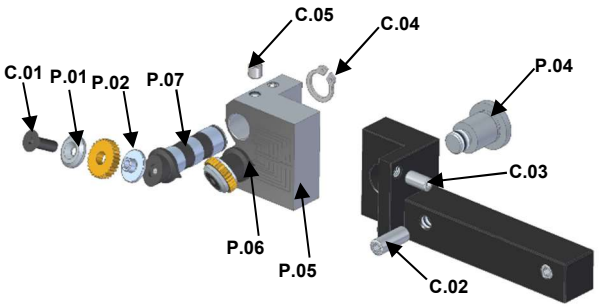
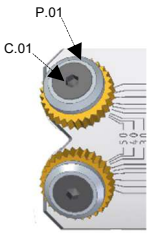


1 FEASIBLE PATTERNS

KNURLING PROFILE	KINURL AXLE L	KINURL AXLE R	FEED (Drawing.3) F
RGE 30°	AA	AA	✓
RGE 45°	BL15°	BR15°	✓

MF14 cut knurling tool is conceived to perform knurling on workpieces with diameters between 3 and 50mm.

2 KNURLS ASSEMBLY



Loosen alternately the screw that lock the knurls C.01 and removed it together with the washers P.01.
Put the knurls into their axles, bearing in mind where each one goes, it is advisable that the bore of the knurl be cleaned before, and graphite grease be spread.
Place the washers P.01 above the knurl.
Firmly tighten the washer, the knurl and the axle through the screw C.01, make sure that the knurls run free.

3 SETTING THE KNURLS ACCORDIN TO THE WORKPIECE´S DIAMETER

- Loosen stud screws C.05 that locks the orientation shafts P.06 and P.07.
- Right after, with the same Allen wrench inserted in the back side of the axles P.06 and P.07, set the shafts until that the graduated scale E indicates the diameter of the corresponding piece to knurl.
- Take into account that the scale does not cover infinite values, so the position not always is exact. In case of the diameter of the workpiece does not appear in the scale, shafts must be oriented in an approximate.
- Once scale is correct, firmly tighten the locking stud screws C.05.

4 CLAMPING AND SETTING THE TOOL INTO THE MACHINE

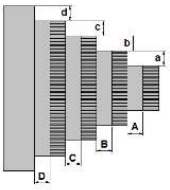
Loosen the screws C.03 that regulate the position of the head, are placed in the head.
Clamp the tool to the turret of the lathe and, keeping the chuck rotating very slowly or even by hand, contact the workpiece with the knurls and check that both knurls rotate simultaneously. If not, it could be due to:

- The head of the tool is not correctly aligned, we should correct the position of the tool.
- The orientation of the shafts is wrong, should be processed as shown on section 4.

Once that both knurls rotate at the same time, we must check that the outer surface of the knurls is parallel to the surface of the workpiece.
Without removing the tool, tighten both screws C.03 until they make pressure on the shank. After that firmly tighten the screw P.04.

5 KNURLING ON STEPPEED WORKPIECES

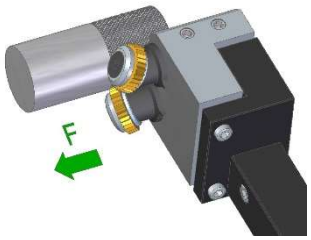
On stepped workpieces, it is possible to knurl all the cylinder up to the shoulder. Depending on the diameter of the knurls, in order to avoid the tool ramming smack against the workpiece and/or mechanical parts on the machine, the following minimum distances have to be taken into account.

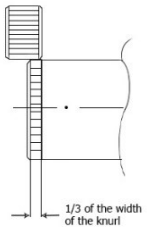


	Ø14.5
a	8
A	5
b	4
B	4
c	3
C	3
d	2
D	2.5

6 BEGGINING 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.





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.

9 RECOMMENDED SETTING

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/mm²	10÷50	14.5	35÷55	0.05÷0.10	0.20	0.15	0.13	0.10
Steel 900 N/mm²			20÷40	0.04÷0.08	0.15	0.10	0.08	0.06
Stainless steel			20÷40	0.04÷0.08	0.15	0.10	0.08	0.06
Cast steel			35÷55	0.05÷0.10	0.20	0.15	0.13	0.10
Aluminium			55÷75	0.05÷0.10	0.20	0.15	0.13	0.10
Brass			40÷60	0.05÷0.10	0.20	0.15	0.13	0.10

Table 1