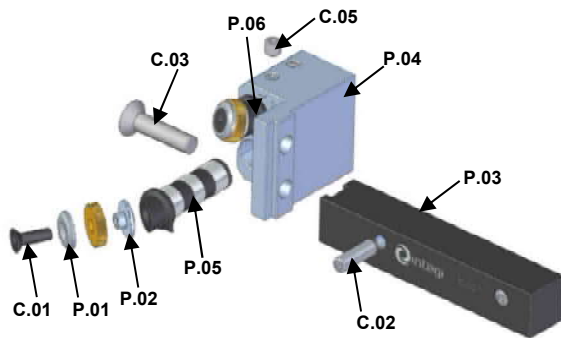




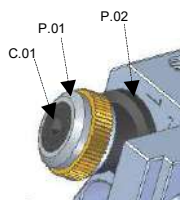
1 FEASIBLE PATTERNS

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

MF1 14 cut knurling tool is conceived to perform knurling on workpieces with diameters between 3 and 50 mm.

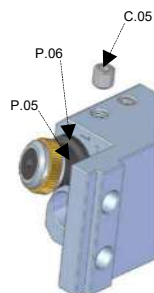
2 KNURL ASSEMBLY

- Loosen alternately the screw that locks 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 (see section 2), 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, keep in mind its unbevelled face makes contact with the knurl.
- Firmly tighten the knurl and the washer through the screw C.01, make sure that the knurls run free.



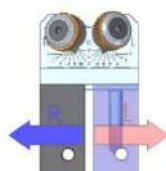
3 SETTING THE KNURLS ACCORDIN TO THE WORKPIECE'S DIAMETER

- Loosen stud screws C.05 that locks the orientation shafts P.05 and P.06.
- Right after, with the same allen wrench inserted in the back side of the axles P.05 and P.06, 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.



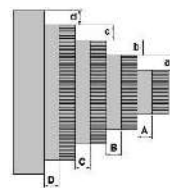
4 HEAD ASSEMBLY FOR LEFT OR RIGHT VERSION

- Remove the retaining rings that secure the shafts EPM in the head.
- Loosen the stud screw that lock the shafts.
- Remove the EMPs.
- Loosen the screw that fix the shank.
- If the shank is 12 mm height, besides to moving it, it will have to turn 180°, if the shanks is 14 or 16 height it will be enough that you move it to the continuous hole.
- Firmly tighten the shank through the screw.
- Place back the EPMs in their bores.
- Secure them through the retaining rings.
- Turn them to the adequate position according to the scale.
- Firmly tighten the stud screws.



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:

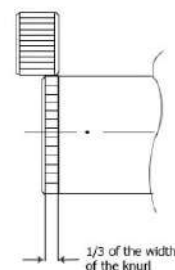
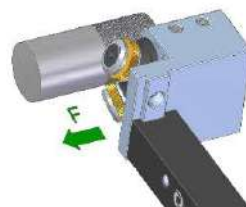


	Ø14.5
a	8
A	5
b	4
B	4
c	3
C	3
d	2
D	2.5

6 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

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 SETTINGS

MATERIAL	Ø WORKPIECE (mm)	Ø KNURL (mm)	CUTTING SPEED (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEED PITCH (mm)			
Steel 600 N/mm ²	10÷50	14.5	35÷55	0.05÷0.10	0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Steel 900 N/mm ²			20÷40	0.04÷0.08	0.20	0.15	0.13	0.10
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