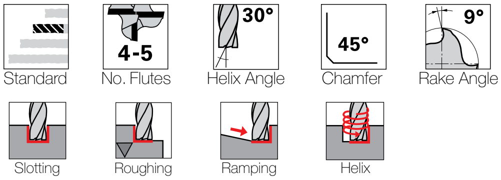
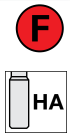
AERO-ROUGH 48 RS100 U (4/5-Flute) - Inch - Standard Length

center cutting

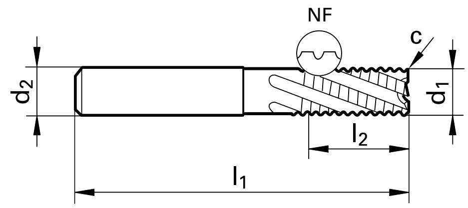




Tool material	**Solid Carbide**
Surface finish	FIREX©
Series	**3097**

Application group	Material examples	Ideal for
P	Steel	●
M	Stainless steel	●
K	Cast iron	●
N	Aluminum	—
S	Ni / Ti alloys	○
H	Hardened steel	—
●=Optimal	○=Secondary	

Speed and Feed data found on page 283



d1 h10 inch	d2 h6 inch	l1 inch	l2 inch	Chamfer inch	No. of Flutes	Code no.	EDP Number
1/4	1/4	2 1/2	3/4	0.012	4	6.350	**9030970063500**
5/16	5/16	2 1/2	13/16	0.012	4	7.940	**9030970079400**
3/8	3/8	2 1/2	7/8	0.012	4	9.520	**9030970095200**
1/2	1/2	3	1	0.020	4	12.700	**9030970127000**
5/8	5/8	3 1/2	1 1/4	0.020	4	15.870	**9030970158700**
3/4	3/4	4	1 5/8	0.020	4	19.050	**9030970190500**
1	1	4	1 3/4	0.031	5	25.400	**9030970254000**

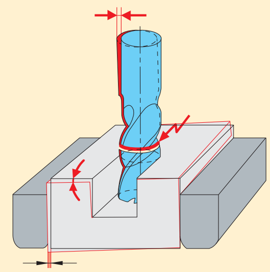
General notes

All the cutting rate recommendations specified in this catalogue are standard values valid exclusively for new tools or tools re-ground to Guhring specifications. Pre-requisites are stable machines, optimal cooling, optimal tool clamping and maximum concentricity of the tool and the machine spindle. Our recommended cutting rates must be reduced if the conditions deviate. The values may also be adjusted to influence Surface finish quality, machining rate or tool life.

1. Workpiece clamping
Loss of tool life or tool breakage through unstable clamping

➤ improve workpiece clamping

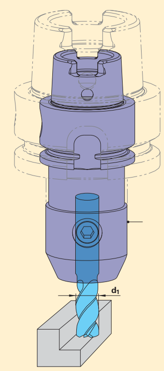
Alternative:
➤ reduce feed
➤ reduce cutting width or depth



2. Tool clamping
Loss of tool life or tool breakage through unstable, worn or too small/long/thin tool holder

➤ apply new or larger tool holder or holder with increased clamping force and increased concentricity

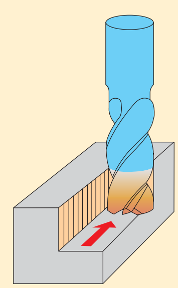
Alternative:
➤ reduce cutting rates
➤ reduce clamping length
➤ apply tool with smaller diameter
➤ check clamping screws for wear



3. Surface finish quality
Excessive peak-to-valley height Ra/Rz at the tool Surface finish through excessive feed and feed rates or vibrations

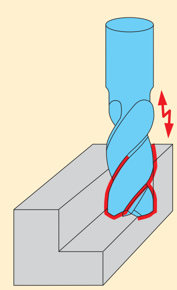
➤ improve workpiece clamping and tool clamping (see points 1 and 2)

Alternative:
➤ reduce feed and feed rate
➤ increase cutting speed



4. Vibrations
High tool wear, insufficient workpiece Surface finish quality and insufficient dimensional accuracy through vibration

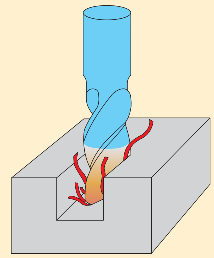
➤ improve workpiece and tool clamping (see points 1 and 2)
➤ increase tooth feed, because the chip centre thickness is too small
➤ modify speed
➤ modify milling strategy, i.e. select alternative cutting distribution
➤ change tool selection, i.e. reduce no. of teeth or spiral



5. Chip congestion/cooling
Significant reduction in tool life, crumbling on cutting lips, edge build-up or conglutination of flutes through insufficient chip evacuation

➤ select milling cutters with internal cooling

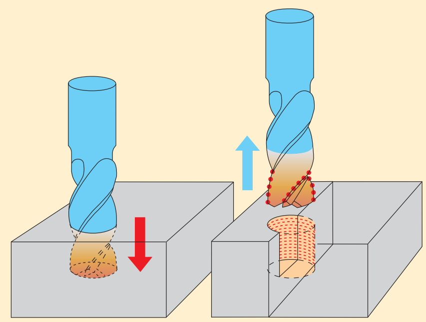
Alternative:
➤ peripheral cooling via GM 300 chuck
➤ increase volume flow
➤ adjust coolant flow
➤ apply compressed air cooling (according to tool and material)
➤ reduce feed rate
➤ modify cutting distribution



6. Pecking when drilling
Significant reduction in tool life as well as crumbling of cutting lips through insufficient chip evacuation and thermal stresses

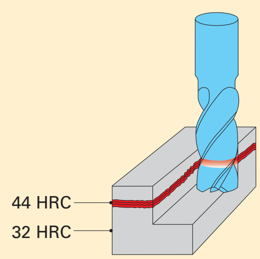
➤ select milling cutter with internal cooling
with drilling depths > 0.5 x D pecking in stages

Alternative:
➤ peripheral cooling via GM 300 chuck
➤ increase volume flow
➤ adjust coolant flow
➤ reduce feed rate

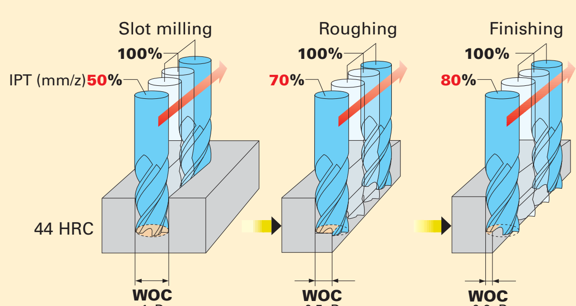


7. Thermal influence on materials
Through welding or torch cutting, the material characteristics at the parting line do not correspond with the specified material class

➤ reduce cutting rates
➤ select tool for materials with a higher tensile strength



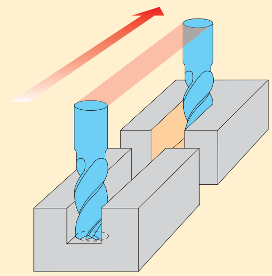
8. Entry in hardened materials
For entering materials over 44 HRC, reduce the feed rate vf (mm/min) in accordance with the illustration on the right



FEEDS & SPEEDS

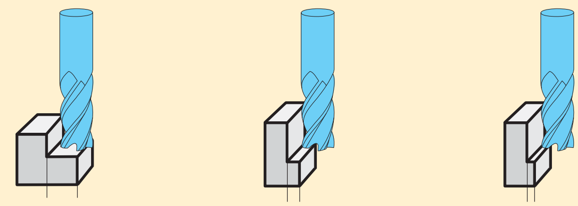
9. Loss in tool life with interrupted cutting
Significant loss in tool life through interrupted cutting (especially with milling angles of 90°)

- ➤ modify cutting distribution
- ➤ reduce feed rate for entry and exit
- ➤ reduce approach angle



10. Feed rate adjustment: Modifying the cutting width

- ➤ when modifying the cutting width WOC, the feed rate must be reduced in accordance with the illustration on the right
- ➤ cutting speed or revolutions remain unchanged
- ➤ double reduction applies when also modifying the cutting depth DOC!



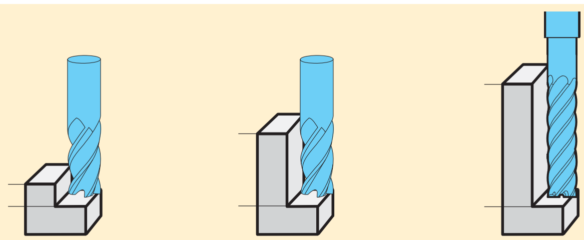
WOC = 1 x D
IPT = 25 %

WOC = 0.5 x D
IPT = 50 %

WOC = 0.25 x D
IPT = 100 %

11. Feed rate adjustment: Modifying the cutting depth

- ➤ when modifying the cutting depth DOC, the feed rate must be reduced in accordance with the illustration on the right
- ➤ cutting speed or revolutions remain unchanged up to cutting depths of 3 x D, must only be adapted over 3 x D
- ➤ double reduction applies when also modifying the cutting width ae!



DOC = 1 x D
IPT = 100 %

DOC = 2 x D
IPT = 50 %

DOC = 3 x D
IPT = 25 %

12. Plunging strategies
for drilling:

- ➤ reduce feed rate v_f (mm/min.)
- ➤ additional pecking for drilling depths > 0.5 x D or transition to radial machining

Attention: Danger of breakage through abrupt load increase!

Oblique plunging up to 15° (preferred):

- ➤ reduction in feed rate v_f (mm/min.) not required

Oblique plunging between 15° and 30°:

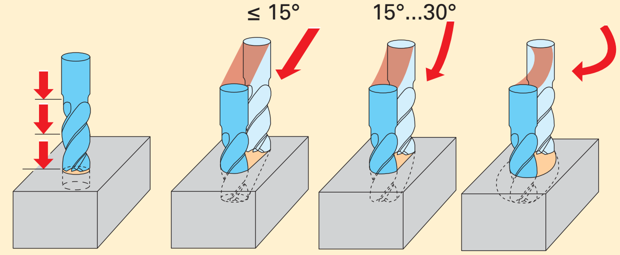
- ➤ reduce feed rate IPT in accordance with the illustration on the right

Helical plunging:

- ➤ for helical plunging on a milling cycle, we recommend a feed of 0.1 to 0.2 per cycle
- ➤ reduce feed rate v_f (mm/min.) in accordance with the illustration on the right
- ➤ select preferred hole diameter 1.8 x D

Drilling | Oblique plunging | Helical plunging

≤ 15° | 15°...30°



90°
IPT -70 %

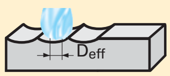
≤ 15°
IPT = 100 %

15°...30°
IPT -30 %

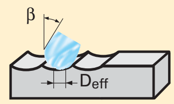
IPT -15 %

13. Copy milling

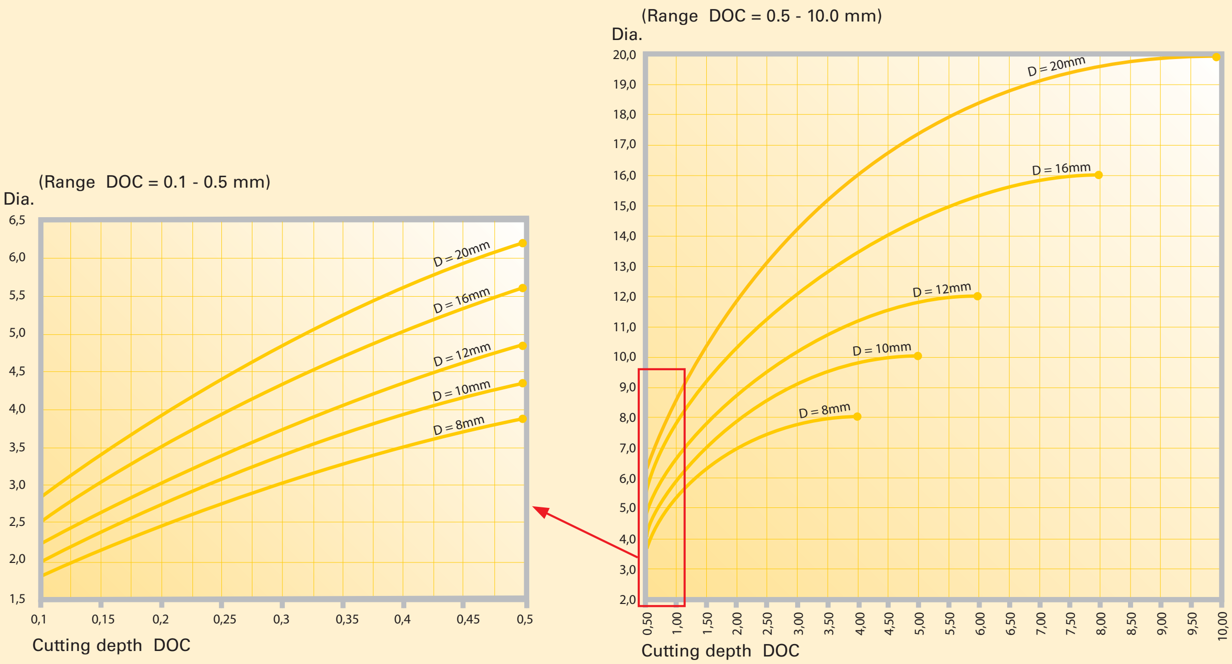
For cutting depths DOC<0.5xD, the engaged effective diameter D_{eff} must be applied to calculate the speed. With the spindle not engaged, the effective diameter is calculated according to the illustration below. To increase tool life, we recommend machining with tilted spindle. The tilt angle must be taken into account when calculating the effective diameter D_{eff}.



$$D_{(eff)} = 2 \cdot \sqrt{D \cdot DOC - DOC^2}$$

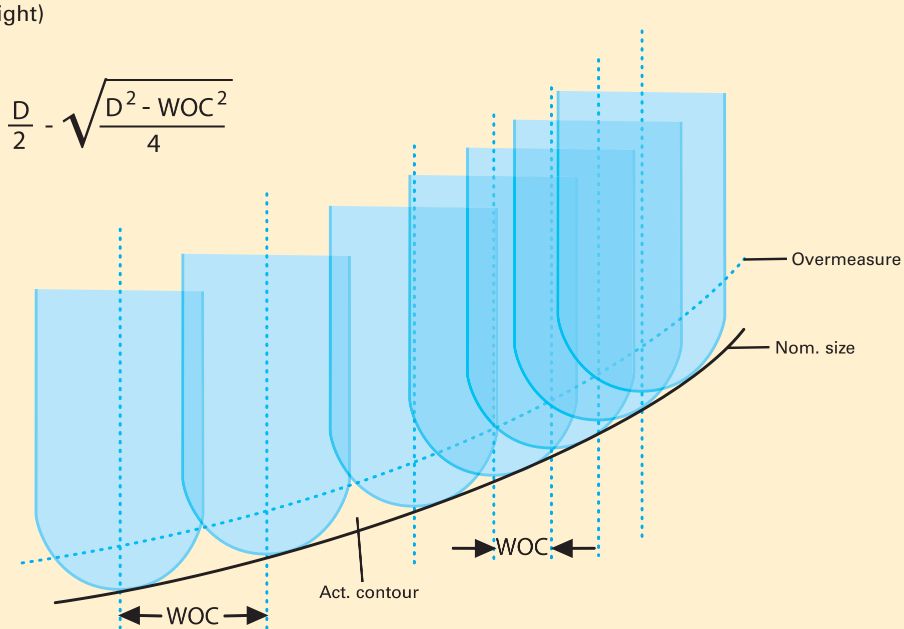


$$D_{(eff)} = D \cdot \sin\left[\beta + \arccos\left(\frac{D - 2DOC}{D}\right)\right]$$



Modifying the cutting width WOC results in improved Surface finish quality of the workpiece (reduced peak-to-valley height)

$$R_{th} = \frac{D}{2} - \sqrt{\frac{D^2 - WOC^2}{4}}$$



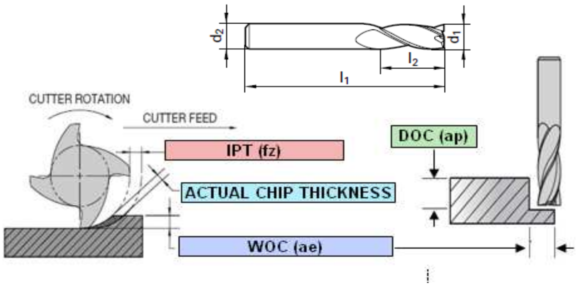
FEEDS & SPEEDS FOR ALL Tech Line - Normal & Rougher

$$RPM = \frac{SFM}{d_1} \times 3.82 \qquad IPM = \text{No. of Teeth} \times IPT \times RPM$$

Example - Adjusting SFM and IPT for 1/2" diameter end mill, WOC .050", material 1018

SFM
WOC / d_1 = xx%
.050 / .500 = 10%
WOC = 10%
SFM = 1350

IPT
WOC 10%
10% = 1.8 IPT multiplier
IPT .0026 x 1.8 = .0047
IPT = .0047



If surface finish is the priority use IPT from table with no adjustment for chip thinning. Use SFM for 10% radial width of cut.

Material	Color Code	Hardness	Tech Line	Surface Feet per Minute - SFM, Radial Width of Cut WOC (ae)*					Feed Rate Inch per Tooth - IPT, d_1 End Mill Diameter							
				5%	10%	30%	50%	100% Slotting	1/8	1/4	5/16	3/8	1/2	5/8	3/4	1
				2.3	1.8	1.1	1	1	← Multiply IPT x this factor based on WOC							
Free Machining & Low Carbon Steels 1006, 1008, 1015, 1018, 1020, 1022, 1025, 1117, 1140, 1141, 11L08, 11L14, 1213, 12L13, 12L14, 1215, 1330	GREEN	up to 28 HRc	GH 100 U RS 100 U GS 100 U	1700	1350	750	425	425	.0005	.0013	.0016	.0020	.0023	.0027	.0036	.0042
Medium Carbon & High Carbon Steels, Alloy Steels & Easy to Machine Tool Steels 1030, 1035, 1040, 1045, 1050, 1052, 1055, 1060, 1085, 1095, 1541, 1551, 9255, 2515, 3135, 3415, 4130, 4137, 4140, 4150, 4320, 4340, 4520, 5015, 5115, 5120, 5132, 5140, 5155, 6150, 8620, 9262, 9840, 52100, O1, O2, O6, S2, W1 to W310	GREEN RED	28 to 38 HRc	GH 100 U RS 100 U GS 100 U	900	625	350	275	275	.0005	.0013	.0016	.0020	.0023	.0027	.0036	.0042
Tool Steels & Die Steels O7, M1, M2, M3, M4, M7, T1, T2, T4, T5, T8, T15, A2, A3, A6, A7, H10, H11, H12, H13, H19, H21, L3, L6, L7, P2, P20, S1, S5, S7, 52100, A 128, D2, D3, D4, D5, D7	RED	28 to 44 HRc	GH 100 U RS 100 F GS 100 H	550	450	300	200	200	.0005	.0011	.0014	.0016	.0020	.0023	.0031	.0034
Hardened Steels Carbon and Alloy Steels, Tool & Die Steels	H	up to 54 HRc	GH 100 U GS 100 H	325	175	125	100	100	.0003	.0006	.0009	.0011	.0014	.0018	.0022	.0027
	H	54 to 60 HRc	GH 100 H	200	105	75	60	60	.0002	.0004	.0006	.0009	.0011	.0015	.0018	.0023
Stainless Steel - Easy to Machine 430F, 301, 303, 410, 416 Annealed, 420F, 430, 430F	BLUE	up tp 28 HRc	GH 100 U RS 100 U GS 100 U	1050	725	400	325	325	.0005	.0013	.0016	.0020	.0023	.0027	.0036	.0042
Stainless Steel - Moderately Difficult 301, 302, 303 High Tensile, 304, 304L, 305, 420, 15-5PH, 17-4PH, 17-7PH	BLUE	up tp 28 HRc	GH 100 U RS 100 U GS 100 U	650	450	250	200	200	.0005	.0011	.0014	.0016	.0020	.0023	.0027	.0033
Stainless Steel - Difficult to Machine 302B, 304B, 309, 310, 316, 316B, 316L, 316Ti, 317, 317L, 321, PH13-8MO, Nitronic	BLUE	over 28 HRc	GH 100 U RS 100 U GS 100 U	600	400	225	175	175	.0005	.0009	.0011	.0014	.0016	.0022	.0025	.0033
High-Temperature Alloys Nimonic, Inconel, Monel, Hastelloy	GRAY	up to 42 HRc	GH 100 U GH 100 H RS 100 F	150	140	120	100	100	.0003	.0006	.0009	.0011	.0014	.0018	.0022	.0027
Titanium Alloys 6AI-4V, 5AI-2.5 Sn, 6AI-2Sn-4Zr-6Mo, 3Ai-8V-6Cr4Mo-4Zr, 10V-2Fe-3Ai, 13V-11Cr-3Ai	GRAY	up to 42 HRc	GH 100 U RS 100 U RS 100 F	450	325	225	175	175	.0005	.0011	.0014	.0016	.0020	.0025	.0032	.0036
Cast Iron - Gray CG ASTM A48, CLASS 20, 25, 30, 35, SAE J431C, GRADES G1800, G3000, G3500, GG 10, 15, 20, 25, 30, 35, 40	WHITE	up to 240 HB 30	GH 100 U GS 100 H RS 100 F	1300	1100	750	375	375	.0005	.0013	.0016	.0020	.0023	.0027	.0036	.0042
Cast Iron - Ductile & Malleable CGI 60-40-18, 65-45-12, D4018, D4512, D5506, 32510, 35108, M3210, M4504, M5503, 250, 300, 350, 400, 450	WHITE	over 240 HB 30	GH 100 U RS 100 F GH 100 H	900	625	400	275	275	.0005	.0013	.0016	.0020	.0023	.0027	.0036	.0042
Aluminum, Al-wrought alloys, Al-alloys 2024, 6061, 7075, 1050, 6351, 5005, 2017, 7075	BLACK	up to 3% Si	GA 200 A GS 100 A GH 100 U	3250	2750	1750	1000	1000	.0009	.0021	.0026	.0032	.0041	.0052	.0061	.0081
Aluminum-cast alloys High Silicon - A380, A390, Castings, 3.2131 G-AlSi5Cu1, 3.2153 G-AlSi7Cu3, 3.2573 G-AlSi9, 3.2581 G-AlSi12, 3.2583 G-AlSi12Cu, - G-AlSi12CuNiMg	BLACK	over 3% Si	GA 200 A GS 100 A GH 100 U	2275	1925	1225	700	700	.0007	.0017	.0021	.0025	.0032	.0042	.0049	.0065
Magnesium Alloys	PURPLE	-	GA 200 A GS 100 A GH 100 U	2100	1500	800	650	650	.0006	.0013	.0017	.0020	.0026	.0033	.0039	.0052
Non-ferrous Copper Alloys, Brass, Bronze	BROWN	up to 28 HRc	GH 100 U GH 100 U GS 100 A	1500	1000	575	450	450	.0005	.0009	.0013	.0016	.0019	.0025	.0030	.0041