GUHRING

RF100

diver

Drilling
Ramping
Roughing
Finishing
Slotting

NEW

EXTENDED PROGRAMME
AND **INTERNAL COOLING**

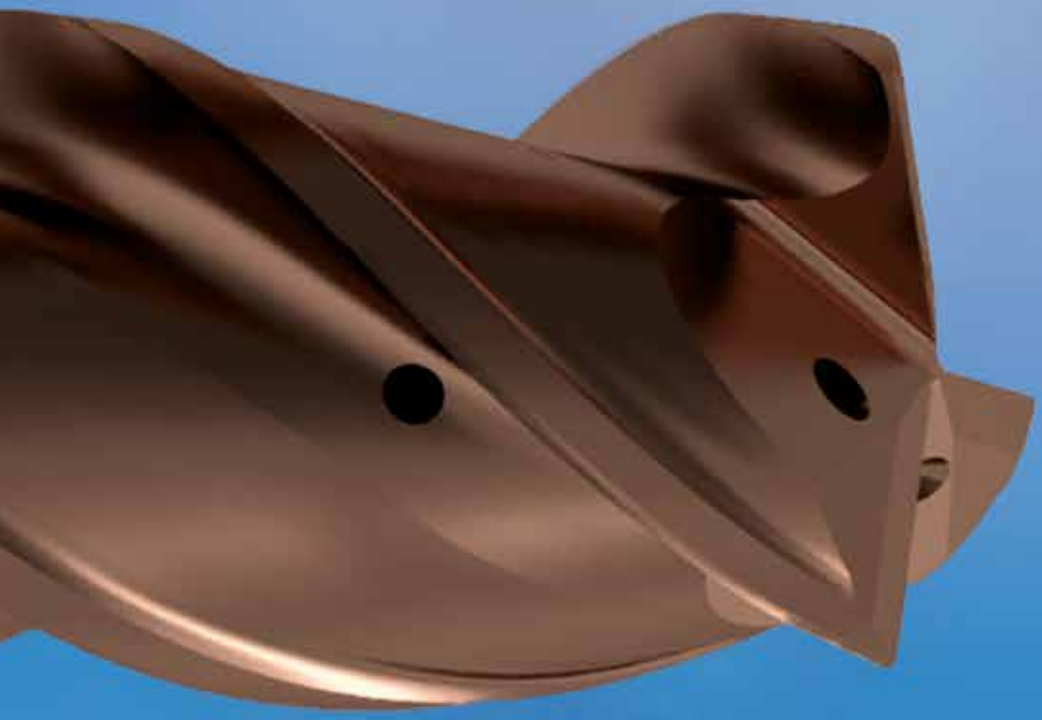
Drilling and milling optimised internal cooling

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

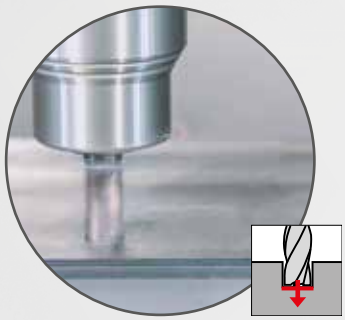
4-fluted

- 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

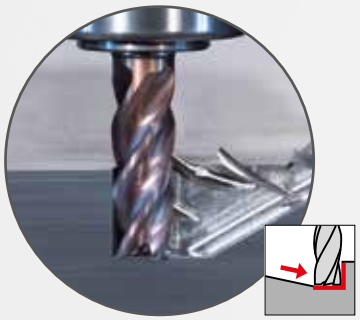
RF100 diver



Drilling

Application example:
Dry machining cast iron

a_p = 12 mm
a_e = 12 mm
v_c = 240 m/min
v_f = 800 mm/min

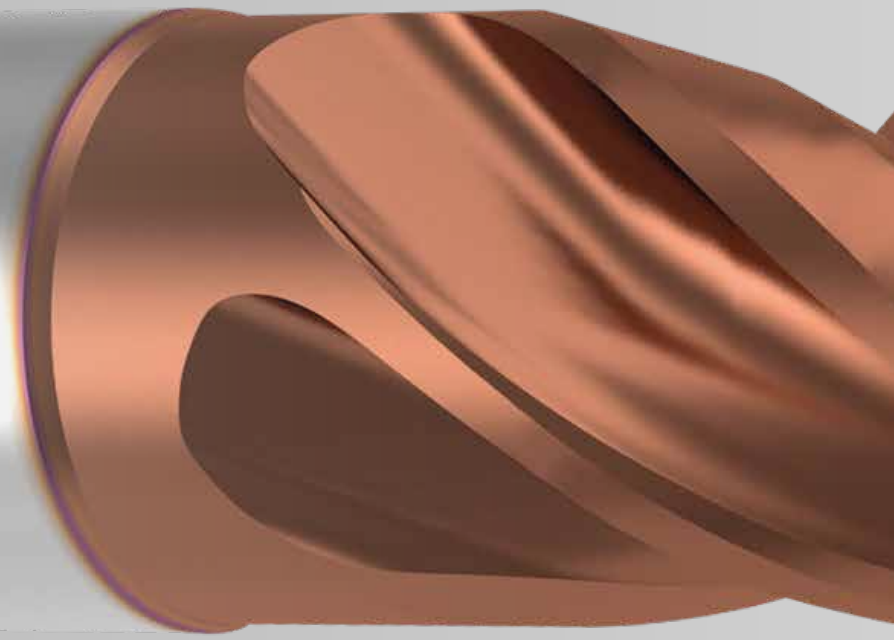


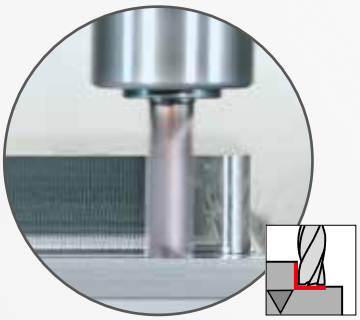
Ramping

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

a_p = 12 mm
a_e = 11.7 mm
v_c = 200 m/min
v_f = 1200 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 programme page 8
- 4-fluted and 3-fluted option NEW
- with and without internal cooling NEW



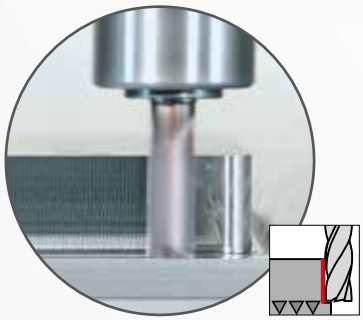


Roughing

Application example:
Dry machining in steel 42CrMo4

a_p = 24 mm
a_e = 3 mm
v_c = 280 m/min

v_f = 3050 mm/min
Metal removal rate Q = 219 cm³/min

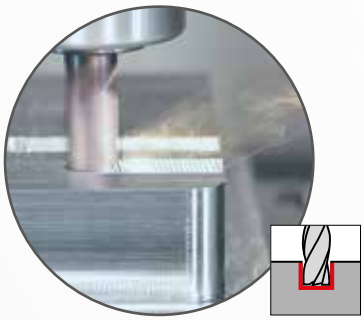


Finishing

Application example:
Wet machining in 1.4301

a_p = 20 mm
a_e = 0.2 mm
v_c = 200 m/min

v_f = 1270 mm/min
R_z = 2.7 µm



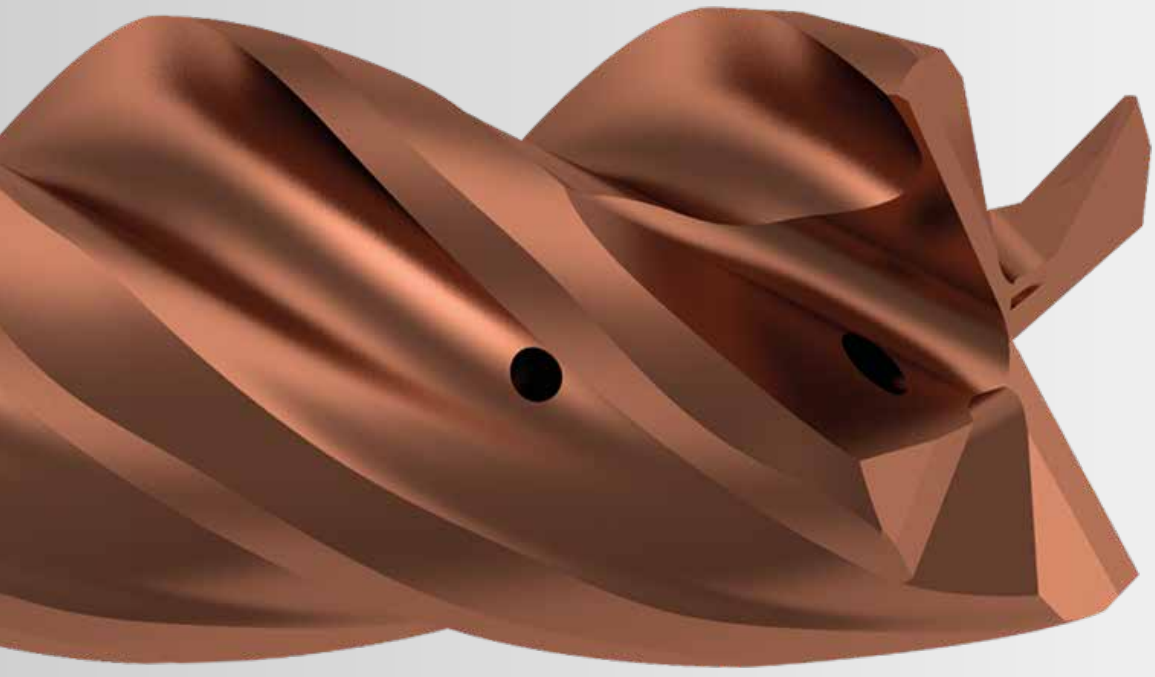
Slotting

Application example:
Dry machining in steel 42CrMo4

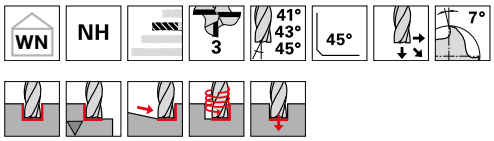
a_p = 12 mm
a_e = 11.7 mm
v_c = 240 m/min

v_f = 1800 mm/min
Metal removal rate Q = 252 cm³/min

Ratio®



Ratio end mills RF 100 DIVER (3-fluted)

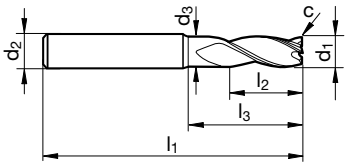


Tool material	Solid carbide	
Surface	Y	Y
Type	NH	NH
Shank form	HA	HB
	NEW	NEW

P	•
M	•
K	•
N	•
S	•
H	

GÜHRINGNAVIGATOR
Cutting data page 12

- neck clearance
- centre cutting
- with special drill face



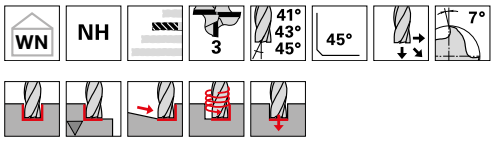
Article no.	6797	6798

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						
			3	6	8	10	12	16	20
			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
	≥ 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

vc	fz (mm/z) / Ø						
	3	6	8	10	12	16	20
	ap = 1,5 x D				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)

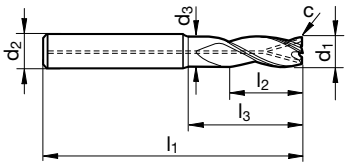


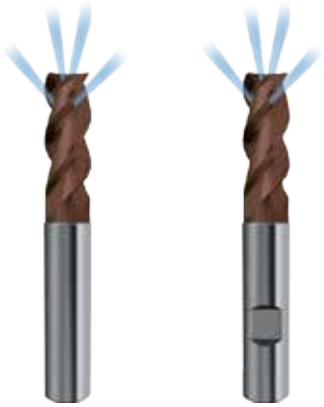
Tool material	Solid carbide	
Surface	Y	Y
Type	NH	NH
Shank form	HA	HB
	NEW	NEW

P	•
M	•
K	•
N	•
S	•
H	

GÜHRINGNAVIGATOR
Cutting data page 12

- 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.	Availability	
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	●	●

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

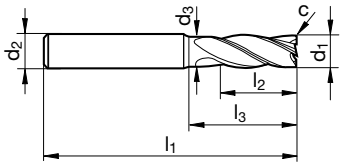
DIN 6527 K | N | 4 | 36° 38° 37° | 45° | 7° | 48 HRC

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

• neck clearance
• centre cutting



Article no.	6803	6804

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	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	●	●

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			HPC		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

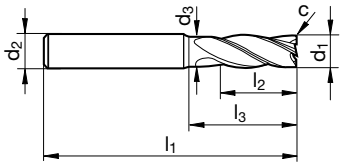
DIN 6527 L | NH | 4 | 36° 38° 37° | 45° | 7° | 48 HRC

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

P	•
M	•
K	•
N	•
S	•
H	○

GÜHRINGNAVIGATOR
Cutting data page 12

- neck clearance
- centre cutting



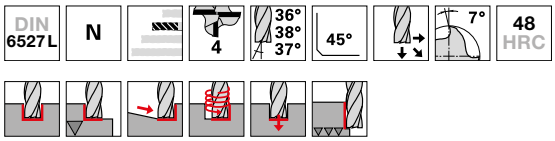
Article no.	6737	6736

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	Availability	
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	●	●

ISO	Hardness	vc	fz (mm/z) / Ø						
			3	6	8	10	12	16	20
			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
	≥ 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

vc	fz (mm/z) / Ø						
	3	6	8	10	12	16	20
	ap = l2			HPC		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

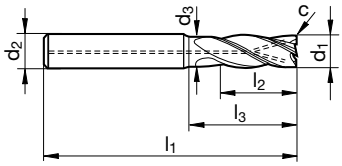


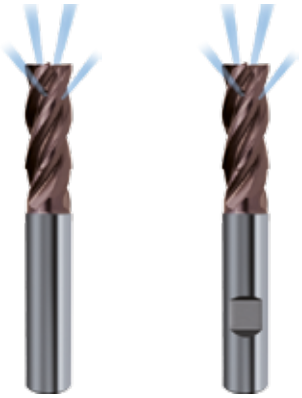
Tool material	Solid carbide	
Surface	Y	Y
Type	N	N
Shank form	HA	HB
	NEW	NEW

P	•
M	•
K	•
N	•
S	•
H	○

GÜHRINGNAVIGATOR
Cutting data page 12

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



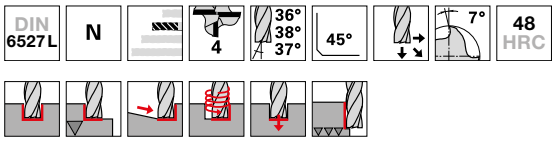


Article no.	6801	6802

d1 h10	d2 h6	d3	l1	l2	l3	c	Z	Code no.	Availability	
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	●	●

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 mill sets RF 100 Diver



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

P	•
M	•
K	•
N	•
S	•
H	

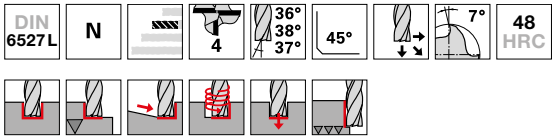
GÜHRINGNAVIGATOR
Cutting data page 12

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

Article no.	**6755**

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

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

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

Article no.	**6754**

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

RF100 diver

SLOTTING

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
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

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
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

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
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

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
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

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
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

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

Exceptions for material ranges

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.

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

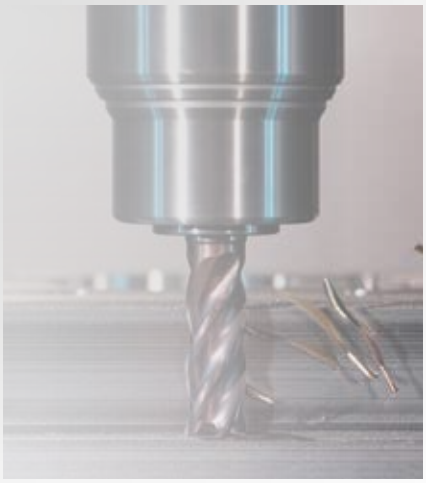
Solid carbide milling cutters with internal cooling
• optimal chip evacuation, very good cutting edge cooling, very effective against built-up edges
• to be recommended especially for larger tool diameters and tough materials

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 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

○ limited suitability

Coatings

○ bright finish

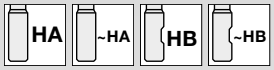
Ⓨ Signum

Pictograms

Tool material

Solid carbide ultrafine grain (carbide UF)

Shank form



to DIN 6535

Type

to DIN

to Guhring standard

Type

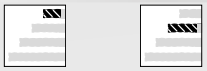
Applications

Slotting | Roughing | Ramping | Helix | Drilling | Finishing | Copying

Milling conditions

maximum volume | maximum speed | unstable conditions

Length

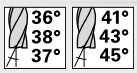


short (DIN) | long (DIN)

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, for oblique plunging and drilling

GUHRING

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