TOOLING SYSTEMS PROCESS OPTIMIZATION CONSULTING IN MILLING STRATEGIES

VHM HPC END MILLS

- HIGH CHIP REMOVAL RATE
- INCREASED HIGH FEED RATES
- INCREASED FEED MOTION

pokolm
PREMIUMTOOLS. WE KNOW HOW.

SOLID CARBIDE HPC END MILLS

END MILLS

0380

0384

0224

0514

0290

HPC milling

In using the HPC (high performance cutting) method, you machine with the highest possible chip removal rate always.
There is a unique difference between HSC (high speed cutting) an HPC (high performance cutting):
in HPC, you use high cutting speeds , small side steps and extreme feed rates, any time.
In using the HPC-technology, you can benefit also from the uprating of conventional milling machines through using moderate tuned feed rates and adapted cutting speeds.

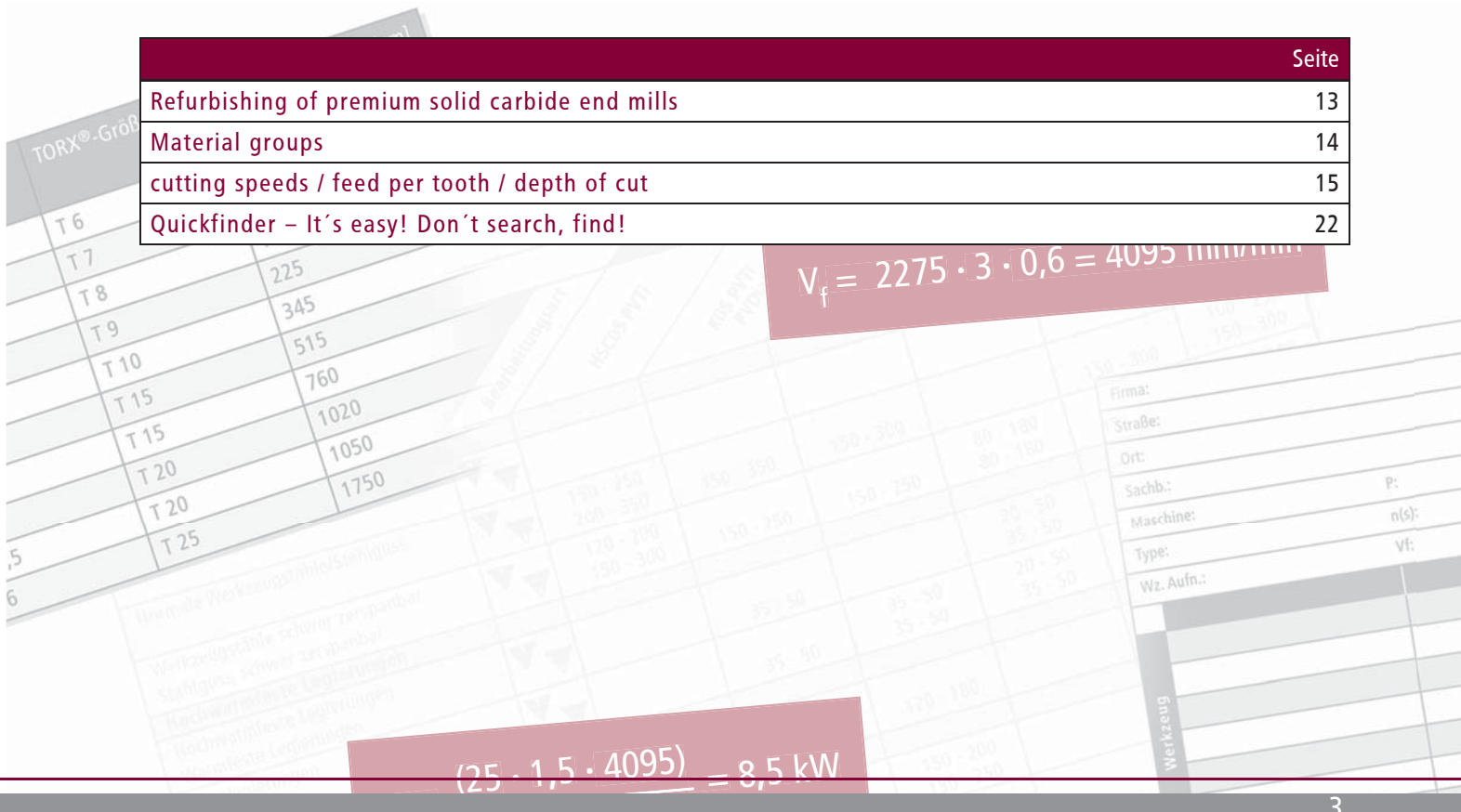
This results in a large chip volume per time-unit. Our solid carbide HPC-End Mills-generation offers a well balanced end mill range for nearly every material and machining application; from a beneficial low-end model , right up to a milling cutter for high-nickel-alloys and for materials with difficult machinability.

SOLID CARBIDE HPC END MILLS

END MILLS

Catalog-No.	grade	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	material	application	features	page
0224 56	4	●	○	○	○	○	○	VHM	HPC		4
0324 56	4	●	○	○	○	○	○	VHM	HPC	AT	5
0370 56	3-4	●		○	○		○	VHM	HPC		6
0290 56	4	●		○	○		○	VHM	HPC		7
0380 56	4	●		○	○		○	VHM	HPC		8
0390 56	4	●		○	○		○	VHM	HPC		9
0504 56	4	●	○	●			○	VHM	HPC		10
0514 56	4	●	○	●			○	VHM	HPC		11
0384 56	4	○	●	●		○		VHM	HPC		12

OPERATION DATA



0224 56
END MILLS

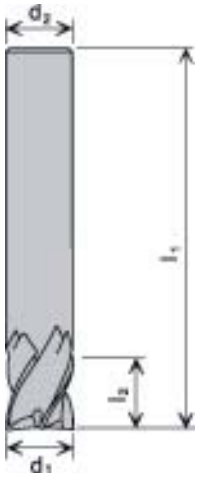
4 flutes for steel

VHM	HPC	
	EF	

4 flutes, plain shank, straight face, centre cutting, 30° right hand helix, PVTi-coated
- standard series
- without working depths
- with chamfer

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●	○	○	○	○	○	MGC	PVTi

no wd. | standard series



Solid carbide end mills	Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
	NV 0224 56 015	1,5	2,5	-	-	50	-	4	4		☑
	NV 0224 56 021	2	3	-	-	50	-	4	4		☑
	NV 0224 56 022	2	3	-	-	57	-	6	4		☑
	NV 0224 56 031	3	4,5	-	-	50	-	4	4		☑
	NV 0224 56 030	3	4,5	-	-	57	-	6	4		☑
	NV 0224 56 040	4	6	-	-	57	-	6	4		☑
	NV 0224 56 050	5	7,5	-	-	57	-	6	4		☑
	NV 0224 56 060	6	9	-	-	57	-	6	4		☑
	NV 0224 56 080	8	12	-	-	63	-	8	4		☑
	NV 0224 56 100	10	15		-	72	-	10	4		☑
	NV 0224 56 120	12	18		-	83	-	12	4		☑
	NV 0224 56 160	16	24	-	-	92	-	16	4		☑
	NV 0224 56 200	20	30	-	-	104	-	20	4		☑

⚠ available as long as stock lasts ? on request ☑ stock item, subject to confirmation

0324 56
END MILLS

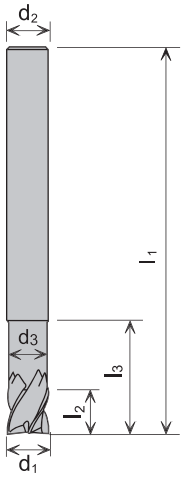
4 flutes for steel

VHM	HPC	AT
	EF	

4 flutes, plain shank, straight face, centre cutting, 30° right hand helix, PVTi-coated
- long series
- with working depths
- with chamfer

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●	○	○	○	○	○	MGC	PVTi

w. wd. | long series



Solid carbide end mills	Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
	NVV 0324 56 020	2	4	10	1,9	75	-	6	4		☑
	NVV 0324 56 030	3	4,5	12	2,9	75	-	6	4		☑
	NVV 0324 56 040	4	6	12	3,8	75	-	6	4		☑
	NVV 0324 56 050	5	7,5	15	4,8	75	-	6	4		☑
	NVV 0324 56 060	6	9	20	5,8	75	-	6	4		☑
	NVV 0324 56 080	8	12	26	7,8	90	-	8	4		☑
	NVV 0324 56 100	10	15	31	9,8	100	-	10	4		☑
	NVV 0324 56 120	12	18	37	11,8	110	-	12	4		☑
	NVV 0324 56 160	16	24	43	15,8	140	-	16	4		☑
	NVV 0324 56 200	20	30	53	19,8	150	-	20	4		☑

major application | minor application

0370 56
END MILLS

3-4 flutes for steel | extreme milling

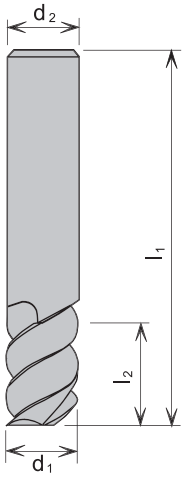
VHM | HPC

3-4 flutes, plain shank, straight face, centre cutting, 50° right hand helix, PVTi-coated
- standard series
- also available with clamping flats, from 12 mm diam. upwards compulsory
- **on demand: available with working depths**

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●		○	○		○	MGC	PVTi

Solid carbide end mills

standard series



Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0370 56 020	2	4	-	-	57	-	6	3		✓
NVV 0370 56 025	2,5	5	-	-	57	-	6	3		⚠
NVV 0370 56 030	3	6	-	-	57	-	6	4		✓
NVV 0370 56 035	3,5	7	-	-	57	-	6	4		⚠
NVV 0370 56 040	4	8	-	-	57	-	6	4		✓
NVV 0370 56 045	4,5	9	-	-	57	-	6	4		⚠
NVV 0370 56 050	5	10	-	-	57	-	6	4		⚠
NVV 0370 56 060	6	12	-	-	57	-	6	4		✓
NVV 0370 56 070	7	14	-	-	63	-	8	4		✓
NVV 0370 56 080	8	16	-	-	63	-	8	4		✓
NVV 0370 56 090	9	18	-	-	72	-	10	4		✓
NVV 0370 56 100	10	20		-	72	-	10	4		✓
NVV 0370 56 120	12	24		-	83	-	12	4		✓
NVV 0370 56 160	16	32		-	92	-	16	4		✓
NVV 0370 56 200	20	40		-	104	-	20	4		✓

⚠ available as long as stock lasts ? on request ✓ stock item, subject to confirmation

0290 56
END MILLS

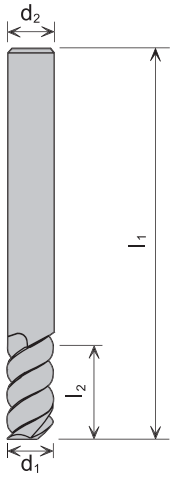
3-4 flutes for steel | extreme milling

VHM	HPC	

3-4 flutes, plain shank, straight face, centre cutting, 50° right hand helix, PVTi-coated
- long series
- also available with clamping flats, from 12 mm diam. upwards compulsory
- **on demand: available with working depths**

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●		○	○		○	MGC	PVTi

long series



Solid carbide end mills	Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
	NVV 0290 56 061	6	18	-	-	75	-	6	4		☑
	NVV 0290 56 081	8	24	-	-	90	-	8	4		☑
	NVV 0290 56 101	10	30		-	100	-	10	4		☑
	NVV 0290 56 121	12	36		-	110	-	12	4		☑
	NVV 0290 56 161	16	48		-	140	-	16	4		☑
	NVV 0290 56 201	20	60		-	150	-	20	4		☑

major application | minor application

0380 56
END MILLS

4 flutes for steel | extreme milling

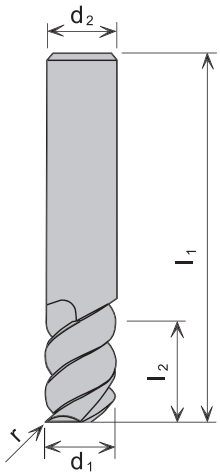
VHM | HPC

4 flutes, plain shank, straight face, centre cutting, 50° right hand helix, PVTi-coated

- standard series
- with corner radius for edge stabilization
- also available with clamping flats, form 12 mm diam. upwards compulsory
- **on demand: available with working depths**

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●		○	○		○	MGC	PVTi

Solid carbide end mills



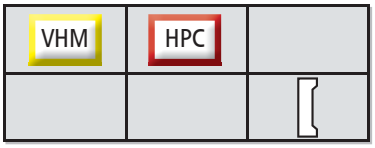
standard series

Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0380 56 030	3	6	-	-	57	0,3	6	4		☑
NVV 0380 56 040	4	8	-	-	57	0,3	6	4		☑
NVV 0380 56 050	5	10	-	-	57	0,3	6	4		☑
NVV 0380 56 060	6	12	-	-	57	0,3	6	4		☑
NVV 0380 56 080	8	16	-	-	63	0,5	8	4		☑
NVV 0380 56 090	9	18	-	-	72	0,5	10	4		☑
NVV 0380 56 100	10	20		-	72	0,5	10	4		☑
NVV 0380 56 120	12	24		-	83	1	12	4		☑
NVV 0380 56 160	16	32	-	-	92	1	16	4		☑
NVV 0380 56 200	20	40		-	104	1	20	4		☑

⚠ available as long as stock lasts | ? on request | ☑ stock item, subject to confirmation

0390 56
END MILLS

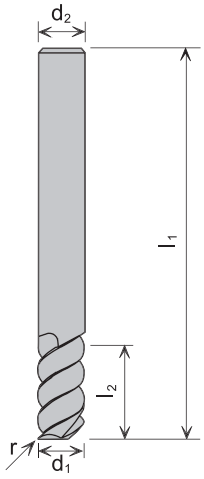
4 flutes for steel | extreme milling



4 flutes, plain shank, straight face, centre cutting, 50° right hand helix, PVTi-coated
- long series
- with corner radius for edge stabilization
- also available with clamping flats, form 12 mm diam. upwards compulsory
- **on demand: available with working depths**

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●		○	○		○	MGC	PVTi

long series



Solid carbide end mills – Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0390 56 061	6	18		-	75	0,3	6	4		☑
NVV 0390 56 081	8	24	-	-	90	0,5	8	4		☑
NVV 0390 56 101	10	30		-	100	0,5	10	4		☑
NVV 0390 56 121	12	36		-	110	1	12	4		☑
NVV 0390 56 161	16	48		-	140	1	16	4		☑
NVV 0390 56 201	20	60		-	150	1	20	4		☑

major application | minor application

0504 56
END MILLS UGT

4 flutes for stainless steel

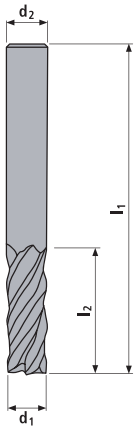
VHM	HPC	

4 flutes, plain shank, centre cutting, PVST-coated
- with or without clamping flats
- unequal division
- unequal helix angle
- also available with clamping flats, form 12 mm diam. upwards compulsory

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●	○	●			○	UMGC	PVST

Solid carbide end mills

no wd. | standard series



Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0504 56 030	3	8	-	-	57	-	6	4		✓
NVV 0504 56 040	4	10	-	-	57	-	6	4		✓
NVV 0504 56 050	5	12	-	-	57	-	6	4		✓
NVV 0504 56 060	6	16	-	-	57	-	6	4		✓
NVV 0504 56 080	8	20	-	-	63	-	8	4		✓
NVV 0504 56 100	10	26	-	-	72	-	10	4		✓
NVV 0504 56 120	12	30		-	83	-	12	4		✓
NVV 0504 56 160	16	37	-	-	92	-	16	4		✓
NVV 0504 56 200	20	44	-	-	104	-	20	4		✓
NVV 0504 56 250	25	50	-	-	121	-	25	4		?

⚠ available as long as stock lasts ? on request ✓ stock item, subject to confirmation

0514 56
END MILLS UGT

4 flutes for stainless steel

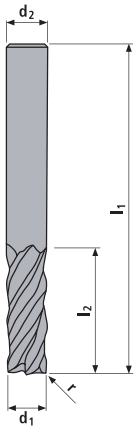
VHM	HPC	

4 flutes, plain shank, centre cutting, PVST-coated
- corner radius
- with or without clamping flats
- unequal division
- unequal helix angle
- also available with clamping flats, form 12 mm diam. upwards compulsory

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	●	○	●			○	UMGC	PVST

Solid carbide end mills

no wd. | standard series



Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0514 56 030	3	8	-	-	57	0,2	6	4		☑
NVV 0514 56 040	4	10	-	-	57	0,3	6	4		☑
NVV 0514 56 050	5	12	-	-	57	0,4	6	4		☑
NVV 0514 56 060	6	16	-	-	57	0,5	6	4		☑
NVV 0514 56 080	8	20	-	-	63	0,5	8	4		☑
NVV 0514 56 100	10	26		-	72	1	10	4		☑
NVV 0514 56 120	12	30		-	83	1	12	4		☑
NVV 0514 56 160	16	37		-	92	2	16	4		☑
NVV 0514 56 200	20	44	-	-	104	2	20	4		☑
NVV 0514 56 250	25	50	-	-	121	3	25	4		☑

major application | minor application

0384 56
END MILLS HGT

4 flutes for high performance milling

VHM | HPC

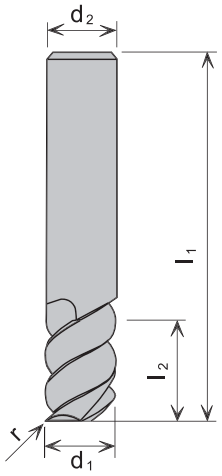
4 flutes, plain shank, straight face, centre cutting, 50° right hand helix, PVTi-coated

- standard series
- corner radius
- unequal division
- also available with clamping flats, form 12 mm diam. upwards compulsory
- **on demand: available with working depths**

Material qualification	steel	heat-resistant alloys	stainless steel	cast iron	non-ferrous-metals/materials	hardened steel	grade	coating
A	○	●	●		○		UMGC	PVTi

Solid carbide end mills

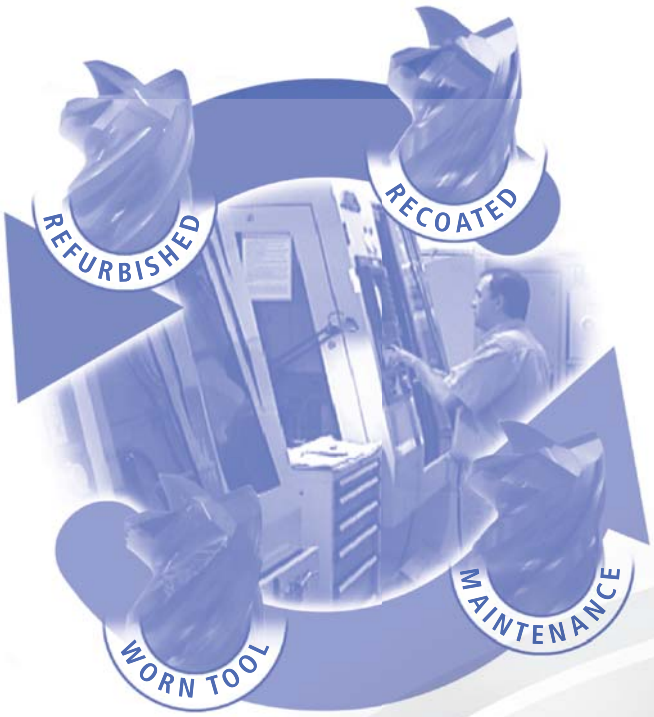
no wd. | standard series

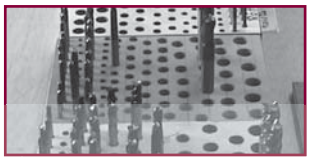


Catalogue-No.	d_1	l_2	l_3	d_3	l_1	r	d_2	z	price	features
NVV 0384 56 060	6	12	-	-	57	0,5	6	4		☑
NVV 0384 56 061	6	12	-	-	57	1	6	4		☑
NVV 0384 56 080	8	16	-	-	63	0,5	8	4		☑
NVV 0384 56 081	8	16	-	-	63	1	8	4		☑
NVV 0384 56 100	10	20	-	-	72	0,5	10	4		☑
NVV 0384 56 101	10	20	-	-	72	1	10	4		☑
NVV 0384 56 120	12	24	-	-	83	1	12	4		☑
NVV 0384 56 021	12	24	-	-	83	2	12	4		☑
NVV 0384 56 160	16	32	-	-	92	1	16	4		☑
NVV 0384 56 161	16	32	-	-	92	2	16	4		☑
NVV 0384 56 200	20	40	-	-	104	1	20	4		☑
NVV 0384 56 201	20	40	-	-	104	2	20	4		☑

⚠ available as long as stock lasts ? on request ☑ stock item, subject to confirmation

REFURBISHING OF PREMIUM SOLID CARBIDE END MILLS





Premium solid carbide tools live longer:
... in more ways than one!

The Voha-Tosec service team offers within this Workout-program for existing, already used Solid carbide tooling a wide variety of services:

- reproduction
- refurbishing
- modification
- recoating

We check, classify and mark every single tool individually, in order to ensure, that every customer receives his own tools back.

WORKOUT offers this service for all genuine Voha-Tosec-tooling and also for non-Voha-Tosec-tools, if its quality allows this.

You can send your tools for refurbishing, using the code „Workout" at any time to the following address:

Voha-Tosec
Werkzeuge GmbH

Schreinerweg 2a + 2b
51789 Lindlar

fon: +49 (0) 22 66 | 47 81-11
fax: +49 (0) 22 66 | 47 81-40

email: info@voha-tosec.de
homepage: www.voha-tosec.com

major application | minor application

MATERIAL GROUP

The most important Material-Groups

materials	material-No.	material-No.	material-No.	material-No.	material-No.	material-No.	material-No.
steel							
Free Machining Steel/ Mild Steel	1.1141	1.1191	1.1730	1.1731			
Normal Tool Steel/ Steel Castings	1.2067	1.2311	1.2312	1.2341	1.2344	1.2842	
Tool Steel and Steel Castings, both difficult to machine	1.2082	1.2369	1.2379	1.2708	1.2713	1.2738	1.2767
heat-resistant alloys							
High-temperature Alloys	1.3401	1.4865	2.4631	2.4631	2.4648	2.4668	2.4856
Titanium Alloys	3.7025	3.7124	3.7145	3.7165	3.7184	3.7185	3.7225
stainless steel							
(all kinds)	2.2316	1.2367	1.4301	1.4401	1.4541	1.4571	1.4712
cast iron							
Grey Cast Iron	0.6010	0.6020	0.6030	0.6040			
Spheroidal Graphite	0.7040	0.7050	0.7060	0.7070	0.7080		
Tempered Castings	GTS 35-10	GTS 45-06	GTS 55-04	GTS 66-02			
non-ferrous- metals / materials							
Aluminium	3.0255	3.1325	3.2315	3.2581	3.4345	3.5105	3.5812
Copper	CuMnF36	CuSiMnF34	CuZn36Pb3	2.0065	2.1285		
Graphite	ISO 63	ISO 90	ISO 93	ISO 95			
Plastics	Ureol	CFK	GFK	AFK	NFK	WPC	
hardened steel							
up to 48HRC	1.2311	1.2312	1.2343	1.2344	1.2708	1.2842	
up to 55HRC	1.2080	1.2344	1.2369	1.2708	1.2713	1.2767	1.2842
up to 65HRC	1.2080	1.2363	1.2369	1.2379	1.2767	1.2842	

These speed and feed values are approximate. Customer-specific factors such as input power, machine stability, tool overhang, etc. are not taken into account. In order to guarantee optimum and economic cutting conditions with our tools, please ask our office or one of our application engineers.

HSC

CUTTING SPEEDS

FOR SOLID CARBIDE END MILLS

▲ roughing ▲ pre-finishing △ finishing

Material	Application	CUTTING MATERIAL AND COATING					
		VHM PVTi PVAT PVALSA	VHM PVCC	VHM PVAS PVCN	VHM PVDiAN PVDiAG	CBN uncoated	PKD uncoated
Steel							
Free Machining Steel/ Mild Steel	▲ △	150 -250 250 - 350	200 - 350	180 - 300		500 - 1000	
Normal Tool Steel/ Steel Castings	▲ △	150 - 220 220 - 300	150 - 220 220 - 300	150 - 250		500 - 1000	
Tool Steel and Steel Castings, both difficult to machine	▲ △	120 - 170 170 - 250	150 - 250	100 - 200		400 - 800	
Heat-resistant alloys							
High-temperature Alloys	▲ △	30 - 50 50 - 80	60 - 80	50 - 60			
Titanium Alloys	▲ △	30 - 50 50 - 80	60 - 80	50 - 60			
Stainless steel							
(all kinds)	▲ △	70 - 110 110 - 150		100 - 120			
Cast iron							
Grey Cast Iron	▲ △	250 - 300 300 - 400	250 - 300 300 - 400	200 - 350		500 - 1000	
Spheroidal Graphite	▲ △	150 - 200 200 - 250	180 - 250	150 - 230		500 - 1000	
Tempered Castings	▲ △	100 - 160 160 - 200	150 - 200	120 - 180		500 - 1000	
NE - Materials							
Aluminium	▲ △	400 - 600	400 - 600 800 - 1000	400 - 600 800 - 1000	400 - 600 800 - 1000		500 -1200
Copper	▲ △	300 - 500	450 - 600	400 - 500 500 - 600			500 - 800
Graphite	▲ △	300 - 500	350 - 500	200 - 350 350 - 500	800 - 870 870 - 1000		500 - 800
Plastics	▲ △	200 - 350	350 - 500	200 - 350 350 - 500	200 - 350 350 - 500		500 - 1200
Hardened steel							
up to 48HRC	▲ △	150 - 190				300 - 800	
up to 55HRC	▲ △	120 - 250				300 - 800	
up to 65HRC	▲ △	80 - 120				200 - 500	

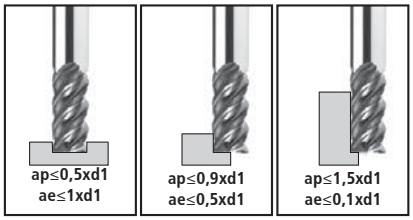
These speed and feed values are approximate. Customer-specific factors such as input power, machine stability, tool overhang, etc. are not taken into account. In order to guarantee optimum and economic cutting conditions with our tools, please ask our office or one of our application engineers.

SPEED/FEED PER TOOTH/ DEPTH OF CUT

HPC

UGT- end mills for pocket- and slot milling 0504 / 0514

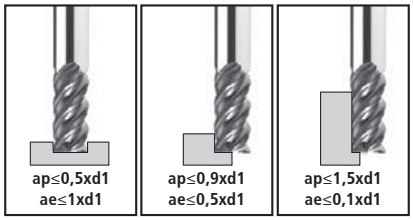
Stainless steel
1.4301, 1.4541, 1.4307 etc.:



feed per tooth f_z
speed V_c=80 m/min

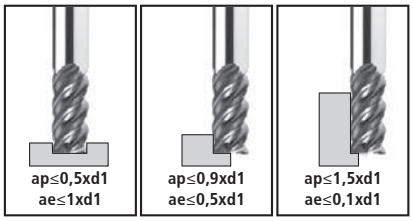
d_1	fz	fz	fz		d_1	fz	fz	fz
3	0,015	0,018	0,015		3	0,010	0,015	0,018
4	0,020	0,023	0,020		4	0,013	0,020	0,025
5	0,025	0,029	0,025		5	0,019	0,025	0,031
6	0,030	0,035	0,040		6	0,024	0,030	0,036
8	0,040	0,047	0,054		8	0,034	0,040	0,053
10	0,055	0,064	0,073		10	0,044	0,055	0,071
12	0,065	0,075	0,085		12	0,056	0,065	0,077
16	0,085	0,100	0,115		16	0,071	0,085	0,089
20	0,105	0,120	0,135		20	0,087	0,950	0,100
25	0,120	0,140	0,160		25	0,100	0,120	0,140

Stainless steel
1.4401, 1.4571, 1.4404 etc.:



feed per tooth f_z
speed V_c=40 m/min

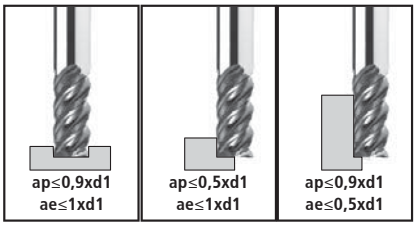
High-temperature alloys
1.4542 etc.:



feed per tooth f_z
speed V_c=25 m/min

d_1	fz	fz	fz		d_1	fz	fz	fz
3	0,004	0,007	0,010		3	0,004	0,007	0,010
4	0,006	0,010	0,015		4	0,006	0,010	0,015
5	0,010	0,014	0,020		5	0,010	0,014	0,020
6	0,015	0,020	0,025		6	0,015	0,020	0,025
8	0,025	0,030	0,035		8	0,025	0,030	0,035
10	0,030	0,035	0,040		10	0,030	0,035	0,040
12	0,040	0,045	0,050		12	0,040	0,045	0,050
16	0,050	0,060	0,065		16	0,050	0,060	0,065
20	0,060	0,070	0,075		20	0,060	0,070	0,075
25	0,070	0,080	0,085		25	0,070	0,080	0,850

High nickel alloys (inconel)
Inconel 718 etc.:



feed per tooth f_z
speed V_c=15 m/min

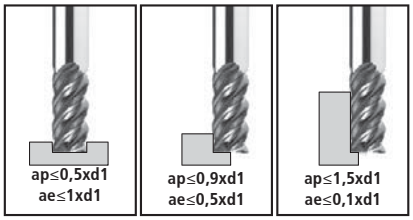
These speed and feed values are approximate. Customer-specific factors such as input power, machine stability, tool overhang, etc. are not taken into account. In order to guarantee optimum and economic cutting conditions with our tools, please ask our office or one of our application engineers.

SPEED/FEED PER TOOTH/ DEPTH OF CUT

HPC

HGT- end mills for pocket- and slot milling 0384

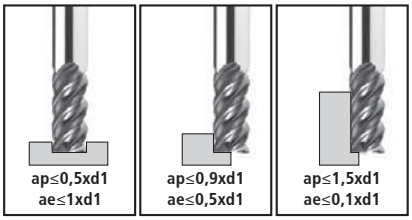
High-temperature alloys 1.4542 etc.:



feed per tooth f_z
speed V_c= 25 m/min

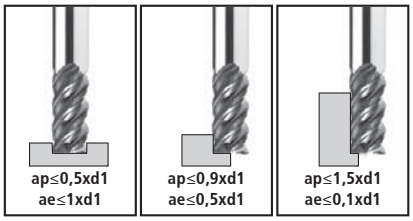
d_1	fz	fz	fz		d_1	fz	fz	fz
6	0,020	0,025	0,025		6	0,020	0,025	0,025
8	0,030	0,035	0,035		8	0,030	0,035	0,035
10	0,035	0,045	0,045		10	0,035	0,045	0,045
12	0,040	0,050	0,050		12	0,040	0,050	0,050
16	0,060	0,075	0,070		16	0,060	0,075	0,070
20	0,070	0,080	0,075		20	0,070	0,080	0,075

High nickel alloys (inconel) 718 etc.:



feed per tooth f_z
speed V_c= 15 m/min

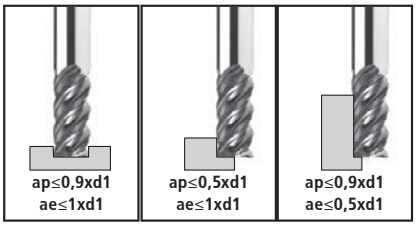
Stainless steel 1.4401, 1.4571, 1.4404 (Cr-Ni-Mo) etc.:



feed per tooth f_z
speed V_c= 40 m/min

d_1	fz	fz	fz		d_1	fz	fz	fz
6	0,025	0,025	0,035		6	0,025	0,025	0,040
8	0,035	0,035	0,050		8	0,035	0,035	0,055
10	0,045	0,045	0,070		10	0,045	0,045	0,075
12	0,050	0,050	0,080		12	0,050	0,050	0,085
16	0,075	0,075	0,090		16	0,075	0,075	0,100
20	0,080	0,080	0,100		20	0,080	0,080	0,125

Stainless steel 1.4301, 1.4541, 1.4307 (Cr-Ni) etc.:



feed per tooth f_z
speed V_c= 80 m/min

These speed and feed values are approximate. Customer-specific factors such as input power, machine stability, tool overhang, etc. are not taken into account. In order to guarantee optimum and economic cutting conditions with our tools, please ask our office or one of our application engineers.

FEED PER TOOTH/DEPTH OF CUT FOR POCKET- AND SLOT MILLING

HPC

Feed per tooth (f_z), depth of cut (a_p)

Material	f_z / a_p	diam. 2	diam. 3 - 4	diam. 5 - 6	diam. 7 - 8	diam. 9 - 10
Steel						
Free Machining Steel/ Mild Steel	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,03 - 0,06 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Normal Tool Steel/ Steel Castings	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,03 - 0,06 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Tool Steel and Steel Castings, both difficult to machine	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,03 - 0,06 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Stainless steel						
(all kinds)	f_z (mm) a_p (mm)	0,02 - 0,04 0,3 - 0,7	0,03 - 0,06 0,7 - 1,2	0,05 - 0,08 1,5 - 1,8	0,05 - 0,08 2,0 - 2,5	0,06 - 0,10 2,5 - 3,0
Cast iron						
Grey Cast Iron	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,3 - 0,6 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Spheroidal Graphite	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,3 - 0,6 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Tempered Castings	f_z (mm) a_p (mm)	0,02 - 0,04 1,0 - 1,5	0,3 - 0,6 1,5 - 2,0	0,05 - 0,08 2,5 - 3,0	0,05 - 0,08 3,5 - 4,0	0,06 - 0,10 4,5 - 5,0
Hardened steel						
up to 48HRC	f_z (mm) a_p (mm)	0,02 - 0,04 0,04 - 0,1	0,03 - 0,6 0,08 - 0,2	0,05 - 0,08 0,1 - 0,3	0,05 - 0,08 0,15 - 0,4	0,06 - 0,10 0,2 - 0,5
up to 55HRC	f_z (mm) a_p (mm)	0,02 - 0,04 0,04 - 0,1	0,03 - 0,6 0,08 - 0,2	0,05 - 0,08 0,1 - 0,3	0,05 - 0,08 0,15 - 0,4	0,06 - 0,10 0,2 - 0,5
up to 65HRC	f_z (mm) a_p (mm)	0,02 - 0,04 0,04 - 0,1	0,03 - 0,6 0,08 - 0,2	0,05 - 0,08 0,1 - 0,3	0,05 - 0,08 0,15 - 0,4	0,06 - 0,10 0,2 - 0,5

These speed and feed values are approximate. Customer-specific factors such as input power, machine stability, tool overhang, etc. are not taken into account. In order to guarantee optimum and economic
cutting conditions with our tools, please ask our office or one of our application engineers.
Fore more detailed recommendations regarding operation data (including the tool level), please take a look at our CD-ROM catalogue.

WITH SOLID CARBIDE SLOTTING AND ROUGHING END MILLS

HPC

for extreme milling conditions

0370 / 0290 / 0380 / 0390

diam. 11 - 12	diam. 13 - 14	diam. 15 - 16	diam. 17 - 18	f_z	Material
					Steel
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	f_z (mm) a_p (mm)	Free Machining Steel/ Mild Steel
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	f_z (mm) a_p (mm)	Normal Tool Steel/ Steel Castings
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	0,08 - 0,12 6,0 - 8,0	f_z (mm) a_p (mm)	Tool Steel and Steel Castings, both difficult to machine
					Stainless steel
0,07 - 0,12 3,5 - 4,0	0,08 - 0,12 4,0 - 4,5	0,08 - 0,12 4,0 - 4,5	0,08 - 0,12 4,0 - 4,5	f_z (mm) a_p (mm)	(all kinds)
					Cast iron
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	f_z (mm) a_p (mm)	Grey Cast Iron
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	f_z (mm) a_p (mm)	Spheroidal Graphite
0,07 - 0,12 5,0 - 6,0	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	0,08 - 0,12 6,0 - 0,8	f_z (mm) a_p (mm)	Tempered Castings
					Hardened steel
0,07 - 0,12 0,2 - 0,7	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	f_z (mm) a_p (mm)	up to 48HRC
0,07 - 0,12 0,2 - 0,7	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	f_z (mm) a_p (mm)	up to 55HRC
0,07 - 0,12 0,2 - 0,7	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	0,08 - 0,12 0,2 - 0,8	f_z (mm) a_p (mm)	up to 65HRC

FEED PER TOOTH | DEPTH OF CUT FOR CONTOUR MILLING

HPC

Feed per tooth (f_z), depth of cut (a_p); up to 100 % of cutting length

side cutting width (a_e) for non-hardened materials: up to 20% of end mill diameter
side cutting width (a_e) for hardened materials: up to 5% of end mill diameter

Material	f_z	diam. 2	diam. 3 - 4	diam. 5 - 6	diam. 7 - 8	diam. 9 - 10
Steel						
Free Machining Steel/ Mild Steel	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Normal Tool Steel/ Steel Castings	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Tool Steel and Steel Castings, both difficult to machine	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Stainless steel						
(all kinds)	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Cast iron						
Grey Cast Iron	f_z (mm)	0,05 - 0,09	0,05 - 0,03	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18
Spheroidal Graphite	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Tempered Castings	f_z (mm)	0,05 - 0,09	0,09 - 0,12	0,12 - 0,18	0,12 - 0,18	0,15 - 0,20
Hardened steel						
up to 48HRC	f_z (mm)	0,03 - 0,06	0,07 - 0,10	0,10 - 0,15	0,10 - 0,15	0,12 - 0,17
up to 55HRC	f_z (mm)	0,03 - 0,06	0,07 - 0,10	0,10 - 0,15	0,10 - 0,15	0,12 - 0,17
up to 65HRC	f_z (mm)	0,03 - 0,06	0,07 - 0,10	0,10 - 0,15	0,10 - 0,15	0,12 - 0,17

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WITH SOLID CARBIDE SLOTTING AND ROUGHING END MILLS

HPC

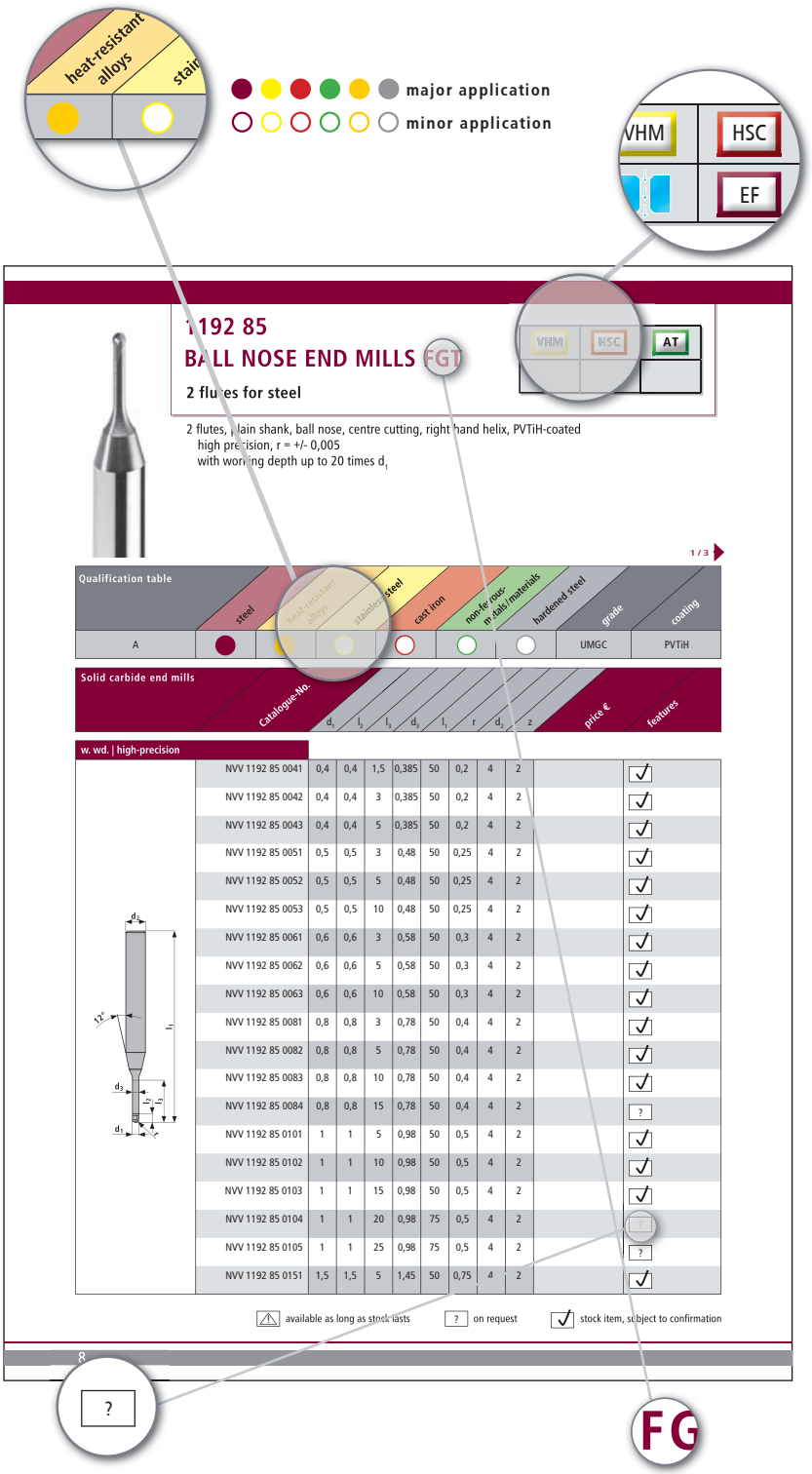
for extreme milling conditions

0370 / 0290 / 0380 / 0390

diam. 11 - 12	diam. 13 - 14	diam. 15 - 16	diam. 17 - 18	f_z	Material
					Steel
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	Free Machining Steel/ Mild Steel
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	Normal Tool Steel/ Steel Castings
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	Tool Steel and Steel Castings, both difficult to machine
					Stainless steel
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	(all kinds)
					Cast iron
0,15 - 0,20	0,15 - 0,20	0,20 - 0,25	0,20- 0,25	f_z (mm)	Grey Cast Iron
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	Spheroidal Graphite
0,15 - 0,20	0,20 - 0,25	0,20 - 0,25	0,25 - 0,30	f_z (mm)	Tempered Castings
					Hardened steel
0,17 - 0,22	0,17 - 0,22	0,17 - 0,22	0,20 - 0,25	f_z (mm)	up to 48HRC
0,17 - 0,22	0,17 - 0,22	0,17 - 0,22	0,20 - 0,25	f_z (mm)	up to 55HRC
0,17 - 0,22	0,17 - 0,22	0,17 - 0,22	0,20 - 0,25	f_z (mm)	up to 65HRC

QUICKFINDER –

It`s easy! Don´t search, find!



MATERIAL

- VHM Solid Carbide End Mills
- CBN CBN tipped End Mills
- PCD PCD tipped End Mills
- CVD CVD tipped End Mills

APPLICATION

HSC
- high cutting speeds
- small steps
- constant high feed rates
- reduced mechanical stress for tooling and machine
- heat elimination by chips

HPC
- high chip volume
- mean cutting speeds
- high feed rates
- increased feed motion

UNI
- normal cutting speeds
- normal feed rates

FEATURES

- AT End Mills with working depth (reach)
- toric End Mills
- EF End Mills with chamfer for edge stabilisation
- End Mills shank with clamping flats
- End Mills with IKZ (internal coolant supply)
- DIA - diamond coated

AVAILABILITY

- ⚠ available as long as stock lasts
- ? on request
- ☑ stock item, subject to confirmation

END MILLS TYPE

- FGT: high-precision End-Mills restricted tolerance
- GGT: HPC-graphite-roughing-tool
- UGT: unequal division unequal helix angle extremely smooth running

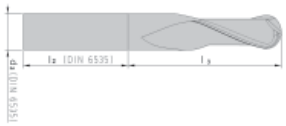
PAGE 15

- ▲ roughing
- ▲ pre-roughing
- △ finishing

QUICKFINDER

general-purpose tolerances for VHM-tools:			
Type of tool	d_1	d_2	r
FGT	f_8	h_5	+/- 0,005
GGT	+0 / -0,12	h_6	
UGT/HGT	e_8	h_6	+0,02 / -0,025 / -0,035
Ball Nose- and Corner Radius End Mills	f_8	h_6	f_8
straight face	e_8	h_6	

Theoretical usable end mill length of Solid carbide end mills in mm*:



diam. of shank (DIN 6535) d2 h6	2 - 5	6 + 8	10	12 + 14	16 + 18
length of shank (DIN 6535) l2 $^{+2}_{-0}$	28	36	40	45	48
diam. of shank (DIN 6535) d2 h6	20	25	32 + 36		
length of shank (DIN 6535) l2 $^{+2}_{-0}$	50	56	60		

* this usable length appears through deduction of the DIN-shank-length (l2 according to DIN 6535) from the overall length of the end mills. See above table.

End-Mill-dimensions by DIN:			
d_1 = cutting diameter	l_2 = cutting length	l_3 = working depth length	d_3 = working depth diameter (neck diameter)
l_1 = total length	r = radius	d_2 = diam. of shank	z = teeth

Notes:

P-F-HPC-E 0311

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