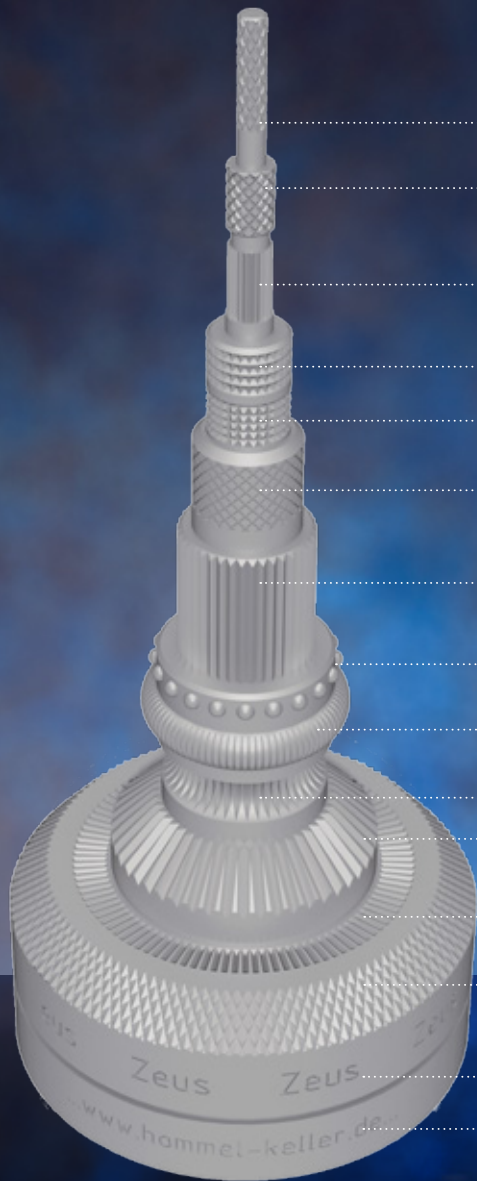


## Our product range

offers tool solutions for the diverse applications of knurling technology. In addition to standard profiles, zeus knurling tools can also be used to manufacture conical, convex, concave and special profiles (e.g. bead knurling).

The example below shows the most important manufacturing applications.



Application	Profile (DIN 82) Marking	Tool Examples	Knurling wheels/ marking rolls
Cut knurling, axial	RGE30°	291	3 x AA
Cut knurling, axial	RGE45°	241	1 x BL15° 1 x BR15°
Cut knurling, axial	RAA	231	1 x BR30°
Form knurling, radial	RKV	132	1 x KE
Form knurling, radial	RKE	131	1 x KV
Form knurling, radial	RGE45°	141	1 x BL45° 1 x BR45°
Form knurling, radial + axial up to a shoulder	RAA	162	2 x AA
Form knurling, radial	RHE	131	1 x HV
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-face	311	1 x AA
Form knurling	RKGV	311	1 x KGE
Continuous roll marking	zeus	130	40 W
Spring return marking	hommel+keller.de	431	41 W

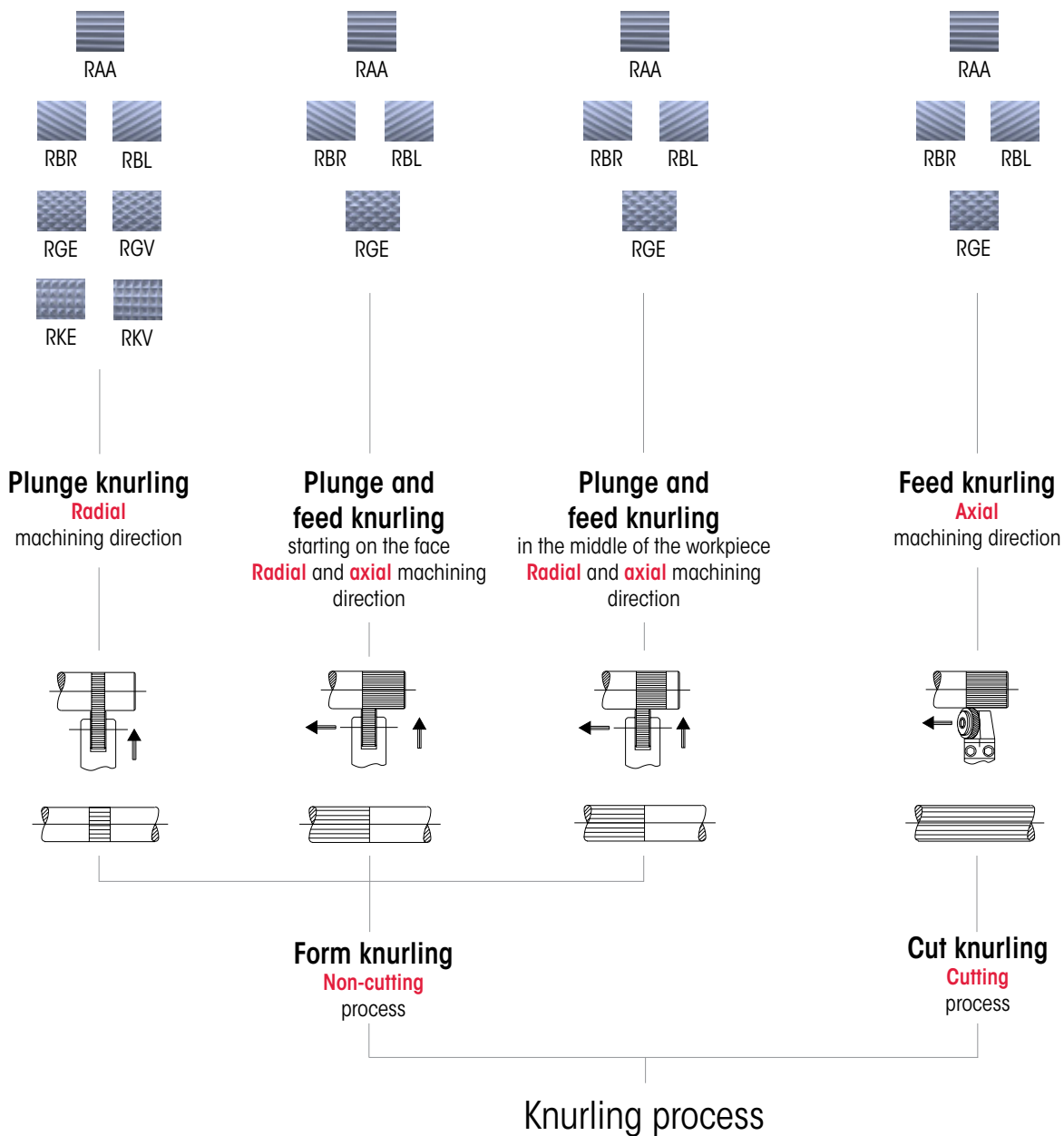
# Knurling process

Knurling technology is divided into two processes: form knurling and cut knurling. Both processes have their special applications and areas of utilisation.

A basic difference in the two marking technologies is the possible direction of machining and the capability of manufacturing knurling profiles on the workpiece.

For more details on manufacturing the individual profiles see the tool view.


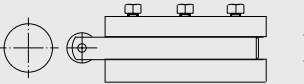
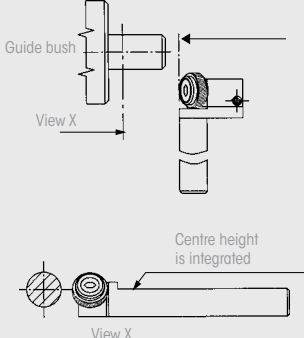
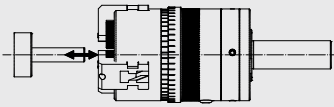
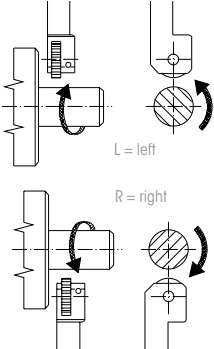
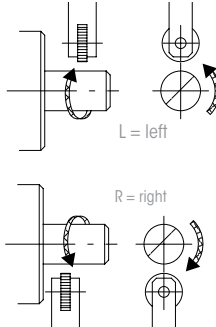
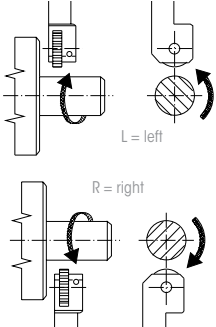
## Possible knurling profiles on the workpiece



# Tool characteristics



## Different characteristics based on machine types and machine properties

Knurling tools for CNC lathes/ automatic lathes	Knurling tools for conventional lathes/ automatic lathes	Knurling tools for Swiss-type lathes/ automatic lathes	Knurling tools for axial machining
<p>The knurling tools for CNC lathes/automatic lathes features an integrated centre height (centre height = top edge of shank). This makes it possible to use them in CNC lathes/automatic lathes without the capability of adjustment (fixed tool holder) of the centre height. In general, these knurling tool series are also suitable for conventional lathes/automatic lathes as long as the centre height can be adjusted on the machine.</p>	<p>Knurling tools from zeus for conventional machine types are designed so that the centre height must be adjusted by the tool holder in the machine. This results in a simplified design of these knurling tools.</p>	<p>In the case of knurling tools that are suitable for Swiss-type lathes/automatic lathes, the knurling wheel must not protrude beyond the front edge of the shank, in order to prevent collision with the guide bush. Most knurling tools with a shank height of 10–16 mm are suitable for Swiss-type lathes/automatic lathes. In general, they can also be used in CNC lathes and conventional lathes/automatic lathes.</p>	<p>Knurling tools for axial machining of the workpiece can be clamped axially to the workpiece on all conventional and CNC lathes/automatic lathes with a tailstock. Machining takes place by means of a rotating workpiece in a stationary tool that is mounted in the tailpiece.</p> <p>On rotary indexing machines, indexing tables and automatic transfer machines, a stationary workpiece is machined by means of an axially rotating tool.</p>
<p>The tool holder is not height adjustable. The centre height is integrated in the tool.</p> 	<p>The tool holder is adjustable. The centre height of the tool must be adjusted.</p> 		
<p>The zeus product range includes special versions for (R) right- and (L) left-oriented lathes/automatic lathes. If the construction allows, zeus knurling tools are available in a modular (M) or universal (U) design. The (M) versions can be converted from counterclockwise to clockwise rotation by simply turning the knurling head. The (U) versions can be used for both clockwise and counterclockwise rotation without conversion.</p> 	<p>Knurling tools from zeus for conventional machine types are designed for universal use and can therefore be used with both clockwise and counterclockwise rotation.</p> 	<p>In the case of Swiss-type lathes/automatic lathes the knurling wheel should be positioned as close to the workpiece clamping as possible to allow machining of workpieces with small diameters. The knurling wheels of the zeus RD1 and RD2 series with shank dimensions of 10 x 10 to 16 x 16 are therefore offset instead of centred.</p> 	<p>Machining possibilities:</p> <ul style="list-style-type: none"> <li>• Tool is stationary</li> <li>• Workpiece rotates</li> <li>• Direction of rotation is universal</li> </ul> <ul style="list-style-type: none"> <li>• Tool rotates</li> <li>• Workpiece is stationary</li> <li>• Direction of rotation is universal</li> </ul>

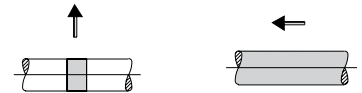
# Tool selection

## Symbols:

- LD** = Swiss-type lathes (CNC/conventional)
- KD** = Automatic-short-turning lathes/universal lathes/ turning/ milling centres (CNC/conventional)
- MS** = Multi-spindle lathes (CNC/conventional)
- RT** = Rotary indexing machines/indexing tables/ automatic transfer machines
- x** = Process is not possible with this application
- ▲** = Length of knurling is limited
- \*** = For cut knurling RBR/RBL possible only to a limited extent

## Explanation of arrows:

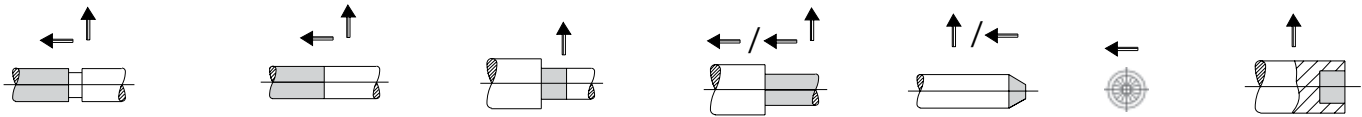
- ↑ Knurl can be manufactured in radial direction (plunge knurling)
- ← Knurl can be manufactured only in axial direction (feed knurling)
- ↔ Knurl can be manufactured in both axial and radial direction



Knurling profile (DIN 82)	Manufacturing process		Machine type	Knurling on workpiece centre/ without plunge cut	Knurling starting at workpiece beginning	
	Form knurling	Cut knurling				
<b>RAA knurl</b> 			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	X	192▲ / 391	
				LD	X	231
				KD		231
				MS		231
				RT		X
<b>RBL left-hand knurl</b> 			LD	130 / 131 / 141 / 161	130 / 131	
			KD	130 / 131 / 141 / 161	130 / 131	
			MS	130 / 131 / 141 / 161	130 / 131	
			RT	X	130 / 131	
				LD	X	231*
				KD		231*
				MS		231*
				RT		X
<b>RBR right-hand knurl</b> 			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	X	231*
				KD		231*
				MS		231*
				RT		X
<b>RGE left/right-hand knurl/ raised points/30°</b> 			LD	130 / 131 / 132 / 161	X	
			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	X	241 / 291▲
				KD		241 / 291▲
				MS		241 / 291▲
				RT		291▲
<b>RGV left/right-hand knurl/ lowered points/30°</b> 			LD	130 / 131	RGV: only plunge knurling possible	
			KD	130 / 131		
			MS	130 / 131		
			RT			
<b>RKE cross knurl/ raised points/90°</b> 			LD	130 / 131	RKE: only plunge knurling possible	
			KD	130 / 131		
			MS	130 / 131		
			RT			
<b>RKV cross knurl/ lowered points/90°</b> 			LD	130 / 131	RKV: only plunge knurling possible	
			KD	130 / 131		
			MS	130 / 131		
			RT			

This matrix provides you with a selection of tool series that can be used for your application. You can use the table to define the profile, process and machine type.

Then you can choose the application based on the pictograms. Starting on page 9 you will find details of the products and tool features.



Knurling starting in centre of workpiece/ after plunge cut	Knurling starting in centre of workpiece/ without plunge cut	Knurling up to a shoulder	Knurling starting at workpiece beginning up to a shoulder	Conical knurling	Knurling on the front face	Knurling in a bore
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
X	X	X	162 ▲ / 192 ▲	X	X	330 / 332
231						
231						
231	X	X	X	X	X	X
X						
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
X	X	X	162 ▲ / 192 ▲	X	X	X
231*						
231*	X	X	X	X	X	X
231*						
X						
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*						
231*	X	X	X	X	X	X
231*						
X						
X	only plunge knurling possible	132	132	X	X	X
		132	132			
		132	132			
		X	162 ▲			
141 / 161	141 / 161	142	141 / 162 ▲ / 192 ▲	161 / 162	X	340 / 342
141 / 161	141 / 161	142	141 / 162 ▲ / 192 ▲	161 / 162		340 / 342
141 / 161	141 / 161	142	141 / 162 ▲ / 192 ▲	161 / 162		340 / 342
X	X	X	162 ▲ / 192 ▲	161 / 162		X
241						
241						
241	X	X	X	X	X	X
X						
RGV: only plunge knurling possible	RGV: only plunge knurling possible	132	RGV: only plunge knurling possible	311 / 312	311 / 312	330 / 332
		132		311 / 312	311 / 312	330 / 332
		132		311 / 312	311 / 312	330 / 332
		X		311 / 312	X	330 / 332
RKE: only plunge knurling possible	RKE: only plunge knurling possible	132	RKE: only plunge knurling possible	X	X	330 / 332
		132				330 / 332
		132				330 / 332
		X				330 / 332
RKV: only plunge knurling possible	RKV: only plunge knurling possible	132	RKV: only plunge knurling possible	X	X	330 / 332
		132				330 / 332
		132				330 / 332
		X				330 / 332