

GUHRING

RF 100
diver



Drilling
Ramping
Roughing
Finishing
Slotting

NEW

**EXTENDED PROGRAMME
AND INTERNAL COOLING**





Drilling and milling optimised internal cooling

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.

- ▶ up to 40 % longer tool life
- ▶ for sticky materials
- ▶ stainless and heat-resistant materials
- ▶ for process reliability in drilling and plunging
- ▶ HPC machining

NEW

extended programme and internal cooling



*For any application
the optimal Diver – now even more choice*

MTC



3-fluted

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

3-fluted **with internal cooling**, page 7
3-fluted **without internal cooling**, page 6

HPC



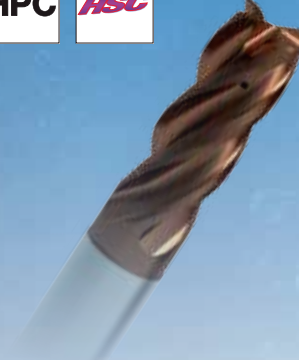
4-fluted, short

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

4-fluted, short
without internal cooling, page 8

HPC

HSC

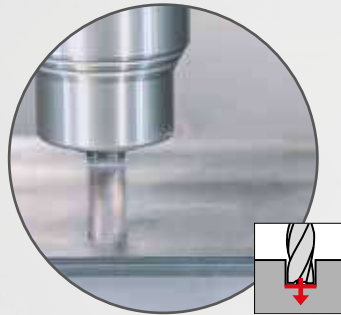


4-fluted

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

4-fluted, **with internal cooling**, page 10
4-fluted, **without internal cooling**, page 9

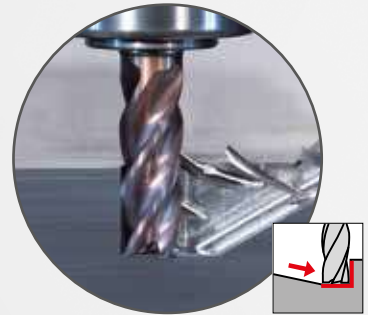
Universally applicable for **all materials and milling strategies**
for outstanding cutting values and tool life



Drilling

Application example:
Dry machining cast iron

$a_p = 12 \text{ mm}$
 $a_e = 12 \text{ mm}$
 $v_c = 240 \text{ m/min}$
 $v_f = 800 \text{ mm/min}$

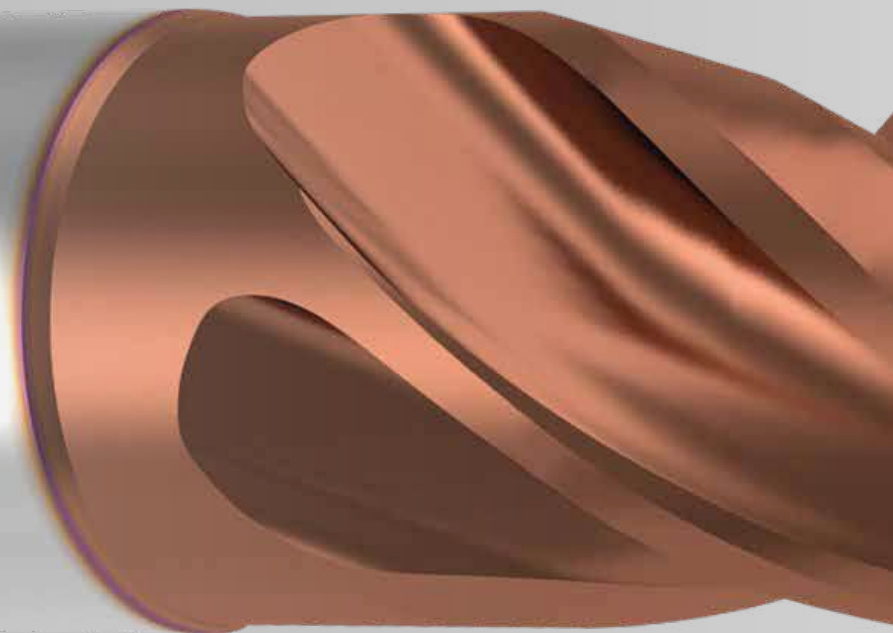


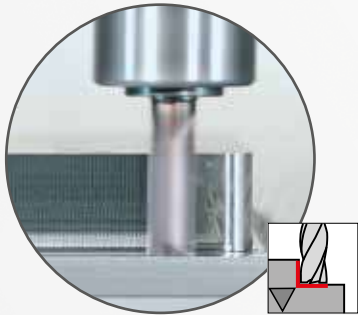
Ramping

Application example:
Wet machining in 42CrMo4
Ramping angle = 30°

$a_p = 12 \text{ mm}$
 $a_e = 11.7 \text{ mm}$
 $v_c = 200 \text{ m/min}$
 $v_f = 1200 \text{ mm/min}$

- » special face geometry for drilling and ramping
- » optimised flute space
- » cutting edge preparation
- » Signum-coating
- » with neck clearance
- » dimensions to DIN 6527 long
- » dimensions to DIN 6527 short, **NEW**
- » 4-fluted and 3-fluted option **NEW**
- » with and without internal cooling **NEW**

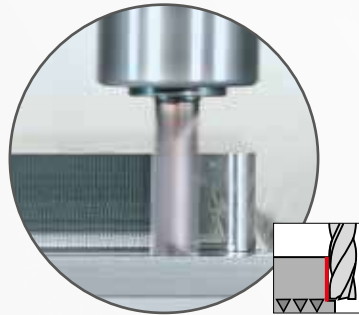




Roughing

Application example:
Dry machining in steel 42CrMo4

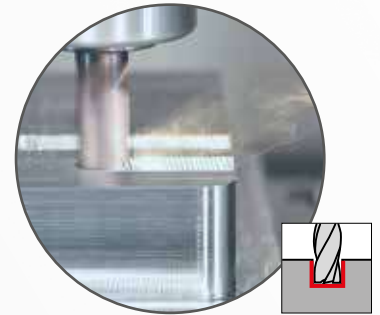
$a_p = 24 \text{ mm}$
 $a_e = 3 \text{ mm}$
 $v_c = 280 \text{ m/min}$
 $v_f = 3050 \text{ mm/min}$
Metal removal rate $Q = 219 \text{ cm}^3/\text{min}$



Finishing

Application example:
Wet machining in 1.4301

$a_p = 20 \text{ mm}$
 $a_e = 0.2 \text{ mm}$
 $v_c = 200 \text{ m/min}$
 $v_f = 1270 \text{ mm/min}$
 $R_z = 2.7 \text{ }\mu\text{m}$

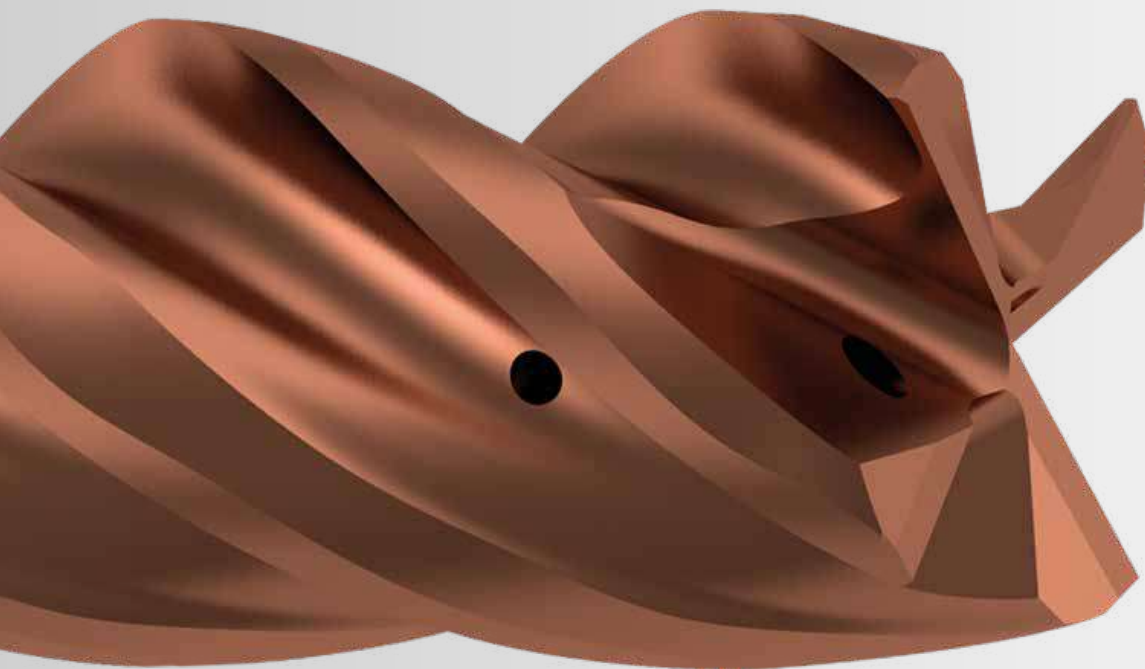


Slotting

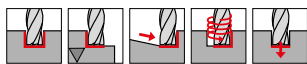
Application example:
Dry machining in steel 42CrMo4

$a_p = 12 \text{ mm}$
 $a_e = 11.7 \text{ mm}$
 $v_c = 240 \text{ m/min}$
 $v_f = 1800 \text{ mm/min}$
Metal removal rate $Q = 252 \text{ cm}^3/\text{min}$

Ratio®



Ratio end mills RF 100 DIVER (3-fluted)


P • **GUHRING** NAVIGATOR

M • Cutting data page 12

- K** •
N •
S •
H •
- neck clearance
 - centre cutting
 - with special drill face

Tool material

Solid carbide

Surface

Y

Y

Type

NH

NH

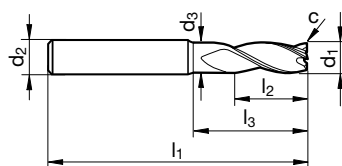
Shank form

HA

HB

NEW

NEW



Article no.

6797

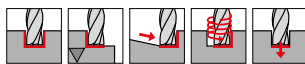
6798

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

ISO	Hardness	vc	fz (mm/z) / Ø							vc	fz (mm/z) / Ø						
			3	6	8	10	12	16	20		3	6	8	10	12	16	20
			ap = 1,0 x D				ae = 1,0 x D				ap = 1,5 x D				ae max = 0,33 x D		
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	350	0,021	0,032	0,042	0,063	0,075	0,100	0,125
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	260	0,018	0,027	0,036	0,059	0,070	0,094	0,117
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090	160	0,018	0,027	0,036	0,059	0,070	0,094	0,117
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080	120	0,019	0,029	0,038	0,060	0,072	0,096	0,120
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080	110	0,017	0,025	0,033	0,052	0,062	0,083	0,104
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100	190	0,021	0,032	0,042	0,063	0,075	0,100	0,125
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110	440	0,023	0,034	0,045	0,069	0,083	0,110	0,138



Ratio end mills RF 100 DIVER (3-fluted)


P • **GUHRING NAVIGATOR**
M • Cutting data page 12

K •

N •

S •

H •

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

Tool material

Solid carbide

Surface

Y

Y

Type

NH

NH

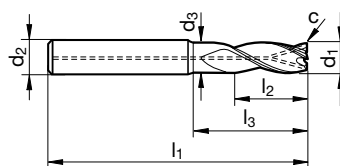
Shank form

HA

HB

NEW

NEW



Article no.

6799

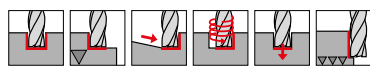
6800

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.
mm	mm	mm	mm	mm	mm	mm		
6.00	6.00	5.70	57	13.0	20.0	0.09	3	6.000
8.00	8.00	7.70	63	19.0	26.0	0.12	3	8.000
10.00	10.00	9.50	72	22.0	30.0	0.15	3	10.000
12.00	12.00	11.50	83	26.0	36.0	0.18	3	12.000
16.00	16.00	15.50	92	32.0	42.0	0.19	3	16.000

Availability	
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•	•

ISO	Hardness	vc	fz (mm/z) / Ø								vc	fz (mm/z) / Ø							
			4	6	8	10	12	16	20	4		6	8	10	12	16	20		
			ap = 1,0 x D					ae = 1,0 x D				ap = 1,0 x D							ae = 1,0 x D
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	270	0,014	0,021	0,028	0,040	0,048	0,064	0,080		
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	180	0,008	0,012	0,016	0,025	0,030	0,040	0,050		
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090	90	0,007	0,011	0,014	0,023	0,027	0,036	0,045		
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080	60	0,006	0,010	0,013	0,020	0,024	0,032	0,040		
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080	50	0,006	0,010	0,013	0,020	0,024	0,032	0,040		
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100	150	0,014	0,021	0,028	0,040	0,048	0,064	0,080		
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110	340	0,014	0,021	0,028	0,040	0,048	0,064	0,080		

Ratio end mills RF 100 DIVER



P	•	GUHRING NAVIGATOR Cutting data page 12
M	•	
K	•	
N	•	
S	•	
H	○	
		• neck clearance
		• centre cutting

Tool material

Solid carbide

Surface

Y

Y

Type

N

N

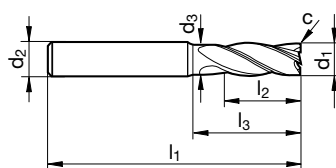
Shank form

HA

HB

NEW

NEW



Article no.

6803

6804

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

Availability

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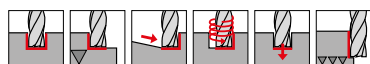
ISO	Hardness	vc	fz (mm/z) / Ø							vc	fz (mm/z) / Ø						
			3	6	8	10	12	16	20		3	6	8	10	12	16	20
			ap = 1,0 x D			ae = 1,0 x D					ap = l2			ae max = 0,20 x D			
P	≤ 850 N/mm ²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	450	0,027	0,040	0,054	0,080	0,10	0,13	0,16
	≥ 850 N/mm ²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	300	0,022	0,034	0,045	0,072	0,09	0,12	0,14
M	≤ 750 N/mm ²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090	200	0,022	0,034	0,045	0,072	0,09	0,12	0,14
	≥ 750 N/mm ²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080	140	0,020	0,031	0,041	0,064	0,08	0,10	0,13
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080	110	0,020	0,031	0,041	0,064	0,08	0,10	0,13
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100	250	0,027	0,040	0,054	0,080	0,10	0,13	0,16
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110	570	0,029	0,043	0,058	0,088	0,11	0,14	0,18

8

GUHRING



Ratio end mills RF 100 DIVER



P	•	GUHRING NAVIGATOR Cutting data page 12
M	•	
K	•	
N	•	
S	•	
H	○	

• neck clearance
• centre cutting

Tool material

Solid carbide

Surface

Y

Y

Type

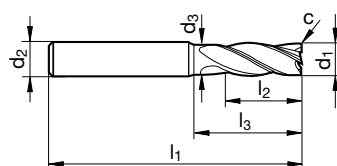
NH

NH

Shank form

HA

HB



Article no.

6737

6736

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

Availability

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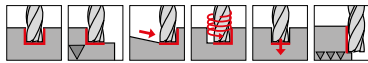
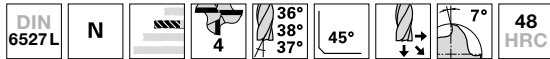
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ISO	Hardness	vc	fz (mm/z) / Ø								vc	fz (mm/z) / Ø							
			3	6	8	10	12	16	20	3		6	8	10	12	16	20		
			ap = 1,0 x D				ae = 1,0 x D					ap = l2					ae max = 0,20 x D		
P	≤ 850 N/mm²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	450	0,027	0,040	0,054	0,080	0,10	0,13	0,16		
	≥ 850 N/mm²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	300	0,022	0,034	0,045	0,072	0,09	0,12	0,14		
M	≤ 750 N/mm²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090	200	0,022	0,034	0,045	0,072	0,09	0,12	0,14		
	≥ 750 N/mm²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080	140	0,020	0,031	0,041	0,064	0,08	0,10	0,13		
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080	110	0,020	0,031	0,041	0,064	0,08	0,10	0,13		
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100	250	0,027	0,040	0,054	0,080	0,10	0,13	0,16		
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110	570	0,029	0,043	0,058	0,088	0,11	0,14	0,18		

Ratio end mills RF 100 DIVER


P • **GUHRING NAVIGATOR**

Cutting data page 12

M	•
K	•
N	•
S	•
H	○

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

Tool material

Solid carbide

Surface

Y

Y

Type

N

N

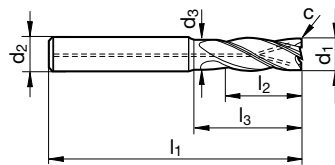
Shank form

HA

HB

NEW

NEW



Article no.

6801

6802

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

Availability

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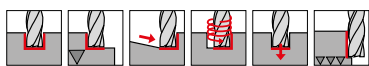
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ISO	Hardness	vc	fz (mm/z) / Ø								vc	fz (mm/z) / Ø							
			4	6	8	10	12	16	20	4		6	8	10	12	16	20		
			ap = 1,0 x D				ae = 1,0 x D					ap = 1,0 x D						ae = 1,0 x D	
P	≤ 850 N/mm ²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	270	0,014	0,021	0,028	0,040	0,048	0,064	0,080		
	≥ 850 N/mm ²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	180	0,008	0,012	0,016	0,025	0,030	0,040	0,050		
M	≤ 750 N/mm ²	120	0,014	0,021	0,028	0,045	0,054	0,072	0,090	90	0,007	0,011	0,014	0,023	0,027	0,036	0,045		
	≥ 750 N/mm ²	80	0,013	0,019	0,026	0,040	0,048	0,064	0,080	60	0,006	0,010	0,013	0,020	0,024	0,032	0,040		
S	Ti-based	60	0,013	0,019	0,026	0,040	0,048	0,064	0,080	50	0,006	0,010	0,013	0,020	0,024	0,032	0,040		
K	≤ 240 HB	150	0,017	0,025	0,034	0,050	0,060	0,080	0,100	150	0,014	0,021	0,028	0,040	0,048	0,064	0,080		
N	≥ 7% Si	340	0,018	0,027	0,036	0,055	0,066	0,088	0,110	340	0,014	0,021	0,028	0,040	0,048	0,064	0,080		



Ratio end mill sets RF 100 Diver

**P** • **GUHRING NAVIGATOR**

M • Cutting data page 12

K •

N •

S •

H •

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

Tool material **Solid carbide**Surface **Y**Type **N**Shank form **HA**Article no. **6755**

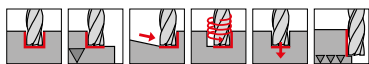
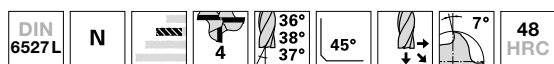
Ø-range	Pieces/set	Code no.
mm	Piece	
5,7/7,7/9,7/11,7/15,6	5	1.000
6/8/10/12/16	5	2.000

Availability

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Ratio end mill sets RF 100 Diver

**P** • **GUHRING NAVIGATOR**

M • Cutting data page 12

K •

N •

S •

H •

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

Tool material **Solid carbide**Surface **Y**Type **N**Shank form **HB**Article no. **6754**

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

Availability

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SLOTING

Material/ISO material	Hardness	a _p max	a _e max	v _c	fz (mm/z) with nom. Ø							
					4	5	6	8	10	12	16	20
Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm ²	1xD	1xD	270	0.017	0.021	0.025	0.034	0.050	0.060	0.080	0.100
P Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm ²	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/mm ²	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/mm ²	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/mm ²	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/mm ²	1xD	1xD	60	0.013	0.016	0.019	0.026	0.040	0.048	0.064	0.080

HPC-ROUGHING

Material/ISO material	Hardness	a _p max	a _e max	v _c	fz (mm/z) with nom. Ø							
					4	5	6	8	10	12	16	20
Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm ²	1.5xD	0.40xD	350	0.021	0.026	0.032	0.042	0.063	0.075	0.100	0.125
P Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm ²	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/mm ²	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/mm ²	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/mm ²	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/mm ²	1.5xD	0.33xD	110	0.017	0.021	0.025	0.033	0.052	0.062	0.083	0.104

HSC-FINISHING

Material/ISO material	Hardness	a _p max	a _e max	v _c	fz (mm/z) with nom. Ø							
					4	5	6	8	10	12	16	20
Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm ²	2xD	0.02xD	540	0.018	0.023	0.028	0.037	0.055	0.066	0.088	0.110
P Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm ²	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/mm ²	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/mm ²	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/mm ²	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/mm ²	2xD	0.02xD	130	0.014	0.018	0.021	0.028	0.044	0.053	0.070	0.088

RAMPING, HELIX, GROOVING

Material/ISO material	Hardness	a _p	Ramping max. angle	v _c	fz (mm/z) with nom. Ø							
					4	5	6	8	10	12	16	20
Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm ²	1 x D	45°	270	0.015	0.019	0.023	0.030	0.045	0.054	0.072	0.090
P Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm ²	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/mm ²	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/mm ²	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/mm ²	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/mm ²	1 x D	10°	60	0.007	0.009	0.011	0.014	0.025	0.030	0.040	0.050

DRILLING

Material/ISO material	Hardness	Drilling depth (a _p max.)	v _c	fz (mm/z) with nom. Ø							
				4	5	6	8	10	12	16	20
Struct./free-cutting steels, unall. heat-treat./case hard. steels	≤ 850 N/mm ²	1.5 x D	270	0.014	0.018	0.021	0.028	0.040	0.048	0.064	0.080
P Free-cutting steels, unalloyed case hard. steels, nitr. steels	850 - 1200 N/mm ²	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/mm ²	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

Steel			Avoid thermal shock
Cast iron		Dry machining, compressed air, MQL:	- Dissipate machining temperature via chip - Supporting chip evacuation
Hardened			
Stainless		Soluble oil, neat oil:	- Cooling of tool cutting edge - Preventing built-up edge - Supporting chip evacuation
Special alloy			
Non-ferrous metals		Soluble oil, neat oil:	- Preventing built-up edge - Supporting chip evacuation

Exceptions for material ranges



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.

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.

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.

Other notes

Finishing

The application of coolant is principally an advantage as a better surface finish can be achieved.

Very long tools

Coolant can result in a smoother process, as the lubricant has a vibration-reducing effect.

Alignment of coolant

- as accurate as possible in the cutting area from at least three directions
- no flushing back of small chips to the cutting area



Solid carbide milling cutters with internal cooling

- optimal chip evacuation, very good cutting edge cooling, very effective against built-up edges
- to be recommended especially for larger tool diameters and tough materials

Peripheral cooling / Gührojet

Best external option: Optimal tool cooling and chip evacuation thanks to the direct route from coolant exit to cutting area



GÜHROJET

HPC & HSC milling strategies

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.



HPC

HIGH PERFORMANCE CUTTING

max. metal removal rate/time → stable conditions; short de-clamping; high performance; good cooling

HSC

HIGH SPEED CUTTING

at high speed/high feed rate → high dynamics; low cutting depth; low drive power

Principles and objectives

Maximum tool utilisation

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

Modification of cutting distribution

- Low cutting widths a_e
- High cutting depths a_p

High process reliability

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

Maximum metal removal rate

- Saving time/machine costs



ISO code

P	Steel, high-alloyed steel
M	Stainless steel
K	Grey cast iron, spheroidal graphite iron 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
- limited suitability

Coatings

○ bright finish  Signum

Pictograms

Tool material	VHM
	Solid carbide ultrafine grain (carbide UF)
Shank form	 HA  ~HA  HB  ~HB
	to DIN 6535
Type	 DIN 6527 K  DIN 6527 L
	to DIN
	
	to Guhring standard
Type	 N  NH
Applications	 Slotting  Roughing  Ramping  Helix  Drilling  Finishing  Copying
Milling conditions	 HPC  HSC  MTC
	maximum volume maximum speed unstable conditions
Length	 short (DIN)  long (DIN)
No. of cutting edges	 3  4
	no. of cutting lips
Helix angle	 36° 38° 37°  41° 43° 45°
	Size of helix angle/no. of different helix angles
Helix angle	 7°
	helix angle of circumference cutting edges
Cutting edge form	 45°
	corner chamfer
Feed	 for lateral feed  for lateral feed and oblique plunging  for lateral feed, oblique plunging and drilling



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