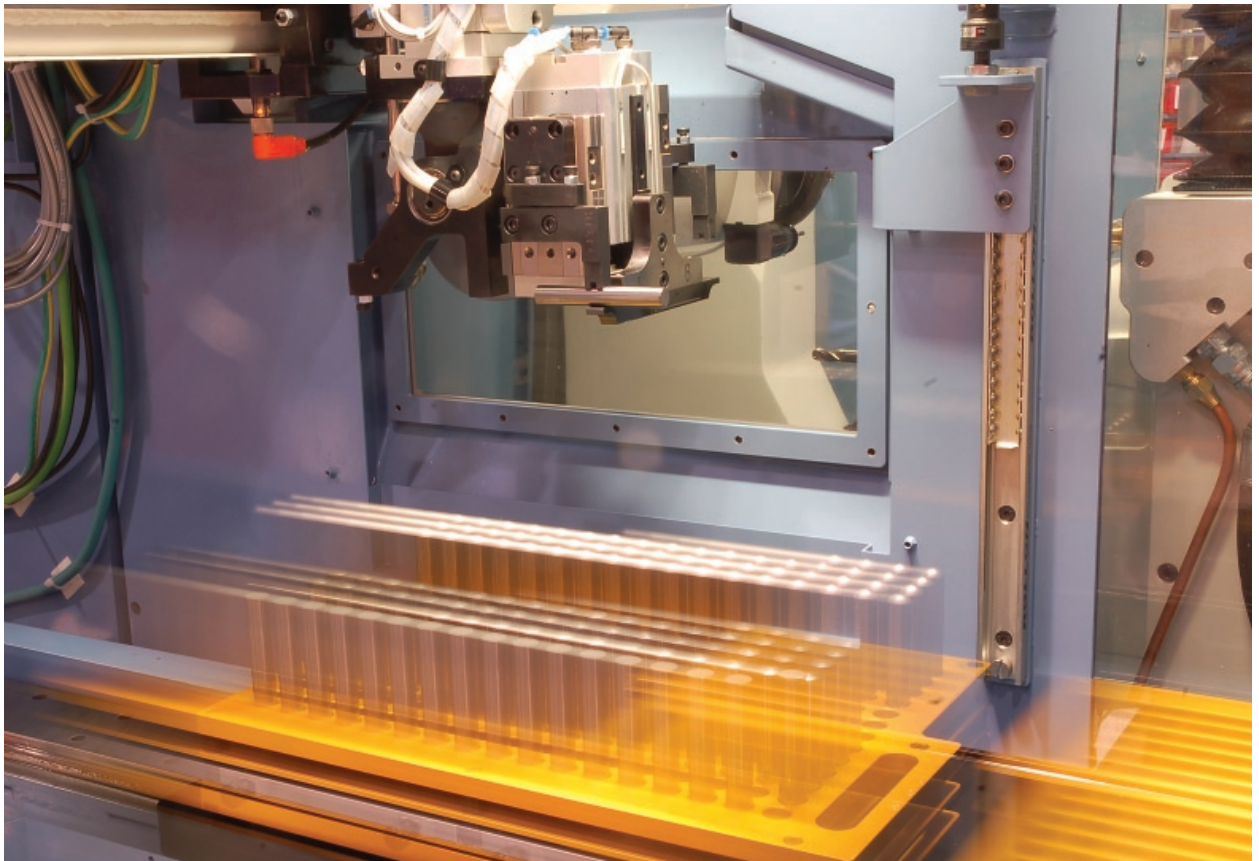
TIP 6 Turn off the lights to save the planet

If you've followed the previous five tips, your tool and cutter grinder should now be purring away, churning out quality tool after quality tool. If you grind a tool with an extremely long cycle time or if you've got a suitable automatic tool loader on your machine, you can now ramp up your profits by ramping down your supervision of the machine. Switch off the lights in your factory and let the machine do the work for you, confidently knowing that your machine is well tuned and optimized, with your process under constant surveillance and control.



Many tool and cutter grinders now include automated wheel pack changers. If your tools require some heavy cutting or ultra-fine tolerances, particularly if you are not able to dress in cycle, it's a good idea to include multiple sets of identical wheel packs so you can schedule wheel pack swaps mid batch to keep your production process accurate and efficient.

In the unlikely event that something does go wrong during grinding, it is possible with some tool grinder CNCs, to have the machine automatically send you a message via SMS, email or instant messaging, telling you exactly what the problem is. Even if no problem occurs, it can be useful to use the CNC's messaging feature to let you know your pallet is full of perfectly ground carbide cutting tools, just waiting for you to unload and turn them into profit.



TIP 7 Rinse and repeat

A modern tool grinder gives you incredible flexibility to quickly design, setup and grind a myriad of complex cutting tools, but never forget that a repeat order for a batch you've already optimized will be profit straight in your pocket. For your regular runs, try to keep a set of wheel packs just for that job and make sure you have a good filing system for your wheel and tool definition files. This will cut your setup and qualification time down dramatically and get you moving from batch to batch in no time at all.

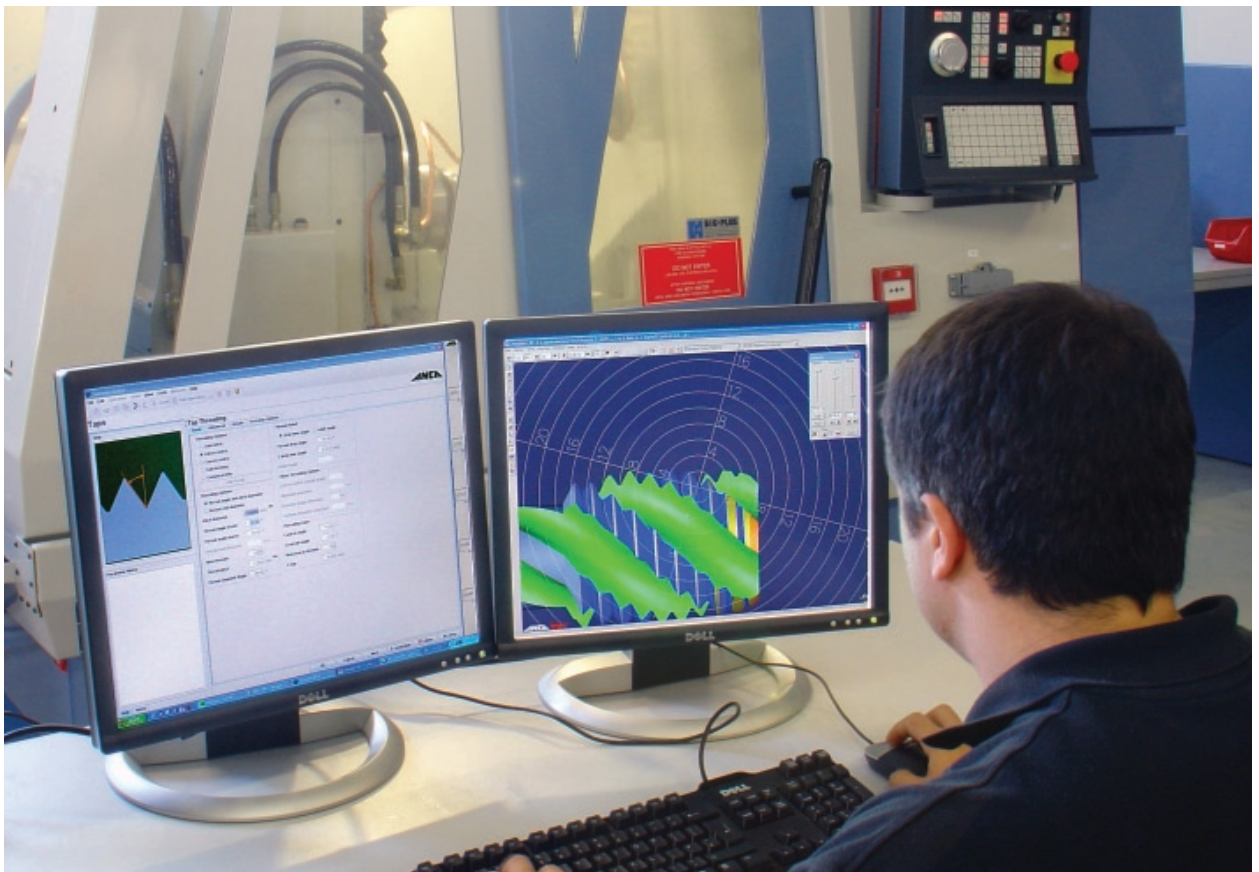
Now, all that's left is to put your feet up and relax, or head to the golf course while your machine makes the money for you, grinding a complete batch of quality carbide cutting tools. Better yet, why not head back to the office, grab a coffee and fire up your 3D simulator to work on your next job while the machine's busy spitting out carbide swarf.

A 3D simulator is not only good for setting up your next job offline, but it's also an invaluable package for new tool design, optimization, diagnostics, costing and training. You can also use it for marketing; just email 3D models of completed tools to your potential customers to show them quickly what you are capable of producing.

If you want to branch out into a new market, some tool and cutter grinder suppliers will let you load a new application software package onto your simulator for free. You can then explore the market, become familiar with the software and produce 3D models of tools to email to your potential customers for acceptance or simply publish them on your company's web page to get your product out there.

Then, when you have secured the order you can commit to purchase the software for your grinding machine and actually launch into production of real parts with a high degree of confidence.

Your 3D simulator is more than a piece of software and can directly contribute to the efficiency of your carbide tool production. It's like a Swiss army knife for your grinding business, with equal parts; 3D simulation, design, optimization, diagnostics, training and a marketing tool. Use it to its full potential and watch your business soar.



7 TIPS SUMMARY

So, when you're setting up your next batch, remember these 7 hot tips to accelerate your carbide tool production:

Tip 1: The wheel is the world's greatest invention, make it work overtime for you

- ☑ Choose the correct wheel shape and size
- ☑ Choose the appropriate grit size for the job
- ☑ Choose the appropriate grit bonding method for the job
- ☑ Dress the wheel (if applicable) on its arbour
- ☑ Balance the wheel
- ☑ White stick your wheel regularly during production
- ☑ Use in-process dressing (if applicable)

Tip 2: Get your coolant clean and mean

- ☑ Use a high pressure, high flow coolant system
- ☑ Mount your coolant nozzles relative to your wheels
- ☑ Use laminar flow nozzles
- ☑ Keep your coolant as clean as possible

Tip 3: Give your tools the support they need

- ☑ Use automated tool support whenever possible
- ☑ Try increasing your feedrates once your tool is supported
- ☑ Reduce your clamping length to optimize your blank length

Tip 4: Invest minutes in optimization to save hours in production

- ☑ Make sure your software fully supports your tool types
- ☑ Monitor spindle power to tune your spindle speed and feedrates
- ☑ Switch on adaptive feedrate control
- ☑ Optimize your approach and retract moves
- ☑ Use "dry run" mode to prove out your new tool designs
- ☑ Use MPG feed to improve safety and efficiency of your dry runs
- ☑ Setup your next job offline on a PC running 3D simulator software

Tip 5: Deploy your anchor to avoid drift

- ☑ Use Statistical Process Control (SPC) software to monitor and control your process
- ☑ Use Coolant Temperature Variation (CTV) compensation to keep your machine perfectly calibrated

Tip 6: Turn off the lights to save the planet

- ☑ Use an automatic tool loader
- ☑ Use an automatic wheel pack changer
- ☑ Switch on process messaging to keep you up to date via SMS

Tip 7: Rinse and repeat

- ☑ Keep one or more sets of pre-qualified wheel packs for each regular job
- ☑ Organize your part and wheel description files to make batch changeover as smooth as possible
- ☑ Use your 3D simulator to prospect for new business

If you're serious about carbide tool production, you know that production rates, accuracy and profit count for everything. So meet the latest addition to the ANCA production tool grinder family - the MX7:



Please turn over...

MX7

Rock steady - Rocket fast

If tools 5/8" and smaller are your bread and butter, then you had better get acquainted with the MX7. We've shrunk the footprint and we've also shrunk the price. But we've packed the MX7 full of heavy duty production features to keep your profits turning over when you turn out the lights. Integrated directly into this compact production powerhouse are the three must have features for continuous, lights out production grinding:

- Integrated wheel pack changer - standard
- Integrated tool loader
- Integrated wheel dresser

A Solid Heritage for a Solid Performer

You want to maximize grinding time, but you don't want to sacrifice tool quality in the process. This brings us to the MX7's impeccable pedigree. Thermal stability, extreme rigidity and strength have been bred into the MX7 by the same design team that brought you the renowned TX7, ANCA's highly successful large tools production grinder.



Call ANCA today to find out more.
Branch details at www.anca.com

Or email us on mx7@anca.com to receive a complete spec sheet, or to find out more about how the new ANCA MX7 can meet your demanding carbide tool production requirements.

ANCA[®]