

THE CPX LINEAR
BLANK PREPARATION
GRINDER

ANCA

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INTRODUCTION

The CPX Linear is ANCA's blank grinding machine that complements the full process in manufacturing cutting tools from a blank to a completed tool.

At ANCA we are constantly seeking feedback to meet and stay ahead of our customers' needs. ANCA's partnerships with customers and in-depth interaction with cutting tool manufacturers gathered the need for a blank grinder, and the CPX Linear is the result of this ongoing commitment to our customers.

Keeping customers and their needs in the forefront of our commitment, the CPX Linear blank grinding solution comes with standard features at no extra cost to achieve the closest diameter tolerance for an unmanned production and with a controlled grinding process.

The BlankX software, MTC and automatic wheel wear compensation are the standard features that will be discussed in the following sections.

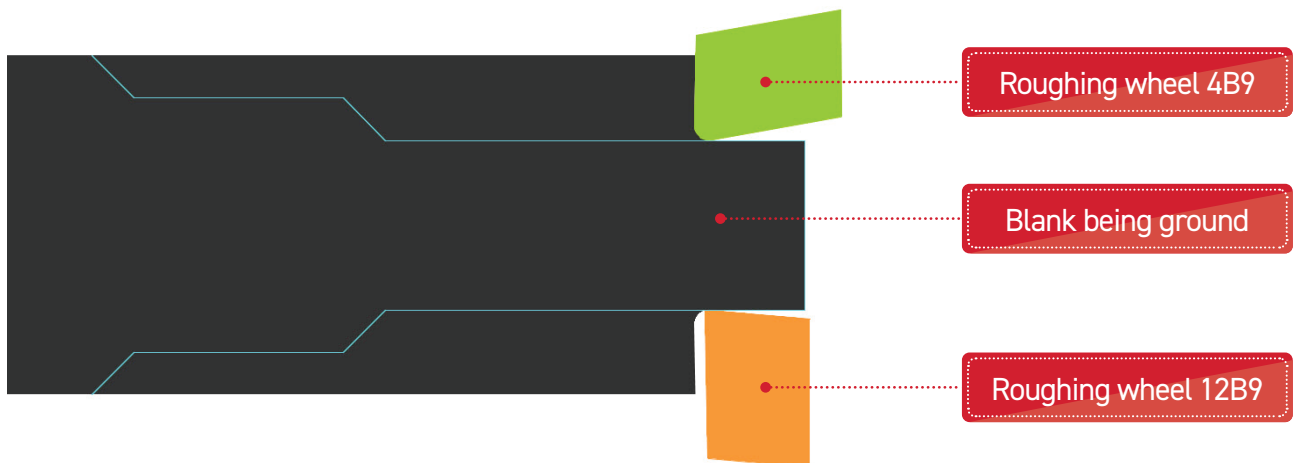
CPX BLANK GRINDING APPLICATION

Cylindrical blanks are ground on the CPX Linear with the proven pinch-peel method of grinding. During the grinding process, the blank is pinched between the roughing and the finishing wheel as the blank rotates at a high RPM and travels longitudinally.

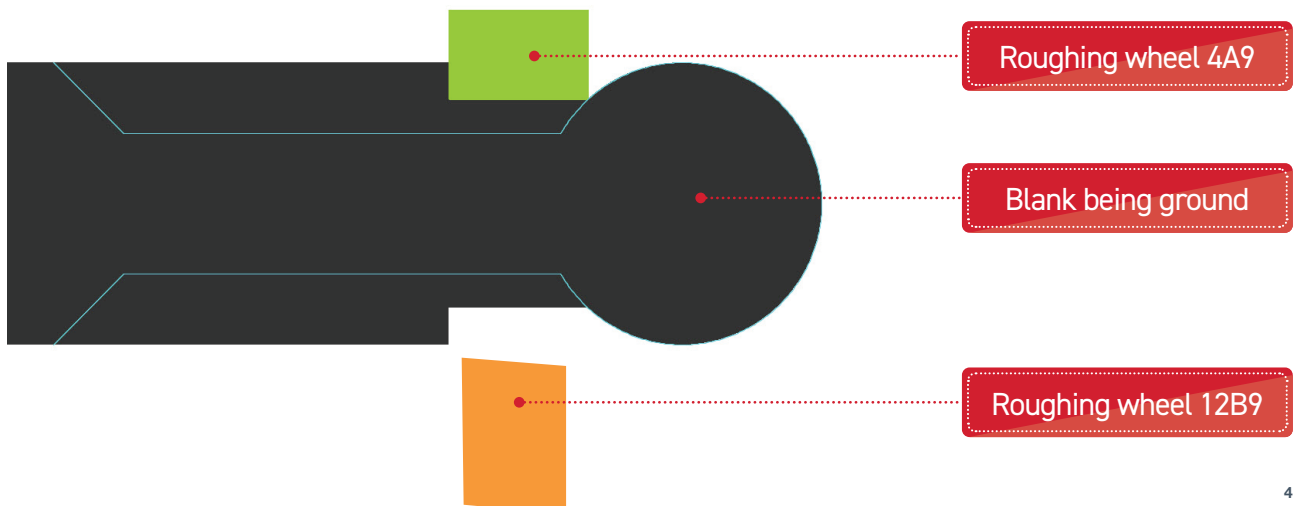
The roughing wheel contacts the blank at 3 o'clock and the finishing wheel contacts the blank at the 9 o'clock position as shown in the image below. The roughing wheel position along the blank axis is set up so that the finishing wheel trails by 0.5mm, commonly referred to as the "separation gap". The roughing wheel is also programmed to leave radial stock on the diameter which is then finish ground by the trailing finishing wheel.

This method of grinding allows higher material removal rates as the distance between the blank support and the grinding wheel remain fixed throughout the grinding process, resulting in less blank deflection and vibration. It also increases the blank form quality and surface finish, and reduces cycle times.

PINCH-PEEL GRINDING WITH THE ROUGHING WHEEL AT 10-DEGREE ORIENTATION



PINCH-PEEL GRINDING WITH THE ROUGHING WHEEL AT 90-DEGREE ORIENTATION



BLANKX SOFTWARE

ANCA's **BlankX software** is a dedicated application used to create and program grinding parameters to grind blanks on a CPX Linear.

The software is filled with simple to advanced features to meet a wide range of requirements for blank grinding. Some of the features are:

- An interface similar to ANCA's popular and flexible iGrind software
- Icon-based programming to quickly create blanks with cylindrical, tapered and radius segments
- 2D profile and DXF import for profiled blank segments
- Add a fillet chamfer or a radius just by selecting the adjacent geometry
- Guided workflows to create a program from geometry to grinding process parameters
- Cycle time estimation
- 2D simulation to verify the program
- Live view of the blank grinding
- Stock per segment independent of roughing and finishing
- Wheel editor and wheel adjustments
- Automatic grinding wheel wear compensation
- Multi pass blank grinding with "Call BlankX file"
- Metric and imperial modes

GRIND SETTINGS

BlankX - P:\toolroom\user\tools\blankx1.blank

File Edit Tool Wheel Machine Grind View Utilities Help

ANCA ONE MACHINES

Cycle time 05:33

Geometry Stock Settings **Grind Settings** Grind Endface Digitize EOT

Approach
Gap 2.0 mm
Feedrate 10.0 mm/min

Wheel spindles
Finishing wheel: CCW CW
Spindle Speed Variation

Dwell
After Plunge: Roughing 0.0 s, Finishing 0.0 s
Before Withdraw: Roughing 0.0 s, Finishing 0.0 s

	Grind Mode	Feedrate		Headstock Speed
		Roughing	Finishing	
Common	Pinch peel		6.0 mm/min	867.0 rpm
Plunge		10.0 mm/min	10.0 mm/min	867.0 rpm
Withdraw		10.0 mm/min	10.0 mm/min	867.0 rpm
Steps	Grind Mode	Specify	Feedrate	Headstock speed
1	Pinch peel	<input type="checkbox"/>	6.0 mm/min	867.0 rpm
2	Pinch peel	<input type="checkbox"/>	6.0 mm/min	867.0 rpm
3	Roughing only	<input checked="" type="checkbox"/>	8.0 mm/min	867.0 rpm
4	Roughing only	<input checked="" type="checkbox"/>	8.0 mm/min	867.0 rpm

STOCK PER SEGMENT

Geometry Stock Settings **Grind Settings** Grind Endface Digitize EOT

Profile type: **Overize**

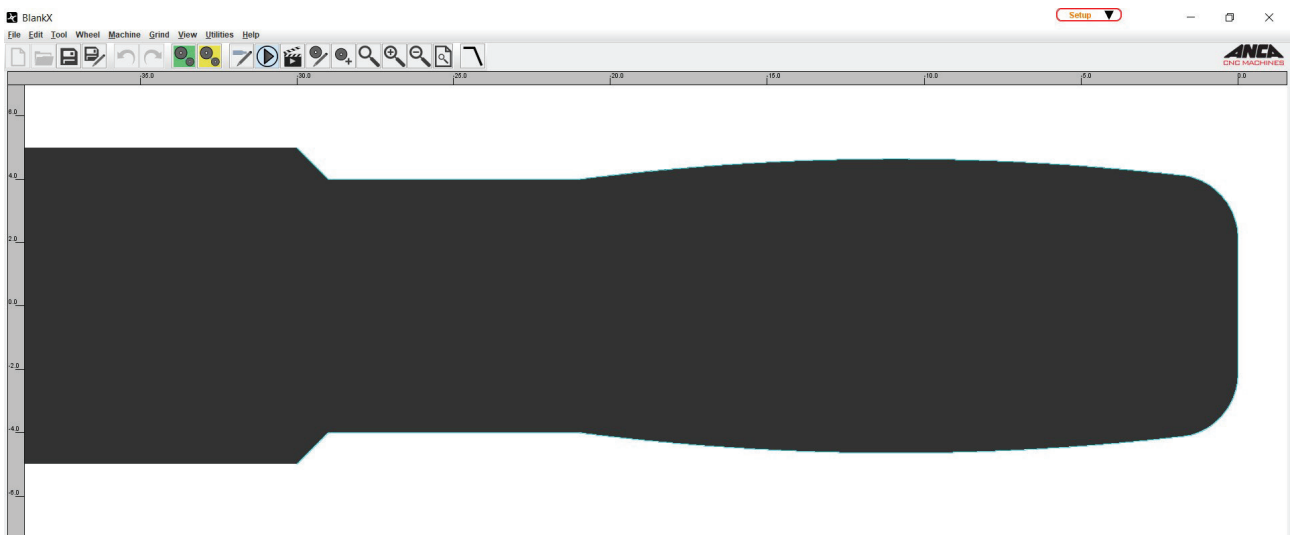
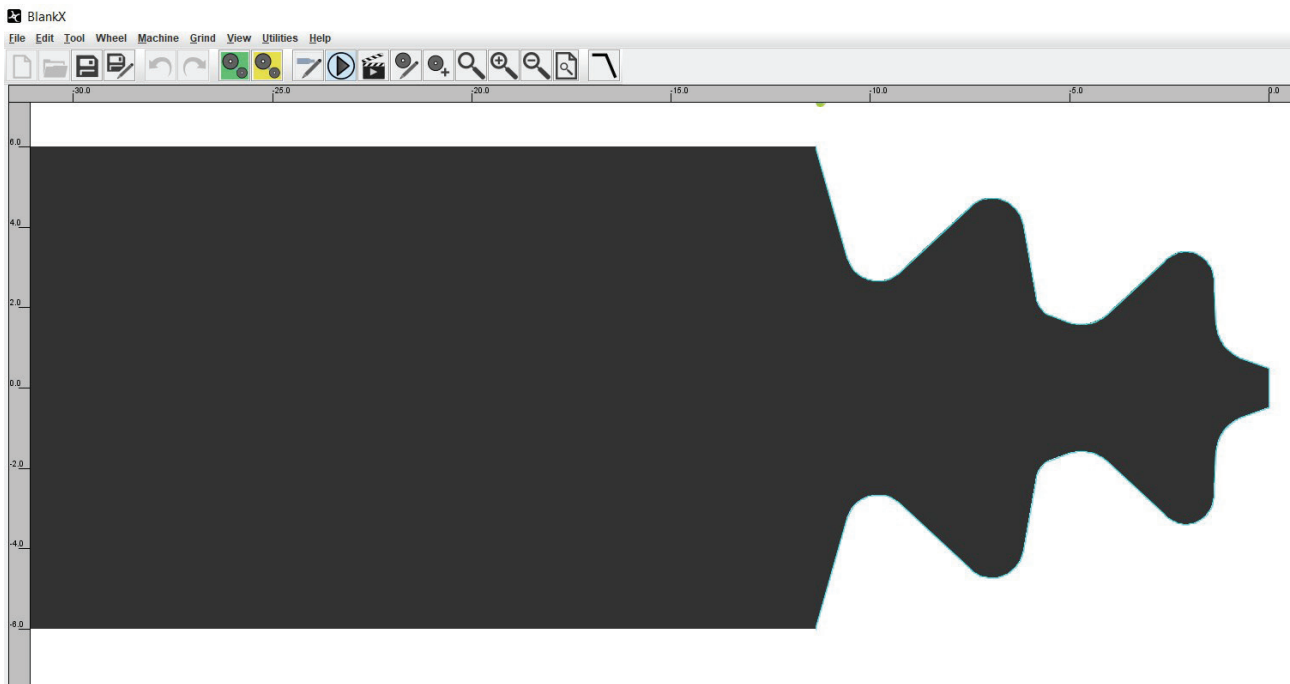
Common	Grind Mode	Specify	Roughing		Specify	Finishing		
			Shank	Shoulder		Shank	Shoulder	
	Pinch peel		0.0 mm	0.0 mm		0.0 mm	0.0 mm	
Steps	Specify	Specify						
1	<input checked="" type="checkbox"/>	Roughing only	<input checked="" type="checkbox"/>	0.0 mm	0.5 mm	<input checked="" type="checkbox"/>	0.0 mm	0.0 mm
2	<input type="checkbox"/>	Pinch peel	<input checked="" type="checkbox"/>	0.1 mm	0.0 mm	<input checked="" type="checkbox"/>	0.0 mm	0.0 mm
3	<input type="checkbox"/>	Pinch peel	<input type="checkbox"/>	0.0 mm	0.0 mm	<input type="checkbox"/>	0.0 mm	0.0 mm
4	<input type="checkbox"/>	Pinch peel	<input type="checkbox"/>	0.0 mm	0.0 mm	<input type="checkbox"/>	0.0 mm	0.0 mm
5	<input type="checkbox"/>	Pinch peel	<input type="checkbox"/>	0.0 mm	0.0 mm	<input type="checkbox"/>	0.0 mm	0.0 mm

2D SIMULATION

BlankX

File Edit Tool Wheel Machine Grind View Utilities Help

ANCA ONE MACHINES



MTC (MOTOR TEMPERATURE CONTROL)

Motor Temperature Control (MTC) is a patent pending innovation from ANCA that controls the temperature in the motor of the grinding spindle/s regardless of the process parameters or the operating conditions.

Grinding large batches of cutting tool blanks requires several elements to be monitored and controlled within a production environment. These include the correct selection of grinding wheels, specification and process parameters, finer temperature control of the grinding coolant and the environment along with the machine setup and incoming blank quality.

Before commencing a batch grind, a few samples are firstly ground, necessary adjustments are then made to the process, and then the batch grinding starts. As common production practice, the first few

blanks are inspected until the process is stabilised. The number of blanks that requires to be inspected at the start and during the batch varies based on the volume of material removed per blank, complexity of the blank and other external factors.

Grinding spindles are exposed to varying grinding loads based on the section being ground and/or the programmed process parameters. This influences the variation in the spindle motor temperature that directly causes the blanks to vary in dimensions. The variation will be a few microns, but it is critical while grinding to closer tolerances and to achieve Cpk of > 1.33 on blank diameters.

MTC is within the process that can reduce the time taken for the batch to stabilise and reduce the number of adjustments required during a long batch run.

In summary, the MTC offers these benefits to blank manufacturers:

- Stable motor temperatures with varying grinding loads and RPMs provide minimal axial spindle growth, resulting in dimensional stability of the blanks.
- As the dimensional stability is improved much fewer parts are inspected during a batch run.
- Time taken to warm up the grinding spindles is significantly reduced to a few minutes, resulting in first part right and reaching batch stability faster.



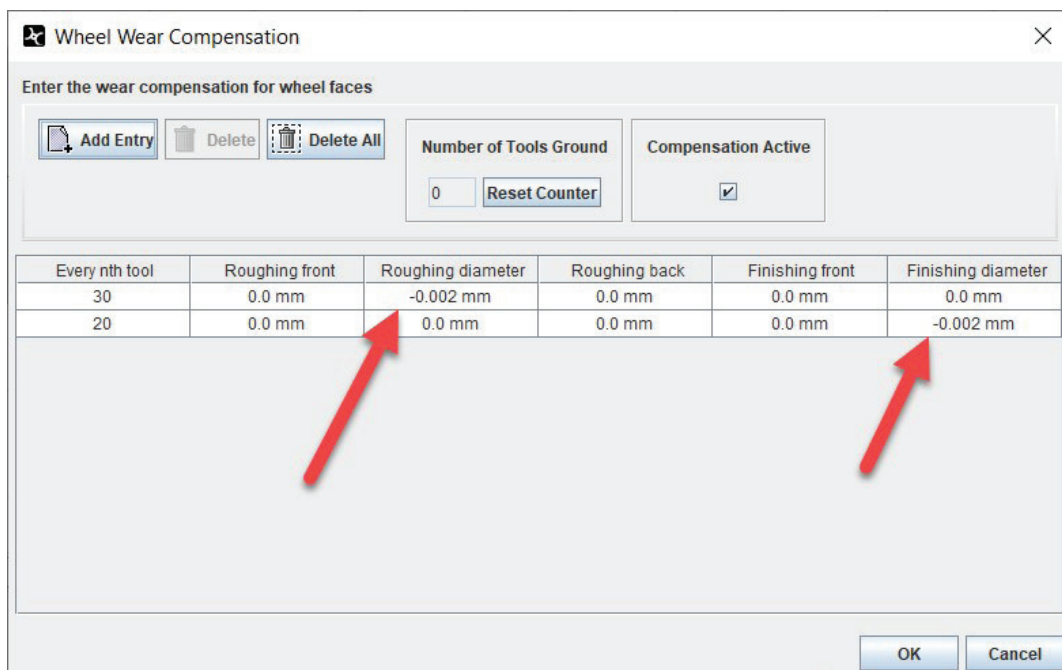
AUTOMATIC GRINDING WHEEL WEAR COMPENSATION

As discussed, grinding large batches of cutting tool blanks requires several elements to be monitored and controlled within a production environment. One of the other elements that requires monitoring is grinding wheel wear for roughing and finishing. This is important to note as the function of these are different, along with the wheel wear rate.

Grinding wheel wear and its control starts with the selection of wheel for its shape, size and specification. To make this process easy the CPX Linear comes with proven and recommended grinding wheels that can be purchased to suit a variety of blank grinding applications. After the wheel is chosen, comes the selection of the correct grinding process parameters, including wheel speeds, grinding feed rate, work speeds and coolant. These are all part of best grinding practices, but the wheel wear is imminent.

The most common production practice is to monitor the wheel wear by measuring the ground blanks at a set frequency within a batch run, followed by the necessary adjustments made to the wheel/s manually. In most cases these adjustments are made while the blank dimensions have drifted away at consuming 50% of a specified tolerance.

To eliminate this manual adjustment the CPX BlankX software comes with the “Wheel wear compensation” utility, which automatically applies an adjustment to the wheel face or OD to a set frequency defined by the user. The image below is an example that shows an adjustment of value of -0.002mm applied to the roughing and finishing wheel that will be executed at the 30th and 20th blanks respectively.





"We have been operating the CPX Linear for nearly one year. We can say that the machine's performance is very outstanding for its productivity and accuracy.

Production scheduling is the one of the hardest parts in running a factory. Without a blank preparation machine, we had to rely on outsourcing which could cause quality or schedule issues. With the CPXLinear, we were able to produce tools more efficiently.

Another benefit of CPX Linear is its powerful performance and ability to cover a wide range of tool sizes. We have ground many blanks between 25mm and 0.4mm (3mm shank).



Our customers are demanding for better surface finishing and even tighter tool tolerances. A runout of drills or reamer should be less than 0.003mm. At the same time, surface finishing needs to be less than 0.2Ra. Our customers are very happy with the tools we have supplied that are produced on the CPX Linear."

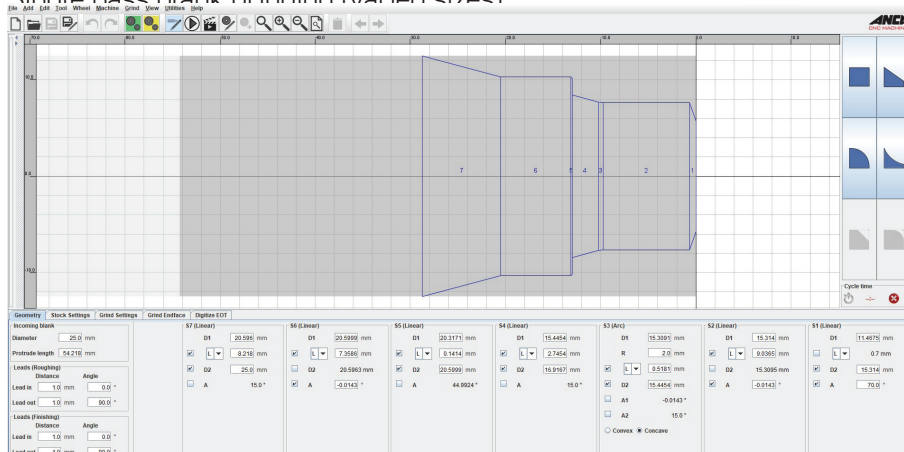
Mr Chunkeun Choi and Mr Kiyong Park, Solixx (South Korea)

CPX BLANK GRINDING EXAMPLES

PROFILE TOOL BLANKS

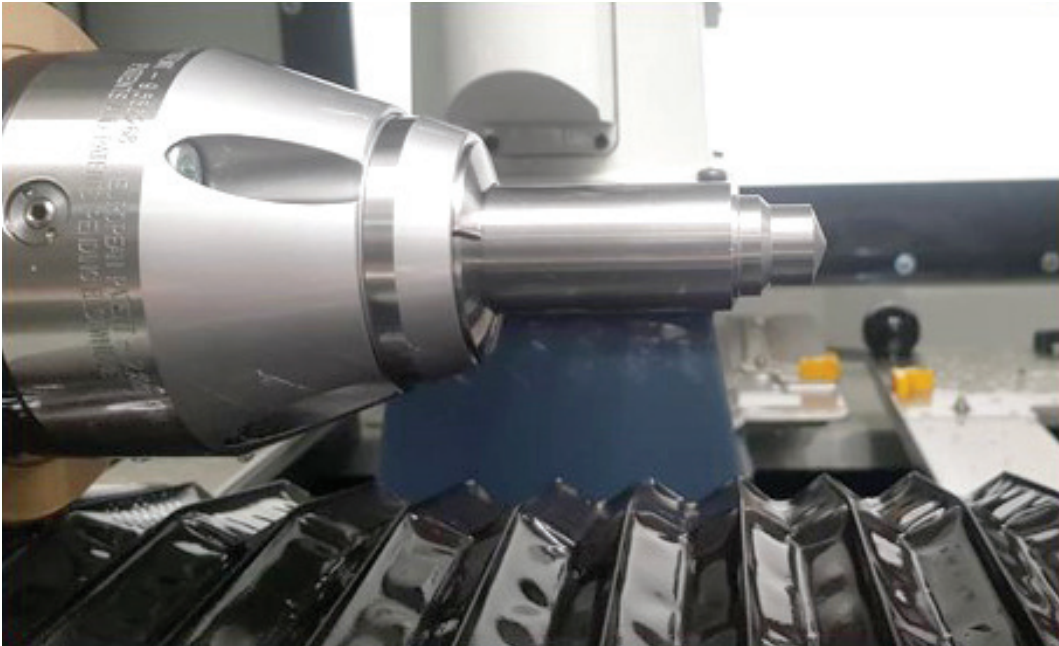
The CPX roughing spindle comes with a 43kW power rating that enables large volume of material removal with high material removal rates (MRR). This results in significant reduction of cycle time per blank as the material is removed with a large depth of cut and at higher feedrates. These images are a few examples of the blank ground in a single pass.

Single pass blank grinding (varied sizes)





D32mm blank grinding

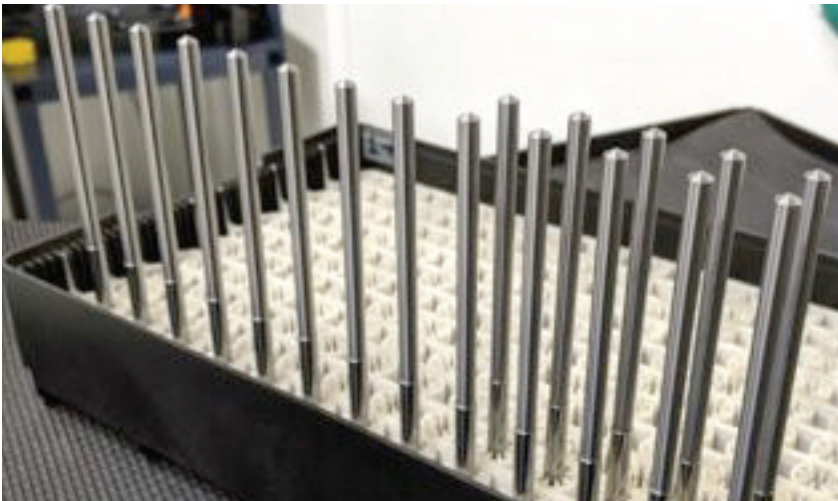
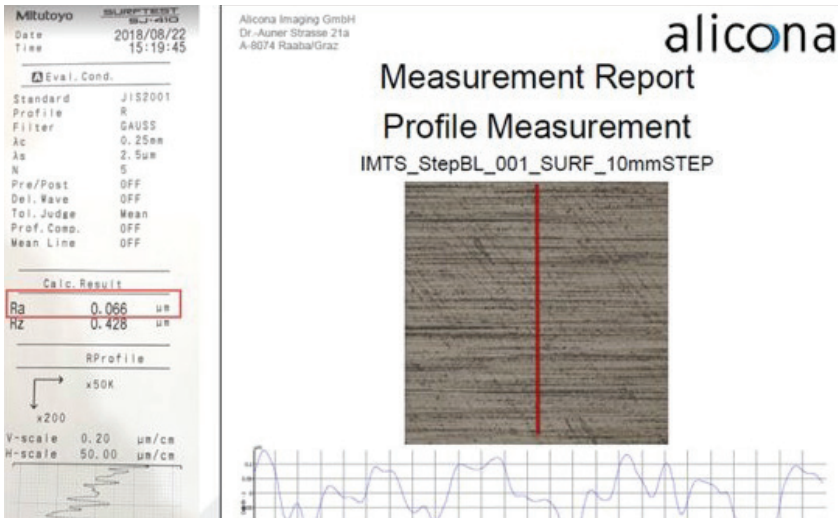


LONG DRILL BLANKS

With its working envelope, the CPX Linear can grind blanks up to 360mm in grinding length. These examples show drill blanks ground with the use of the tail stock.

A full batch of drill blanks was ground using the pinch peel method of grinding to its full length in a single pass to achieve <0.002 diametric tolerance and a very high surface finish value of Ra0.06.





MICRO TOOL BLANKS

Cutting tools in the micro tooling space can be grouped into two categories: diameters <1mm and diameters between 1-3mm.

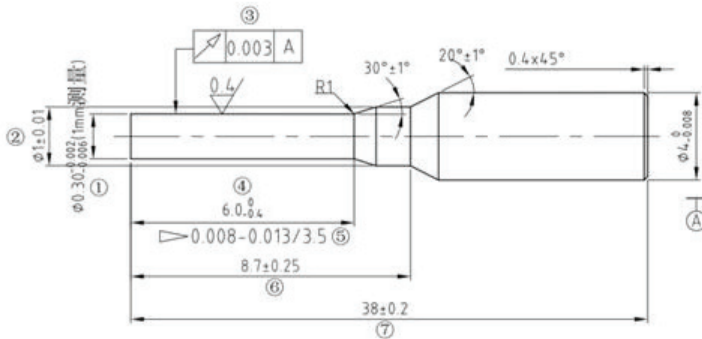
These categories demand very high dimensional and form tolerances thus specialising the grinding application. The CPX Linear comes standard with features that supports the micro tool blank grinding process. These are a few examples shared by our customers.

D0.3mm Micro Tool Blank

The image below is a batch grinding example of a D0.3 with 20:1 length to diameter ratio, the diameter range within 2.5 microns and runout 0.001mm.

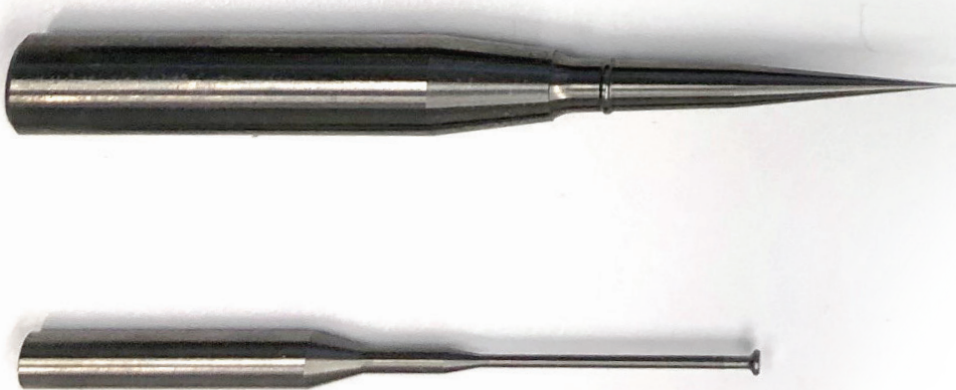
□ 性能表现

- ✓ 外径公差 ± 0.002 MM, 跳动不大于0.003MM
- ✓ 最大切深1.85MM, 长径比3.0(14.1)
- ✓ 进给速度5MM/Min
Feedrate



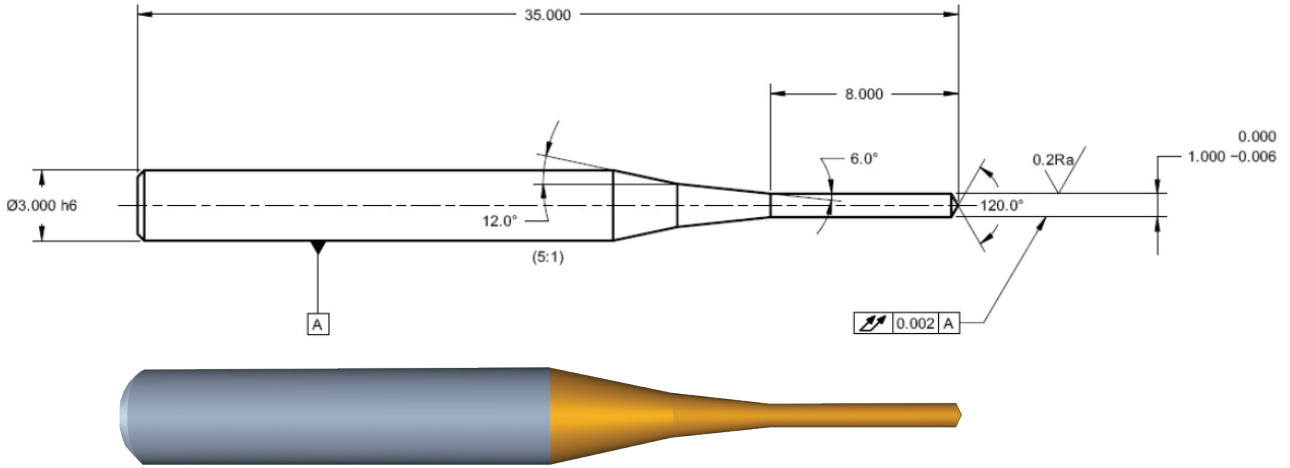
序号(D1)	Dia	Runout
1	0.2922	0.001
2	0.2917	0.001
3	0.292	0.001
4	0.2923	0.001
5	0.2916	0.001
6	0.293	0.001
7	0.2915	0.001
8	0.2922	0.001
9	0.2918	0.001
10	0.2917	0.001
11	0.2929	0.001
12	0.2913	0.001
13	0.2924	0.001
14	0.2912	0.001
15	0.2915	0.001
16	0.2916	0.001
17	0.2909	0.001
18	0.2924	0.001
19	0.2911	0.001
20	0.2924	0.001
21	0.2914	0.001
22	0.2914	0.001
23	0.2918	0.001
24	0.2905	0.001
25	0.292	0.001
26	0.2913	0.001
27	0.2918	0.001
28	0.2914	0.001

Micro tool blanks (varied sizes)

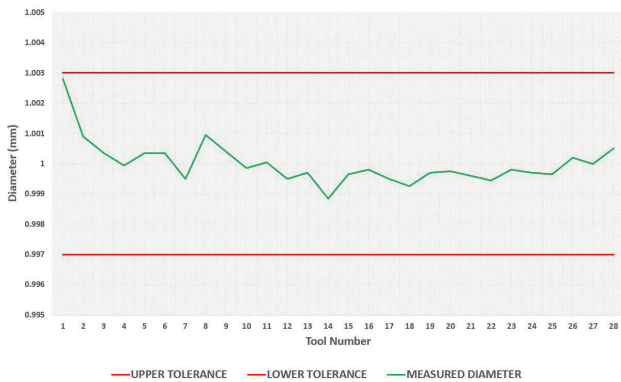


D1MM MICRO TOOL BLANK

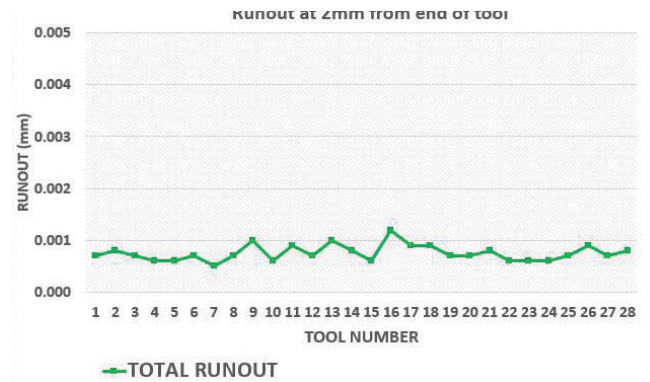
Batch grinding example of a D1mm, the results of the diameter range of 2.3 microns with a runout <0.001mm and with excellent surface finish.



Ø1MM MICRO DRILL BLANK DIAMETERS



RUNOUT AT 2MM FROM END OF TOOL



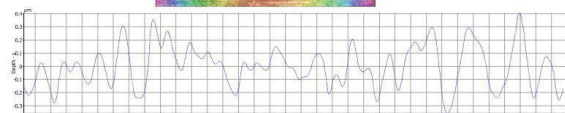
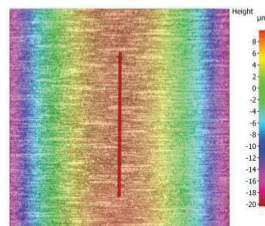
Alicona Imaging GmbH
Dr.-Auner-Strasse 21a
A-8074 Raaba/Graz

alicona

Measurement Report

Profile Measurement

D1_Micro_Drill_pp_Surface



Ra: 0.124µm
Rq: 0.154µm
Rz: 0.572µm

Filter:

high pass - roughness profile
Lc:= 80.000µm

SUMMARY

Capable of achieving a surface finish better than 0.2Ra with runout of less than 2 microns, the CPX Linear for grinding tool blanks complements ANCA's full machine range.

The CPX Linear has a large working envelope and powerful grinding spindles to achieve the highest precision and productivity for blank preparation in the market today. Using the pinch peel method of grinding it offers the same strength, rigidity and thermal stability expected from an ANCA tool grinder.

The CPX Linear machine with its BlankX software is technologically advanced and continues to evolve to stay ahead of the needs in the blank grinding space. The blank grinding results in this document are real world examples proven by our valued partners that the technology continues to exceed our customers' blank grinding needs.



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