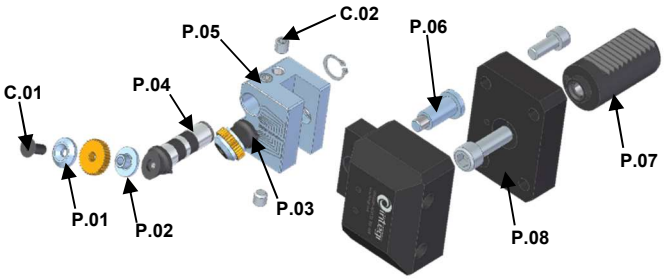
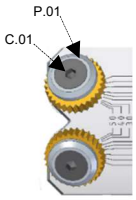


1 FEASIBLE PATTERNS

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

MF 21 VDI cut knurling tool is conceived to perform knurling on workpieces with diameters between 5 and 250mm.

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 runs free.

3 SETTING THE KNURLS ACCORDING TO THE WORKPIECE´S DIAMETER

- Loosen stud screws C.02 that locks the orientation shafts P.03 and P.04.
- Right after, with the same Allen wrench inserted in the back side of the axles P.03 and P.04, set the shafts until that the graduated scale E indicates the diameter of the corresponding piece to knurl.
- 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.
- Once scale is correct, firmly tighten the locking stud screws C.02.

4 PRE-ALIGNMENT OF THE TOOL

To ensure that the tool works well, the head must be aligned with the upper face of the shank; that means matching the notch in the shank with the "0" position in the graduated scale EP located in the side of the tool's head P.05.

- Loosen the head fixing screw P.04 without taking it out.
- Move the tool head P.05 by means of the stud screws until the notch in the shank matches the "0" position in the graduated scale EP.
- Fix again the tool head P.05 with the screw P.04.

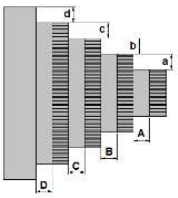
5 CLAMPING AND SETTING THE TOOL INTO THE MACHINE

After having pre-aligned the tool, having it secured to the turret of the lathe and, make the chuck turn at very low speed or by hand, make contact the workpiece with the knurls and check that both rotate simultaneously. If not, it could be due to:

- The workpiece rotation axis and the tool-head are not aligned, correct the alignment between the head and the shank.
- Angular position of the orientation axles is not adequate, follow the steps described in section 4.

6 KNURLING ON STEPPED WORKPIECES

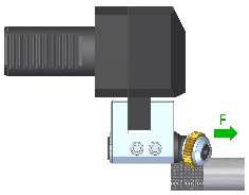
On stepped workpieces, it is possible to knurl all the cylinder up to the shoulder. Depending on the diameter of the knurls, in order to avoid the tool ramming smack against the workpiece and/or mechanical parts on the machine, the following minimum distances have to be taken into account.

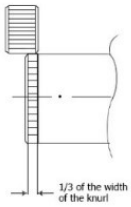


	Ø21.5
a	10
A	7
b	5
B	5
c	3
C	3.5
d	2
D	3

7 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.
We feed longitudinally following the parameters shown on the table 1.





8 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.

9 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.

10 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	21.5	35÷55	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		40÷60		0.25	0.20	0.15	0.12
	100÷200							
Steel 900 N/mm²	10÷50		20÷40	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100		25÷45		0.20	0.15	0.10	0.08
	100÷200							
Stainless steel	10÷50		20÷40	0.04÷0.08	0.15	0.10	0.08	0.06
	50÷100		25÷45		0.20	0.15	0.10	0.08
	100÷200							
Cast steel	10÷50		35÷55	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		40÷60		0.25	0.20	0.15	0.12
	100÷200							
Aluminium	10÷50		55÷75	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		60÷90		0.25	0.20	0.15	0.12
	100÷200							
Brass	10÷50		40÷60	0.05÷0.10	0.20	0.15	0.13	0.10
	50÷100		45÷65		0.25	0.20	0.15	0.12
	100÷200							

Table 1