

Jongen Werkzeugtechnik

# The Step Milling System

## FP 49

Depth of Cut  
 $a_p$  = up to 17 mm  
possible!



## THE TOOL

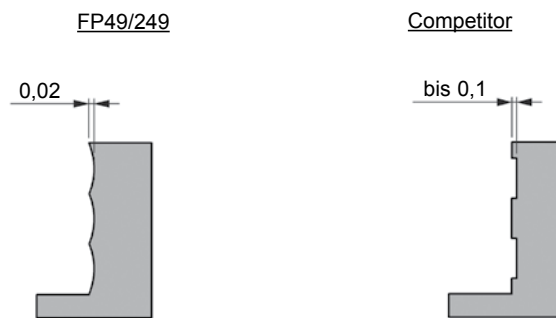
☞ New step milling programme ensure a smooth running of the machines, with highest productivity and precision

## CHARACTERISTICS

Multi-functional step-, slot- and contour milling

☞ The positive cutting geometry allows a smooth running with lowest vibrations rate

☞ Almost step-free milling can be obtained



No visible edges with milling up to ap approx. 10 mm

☞ The different tool versions shank-, screw-in-, shell- and multi-tooth milling cutters and cassette holders, allow almost all usual milling operations



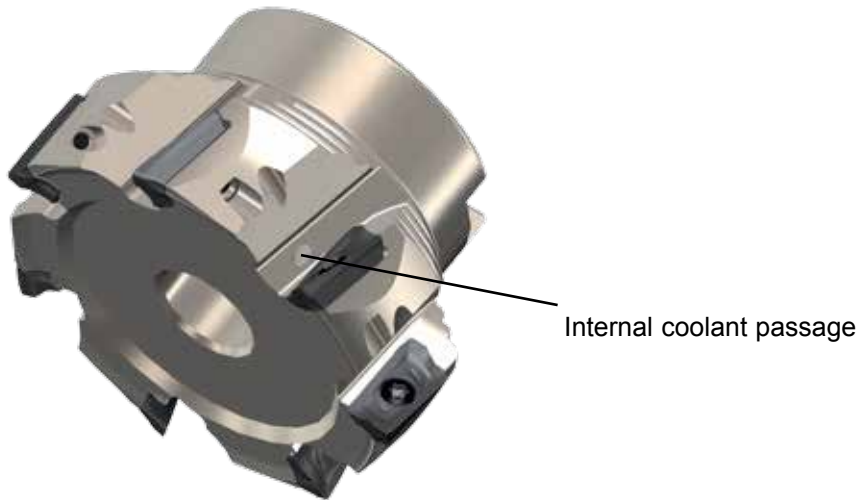
The different available versions are:

- Shell type cutters with normal and close tooth pitch, with diameter range 40-160mm
- Shank type milling cutters made to DIN1835-B, normal and close tooth pitch, diameters 25-40mm
- Shank type milling cutters made to DIN1835-A, long version, diameter 25-40mm
- Screw-in milling cutters for machining big cavities, diameters 25-40 mm
- Multi-tooth milling cutters made to DIN1835-B, diameters 32+40mm
- Multi-tooth milling cutters with crosswise slot, made to DIN8030-A, diameters 50-80mm
- Cassettes for our milling heads with diameters 80-312mm

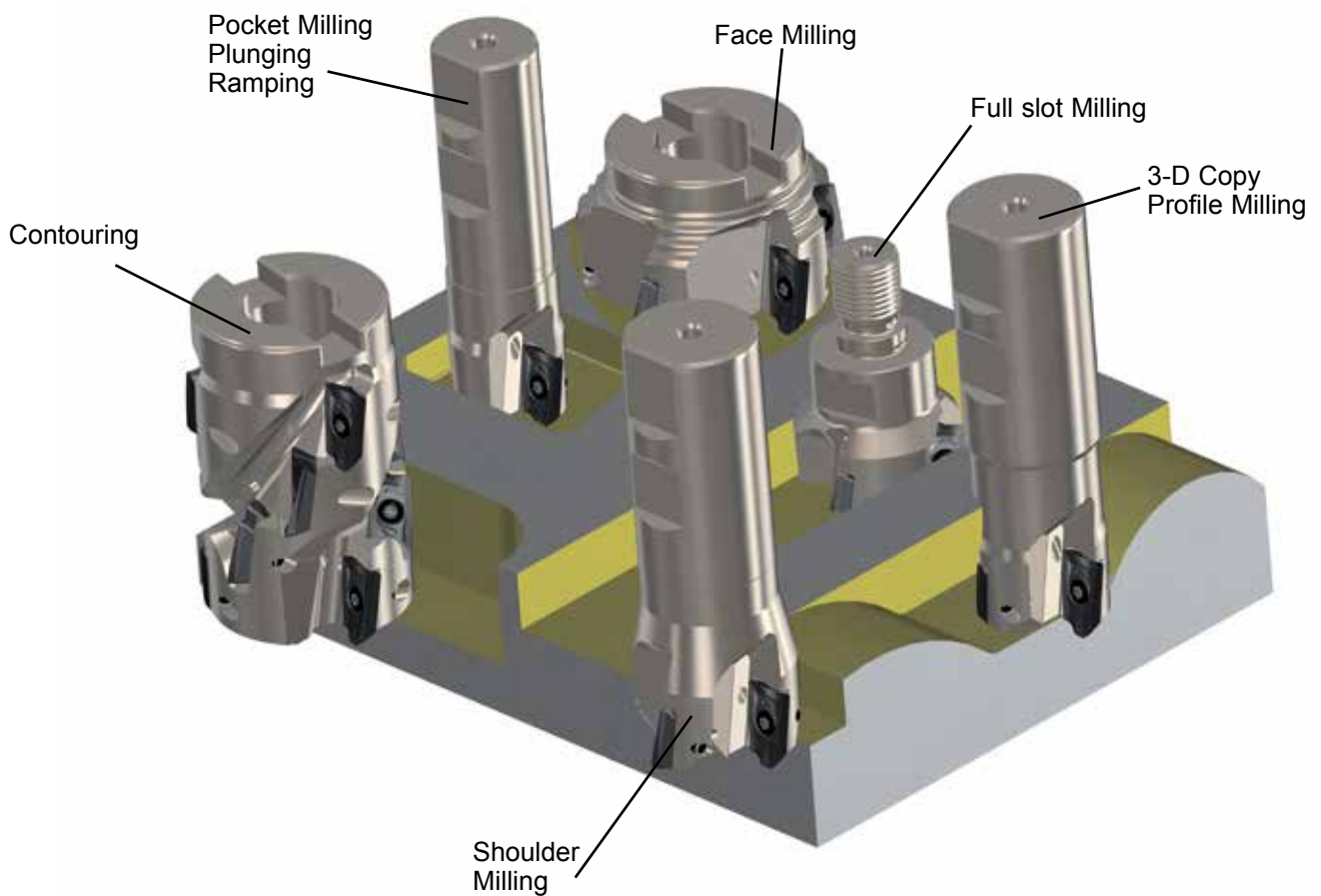
☞ Different numbers of teeth ensure almost all milling applications, in terms of roughing, finishing, big cavities etc.



☞ All tools include internal coolant passages



## APPLICATION AREAS

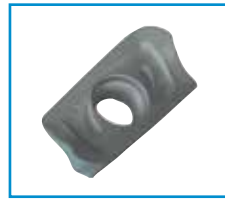


## THE INSERT

- ☞ 2-edge step milling insert that allows a depth of cut of up to 17 mm ( $a_p = 17$  mm max.).
- ☞ Precision sintered inserts type FP 49 with edge radii 1,0 – 1,6 – 2,0 – 3,2 as well as completely precision ground inserts type FP 249 with edge radius 1,0 are available.

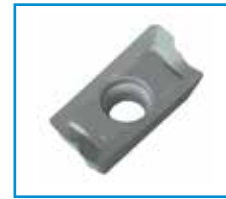


FP 49 R1,0



FP 49 R3,2

Precision sintered version



FP 249 R1,0

Completely precision ground Version

- ☞ The cutting geometry and the stable cutting edges illustrate focal insert features.
- ☞ Different carbide qualities are available for processing all usual materials.

Following carbide qualities are offered:

### HT45



#### Code 31 , Iso-Classifizierung P30-35

Very tough fine grain carbide with an AlTiN- Nanocomposit-coating for middle to high cutting speeds with high feed rates. This quality is suitable for dry milling and can also be adopted with cooling. Application areas are roughing and finishing of almost all steels and cast iron qualities such as: structural steel, tool steel, heat-treatable steel as well as unalloyed steel, low alloyed steel, high alloyed steel and also grey cast iron, globular graphite cast iron etc.

### HT32



#### Code 33 , Iso-Classifizierung M20-M30

Hard wearing and tough finest grain carbide with an AlTiN- Nanocomposit-coating for medium to high cutting speeds and middle feed rates. This quality is equally applicable for dry as well as wet milling. It is especially suited for processing stainless steel, tool steel as well as high alloyed steel.

### HT20



#### Code 32 , Iso-Classifizierung K15-K20

Very hard wearing fine grain carbide with an AlTiN- Nanocomposit-coating for middle – high cutting speeds with high feed rates. This quality is suitable for dry milling and can also be adopted with cooling. Application areas are roughing and finishing of cast iron materials, e.g. grey-, tempered-, vermicular-, graphite- and globular graphite cast iron.

### K15M



#### Code 8, ISO-Classifizierung K10

Very hard wearing fine grain carbide, for high cutting speeds with high feed rates. This quality is suitable for dry milling and can also be adopted with cooling. Application areas are roughing and finishing nonferrous heavy materials and aluminium up to a Si-content of approx. 8%.

### XC35

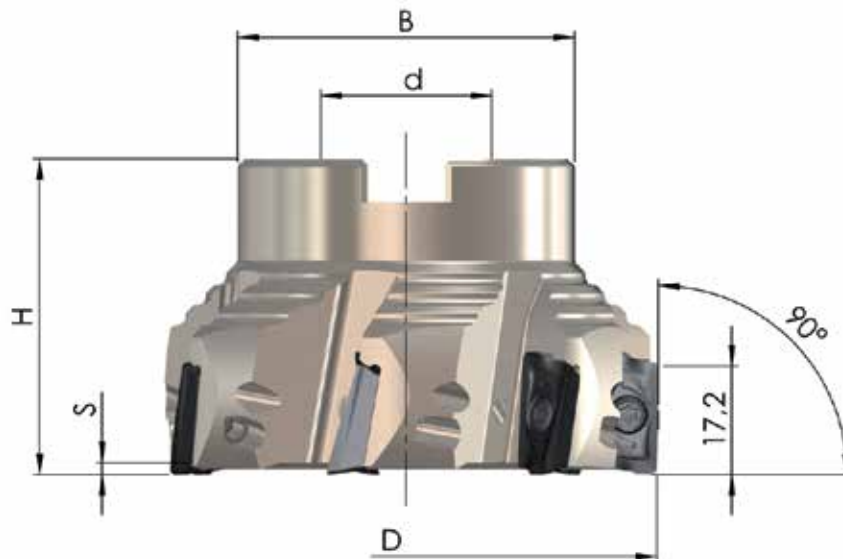


#### Code 46 , Iso-Classifizierung M20-M30

Wear resistant and tough finest grain hard metal quality with power nitride coating. On the basis of the experience gained wet machining is preferably to be adopted with this quality; however the dry processing is also possible. XC35 has been especially developed for processing stainless steel, duplex steel and high-alloyed materials, but also for titanium etc. .

## TECHNICAL DATA

### Shell Type Milling Cutters

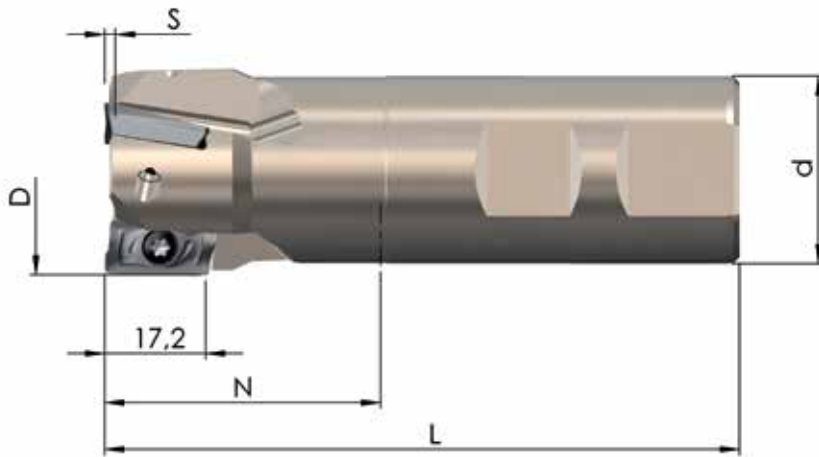


Order-Nr.	D	H	d	B	S	Z	MS
90PP-040-49-3	40	40	16	32	1,8	3	MS-8x25-912
90PP-050-49-4	50	40	22	46	1,8	4	MS-10x25-912
90PP-063-49-5	63	40	22	46	1,8	5	MS-10x25-912
90PP-080-49-5	80	50	27	58	1,8	5	MS-12x35-912
90PP-100-49-7	100	50	32	64	1,8	7	MS-16x35-6912
90PP-125-49-8	125	63	40	90	1,8	8	MS-20x60-7991
90PP-160-49-11	160	63	40	90	1,8	11	MS-20x60-7991
<b>Close teeth pitch:</b>							
90PP-040-49-4	40	40	16	32	1,8	4	MS-8x25-912
90PP-050-49-5	50	40	22	46	1,8	5	MS-10x25-912
90PP-063-49-6	63	40	22	46	1,8	6	MS-10x25-912
90PP-080-49-7	80	50	27	58	1,8	7	MS-12x35-912
90PP-100-49-8	100	50	32	64	1,8	8	MS-16x35-6912
90PP-125-49-10	125	63	40	90	1,8	10	MS-20x60-7991
90PP-160-49-13	160	63	40	90	1,8	13	MS-20x60-7991

MS= central screw

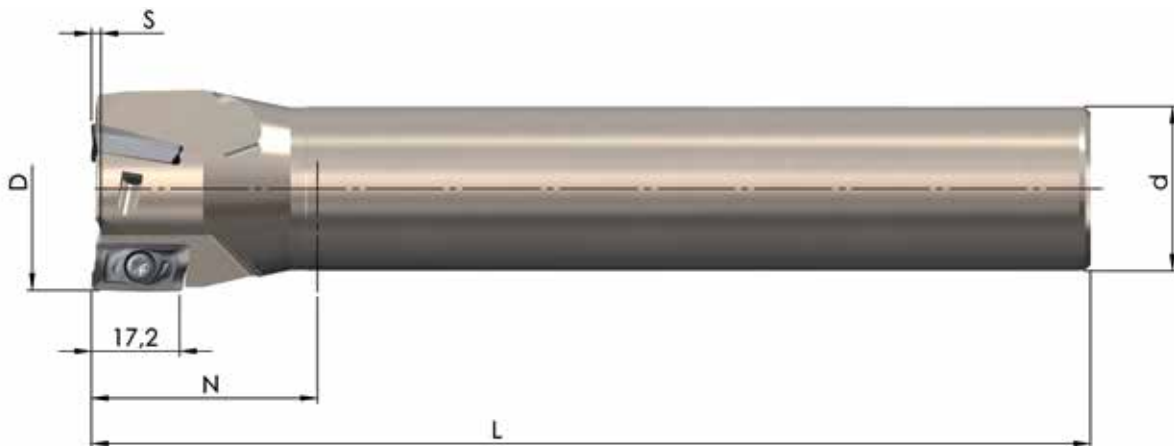


## Shank Type Milling Cutters made to DIN 1835-B (Weldon)



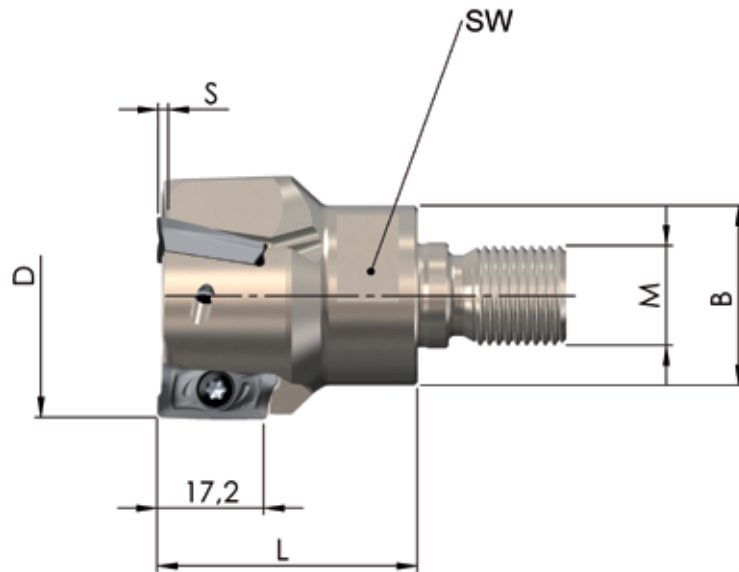
Order-Nr.	D	L	d	N	S	Z
90PP-25-38-49-2	25	95,2	25	38	1,3	2
90PP-28-42-49-2	28	98,2	25	42	1,8	2
90PP-30-45-49-2	30	101,2	25	45	1,8	2
<b>Close teeth pitch:</b>						
90PP-32-48-49-3	32	108,2	32	48	1,8	3
90PP-36-48-49-3	36	108,2	32	48	1,8	3
90PP-40-48-49-4	40	108,2	32	48	1,8	4

## Shank Type Milling Cutters made to DIN 1836 (cylindrical)



Order-Nr.	D	L	d	N	S	Z
90PP-25-49-2-170	25	170	20	38	1,8	2
90PP-32-49-2-195	32	195	25	52	1,8	2
90PP-40-49-3-195	40	195	32	42	1,8	3

## Screw-In Cutters



Order-Nr.	D	L	M	B	SW	S	Z
ESF-25-32-M12-49-2	25	32	M12	21,0	SW18	1,8	2
ESF-32-42-M16-49-3	32	42	M16	29,0	SW24	1,8	3
ESF-35-42-M16-49-3	35	42	M16	29,0	SW24	1,8	3
ESF-40-42-M16-49-3	40	42	M16	29,0	SW24	1,8	3

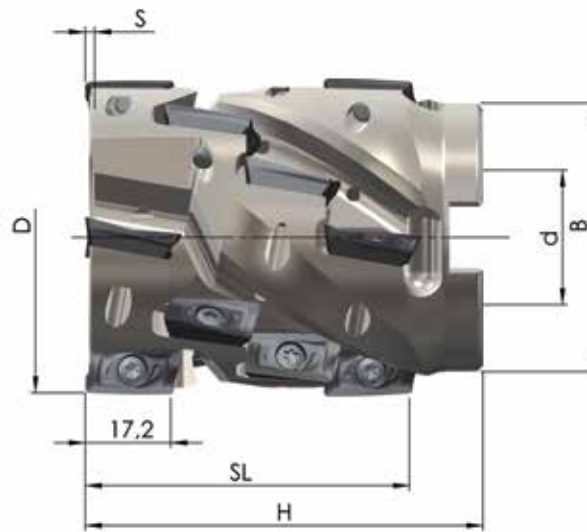
## Screw-In Holders



Order-Nr.	D	M	d	l
FS20W-M10-25	20	M10	18	25
FS20W-M10-45	20	M10	18	45
FS25W-M12-30	25	M12	21	30
FS25W-M12-50	25	M12	21	50
FS32W-M16-30	32	M16	29	30
FS32W-M16-50	32	M16	29	50

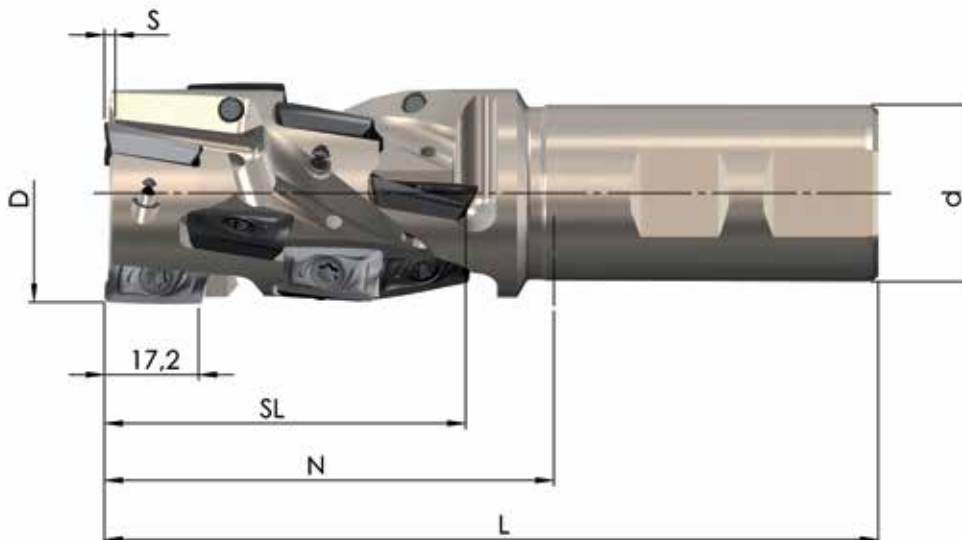
(For further holders: see our tool holder catalogue)

## Multi-Tooth Milling Cutters



Order-Nr.	D	SL	H	d	B	S	Z <sub>eff.</sub>	ZZ	MS
VZF-63-64-49-3 KD27	63	64	90	27	58	1,8	3	12	MS-12x75-912
VZF-80-64-49-4 KD32	80	64	90	32	78	1,8	4	16	MS-16x70-912
<b>Close teeth pitch:</b>									
VZF-50-64-49-3 KD22	50	64	80	22	46	1,8	3	12	MS-10x65-912
VZF-63-64-49-4 KD27	63	64	80	27	54	1,8	4	16	MS-12x65-912
VZF-80-64-49-5 KD32	80	64	80	32	64	1,8	5	20	MS-16x60-912


MS= central screw




























Order-Nr.	D	SL	N	L	d	S	Z <sub>eff.</sub>	ZZ
VZF-32-48-25-49-2	32	48	59	115	25	1,8	2	6
VZF-32-48-32-49-2	32	48	60	120	32	1,8	2	6
VZF-40-64-32-49-2	40	64	80	140	32	1,8	2	8
<b>Close teeth pitch:</b>								
VZF-40-64-32-49-3	40	64	60	140	32	1,8	3	12







## Cassettes

	<p>K90-49-G</p>	<p>Hard wearing TiN-Coating</p> <p>☞ For milling heads see catalogue page 12</p>
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## Inserts

		HT45 (code 31)	HT32 (code 33)	HT20 (code 32)	K15M (code 8)	XC35 (code 46)	
	<b>FP 49</b> (B18) 18,0x9,54x5,5 R1,0						
	<b>FP 49 R1,6</b> (B18) 18,0x9,54x5,5 R1,6						
	<b>FP 49 R2,0</b> (B18) 18,0x9,54x5,5 R2,0						
	<b>FP 49 R3,2</b> (B18) 18,0x9,54x5,5 R3,2						
	<b>FP 249</b> (B18) 18,0x9,54x5,5 R1,0						
	<b>FP 249</b> (B18) 18,0x9,54x5,5 R1,0						
	<b>FP 249 R1,0</b> (B18) 18,0x9,54x5,5 R1,0						
	VPE	10	10	10	10	10	

## Spare Parts

	<p>SS 4,0-2</p>	<p>tightening torque 3,2 Nm</p>	<p>Fixing screw for milling heads from diam. 40 and cassettes</p>
	<p>SS 4,0-3</p>	<p>tightening torque 3,2 Nm</p>	<p>Fixing screw for milling heads up to diam. 40</p>
	<p>T 15</p>	<p>Screw driver</p>	
	<p>100g</p>	<p>Heavy duty grease</p>	

## PARAMETERS STEP MILLING

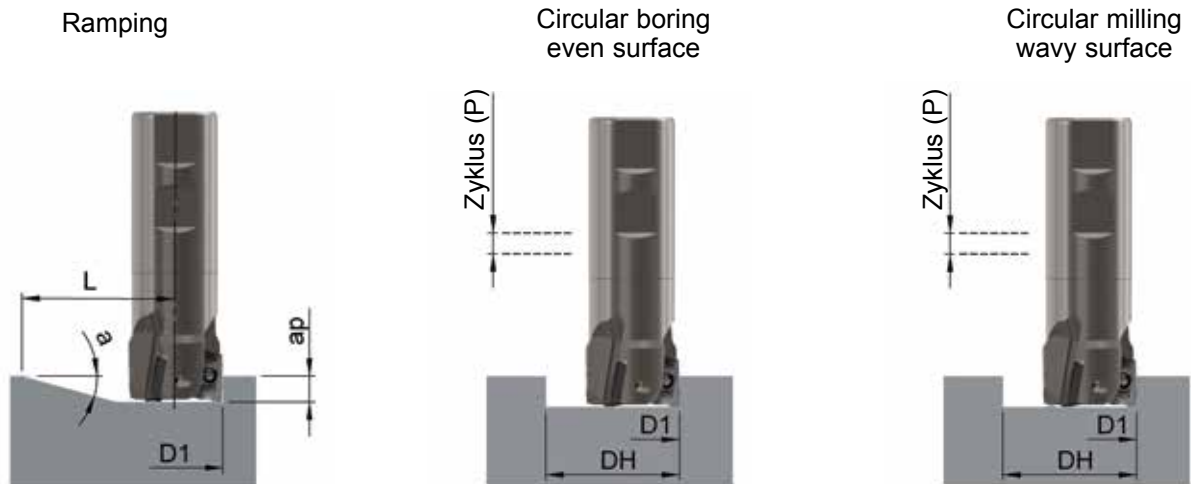
	Material	Hardness	Quality	Depth of cut $a_e$ [mm]	Cutting speed $V_c$ [m/min]
P	Structural steel, Unalloyed steel	<180 HB	HT45	-0,25D	250 (200-350)
				-0,5D	
				-0,75D	
				>0,75D-1D	
	Tool steel, Heat-treatable steel, Alloyed steel	180-350 HB	HT32 HT45	-0,25D	220 (160-280)
				-0,5D	
				-0,75D	
				>0,75D-1D	
M	Stainless-steel, High grade steel, High alloyed steel,	<270 HB	HT32 (HT45)	-0,25D	240 (140-300)
				-0,5D	
				-0,75D	
				>0,75D-1D	
S	Heat-resistant super alloys Titan alloys		HT32 (HT45)	-0,25D	60 (40-200)
				-0,5D	
				-0,75D	
				>0,75D-1D	
H	Tempered steel	40-55 HRC	HT20	-0,25D	80 (50-120)
				-0,5D	
				-0,75D	
				>0,75D-1D	
K	Grey cast iron	<800 N/mm <sup>2</sup>	HT20	-0,25D	250 (180-350)
				-0,5D	
				-0,75D	
				>0,75D-1D	
	Globular graphite cast iron	<350 N/mm <sup>2</sup>	HT20 (HT45)	-0,25D	200 (130-280)
				-0,5D	
				-0,75D	
				>0,75D-1D	
N	Aluminium Non-ferrous metals	bis 12% Si	K15M	-0,25D	500 (500-1000)
				-0,5D	
				-0,75D	
				>0,75D-1D	

The above mentioned data are standard values.

Up and down corrections are admitted depending on the machine type, tool and holding fixture.

ø25-32 f <sub>z</sub> [mm]	ø36-50 f <sub>z</sub> [mm]	ø63-100 f <sub>z</sub> [mm]	ø125-160 f <sub>z</sub> [mm]
0,20 (0,10-0,35)	0,24 (0,14-0,39)	0,30 (0,20-0,45)	0,30 (0,20-0,45)
0,14 (0,09-0,29)	0,17 (0,07-0,32)	0,21 (0,11-0,36)	0,21 (0,11-0,36)
0,12 (0,08-0,27)	0,14 (0,09-0,29)	0,17 (0,12-0,32)	0,17 (0,12-0,32)
0,10 (0,10-0,30)	0,12 (0,10-0,32)	0,15 (0,10-0,35)	0,15 (0,10-0,35)
0,20 (0,10-0,35)	0,24 (0,14-0,39)	0,30 (0,20-0,45)	0,30 (0,20-0,45)
0,14 (0,09-0,29)	0,17 (0,07-0,32)	0,21 (0,11-0,36)	0,21 (0,11-0,36)
0,12 (0,08-0,27)	0,14 (0,09-0,29)	0,17 (0,12-0,32)	0,17 (0,12-0,32)
0,08 (0,10-0,30)	0,12 (0,10-0,32)	0,15 (0,10-0,35)	0,15 (0,10-0,35)
0,20 (0,10-0,35)	0,24 (0,10-0,39)	0,30 (0,10-0,45)	0,30 (0,10-0,45)
0,14 (0,10-0,35)	0,17 (0,10-0,32)	0,21 (0,11-0,36)	0,21 (0,11-0,36)
0,12 (0,10-0,37)	0,14 (0,10-0,29)	0,17 (0,10-0,32)	0,17 (0,10-0,32)
0,10 (0,10-0,37)	0,12 (0,10-0,27)	0,15 (0,10-0,35)	0,15 (0,10-0,35)
0,16 (0,10-0,30)	0,20 (0,10-0,35)	0,24 (0,15-0,39)	0,24 (0,14-0,39)
0,11 (0,10-0,30)	0,14 (0,10-0,29)	0,17 (0,12-0,32)	0,17 (0,12-0,32)
0,10 (0,10-0,30)	0,12 (0,10-0,27)	0,14 (0,10-0,29)	0,14 (0,10-0,29)
0,10 (0,10-0,30)	0,10 (0,10-0,25)	0,12 (0,10-0,27)	0,12 (0,10-0,27)
0,10 (0,05-0,20)	0,10 (0,05-0,20)	0,14 (0,09-0,24)	0,14 (0,09-0,24)
0,07 (0,05-0,20)	0,07 (0,05-0,20)	0,10 (0,05-0,25)	0,10 (0,05-0,25)
0,06 (0,05-0,20)	0,06 (0,05-0,20)	0,08 (0,05-0,25)	0,08 (0,05-0,25)
0,05 (0,05-0,20)	0,05 (0,05-0,20)	0,07 (0,05-0,25)	0,07 (0,05-0,25)
0,30 (0,20-0,40)	0,36 (0,20-0,50)	0,30 (0,20-0,50)	0,30 (0,20-0,50)
0,21 (0,15-0,40)	0,25 (0,15-0,50)	0,28 (0,20-0,50)	0,28 (0,20-0,50)
0,17 (0,15-0,45)	0,21 (0,15-0,50)	0,23 (0,20-0,50)	0,23 (0,20-0,50)
0,15 (0,10-0,45)	0,18 (0,15-0,50)	0,20 (0,20-0,50)	0,20 (0,20-0,50)
0,26 (0,20-0,45)	0,32 (0,20-0,50)	0,36 (0,20-0,50)	0,36 (0,20-0,50)
0,18 (0,15-0,45)	0,23 (0,18-0,50)	0,25 (0,18-0,50)	0,25 (0,18-0,50)
0,15 (0,15-0,45)	0,18 (0,13-0,50)	0,21 (0,13-0,50)	0,21 (0,13-0,50)
0,15 (0,15-0,45)	0,16 (0,10-0,50)	0,18 (0,10-0,50)	0,18 (0,10-0,50)
0,40 (0,20-0,60)	0,44 (0,20-0,60)	0,50 (0,20-0,60)	0,50 (0,20-0,60)
0,28 (0,20-0,60)	0,31 (0,20-0,60)	0,35 (0,20-0,60)	0,35 (0,20-0,60)
0,23 (0,20-0,60)	0,25 (0,20-0,60)	0,29 (0,20-0,60)	0,29 (0,20-0,60)
0,20 (0,20-0,60)	0,22 (0,20-0,60)	0,25 (0,20-0,60)	0,25 (0,20-0,60)

# PARAMETERS PROFILE MILLING AND CIRCULAR MILLING



D1	Ramping Angle		Circular boring (flat surface)				Circular milling (wavy surface)	
	Anlge of lead max. $\alpha$ (°)	Processing distance min. L (mm)	Diam. max. DH (mm)	Depth of cut max. cycle P (mm)	Diam. min. DH (mm)	Depth of cut max. cycle P (mm)	Diam. min. DH (mm)	Depth of cut max. cycle P (mm)
25	5,9	16	49,0	5,0	48	4,8	42,5	3,7
28	4,9	19	55,0	4,7	54	4,5	48,5	3,6
30	4,5	21	59,0	4,6	58	4,4	52,5	3,5
32	4,1	23	63,0	4,4	62	4,3	56,5	3,5
35	3,6	26	69,0	4,3	68	4,1	62,5	3,5
36	3,5	27	71,0	4,2	70	4,1	64,5	3,4
40	3,0	31	79,0	4,1	78	4,0	72,5	3,4
50	2,3	41	99,0	3,8	98	3,8	92,5	3,3
63	1,7	54	125,0	3,7	124	3,6	118,5	3,3
80	1,3	71	159,0	3,5	158	3,5	152,5	3,3
100	1,0	91	199,0	3,5	198	3,4	192,5	3,2
125	0,8	116	249,0	3,4	248	3,4	242,5	3,2
160	0,6	151	319,0	3,3	318	3,3	312,5	3,2

Formula for calculating the max. angle of immersion:

$$\tan \alpha = \frac{s}{(D-9,54)}$$

$s$  = Variable (see above)  
 $9,54$  = Insert's width  
 $D$  = Tool diam.

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Errors and omissions excepted.