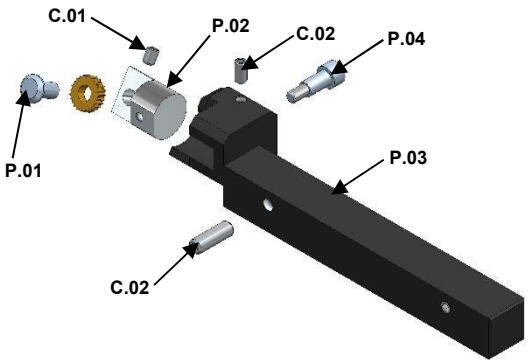


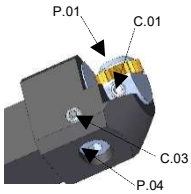

## 1 FEASIBLE PATTERNS

| KNURLING PROFILE | KNURL | FEED (Drawing.4) F |
|---|---|---|
| Right version | | |
| RAA | BR30° | ✓ |
| RBR 30° | AA | ✓ |
| Left version | | |
| RAA | BL30° | ✓ |
| RBL 30° | AA | ✓ |

MFS 89 cut knurling tool is conceived to perform knurling on workpieces with diameters between 1.5 and 12 mm.

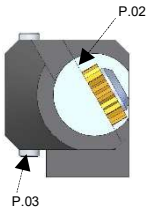
## 2 KNURL ASSEMBLY

Loosen the screw that locks the axle of the knurl C.01 and removed it together with the axle P.01.
Put the axle P.01 into the knurl, it is advisable that the bore of the knurl be cleaned before and graphite grease be spread.
Return the axle P.01 to its original position.
Firmly tighten the knurl and the axle through the stud screw C.01, make sure that the knurl runs free.



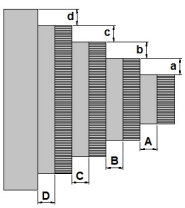

## 3 ADJUST THE ANGLE OF THE HEAD

To adjust the inclination of the knurling head, the studs P.03 must be actuated (loosen one and tighten the opposite one) by slightly rocking the head P.02 until the knurling grooves are completely parallel to the axis of rotation of the workpiece (in the case of straight knurling).




## 4 KNURLING ON STEPPED WORKPIECES

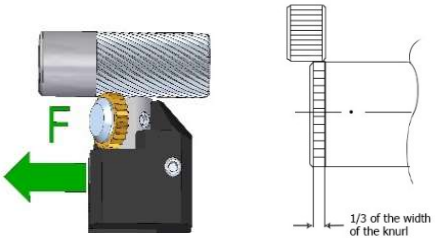
On stepped workpieces, it is not possible to knurl all the cylinder up to the shoulder. Depending on the diameter of the knurls, in order to avoid the tool ramming smack against the workpiece and/or mechanical parts on the machine, the following minimum distances have to be taken into account:




| | Ø8.9 |
|---|---|
| a | 6 |
| A | 2.5 |
| b | 3 |
| B | 2.5 |
| c | 2 |
| C | 2 |
| d | 1 |
| D | 1.5 |

## 5 BEGINNING TO KNURL

With the chuck rotating according to the conditions recommended in table 1, move the tool until the knurling wheel is positioned in the corner of the workpiece with only 1/3 of the width of the knurling wheel 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**

## 6 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.

## 7 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.

## 8 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 | <12 | 8.9 | 30÷50 | 0.05÷0.10 | 0.15 | 0.10 | 0.08 | 0.05 |
| Steel 900 N/mm² | <12 | | 15÷30 | 0.04÷0.08 | 0.12 | 0.08 | 0.05 | 0.04 |
| Stainless steel | <12 | | 15÷30 | 0.04÷0.08 | 0.12 | 0.08 | 0.05 | 0.04 |
| Cast steel | <12 | | 30÷50 | 0.05÷0.10 | 0.15 | 0.10 | 0.08 | 0.05 |
| Aluminium | <12 | | 50÷70 | 0.05÷0.10 | 0.15 | 0.10 | 0.05 | 0.05 |
| Brass | <12 | | 35÷55 | 0.05÷0.10 | 0.15 | 0.10 | 0.12 | 0.05 |

**Table 1**