zeus ®

Knurling Tools

SUN TOOLS
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ZERTIFIKAT
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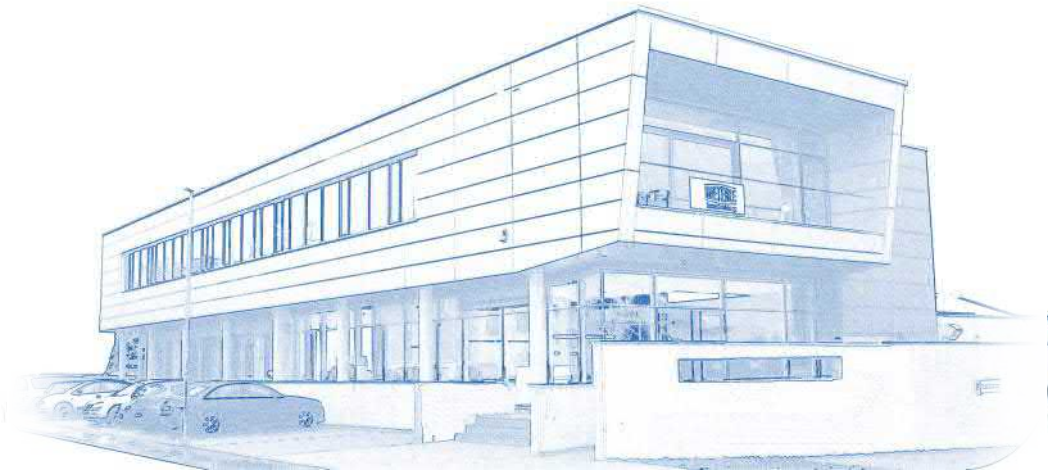
Our special knowledge in the technically advanced field of producing turned parts enables us to produce tooling solutions which are outside of typical standards. We are convinced that quality is the most important factor for the future prospects of any company in that market. This is why we are always searching for new solutions to solve new problems of our customers. It is our aim to help our customers succeed on their market through supplying best solutions for their manufacturing problems.



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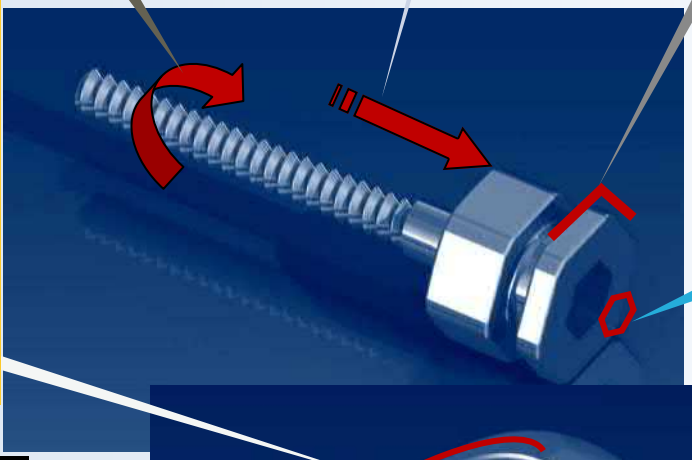
External thread whirling

Long turning

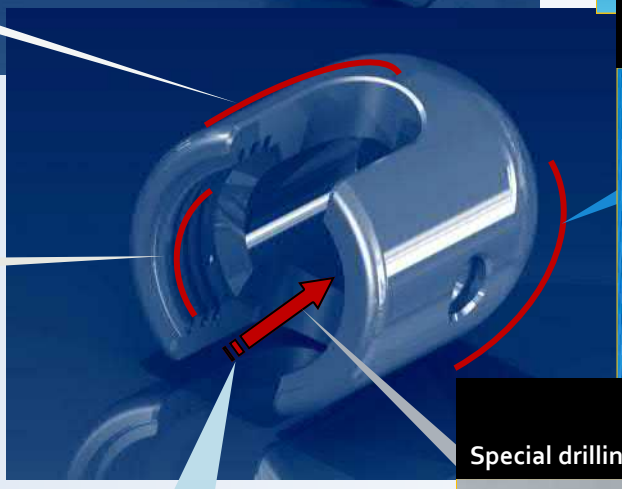
Polygonal milling

Form milling



Broaching

Form grooving



Internal thread whirling

Special drilling

Internal machining

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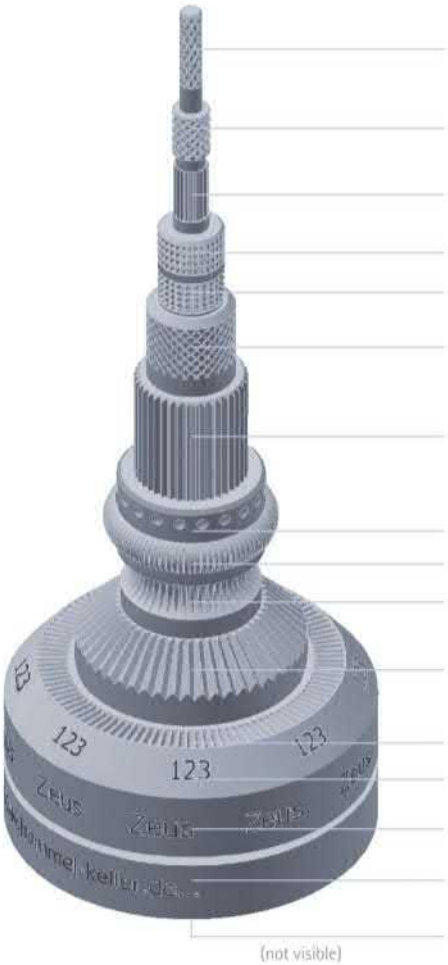
TABLE OF CONTENT

APPLICATIONS

Our product programme offers tool solutions for manifold requirements of the knurling technique. zeus® knurling tools are suited to produce standard profiles according to DIN standard, as well as conical, convex, concave and special profiles (e. g. E, C profiles). The application example below shows the multitude of application possibilities that can be covered with a zeus® knurling tool.

APPLICATION EXAMPLE:



Application	Profile (DIN 82) Pitch	Tool	Knurling wheels
Cut knurling (Axial)	RGE30° 0,8	291	3 x AA
Cut knurling (Axial)	RGE45° 0,6	241	1 x BL15° 1 x BR15°
Cut knurling (Axial)	RAA 1,0	231	1 x BR30°
Form knurling (Radial)	RKE 0,8	131	1 x KV
Form knurling (Radial)	RKV 0,6	132	1 x KE
Form knurling (Radial)	RGE45° 0,8	141	1 x BL45° 1 x BR45°
Form knurling (Radial + Axial) Knurling to a shoulder	RAA 1,0	132	1 x AA
Form knurling (Radial)	RHV	131	1 x HE
Form knurling (Radial)	RE	131	1 x C
Form knurling (Radial)	RC	131	1 x E
Form knurling (Radial + Axial)	RKAA	311	1 x KAA
Form knurling (Axial)	RAA-plane	311	AA
Marking conical	123	312	40W
Marking revolving	zeus®	130	40W
Marking spring-back	hommel-keller.de	431	41W
Marking plane	XYZ	311	40W

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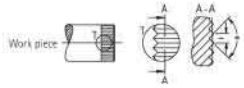
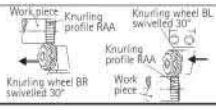
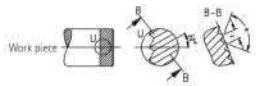
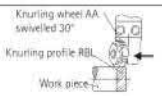
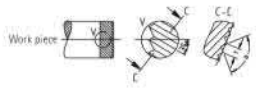
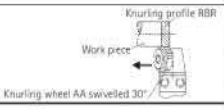
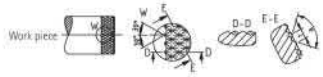
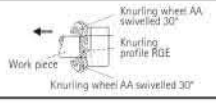
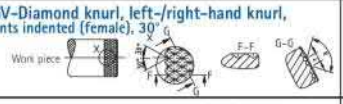
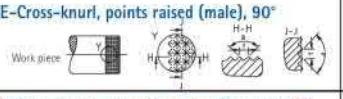
TOOL CHOICE

The matrix below provides a selection of the tools that are suitable for a specific application. To begin with, please select the required profile according to DIN 82. Row 2 suggests which technique (Form knurling and / or Cut knurling) is suitable for producing the required knurling profile. As a next step, please select the machine type. Essential for the choice of tool is the knurl position on the work piece (at the beginning of / in the middle of or knurling to a shoulder etc.), as outlined by the different pictograms. By selecting the required application you receive a number of tool suggestions. The product details for each tool series can be found from page 14 onwards.

Knurling profile (DIN 82)	Knurling technique		Machine type	Profile in the middle of the work piece, without groove	Profile starts at work piece
	Form Knurling	Cut Knurling			
RAA-Knurl with straight pattern			LD	130, 131, 141, 161	130, 131, 141, 161, 162▲, 192▲, 391
			KD	130, 131, 141, 161	130, 131, 141, 161, 162▲, 192▲, 391
			MS	130, 131, 141, 161	130, 131, 141, 161, 162▲, 192▲, 391
			RT		192▲, 391
			LD		231
			KD	X	231
			MS		231
			RT		
RBL-Knurl, left-hand spiral			LD	130, 131, 141, 161	130, 131
			KD	130, 131, 141, 161	130, 131
			MS	130, 131, 141, 161	130, 131
			RT		130, 131
			LD		231*
			KD	X	231*
			MS		231*
			RT		
RBR-Knurl, right-hand spiral			LD	130, 131, 141, 161	130, 131
			KD	130, 131, 141, 161	130, 131
			MS	130, 131, 141, 161	130, 131
			RT		130, 131
			LD		231*
			KD	X	231*
			MS		231*
			RT		
RGE-Diamond knurl, left-/right-hand knurl, points raised (male), 30°			LD	130, 131, 132, 161	
			KD	130, 131, 132, 161	
			MS	130, 131, 132, 161	
			RT		
			LD	141, 161	141, 161, 162, 192▲
			KD	141, 161	141, 161, 162, 192▲
			MS	141, 161	141, 161, 162, 192▲
			RT		161, 162▲, 192▲
			LD		241, 291▲
			KD	X	241, 291▲
			MS		241, 291▲
			RT		291▲
RGV-Diamond knurl, left-/right-hand knurl, points indented (female), 30°			LD	130, 131	RGV: Only suitable for plunge knurling
			KD	130, 131	
			MS	130, 131	
			RT		
RKE-Cross-knurl, points raised (male), 90°			LD	130, 131	RKE: Only suitable for plunge knurling
			KD	130, 131	
			MS	130, 131	
			RT		
RKV-Cross-knurl, points indented (female), 90°			LD	130, 131	RKV: Only suitable for plunge knurling
			KD	130, 131	
			MS	130, 131	
			RT		

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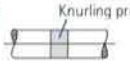
EXAMPLE: Knurling profile

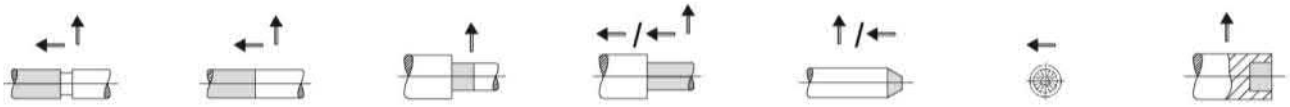


EXPLANATION OF AROWS:

↑ Profile can only be produced in radial tool direction (plunge knurling)
← Profile can only be produced in axial tool direction (feed knurling)
←↑ Profile can be produced in axial and radial tool direction

SYMBOLS:

LD = Swiss type autolathes
KD = Automatic short-turning lathes, Universal lathes, Turning-/milling centre
MS = Multispindle automatic lathes
RT = Rotary indexing machines / Indexing table machines / Automatic transfer machines
X = Cut knurling not possible for this application (see also p.13)
▲ = Limited length of knurling profile
* = When cut knurling the manufacture of RBR/RBL profiles is restricted



	Profile starts in the middle of the work piece, after a groove	Profile starts in the middle of the work piece, without a groove	Knurling to a shoulder	Profile starts at work piece, knurling to a shoulder	Conical knurling profile	Face knurling	Knurling within a bore
1	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
1	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
1	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
				162▲, 192▲			330, 332
	231	X	X	X	X	X	X
	231						
	231						
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
				162▲, 192▲			
	231*	X	X	X	X	X	X
	231*						
	231*						
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
	130, 131, 141, 161	130, 131, 141, 161	132, 142	132, 142, 162▲, 192▲	311, 312	311, 312	330, 332
				162▲, 192▲			
	231*	X	X	X	X	X	X
	231*						
	231*						
		Only suitable for plunge knurling	132	132	311, 312	311, 312	330, 332
			132	132	311, 312	311, 312	330, 332
			132	132	311, 312	311, 312	330, 332
				162▲			
	141, 161	141, 161	142	141, 162▲, 192▲			340, 342
	141, 161	141, 161	142	141, 162▲, 192▲			340, 342
	141, 161	141, 161	142	141, 162▲, 192▲			340, 342
				162▲, 192▲			
	241	X	X	X	X	X	X
	241						
	241						
	RGV: Only suitable for plunge knurling	RGV: Only suitable for plunge knurling	132	RGV: Only suitable for plunge knurling	311, 312	311, 312	330, 332
			132		311, 312	311, 312	330, 332
			132		311, 312	311, 312	330, 332
					311, 312		330, 332
	RKE: Only suitable for plunge knurling	RKE: Only suitable for plunge knurling	132	RKE: Only suitable for plunge knurling			330, 332
			132				330, 332
			132				330, 332
							330, 332
	RKV: Only suitable for plunge knurling	RKV: Only suitable for plunge knurling	132	RKV: Only suitable for plunge knurling			330, 332
			132				330, 332
			132				330, 332
							330, 332

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Machine types

Distinctive features according to machine characteristics

Swiss type autolathes	**Tool fitting in:** • Long slide • Cross slide • Turret	CNC	Right-hand turning Left-hand turning	LD
		Conventional	Direction of rotation universal	
Automatic short-turning lathes / Universal lathes / Turning-/milling centre	**Tool fitting in:** • Long slide • Cross slide • Turret	CNC	Right-hand turning Left-hand turning	KD
		Conventional	Direction of rotation universal	
Multispindle automatic lathes	**Tool fitting in:** • Long slide • Cross slide • Support of an automatic lathe	CNC	Right-hand turning Left-hand turning	MS
		Conventional	Direction of rotation universal	
Rotary indexing machine / Indexing table type machine / Transfer machine	**Tool fitting in:** • Spindle nose unit		Tool rotating Work piece fix Direction of rotation universal	RT

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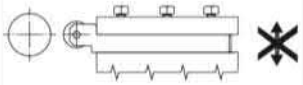
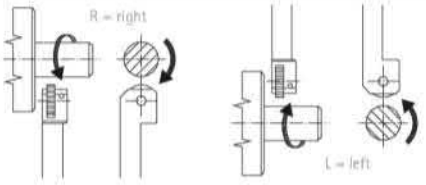
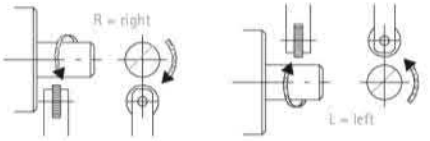
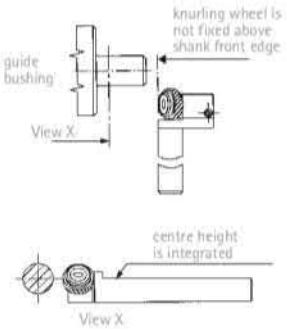
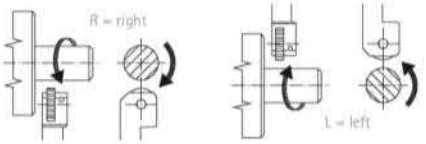
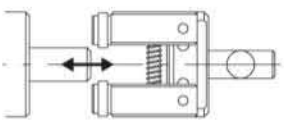
Tool Characteristics

Distinctive features according to machine types and machine characteristics

Knurling tools for CNC lathes/autolathes On the knurling tools for **CNC lathes / autolathes,** the centre height is already incorporated (centre height = top of shank). As a result it is possible to employ these in CNC lathes / autolathes without adjustment of the centre height (fixed tool holder). Basically these knurling tool series are also suitable for conventional lathes / autolathes, insofar as the centre height can be set on the machine.	 Tool holder fixed (not adjustable in height) centre height is incorporated in the tool.	 The zeus® range of products includes special designs for right- **(R)** and left-oriented **(L)** lathes/ autolathes. Insofar as constructionally possible, zeus® Knurling tools are of modular tool design **(M)**. These **(M)**-versions can be used rotating both right and left.	LD KD MS
Knurling tools for conventional lathes/autolathes zeus® Knurling tools for **conventional lathes / autolathes** are designed in a way that the centre height adjustment is effected by means of the tool holder. As a result these tools have a basic design.	 Tool holder adjustable. Centre height has to be set.	 zeus® Knurling wheels for conventional machine types can be used rotating both right and left.	LD KD MS
Knurling tools for swiss type autolathes On knurling tools that are suitable for **swiss type autolathes,** the knurling wheel must not protrude over the front edge of the shank, in order to prevent a collision with the guide bush. Most knurling tools with a shank height of 8-16 mm are suitable for swiss type autolathes. Basically these can also be used in CNC and conventional lathes / autolathes.		 On swiss type autolathes the knurling wheel should be positioned as closely as possible to the clamping of the work piece, to be able to machine small work piece diameters. For this reason, on the knurling tools of the zeus® RD1 and RD2 series with the shank dimensions of 8 x 8 to 16 x 16, the knurling wheels are not arranged centrally but laterally offset.	LD
Knurling tools for axial machining Knurling tools for axial machining of the work piece can be clamped axially to the work piece on all **conventional and CNC lathes/autolathes with tailstock.** The machining takes place through a work piece rotating in a tool fixed and stationary in a tailstock. On **rotary indexing machines / indexing table machines / automatic transfer machines** a stationary work piece is machined by a tool rotating axially.		Machining options: • Tool stationary • Work piece revolving • Direction of rotation universal • Tool revolving • Work piece stationary • Direction of rotation universal	LD KD MS RT

APPLICATION TECHNIQUES

CONTENT

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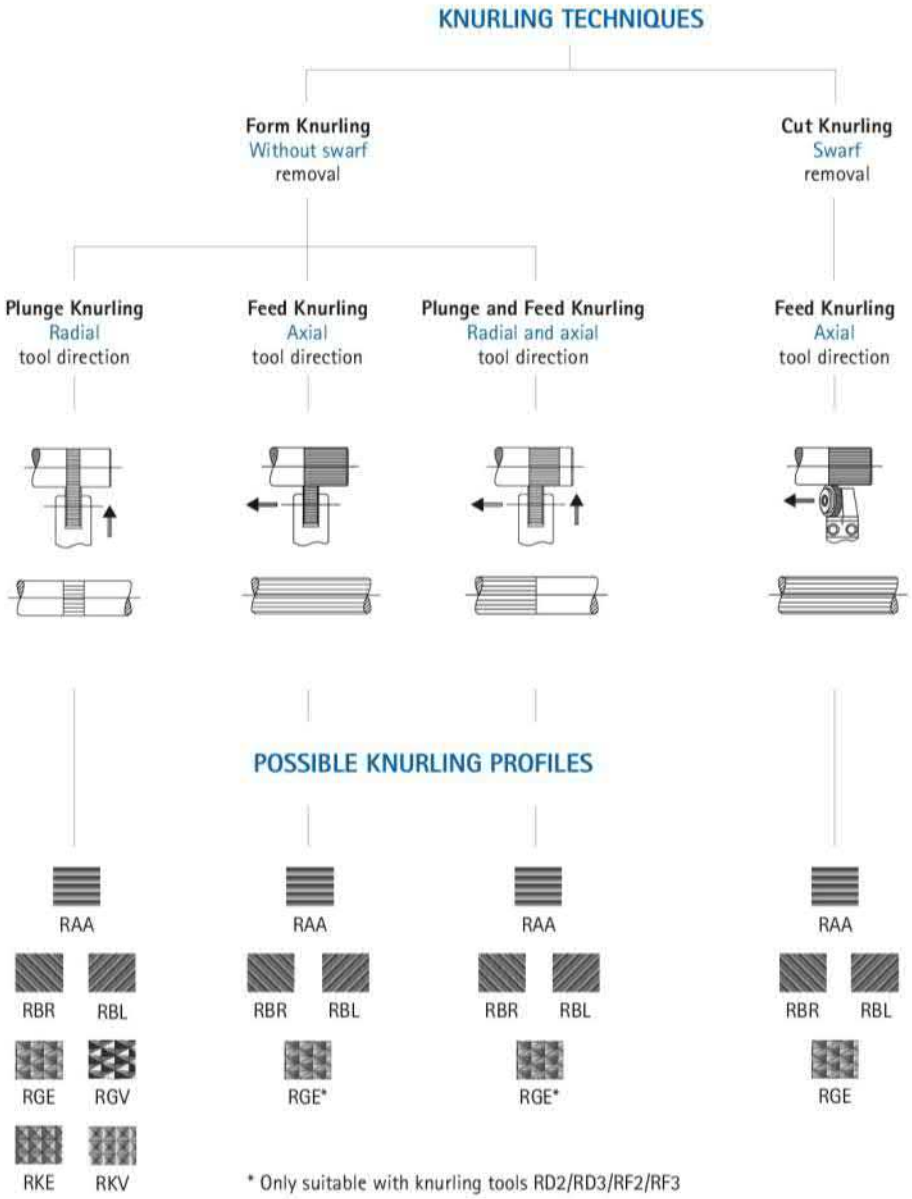
In knurling technology two different application techniques can be distinguished: Cut Knurling and Form Knurling. Both techniques have their own characteristics, range of applications, advantages and limitations. Whereas one advantage of form knurling is the easy tool handling, cut knurling is always the preferred method whenever the surface quality requires uncompromising precision. On the following pages, the different attributes, the range of applications, their advantages and limitations are summarized.

A fundamental distinction lies in the relation between tool direction and possible knurling profiles. The chart below outlines this important distinction:



* Only suitable with knurling tools RD2/RD3/RF2/RF3

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FORM KNURLING

Form knurling is a non-cutting process during which a surface compression of the work piece takes place. As form knurling is a cold forming process, the technique is only suitable for cold deformable materials. As a result of the forming process, the outer diameter is increased. A main advantage of the technique lies in the application diversity. With form knurling all knurling profiles can be produced and it is also suitable for front, internal or conical knurling. It is further possible to knurl up to a shoulder.

Form Knurling

Application

- Processing of cold deformable material
- Suitable for all knurling patterns, profiles and markings
- Suitable for front and internal knurling
- Knurling to a shoulder
- Tool can be started at any position of the work piece

Knurling profile on work piece DIN 82:

Characteristics

- Work piece diameter is increased through displacement
- Surface is compressed
- More strain on machine compared to cut knurling
- Form knurling of thin-walled work pieces can cause difficulties
- Knurling of small diameters can cause difficulties

Handling

- Preparation of work piece generally not required (reduced setting time)
- Easy tool handling

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CUT KNURLING

Cut knurling is the milling alternative to form knurling. During feed, material is removed. This technique is especially suitable for thin-walled work pieces, soft materials (e.g. plastics) or difficult to machine materials. Cut knurling excels in high precision and excellent surface quality, a reason why it is recommended for producing high-quality visual profiles. Contrary to form knurling, the surface compression and the material displacement are negligible. The strain on the machine is also relatively small. One major restriction of the cut knurling technique is the smaller range of application. Cut knurling is only suitable for producing the knurling profiles RAA and RGE. Furthermore, due to the minimal surface compression, the toughness of the knurling profile is reduced.

Cut Knurling

Application

- Suitable for most materials
- Suitable for thin-walled work pieces
- Suitable for very small work pieces
- High precision and surface quality, therefore suitable for excellent visual profiles
- Limited range of application: The knurling profiles RAA and RGE can be produced with all tool series. The possibility of the knurling profiles RBR and RBL is limited
- Only suitable for cylindrical work pieces in axial tool direction
- Knurling to be started at work piece end or in the middle after a groove
- Knurling up to a shoulder is not possible

Knurling profile on work piece DIN 82:

RAA RBL* RBR* RGE

Characteristics

- No major change in diameter after knurling
- Minimal surface compression
- Less strain on machine compared to form knurling
- Minimal strain on tool and work piece

Handling

- Precise setting of tool and fine adjustment required
- Precise setting of work piece required

* With cut knurling, the manufacture of the knurling profiles RBR and RBL is subject to restriction.

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FORM KNURLING TOOLS
CUT KNURLING TOOLS
SPECIAL TOOLS

Otto Dieterle Spezialwerkzeuge GmbH,
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CONTENT

FORM KNURLING TOOLS RD1

The zeus® RD1 series for form knurling applications is the economic and easy solution for producing all kinds of knurling profiles. A classic, that can also be used for the marking of work pieces on autolathes. A further advantage: The knurling profile can start at any position of the work piece – a groove is not required.

APPLICATION ADVANTAGES:

EASY TOOL HANDLING:

- Easy application and tool handling
- Minimal work piece preparation
- Integrated set screws for easy adjustment of the clearance angle
- Click-pin® versions for still faster and safer change of knurling wheels

HIGH WEAR RESISTANCE:

- Special surface hardening for increased tool life
- Carbide pins for higher speed rates, faster production, prolonged life

MODULAR PRODUCT DESIGN:

- Modular shank system for cost-effective use on all CNC- / and cam- controlled swiss type autolathes

MODULAR PRODUCT DESIGN

For swiss type autolathe versions:

CLICK-PIN®-SYSTEM

For fast and safe change of the knurling wheel:

--> No more break off through overtightening
--> No more loosening through impact, hits or vibration
--> Quick change and positioning of the knurling wheel

KNURLING TO SHOULDER

Tool types for knurling to shoulder:

APPLICATION EXAMPLE:

Bushing

APPLICATION:

Material:	Cu2n38Pb2
Knurling Profile/Pitch (DIN 82):	RGE45° / P. 0.6
Machine:	Traub TD 60
No. of pcs. produced/ knurling wheel:	150,000

APPLICATION PARAMETERS zeus® RD1:

Knurling tool:	130-12U250606
Knurling wheel:	GV45°20x6x6, P. 0.6
Cycle time:	0.8 sec/piece
Speed rate:	240 m/min
Feed rate:	0.2 mm/rev
Tool life knurling wheel:	2,000 (min/knurling wheel)
Performance:	18.378 m²/knurling wheel

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FORM KNURLING TOOL 130

zeus® FORM KNURLING TOOL 130:

THE CLASSIC WITH ONE KNURLING WHEEL – CONVINCING EFFICIENCY FOR CONVENTIONAL AUTOLATHES!

Machine type: Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA, RBL, RBR, RGE, RGV, RKE, RKV

Knurling wheels: AA, BR, BL, GV, GE, KV, KE

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Centre height adjustable
- Integrated set screws for easy adjustment of the clearance angle
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 130-16 U 250806-A
- Product series
- Shank size 16 x 16 mm
- Right-/ and left- hand use
- Model A
- For knurling wheels 25 x 8 x 6 (Ø x width x bore)

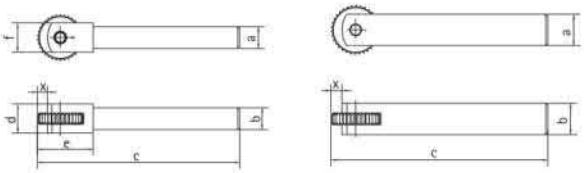
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm width Ø 15 width Ø 25	d mm	e mm width Ø 15 width Ø 25	f mm	x mm width Ø 15 width Ø 25	Knurling wheels mm (Ø x width x bore)	Spare part Pin
130-08U150404-A	3-20	8	8	99	10	19	10	4	10 / 15 x 4 x 4	06TER0972
130-08U150604-A	3-20	8	8	99	14	19	10	4	10 / 15 x 6 x 4	06TER0974
130-10U150404-A	3-20	10	10	99	10	-	10	4	10 / 15 x 4 x 4	06TER0972
130-10U150604-A	3-20	10	10	99	14	19	10	4	10 / 15 x 6 x 4	06TER0974
130-10U250806-A	15-200	10	10	110,5	16	30,5	16	5,5	20 / 25 x 8 x 6	06TER0980
130-12U150404-A	3-20	12	12	99	12	-	12	4	10 / 15 x 4 x 4	06TER0973
130-12U250606-A	15-200	12	12	110,5	14	30,5	14	5,5	20 / 25 x 6 x 6	06TER0979
130-12U250806-A	15-200	12	12	110,5	16	30,5	16	5,5	20 / 25 x 8 x 6	06TER0980
130-14U150604-A	3-20	14	14	99	14	-	14	4	10 / 15 x 6 x 4	06TER0974
130-14U250606-A	15-200	14	14	110,5	14	-	14	5,5	20 / 25 x 6 x 6	06TER0979
130-16U250806-A	15-200	16	16	110,5	16	-	16	5,5	20 / 25 x 8 x 6	06TER0980
130-20U251006-A	15-200	20	20	110,5	20	-	20	5,5	20 / 25 x 10 x 6	06TER0982
130-20U251506-A	15-200	20	25	110,5	25	-	20	5,5	20 / 25 x 15 x 6	06TER0983

Carbide pin

Tool holder No.	Working area Ø mm	a inch	b inch/ mm	c mm	d mm	e mm	f mm	x mm	Knurling wheels inch (Ø x width x bore)	Spare part Pin
130-70U515318-A	3-20	5/16	5/16	96	10	16	10	1	5/16 x 5/32 x 1/8	06TER0985
130-75U123131-A	3-20	1/2	1/2	96,3	12,7	-	12,7	1,3	1/2 x 3/16 x 3/16	06TER0986
130-80U581414-A	3-20	5/8	5/8	107	15,8	-	15,8	2	5/8 x 1/4 x 1/4	06TER0988
130-85U343814-A	15-200	3/4	3/4	108	19,05	-	19,05	3	3/4 x 3/8 x 1/4	06TER0970
130-90U343814-A	15-200	3/4	20 mm	111	20	-	25,4	6	3/4 x 3/8 x 1/4	06TER0970

Carbide pin



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FORM KNURLING TOOL 131

zeus® FORM KNURLING TOOL 131:

THE CLASSIC WITH ONE KNURLING WHEEL – CONVINCING EFFICIENCY FOR SWISS TYPE AUTOLATHES!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RBL | RBR | RGE | RGV | RKE | RKV

Knurling Knurling wheel: AA | BR | BL | GV | GE | KV | KE

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Modular shank construction for conversion to alternative shank sizes
- Integrated set screws for easy adjustment of the clearance angle
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 131 - 10 L 100306 - A (-Z) — with ClickPin®
- Product series
- Shank size 10 x 10 mm
- Left-hand use
- Model A
- for knurling wheels 10 x 3 x 6 (Ø x width x bore)

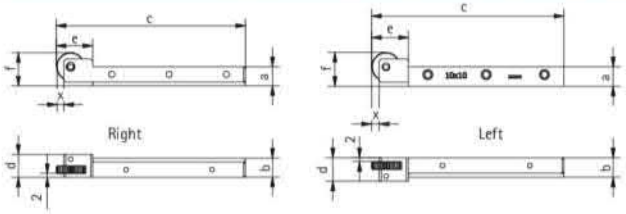
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c* mm	d mm	e* mm	f* mm	x* mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin
131-08L150404-A	3-50	8	8	99	12	19	15,5	4	10/15 x 4 x 4	06TER0960
131-08R150404-A	3-50	8	8	99	12	19	15,5	4	10/15 x 4 x 4	06TER0960
131-10L150404-A	3-50	10	10	99	12	19	17,5	4	10/15 x 4 x 4	06TER0960
131-10R150404-A	3-50	10	10	99	12	19	17,5	4	10/15 x 4 x 4	06TER0960
131-12L150404-A	3-50	12	12	99	12	19	19,5	4	10/15 x 4 x 4	06TER0960
131-12R150404-A	3-50	12	12	99	12	19	19,5	4	10/15 x 4 x 4	06TER0960
131-16L150404-A	3-50	16	16	99	12	19	23,5	4	10/15 x 4 x 4	06TER0960
131-16R150404-A	3-50	16	16	99	12	19	23,5	4	10/15 x 4 x 4	06TER0960
Mit ClickPin®:										
131-08L150404-A-Z	3-50	8	8	99	12	19	15,5	4	10/15 x 4 x 4	06TER1015
131-08R150404-A-Z	3-50	8	8	99	12	19	15,5	4	10/15 x 4 x 4	06TER1015
131-10L150404-A-Z	3-50	10	10	99	12	19	17,5	4	10/15 x 4 x 4	06TER1015
131-10R150404-A-Z	3-50	10	10	99	12	19	17,5	4	10/15 x 4 x 4	06TER1015
131-12L150404-A-Z	3-50	12	12	99	12	19	19,5	4	10/15 x 4 x 4	06TER1015
131-12R150404-A-Z	3-50	12	12	99	12	19	19,5	4	10/15 x 4 x 4	06TER1015
131-16L150404-A-Z	3-50	16	16	99	12	19	23,5	4	10/15 x 4 x 4	06TER1015
131-16R150404-A-Z	3-50	16	16	99	12	19	23,5	4	10/15 x 4 x 4	06TER1015

06TER0960

06TER1015

* width Ø 15



CLICK-PIN®-SYSTEM:

For fast and safe change of the knurling wheel:
--> No more break off through overtightening
--> No more loosening through impact, hits or vibration
--> Quick change and positioning of the knurling wheel

SHANK ADAPTORS:

Shank size	Part-No.
10 x 10	21BHR0833
12 x 12	21BHR0834
16 x 16	21BHR0835

Modular shank construction for conversion to alternative shank sizes

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FORM KNURLING TOOL 131

zeus® FORM KNURLING TOOL 131:

THE CLASSIC WITH ONE KNURLING WHEEL – CONVINCING EFFICIENCY FOR CNC-AUTOLATHES!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RBL | RBR | RGE | RGV | RKE | RKV

Knurling wheels: AA | BR | BL | GV | GE | KV | KE

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Integrated set screws for easy adjustment of the clearance angle
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 131-20 U 250806- A (-Z) — with ClickPin®
- Product series
- Shank size 20 x 20 mm
- Right-/ and left- hand use
- For knurling wheels 25 x 8 x 6 (Ø x width x bore)
- Model A

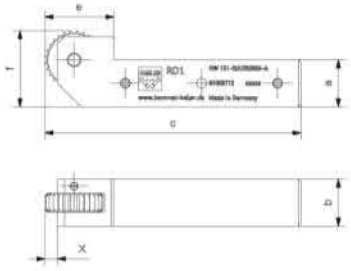
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm width Ø 25	e mm width Ø 25	f mm width Ø 25	x mm width Ø 25	Knurling wheels mm (Ø x width x bore)	Spare part Pin
131-20U250806-A	8-200	20	20	109,5	29,5	32,5	5,5	20 / 25 x 8 x 6	06TER0965
131-25U250806-A	8-200	25	20	109,5	29,5	37,5	5,5	20 / 25 x 8 x 6	06TER0965
With ClickPin®:									
131-20U250806-A-Z	8-200	20	20	109,5	29,5	32,5	5,5	20 / 25 x 8 x 6	06TER1018
131-25U250806-A-Z	8-200	25	20	109,5	29,5	37,5	5,5	20 / 25 x 8 x 6	06TER1018

06TER0965/ 06TER0989

Tool holder No.	Working area Ø mm	a inch	b mm	c mm	e mm	f mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin
131-85U343814-A	8-200	3/4"	20	116,5	24,5	29	2,5	3/4" x 3/8" x 1/4"	06TER0989
131-90U343814-A	8-200	1"	20	116,5	24,5	35	2,5	3/4" x 3/8" x 1/4"	06TER0989

06TER1018



CLICK-PIN®-SYSTEM:

For fast and safe change of the knurling wheel:
--> No more break off through overtightening
--> No more loosening through impact, hits or vibration
--> Quick change and positioning of the knurling wheel

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FORM KNURLING TOOL 132

zeus® FORM KNURLING TOOL 132:

THE CLASSIC FOR KNURLING TO A SHOULDER – CONVINCING FUNCTIONALITY!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RBL | RBR | RGE | RGV | RKE | RKV

Knurling wheels: AA | BR | BL | GV | GE | KV | KE

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Knurling to a shoulder – knurling wheel fixed by a shoulder pin. Fitting of the knurling wheel on the pin adjustable.
- Modular shank construction for conversion to alternative shank sizes
- Integrated set screws for easy adjustment of the clearance angle
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 132 - 08 L 150611 - A

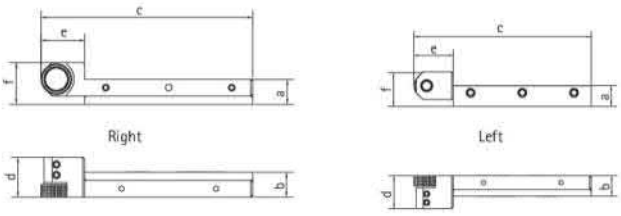
- 132: Product series
- 08: Shank size 8 x 8 mm
- L: Left-hand use
- 150611: For knurling wheels 15 x 6 x 6/11 (Ø x width x bore)
- A: Model A

TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
132-08L150611-A	3-50	8	8	101	19	21	16	15 x 6 x 6/11	06TER0444	21BHR0375
132-08R150611-A	3-50	8	8	101	19	21	16	15 x 6 x 6/11	06TER0444	21BHR0375
132-10L150611-A	3-50	10	10	101	19	21	18	15 x 6 x 6/11	06TER0444	21BHR0375
132-10R150611-A	3-50	10	10	101	19	21	18	15 x 6 x 6/11	06TER0444	21BHR0375
132-12L150611-A	3-50	12	12	101	19	21	20	15 x 6 x 6/11	06TER0444	21BHR0375
132-12R150611-A	3-50	12	12	101	19	21	20	15 x 6 x 6/11	06TER0444	21BHR0375
132-16L150611-A	3-50	16	16	101	19	21	24	15 x 6 x 6/11	06TER0444	21BHR0375
132-16R150611-A	3-50	16	16	101	19	21	24	15 x 6 x 6/11	06TER0444	21BHR0375


06TER0444


21BHR0375



KNURLING TO A SHOULDER:

Suitable for knurling up to a shoulder

SHANK ADAPTORS:

Shank size	Part-No.
10 x 10	21BHR0833
12 x 12	21BHR0834
16 x 16	21BHR0835

Modular shank construction for conversion to alternative shank sizes

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FORM KNURLING TOOL 132

zeus® FORM KNURLING TOOL 132:

THE CLASSIC FOR KNURLING TO A SHOULDER – CONVINCING FUNCTIONALITY!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA, RBL, RBR, RGE, RGV, RKE, RKV

Knurling wheels: AA, BR, BL, GV, GE, KV, KE

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Knurling to a shoulder – knurling wheel fixed by a shoulder Fitting of the knurling wheel on the pin adjustable
- Integrated set screws for easy adjustment of the clearance angle
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 132-20 U 200813-A

- 132: Product series
- 20: Shank size 20 x 20 mm
- U: Right-/ and left- hand use
- 200813: For knurling wheels 20 x 8 x 6/13 (Ø x width x bore)
- A: Model A

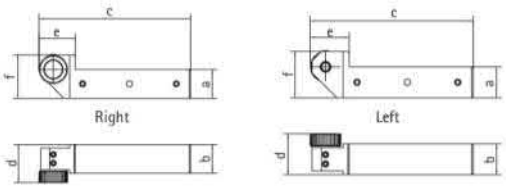
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
132-20U200813-A	8-200	20	20	105,5	24	25,5	30	20 x 8 x 6/13	06TER0445	21BHR0380
132-25U200813-A	8-200	25	20	105,5	24	25,5	35	20 x 8 x 6/13	06TER0445	21BHR0380


06TER0445

Tool holder No.	Working area Ø mm	a inch	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
132-85U200813-A	8-200	3/4"	20	105,5	24	25,5	29	20 x 8 x 6/13	06TER0445	21BHR0380
132-90U200813-A	8-200	1"	20	105,5	24	25,5	35,4	20 x 8 x 6/13	06TER0445	21BHR0380


21BHR0380



KNURLING TO A SHOULDER:

Suitable for knurling up to a shoulder

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FORM KNURLING TOOLS RD2

MODEL 141 / 142

The zeus® RD2 series is the first choice for producing RGE profiles in axial tool direction. Working axially, the knurl width can be chosen according to any size required. The tool series offers many add-ons, that simplify the tool handling. Due to its modular design, the RD2 is suitable for both right-hand and left-hand operations. For the swiss type autolathe versions the flexible shank system allows a conversion to different shank sizes.

APPLICATION ADVANTAGES:

EASY TOOL HANDLING:

- Easy appliance and tool handling
- Minimal work piece preparation
- Integrated set screws for easy adjustment of the clearance angle
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheel
- Click-pin® versions for still faster and safer change of knurling wheels

HIGH WEAR RESISTANCE:

- Special surface hardening for increased tool life
- Carbide pins for higher speed rates, faster production, prolonged life

MODULAR PRODUCT DESIGN:

- Modular shank system for cost-effective use on all CNC- / and cam- controlled swiss type auto lathes
- Modular system: universal knurling tool for both right- / and left-hand orientation. Retooling through fast and easy turning of the knurling head

MODULAR PRODUCT DESIGN

For swiss type autolathe versions:

CLICK-PIN®-SYSTEM

For fast and safe change of the knurling wheel:

--> No more break off through overtightening
--> No more loosening through impact, hits or vibration
--> Quick change and positioning of the knurling wheel

KNURLING TO SHOULDER

Tool types for knurling to shoulder:

APPLICATION EXAMPLE:

Threaded bushing M5

APPLICATION:

Material:	C35Pb
Knurling Profile/Pitch (DIN 82):	RGE30° / P. 0.8
Machine:	Tornos SAS 16DC
No. of pcs. produced/ knurling wheel:	120,000

APPLICATION PARAMETERS zeus® RD2:

Knurling tool:	141-16M150604
Knurling wheel:	BL30° 15x6x4, P. 0.8 BR30° 15x6x4, P. 0.8
Cycle time:	0.8 sec/piece
Speed rate:	68 m/min
Feed rate:	0.2 mm/rev
Tool life knurling wheel:	1,600 min/knurling wheel
Performance:	19.2 m²/knurling wheel

FORM KNURLING TOOL 141

zeus® FORM KNURLING TOOL 141:

THE GENERALIST WITH TWO KNURLING WHEELS – TWICE THE RIGIDITY, EASY TO USE!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Modular shank construction for conversion to alternative shank sizes
- Modular system: universal knurling tool for both right- / and left-hand orientation. Retooling through fast and easy turning of the knurling head
- Flexible centering of the tool head
- Integrated set screws for clearance angle adjustment
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheel
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

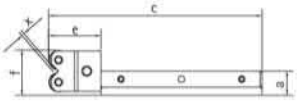
Tool holder No. 141-08M100404-A

- 141 – Product series
- 08 – Shank size 8 x 8 mm
- M – Modular
- 100404 – For knurling wheels 10 x 4 x 4 (Ø x width x bore)
- A – Model A

TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin
141-08M100404-A	3-12	8	8	105,5	12	26	21	1	10 x 4 x 4	06TER0960
141-10M100404-A	3-12	10	10	105,5	12	26	21	1	10 x 4 x 4	06TER0960
141-12M100404-A	3-12	12	12	105,5	12	26	23	1	10 x 4 x 4	06TER0960
141-16M100404-A	3-12	16	16	105,5	12	26	27	1	10 x 4 x 4	06TER0960
141-16M150604-A	5-40	16	16	129	16	39	33	1,5	15 x 6 x 4	06TER0964

06TER0960
06TER0964



FLEXIBILITY:

Fast and easy turning of the tool head for right- / and left-hand use

SHANK ADAPTORS:

Shank size	Part-No.
10 x 10	21BHR0833
12 x 12	21BHR0834
16 x 16	21BHR0835

Modular shank construction for conversion to alternative shank sizes

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www.dieterle-tools.com

FORM KNURLING TOOL 141

zeus® FORM KNURLING TOOL 141:

THE GENERALIST WITH TWO KNURLING WHEELS – DOUBLE THE RIGIDITY, EASY TO USE!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Flexible centering of the tool head
- Integrated set screws for clearance angle adjustment
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheel
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 141-20M 200806-A-(Z) — with ClickPin®
- Product series
- Shank size 20 x 20 mm
- Modular
- For knurling wheels 20 x 8 x 6 (Ø x width x bore)
- Model A

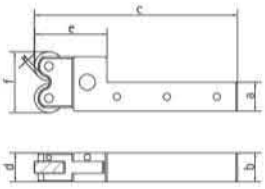
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin
141-20M200806-A	10-80	20	20	130	20	50	42	2,5	20 x 8 x 6	06TER0965
141-25M250806-A	50-200	25	20	156	20	56	55	2,5	25 x 8 x 6	06TER0965
With ClickPin®:										
141-20M200806-A-Z	10-80	20	20	130	20	50	42	2,5	20 x 8 x 6	06TER1018
141-25M250806-A-Z	50-200	25	20	156	20	56	55	2,5	25 x 8 x 6	06TER1018

06TER0965
06TER0969
06TER0989

Tool holder No.	Working area Ø mm	a inch	b mm	c mm	d mm	e mm	f mm	x mm	Knurling wheels inch (Ø x width x bore)	Spare part Pin
141-80M581414-A	6-15	5/8"	16	119	16	29	34	2	5/8" x 1/4" x 1/4"	06TER0969
141-85M343814-A	10-80	3/4"	20	130	20	50	41	2	3/4" x 3/8" x 1/4"	06TER0989
141-90M343814-A	10-80	1"	20	140	20	50	41	2	3/4" x 3/8" x 1/4"	06TER0989

06TER1018



CLICK-PIN®-SYSTEM:

For fast and safe change of the knurling wheel:
- --> No more break off through overtightening
- --> No more loosening through impact, hits or vibration
- --> Quick change and positioning of the knurling wheel

FLEXIBILITY:

Fast and easy turning of the tool head for right- / and left-hand use

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FORM KNURLING TOOL 142

zeus® FORM KNURLING TOOL 142:

THE GENERALIST WITH DOUBLE POWER UP TO A SHOULDER !

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Knurling to a shoulder – knurling wheel fixed by a shoulder pin. Fitting of the knurling wheels on the pin adjustable
- Modular system: universal knurling tool for right- / and left-hand orientation. Retooling through fast and easy turning of the knurling head
- Flexible centering of the tool head
- Integrated set screws for clearance angle adjustment
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 142 - 16 M 150611 - A

- 142 – Product series
- 16 – Shank size 16 x 16 mm
- M – Modular
- 150611 – For knurling wheels 15 x 6 x 6/11 (Ø x width x bore)
- A – Model A

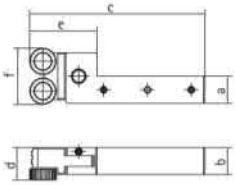
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
142-16M150611-A	8-15	16	16	119	19	39	33	15 x 6 x 6/11	06TER0444	21BHR0375
142-20M200813-A	10-80	20	20	130	24	50	42	20 x 8 x 6/13	06TER0445	21BHR0380
142-25M200813-A	10-80	25	20	130	24	50	42	20 x 8 x 6/13	06TER0445	21BHR0380

06TER0444
06TER0445

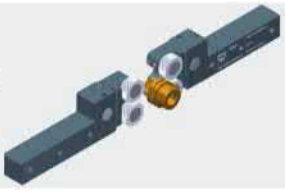
Tool holder No.	Working area Ø mm	a inch	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
142-80M150611-A	8-15	5/8"	16	119	19	39	33	15 x 6 x 6/11	06TER0444	21BHR0375
142-85M200813-A	10-80	3/4"	20	130	24	50	42	20 x 8 x 6/13	06TER0445	21BHR0380
142-90M200813-A	10-80	1"	20	130	24	50	42	20 x 8 x 6/13	06TER0445	21BHR0380

21BHR0375
21BHR0380



FLEXIBILITY:

Fast and easy turning of the tool head for right- / and left-hand use



KNURLING TO A SHOULDER:

Suitable for knurling up to a shoulder

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MODEL 161 / 162

The zeus® RD2 series 161/162 allows for a fine machining. Due to the special tool design with two knurl holders, the lateral pressure exerted on work piece and machine is minimal. The series is therefore especially suitable for form knurling small and delicate parts. Several versions are available for different applications and machine types. Where work space is limited and tiny work piece diameters have to be knurled, this tool range should be the first choice!

APPLICATION ADVANTAGES:

RIGIDITY AND PRECISION:

- No lateral pressure – reduced strain on work piece and machine
- Round shank with four flat sides – for an optimal clamping and tool positioning (Model 162)
- Easy setting of the knurl holders to work piece and centre height

EASY TOOL HANDLING:

- Easy setting of the knurl holders to work piece diameter and centre height (Model 161)
- Easy setting of work piece diameter with setting scale
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheels (Model 161)

HIGH WEAR RESISTANCE:

- Special surface hardening for increased tool life
- Carbide pins/bushings for higher speed rates, faster production, prolonged life

APPLICATION-ORIENTED PRODUCT DESIGN:

- Modular shank system for cost-effective use on all CNC- / and cam-controlled swiss type autolathes (Model 161 for swiss type autolathes)
- Suitable for limited work spaces: tool designed for small machine spaces and working in axial tool direction. Suitable for back end working
- Tool versions available for knurling to a shoulder
- Retooling accessories available for knurling to a shoulder (Model 162)

MODULAR PRODUCT DESIGN

For swiss type autolathe versions:

FINE MACHINING

SUITABLE FOR LIMITED WORK SPACES

APPLICATION EXAMPLE:

Cylinder pin

APPLICATION:

Material:	1.4305
Knurling Profile/Pitch (DIN 82):	RAA / P. 0.3
Machine:	Star SR 10J
No. of pcs. produced/ knurling wheel:	5,000

APPLICATION PARAMETERS zeus® RD2:

Knurling tool:	161-08R100404-B
Knurling wheel:	AA 10x4x4, P. 0.3
Cycle time:	9 sec/piece
Speed rate:	14 m/min
Feed rate:	0.025 mm/rev
Tool life knurling wheel:	750 min/knurling wheel
Performance:	0.11 m²/knurling wheel

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FORM KNURLING TOOL 161

zeus® FORM KNURLING TOOL 161:

THE GENERALIST – DOUBLE FORCE FOR MINIMAL PRESSURE ON SMALL WORK PIECES!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Modular shank construction for conversion to alternative shank sizes
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheel
- Easy adjustment of the knurl holder to work piece diameter
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 161-08 L 100404- B

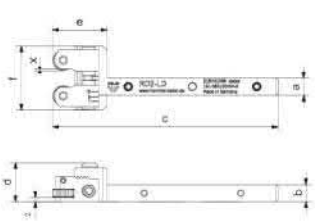
- 161-08: Product series, Shank size 8 x 8 mm
- L: Left-hand use
- 100404: For knurling wheels 10 x 4 x 4 (Ø x width x bore)
- B: Model B

TOOL TYPES:

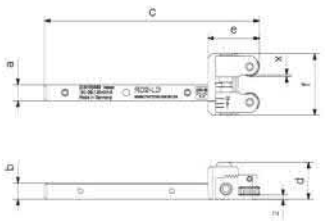
Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	x mm
161-08L100404-B	1-10	8	8	105,5	18	25,5	30	1
161-08R100404-B	1-10	8	8	105,5	18	25,5	30	1
161-10L100404-B	1-10	10	10	105,5	18	25,5	30	1
161-10R100404-B	1-10	10	10	105,5	18	25,5	30	1
161-12L100404-B	1-10	12	12	105,5	18	25,5	30	1
161-12R100404-B	1-10	12	12	105,5	18	25,5	30	1
161-16L100404-B	1-10	16	16	105,5	18	25,5	30	1
161-16R100404-B	1-10	16	16	105,5	18	25,5	30	1

Knurling wheels mm (Ø x width x bore)	Spare part Pin
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960
10 x 4 x 4	06TER0960

06TER0960



Right



Left

WITH SPINDLE + SETTING SCALE:

Easy and precise setting

NO LATERAL PRESSURE:

Reduced strain on work piece and machine

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FORM KNURLING TOOL 162

zeus® FORM KNURLING TOOL 162:

THE UNIVERSAL – DOUBLE OPERATION ON WHEELS FOR MAXIMUM RIGIDITY WITH MINIMAL PRESSURE!

KNURLING TO A SHOULDER

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)
Knurling up to a shoulder

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Knurling to a shoulder – knurling wheel fixed by a shoulder pin. Fitting of the knurling wheels on the pin adjustable
- Modular shank construction for conversion to alternative shank sizes
- Easy adjustment of the knurl holder to work piece diameter
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 162-08 R 150606A11-B

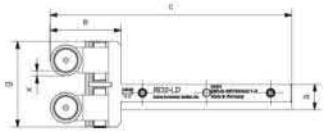
- 162-08: Product series, Shank size 8 x 8 mm
- R: Right-hand use
- 150606A11: For knurling wheels 15 x 6 x 6/11 (Ø x width x bore)
- B: Model B

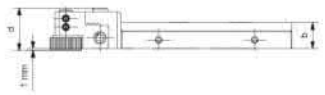
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	g mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin	Spare part Run disc
162-08R150606A11-B	0 - 15	8	8	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-08L150606A11-B	0 - 15	8	8	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-10R150606A11-B	0 - 15	10	10	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-10L150606A11-B	0 - 15	10	10	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-12R150606A11-B	0 - 15	12	12	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-12L150606A11-B	0 - 15	12	12	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-16R150606A11-B	0 - 15	16	16	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380
162-16L150606A11-B	0 - 15	16	16	113,3	19,8	33,3	40	2,4	15 x 6 x 6/11	06TER0445	21BHR0380


06TER0445


21BHR0380





KNURLING TO A SHOULDER:
Suitable for knurling up to a shoulder

WITH SPINDLE:
Easy and precise setting

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FORM KNURLING TOOL 161

zeus® FORM KNURLING TOOL 161:

THE UNIVERSAL – DOUBLE OPERATION ON WHEELS FOR MAXIMUM RIGIDITY WITH MINIMAL PRESSURE!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Special versions for star turret machines available

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Pin with face – fixed by a screw
- With setting spindle for easy adjustment of the knurl holder to work piece diameter
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

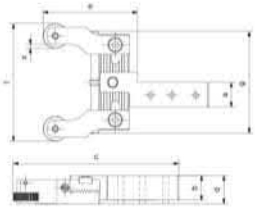
Tool Holder No. 161-16 M 250806
- Product series
- Shank size 16 x 16 mm
- Modular
- For knurling wheels 25 x 8 x 6 (Ø x width x bore)

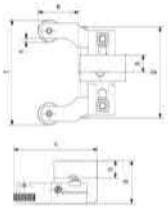
TOOL TYPES:

Tool Holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	g mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Bolt
161-16M250806	0 - 65	16	25	167,3	28,4	93,5	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	16	25	167,3	28,4	91	115	103	1,5	20 x 8 x 6	06TER0983
161-20M250806	0 - 65	20	25	167,3	28,4	93,5	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	20	25	167,3	28,4	91	115	103	1,5	20 x 8 x 6	06TER0983
161-25M250806	0 - 65	25	25	167,3	28,4	93,5	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	25	25	167,3	28,4	91	115	103	1,5	20 x 8 x 6	06TER0983
161-16R/L250806-ST	0 - 65	16	16	99,3	50,4	46	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	16	16	99,3	50,4	43,5	115	103	1,5	20 x 8 x 6	06TER0983
161-20R/L250806-ST	0 - 65	20	20	99,3	50,4	46	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	20	20	99,3	50,4	43,5	115	103	1,5	20 x 8 x 6	06TER0983
161-25R/L250806-ST	0 - 65	25	25	99,3	50,4	46	119	103	4	25 x 8 x 6	06TER0983
	3,5 - 65	25	25	99,3	50,4	43,5	115	103	1,5	20 x 8 x 6	06TER0983

06TER0983

Alternative versions available on demand, e.g. for knurling to a shoulder





STAR TURRET VERSION

The star turret versions (-ST) are to be ordered separately for right- or left-handed machines.

ORDER EXAMPLES:

No. 161-16R250806-ST (for right-handed machine)
No. 161-16L250806-ST (for left-handed machine)

GENTLE PROCESSING:

Reduced strain on work piece and machine

MODULAR DESIGN:

Retooling kit for knurling to a shoulder

E-Kit: 21BHR1214

SETTING SPINDLE

Easy and precise setting

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FORM KNURLING TOOL 162

zeus® FORM KNURLING TOOL 162:

THE UNIVERSAL – DOUBLE OPERATION ON WHEELS FOR MAXIMUM RIGIDITY WITH MINIMAL PRESSURE!

KNURLING TO A SHOULDER

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Knurling to a shoulder
- Pin with face – fixed by a screw – for a quick replacement of the knurling wheel
- Easy adjustment of the knurl holder to work piece diameter
- Carbide pins
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool Holder No. 162-16 M 200813

Product series 162
Shank size 16 x 16 mm 16
Modular M
For knurling wheels 20 x 8 x 6/13 (Ø x width x bore) 200813

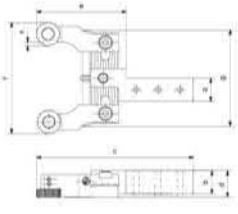
TOOL TYPES:

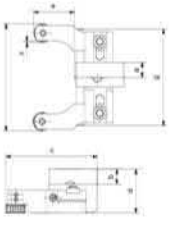
Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	g mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part Pin	Spare part Run disc
162-16M200813	3,5 - 65	16	25	164,8	28,4	92,8	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380
162-20M200813	3,5 - 65	20	25	164,8	28,4	92,8	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380
162-25M200813	3,5 - 65	25	25	164,8	28,4	92,8	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380
162-16R/L200813-ST	3,5 - 65	16	16	96,8	50,4	43,5	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380
162-20R/L200813-ST	3,5 - 65	20	20	96,8	50,4	43,5	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380
162-25R/L200813-ST	3,5 - 65	25	25	96,8	50,4	43,5	114	103	1,5	20 x 8 x 6/13	06TER0445	21BHR0380


06TER0445


21BHR0380

Alternative versions available on demand.





STAR TURRET VERSION (ST)

The star turret versions (-ST) are to be ordered separately for right- or left-handed machines.

ORDER EXAMPLES:

No. 162-16R200813-ST (for right-handed machine)
No. 162-16L200813-ST (for left-handed machine)

MODULAR DESIGN:

Retooling kit

E-Kit: 21BHR1213

KNURLING TO A SHOULDER

SETTING SPINDLE

Easy and precise setting

Otto Dieterle Spezialwerkzeuge GmbH,
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FORM KNURLING TOOL 162

zeus® FORM KNURLING TOOL 162:

THE MINIMALIST – FOR HIGH PRECISION ON TINY WORK PIECES IN LIMITED WORK SPACE!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Rotary indexing machines, Indexing table type machines, Transfer machines (Work piece fix / tool rotating)

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Easy adjustment of the knurl holder to work piece diameter and centre height
- Easy setting of work piece diameter with setting scale
- Round shank with four flat sides - for an optimal clamping and tool positioning
- Available on demand: Retooling accessories for knurling to a shoulder
- Carbide bushings
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

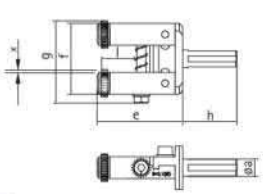
Tool holder No. 162 - 06 U 150408
- Product series
- Shank size 6 x 6 mm
- Right-/ and left- hand use
- For knurling wheels: 15 x 4 x 8 (Ø x width x bore)

TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	e mm	f mm	g mm	h mm	k mm	l mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
162-06U150408	1-14,5	6	49	44	51	40	24	21	1,2	15 x 4 x 8	21BHR0504
162-12U150408	1-14,5	12	49	44	51	40	24	21	1,2	15 x 4 x 8	21BHR0504
162-16U250608	3-25	16	76	67	84	50	40	32	2,5	25 x 6 x 8	21BHR0506
162-20U250608	3-25	20	76	67	84	50	40	32	2,5	25 x 6 x 8	21BHR0506
162-22U250608	3-25	22	76	67	84	50	40	32	2,5	25 x 6 x 8	21BHR0506
162-25U250608	3-25	25	76	67	84	50	40	32	2,5	25 x 6 x 8	21BHR0506

Tool holder No.	Working area Ø mm	a mm	e mm	f mm	g mm	h mm	k mm	l mm	x mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
162-85U250608	3-25	3/4"	76	67	84	40	50	21	2,5	25 x 6 x 8	21BHR0506
162-90U250608	3-25	1"	76	67	84	40	50	21	2,5	25 x 6 x 8	21BHR0506

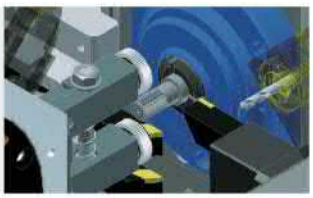
21BHR0504
21BHR0506



Note:
Please order knurling wheels with chamfer for this tool type. Available versions on page 53-57.

APPLICATION-ORIENTED TOOL DESIGN:

Reduced lateral pressure, suitable for small work spaces



FLEXIBILITY:

Retooling accessories for knurling to a shoulder

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FORM KNURLING TOOL 162

zeus® FORM KNURLING TOOL 162:

THE MINIMALIST – FOR KNURLINGS TO A SHOULDER IN LIMITED WORK SPACES!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Rotary indexing machines, Indexing table type machines, Transfer machines (Work piece fix / tool rotating)

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82: RAA | RGE30° | RGE45°

Knurling wheels: 2 x AA | 1 x BL30° / 1 x BR30° | 1 x BL45° / 1 x BR45°

Tool direction:
- Plunge knurling
- Feed knurling

Product highlights:
- Knurling to a shoulder – knurling wheel fixed by a shoulder pin. Fitting of the knurling wheels on the pin adjustable
- Easy adjustment of the knurl holder to work piece diameter and centre height
- Easy setting of work piece diameter with setting scale
- Round shank with four flat sides – for an optimal clamping and tool positioning
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 162-06 U 150611
- Product series
- Shank size 6 x 6 mm
- Right-/ and left- hand use
- For knurling wheels 15 x 6 x 6/11 (Ø x width x bore)

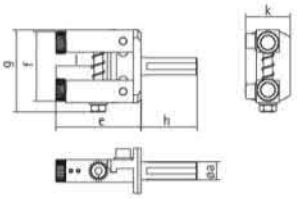
TOOL TYPES:

Tool holder No.	Working area Ø mm	a Ø mm	e mm	f mm	g mm	h mm	k mm	l mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
162-06U150611	1-14	6	49	44	51	40	24	22	15 x 6 x 6/11	06TER0444	21BHR0375
162-12U150611	1-14	12	49	44	51	40	24	22	15 x 6 x 6/11	06TER0444	21BHR0375
162-16U200813	4-27,5	16	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380
162-20U200813	4-27,5	20	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380
162-22U200813	4-27,5	22	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380
162-25U200813	4-27,5	25	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380

06TER0444
06TER0445

Tool holder No.	Working area Ø mm	a Ø inch	e mm	f Ø mm	g mm	h mm	k mm	l mm	Knurling wheels mm (Ø x width x bore)	Spare part Shoulder pin	Spare part Run disc
162-85U200813	4-27,5	3/4"	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380
162-90U200813	4-27,5	1"	76	67	80	50	40	32	20 x 8 x 6/13	06TER0445	21BHR0380

21BHR0375
21BHR0380

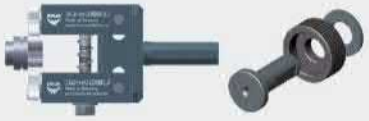


APPLICATION-ORIENTED TOOL DESIGN:

Reduced lateral pressure, suitable for small work spaces

KNURLING TO A SHOULDER:

Suitable for knurling to a shoulder



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FORM KNURLING TOOLS RD3

The zeus® RD3 series for the axial machining of workpieces has been completely overhauled. The new tool design meets the high expectations towards rigidity and precision for processing smallest workpiece diameters. The tool is especially suitable for high precision turned-parts for the optical or watch industry, the medical industry or the electronic industry. The product series is suitable for straight and RGE knurling profiles.

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Minimal vibration, high quality visual profiles, close tolerances
- Controlled tool change: precise fitting of the knurl and exact bearing of the knurl holding unit
- Precise setting of the required tooth depth
- No lateral pressure – reduced strain on work piece and machine
- Stable guiding of jaws across incline

EFFICIENCY:

- Processing of different work piece diameters possible
- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels

TOOL HANDLING:

- Reduced setting time, user-friendly handling due to easy pre-setting of the workpiece diameter and the tooth depth
- Easy and precise fine adjustment
- Self-centering setting of the knurl holder jaws
- Optimal lock in of the knurl holders

MODULAR PRODUCT DESIGN

- Modular exchangeable knurl holder jaws: for retooling to a cut knurling tool RF3 (swarf removal machining)
- Modular exchangeable knurl holder jaws: retooling possible for knurlings to a shoulder

- **Process stability:** Form knurling with minimal pressure

- **Modular product design:** Knurl holding jaws exchangeable

APPLICATION EXAMPLE:

Crimp connection

APPLICATION:

Material:	Brass (CuZn38Pb1,5)
Knurling Profile/Pitch (DIN 82):	RGE 30° / P. 0.4
Machine:	Star SR 10J

APPLICATION PARAMETERS zeus® RD3:

Knurling tool:	192-12M100404
Knurling wheel:	2xBL30° 10x4x4, P. 0.4 1xBR30° 10x4x4, P. 0.4
Speed rate:	76 m/min
Feed rate:	0.25 mm/rev

FORM KNURLING TOOL 192

zeus® FORM KNURLING TOOL 192:

THE ALL-ROUNDER – A SAFE BET ON ALL MACHINE TYPES FOR MAXIMUM RIGIDITY WITH MINIMAL PRESSURE!

Machine type: Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Rotary indexing machines, Indexing table type machines, Transfer machines (Work piece fixed / tool rotating)

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:	RAA	RGE30°	RGE45°
Knurling wheels:	3 x AA	1xBL30° / 2xBR30° or 2xBL30° / 1xBR30°	1xBL45° / 2xBR45° or 2xBL45° / 1xBR45°

Tool direction:
- Feed knurling

Product highlights:
- No lateral pressure – reduced strain on work piece and machine
- Easy and precise fine adjustment
- Modular exchangeable knurl holder jaws: for retooling to a cut knurling tool RF3 (swarf removal machining) or knurling to a shoulder
- Carbide bushings
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 192 - 12 M 100404 - B

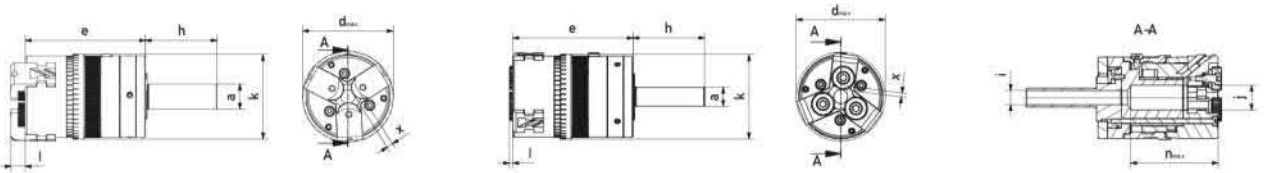
- Product series
- Shank size Ø 12
- Modular
- Model B
- For knurling wheels 10 x 4 x 4 (Ø x width x bore)

TOOL TYPES:

Tool holder No.	Working area Ø mm	a Ø mm	d max. Ø mm	e mm	h mm	i Ø mm	j Ø mm	k Ø mm	l mm	n max. mm	x Ø	Knurling wheels mm (Ø x width x bore)
192-12M150404-B	2 - 13,5	12	57	77	46	9	16	54	9	56	1,5	10 x 4 x 4
	3 - 8,5	12	57	77	46	9	16	54	9	56	4	15 x 4 x 4
192-12M150606A8-B	3 - 12	12	57	77	46	9	16	54	2	56	2,5	15 x 6 x 6/8

d = with max. work piece Ø n = max. work piece length (with Øi)

Further tool dimensions available on demand.



MODULAR PARTS:

Optionally available for cut knurling / knurling to a shoulder

Cut knurling
E-Kit: 21BHR1127

Form knurling
E-Kit: 21BHR1096

Knurling to a shoulder
E-Kit: 21BHR1128

Modular jaws

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CUT KNURLING TOOLS RF1

The new RF1-LD generation for swiss type autolathes meets high demands with regards to process stability, efficiency and profitability. The modular tool series is suitable for producing straight and right-/left-hand knurls in axial tool direction. The cut knurling tool series RF1-LD stands for highest precision, excellent surface quality and maximum flexibility – especially for difficult to machine materials.

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Minimal vibration, high quality visual profiles, close tolerances
- Reproducible processes through scaling and positioning aids
- All setting parameters can be preset and documented
- Controlled tool change: precise fitting of the knurl and exact location of the knurl holding unit
- High precision for connectors, bushings, fittings, housings, etc., as required in the electronic, automotive industry or fluid technology
- Superb visual knurling profiles for the watch-making or surgical industry

EFFICIENCY:

- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels
- Modular shank system for cost-effective use on all CNC- / and cam- controlled swiss type autolathes
- Modular cut knurling tool head for right-/left-hand use and different work piece diameters

TOOL HANDLING:

- Reduced setting times, user-friendly fine adjustment of the clearance angle and the knurling tool head
- Easy change of knurling wheels and precise positioning of the knurl holding unit

- **Increased efficiency:** Exchangeable tool head for processing different work piece diameters

- **Modular product design:** Modular shank adaptors for an easy adjustment to required shank size

- **Modular use right and left:** Retooling through fast and easy turning of the cut knurling head

APPLICATION EXAMPLE:

Knurl pin

APPLICATION:

Material:	11SMn30
Knurling Profile/Pitch (DIN 82):	RAA / P.0,8
Machine:	Citizen C 3L

APPLICATION PARAMETERS zeus® RF1

Knurling tool:	231-16M150408
Knurling wheel:	BR30°15x4x8, P. 0.8
Speed rate:	60 m/min
Feed rate:	0.13 mm/rev

CUT KNURLING TOOL 231

zeus® CUT KNURLING TOOL 231:

THE SPECIALIST FOR HIGH PRECISION RAA-PROFILES AND SMALL DIAMETERS!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes

Application: Cut knurling (swarf removal)

Knurling profile on work piece DIN 82: RAA | RBL30° | RBR30°

Knurling wheels: 1 x BR30° (right-turning) 1 x BL30° (left-turning) | 1 x AA | 1 x AA

Tool direction:
- Feed knurling

Product highlights:
- Modular shank construction for conversion to alternative shank sizes
- Exchangeable tool head for adaptation to different work piece diameters
- Scale and positioning aids
- Setting spindle for fine adjustment of the cut knurling head
- Precise knurl holding unit
- Fine adjustment of the clearance angle and the cut knurling head
- Carbide bushings
- Special surface hardening for increased wear resistance

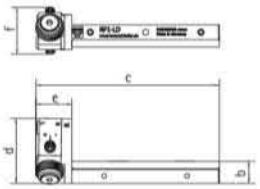
ORDER EXAMPLE:

Tool holder No. 231-12 M 100306-VS
- 231: Product series
- 12: Shank size 12x12 mm
- M: Modular
- 100306: For knurling wheels 10x3x6 (Ø x width x bore)
- VS: Full-shank version

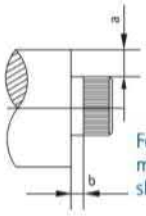
TOOL TYPES:

Tool holder with adaptor	Tool holder with full-shank	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
231-08M100306	231-08M100306	1,5-12	8	8	94	35	14	26	10 x 3 x 6	21BHR0791
231-10M100306	231-10R100306-VS	1,5-12	10	10	94	35	14	26	10 x 3 x 6	21BHR0791
231-12M100306	231-12R100306-VS	1,5-12	12	12	94	35	14	26	10 x 3 x 6	21BHR0791
231-16M100306	231-16R100306-VS	1,5-12	16	16	94	35	14	26	10 x 3 x 6	21BHR0791
231-08M150408	231-08M150408	3-50	8	8	99	35	19	26	15 x 4 x 8	21BHR0792
231-10M150408	231-10R150408-VS	3-50	10	10	99	35	19	26	15 x 4 x 8	21BHR0792
231-12M150408	231-12R150408-VS	3-50	12	12	99	35	19	26	15 x 4 x 8	21BHR0792
231-16M150408	231-16R150408-VS	3-50	16	16	99	35	19	26	15 x 4 x 8	21BHR0792

Fullshaft version also available in left-hand version on request.



21BHR0791 21BHR0792



For more information on the required minimum distance to work piece shoulder, please refer to page 67.

MODULAR PARTS:

SHANK ADAPTORS:

Shank size	Part-No.
10 x 10	21BHR0833
12 x 12	21BHR0834
16 x 16	21BHR0835

Modular shank construction for conversion to alternative shank sizes

CUT KNURLING HEADS:

Working area	Cut knurling head	Part-No.
1,5 - 12 mm	RFK 10x3x6	21BHR0793
3 - 50 mm	RFK 15x4x8	21BHR0794

Optional: For conversion to alternative working area

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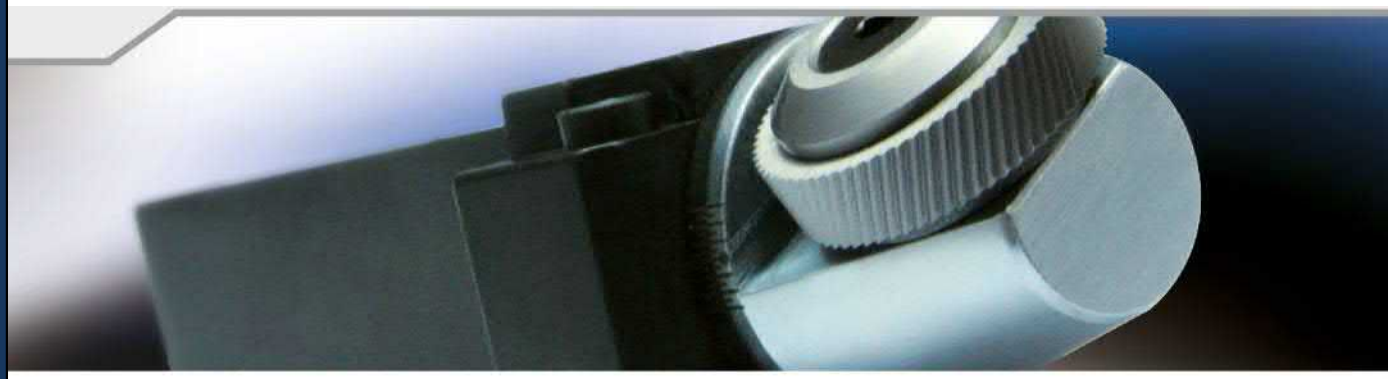
CUT KNURLING TOOLS RF1



The alternative for knurling impressive RAA profiles. Setting and scaling aids for a fine adjustment of the cut knurling head offer special advantages concerning precision, knurl quality and user-friendliness. The simplified tool setting in combination with a more stable design allow for increased process rigidity. The optimal tool solution for visual knurling profiles with minimal pressure!

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Process stability through protection from radial deflection and axial torque: for an optimal tool guiding of the work piece and minimal vibration of the tool. Superb precision and surface quality on the work piece. Easy and precise positioning of the cut knurling head
- Lock-in position at 30° - for an optimal starting position
- Precise fine adjustment of the tool head by means of scaling aid: for an easy presetting and reproducible processes
- Controlled tool change: precise fitting of the knurl and exact location of the knurl holding unit
- All setting parameters can be preset and documented

EFFICIENCY:

- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels
- Modular cut knurling tool head for right-/left-hand turning machines
- Reduced setting time through easy presetting and reproducible setting parameters

TOOL HANDLING:

- Integrated set screws for easy adjustment of the clearance angle
- Fine adjustment of the cut knurling head with setting spindle for a perfectly milled profile and even knurl depth
- Easy change of knurling wheels and precise positioning of the knurl holding unit
- Stability and precision due to a three-point bearing of the tool head on the shank construction

- **Modular use right and left:** Retooling through fast and easy turning of the cut knurling head

- **User-friendly tool handling:** Scaling and positioning aids

APPLICATION EXAMPLE:

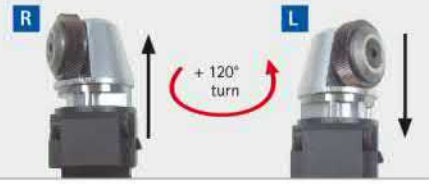
Housing

APPLICATION:

Material:	1.4305
Knurling Profile/Pitch (DIN 82):	RAA / P. 1.0
Machine:	Boley BE 42
No. of pcs. produced/ knurling wheel:	400

APPLICATION PARAMETERS zeus® RF1:

Knurling tool:	231-20M250608-A
Knurling wheel:	BR30° 25x6x8, P. 1.0
Cycle time:	25 sec/piece
Speed rate:	35 m/min
Feed rate:	0.08 mm/rev
Tool life knurling wheel:	166 min/knurling wheel
Performance:	0.72 m²/knurling wheel



CUT KNURLING TOOL 231

zeus® CUT KNURLING TOOL 231:

THE SPECIALIST FOR FIRST-CLASS VISUAL PROFILES WITH EXCEPTIONAL DEMANDS ON SURFACE QUALITY!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Cut knurling (swarf removal)

Knurling profile on work piece DIN 82:

RAA	RBL30°	RBR30°
1 x BR30° (right-turning) 1 x BL30° (left-turning)	1 x AA	1 x AA

Knurling wheels:

Tool direction:
- Feed knurling

Product highlights:
- Setting spindle for fine adjustment of the cut knurling head
- Scaling and positioning aids
- Lock-in position at 30° for an optimal starting position
- Precise knurl holding unit
- Integrated set screws for clearance angle adjustment
- Exchangeable tool head for flexible use on right-/ and left-hand turning machines
- Carbide bushings
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 231-25 M 250608 - A

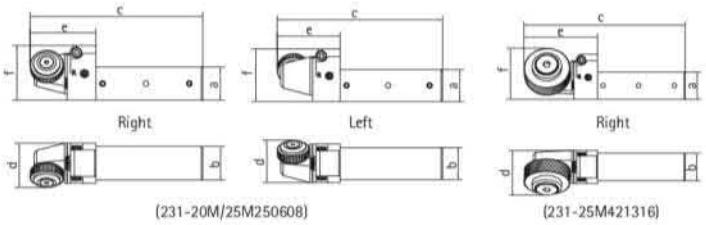
- 231-25: Product series, Shank size 25x25 mm
- M: Modular
- 250608: For knurling wheels 25x6x8 (Ø x width x bore)
- A: Model A

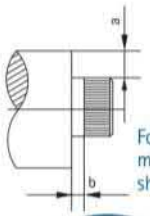
TOOL TYPES:

Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
231-20M250608-A	10-300	20	25	129	33	49	36	25 x 6 x 8	21BHR0506
231-25M250608-A	10-300	25	25	129	33	49	41	25 x 6 x 8	21BHR0506
231-25M421316	30-3000	25	25	147	41	67	47	42 x 13 x 16	21BHR0508

21BHR0506
21BHR0508

Further tools versions with VDI-shank system available on demand.





For more information on the required minimum distance to work piece shoulder, please refer to page 67.

FLEXIBILITY:

Fast and easy turning of the tool head for right- / and left-hand use

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CUT KNURLING TOOLS RF2

The new RF2-LD generation for swiss type autolathes meets high demands with regards to process stability, efficiency and profitability. Due to the modular system with four shank adaptors and two cut knurling heads, the tool series can be adjusted easily to different applications and machine types. The small but rigid tool design is ideal for limited work spaces, and excels also in long-term operations. The best alternative for producing excellent RGE profiles on small diameters.

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Minimal vibration, high quality visual profiles, close tolerances
- Serration between tool holder and cut knurling head for increased stability and precision during processing
- Fine adjustment of the knurl head through setting spindle (with scale) – ensuring a knurling profile parallel to the axis
- Precise fine adjustment of the tool head by means of scaling aid: for an easy presetting and reproducible processes
- All setting parameters can be preset and documented
- Controlled tool change: precise fitting of the knurl and exact location of the knurl holding unit
- Rigid tool construction allows an exact positioning of the cut knurling tool head – for an optimal tool guiding on the work piece

EFFICIENCY:

- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels
- Modular shank system for cost-effective use on all CNC- / and cam-controlled swiss type autolathes
- Modular cut knurling tool head for right-/lefthand use

TOOL HANDLING:

- Reduced setting times through user-friendly fine adjustment of the clearance angle and the knurling tool head
- User-friendly fine adjustment of the center height through vertical height adjustment with the setting spindle
- Easy setting of the work piece diameter with the setting scale and the synchronously adjusted setting spindle

- **Increased efficiency:** Exchangeable tool head for processing different work piece diameters

- **Modular product design:** Modular shank adaptors for an easy adjustment to required shank size

- **Modular use right and left:** Retooling through fast and easy turning of the cut knurling head

APPLICATION EXAMPLE:

Knurled screw

APPLICATION:

Material:	9SMnPb28K
Knurling Profile/Pitch (DIN 82):	RGE30° / P. 1.0
Machine:	Boley BE42
No. of pcs. produced/ knurling wheel:	2,000

APPLICATION PARAMETERS zeus® RF2:

Knurling tool:	241-16M150408
Knurling wheel:	AA 15x4x8, P. 1.0 AA 15x4x8, P. 1.0
Cycle time:	10 sec/piece
Speed rate:	55 m/min
Feed rate:	0.1 mm/rev
Tool life knurling wheel:	330 min/knurling wheel
Performance:	1.41 m²/knurling wheel

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CUT KNURLING TOOL 241

zeus® CUT KNURLING TOOL 241:

THE SPECIALIST FOR RGE – PROFILES WITH MAXIMUM PROCESS-STABILITY ON SMALL DIAMETERS!

Machine type: Conventional and CNC – suitable for:
- Swiss type autolathes

Application: Cut knurling (swarf removal)

Knurling profile on work piece DIN 82: RGE30° RGE45°

Knurling wheels: 2 x AA | 1 x BL15° / 1 x BR15°

Tool direction:
- Feed knurling

Product highlights:
- Serration between tool holder and cut knurling head
- Scale and positioning aids
- Precise knurl holding unit
- Modular shank construction for conversion to alternative shank sizes
- Exchangeable tool head for adaptation to different work piece diameters
- Setting scale and synchronously adjusted setting spindle for adjustment of the work piece diameter / clearance angle correction
- Carbide bushings
- Special surface hardening for increased wear resistance

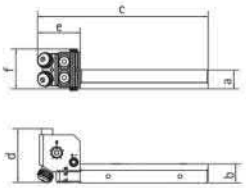
ORDER EXAMPLE:

Tool holder No. 241-08 M 100306
- 241-08: Product series, Shank size 8 x 8 mm
- M: Modular
- 100306: For knurling wheels 10x3x6 (Ø x width x bore)

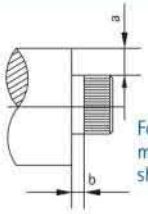
TOOL TYPES:

Tool holder with adaptor	Tool holder with full-shank	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
241-08M100306	241-08M100306	2-12	8	8	107	34	27	26	10 x 3 x 6	21BHR0889
241-10M100306	241-10M100306-VS	2-12	10	10	107	34	27	26	10 x 3 x 6	21BHR0889
241-12M100306	241-12M100306-VS	2-12	12	12	107	34	27	26	10 x 3 x 6	21BHR0889
241-16M100306	241-16M100306-VS	2-12	16	16	107	34	27	29	10 x 3 x 6	21BHR0889
241-08M150408	241-08M150408	3-50	8	8	114	36	34	32	15 x 4 x 8	21BHR0792
241-10M150408	241-10M150408-VS	3-50	10	10	114	36	34	32	15 x 4 x 8	21BHR0792
241-12M150408	241-12M150408-VS	3-50	12	12	114	36	34	32	15 x 4 x 8	21BHR0792
241-16M150408	241-16M150408-VS	3-50	16	16	114	36	34	32	15 x 4 x 8	21BHR0792
241-20M150408-A*	241-20R/L150408-VS	3-50	20	20	118	45	38	36	15 x 4 x 8	21BHR0792

* Design as 241-08M100306, shank, however as 241-20/25M (as shown on page 41)



21BHR0889 21BHR0792



For more information on the required minimum distance to work piece shoulder, please refer to page 67.

MODULAR PARTS:

SHANK ADAPTORS:

Shank size	Part-No.
10 x 10	21BHR0833
12 x 12	21BHR0834
16 x 16	21BHR0835

Modular shank construction for conversion to alternative shank sizes

CUT KNURLING HEADS:

Working area	Cut knurling head	Part-No.
1,5 - 12 mm	RFK 10x3x6	21BHR0831
3 - 50 mm	RFK 15x4x8	21BHR0832

Optional: For conversion to alternative working area

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CUT KNURLING TOOLS RF2

Maximum rigidity, process stability and simplified handling: These are the advantages of the new RF2-A generation. The tool series is mainly suitable for producing RGE profiles. Serration between tool holder and cut knurling head provides extra rigidity and reduced wear on the knurling wheels. A special advantage offers the vertical height adjustment for a flexible use on different shank sizes. Setting aids for fine adjustment of the cut knurling head make the tool setting easy and offer increased process stability for exacting work pieces.

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Serration between tool holder and cut knurling head – for increased rigidity and precision
- Rigid tool construction allows an exact positioning of the cut knurling tool head – for an optimal tool guiding on the work piece and minimal vibration of the tool. Superb precision and surface quality on the work piece
- Precise positioning of the tool head by means of scaling aid – for an easy presetting and reproducible processes
- Controlled tool change: precise fitting of the knurl and exact location of the knurl holding unit

EFFICIENCY:

- Universal use – tool designed for machines with both 20 and 25 mm shanks
- Through the vertical height adjustment the tool can be used flexibly for both shank sizes
- Modular cut knurling tool head for right- / left-hand use
- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels

TOOL HANDLING:

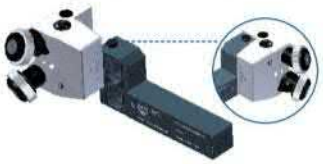
- Reduced setting time through easy presetting and reproducible setting parameters
- User-friendly fine adjustment of the center height through vertical height adjustment with the setting spindle
- Easy setting of the work piece diameter with the setting scale and the synchronously adjusted setting spindle
- Fine adjustment of the knurl head through setting spindle (with scale) – ensuring a knurling profile parallel to the axis
- Fine-adjustment through adjustable knurling tool head

UNIVERSAL USE:

Vertical height adjustment for center height 20 and 25 mm

MODULAR USE RIGHT AND LEFT:

Retooling through fast and easy turning of the cut knurling head



APPLICATION EXAMPLE:

Housing

APPLICATION:

Material:	9SMnPb28K
Knurling Profile/Pitch (DIN 82):	RGE30° / P. 1.0
Machine:	Index
No. of pcs. produced/ knurling wheel:	1,000

APPLICATION PARAMETERS zeus® RF2:

Knurling tool:	241-20/25M250608-A.1
Knurling wheel:	AA 25x6x8, P. 1.0
Cycle time:	15 sec/piece
Speed rate:	47 m/min
Feed rate:	0.1 mm/rev
Tool life knurling wheel:	250 min/knurling wheel
Performance:	1.4 m²/knurling wheel

CUT KNURLING TOOL 240/241

zeus® CUT KNURLING TOOL 240/241:

THE SPECIALIST FOR KNURLING APPLICATIONS WITH HIGH DEMANDS ON RIGIDITY AND SURFACE QUALITY!

Machine type: Conventional and CNC – suitable for:
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes

Application: Cut knurling (swarf removal)

Knurling profile on work piece DIN 82: RGE30° RGE45°

Knurling wheels: 2 x AA | 1 x BL15° / 1 x BR15°

Tool direction:
- Feed knurling

Product highlights:
- Serration between tool holder and cut knurling head
- Exchangeable tool head for left- / and right-hand use
- Setting scale and synchronously adjusted setting spindle for adjustment of the work piece diameter / clearance angle correction
- Cut knurling head spindle with scaling
- Fine adjustment of the center height and cut knurling head with setting scale and spindle
- Carbide bushings
- Special surface hardening for increased wear resistance
- Vertical height adjustment for center height 20 and 25 mm (Model 241-20/25M250608-A1)

ORDER EXAMPLE:

Tool holder No. 241-20M 250608-A1
- Product series: Modular
- Shank size 20 x 20 mm
- For knurling wheels 25 x 6 x 8 (Ø x width x bore)
- Model A1

TOOL TYPES:

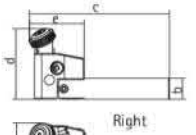
Tool holder No.	Working area Ø mm	a mm	b mm	c mm	d mm	e mm	f mm	Knurling wheels mm (Ø x width x bore)	Spare part E-Kit
241-20M150408-A*	3 - 50	20	20	118	45	38	36	15 x 4 x 8	21BHR0792
241-20/25M250608-A1	10 - 250	20	20	134	68	54	58	25 x 6 x 8	21BHR0506
241-25M250608-A1	10 - 250	20	25	134	68	54	58	25 x 6 x 8	21BHR0506

* Design as 241-08M100306 (see picture on page 39), shank, however, as shown above.

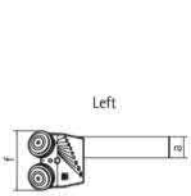
21BHR0506
21BHR0508
21BHR0792

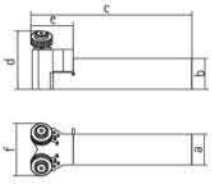
Special tool types for large working diameters:									
240-40U421316	50 - 3000	40	60	319	114	86	102	42 x 13 x 16	21BHR0508
240-60U421316-A	50 - 3000	60	60	316	114	83	102	42 x 13 x 16	21BHR0508

Further tool versions with VDI-shank system available on demand.

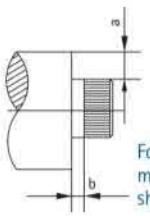


241-20/25M250608-A1





240-40/60U421316



For more information on the required minimum distance to work piece shoulder, please refer to page 67.

EASY HANDLING:

Easy presetting for reduced setting time

PROCESS STABILITY:

Stability and precision

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CUT KNURLING TOOLS RF3

The zeus® RF3 series is designed for the fine machining of very small and thin-walled work pieces in axial tool direction. The product series is suitable for producing straight and RGE profiles with high demands on surface quality and dimensional accuracy. Due to the special design with three knurling wheels operating, the lateral pressure is reduced to a minimum. zeus® RF3: A specialist for knurling thin or pressure-sensitive parts, as for example spindles, tubes, or delicate bushings.

APPLICATION ADVANTAGES:

PROCESS STABILITY:

- Minimal vibration, high quality visual profiles, close tolerances
- No lateral pressure - reduced strain on work piece and machine
- Controlled tool change: precise fitting of the knurl and exact bearing of the knurl holding unit
- Precise setting of the required tooth depth and work piece diameter
- No lateral pressure – reduced strain on work piece and machine
- Stable guiding of jaws across incline

EFFICIENCY:

- Processing of different work piece diameters possible
- Higher feed and speed rates, reduced production times
- Reduced wear on knurling wheels
- Modular tool design – easy adjustment to different application requirements

TOOL HANDLING:

- Reduced setting time, user-friendly handling due to easy pre-setting of the workpiece diameter and the tooth depth
- Easy and precise fine adjustment
- Self-centering setting of the knurl holder jaws
- Optimal lock in of the knurl holders

MODULAR PRODUCT DESIGN:

- Modular exchangeable knurl holder-jaws: for retooling to a form knurling tool RD3 (Non-cutting forming)
- Modular exchangeable knurl holder-jaws: retooling possible for knurling to a shoulder

- **Process stability:** Cut knurling with minimal pressure

- **Modular product design:** Knurl holder-jaws exchangeable

APPLICATION EXAMPLE:

Turned-part, Endoscopy

APPLICATION:

Material:	1.4542
Knurling Profile/Pitch (DIN 82):	RGE30° / P. 0.8
Machine:	Maier Swiss type autolathe

APPLICATION PARAMETERS zeus® RF2:

Knurling tool:	291-12M100306-B
Knurling wheel:	3xAA 10x3x6, P. 0.8 TENIFER treated
Speed rate:	25 m/min
Feed rate:	0.07 mm/rev

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CUT KNURLING TOOL 291

zeus® CUT KNURLING TOOL 291:

THE ALL-ROUNDER – A SAFE BET ON ALL MACHINE TYPES FOR MAXIMUM RIGIDITY WITH MINIMAL PRESSURE!

Machine type: Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Rotary indexing machines, Indexing table type machines, Transfer machines (Work piece fixed / tool rotating)

Application: Cut knurling (swarf removal)

Knurling profile on work piece DIN 82: RGE30° | RGE45°

Knurling wheels: 3 x AA | 1 x BL15° / 2 x BR15° or 2 x BL15° / 1 x BR15°

Tool direction:
- Feed knurling

Product highlights:
- No lateral pressure – reduced strain on work piece and machine
- Easy and precise fine adjustment
- Modular exchangeable knurl holder-jaws: for retooling to a form knurling tool RD3 (non-cutting forming) or knurling to a shoulder
- Carbide bushings
- Special surface hardening for increased wear resistance

ORDER EXAMPLE:

Tool holder No. 291-12 M 100306-B

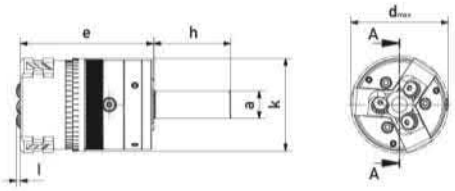
- 291: Product series
- 12: Shank size Ø 12
- M: Modular
- 100306: For knurling wheels 10 x 3 x 6 (Ø x width x bore)
- B: Model B

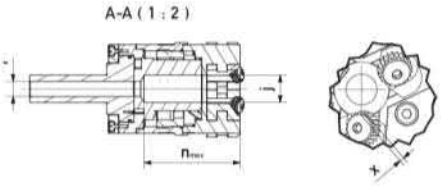
TOOL TYPES:

Tool holder No.	Working area Ø mm	a Ø mm	d max. Ø mm	e mm	h mm	i Ø mm	j Ø mm	k Ø mm	l mm	n max. mm	x Ø	Knurling wheels mm (Ø x width x bore)
291-12M100306-B	3,5 - 13,5	12	57	78	45	9	16	54	3	56	1	10 x 3 x 6

d = with max. work piece Ø

n = max. work piece lenght (with Øi)





MODULAR PARTS:

Optionally available for form knurling / knurling to a shoulder

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SPECIAL TOOLS 311 / 312

zeus® SPECIAL TOOLS 311/312:

THE SPECIALISTS FOR CONICAL AND FACE KNURLING

zeus® SPECIAL TOOLS 311-45°

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Conical knurling
Face knurling
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:

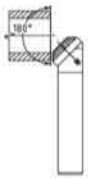
RAA RBL RBR RGV

KAA KBR KBL KGE

(Knurling wheels)

Tool direction:
- Plunge knurling

Product highlights:
- Special surface hardening for increased wear resistance



zeus® SPECIAL TOOLS 311-90°

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Knurling within a bore - (up to a shoulder)
Face knurling
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:

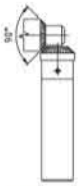
RAA RBL RBR RGE RGV RKE RKV

AA BR BL GV GE KV KE

(Knurling wheels)

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Shoulder pin fixed by a screw
- Special surface hardening for increased wear resistance



zeus® SPECIAL TOOLS 312

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Conical knurling
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:

RAA RBL RBR RGV

KAA KBR KBL KGE

(Knurling wheels)

Tool direction:
- Plunge knurling

Product highlights:
- Integrated set screws for clearance angle adjustment
- Special surface hardening for increased wear resistance

Note: Further tool versions available on demand. For more information, please order the zeus ® Special Tooling Catalogue.

APPLICATION EXAMPLE:

Threaded insert

APPLICATION:

Material:	1.4305
Knurling Profile/Pitch (DIN 82):	RGE30° / P. 0.6
Machine:	INDEX ABC
No. of pcs. produced/ knurling wheel:	2,000

APPLICATION PARAMETERS zeus® special tools:

Knurling tool:	Special tool
Knurling wheel:	GV30° 15x6x4, P. 0.6
Cycle time:	2 sec/piece
Speed rate:	33 m/min
Feed rate:	0.2 mm/rev
Tool life knurling wheel:	66 min/knurling wheel
Performance:	0.24 m²/knurling wheel

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SPECIAL TOOLS 330 / 332 / 342

zeus® SPECIAL TOOLS 330/332/342:

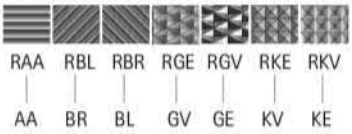
THE PROFESSIONALS FOR KNURLING WITHIN A BORE!

zeus® SPECIAL TOOLS 330

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Knurling within a bore
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:



(Knurling wheels)

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

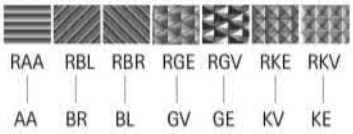
Product highlights:
- Suitable for small work spaces
- Round shank with four clamping flats
- Special surface hardening for increased wear resistance

zeus® SPECIAL TOOLS 332

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Knurling within a bore - (up to a shoulder)
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:



(Knurling wheels)

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

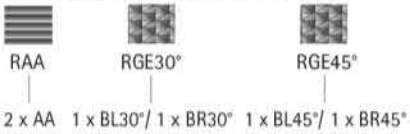
Product highlights:
- Suitable for small work spaces
- Shoulder pin fixed by a screw
- Fitting of the knurling wheel on the pin adjustable
- Round shank with four clamping flats
- Special surface hardening for increased wear resistance

zeus® SPECIAL TOOLS 342

Machine type:
Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning-/milling centres
- Multi spindle automatic lathes

Application:
Knurling within a bore - (up to a shoulder)
Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:



(Knurling wheels)

Tool direction:
- Plunge knurling: Suitable for all knurling profiles, patterns and markings
- Feed knurling: Suitable for RAA, RBL, RBR

Product highlights:
- Suitable for small work spaces
- Round shank with four clamping flats
- Shoulder pin fixed by a screw. Fitting of the knurling wheel on the pin adjustable
- Integrated set screws for clearance angle adjustment
- Special surface hardening for increased wear resistance

Note: Further tool versions available on demand. For more information, please order the zeus ® Special Tooling Catalogue.

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www.dieterle-tools.com

SPECIAL TOOL 391

zeus® SPECIAL TOOL 391:

THE SPECIALIST FOR MAXIMUM RIGIDITY AND PRECISION WITH CUSTOMIZED DESIGN!

To insert into standard machine die holder*

Machine type: Conventional and CNC – suitable for:
- Lathe / autolathes
- Swiss type autolathes
- Automatic short-turning lathes, Universal lathes, Turning- / milling centre
- Multispindle automatic lathes
- Rotary indexing machines, Indexing table type machines, Transfer machines
- (Work piece fixed / tool rotating)

Application: Form knurling (non-cutting forming)

Knurling profile on work piece DIN 82:	RAA	RGE30°	RGE45°
Knurling wheels:	3 x AA	2 x BL30° / 1 x BR30°	2 x BL45° / 1 x BR 45°

Tool direction:
- Feed knurling

Product highlights:
- Customer specific tool design: according to exact diameter and pitch of the work piece
- The die dimensions are in keeping with those of standard threading dies
- Low radial pressure on the work piece
- Easy handling
- Special surface hardening for increased wear resistance

* Not included in delivery – available on demand.

Enquiry Form:

(Please tick/complete as required)

Application for variable work piece-Ø (Preturn-Ø of work piece provided by Hommel + Keller):

Die diameter (a): Ø25 ☐ Ø30 ☐ Ø38 ☐ Ø45 ☐ Ø55 ☐

Knurling profile: RAA ☐ RGE30° ☐ RGE45° ☐ RBL ☐ RBR ☐

Pitch: _____ mm _____ TPI/CP _____ DP

Work piece-Ø after knurling (da): _____ mm Material of work piece: _____

Application for given work piece-Ø (e.g. blank bars):

Die diameter (a): Ø25 ☐ Ø30 ☐ Ø38 ☐ Ø45 ☐ Ø55 ☐

Knurling profile: RAA ☐ RGE30° ☐ RGE45° ☐ RBL ☐ RBR ☐

Pitch: _____ mm _____ TPI/CP _____ DP

Work piece-Ø: _____ mm Material of work piece: _____

Note: Measurement "a" depends partly on work piece diameter. Please submit work piece drawing!

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MC1


MR1


MRS1


MCC1

The zeus® product range offers cost-effective and efficient solutions for the marking of turned-parts on autolathes. With these innovative tooling concepts, subsequent manual production steps for the marking are no longer required. As a consequence, the overall processing times and labour costs are substantially reduced. The technique offers a wide range of applications for marking components with serial numbers, production dates, component ID's or logos.

MC1 – PROCESS-SAFE RESULTS WITH HIGH SPEED RATES:

- Different types of markings with a horizontal or vertical text layout can be engraved. With further processing the driving knurl can be removed after the operation.

MR1 – FLEXIBLE AND PRECISE:

- The main advantage of the spring return system lies in the flexible marking of different work pieces or product series. The programme includes tool versions for different machine types.

MRS1 – EXCHANGEABLE SEGMENTS:

- Maximum flexibility in marking several work pieces, with differing texts and diameters is hence provided.

MCC1 – MARKING UP TO A SHOULDER:

- Especially when developing customized tool solutions, we focus on application advantages, functionality and process stability.

MARKING ROLLS/MARKING SEGMENTS

Each zeus® marking roll is individually manufactured according to the customers' requirements. Letters, logos or numbers are engraved with highest precision and care.

- Our know-how guarantees highest precision which is reflected by the quality of the marking on the end-part. The application possibilities are boundless.

More information on page 59 (marking rolls) and in the catalogue zeus® Marking Technology.

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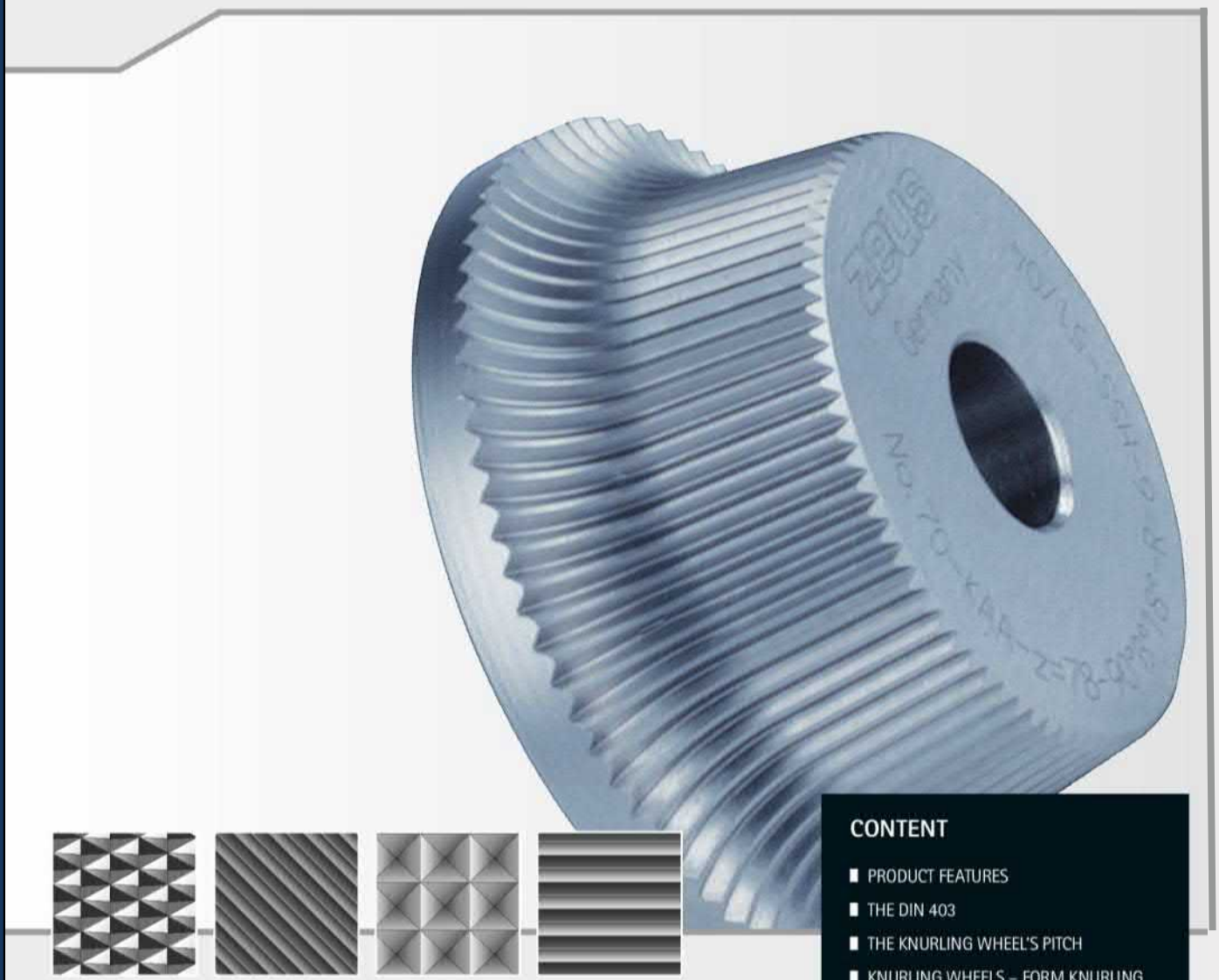
KNURLING WHEELS



CONTENT

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The zeus® product programme for knurling wheels includes all types of knurling wheels for form and cut knurling applications. In addition to standard forms according to the DIN 403, we offer special profiles and customized knurling wheels. Maximum precision and the use of tool life increasing product features are the decisive product characteristics of a zeus® premium knurling wheel. For special applications, we design an individual knurling wheel according to your requirements.

zeus® PREMIUM POWDER METAL FOR INCREASED TOOL LIFE

As your tool supplier for premium products we focus on product features that ensure maximum tool life, in particular for hard to machine materials. zeus® standard knurling wheels are therefore made of powder metal. This material is characterised by its high warm hardness, high wear resistance and its increased ability to work under pressure. For knurling applications the following advantages can be summarized:

- Failure-free production cycles
- Reduced cutting forces
- Increased tool life
- Reduced tool costs
- Reduced setting costs

In addition to the standard material PM, we offer HSS and Carbide knurling wheels as an alternative.

TOOL-LIFE OPTIMIZATION THROUGH AFTER-TREATMENT

An optimal after-treatment process can have positive effects on the knurling wheel's tool life. The optimal after-treatment depends in all cases on the application itself (knurling technique applied, material processed, knurling wheel dimension, feed and speed rate, etc.). The following options are available:

- HEAT TREATMENT – TENIFER®-TREATMENT (NITRIDING)
- SURFACE TREATMENT – PVD COATINGS
- POLISHED KNURLING WHEELS

APPLICATION EXAMPLE:

Windscreen wiper spindle

APPLICATION:

Material:	C45 Pb
Knurling Profile/Pitch (DIN 82):	KAA / P. 0.6
Machine:	Citizen L 32L

APPLICATION PARAMETERS:

Knurling tool:	Special tool
Knurling wheel:	Customized knurling wheel
Speed rate:	10 m/min
Feed rate:	0.27 mm/rev

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AFTER-TREATMENT FOR INCREASED TOOL LIFE

With an optimal surface finish that is adjusted to the material processed, a substantial increase in tool life can be realized. The optimal after-treatment depends in all cases on the application itself (knurling technique applied, material processed, knurling wheel dimension, feed and speed rate, etc.). The following options are available:

POLISHED KNURLING WHEELS

For adhesive materials that require an optimal chip-flow, we recommend fine-polished knurling wheels. zeus® knurling wheels are polished in-house with a special technique that allows a highly-precise rounding of the edges and excellent surface smoothing. The precise edge rounding of the tooth flanks enhances the edge stability and prevents built-up edges. Premature breakage of the knurling wheels' teeth can thus be prevented. Moreover, polished knurling wheels are a cost-effective alternative to ground carbide knurling wheels, that are commonly used for adhesive materials.

HEAT TREATMENT – TENIFER®-TREATMENT (NITRIDING)

TENIFER®-treatment in salt-bath plants is applied for increasing the knurling wheel's wear resistance and endurance strength. By the nitrocarburizing treatment, the material's case hardness is augmented.

SURFACE TREATMENT – PVD COATINGS

Further possibilities to increase tool life is to apply an application specific PVD coating. As a standard we can offer TiN, TiCN, TiAlN, TiAlCN, which are especially suitable for cut knurling applications.

The ideal after-treatment should always be determined by a field experiment, considering the application parameters, i.e material processed, feed and speed rates, knurling technique, etc.

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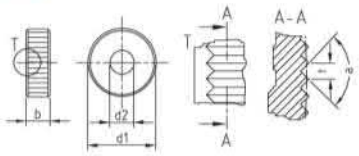
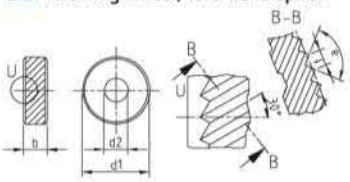
THE KNURLING WHEEL - DIN 403

The DIN 403 is the standard for the knurling profile on the knurling wheel. The DIN 403 specifies the knurl profiles AA, BL, BR, GE,GV, KE and KV. Knurling wheels with profiles other than the ones described in the DIN 82, are classified as customized knurling wheels and are manufactured by Hommel + Keller according to customer drawings.

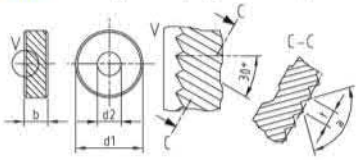
AA Knurling wheel with straight pattern



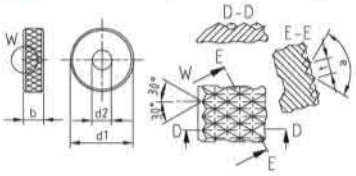
BL Knurling wheel, left-hand spiral



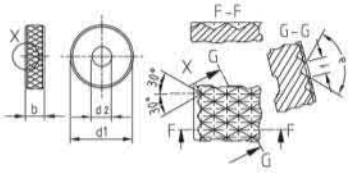
BR Knurling wheel, right-hand spiral



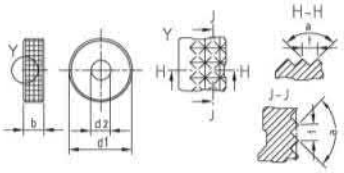
GE Cross-knurling wheel, points up, 30°, male



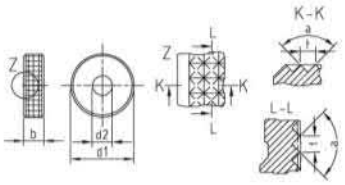
GV Cross-knurling wheel, points down, 30°, female



KE Square knurling wheel, crossed, points up, 90°, male



KV Square knurling wheel, crossed, points down, 90°, female



The appropriate knurling wheel's profile depends on the required profile on the work piece according to DIN 82 and the knurling tool applied. The product details from page 15 onwards, suggests the appropriate knurling wheel according to the application.

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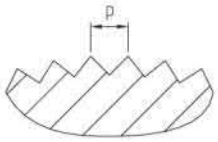
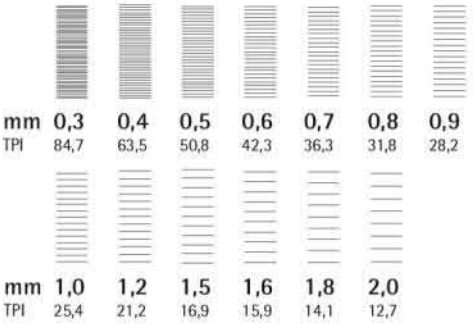
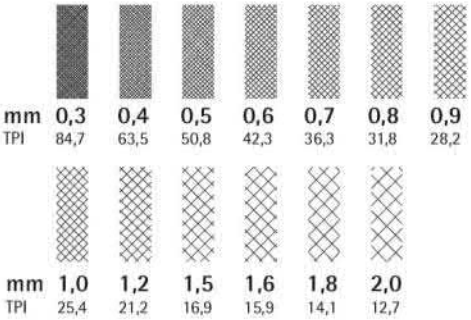
The knurling wheel's pitch 'p' refers to the distance between the tips of two teeth.
Standard pitch sizes according to DIN 403 include: p=0,5/0,6/0,8/1,0/1,2/1,6.
The Hommel + Keller product programme covers also non-standard pitch sizes.
They are listed below in mm and TPI. Additional pitch sizes are available on demand.



STANDARD PITCH SIZES:



mm	0,3	0,4	0,5	0,6	0,7	0,8	0,9
TPI	84,7	63,5	50,8	42,3	36,3	31,8	28,2



mm	0,3	0,4	0,5	0,6	0,7	0,8	0,9
TPI	84,7	63,5	50,8	42,3	36,3	31,8	28,2

mm	1,0	1,2	1,5	1,6	1,8	2,0
TPI	25,4	21,2	16,9	15,9	14,1	12,7

mm	1,0	1,2	1,5	1,6	1,8	2,0
TPI	25,4	21,2	16,9	15,9	14,1	12,7

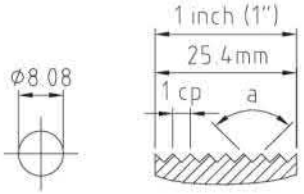
KNURLINGS ACCORDING TO AMERICAN NATIONAL STANDARD CP (TPI) AND DP:

Apart from the DIN 82 / DIN 403 the American National Standard specifies the pitch and profile angle of the knurling application. The CP (TPI) and DP are distinguished as follows:

CP (TPI) = Circular Pitch (Teeth Per Inch)

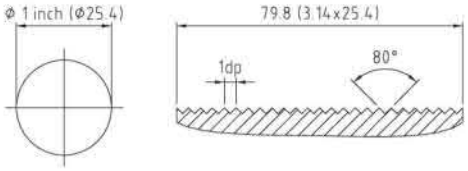
This standard specifies the number of teeth on a length of 1 inch (1"~25,4 mm). The CP (TPI) is calculated by dividing 1 inch through the number of teeth. The profile angle is determined according to the number of teeth with either 70° or 90°.

Arithmetic example:
Value CP (TPI) = 20
Pitch (mm) = 1 inch (~25,4 mm) : 20 (Number of teeth) = 1.27 mm



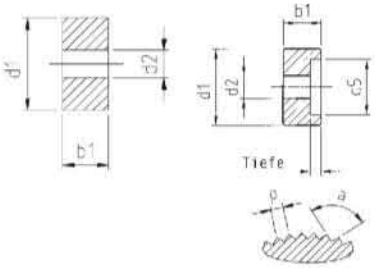
DP = Diametral Pitch

Contrary to the CP (TPI), this standard specifies the number of teeth along the circumference of a circle with a diameter of 1 inch (1"~25,4 mm). The pitch is calculated by dividing the circumference (= 1 inch) by the number of teeth. The profile angle is generally determined with 80°.



Arithmetic example:
Value DP = 64
Pitch (mm) = 1 inch (~25,4) x π (3,14...) : 64 (Number of teeth) = 1.25 mm

A list of mm and CP (TPI) conversions can be found on page 63. Furthermore, the Technical Appendix contains a separate chapter on how to optimize the relation between number of teeth and work piece circumference by adjusting the pitch size.



KNURLING WHEELS WITH CHAMFER (45°) – METRIC – POWDER METAL, S590

Standard version	Dimension			Standard Pitch	Type							
	Diameter	Width	Bore		AA	BL30°	BL45°	BR30°	BR45°	GE30°	GE45°	KE
No. 11	* 10	3	6	○	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	10	4	4	○	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	15	4	4	○	✓	✓	✓	✓	✓	✓	✓	✓
No. 11	* 15	4	8	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	15	6	4	○	✓	✓	✓	✓	✓	✓	✓	✓
No. 11	15	6	6/8	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	15	6	6/11	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	20	6	6	●	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	20	8	6	●	✓	✓	✓	✓	✓	✓	✓	✓
No. 11	20	8	6/13	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	20	8	10/12	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	20	10	6	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	25	6	6	■	✓	✓	✓	✓	✓	☑	☑	☑
No. 11	* 25	6	8	■	✓	✓	✓	✓	✓	☑	☑	☑
No. 11	25	8	6	■	✓	✓	✓	✓	✓	☑	☑	☑
No. 11	25	10	6	■	✓	✓	✓	✓	✓	☑	☑	☑

* Chamfer 60°

Further dimensions and customized knurling wheels available on demand.

✓ = Stock item / immediate availability
☑ = Available on demand

STANDARD PITCH SIZES / PROFILE ANGLE 90°

●	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5 / 1,6 / 1,8 / 2,0
○	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5
■	0,6 / 0,8 / 1,0 / 1,2 / 1,5
□	0,6 / 0,8 / 1,0 / 1,2
☑	On demand

SPECIAL PITCHES

Further pitch sizes and customized knurling wheels available on demand.

ALTERNATIVE TYPES, METRIC

Powder Metal (PM)

No.	Type
No. 13	milled, without chamfer
No. 30	ground, with chamfer
No. 32	ground, without chamfer

Carbide (HM)

No.	Type
No. 50	ground, with chamfer
No. 52	ground, without chamfer

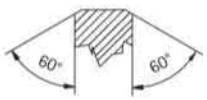
High Speed Automatic Steel (HSS)

No.	Type
No. 10	milled, with chamfer
No. 12	milled, without chamfer

Further versions available on demand.

PROTECTION CHAMFER

For form knurling applications in axial tool direction and big pitch sizes, a 60° chamfer on the knurling wheel might bring better results. The chamfer can support a better material flow.



Order No. PM = Nr. 95
Order No. HSS = Nr. 94

PVD-COATINGS

- TiN-coatings
- TiCN-coatings
- TiAlN-coatings
- TiAlCN-coatings

SPECIAL HEAT-TREATMENT

- TENIFER®-nitriding
- Defined hardness

SURFACE TREATMENT

- Polished knurling wheels

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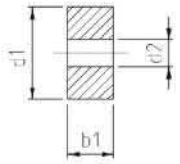
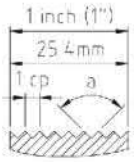




KNURLING WHEELS WITH CHAMFER (45°) – INCH – POWDER METAL, S590

Standard version	Dimension			Standard Pitch	Type							
	Diameter	Width	Bore		AA	BL30°	BL45°	BR30°	BR45°	GE30°	GE45°	KE
No. 11	5/16	5/32	1/8	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	1/2	3/16	3/16	○	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	1/2	1/4	3/16	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	5/8	1/4	1/4	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	5/8	5/16	7/32	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	3/4	1/4	1/4	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	3/4	3/8	1/4	■	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	3/4	1/2	1/4	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	7/8	3/8	1/4	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	1	3/8	5/16	□	✓	✓	✓	✓	✓	✓	✓	☑
No. 11	1 1/4	1/2	1/2	□	✓	✓	✓	✓	✓	✓	✓	☑

Further dimensions and customized knurling wheels available on demand.

✓ = Stock item / immediate availability
☑ = Available on demand

	STANDARD PITCH SIZES / PROFILE ANGLE 90°	STANDARD PITCH SIZES / PROFILE ANGLE 70°	STANDARD PITCH SIZES / PROFILE ANGLE 80°
○	cp 20 / 25 / 30 / 32 / 35 / 41 / 47	cp 35 / 50 / 80	dp 96 / 128 / 160
■	cp 16 / 20 / 25 / 30 / 32 / 35 / 40 / 47	cp 35 / 50 / 80	dp 64 / 96 / 128 / 160
□	cp 16 / 24 / 29 / 33 / 40		
☑	On demand		

SPECIAL PITCHES

Further pitch sizes and customized knurling wheels available on demand.

ALTERNATIVE TYPES, INCH

Powder Metal (PM)

No.	Type
No. 13	milled, without chamfer
No. 30	ground, with chamfer
No. 32	ground, without chamfer

Carbide (HM)

No.	Type
No. 50	ground, with chamfer
No. 52	ground, without chamfer

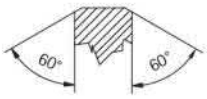
High Speed Automatic Steel (HSS)

No.	Type
No. 10	milled, with chamfer
No. 12	milled, without chamfer

Further versions available on demand.

PROTECTION CHAMFER

For form knurling applications in axial tool direction and big pitch sizes, a 60° chamfer on the knurling wheel might bring better results. The chamfer can support a better material flow.



Order No. PM = Nr. 95
Order No. HSS = Nr. 94

PVD-COATINGS

- TiN-coatings
- TiCN-coatings
- TiAlN-coatings
- TiAlCN-coatings

SPECIAL HEAT-TREATMENT

- TENIFER®-nitriding
- Defined hardness

SURFACE TREATMENT

- Polished knurling wheels

Otto Dieterle Spezialwerkzeuge GmbH,
Predigerstr. 56, 78628 Rottweil, Germany Tel.:+49(0) 741 94205-0 Fax:+49(0) 741 94205-50 info@dieterle-tools.com
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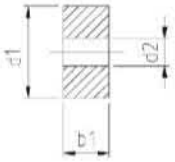
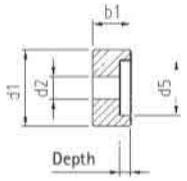
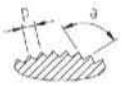
GV 30°

GV 45°

KV







KNURLING WHEELS WITH POINTS DOWN – WITH CHAMFER (45°) – METRIC – POWDER METAL, S590

Standard version	Dimension			Standard Pitch	Type		
	Diameter	Width	Bore		GV30°	GV45°	KV
No. 21	10	4	4	○	✓	✓	☑
No. 21	15	4	4	○	✓	✓	✓
No. 21	15	6	4	■	✓	✓	☑
No. 21	15	6	6/8	■	✓	✓	☑
No. 21	15	6	6/11	■	✓	✓	☑
No. 21	20	6	6	■	✓	✓	☑
No. 21	20	8	6	●	✓	✓	✓
No. 21	20	8	6/13	■	✓	✓	☑
No. 21	20	8	10/12	■	✓	✓	☑
No. 21	20	10	6	■	✓	✓	☑
No. 21	25	6	6	■	✓	✓	☑
No. 21	25	8	6	■	✓	✓	☑
No. 21	25	10	6	■	✓	✓	☑

Further dimensions and customized knurling wheels available on demand.

✓ = Stock item / immediate availability
☑ = Available on demand

STANDARD PITCH SIZES / PROFILE ANGLE 90°

●	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5 / 1,6 / 1,8 / 2,0
○	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5
■	0,6 / 0,8 / 1,0 / 1,2 / 1,5
□	0,6 / 0,8 / 1,0 / 1,2
☑	On demand

SPECIAL PITCHES

Further pitch sizes and customized knurling wheels available on demand.

ALTERNATIVE TYPES, METRIC

Powder Metal (PM)

No.	Type
No. 23	without chamfer

High Speed Automatic Steel (HSS)

No.	Type
No. 20	with chamfer
No. 22	without chamfer

Further versions available on demand.

PVD-COATINGS

- TiN-coatings
- TiCN-coatings
- TiAlN-coatings
- TiAlCN-coatings

SPECIAL HEAT-TREATMENT

- TENIFER®-nitriding
- Defined hardness

SURFACE TREATMENT

- Polished knurling wheels

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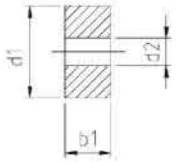
AA

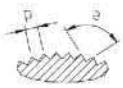

BL 15°


BL 30°


BR 15°


BR 30°





KNURLING WHEEL WITHOUT CHAMFER – METRIC – POWDER METAL, S590

Standard version	Dimension			Standard Pitch	Type				
	Diameter	Width	Bore		AA	BL30°	BL15°	BR30°	BR15°
No. 16	8,9	2,5	4	○	✓	✓	✓	✓	✓
No. 16	10	3	6	○	✓	✓	✓	✓	✓
No. 16	14,5	3	5	○	✓	✓	✓	✓	✓
No. 16	15	4	8	○	✓	✓	✓	✓	✓
No. 16	21,5	5	8	●	✓	✓	✓	✓	✓
No. 16	25	6	8	●	✓	✓	✓	✓	✓
No. 16	32	13	16	■	✓	✓	✓	✓	✓
No. 16	42	13	16	■	✓	✓	✓	✓	✓

Further dimensions and customized knurling wheels available on demand.

✓ = Stock item / immediate availability
☑ = Available on demand

STANDARD PITCH SIZES / PROFILE ANGLE 90°

●	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5 / 1,6 / 1,8 / 2,0
○	0,3 / 0,4 / 0,5 / 0,6 / 0,7 / 0,8 / 0,9 / 1,0 / 1,2 / 1,5
■	0,6 / 0,8 / 1,0 / 1,2 / 1,5
□	0,6 / 0,8 / 1,0 / 1,2
☑	On demand

SPECIAL PITCHES

Further pitch sizes and customized knurling wheels available on demand.

ALTERNATIVE TYPES, METRIC

Powder Metal (PM)

No.	Type
No. 18	milled, 10° chamfer
No. 35	ground, without chamfer
No. 37	ground, 10° chamfer

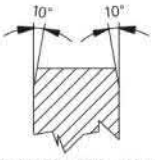
Carbide (HM)

No.	Type
No. 55	ground, without chamfer
No. 57	ground, 10° chamfer

High Speed Automatic Steel (HSS)

No.	Type
No. 15	milled, without chamfer
No. 17	milled, with chamfer

Further versions available on demand.



Order No. PM = Nr. 18
Order No. HSS = Nr. 17

PROTECTION CHAMFER

For cut knurling applications difficult to machine materials, a 10° chamfer on the knurling wheel might bring better results. The chamfer can prevent teeth breaking out.

PVD-COATINGS

- TiN-coatings
- TiCN-coatings
- TiAlN-coatings
- TiAlCN-coatings

SPECIAL HEAT-TREATMENT

- TENIFER®-nitriding
- Defined hardness

SURFACE TREATMENT

- Polished knurling wheels

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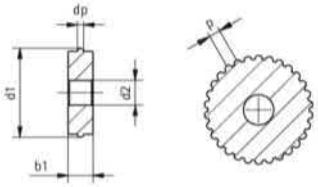
No. 60 – BEAD KNURLING WHEELS

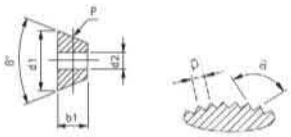
HE HHE HV HHV



Note: Please specify the bead diameter.

No. 70 – CONICAL KNURLING WHEELS

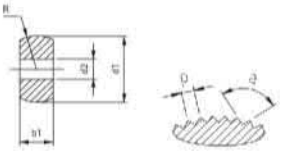
KAA KBL KBR KGE



Note: The completeness of the teeth numbers on the knurling wheel depends on the width/pitch of the knurl.

No. 80 – CONVEX / CONCAVE KNURLING WHEELS

C* DL 20° * DR 20° * E FL 20° * FR 20° *

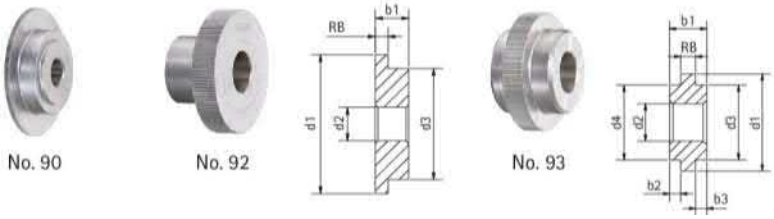


Model DL, DR, FL, FR: maximum 20° spiral angle

* With radius < 3 = formed version

With radius > 3 = milled version

No. 90, 92, 93 – SPECIAL KNURLING WHEELS



No. 90 No. 92 No. 93

The picture of knurling wheel No. 90 is only an example. No. 90 stands for all special designs, which are not covered by No. 92 and No. 93.

zeus® Burnishing rolls can be applied in a standard zeus® form knurling tool. If required, a customer specific bearing system can be developed and produced. These tool systems are suitable for processing cylindrical work pieces, bores, plane sides, conical work pieces and also convex and concave outlines.

RANGE OF APPLICATION:

zeus® Burnishing rolls are mainly used for roller-burnishing or supporting round material during machining on a lathe.

CHARACTERISTICS:

Material:	1.3343 HSS
Hardness:	61-63 HRC

ADVANTAGES:

- Burnished work pieces show less friction and increased corrosion resistance
- Subsequent-treatments like grinding, honing or lapping can be easily replaced through roller-burnishing processes
- When used as a supportive roll, the bearing axis and clamping devices are less stressed, and the pressure on the work piece is minimized

RESULT:

- Improved surface quality
- Increased size accuracy
- Strain hardening of the surface

TYPE RRA - CYLINDRICAL

Type	Dimension			Quality		
	Ø mm	Width mm	Bore mm	No. 04 turned & polished, Rz 4 µm	No. 05 ground, Rz 2-3 µm	No. 06 ground & polished, Rz 1 µm
RRA	10	4	4	✓	✓	✓
	15	4	4	✓	✓	✓
	20	8	6	✓	✓	✓
	25	8	6	✓	✓	✓

TYP RRE - KONVEX

Type	Dimension			R	Quality		
	Ø mm	Width mm	Bore mm		No. 04 turned & polished, Rz 4 µm	No. 05 ground, Rz 2-3 µm	No. 06 ground & polished, Rz 1 µm
RRE	10	4	4	2	✓	✓	✓
	15	4	4	2	✓	✓	✓
	20	8	6	6	✓	✓	✓
	25	8	6	6	✓	✓	✓

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REVOLVING SYSTEM – zeus® MARKING ROLL No. 40 / No. 40-A / No. 40-K

No. 40: for identical text

- The design is based on the diameter of the workpiece

Possible types of marking No. 40, No. 40-A, No. 40-K:

No. 40-A: exchangeable characters

No. 40-K: for marking of tapered workpieces and flat faces.

SPRING-RETURN SYSTEM – zeus® MARKING ROLL No. 41

- The design is independent of the workpiece diameter

Possible types of marking:

SPRING-RETURN SYSTEM – zeus® MARKING ROLL No. 42

- The design is independent of the workpiece diameter
- Exchangeable segments

Possible types of marking:

SPRING-RETURN SYSTEM – zeus® MARKING ROLL No. 43

- The design is independent of the workpiece diameter
- Exchangeable segments
- Marking up to a shoulder

Possible types of marking:

SPRING-RETURN SYSTEM – zeus® MARKING ROLL No. 44

- The design is independent of the workpiece diameter
- Marking up to a shoulder

Possible types of marking:

More information on page 47 (marking rolls) and in the catalogue zeus® Marking Technology.

ENGRAVING TECHNOLOGY

Stamping tools are essential in everyday industrial operations. Whether you stamp your product with a number, your logo or a decorative element – zeus® engraving technology will make it unmistakeably yours. We develop the customized solution for your requirements. As an essential quality criterion we offer you state-of-the-art heat and surface treatment, in addition to ultra-quality high-tech PVD coatings in our competence centre. This allows us to manufacture products with excellent material properties and above-average stability.

ROLLS / DRUMS:

- **Scribing rolls** Marking and labelling of turned parts.
- **Segment rolls** Marking and labelling of turned parts with flexibly replaceable text and symbol modules.
- **Embossing rolls** Embossing of bar stock.
- **Embossing drums** Embossing and printing of various materials, such as leather and textiles. Embossing drums are provided with raised or recessed lettering, as needed.

STAMPS:

- **Hand stamps** Marking of various materials for identification, numbering or decoration. The texts/symbols are applied in mirror image and are then legible after being stamped into the material.
- **Machine stamps** In comparison with hand stamps, the machine stamps are designed on the shank end with a journal or threads for mounting on the machine. Our machine stamps are hardened and tempered to suit the application.
- **Segment stamps** Labelling with variable segments, which you can combine/supplement as needed.
- **Embossing stamps** Individual marking of your products by cold or warm stamping.

EMBOSSING DIES:

- **Blind and relief stamps** Surface embossing of various materials for the final touch. Our blind and relief stamps will give your paper, cardboard, leather or wood products that something extra to make them stand apart.
- **Sheet metal stamps** The sheet metal stamp consists of a top and bottom die and is suitable for raised or recessed embossing of sheet metal.
- **Printing plates** Printing plates or paper embossing tools made of brass for finishing your products. Give your high-quality packages/products an exquisite finish. We manufacture printing plates and embossing tools that are exactly customized for your requirements.

SPECIAL ENGRAVING:

For marking of complex surfaces we will be glad to develop an individual solution. Based on your data and drawings we will develop and deliver the right tool, also for exceptionally complex applications.

More information in the catalogue zeus® Marking Technology.

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TECHNICAL APPENDIX

CONTENT

- MATERIAL DISPLACEMENT
- SPEED / FEED RATES
- KNURLING OPTIMIZATION
- CONVERSION TABLE
- INFLUENCING FACTORS

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Our experience values for the increase in work piece diameter through form knurling

Knurling profile according to DIN 82: RAA (Profile on work piece)
Knurling wheels according to DIN 403: AA (Profile for knurling wheels)


RAA

Pitch		0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,2	1,5	1,6	1,8	2,0
Material	Work piece-Ø	Increase in work piece diameter-ø in mm												
Free-cutting Steel	5	0,08	0,14	0,18	0,22	0,27	0,29	0,33	0,35	0,50	-	-	-	-
	15	0,08	0,14	0,18	0,23	0,30	0,40	0,41	0,44	0,50	0,60	0,65	0,67	0,70
	25	0,08	0,15	0,23	0,24	0,28	0,35	0,38	0,44	0,53	0,62	0,70	0,70	0,98
Stainless Steel	5	0,10	0,15	0,20	0,25	0,28	0,30	0,35	0,42	0,41	-	-	-	-
	15	0,10	0,15	0,19	0,25	0,30	0,34	0,40	0,45	0,51	0,60	-	-	-
	25	0,10	0,14	0,20	0,26	0,31	0,33	0,38	0,43	0,50	0,62	-	-	-
Brass	5	0,08	0,12	0,18	0,20	0,21	0,22	0,23	0,25	0,28	-	-	-	-
	15	0,10	0,14	0,20	0,26	0,28	0,29	0,31	0,35	0,41	0,44	0,48	0,50	0,55
	25	0,10	0,15	0,20	0,25	0,28	0,30	0,32	0,36	0,43	0,46	0,50	0,53	0,53
Aluminium	5	0,09	0,15	0,19	0,23	0,28	0,30	0,34	0,41	0,40	-	-	-	-
	15	0,10	0,15	0,19	0,26	0,29	0,33	0,39	0,45	0,51	0,57	0,65	-	-
	25	0,09	0,15	0,19	0,26	0,29	0,32	0,37	0,45	0,52	0,59	0,65	0,78	0,75

Knurling profile according to DIN 82: RBL 30°/RBR 30° (Profile on work piece)
Knurling wheels according to DIN 403: BR 30°/BL 30° (Profile for knurling wheels)


RBL 30°


RBR 30°

Pitch		0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,2	1,5	1,6	1,8	2,0
Material	Work piece-Ø	Increase in work piece diameter-ø in mm												
Free-cutting Steel	5	0,11	0,15	0,20	0,24	0,28	0,34	0,38	0,45	0,55	-	-	-	-
	15	0,11	0,15	0,22	0,26	0,30	0,35	0,42	0,45	0,52	0,67	0,73	0,75	0,85
	25	0,11	0,14	0,23	0,25	0,28	0,36	0,42	0,45	0,56	0,70	0,72	0,78	0,90
Stainless Steel	5	0,09	0,14	0,19	0,25	0,31	0,34	0,39	0,45	0,52	-	-	-	-
	15	0,12	0,20	0,23	0,31	0,35	0,40	0,45	0,51	0,62	0,66	0,73	0,85	0,97
	25	0,12	0,18	0,24	0,27	0,37	0,39	0,43	0,49	0,59	0,80	0,84	0,93	0,96
Brass	5	0,10	0,14	0,20	0,23	0,24	0,28	0,30	0,33	0,37	-	-	-	-
	15	0,10	0,15	0,21	0,23	0,24	0,31	0,36	0,41	0,47	0,53	0,55	0,64	0,63
	25	0,11	0,15	0,22	0,22	0,25	0,30	0,35	0,40	0,45	0,55	0,61	0,62	0,68
Aluminium	5	0,12	0,14	0,21	0,24	0,29	0,34	0,39	0,41	0,51	-	-	-	-
	15	0,12	0,18	0,23	0,26	0,36	0,40	0,43	0,50	0,56	0,56	0,61	0,74	0,75
	25	0,12	0,16	0,25	0,28	0,37	0,39	0,46	0,50	0,58	0,77	0,82	0,84	0,96

Knurling profile according to DIN 82: RGE 30° (Profile on work piece)
Knurling wheels according to DIN 403: BR 30° + BL 30° (Profile for knurling wheels)


RGE 30°

Pitch		0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	1,2	1,5	1,6	1,8	2,0
Material	Work piece-Ø	Increase in work piece diameter-ø in mm												
Free-cutting Steel	5	0,12	0,16	0,20	0,25	0,33	0,41	0,45	0,55	0,65	-	-	-	-
	15	0,13	0,22	0,30	0,32	0,35	0,41	0,43	0,52	0,62	0,67	0,81	0,86	0,95
	25	0,12	0,18	0,28	0,32	0,35	0,38	0,43	0,55	0,67	0,77	0,87	0,98	0,98
Stainless Steel	5	0,11	0,20	0,25	0,30	0,36	0,39	0,41	0,55	0,55	-	-	-	-
	15	0,10	0,14	0,21	0,24	0,29	0,34	0,40	0,43	0,53	0,66	0,72	0,70	0,88
	25	0,11	0,13	0,20	0,25	0,28	0,32	0,41	0,44	0,52	0,67	0,70	0,71	0,83
Brass	5	0,12	0,13	0,16	0,20	0,24	0,28	0,30	0,32	0,38	-	-	-	-
	15	0,12	0,16	0,18	0,24	0,28	0,30	0,37	0,39	0,40	0,48	0,52	0,55	0,63
	25	0,12	0,17	0,22	0,23	0,27	0,30	0,34	0,38	0,41	0,48	0,50	0,63	0,63
Aluminium	5	0,10	0,15	0,21	0,25	0,33	0,36	0,41	0,50	0,57	-	-	-	-
	15	0,11	0,14	0,20	0,25	0,28	0,33	0,39	0,43	0,54	0,67	0,71	0,76	0,89
	25	0,11	0,15	0,22	0,25	0,29	0,34	0,40	0,44	0,53	0,68	0,69	0,71	0,88

Note: These values are guidelines only. Minor deviations may occur depending on material. Applies only to form knurling.

Wichtiger Hinweis: Diese Angaben sind Erfahrungswerte. Abweichungen in Abhangigkeit vom Material sind moglich.

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Cut Knurling – Swarf removal

Material	Work piece-Ø	Knurling wheel-Ø [mm]	Vc [m/min]		f [mm/U]					
					Radial		Axial			
							Pitch			
			from	to	from	to	> 0,3 < 0,5	> 0,5 < 1,0	> 1,0 < 1,5	> 1,5 < 2,0
Free-cutting steel	< 10	10 / 15	40	70	0,04	0,08	0,14	0,09	0,06	0,05
	10 - 40	15 / 25	50	90	0,05	0,10	0,20	0,13	0,10	0,07
	40 - 100	25 / 32 / 42	65	110	0,05	0,10	0,25	0,18	0,12	0,08
	100 - 250	25 / 32 / 42	65	110	0,05	0,10	0,30	0,20	0,13	0,09
	> 250	32 / 42	80	100	0,05	0,10	0,32	0,21	0,14	0,10
Stainless steel	< 10	10 / 15	22	40	0,04	0,08	0,12	0,08	0,05	0,04
	10 - 40	15 / 25	30	50	0,05	0,10	0,17	0,11	0,09	0,06
	40 - 100	25 / 32 / 42	35	60	0,05	0,10	0,21	0,15	0,10	0,07
	100 - 250	25 / 32 / 42	35	60	0,05	0,10	0,26	0,17	0,11	0,08
	> 250	32 / 42	45	55	0,05	0,10	0,27	0,18	0,12	0,09
Brass	< 10	10 / 15	55	100	0,04	0,08	0,15	0,09	0,06	0,05
	10 - 40	15 / 25	70	125	0,05	0,10	0,21	0,14	0,11	0,07
	40 - 100	25 / 32 / 42	90	155	0,05	0,10	0,26	0,19	0,13	0,08
	100 - 250	25 / 32 / 42	90	155	0,05	0,10	0,32	0,21	0,14	0,09
	> 250	32 / 42	115	140	0,05	0,10	0,34	0,22	0,15	0,11
Aluminium	< 10	10 / 15	70	120	0,04	0,08	0,18	0,11	0,08	0,06
	10 - 40	15 / 25	80	150	0,05	0,10	0,25	0,16	0,13	0,09
	40 - 100	25 / 32 / 42	110	160	0,05	0,10	0,31	0,23	0,15	0,10
	100 - 250	25 / 32 / 42	110	160	0,05	0,10	0,38	0,25	0,16	0,11
	> 250	32 / 42	130	150	0,05	0,10	0,40	0,26	0,18	0,13

Form Knurling – non-cutting forming

Material	Work piece-Ø	Knurling wheel-Ø [mm]	Vc [m/min]		f [mm/U]					
					Radial		Axial			
							Pitch			
			from	to	from	to	> 0,3 < 0,5	> 0,5 < 1,0	> 1,0 < 1,5	> 1,5 < 2,0
Free-cutting steel	< 10	10 / 15	20	50	0,04	0,08	0,20	0,13	0,08	0,07
	10 - 40	15 / 20	25	55	0,05	0,10	0,28	0,18	0,14	0,10
	40 - 100	20 / 25	30	60	0,05	0,10	0,35	0,25	0,17	0,11
	100 - 250	20 / 25	30	60	0,05	0,10	0,42	0,28	0,18	0,13
	> 250	25	30	60	0,05	0,10	0,45	0,29	0,20	0,14
Stainless steell	< 10	10 / 15	15	40	0,04	0,08	0,14	0,09	0,06	0,05
	10 - 40	15 / 20	20	50	0,05	0,10	0,20	0,13	0,10	0,07
	40 - 100	20 / 25	25	50	0,05	0,10	0,25	0,18	0,12	0,08
	100 - 250	20 / 25	25	50	0,05	0,10	0,29	0,20	0,13	0,09
	> 250	25	25	50	0,05	0,10	0,31	0,21	0,14	0,10
Brass	< 10	10 / 15	30	75	0,04	0,08	0,22	0,14	0,09	0,08
	10 - 40	15 / 20	40	85	0,05	0,10	0,31	0,20	0,15	0,11
	40 - 100	20 / 25	45	90	0,05	0,10	0,39	0,28	0,18	0,12
	100 - 250	20 / 25	45	90	0,05	0,10	0,46	0,31	0,20	0,14
	> 250	25	45	90	0,05	0,10	0,49	0,32	0,22	0,15
Aluminium	< 10	10 / 15	25	60	0,04	0,08	0,12	0,08	0,05	0,04
	10 - 40	15 / 20	30	65	0,05	0,10	0,17	0,11	0,08	0,06
	40 - 100	20 / 25	35	70	0,05	0,10	0,21	0,15	0,10	0,07
	100 - 250	20 / 25	35	70	0,05	0,10	0,25	0,17	0,11	0,08
	> 250	25	35	70	0,05	0,10	0,27	0,18	0,12	

Note: These values are approximate values only.
Sufficient cooling and lubrication is necessary to prevent chips from being rolled in and to increase tool life of knurling wheels.

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KNURLING OPTIMIZATION

The exact relation of the number of teeth to work piece circumference is a significant factor influencing the knurling result and tool life. For many end-users this factor is more or less unknown and is therefore often neglected when it comes down to knurling optimization methods. In practice it is a common mistake to determining the pitch without considering the dependence of the work piece circumference. The consequences on the knurling result and tool life can be considerable, though. The following discussion explains the context between pitch and work piece circumference and provides systematic proceedings for optimization of the knurling profile.

1. The relation between number of teeth and work piece circumference is almost exact

In many cases, the end-user does not notice much of the issue discussed, as the relation between number of teeth and work piece diameter is already sufficiently exact. In this case, the knurling wheel is able to equalize the deformation of the pitch, so that a clean profile can be produced **(see also figure 1).**

2. The relation between number of teeth and work piece circumference is not optimal

With an increasing imbalance of the relation between number of teeth and work piece circumference, the knurling wheel has to equalize the imbalance. As a result the quality of the knurling profile is diminished and the tool life is decreased.

The effects of this process for the two different knurling techniques can be summarized as follows:

Form Knurling:
Here, the deformation process (as the material is compressed during forming) leads to a rough surface and a decrease in tool life. Through the deterioration of the penetration process, material abrasion occurs, which is consequently formed into the material. A distortion of the knurling profile takes place, which is recognizable as a flatter profile and a rounding off of the teeth tips **(see also figure 2).**

Cut Knurling:
The deterioration of the penetration process leads to unclean profile flanks. A distorted knurling profile results, recognizable from the flattening of the profile and the rounding in the tooth form / the teeth tips **(see also figure 2).**

3. The relation between number of teeth and work piece circumference is insufficient

If the relation between number of teeth and work piece circumference is insufficiently precise, the knurling wheel can no longer equalize the imbalance resulting in a deformation of the profile.

In the worst case, a double knurl might arise as a consequence, as the knurling wheel does not return exactly into the knurling profile after the first work piece rotation. The problem can also be recognized from the finer pitch of the knurling profile **(see also figure 3).**

Figure 1:
Optimal knurling profile

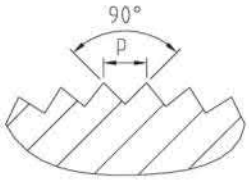


Figure 2:
Distorted knurling profile

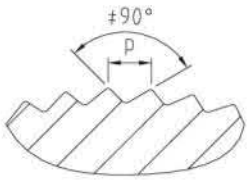
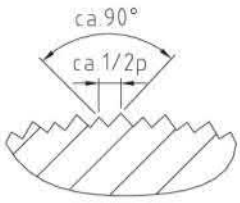


Figure 3:
Double knurling profile



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KNURLING OPTIMIZATION

An optimization of the knurling profile can take place through adjustment of either the pre-turning diameter or the pitch. Both optimization methods can result in a better knurling quality and an increased tool life.

A systematic optimization approach includes the following steps:

→ Correction of the pre-turning diameter until an optimum knurl quality is achieved.

Note:
Even a small change of less than 1/100 mm of the pre-turning diameter affects the work piece circumference considerably {factor π (x 3,14...)} and can lead to a significant improvement of the knurling quality.

If a correction of the pre-turning diameter is not possible because tolerances cannot be kept:

→ Adjust pitch size

If the pitch cannot be adjusted, the manufacture of a special wheel with a predefined pitch (defined number of teeth / work piece outer diameter) is necessary.

The Hommel + Keller application technicians will give the necessary advice and consultation by means of a work piece drawing and the machine specifications. The calculation of the optimum number of teeth takes place on the basis of approximation formulas. Due to a number of influencing variables, such as material characteristics, a further optimization approach might involve an application specific test series.

Summary:

The customer requirements are:

- A clean, fully formed knurling profile
- Fully formed teeth
- No double knurling profile
- Work piece with defined number of teeth

Solutions:

1) Optimization measures by end-user:

1.1 Correction of pre-turning diameter
1.2 Adjustment of pitch

2) Optimization measures by Hommel + Keller Präzisionswerkzeuge GmbH:

Optimization through design of a special knurling wheel: By calculating the number of teeth, the knurling wheel is adjusted to the specific application through an optimum relation between diameter and teeth number. With this approach knurling wheels with a defined number of teeth can also be manufactured.

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Converting pitch mm in CP (TPI) / CP (TPI) in mm

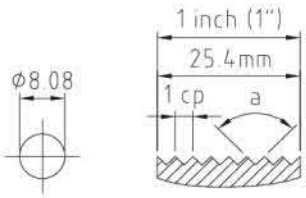
CP (TPI) = Circular Pitch (Teeth Per Inch)
This standard specifies the number of teeth on a length of 1 inch (1"~25,4 mm).
The CP (TPI) is calculated by dividing 1 inch through the number of teeth.
The profile angle is determined according to the number of teeth with either 70° or 90°.

Arithmetic example:
Pitch = 0,6 mm
cp (TPI) = 1 inch (~ 25,4 mm) : 0,6 = 42,3

Pitch (mm)	Profile angle	CP (TPI) Circular Pitch (Teeth Per Inch)*
0,3	90°	85
0,4	90°	64
0,5	90°	51
0,6	90°	42
0,7	90°	36
0,8	90°	32
0,9	90°	28
1,0	90°	25
1,2	90°	21
1,5	90°	17
1,6	90°	16
1,8	90°	14
2,0	90°	13

* Values are rounded off.

Calculating formula:
cp (TPI) = 1 inch (~25,4 mm) : Pitch (mm)



CP (TPI) Circular Pitch (Teeth Per Inch)	Profile angle	Pitch (mm)**
cp8	90°	3,18
cp10	90°	2,54
cp12	90°	2,11
cp14	90°	1,81
cp16	90°	1,59
cp18	90°	1,41
cp19	90°	1,34
cp20	90°	1,27
cp21	90°	1,21
cp24	90°	1,06
cp25	90°	1,02
cp29	90°	0,88
cp30	90°	0,85
cp32	90°	0,79
cp33	90°	0,77
cp35	70°/90°	0,73
cp40	70°/90°	0,64
cp41	90°	0,62
cp47	90°	0,54
cp50	70°	0,51
cp60	70°	0,42
cp70	70°	0,36
cp80	70°	0,32
cp90	70°	0,28
cp100	70°	0,25
dp64	80°	1,25
dp96	80°	0,83
dp128	80°	0,62
dp160	80°	0,50

* Values are rounded off from the 2. decimal place.

Calculating formula:
for cp: Pitch (mm) = 1 inch (25,4 mm) : cp (TPI)
for dp: Pitch (mm) = 1 inch (25,4 mm) x π : dp

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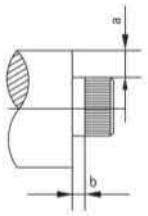
Distance dimension / Clearance groove
Cut Knurling

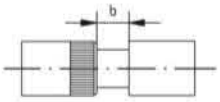
Minimum distance towards work piece shoulder
Due to the inclination of the cut knurling head (30°) and the overhang of the washer, it is not possible to knurl up to a shoulder with a cut knurling tool.

Please adhere to the minimum distance values given in the table
a = increase in shoulder (mm)
b = minimum distance (ø) in mm



Measure "a"	b (10x3x6)	b (15x4x8)	b (25x6x8)	b (42x13x16)
1	2	1,5	2	3
3	2,5	3,5	3	5
5	3	6	5	7
7			8	9
10				12
12				13

Minimum width of groove
In order to start the knurling profile in the middle of the work piece, a groove is required (knurling wheel requires a chamfer for centering).
Minimum depth of groove: ½ pitch +0,3 mm



Dimensions knurling wheel	10x3x6	15x4x8	26x6x8	42x13x6
Minimum width of groove [b]	3 mm	4 mm	6,5 mm	14 mm

Factors influencing profile quality and process rigidity for knurling applications

For a high quality and functionally immaculate knurling profile, there are a number of factors that should be considered and if necessary improved in order to optimize the overall end-result:

Tool characteristics	**Quality and specification of the knurling wheel**	Knurling wheel width		
		Knurling wheel with chamfer		
		Material characteristics	Material of the knurling wheel	
			Hardness of the knurling wheel	
			After-treatment	PVD-coating
				TENIFER®-TREATMENT
		Precision	Truth of running	
			Concentricity	
			Profile characteristics	Sharpness of the tooth tips
				Radius in the tooth depth
				Profile angle
	Type of knurling tool	**Applied knurling technique**	**Form knurling**	Plunge knurling
				Feed knurling
				Plunge and feed knurling
			Cut knurling	
		Quality and condition of the knurling pin / run disk		
		Stability / no vibrations		
		Precision		
Machine characteristics	Precision			
	Stability / no vibrations			
Characteristics of the material processed	Hardness			
	Toughness			
Application specific characteristics	Speed rate	Feed rate		
	Plunge depth	Speed rate		
	Cooling / Lubrication			
	Clearance angle			
	Quality of the gearing	Pre-turning diameter		
		Pitch / Number of teeth		
		Material displacement		

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