GUHRING

德國鈷領 RF 100 Diver 銑刀

RF 100
diver

最泛用型的銑刀

Drilling 鑽銑
Ramping 斜向進刀
Roughing 粗加工
Finishing 精加工
Slotting 開槽

NEW

EXTENDED PROGRAMME 新規格系列推出
AND **INTERNAL COOLING** 中心出水（底部與側刃）

Drilling and milling optimised internal cooling

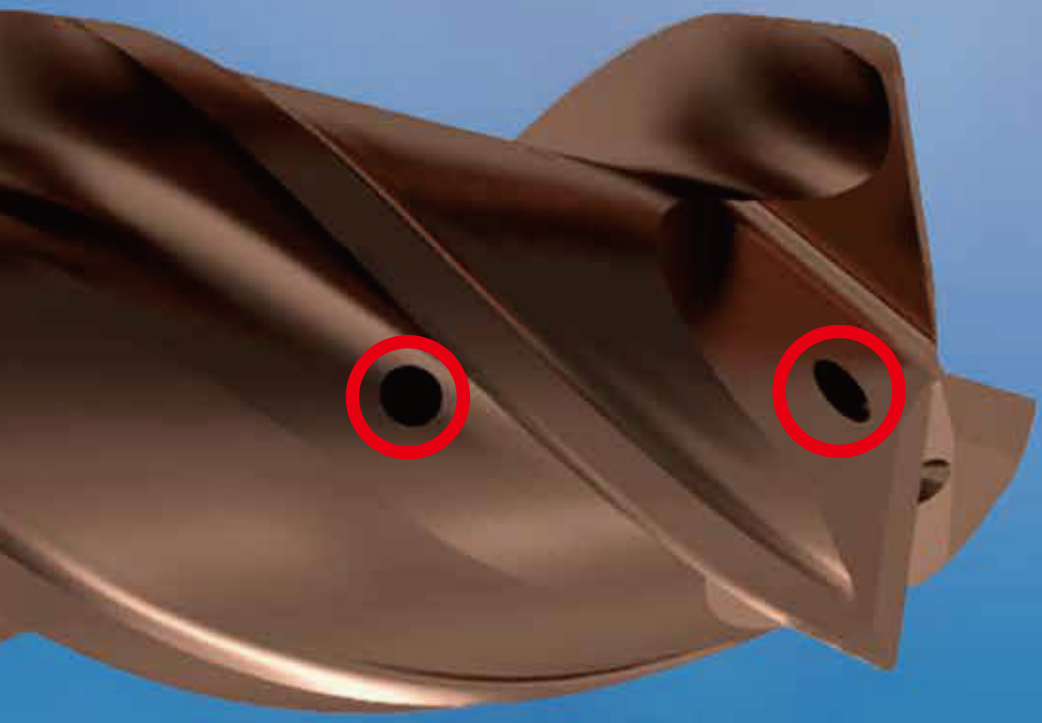
採用內冷中心出水的銑刀，用於往下鑽銑與所有銑削加工，可以得到最佳的效果

Where drills use axial coolant ducts and milling cutters radial coolant ducts, the RF 100 Diver cutter offers both in order to optimise cooling and protection to the face and diameter when drilling and plunging.
Guhring's decades of expertise in carbide production as well as FEM optimisation ensure maximum efficiency of cooling lubrication, chip evacuation and tool stability.
當鑽頭加工使用軸向冷卻孔及銑刀加工使用徑向冷卻孔，RF 100 Diver 銑刀同時採用了以上兩種冷卻孔，
當在實施鑽銑及螺旋下刀加工時會以最優越的冷卻條件來保護外側及端面的刃口。
Guhring在鎢鋼生產及 FEM工廠環境管理模組 (Facility Environment Module)方面有數十年的經驗、
專業知識豐富，能確保最佳的冷卻潤滑效率、排屑性及刀具加工時的穩定性。

▶ up to 40 % longer tool life	刀具壽命最高提升40%
▶ for sticky materials	可應用於沾黏性高的材料加工
▶ stainless and heat-resistant materials	適用於不銹鋼和耐熱材料
▶ for process reliability in drilling and plunging	鑽銑及螺旋下刀銑削加工，可靠度高
▶ HPC machining	適用 HPC高移除率銑削加工

NEW

extended programme and internal cooling



刀底、側刃刀口
皆有出孔水
（避免刃口沾黏積屑，效果最佳）

For any application
the optimal Diver – now even more choice
適用於任何型態的銑削加工，規格樣式選擇性多

MTC
適用於工況不佳

3-fluted 3刃 標準長

- for less powerful machines & clamping conditions
- for turning machines & driven tools
- specially for slotting with smaller milling cutter diameters

適用於機台馬力不足及工件夾持不穩固的情況
適用於車床及動力刀座機台
專門適用於較小直徑銑刀的開槽加工

3-fluted **with internal cooling, page 7**
（3刃中心出水在第 9頁）
3-fluted **without internal cooling, page 6**
（3刃無中心出水在第 6頁）

HPC

4-fluted, short 4刃 短刃型

- for more stability with slotting
- up to 25 % higher feed rate
- reduced deflection

開槽可提高穩定性
最高進給速度提高25%
減少切刃被頂出，工件面垂直度佳

4-fluted, short
without internal cooling, page 8
（4刃短刃型 無中心出水在第 8頁）

HPC HSC

4-fluted 4刃 標準長

- for stable machines & clamping conditions
- high-performance milling with maximum cutting speeds

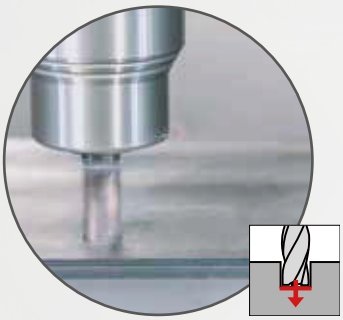
適用於穩定的好機台及工件夾持穩固
可以以最大的切削速度進行高效率銑削

4-fluted, **with internal cooling, page 10**
（4刃中心出水在第 10頁）
4-fluted, **without internal cooling, page 9**
（4刃無中心出水在第 9頁）

Universally applicable for **all materials and milling strategies** for outstanding cutting values and tool life

適用於所有材料銑削、各種銑削方式皆適用、出色的切削效率和刀具壽命

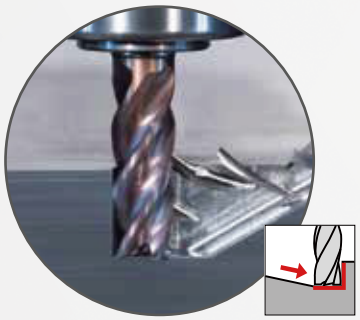
RF100 diver



Drilling
鑽銑削

Application example:
Dry machining cast iron
鑄鐵乾式切削

a_p = 12 mm 切深
a_e = 12 mm 切寬
v_c = 240 m/min 切削速度
v_f = 800 mm/min 每分鐘進給

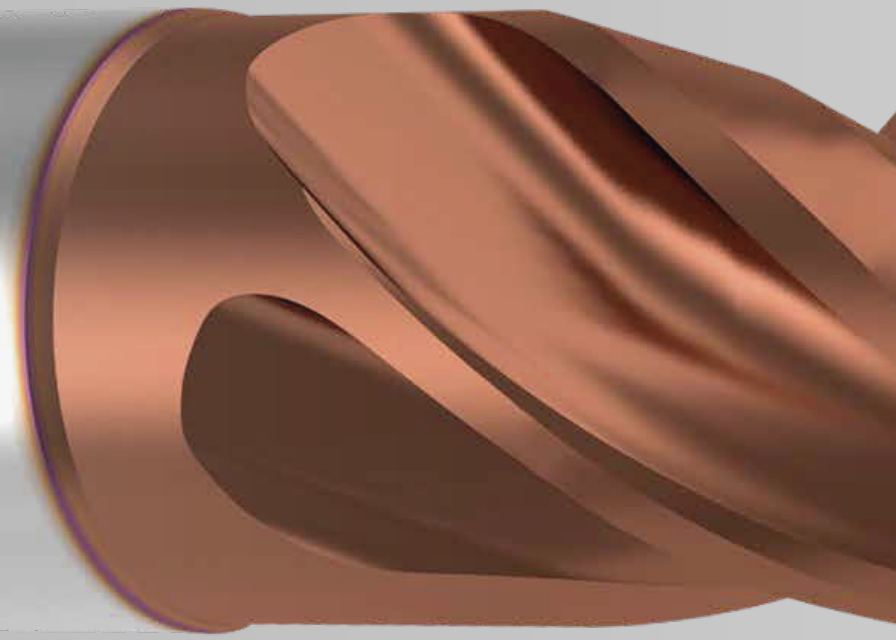


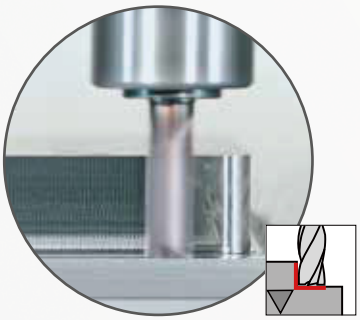
Ramping
斜向進刀銑削

Application example: 紅十字 鉻鉬合金鋼
Wet machining in 42CrMo4 斜向30度進刀
Ramping angle = 30° 濕式切削

a_p = 12 mm 切深
a_e = 11.7 mm 切寬
v_c = 200 m/min 切削速度
v_f = 1200 mm/min 每分鐘進給

- special face geometry for drilling and ramping
  端面特殊幾何角度設計 適用於鑽銑與斜向進刀銑削
- optimised flute space
  溝槽空間最佳化設計
- cutting edge preparation
  刃口特殊處理
- Signum-coating
  Signum 鍍層
- with neck clearance
  縮頸設計
- dimensions to DIN 6527 long
  長刃尺寸參考 DIN 6527
- dimensions to DIN 6527 short, NEW
  programme page 8
  短刃尺寸參考 DIN 6527，頁數 8
- 4-fluted and 3-fluted option NEW
  3刃及 4刃可以選用
- with and without internal cooling NEW
  中心出水型、無中心出水型皆可選用



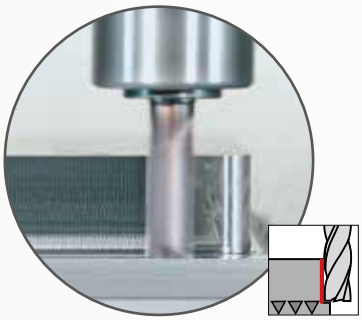


Roughing
粗銑削

Application example:
Dry machining in steel 42CrMo4
鉻鉬合金鋼 乾式切削

a_p = 24 mm 切深
a_e = 3 mm 切寬
v_c = 280 m/min 切削速度

v_f = 3050 mm/min 每分鐘進給
Metal removal rate Q = 219 cm³/min
每分鐘金屬移除率

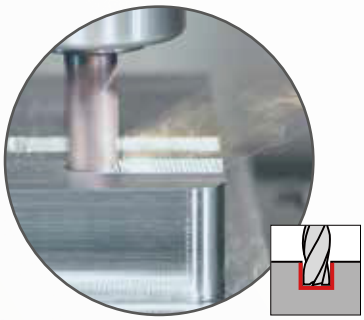


Finishing
精銑削

Application example:
Wet machining in 1.4301
304不銹鋼 濕式切削

a_p = 20 mm 切深
a_e = 0.2 mm 切寬
v_c = 200 m/min 切削速度

v_f = 1270 mm/min 每分鐘進給
R_z = 2.7 µm Rz 面粗度



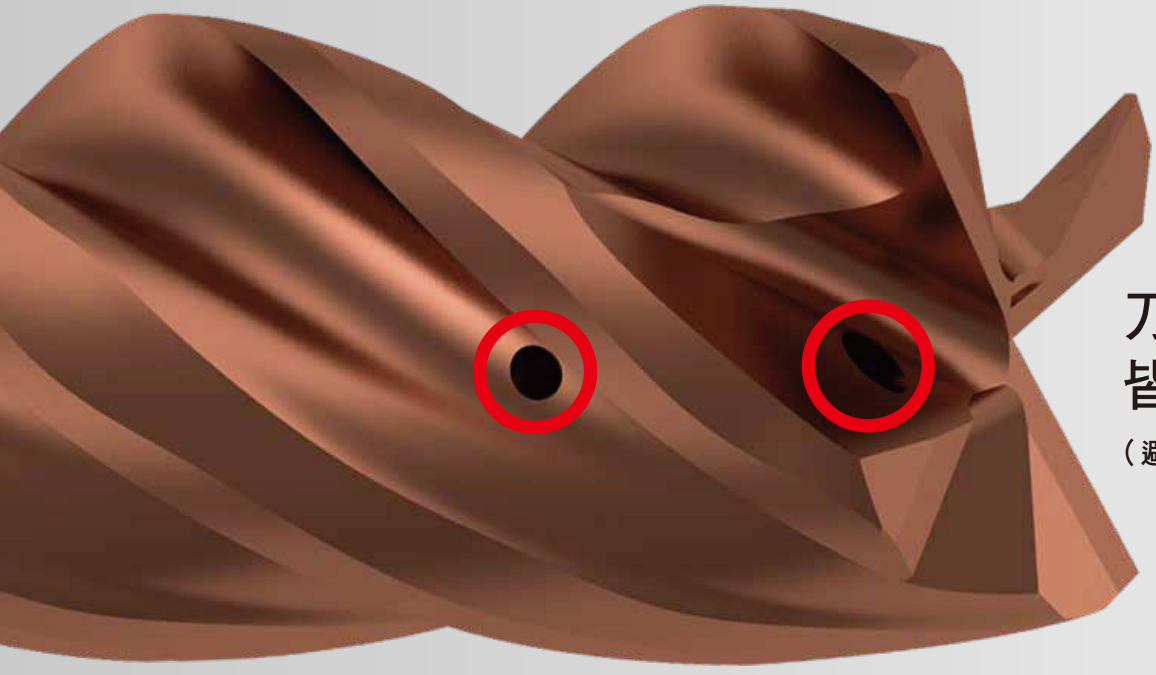
Slotting
開槽銑削

Application example:
Dry machining in steel 42CrMo4
鉻鉬合金鋼 乾式切削

a_p = 12 mm 切深
a_e = 11.7 mm 切寬
v_c = 240 m/min 切削速度

v_f = 1800 mm/min 每分鐘進給
Metal removal rate Q = 252 cm³/min
每分鐘金屬移除率

Ratio®



刀底、側刃刀口皆有出孔水

（避免刃口沾黏積屑，效果最佳）

Ratio end mills RF 100 DIVER (3-fluted) | RF 100 Diver 3刃標準長

WN | NH | 3 | 41° 43° 45° | 45° | 7°

P	●
M	●
K	●
N	●
S	●
H	

GÜHRINGNAVIGATOR

Cutting data page 12 (切削參數在 12頁)

- neck clearance
- centre cutting
- with special drill face

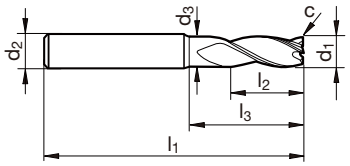
- 縮頸設計
- 刀底端面過中心
- 刀底刃口可以鑽銑

M7C

unstable conditions

特別適用於以下工況

- 機台馬力不足
- 工件夾持不穩固的情況
- 車床及動力刀座機台
- 小直徑銑刀的開槽加工



Tool material	Solid carbide	
Surface	Y	Y
Type	NH	NH
Shank form	HA	HB
	NEW	NEW

編號	6797	6798

d1 h10 mm	d2 h6 mm	d3 mm	l1 mm	l2 mm	l3 mm	c mm	Z	Code no.	價格	
3.00	6.00	2.80	57	8.0	15.0	0.05	3	3.000	1,200	1,200
3.50	6.00	3.30	57	10.0	15.0	0.05	3	3.500	1,200	1,200
3.70	6.00	3.50	57	11.0	15.0	0.06	3	3.700	1,200	1,200
4.00	6.00	3.80	57	11.0	18.0	0.06	3	4.000	1,200	1,200
4.50	6.00	4.30	57	11.0	18.0	0.07	3	4.500	1,200	1,200
4.70	6.00	4.50	57	13.0	18.0	0.07	3	4.700	1,200	1,200
5.00	6.00	4.80	57	13.0	18.0	0.08	3	5.000	1,200	1,200
5.50	6.00	5.30	57	13.0	19.4	0.08	3	5.500	1,200	1,200
5.70	6.00	5.50	57	13.0	19.6	0.09	3	5.700	1,200	1,200
6.00	6.00	5.70	57	13.0	20.0	0.09	3	6.000	1,200	1,200
6.50	8.00	6.20	63	16.0	24.4	0.10	3	6.500	1,300	1,400
7.00	8.00	6.70	63	16.0	24.9	0.11	3	7.000	1,400	1,500
7.50	8.00	7.20	63	19.0	25.3	0.11	3	7.500	1,600	1,600
8.00	8.00	7.70	63	19.0	26.0	0.12	3	8.000	1,600	1,700
8.50	10.00	8.20	72	19.0	29.4	0.13	3	8.500	1,800	1,900
9.00	10.00	8.70	72	19.0	29.9	0.14	3	9.000	2,000	2,100
9.50	10.00	9.20	72	22.0	30.3	0.14	3	9.500	2,300	2,300
10.00	10.00	9.50	72	22.0	30.0	0.15	3	10.000	2,500	2,600
12.00	12.00	11.50	83	26.0	36.0	0.18	3	12.000	3,100	3,200
16.00	16.00	15.50	92	32.0	42.0	0.19	3	16.000	5,400	5,600
20.00	20.00	19.50	104	38.0	52.0	0.24	3	20.000	8,300	8,500

開槽銑削 加工參數

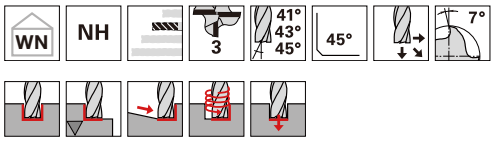
材料 ISO	抗拉強度 Hardness	切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
			切深 ap = 1,0 x D				切寬 ae = 1,0 x D		
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110

側銑加工參數

切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
	切深 ap = 1,5 x D				最大切寬 ae max = 0,33 x D		
350	0,021	0,032	0,042	0,063	0,075	0,100	0,125
260	0,018	0,027	0,036	0,059	0,070	0,094	0,117
160	0,018	0,027	0,036	0,059	0,070	0,094	0,117
120	0,019	0,029	0,038	0,060	0,072	0,096	0,120
110	0,017	0,025	0,033	0,052	0,062	0,083	0,104
190	0,021	0,032	0,042	0,063	0,075	0,100	0,125
440	0,023	0,034	0,045	0,069	0,083	0,110	0,138

Ratio end mills RF 100 DIVER (3-fluted)

RF 100 Diver 3刃標準長 中心出水



Tool material	Solid carbide	
Surface	Y	Y
Type	NH	NH
Shank form	HA	HB
	NEW	NEW

P	●
M	●
K	●
N	●
S	●
H	

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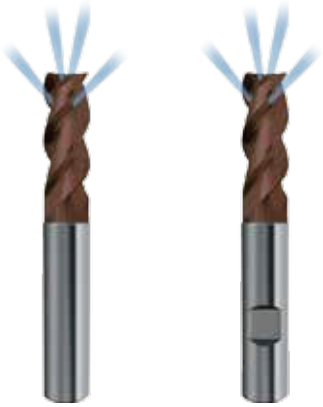
Cutting data page 12 (切削參數在 12頁)

- with internal cooling: Radial and axial exits
- neck clearance
- centre cutting
- with special drill face

- 縮頸設計
- 刀底端面過中心
- 刀底刃口可以鑽銑

刀底與側刃刀口皆有出水

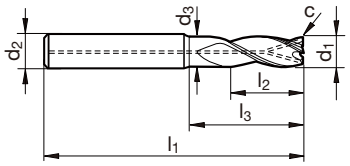


MTC

unstable conditions

特別適用於以下工況

- 機台馬力不足
- 工件夾持不穩固的情況
- 車床及動力刀座機台
- 較小直徑銑刀的開槽加工



編號	6799	6800

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	價格	
mm	mm	mm	mm	mm	mm	mm				
6.00	6.00	5.70	57	13.0	20.0	0.09	3	6.000	1,500	1,600
8.00	8.00	7.70	63	19.0	26.0	0.12	3	8.000	2,100	2,200
10.00	10.00	9.50	72	22.0	30.0	0.15	3	10.000	3,000	3,000
12.00	12.00	11.50	83	26.0	36.0	0.18	3	12.000	3,800	3,900
16.00	16.00	15.50	92	32.0	42.0	0.19	3	16.000	6,200	6,400

開槽銑削 加工參數

材料 ISO	抗拉強度 Hardness	切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑						
			4	6	8	10	12	16	20
			切深 ap = 1,0 x D				切寬 ae = 1,0 x D		
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110

其他加工方式參數

切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑						
	4	6	8	10	12	16	20
	切深 ap = 1,0 x D					切寬 ae = 1,0 x D	
270	0,014	0,021	0,028	0,040	0,048	0,064	0,080
180	0,008	0,012	0,016	0,025	0,030	0,040	0,050
90	0,007	0,011	0,014	0,023	0,027	0,036	0,045
60	0,006	0,010	0,013	0,020	0,024	0,032	0,040
50	0,006	0,010	0,013	0,020	0,024	0,032	0,040
150	0,014	0,021	0,028	0,040	0,048	0,064	0,080
340	0,014	0,021	0,028	0,040	0,048	0,064	0,080

Ratio end mills RF 100 DIVER — RF 100 Diver 4刃 短刃型

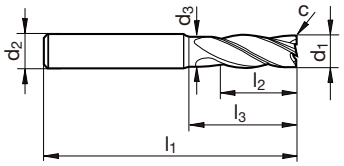
DIN 6527 K | N | 4 | 36° 38° 37° | 45° | 7° | 48 HRC

Tool material	Solid carbide	
Surface	Y	Y
Type	N	N
Shank form	HA	HB
	NEW	NEW

P ● M ● K ● N ● S ● H ○

GÜHRINGNAVIGATOR
Cutting data page 12 (切削參數在 12頁)

- neck clearance
- centre cutting
- 縮頸設計
- 刀底端面過中心



短刃型優點：

- 開槽可提高穩定性
- 最高進給速度提高25%
- 減少切刃被頂出，工件面垂直度佳

編號	6803	6804

d1 h10 mm	d2 h6 mm	d3 mm	l1 mm	l2 mm	l3 mm	c mm	Z	Code no.	價格	
3.00	6.00	2.80	50	5.0	12.0	0.03	4	3.000	1,100	1,200
3.70	6.00	3.50	54	8.0	12.0	0.04	4	3.700	1,100	1,200
4.00	6.00	3.80	54	8.0	15.0	0.04	4	4.000	1,100	1,200
4.70	6.00	4.50	54	9.0	15.0	0.05	4	4.700	1,100	1,200
5.00	6.00	4.80	54	9.0	15.0	0.05	4	5.000	1,100	1,200
5.70	6.00	5.50	54	10.0	16.6	0.06	4	5.700	1,100	1,200
6.00	6.00	5.70	54	10.0	17.0	0.06	4	6.000	1,100	1,200
7.00	8.00	6.70	58	11.0	19.9	0.07	4	7.000	1,500	1,600
7.70	8.00	7.40	58	12.0	20.5	0.08	4	7.700	1,500	1,600
8.00	8.00	7.70	58	12.0	21.0	0.08	4	8.000	1,500	1,600
9.00	10.00	8.70	66	13.0	23.9	0.09	4	9.000	2,300	2,400
9.70	10.00	9.40	66	14.0	24.5	0.10	4	9.700	2,300	2,400
10.00	10.00	9.50	66	14.0	24.0	0.10	4	10.000	2,300	2,400
11.70	12.00	11.20	73	16.0	25.3	0.12	4	11.700	2,900	3,000
12.00	12.00	11.50	73	16.0	26.0	0.12	4	12.000	2,900	3,000
15.60	16.00	15.10	82	22.0	31.2	0.16	4	15.600	5,100	5,300
16.00	16.00	15.50	82	22.0	32.0	0.16	4	16.000	5,100	5,300
19.00	20.00	18.50	92	26.0	38.7	0.19	4	19.000	7,700	7,800
20.00	20.00	19.50	92	26.0	40.0	0.20	4	20.000	7,700	7,800

開槽銑削 加工參數

材料 ISO	抗拉強度 Hardness	切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
			切深 ap = 1,0 x D					切寬 ae = 1,0 x D	
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110

側銑加工參數

切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
	全刃長切深 ap = l2			HPC		最大切寬 ae max = 0,20 x D	
450	0,027	0,040	0,054	0,080	0,10	0,13	0,16
300	0,022	0,034	0,045	0,072	0,09	0,12	0,14
200	0,022	0,034	0,045	0,072	0,09	0,12	0,14
140	0,020	0,031	0,041	0,064	0,08	0,10	0,13
110	0,020	0,031	0,041	0,064	0,08	0,10	0,13
250	0,027	0,040	0,054	0,080	0,10	0,13	0,16
570	0,029	0,043	0,058	0,088	0,11	0,14	0,18

Ratio end mills RF 100 DIVER

RF 100 Diver 4刃標準長

DIN 6527 L | NH | 4 | 36° 38° 37° | 45° | 7° | 48 HRC

Tool material	Solid carbide	
Surface	Ⓨ	Ⓨ
Type	NH	NH
Shank form	HA	HB

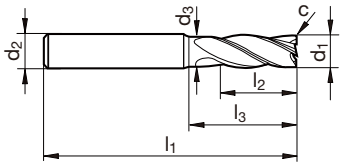
P	●
M	●
K	●
N	●
S	●
H	○

GÜHRINGNAVIGATOR

Cutting data page 12 (切削參數在 12頁)

- neck clearance
- centre cutting

- 縮頸設計
- 刀底端面過中心



編號	6737	6736

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	價格	
mm	mm	mm	mm	mm	mm	mm				
4.00	6.00	3.80	57	11.0	18.0	0.04	4	4.000	1,300	1,400
5.00	6.00	4.80	57	13.0	18.0	0.05	4	5.000	1,300	1,400
5.70	6.00	5.50	57	13.0	19.6	0.06	4	5.700	1,300	1,400
6.00	6.00	5.70	57	13.0	20.0	0.06	4	6.000	1,300	1,400
7.70	8.00	7.40	63	19.0	25.5	0.08	4	7.700	1,800	1,900
8.00	8.00	7.70	63	19.0	26.0	0.08	4	8.000	1,800	1,900
9.70	10.00	9.40	72	22.0	30.5	0.10	4	9.700	2,700	2,800
10.00	10.00	9.50	72	22.0	30.0	0.10	4	10.000	2,700	2,800
11.70	12.00	11.20	83	26.0	35.3	0.12	4	11.700	3,500	3,600
12.00	12.00	11.50	83	26.0	36.0	0.12	4	12.000	3,500	3,600
13.70	14.00	13.20	83	26.0	35.3	0.14	4	13.700	4,700	4,800
14.00	14.00	13.50	83	26.0	36.0	0.14	4	14.000	4,700	4,800
15.60	16.00	15.10	92	32.0	41.2	0.16	4	15.600	6,100	6,200
16.00	16.00	15.50	92	32.0	42.0	0.16	4	16.000	6,100	6,200
19.50	20.00	19.00	104	38.0	51.1	0.20	4	19.500	9,300	9,500
20.00	20.00	19.50	104	38.0	52.0	0.20	4	20.000	9,300	9,500

開槽銑削 加工參數

材料 ISO	抗拉強度 Hardness	切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
			切深 ap = 1,0 x D					切寬 ae = 1,0 x D	
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110

側銑加工參數

切速 vc	fz (mm/z) / Ø 每刃進給/ 刃徑 3	6	8	10	12	16	20
	全刃長切深 ap = l2			HPC		最大切寬 ae max = 0,20 x D	
450	0,027	0,040	0,054	0,080	0,10	0,13	0,16
300	0,022	0,034	0,045	0,072	0,09	0,12	0,14
200	0,022	0,034	0,045	0,072	0,09	0,12	0,14
140	0,020	0,031	0,041	0,064	0,08	0,10	0,13
110	0,020	0,031	0,041	0,064	0,08	0,10	0,13
250	0,027	0,040	0,054	0,080	0,10	0,13	0,16
570	0,029	0,043	0,058	0,088	0,11	0,14	0,18

掃描觀看 實際加工-1

掃描觀看 實際加工-2

掃描觀看 實際加工-3

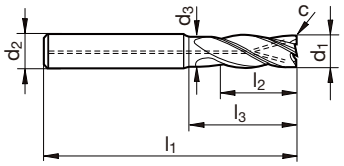
Ratio end mills RF 100 DIVER | RF 100 Diver 4刃標準長 中心出水

DIN 6527 L | N | 4 | 36° 38° 37° | 45° | 7° | 48 HRC

P	●
M	●
K	●
N	●
S	●
H	○

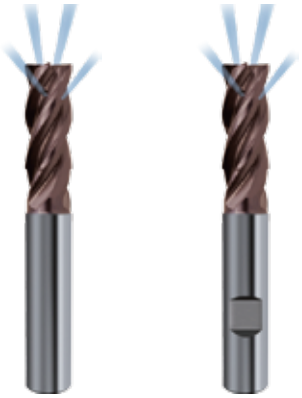
GÜHRING NAVIGATOR
Cutting data page 12 (切削參數在 12頁)

- with internal cooling: Radial and axial exits
- neck clearance
- centre cutting
- 刀底與側刃刀口皆有出水
- 縮頸設計
- 刀底端面過中心



Tool material	Solid carbide	
Surface	Y	Y
Type	N	N
Shank form	HA	HB
	NEW	NEW

刀底與側刃刀口皆有出水



編號	6801	6802

d1 h10 mm	d2 h6 mm	d3 mm	l1 mm	l2 mm	l3 mm	c mm	Z	Code no.	價格	
6.00	6.00	5.70	57	13.0	20.0	0.06	4	6.000	1,700	1,800
8.00	8.00	7.70	63	19.0	26.0	0.08	4	8.000	2,400	2,400
10.00	10.00	9.50	72	22.0	30.0	0.10	4	10.000	3,300	3,400
12.00	12.00	11.50	83	26.0	36.0	0.12	4	12.000	4,300	4,400
16.00	16.00	15.50	92	32.0	42.0	0.16	4	16.000	6,700	6,900
20.00	20.00	19.50	104	38.0	52.0	0.20	4	20.000	10,300	10,400
25.00	25.00	24.00	121	45.0	63.0	0.25	4	25.000	14,700	14,900

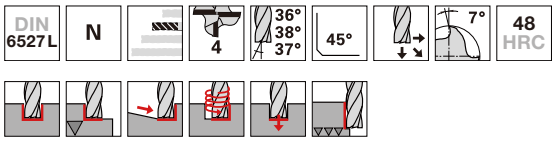
開槽銑削 加工參數

材料 ISO	抗拉強度 Hardness	切速 vc	fz (mm/z) / Ø 每刃進給 / 刃徑 4	6	8	10	12	16	20
			切深 ap = 1,0 x D				切寬 ae = 1,0 x D		
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110

其他加工方式參數

切速 vc	fz (mm/z) / Ø 每刃進給 / 刃徑 4	6	8	10	12	16	20
	切深 ap = 1,0 x D					切寬 ae = 1,0 x D	
270	0,014	0,021	0,028	0,040	0,048	0,064	0,080
180	0,008	0,012	0,016	0,025	0,030	0,040	0,050
90	0,007	0,011	0,014	0,023	0,027	0,036	0,045
60	0,006	0,010	0,013	0,020	0,024	0,032	0,040
50	0,006	0,010	0,013	0,020	0,024	0,032	0,040
150	0,014	0,021	0,028	0,040	0,048	0,064	0,080
340	0,014	0,021	0,028	0,040	0,048	0,064	0,080

Ratio end mill sets RF 100 Diver



Tool material	Solid carbide
Surface	Y
Type	N
Shank form	HA

P	●
M	●
K	●
N	●
S	●
H	

GÜHRINGNAVIGATOR
Cutting data page 12 (切削參數在 12頁)

- neck clearance
- centre cutting
- consisting of art. no. 6737

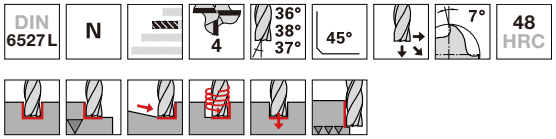
- 縮頸設計
- 刀底端面過中心
- 內含 # 6737

內含 4刃 # 6737 標準長

編號	6755

Ø-range mm	Pieces/set Piece	Code no.	價格
5,7/7,7/9,7/11,7/15,6	5	1.000	19,400
6/8/10/12/16	5	2.000	19,400

Ratio end mill sets RF 100 Diver



Tool material	Solid carbide
Surface	Y
Type	N
Shank form	HB

P	●
M	●
K	●
N	●
S	●
H	

GÜHRINGNAVIGATOR
Cutting data page 12 (切削參數在 12頁)

- neck clearance
- centre cutting
- consisting of art. no. 6736

- 縮頸設計
- 刀底端面過中心
- 內含 # 6736

內含 4刃 # 6736 側固標準長

編號	6754

Ø-range mm	Pieces/set Piece	Code no.	價格
5,7/7,7/9,7/11,7/15,6	5	1.000	19,400
6/8/10/12/16	5	2.000	19,400

RF100 diver

SLOTTING 開槽銑削

Material/ISO material 材料群組		抗拉強度 Hardness	最大切深 a_p max	最大切寬 a_e max	切速 v_c	fz (mm/z) with nom. Ø 每刃進給 / 刃徑							
						4	5	6	8	10	12	16	20
P	Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm²	1xD	1xD	270	0.017	0.021	0.025	0.034	0.050	0.060	0.080	0.100
	Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm²	1xD	1xD	230	0.017	0.021	0.025	0.034	0.050	0.060	0.080	0.100
	Alloyed heat-treatable, tool and high speed steels	850 - 1400 N/mm²	1xD	1xD	180	0.014	0.018	0.021	0.028	0.045	0.054	0.072	0.090
M	Stainless steel - easy to machine / sulphured	≤ 750 N/mm²	1xD	1xD	120	0.014	0.018	0.021	0.028	0.045	0.054	0.072	0.090
	Stainless steel - moderately difficult to machine	750 - 950 N/mm²	1xD	1xD	80	0.013	0.016	0.019	0.026	0.040	0.048	0.064	0.080
K	Cast iron, grey cast iron, spher. graphite/malleable cast iron	≥ 240 HB	1xD	1xD	150	0.017	0.021	0.025	0.034	0.050	0.060	0.080	0.100
N	Aluminium, Al-wrought alloys, Al-alloys	≤ 7% Si	1xD	1xD	500	0.022	0.028	0.033	0.044	0.065	0.078	0.104	0.130
	Aluminium-cast alloys	≥ 7% Si	1xD	1xD	340	0.018	0.023	0.027	0.036	0.055	0.066	0.088	0.110
S	Titanium, Titanium alloys	≤ 1300 N/mm²	1xD	1xD	60	0.013	0.016	0.019	0.026	0.040	0.048	0.064	0.080

HPC-ROUGHING HPC高效能銑削

Material/ISO material 材料群組		抗拉強度 Hardness	最大切深 a_p max	最大切寬 a_e max	切速 v_c	fz (mm/z) with nom. Ø 每刃進給 / 刃徑							
						4	5	6	8	10	12	16	20
P	Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm²	1.5xD	0.40xD	350	0.021	0.026	0.032	0.042	0.063	0.075	0.100	0.125
	Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm²	1.5xD	0.40xD	290	0.021	0.026	0.032	0.042	0.063	0.075	0.100	0.125
	Alloyed heat-treatable, tool and high speed steels	850 - 1400 N/mm²	1.5xD	0.33xD	260	0.018	0.023	0.027	0.036	0.059	0.070	0.094	0.117
M	Stainless steel - easy to machine / sulphured	≤ 750 N/mm²	1.5xD	0.33xD	160	0.018	0.023	0.027	0.036	0.059	0.070	0.094	0.117
	Stainless steel - moderately difficult to machine	750 - 950 N/mm²	1.5xD	0.25xD	120	0.019	0.024	0.029	0.038	0.060	0.072	0.096	0.120
K	Cast iron, grey cast iron, spher. graphite/malleable cast iron	≥ 240 HB	1.5xD	0.40xD	190	0.021	0.026	0.032	0.042	0.063	0.075	0.100	0.125
N	Aluminium, Al-wrought alloys, Al-alloys	≤ 7% Si	1.5xD	0.40xD	600	0.028	0.034	0.041	0.055	0.081	0.098	0.130	0.163
	Aluminium-cast alloys	≥ 7% Si	1.5xD	0.40xD	440	0.023	0.028	0.034	0.045	0.069	0.083	0.110	0.138
S	Titanium, Titanium alloys	≤ 1300 N/mm²	1.5xD	0.33xD	110	0.017	0.021	0.025	0.033	0.052	0.062	0.083	0.104

HSC-FINISHING 高速度精銑削

Material/ISO material 材料群組		抗拉強度 Hardness	最大切深 a_p max	最大切寬 a_e max	切速 v_c	fz (mm/z) with nom. Ø 每刃進給 / 刃徑							
						4	5	6	8	10	12	16	20
P	Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm²	2xD	0.02xD	540	0.018	0.023	0.028	0.037	0.055	0.066	0.088	0.110
	Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm²	2xD	0.02xD	460	0.018	0.023	0.028	0.037	0.055	0.066	0.088	0.110
	Alloyed heat-treatable, tool and high speed steels	850 - 1400 N/mm²	2xD	0.02xD	350	0.015	0.019	0.023	0.031	0.050	0.059	0.079	0.099
M	Stainless steel - easy to machine / sulphured	≤ 750 N/mm²	2xD	0.02xD	220	0.015	0.019	0.023	0.031	0.050	0.059	0.079	0.099
	Stainless steel - moderately difficult to machine	750 - 950 N/mm²	2xD	0.02xD	160	0.014	0.018	0.021	0.028	0.044	0.053	0.070	0.088
K	Cast iron, grey cast iron, spher. graphite/malleable cast iron	≥ 240 HB	2xD	0.02xD	300	0.018	0.023	0.028	0.037	0.055	0.066	0.088	0.110
N	Aluminium, Al-wrought alloys, Al-alloys	≤ 7% Si	2xD	0.02xD	1000	0.024	0.030	0.036	0.048	0.072	0.086	0.114	0.143
	Aluminium-cast alloys	≥ 7% Si	2xD	0.02xD	680	0.020	0.025	0.030	0.040	0.061	0.073	0.097	0.121
S	Titanium, Titanium alloys	≤ 1300 N/mm²	2xD	0.02xD	130	0.014	0.018	0.021	0.028	0.044	0.053	0.070	0.088

RAMPING, HELIX, GROOVING 斜向及螺旋下刀

Material/ISO material 材料群組		抗拉強度 Hardness	最大切深 a_p	斜向進刀最大角度 Ramping max. angle	切速 v_c	fz (mm/z) with nom. Ø 每刃進給 / 刃徑							
						4	5	6	8	10	12	16	20
P	Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm²	1 x D	45°	270	0.015	0.019	0.023	0.030	0.045	0.054	0.072	0.090
	Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm²	1 x D	45°	230	0.013	0.017	0.020	0.026	0.040	0.048	0.064	0.080
	Alloyed heat-treatable, tool and high speed steels	850 - 1400 N/mm²	1 x D	30°	180	0.011	0.014	0.017	0.022	0.030	0.036	0.048	0.060
M	Stainless steel - easy to machine / sulphured	≤ 750 N/mm²	1 x D	10°	120	0.009	0.012	0.014	0.018	0.030	0.036	0.048	0.060
	Stainless steel - moderately difficult to machine	750 - 950 N/mm²	1 x D	5°	80	0.007	0.009	0.011	0.014	0.025	0.030	0.040	0.050
K	Cast iron, grey cast iron, spher. graphite/malleable cast iron	≥ 240 HB	1 x D	45°	150	0.015	0.019	0.023	0.030	0.045	0.054	0.072	0.090
N	Aluminium, Al-wrought alloys, Al-alloys	≤ 7% Si	1 x D	30°	500	0.013	0.017	0.020	0.026	0.040	0.048	0.064	0.080
	Aluminium-cast alloys	≥ 7% Si	1 x D	45°	340	0.015	0.019	0.023	0.030	0.045	0.054	0.072	0.090
S	Titanium, Titanium alloys	≤ 1300 N/mm²	1 x D	10°	60	0.007	0.009	0.011	0.014	0.025	0.030	0.040	0.050

DRILLING 鑽銑削

Material/ISO material 材料群組		抗拉強度 Hardness	鑽銑最大切深 Drilling depth (a_p max.)	切速 v_c	fz (mm/z) with nom. Ø 每刃進給 / 刃徑							
					4	5	6	8	10	12	16	20
P	Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm²	1.5 x D	270	0.014	0.018	0.021	0.028	0.040	0.048	0.064	0.080
	Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm²	1.5 x D	230	0.012	0.015	0.018	0.024	0.035	0.042	0.056	0.070
	Alloyed heat-treatable, tool and high speed steels	850 - 1400 N/mm²	1.0 x D	180	0.008	0.010	0.012	0.016	0.025	0.030	0.040	0.050
K	Cast iron, grey cast iron, spher. graphite/malleable cast iron	≥ 240 HB	1.5 x D	150	0.014	0.018	0.021	0.028	0.040	0.048	0.064	0.080
N	Aluminium, Al-wrought alloys, Al-alloys	≤ 7% Si	1.0 x D	500	0.012	0.015	0.018	0.024	0.035	0.042	0.056	0.070
	Aluminium-cast alloys	≥ 7% Si	1.0 x D	340	0.014	0.018	0.021	0.028	0.040	0.048	0.064	0.080

General recommendation 一般建議

Steel **Cast iron** **Hardened**	P K H	Dry machining, compressed air, MQL: 乾式切削、噴壓縮空氣、MQL霧化切削液冷卻	• Avoid thermal shock 避免熱產生對刀具的衝擊 • Dissipate machining temperature via chip 切屑把熱帶走 • Supporting chip evacuation 幫助排屑
Stainless **Special alloy**	M S	Soluble oil, neat oil: 乳化液、純油性	• Cooling of tool cutting edge 切削刃口冷卻 • Preventing built-up edge 避免刃口沾黏積屑 • Supporting chip evacuation 幫助排屑
Non-ferrous metals	N	Soluble oil, neat oil: 乳化液、純油性	• Preventing built-up edge 避免刃口沾黏積屑 • Supporting chip evacuation 幫助排屑

Exceptions for material ranges 材料範圍以外的注意事項

P K

When **coolant** is not available the cutting speed (vc) and/or the radial feed (ae) should be reduced.
The resulting reduced temperature reduces the risk of thermal shock.
如果冷卻條件不佳，則應該降低切削速度（vc）及降低切寬（ae），這樣才能降低溫度，降低熱對刀刃的衝擊風險

If there are **chip evacuation problems** the application of coolant should be taken into consideration, poor evacuation of chips can lead to massive tool wear and even tool breakage.
如果排屑不良有問題，則應考慮使用冷卻液，排屑不良會大大導致刀刃磨損甚至斷刀。

When **heat is being generated due to poor chip evacuation**, it should be checked if through coolant is available. By using a specifically directed “coolant jet”, coolant can be supplied where congested without hitting the cutting area. Alternatively, the application of coolant for the entire machining operation is recommended.
當排屑不良而產生熱能時應檢查是否可以使用冷卻液，透過使用專門的“冷卻液噴嘴”，可以將冷卻液供應到堵塞處而不會碰到切削區域，另外，建議在整個加工過程中使用冷卻液。

Other notes 其他注意事項

A. Finishing 精銑削
The application of coolant is principally an advantage as a better surface finish can be achieved.
使用冷卻液原則上是一個優勢，因為可以實現更好的表面光潔度

B. Very long tools 長刃型銑削
Coolant can result in a smoother process, as the lubricant has a vibration-reducing effect.
使用冷卻液可以使加工過程更順暢，因為潤滑劑具有減振作用

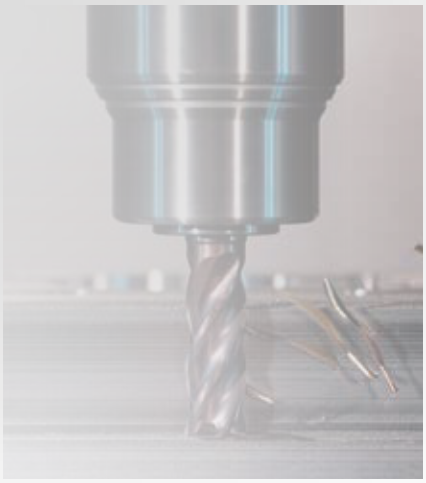
C. Alignment of coolant 冷卻液對準加工區域
- as acurate as possible in the cutting area from at least three directions
  至少有三個方向的切削液噴嘴，需對準切削區域噴射
- no flushing back of small chips to the cutting area
  不要將小切屑衝回切削區域

E. Solid carbide milling cutters with internal cooling 中心出水型銑刀
- optimal chip evacuation, very good cutting edge cooling, very effective against built-up edges
  最佳的排屑性，非常好的切削刃口冷卻，避免刃口沾黏積屑非常有效
- to be recommended especially for larger tool diameters and tough materials
  特別推薦用於較大尺寸的刀具和堅韌的難切削材銑削

D. Peripheral cooling / Guhrojet Guhrojet 刀具周邊外圍冷卻
Best external option: Optimal tool cooling and chip evacuation thanks to the direct route from coolant exit to cutting area
由於冷卻液直接噴到切削區域，達到最佳的刀具冷卻和排屑性

GÜHRO JET

HPC & HSC milling strategies 高性能 / 高速度切削加工 策略



These milling strategies belong to the state-of-the-art and most effective application methods for current solid carbide milling tools. When applied, an enormously high metal removal rate ensures a considerable increase in productivity. Very high cutting parameters can be achieved even with less powerful machines or unstable machining conditions. With difficult-to-machine materials or unfavourable diameter-length-ratios of the tools a massive increase of process reliability can be achieved.

這些銑削策略的應用屬於當前全鎢鋼銑刀的最新技術和最有效的應用方法。
使用時，極高的金屬移除率可確保生產效率的顯著提升，即使在功率較小的機台或是工況不穩定的條件下，也可以實現非常高的切削參數。即使加工難切削材，或是刀具的直徑長度比不理想，也是可以大大提高加工過程的穩定性。

HPC **HIGH PERFORMANCE CUTTING 高性能切削加工（最高的金屬移除率）**

max. metal removal rate/time → stable conditions; short de-clamping; high performance; good cooling
單位時間內最高的金屬移除率 → 工況條件穩定、快速換模上下料；高性能；冷卻條件優良

HSC **HIGH SPEED CUTTING 高速度加工（用於模具類球刀、圓鼻銑刀成形銑削）**

at high speed/high feed rate → high dynamics; low cutting depth; low drive power
高轉速/ 高進給 → 高動能；低切寬、低切深；主軸馬力低

Principles and objectives 銑削加工的大原則和目標

Maximum tool utilisation
- Utilisation of entire cutting edge length
- Full power delivery
- Increased tool life
- Balanced wear

最大限度地利用刀具
- 盡量利用全部切削刃長度
- 機台全功率輸出利用
- 延長刀具壽命
- 刀具磨損磨耗均勻

Modification of cutting distribution
- Low cutting widths a_e
- High cutting depths a_p

切削參數調整分配
- 低切割寬度 a_e
- 高切削深度 a_p

High process reliability
- Low tool wrapping
- Improved thermal conditions at tool cutting edge
- Low mechanical stress

高加工的穩定性
- 刀具纏屑情況低
- 改善刀具刃口的散熱
- 工件加工面不能產生應力不能硬化

Maximum metal removal rate
- Saving time/machine costs

最大金屬移除率
- 節省時間與機器成本

ISO code

P	Steel, high-alloyed steel
M	Stainless steel
K	Grey cast iron, spheroidal graphite ion and malleable cast iron
N	Aluminium and other non-ferrous metals
S	Special-, super- and titanium-alloys
H	Hardened steel and chilled cast iron

Tool recommendations regarding the suitability for application groups or specifications of max. tensile strength and hardness can be found in the product pages:

● optimal suitability 最適用
○ limited suitability 使用有限制

適用的刀具推薦，關於工件材料的最大抗拉強度和硬度，可在產品頁面中找到：

Coatings

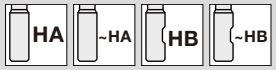
○ bright finish　　Ⓨ Signum

Pictograms

Tool material

Solid carbide ultrafine grain (carbide UF)

Shank form



to DIN 6535

Type

to DIN

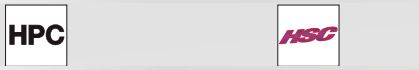
to Guhring standard

Type

Applications

Slotting　Roughing　Ramping　Helix　Drilling　Finishing　Copying

Milling conditions



maximum volume　maximum speed

unstable conditions
工況不佳，例如：
機台馬力不足、機台轉速與進給有限制；
工件形狀特殊、夾持不穩固容易震動位移。

請盡量使用小尺寸銑刀、降低銑削時的力量並降低轉速與進給

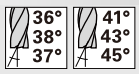
Length

short (DIN)　long (DIN)

No. of cutting edges

no. of cutting lips

Helix angle



Size of helix angle / no. of different helix angles

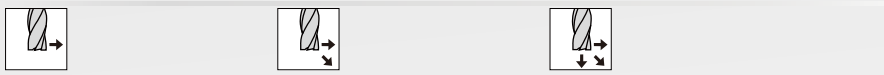
Helix angle

helix angle of circumference cutting edges

Cutting edge form

corner chamfer

Feed



for lateral feed

for lateral feed
and oblique plunging
用於橫向進給切削和斜向切削

for lateral feed,
for oblique plunging and drilling
用於橫向進給切削、斜向切削及鑽孔