

GUHRING

RF 100 *diver*



Drilling
Ramping
Roughing
Finishing
Slotting



NEW

**EXTENDED PROGRAMME
AND INTERNAL COOLING**



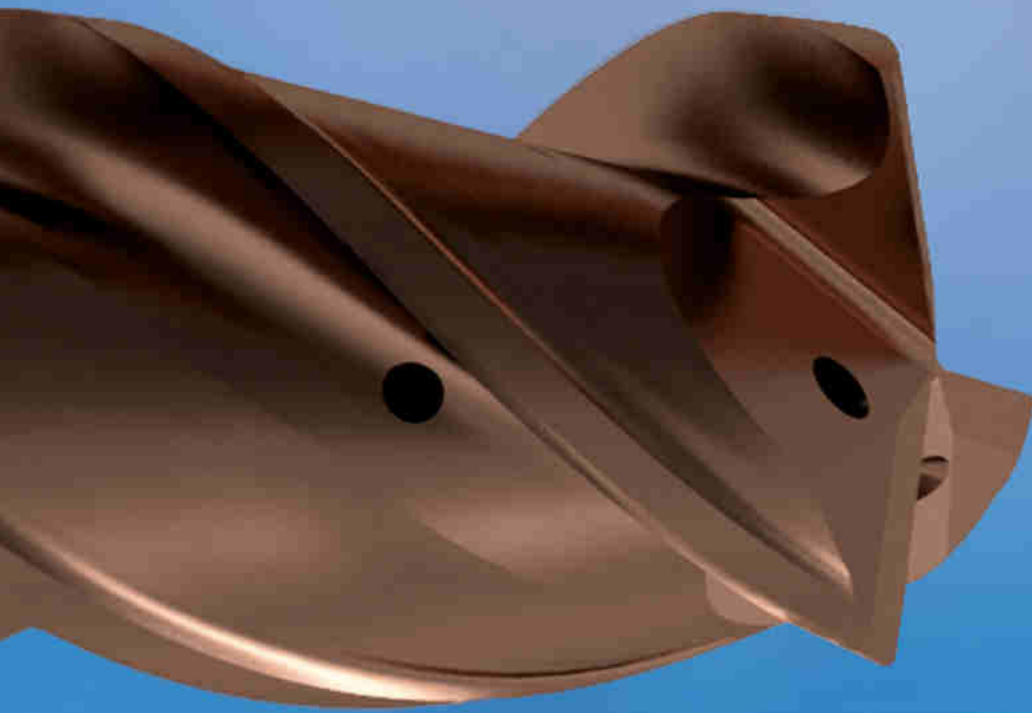
Drilling and milling optimised internal cooling

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

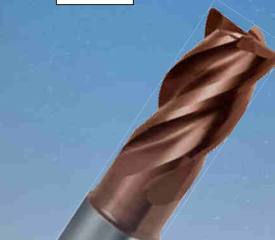


3-fluted

- ▶ 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

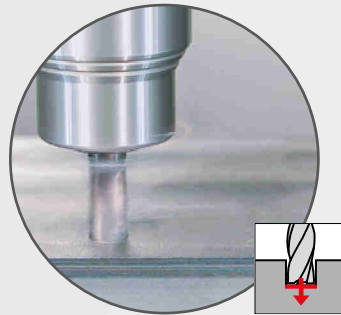


4-fluted

- ▶ 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

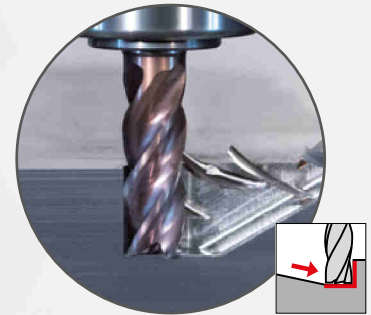
Universally applicable for **all materials and milling strategies**
for outstanding cutting values and tool life



Drilling

Application example:
Dry machining cast iron

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

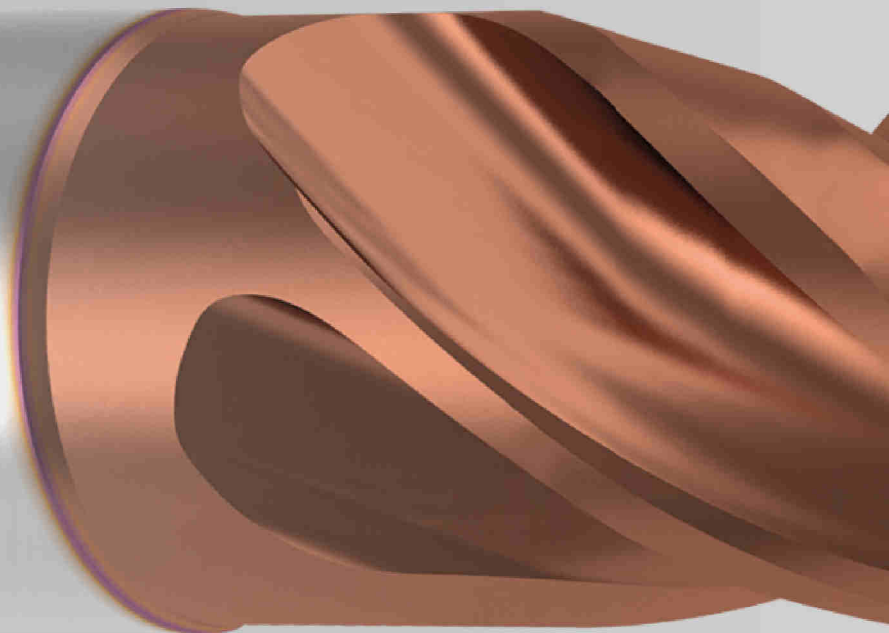


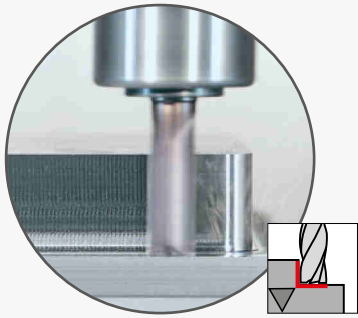
Ramping

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**

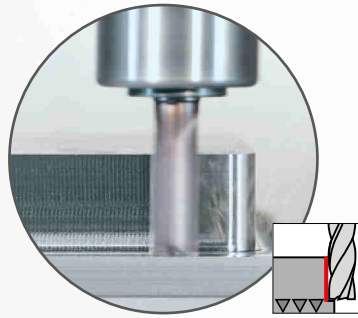




Roughing

Application example:
Dry machining in steel 42CrMo4

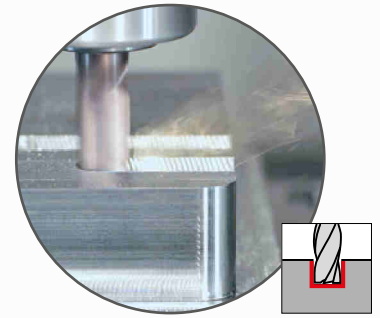
$a_p = 24 \text{ mm}$
 $a_e = 3 \text{ mm}$
 $v_c = 280 \text{ m/min}$
 $v_f = 3050 \text{ mm/min}$
Metal removal rate Q = 219 cm³/min



Finishing

Application example:
Wet machining in 1.4301

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

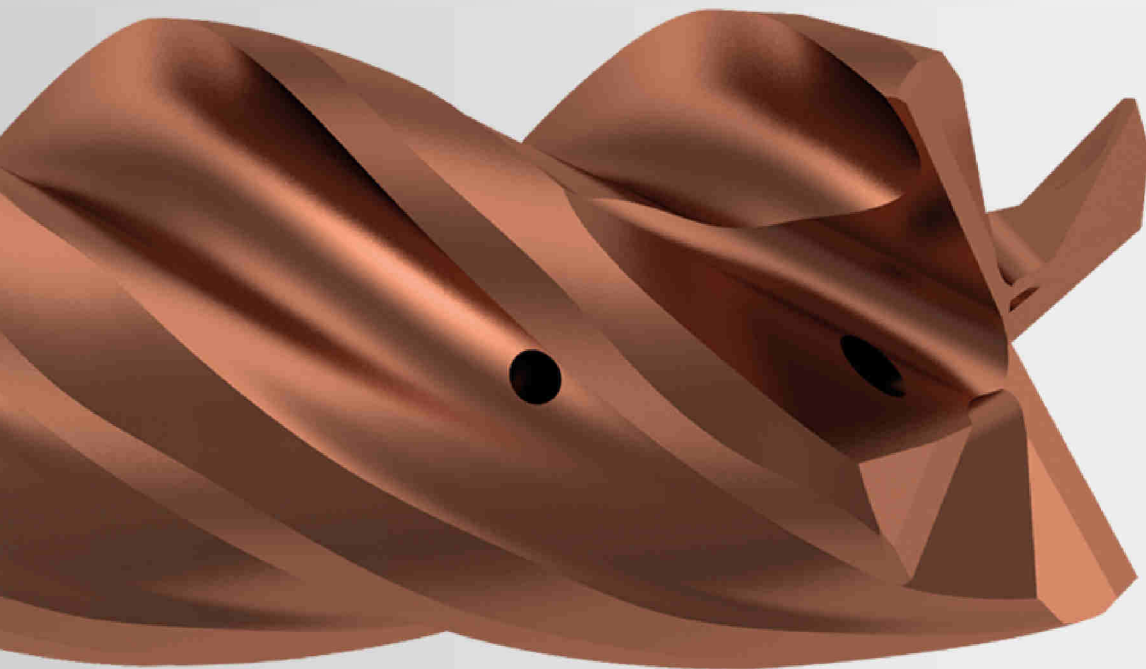


Slotting

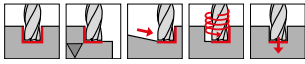
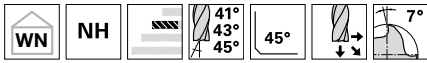
Application example:
Dry machining in steel 42CrMo4

$a_p = 12 \text{ mm}$
 $a_e = 11.7 \text{ mm}$
 $v_c = 240 \text{ m/min}$
 $v_f = 1800 \text{ mm/min}$
Metal removal rate Q = 252 cm³/min

Ratio®

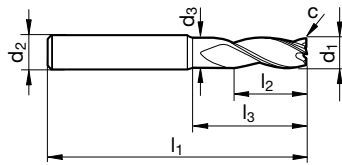


Ratio end mills RF 100 DIVER (3-fluted)



P • **GUHRING NAVIGATOR**
M • Cutting data page 12
K •
N •
S • neck clearance
 centre cutting
 with special drill face
H •

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



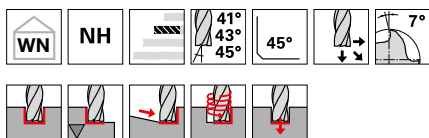
Article no. **6797** **6798**

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	EUR/piece	
mm	mm	mm	mm	mm	mm	mm				
3.00	6.00	2.80	57	8.0	15.0	0.05	3	3.000	43.00	45.00
3.50	6.00	3.30	57	10.0	15.0	0.05	3	3.500	43.00	45.00
3.70	6.00	3.50	57	11.0	15.0	0.06	3	3.700	43.00	45.00
4.00	6.00	3.80	57	11.0	18.0	0.06	3	4.000	43.00	45.00
4.50	6.00	4.30	57	11.0	18.0	0.07	3	4.500	43.00	45.00
4.70	6.00	4.50	57	13.0	18.0	0.07	3	4.700	43.00	45.00
5.00	6.00	4.80	57	13.0	18.0	0.08	3	5.000	43.00	45.00
5.50	6.00	5.30	57	13.0	19.4	0.08	3	5.500	43.00	45.00
5.70	6.00	5.50	57	13.0	19.6	0.09	3	5.700	43.00	45.00
6.00	6.00	5.70	57	13.0	20.0	0.09	3	6.000	43.00	45.00
6.50	8.00	6.20	63	16.0	24.4	0.10	3	6.500	49.00	51.00
7.00	8.00	6.70	63	16.0	24.9	0.11	3	7.000	54.00	56.00
7.50	8.00	7.20	63	19.0	25.3	0.11	3	7.500	59.00	61.00
8.00	8.00	7.70	63	19.0	26.0	0.12	3	8.000	61.00	63.00
8.50	10.00	8.20	72	19.0	29.4	0.13	3	8.500	67.00	69.00
9.00	10.00	8.70	72	19.0	29.9	0.14	3	9.000	76.00	79.00
9.50	10.00	9.20	72	22.0	30.3	0.14	3	9.500	84.00	87.00
10.00	10.00	9.50	72	22.0	30.0	0.15	3	10.000	92.00	95.00
12.00	12.00	11.50	83	26.0	36.0	0.18	3	12.000	117.00	121.00
16.00	16.00	15.50	92	32.0	42.0	0.19	3	16.000	202.00	208.00
20.00	20.00	19.50	104	38.0	52.0	0.24	3	20.000	310.00	316.00

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
P	≤ 850 N/mm ²	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/mm ²	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/mm ²	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/mm ²	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)



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

P • **GUHRING NAVIGATOR**

M • Cutting data page 12

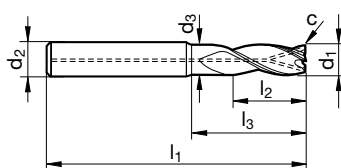
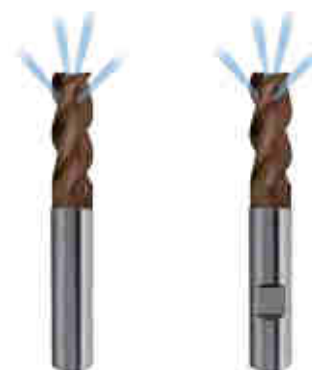
K •

N •

S •

H •

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

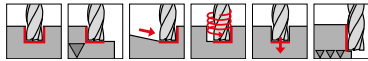
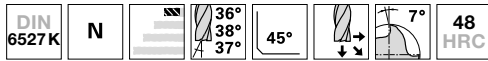


Article no. **6799** **6800**

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	EUR/piece	
mm	mm	mm	mm	mm	mm	mm				
6.00	6.00	5.70	57	13.0	20.0	0.09	3	6.000	56.00	58.00
8.00	8.00	7.70	63	19.0	26.0	0.12	3	8.000	79.00	81.00
10.00	10.00	9.50	72	22.0	30.0	0.15	3	10.000	110.00	113.00
12.00	12.00	11.50	83	26.0	36.0	0.18	3	12.000	140.00	144.00
16.00	16.00	15.50	92	32.0	42.0	0.19	3	16.000	232.00	238.00

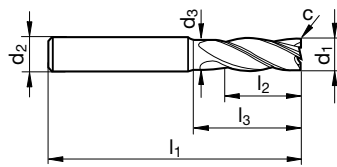
ISO	Hardness	vc	fz (mm/z) / Ø							vc	fz (mm/z) / Ø						
			4	6	8	10	12	16	20		4	6	8	10	12	16	20
P	≤ 850 N/mm ²	270	0,017	0,025	0,034	0,050	0,060	0,080	0,100	270	0,014	0,021	0,028	0,040	0,048	0,064	0,080
	≥ 850 N/mm ²	180	0,014	0,021	0,028	0,045	0,054	0,072	0,090	180	0,008	0,012	0,016	0,025	0,030	0,040	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 mills RF 100 DIVER



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

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

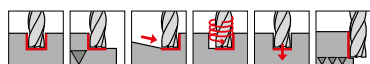


									Article no.	6803	6804
d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	EUR/piece		
mm	mm	mm	mm	mm	mm	mm					
3.00	6.00	2.80	50	5.0	12.0	0.03	4	3.000	41.00	43.00	
3.70	6.00	3.50	54	8.0	12.0	0.04	4	3.700	41.00	43.00	
4.00	6.00	3.80	54	8.0	15.0	0.04	4	4.000	41.00	43.00	
4.70	6.00	4.50	54	9.0	15.0	0.05	4	4.700	41.00	43.00	
5.00	6.00	4.80	54	9.0	15.0	0.05	4	5.000	41.00	43.00	
5.70	6.00	5.50	54	10.0	16.6	0.06	4	5.700	41.00	43.00	
6.00	6.00	5.70	54	10.0	17.0	0.06	4	6.000	41.00	43.00	
7.00	8.00	6.70	58	11.0	19.9	0.07	4	7.000	57.00	59.00	
7.70	8.00	7.40	58	12.0	20.5	0.08	4	7.700	57.00	59.00	
8.00	8.00	7.70	58	12.0	21.0	0.08	4	8.000	57.00	59.00	
9.00	10.00	8.70	66	13.0	23.9	0.09	4	9.000	85.00	88.00	
9.70	10.00	9.40	66	14.0	24.5	0.10	4	9.700	85.00	88.00	
10.00	10.00	9.50	66	14.0	24.0	0.10	4	10.000	85.00	88.00	
11.70	12.00	11.20	73	16.0	25.3	0.12	4	11.700	108.00	112.00	
12.00	12.00	11.50	73	16.0	26.0	0.12	4	12.000	108.00	112.00	
15.60	16.00	15.10	82	22.0	31.2	0.16	4	15.600	191.00	197.00	
16.00	16.00	15.50	82	22.0	32.0	0.16	4	16.000	191.00	197.00	
19.00	20.00	18.50	92	26.0	38.7	0.19	4	19.000	286.00	292.00	
20.00	20.00	19.50	92	26.0	40.0	0.20	4	20.000	286.00	292.00	

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
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
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
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

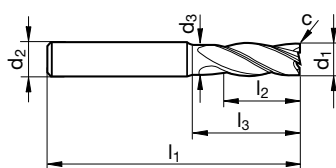


Ratio end mills RF 100 DIVER



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

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

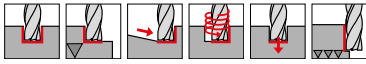
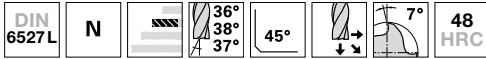


Article no. **6737** **6736**

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	EUR/piece	
mm	mm	mm	mm	mm	mm	mm				
4.00	6.00	3.80	57	11.0	18.0	0.04	4	4.000	49.40	51.40
5.00	6.00	4.80	57	13.0	18.0	0.05	4	5.000	49.40	51.40
5.70	6.00	5.50	57	13.0	19.6	0.06	4	5.700	49.40	51.40
6.00	6.00	5.70	57	13.0	20.0	0.06	4	6.000	49.40	51.40
7.70	8.00	7.40	63	19.0	25.5	0.08	4	7.700	67.90	70.00
8.00	8.00	7.70	63	19.0	26.0	0.08	4	8.000	67.90	70.00
9.70	10.00	9.40	72	22.0	30.5	0.10	4	9.700	101.90	105.00
10.00	10.00	9.50	72	22.0	30.0	0.10	4	10.000	101.90	105.00
11.70	12.00	11.20	83	26.0	35.3	0.12	4	11.700	131.70	134.80
12.00	12.00	11.50	83	26.0	36.0	0.12	4	12.000	131.70	134.80
13.70	14.00	13.20	83	26.0	35.3	0.14	4	13.700	173.90	178.00
14.00	14.00	13.50	83	26.0	36.0	0.14	4	14.000	173.90	178.00
15.60	16.00	15.10	92	32.0	41.2	0.16	4	15.600	226.40	232.60
16.00	16.00	15.50	92	32.0	42.0	0.16	4	16.000	226.40	232.60
19.50	20.00	19.00	104	38.0	51.1	0.20	4	19.500	347.80	354.00
20.00	20.00	19.50	104	38.0	52.0	0.20	4	20.000	347.80	354.00

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
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
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
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**

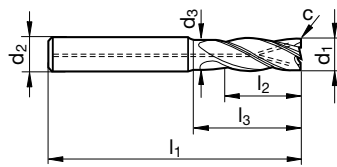
M • Cutting data page 12

K •

N •

- S** • with internal cooling: Radial and axial exits
- H** • neck clearance
- centre cutting

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



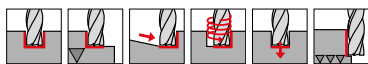
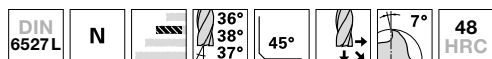
Article no. **6801** **6802**

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	EUR/piece	
mm	mm	mm	mm	mm	mm	mm				
6.00	6.00	5.70	57	13.0	20.0	0.06	4	6.000	65.00	67.00
8.00	8.00	7.70	63	19.0	26.0	0.08	4	8.000	88.00	90.00
10.00	10.00	9.50	72	22.0	30.0	0.10	4	10.000	123.00	126.00
12.00	12.00	11.50	83	26.0	36.0	0.12	4	12.000	159.00	163.00
16.00	16.00	15.50	92	32.0	42.0	0.16	4	16.000	250.00	256.00
20.00	20.00	19.50	104	38.0	52.0	0.20	4	20.000	382.00	388.00
25.00	25.00	24.00	121	45.0	63.0	0.25	4	25.000	548.00	556.00

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
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
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
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**

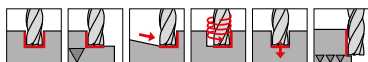
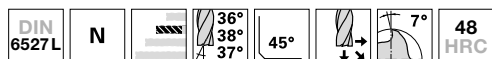
Shank form **HA**



Article no. **6755**

Ø-range	Pieces/set	Code no.	Net/price
mm	Piece		
5.7/7.7/9.7/11.7/15.6	5	1.000	149.00
6/8/10/12/16	5	2.000	149.00

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.	Net/price
mm	Piece		
5.7/7.7/9.7/11.7/15.6	5	1.000	149.00
6/8/10/12/16	5	2.000	149.00



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	$\leq 7\%$ Si	1xD	1xD	500	0.022	0.028	0.033	0.044	0.065	0.078	0.104	0.130
Aluminium-cast alloys	$\geq 7\%$ 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	$\leq 7\%$ 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	$\geq 7\%$ 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	$\leq 7\%$ Si	2xD	0.02xD	1000	0.024	0.030	0.036	0.048	0.072	0.086	0.114	0.143
Aluminium-cast alloys	$\geq 7\%$ 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	$\leq 7\%$ 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	$\geq 7\%$ 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	$\leq 7\%$ 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	$\geq 7\%$ 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			<ul style="list-style-type: none"> • Avoid thermal shock
Cast iron		Dry machining, compressed air, MQL:	<ul style="list-style-type: none"> • Dissipate machining temperature via chip • Supporting chip evacuation
Hardened			
Stainless			<ul style="list-style-type: none"> • Cooling of tool cutting edge
Special alloy		Soluble oil, neat oil:	<ul style="list-style-type: none"> • Preventing built-up edge • Supporting chip evacuation
Non-ferrous metals		Soluble oil, neat oil:	<ul style="list-style-type: none"> • Preventing built-up edge • Supporting chip evacuation

Exceptions for material ranges



When **coolant** is not available the cutting speed (v_c) and/or the radial feed (a_e) 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 / Guhrojet

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







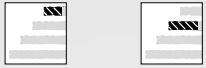

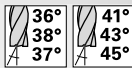



Tool recommendations regarding the suitability for application groups or specifications of max. tensile strength and hardness can be found in the product pages:

- optimal suitability
- limited suitability

Coatings

- bright finish
- Signum

Pictograms

Tool material	VHM
	Solid carbide ultrafine grain (carbide UF)
Shank form	 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
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 for lateral feed, oblique plunging and drilling



Drilling

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fluteless tapping

Milling

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