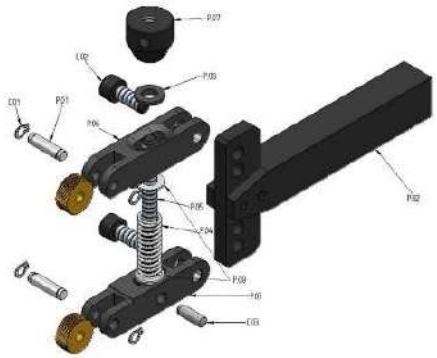


1 FEASIBLE PATTERNS

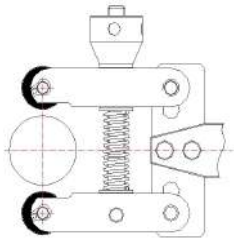
KNURLING PROFILE	KNURL		FEED (Drawing.3)	
	L-AXIS	R-AXIS	F	R
RAA	AA	AA	✓	✓
RGE 30°	BL30°	BR30°	✓	✓
RGE 45°	BL45°	BR45°	✓	✓

The M3 form knurling tool is conceived for knurling on workpieces with two possibilities:

- Position A, diameters between 5 and 40 mm.
  The screws of the C.02 arms need to be placed in the outer bores of the shank.
- Position B, diameters between 30 and 50 mm.
  The screws of the C.02 arms need to be placed in the inner bores.

2 CLAMPING AND SETTING THE MACHINE

The tool needs to be clamped to the turret of the lathe. While the chuck rotates very slowly, approach the tool to the workpiece until the knurl axles and the workpiece are aligned.
While the workpiece is rotating, turn P.07 nut until the knurling wheels leave a print on the workpiece. Check whether the width of the print matches the width of the knurls. If not, the tool is not correctly clamped, so you need to modify the clearance angle.



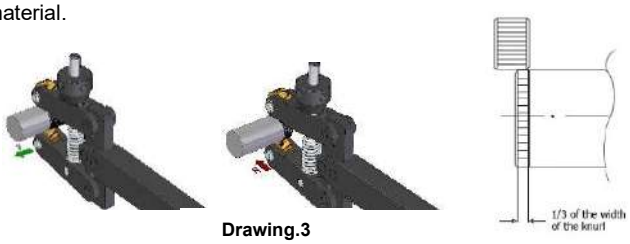
Drawing.2

3 KNURLING ON STEPPED WORKPIECES

When knurling on stepped workpieces, it is not possible to knurl up to a shoulder. Using this tool, no knurling should be performed closer to 8,2 mm from the shoulder itself.

4 BEGGINING TO KNURL

While the chuck is rotating at the speed recommended, feed the tool so that 1/3 of the width of the knurling wheel 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)	LONGITUDINAL FEED PITCH (mm) 0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Steel 600 N/mm²	10÷50	20	25÷50	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		30÷60		0.25	0.20	0.15	0.13
	100÷200							
Steel 900 N/mm²	10÷50	20	20÷45	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100		25÷50		0.20	0.15	0.10	0.08
	100÷200							
Stainlees steel	10÷50	20	20÷45	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100		25÷50		0.20	0.15	0.10	0.08
	100÷200							
Cast steel	10÷50	20	25÷45	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		30÷50		0.25	0.20	0.15	0.13
	100÷200							
Aluminium	10÷50	20	30÷50	0.05÷0.10	0.20	0.15	0.10	0.06
	50÷100		35÷60		0.25	0.20	0.15	0.13
	100÷200							
Brass	10÷50	20	35÷55	0.05÷0.10	0.25	0.20	0.18	0.15
	50÷100		40÷65		0.30	0.25	0.20	0.18
	100÷200							

Table 1