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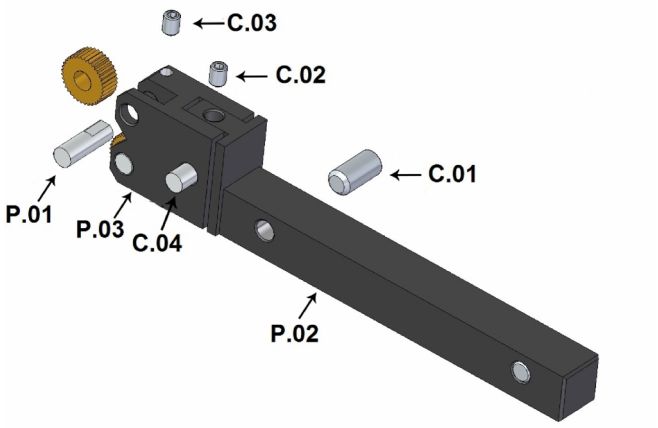
M9 INSTRUCTION MANUAL

1. TOOLS PARTS



Drawing 1

ITEM	CODE	REFERENCE	DESCRIPTION	ITEMS INCLUDED
Ø15 KNURL				
P.01	01982200	E 16.4 HM	Pin HM Ø4x16	P.01
P.02	01180401	MM9 15.00.16	16x16mm shank	P.02+C.02+C.01(2x)
P.03	01180402	CM9 15.04	Knurl bearing head 4mm	P.03+C.03(2x)
	01180502	CM9 15.05	Knurl bearing head 5mm	
	01180602	CM9 15.06	Knurl bearing head 6mm	
C.01	01900079	EA M8-16	Espárrago M8x16	C.01
C.02	01987900	EA M4-8	Stud screw DIN 913 M4x8	C.02
C.03	01982800	EA M3-4	Stud screw DIN 913 M3x4	C.03
C.04	01900034	P D5-16	Screw DIN 6325 Ø5x16	C.04
Ø10 KNURL				
P.01	01989701	E 12.4 HM	Pin Ø4x12	P.01
P.03	01180102	CM9 10.04	Knurl bearing 4mm	P.03+C.03(2x)
C.02	01998900	EA M3-6	Stud screw DIN 913 M3x6	C.02
C.03	01982800	EA M3-4	Stud screw DIN 913 M3x4	C.03
C.04	01900033	P D4-12	Screw DIN 6325 Ø4x12	C.04
3 models				
M9 10.04.08 P.02	01180101	MM9 10.00.08	8x8mm shank	P.02+C.02+C.01(2x)
M9 10.04.08 C.01	01981200	EA M5-8	Stud screw M5x8	C.01
M9 10.04.10 P.02	01180201	MM9 10.00.10	10x10m m shank	P.02+C.02+C.01(2x)
M9 10.04.10 C.01	01900171	EA M5-10	M5x10	C.01
M9 10.04.12 P.02	01180301	MM9 10.00.12	12x12 shank	P.02+C.02+C.01(2x)
M9 10.04.12 C.02	01900172	EA M5-12	Stud screw M5x12	C.01

Table 1

2. FEASIBLE PATTERNS

The M9 ø10 form knurling tool is conceived for knurling on pieces with diameters between 3 and 50 mm.

The M9 ø15 form knurling tool is conceived for knurling on pieces with diameters between 3 and 100 mm.

The obtained pattern depends on the knurls used as shown below.

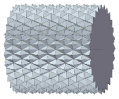
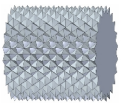
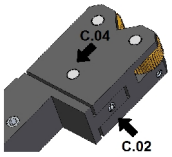
KNURLING PROFILE		DESCRIPTION	TYPE OF KNURL		AXIAL FEED	RADIAL FEED
			Axle 1	Axle 2		
	RAA	Straight Outward tips	AA knurl	AA knurl	✓	✓
	RGE 30º	30º diamond pattern Male Outward tips	BL30° knurl	BR30° knurl	✓	✓
	RGE 45º	45º diamond pattern Male Outward tips	BL45° knurl	BR45° knurl	✓	✓

Table 2

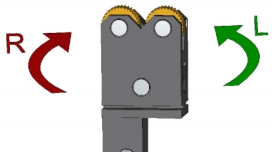
3. RIGHT HAND OR LEFT-HAND ASSEMBLY

M9 tool is designed to work on both right hand and left-hand lathes just changing the assembly position of the head.

- Loosen the C.02 screw that blocks the head-pivoting pin C.04.
- Remove the pin C.04
- Turn over the head 180°.
- Place the pin back into the bore C.04 and firmly lock it with the screw C.02.



Drawing 2



Drawing 3

4. CLAMPING AND SETTING THE TOOL INTO THE MACHINE

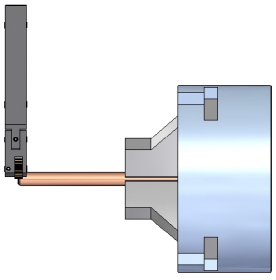
First, we need to make sure that the knurl rotates freely around the pin. Spread graphite grease if necessary.

Clamp the tool to the turret of the lathe.

While the chuck rotates very slowly, approach the tool to the workpiece until the knurl makes contact with the workpiece.

Approach the knurling wheel to the workpiece following the 'F' direction up until the teeth plunge a little into it. Check out the resulted print. The printed width (h) must be equal to the width of the teeth on the knurl. If the width isn´t correct, change the clearance angle.

The tool and the workpiece need to be aligned as shown on the Drawing 4.



Drawing 4

5. KNURLING STEPPED WORKPIECES

When knurling stepped workpieces, it is not possible to knurl up to a shoulder. Using this tool, no knurling should be performed closer to 3,5mm from the shoulder itself.

6. BEGINNING TO KNURL

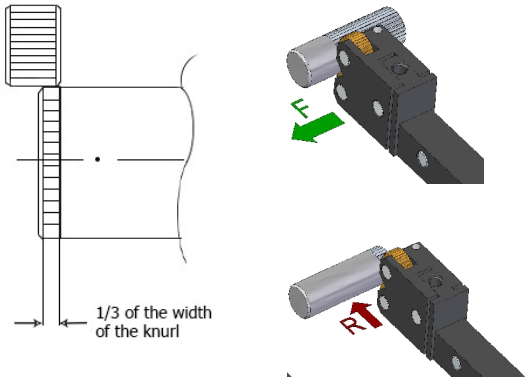
While the chuck is rotating at the speed recomended at point 8, feed the

tool so that 1/3 of the width of the knurling wheel gets in contact with the workpiece.

Press the knurl against the workpiece. The value of the radial feed must be according to the conditions recommended on the table 4 (next page). After that, you will be able to feed longitudinally.

To calculate up to what diameter we must deepen with the knurl, we must take into account the height of the tooth (in the case of standard knurls is always equal to half the step) and the increase in diameter that suffers the material.

That information is available at www.integi.com and in our catalog.



Drawing 5

7. BEFORE AND DURING 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.
- Always apply plenty of coolant, lubricant or cutting oil flowing in order to sweep the swarf away.
- 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*.
	Perimeter of the workpiece is not an exact multiple of the pitch.	Turn a diameter that makes the perimeter to be knurled an exact multiple of the pitch. *
Knurls easily breakable	Knurling too deep.	Reduce the depth to values according to the pitch.
Knurls 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 axial feed.

Table 3

* Sometimes, it is not possible to increase radial feed or, radial feed is just impossible because the workpiece is too small or its clamping is too weak.

9. RECOMMENDED SETTINGS

MATERIAL	Ø workpiece (mm)	Ø KNURLING WHEEL (mm)	Cutting speed (m/min)	RADIAL FEED (mm/rev)	TRAVERSE FEED (mm/rev) PITCH (mm) 0.3÷0.6	0.6÷1.2	1.2÷1.6	1.6÷2.0
Acero 600 N/mm^2	<10	10÷15	20÷50	0.05÷0.10	0.15	0.10	0.08	0.07
	10÷50	15÷20	25÷55		0.20	0.15	0.13	0.10
Acero 900 N/mm^2	<10	10÷15	15÷40	0.04÷0.08	0.12	0.08	0.05	0.04
	10÷50	15÷20	20÷45		0.15	0.10	0.08	0.06
Acero inoxidable	<10	10÷15	15÷40	0.04÷0.08	0.12	0.08	0.05	0.04
	10÷50	15÷20	20÷45		0.15	0.10	0.08	0.06
Acero fundido	<10	10÷15	20÷40	0.05÷0.10	0.15	0.10	0.08	0.07
	10÷50	15÷20	25÷45		0.20	0.15	0.13	0.10
Aluminio	<10	10÷15	25÷45	0.05÷0.10	0.12	0.08	0.05	0.04
	10÷50	15÷20	30÷50		0.20	0.15	0.10	0.06
Latón	<10	10÷15	30÷50	0.05÷0.10	0.20	0.15	0.12	0.10
	10÷50	15÷20	35÷55		0.25	0.20	0.18	0.15

Table 4

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INTEGI, S.A.

Autonomía Kalea, 5 - 48250 Zaldibar (Bizkaia) - Spain

+34 943 174 800 integi@integi.com www.integi.com