

**1 FEASIBLE PATTERNS**

KNURLING PROFILE	KNURL	FEED (Drawing.5) F
Right version		
RAA	BR30°	✓
RBR 30°	AA	✓
Left version		
RAA	BL30°	✓
RBL 30°	AA	✓

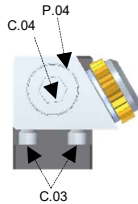
MFS 21 cut knurling tool is conceived to perform knurling on workpieces with diameters between 4 and 250 mm.

**2 KNURL ASSEMBLY**

Loosen the screw that locks the axle of the knurl C.01 and removed it together with the knurl's washer P.01.  
Put the axle P.02 into the knurl, it is advisable that the bore of the knurl be cleaned before and graphite grease be spread.  
Place the washer P.01 above the knurl.  
Firmly tighten the knurl and the washer through the screw C.01, make sure that the knurl runs free.

**3 ADJUST THE ANGLE OF THE HEAD**

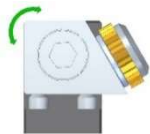
The lower face of the head P.04, must be parallel to the upper face of the shank.  
If it is necessary to change the inclination, loosen the screw C.04 on the tool head without removing it.  
Adjust the angular position using C.03 screws until the head P.04 is in the desired position.  
Secure the head P.04 again tightening C.04 screw.



**4 HEAD ASSEMBLY FOR LEFT OR RIGHT VERSION**

MFS 21 tool model is reversible. Just turning over the head we will get the right or left version of it.  
To turn the head over, we must proceed as we describe below:

- Slightly loosen adjusting stud screws C.03.
- Loosen and take out the head fixing screw C.04.
- Turn 180° the head keeping in mind that the longest base is the one that has to remain in contact with adjusting stud screws.
- Place screw C.04 again into its housing and tighten firmly.
- Tighten stud screws C.03 up to contact the head.



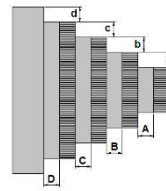
**9 RECOMMENDED SETTINGS**

MATERIAL	Ø WORKPIECE (mm)	Ø KNURL (mm)	CUTTING SPEED (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEED PITCH (mm)			
					0.3+0.6	0.6+1.2	1.2+1.6	1.6+2.0
Steel 600 N/mm <sup>2</sup>	10+50	21.5	40+60	0.05+0.10	0.20	0.15	0.13	0.10
	50+100				0.25	0.20	0.15	0.12
	100+200				0.15	0.10	0.08	0.06
Steel 900 N/mm <sup>2</sup>	10+50		20+40	0.04+0.08	0.20	0.15	0.10	0.08
	50+100				0.20	0.15	0.10	0.08
	100+200				0.15	0.10	0.08	0.06
Stainless steel	10+50		25+45	0.04+0.08	0.20	0.15	0.10	0.08
	50+100				0.20	0.15	0.10	0.08
	100+200				0.20	0.15	0.13	0.10
Cast steel	10+50		40+60	0.05+0.10	0.25	0.20	0.15	0.12
	50+100				0.25	0.20	0.15	0.12
	100+200				0.20	0.15	0.13	0.10
Aluminium	10+50	55+75	0.05+0.10	0.20	0.15	0.13	0.10	
	50+100			0.25	0.20	0.15	0.12	
	100+200			0.20	0.15	0.13	0.10	
Brass	10+50	40+60	0.05+0.10	0.20	0.15	0.13	0.10	
	50+100			0.25	0.20	0.15	0.12	
	100+200			0.25	0.20	0.15	0.12	

Table 1

**5 KNURLING ON STEPPED WORKPIECES**

On stepped workpieces, it is not possible to knurl all the cylinder up to the shoulder. Depending on the diameter of the knurls, in order to avoid the tool ramming smack against the workpiece and/or mechanical parts on the machine, the following minimum distances have to be taken into account:



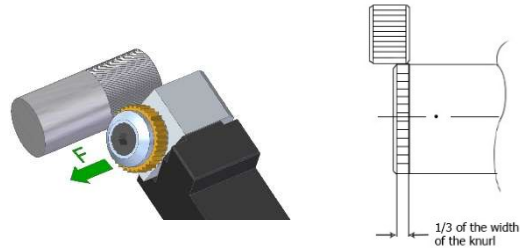
	Ø21.5
a	10
A	7
b	5
B	5
c	3
C	3.5
d	2
D	3

**6 BEGINNING TO KNURL**

With the chuck rotating according to the conditions recommended in table 1, move the tool until the knurl is positioned in the corner of the workpiece with only 1/3 of the width of the knurl on the workpiece and 2/3 in the air.

Once the knurl contacts the piece, plunge until the desired depth is got, by no means plunge in the beginning more than 45+48 knurl's pitch being used. When the knurling is being performed, we realize that there is an angular misalignment and that misalignment does not exceed 5°, we correct the position of the head as it is explained on section 3.

We feed longitudinally following the parameters shown on the table 1.



Drawing.4

**7 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.

**8 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.