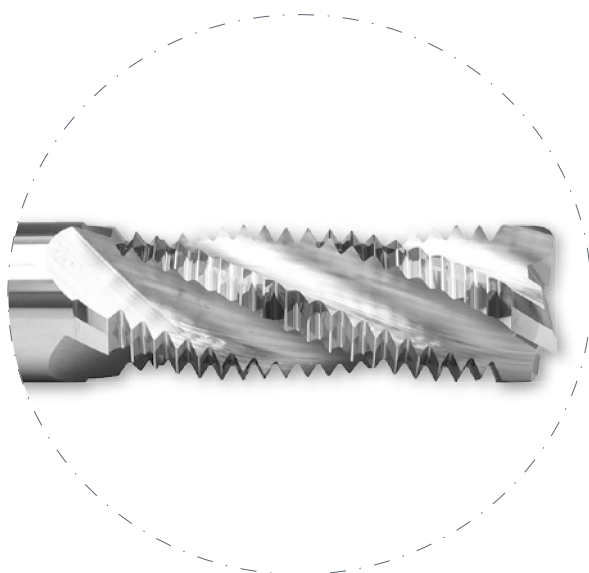


# 2. Special tools



# Index - Special tools

	<b>Page</b>
<b>2. Special tools</b>	<b>13</b>
Tools for the machine 701S	17
Special T-slot cutters and end mills	25
Step drills	26
Form cutters in PCD	28
Turning tools with profiled inserts	30
Offset whirl thread cutter	31
Special punch tools	32
Mills for snailing	33
Tools with coolant holes	34

## 2. Special tools



**701S tools**  
page 17



**Turning tool with  
profiled insert**  
page 30



**Special T-slot cutters and  
end mills**  
page 25



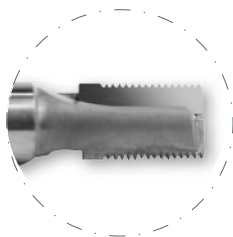
**Offset whirl thread  
cutters**  
page 31



**Step drills**  
page 26



**Punch tools**  
page 32



**Form Cutters in PCD /  
CVD / CBN**  
page 28



**Snailing tools**  
page 33



# Tools for the machine 701S from Willemin-Macodel

**SPECIAL**

Louis Bélet has developed an assortment of tools for the machine 701S from Willemin-Macodel.

These mills and drills have been specifically designed to take advantage of the potentials of this machine.

They allow a precise and fast machining, with an excellent surface quality



## Tools tested and validated on the 701S machine :

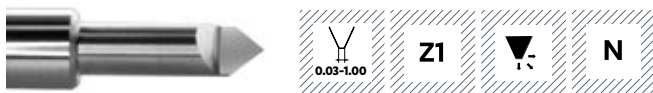
**REF. 7010** End mill for 701S machine



**REF. 7102** Micro end mill 2 teeth for 701S machine



**REF. 7119** Engraving mill for 701S machine



**REF. 7111-1** Straight cut end mill Z1 for 701S machine



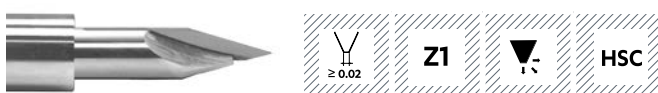
**REF. 7339** Twist drill helix 24° for 701S machine



**REF. 7111-3** Straight cut end mill Z3 for 701S machine

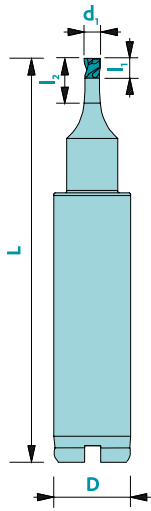
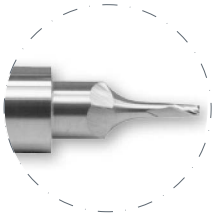


**REF. 74119-3** Engraving mill in PCD for 701S machine



Any other geometry upon request





Material	Vc uncoated	Vc coated	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	100	130	☐	☐	Trio
Steel > 700 N/mm <sup>2</sup>	80	100	☐	☐	Trio
Stainless steel	50	70	☐	☐	Trio
Cast iron	60	100	☐	☐	Trio
Copper	150	180	☐	☐	Solo
Brass - Bronze	150	180	■	■	Solo
Aluminium	200	350	☐	☐	Rico/Solo
Gold - Silver	140	180	☐	☐	Solo
Platinum - Palladium	-	35	-	☐	Solo
Superalloys	-	40	-	☐	Trio
Titanium	40	60	☐	☐	Rico/Trio

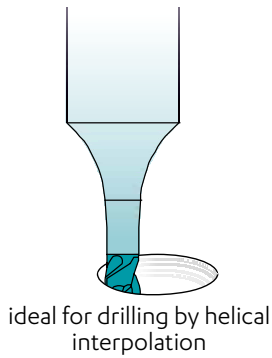
not adapted - adapted ☐ highly adapted ■

Tolerances  $d_1 \leq 1 \text{ mm: } +0/-0.01$   $D: h5$   
 $d_1 > 1 \text{ mm: } +0/-0.02$

### Z2

### MG10

### N



Art. n°	$d_1$	$l_1$	$l_2$	D	L
7010d0.10	0.10	0.05	0.40	6	33
7010d0.20	0.20	0.10	0.80	6	33
7010d0.32	0.32	0.16	1.28	6	33
7010d0.50	0.50	0.25	2.00	6	33
7010d0.63	0.63	0.32	2.52	6	33
7010d0.80	0.80	0.40	3.20	6	33
7010d1.25	1.25	0.63	5.00	6	33
7010d2.00	2.00	1.00	-	6	33
7010d3.20	3.20	1.60	-	6	33

$ap=0.24x d_1$

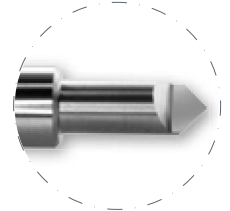
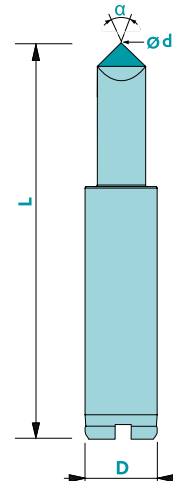
$ae=0.8x d_1$   
 $ap=0.3x d_1$

# Engraving mill for 701S machine

Material	n [rpm]	Ap	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	25 - 40'000	0.05 - 0.40	☐	■	Nemo
Steel > 700 N/mm <sup>2</sup>	20 - 40'000	0.05 - 0.30	-	■	Nemo
Stainless steel	20 - 30'000	0.05 - 0.30	-	☐	Nemo
Cast iron	25 - 40'000	0.05 - 0.40	☐	■	Trio
Copper	20 - 40'000	0.05 - 0.40	☐	■	Solo
Brass - Bronze	25 - 40'000	0.05 - 0.40	☐	■	Solo
Aluminium	-	-	☐	■	-
Gold - Silver	20 - 40'000	0.05 - 0.40	■	☐	Solo
Platinum - Palladium	-	-	-	-	-
Superalloys	-	-	☐	■	-
Titanium	25 - 40'000	0.05 - 0.40	☐	■	Rico

not adapted - adapted ☐ highly adapted ■

Tolerances a: +/- 0.01  
D: h5



Article number: 7119a##d#.#

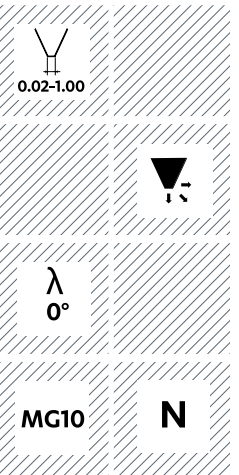
Example: End mill ref. 7119 with 25° angle and tip diameter 0.05 mm: 7119a25d0.05

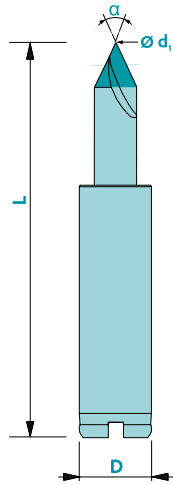
$\alpha^*$	$d_1^{**}$	D	L
15°-45°	0.02-0.09	6	33
15°-45°	0.10-0.30	6	33
50°-140°	0.02-0.09	6	33
50°-140°	0.10-0.30	6	33

\* Available angles: every 5° between 15° and 45°; every 10° between 50° and 140°

\*\* Available diameters: every 0.01 mm between 0.02 and 0.09 mm; every 0.05 mm between 0.10 and 0.30 mm

Other dimensions (angle, tip diameter, shank) upon request





Material	n [rpm]	Ap	Perf.
Steel < 700 N/mm <sup>2</sup>	-	-	-
Steel > 700 N/mm <sup>2</sup>	-	-	-
Stainless steel	-	-	-
Cast iron	-	-	-
Copper	≥ 40'000	0.05 - 0.40	■
Brass - Bronze	≥ 40'000	0.05 - 0.40	■
Aluminium	≥ 40'000	0.05 - 0.40	■
Gold - Silver	≥ 40'000	0.05 - 0.40	■
Platinum - Palladium	≥ 40'000	0.05 - 0.40	■
Superalloys	-	-	-
Titanium	-	-	-

not adapted - adapted  highly adapted

Tolerances d<sub>1</sub>: +/- 0.01  
D: h5

**Z1**

≥ 0.02

**PCD** **HSC**

Art. n°	α	d <sub>1</sub>	D	L
74119-3a40d0.05	40	0.05	6	33
74119-3a40d0.08	40	0.08	6	33
74119-3a40d0.10	40	0.10	6	33
74119-3a50d0.05	50	0.05	6	33
74119-3a50d0.08	50	0.08	6	33
74119-3a50d0.10	50	0.10	6	33
74119-3a60d0.05	60	0.05	6	33
74119-3a60d0.08	60	0.08	6	33

Art. n°	α	d <sub>1</sub>	D	L
74119-3a60d0.10	60	0.10	6	33
74119-3a70d0.05	70	0.05	6	33
74119-3a70d0.08	70	0.08	6	33
74119-3a70d0.10	70	0.10	6	33
74119-3a90d0.05	90	0.05	6	33
74119-3a90d0.08	90	0.08	6	33
74119-3a90d0.10	90	0.10	6	33

Order  Quotation request

<b>Angle (α):</b> <input type="checkbox"/> By default : 60° <input type="checkbox"/> 30° <input type="checkbox"/> 35° <input type="checkbox"/> 45° <input type="checkbox"/> Other : _____ <input type="checkbox"/> 50° <input type="checkbox"/> 55° <input type="checkbox"/> 90°		<b>Shank Ø :</b> <input type="checkbox"/> By default : D=3 <input type="checkbox"/> Other : D= _____		<b>Order No :</b> _____	
<b>Machined material :</b> _____		<b>Quantity :</b> _____		<b>d<sub>1</sub> (from 0.02 mm) :</b> _____	
<b>Contact person :</b> _____			<b>Company's stamp &amp; date :</b> _____		

Standard dimensions of the bars : Ø 3x L 38, Ø 4x L 38, Ø 6x L 38, Ø 6x L 51, Ø 8x L 61, Ø 10x L 72, Ø 12x L 83, Ø 16x L 92, Ø 20x L 104

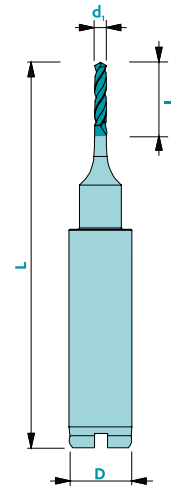
Other dimensions, CVD/CBN available upon request.

# Twist drill helix 24° for 701S machine

Material	Vc uncoated	Vc coated	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	60	70	□	■	Trio
Steel > 700 N/mm <sup>2</sup>	50	60	□	■	Trio
Stainless steel	40	50	□	■	Trio
Cast iron	30	40	□	■	Solo
Copper	50	60	□	■	Solo
Brass - Bronze	120	130	■	□	Solo
Aluminium	130	140	□	■	Nemo
Gold - Silver	80	90	■	□	Solo
Platinum - Palladium	-	18	-	■	Solo
Superalloys	-	20	-	■	Trio
Titanium	30	40	□	■	Nemo

not adapted - adapted □ highly adapted ■

Tolerances  $d_1$ : -0.002/-0.004  
D: h5



Art. n°	$d_1$	$l_1$	D	L
7339d0.230	0.230	1.0	6	33
7339d0.275	0.275	1.0	6	33
7339d0.320	0.320	1.5	6	33
7339d0.400	0.400	2.0	6	33
7339d0.480	0.480	3.0	6	33
7339d0.560	0.560	4.0	6	33
7339d0.640	0.640	4.0	6	33
7339d0.720	0.720	4.0	6	33
7339d0.800	0.800	4.0	6	33
7339d1.000	1.000	4.0	6	33
7339d1.150	1.150	4.0	6	33



118°

**Z2**



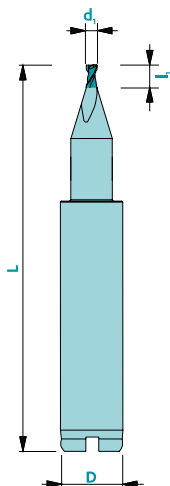
$\lambda$   
24°

MG10

**N**

# 7102

## Micro end mill Z2 for 701S machine



Material	Vc uncoated	Vc coated	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	100	130	□	□	Trio
Steel > 700 N/mm <sup>2</sup>	80	100	□	□	Trio
Stainless steel	50	70	□	□	Trio
Cast iron	60	100	□	□	Trio
Copper	150	180	□	□	Solo
Brass - Bronze	150	180	■	■	Solo
Aluminium	200	350	□	□	Rico/Solo
Gold - Silver	140	180	□	□	Solo
Platinum - Palladium	-	35	-	□	Trio
Superalloys	-	40	-	□	Trio
Titanium	40	60	□	□	Rico/Trio

not adapted - adapted □ highly adapted ■

Tolerances  $d_1 \leq 1 \text{ mm: } +0/-0.01$   $D: h5$   
 $d_1 > 1 \text{ mm: } +0/-0.02$

	<b>Z2</b>
$\lambda$ 35°	$\gamma$ 8-10°
<b>MG10</b>	<b>N</b>
$ap=0.25d_1$	$ae=0.5d_1$ $ap=0.5d_1$

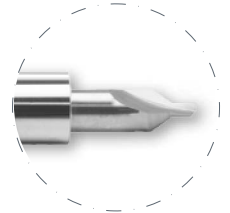
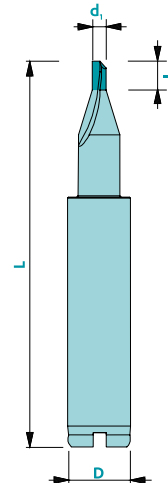
Art. n°	$d_1$	$l_1$	D	L
7102d0.10l0.10	0.10	0.10	6	33
7102d0.20l0.30	0.20	0.30	6	33
7102d0.25l0.75	0.25	0.75	6	33
7102d0.32l0.48	0.32	0.48	6	33
7102d0.40l0.80	0.40	0.80	6	33
7102d0.40l1.60	0.40	1.60	6	33
7102d0.50l0.75	0.50	0.75	6	33
7102d0.63l1.89	0.63	1.89	6	33
7102d0.80l1.60	0.80	1.60	6	33
7102d0.80l3.20	0.80	3.20	6	33
7102d1.25l2.50	1.25	2.50	6	33
7102d1.60l4.00	1.60	4.00	6	33
7102d2.00l2.50	2.00	2.50	6	33
7102d2.50l3.00	2.50	3.00	6	33
7102d3.20l3.20	3.20	3.20	6	33

# Straight cut end mill Z1 for 701S machine

Material	Vc uncoated	Vc coated	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	-	60	-	□	Trio
Steel > 700 N/mm <sup>2</sup>	-	-	-	-	-
Stainless steel	-	-	-	-	-
Cast iron	-	-	-	-	-
Copper	-	-	-	-	-
Brass - Bronze	80	110	■	□	Solo
Aluminium	-	-	-	-	-
Gold - Silver	50	60	■	■	Solo
Platinum - Palladium	-	-	-	-	-
Superalloys	-	-	-	-	-
Titanium	20	30	□	■	Rico

not adapted - adapted □ highly adapted ■

Tolerances  $d_1 \leq 1 \text{ mm}$ : +0/-0.01  $D$ : h5  
 $d_1 > 1 \text{ mm}$ : +0/-0.02

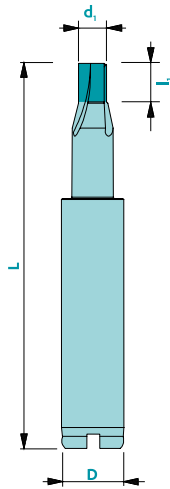
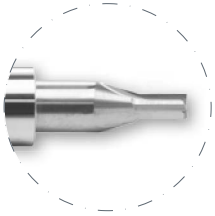


Art. n°	$d_1$	$l_1$	D	L
7111-1d0.63	0.63	1.89	6	33
7111-1d0.80	0.80	3.20	6	33
7111-1d1.25	1.25	2.50	6	33
7111-1d1.60	1.60	4.00	6	33
7111-1d2.00	2.00	2.50	6	33
7111-1d2.50	2.50	3.00	6	33
7111-1d3.20	3.20	3.20	6	33

	<b>Z1</b>
$\lambda$ 0°	$\gamma$ 0°
<b>MG10</b>	<b>N</b>
$ap=0.5d_1$	$ae=0.5d_1$ $ap=0.5d_1$

# 7111-3

## Straight cut end mill Z3 for 701S machine



Material	Vc uncoated	Vc coated	Uncoated	Coated	Rec. Coating
Steel < 700 N/mm <sup>2</sup>	-	60	-	□	Trio
Steel > 700 N/mm <sup>2</sup>	-	-	-	-	-
Stainless steel	-	-	-	-	-
Cast iron	-	-	-	-	-
Copper	-	-	-	-	-
Brass - Bronze	80	110	■	□	Solo
Aluminium	-	-	-	-	-
Gold - Silver	50	60	■	■	Solo
Platinum - Palladium	-	-	-	-	-
Superalloys	-	-	-	-	-
Titanium	20	30	□	■	Rico

not adapted - adapted □ highly adapted ■

Tolerances  $d_1 \leq 1 \text{ mm: } +0/-0.01$   $D: h5$   
 $d_1 > 1 \text{ mm: } +0/-0.02$

	<b>Z3</b>
$\lambda$ 0°	$\gamma$ 0°
<b>MG10</b>	<b>N</b>

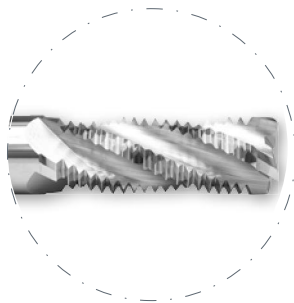
$ap=0.25d_1$

$ae=0.5d_1$   
 $ap=0.5d_1$

Art. n°	$d_1$	$l_1$	D	L
7111-3d0.63	<b>0.63</b>	<b>1.89</b>	6	33
7111-3d0.80	<b>0.80</b>	<b>3.20</b>	6	33
7111-3d1.25	<b>1.25</b>	<b>2.50</b>	6	33
7111-3d1.60	<b>1.60</b>	<b>4.00</b>	6	33
7111-3d2.00	<b>2.00</b>	<b>2.50</b>	6	33
7111-3d2.50	<b>2.50</b>	<b>3.00</b>	6	33
7111-3d3.20	<b>3.20</b>	<b>3.20</b>	6	33

- ▶ Form cutters in tungsten carbide
- ▶ Manufactured according to specific tool drawing or finished product drawing
- ▶ Regrinding possible
- ▶ Choice of external diameter and teeth number upon request
- ▶ Straight, spiral or staggered teeth
- ▶ Logarithmical relief upon request

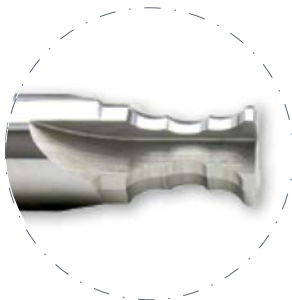
**Finishing end mill with "hedgehog profile"**



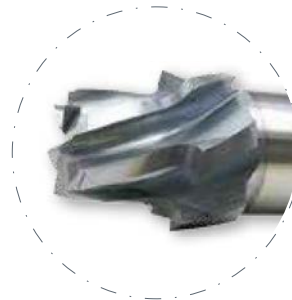
**Thread mill**



**Straight cut end mill for jewellery parts**



**Helicoid multi-function end mill**



**Profiled T-slot end mill with staggered teeth for medical piece**



**Milling cutter with logarithmical relief**



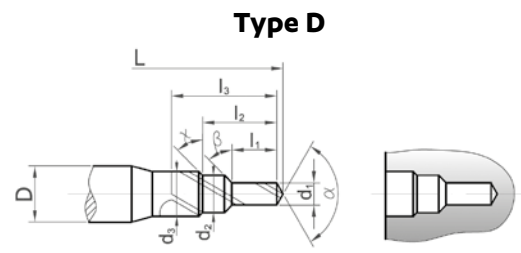
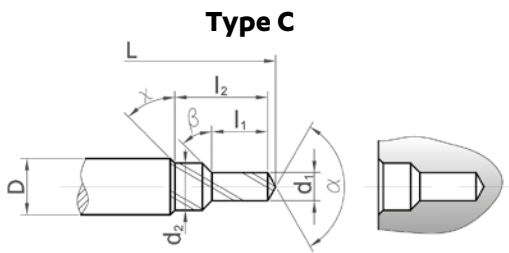
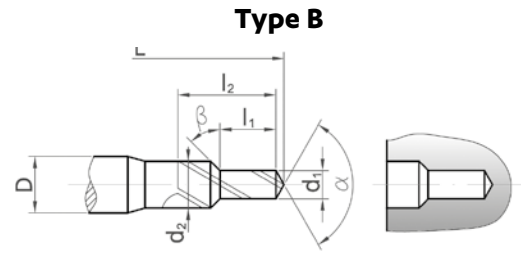
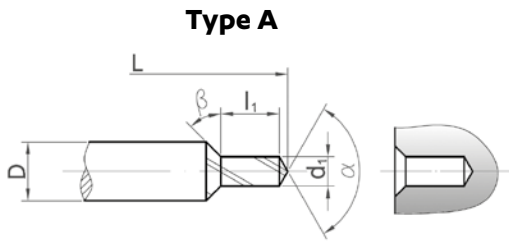
## Step drills - Ref. 335



- ▶ Step drills in tungsten carbide
- ▶ Helix angle according to the machined material
- ▶ Right or left cut
- ▶ Four types of standard step drills are available (A, B, C and D type).  
Other types upon request
- ▶ Custom drills made to order
- ▶ With or without coolant holes

# Step drills - Ref. 335

**SPECIAL**



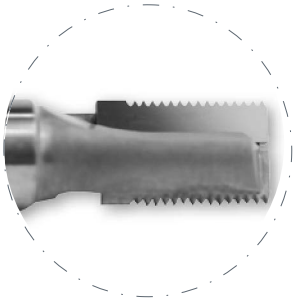
Order  Quotation request

<input type="checkbox"/> Type A	<input type="checkbox"/> Type B	<input type="checkbox"/> Type C	<input type="checkbox"/> Type D
<b>Dimensions :</b> D : _____ L : _____ $\alpha$ : _____ d <sub>1</sub> : _____ l <sub>1</sub> : _____ $\beta$ : _____ d <sub>2</sub> : _____ l <sub>2</sub> : _____ $\chi$ : _____ d <sub>3</sub> : _____ l <sub>3</sub> : _____ Z : <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3		<b>Helix angle :</b> <input type="checkbox"/> 24° for brass <input type="checkbox"/> 34° for stainless steel  <b>Coating :</b> <input type="checkbox"/> Coated * : _____ <input type="checkbox"/> Uncoated	
		<b>With coolant holes ?</b> <input type="checkbox"/> No <input type="checkbox"/> Yes	
		<b>Quantity :</b> _____	
<b>Machined material :</b> _____		<b>Order No :</b> _____	
<b>Company's stamp &amp; date :</b> _____		<b>Contact person :</b> _____	

Standard dimensions of the bars :  $\emptyset$  3x L 38,  $\emptyset$  4x L 38,  $\emptyset$  6x L 38,  $\emptyset$  6x L 51,  $\emptyset$  8x L 61,  $\emptyset$  10x L 72,  $\emptyset$  12x L 83,  $\emptyset$  16x L 92,  $\emptyset$  20x L 104

\* Without information, the most suitable Coating will be applied.

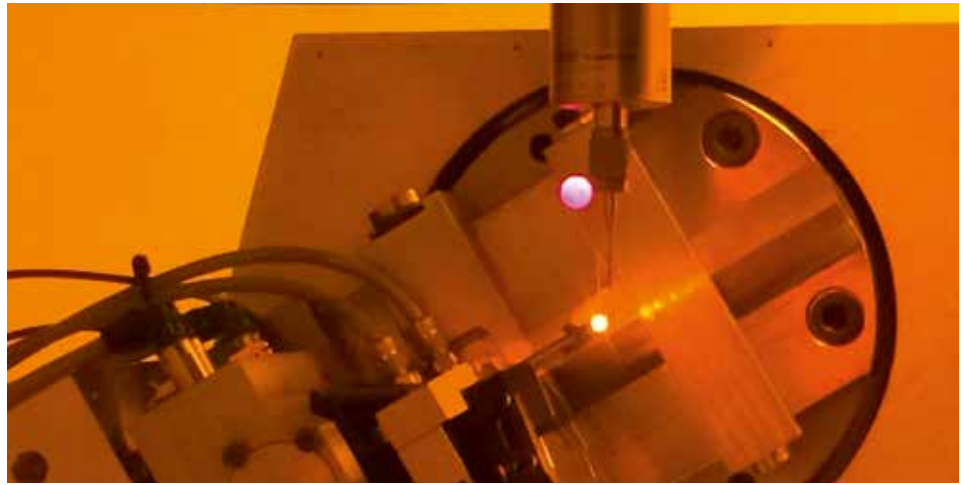
# Form cutters in PCD/CVD/CBN Laser machining



**Profiled  
cutters**



**Form cutters**

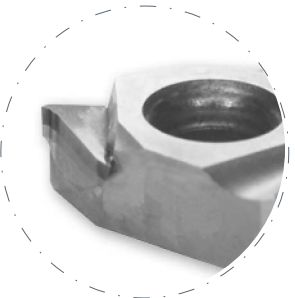


The production of PCD cutting tools by laser machining is highly complex, requiring ultra-precise and sophisticated machines.



**Slitting saws**

Laser sharpening generating no efforts on the tool, the mass and the kinetic of the machine have been developed specifically to ensure very fast and precise movements.

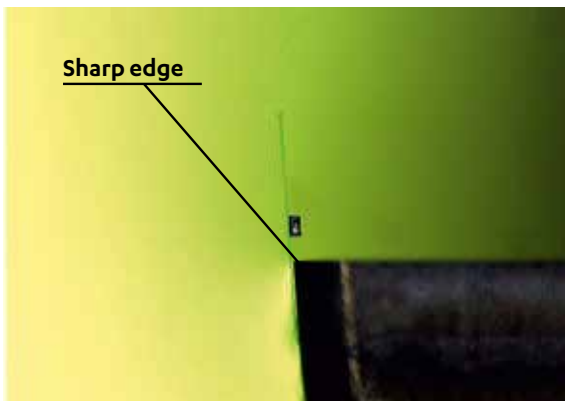


**Turning tool with  
profiled insert**

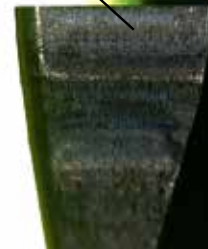
## The 3 advantages of laser machining of cutting tools :

1°

Very sharp cutting edges can be achieved. The laser cuts the synthetic diamond.



Excellent surface quality

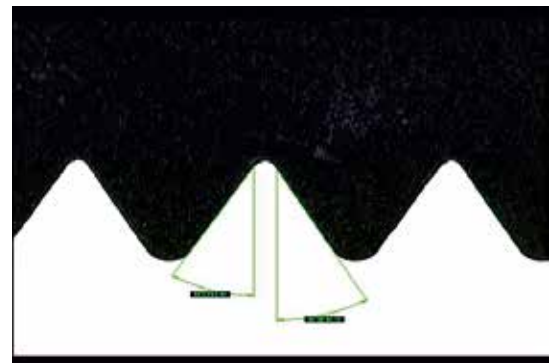


2°

Very long tool life

3°

Allows the production of highly complex shapes from a dxf file provided by the customer.



- ▶ Turning tool with reversible solid tungsten carbide insert
- ▶ Change of insert without adjustment
- ▶ High precision of the insert's position
- ▶ Reduction of the machining time: only one adjustment!
- ▶ Manufactured according to specific tool drawing or finished product drawing
- ▶ Long lifetime due to the coating



**Multi function turning tool with profiled insert**



**Turning tool with profiled insert**

# Offset whirl thread cutter

Segments: Automotive and medical equipment

SPECIAL



## Offset whirl thread cutter for machining deep threads

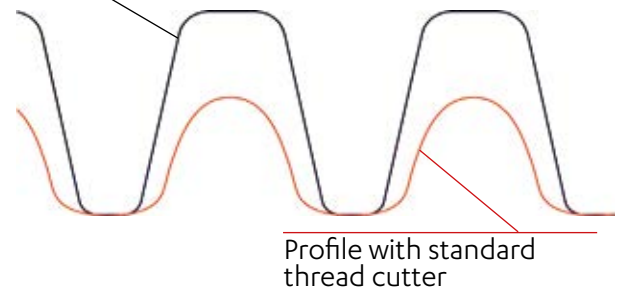
Internal thread whirling is a know and popular method for machining metric ISO threads and for threads with a relatively large opening angle.

**For other types of threading operations (e.g. deep trapezoid-shaped) or special threads, internal thread whirling causes problems!**

### The problem

By milling the thread keeping the tool parallel to the part axis, interferences develop and the shape of the thread is not transferred correctly.

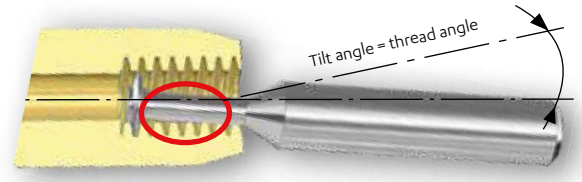
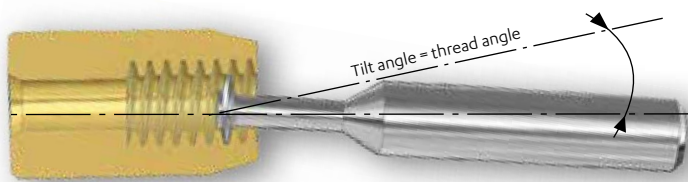
Theoretical profile



### Standard solution

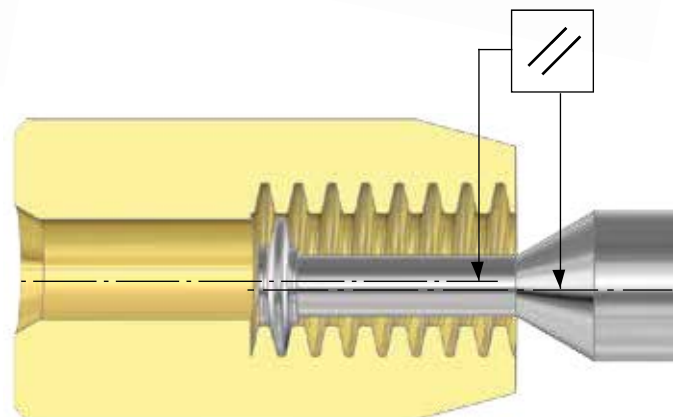
One solution is to tilt the tool in accordance with the helix angle. This solution is effective for short threads, but the spindle must be tilted while interpolating with the whirling cycle.

If the thread is deep, the tool touches the work-piece.



### New solution!

With a specific modification to the shape of the thread cutter, the work-piece can be machined while the tool is kept parallel to the work-piece axis, which means that the correct shape is ensured.



**Machining an internal profile using a special punch tool**

Louis Bélet manufactures also profiled punch tools for the machining of internal NIHS profiles (DIN or ISO). Tight tolerances are applied to these punches, as on all our profiled tools. Rotating punch tools are also available.



The punch tool may have a partially profiled shape, or a full one



# Mills for snailing in solid carbide and PCD

Snailing mills are used to decorate timepieces by means of curved eccentric lines. They advantageously replace the conventional methods ensuring a constant aspect of the first to the last workpiece.



Snailing

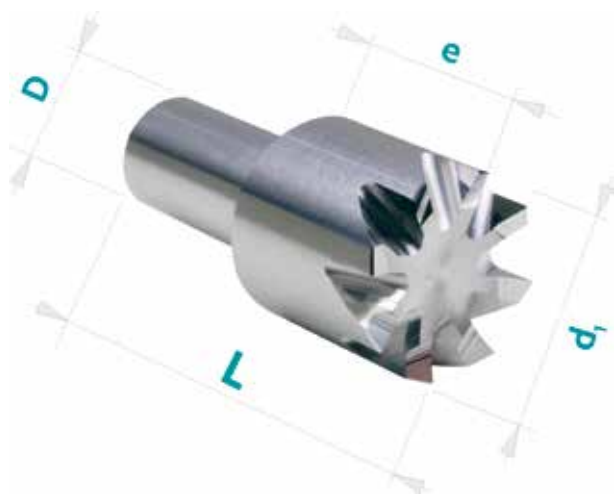


Côte de Genève

## Dimensions T-slot cutter

$\varnothing d_1$	e	D	L	Z
10	10	6	22	8
20	10	10	30	20
30	12	10	30	30
40	12	10	39	30
45	12	10	39	55

Snailing mills are available either right handed or left handed. The number of teeth may also be chosen for customized patterns on the workpiece. Available as circular mill or T shape.



End mill for snailing

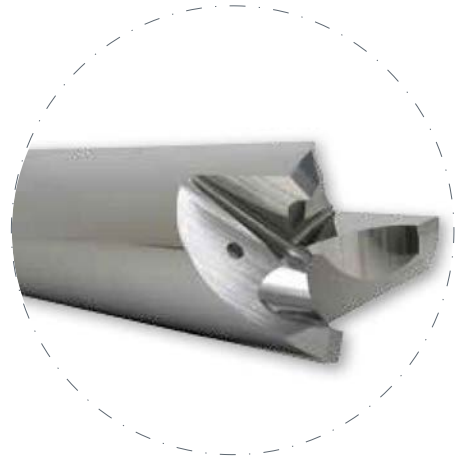


Circular mill for snailing

## Tools with coolant holes



Step drills with  
coolant holes



Special end mill with  
coolant holes

Special tools et step drills can be manufactured with coolant holes. This allows a better chip removal and heat dissipation. Moreover, an increased tool life is generally observed.