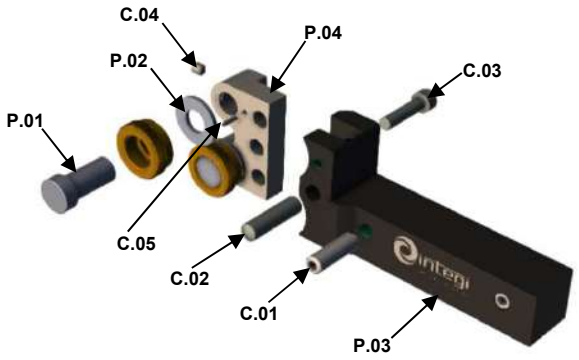


1 FEASIBLE PATTERNS

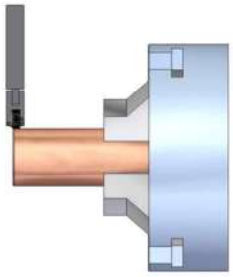
KNURLING PROFILE	KNURL		FEED (Drawing.3)	
	AXLE 1	AXLE 2	F	R
RAA	AA	AA	✓	✓
RGE 30º	BL30°	BR30°	✓	✓
RGE 45º	BL45°	BR45°	✓	✓

The M11 form knurling tool is conceived for knurling on pieces with diameters between 8 and 200 mm.

2 CLAMPING AND SETTING THE TOOL IN THE MACHINE

Clamp the tool to the turret of the lathe. While the chuck rotates very slowly, approach the tool to the workpiece until the knurl makes contact with the workpiece.

Approach the knurl to the workpiece following the 'F' direction up until the teeth plunge a little into it. Check out the resulted print. The printed width (h) must be equal to the width of the teeth on the knurl. If the width isn´t correct, change the clearance angle.



Drawing.2

3 KNURLING ON STEPPED WORKPIECES

The design of this tool allows the knurling of workpieces with steps almost up to the walls. However, a safety distance of 0.5 mm must be observed to prevent unnecessary damage to both the workpieces and the tool.

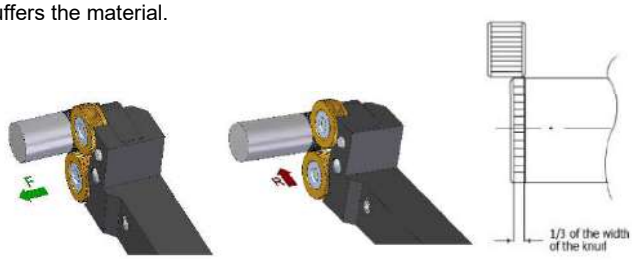
4 BEGINNING TO KNURL

While the chuck is rotating at the speed recommended, feed the tool so that 1/3 of the width of the knurl gets in contact with the workpiece.

Press the knurl against the workpiece. The value of the radial feed must be according to the conditions recommended on the table 1.

After that, you will be able to feed longitudinally.

To calculate up to what diameter we must deepen with the knurl, we must take into account the height of the tooth (**in the case of standard knurls is always equal to half the step**) and the increase in diameter that suffers the material.



Drawing.3

5 BEAR IN MIND BEFORE AND WHILE WORKING PROCESS

Make sure that the knurl pins are firmly fastened.

Make sure that the axis of the knurl is aligned with the axis of the workpiece.

Always work plenty of coolant, lubricant or cutting oil.

The working direction, longitudinal advance, will always be against the tool.

6 TROUBLE SHOOTING

PROBLEM	CAUSE	SOLUTION
Double knurling	Too slow radial feed at the beginning of the knurling	Increase radial feed at the beginning of the knurling*
	The perimeter of the workpiece is not an exact multiple of the pitch	Turn a diameter so that the perimeter to be knurled is an exact multiple of the pitch*
Knurling wheels easily breakable	Knurling too deep	Reduce the depth to values according to the pitch
Knurling wheels wear out too fast	Knurling too deep	Reduce the depth to values according to the pitch
	Working conditions are not adequate	Check cutting speed and traverse feeding speeds

* Sometimes, it is not possible to increase radial feed, or it just cannot be radially fed in the workpiece is too weak

7 RECOMMENDED SETTINGS

MATERIAL	Ø WORKPIECE (mm)	Ø KNURL (mm)	CUTTING SPEED (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEDD (mm/rev) PITCH (mm) 0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Steel 600 N/mm²	<10	25	20÷50	0.05÷0.10	0.20	0.12	0.08	0.06
	10÷50		30÷60		0.30	0.18	0.15	0.10
	50÷100							
	100÷200				0.40	0.26	0.16	0.12
Steel 900 N/mm²	<10	25	20÷50	0.04÷0.08	0.18	0.10	0.06	0.04
	10÷50		20÷55		0.28	0.16	0.12	0.08
	50÷100							
	100÷200				0.36	0.24	0.14	0.10
Stainless steel	<10	25	20÷40	0.04÷0.08	0.14	0.08	0.06	0.04
	10÷50		20÷45		0.25	0.15	0.12	0.08
	50÷100							
	100÷200				0.30	0.20	0.14	0.10
Cast steel	<10	25	25÷60	0.05÷0.10	0.12	0.08	0.05	0.04
	10÷50		35÷70		0.20	0.15	0.10	0.06
	50÷100							
	100÷200				0.26	0.18	0.12	0.08
Aluminium	<10	25	25÷45	0.05÷0.10	0.12	0.08	0.05	0.04
	10÷50		30÷50		0.20	0.15	0.10	0.06
	50÷100		35÷60					
	100÷200				0.26	0.18	0.12	0.08
Brass	<10	25	25÷55	0.05÷0.10	0.25	0.15	0.10	0.08
	10÷50		30÷60		0.40	0.25	0.20	0.15
	50÷100							
	100÷200				0.50	0.30	0.20	0.15

Table 1