

GÜHRING

GÜHRING HIGH-PERFORMANCE TOOLS FOR
MACHINING FIBRE COMPOSITE MATERIALS

- without fraying of fibres and delamination
- for optimal component surface finish quality



Machining modern composite materials

GÜHRING - YOUR WORLDWIDE PARTNER

Pictograms

Tool material	VHM		PKD				
	Solid carbide		Polycrystalline diamond				
Surface finish							
	bright	TiCN	Cristall				
Ø-tolerance							
Shank form							
	to DIN 6535						
Standard							
	to Guhring std.						
Type							
Cutting direction							
	right-hand						
Applications							
	slotting	roughing	ramping	Helix	drilling	finishing	copying
Lenght							
	long (DIN)		medium length				
No. of cutting edges							
	no. of cutting lips						
Web thinning							
Helix angle							
	size of helix angle / no. of different helix angles						
Rake angle							
	rake angle of circumferential cutting edges						
Infeed							
	for lateral infeed		for lateral infeed and oblique plunging		for lateral infeed, oblique plunging and drilling		

MACHINING MODERN COMPOSITE MATERIALS

Modern fibre reinforced plastics (FRP's) are making an entry into a broad range of industrial applications for reasons of efficiency, weight reduction, strength and dynamics. With their specific properties they extend the group of conventional metal lightweight construction materials such as aluminium- and titanium-alloys. FRP's or multi-material combinations, ie. a mixture of FRP and metallic materials, are therefore no longer exclusively retained for the aerospace industry, motorsport and other high-end applications. It is especially worth highlighting the great growth in the general automotive and commercial vehicle technology.

FRP's are applied where high specific strength and low weight as well as high dynamic or energy efficient processes can be found. For the machining of CFRP, GFRP and stacks (FRP-metal-layer composite) without component damage, cutting edge quality and wear resistance of the tool material are of absolute importance. Guhring provides special solid carbide, coated carbide and PCD tooling solutions for these demanding materials. They are specially adapted to the respective material structure and ensure optimum chip evacuation as well as uniform hole diameters across all materials.

CHALLENGES

- components without fraying of fibres
- delamination-free component surface finish
- no component damage through "peel-up or "push-out"
- prevention of split fibres on component
- minimising burr development
- prevention of thermal damage

TOOLS

FOR THE MACHINING OF MODERN COMPOSITE MATERIALS



SOLID CARBIDE DRILLS

from Ø 2.50 mm to Ø 10.00 mm
see pages 7–8

Solid carbide



END MILLS Z=4

from Ø 8.00 mm to Ø 12.70 mm
see page 22

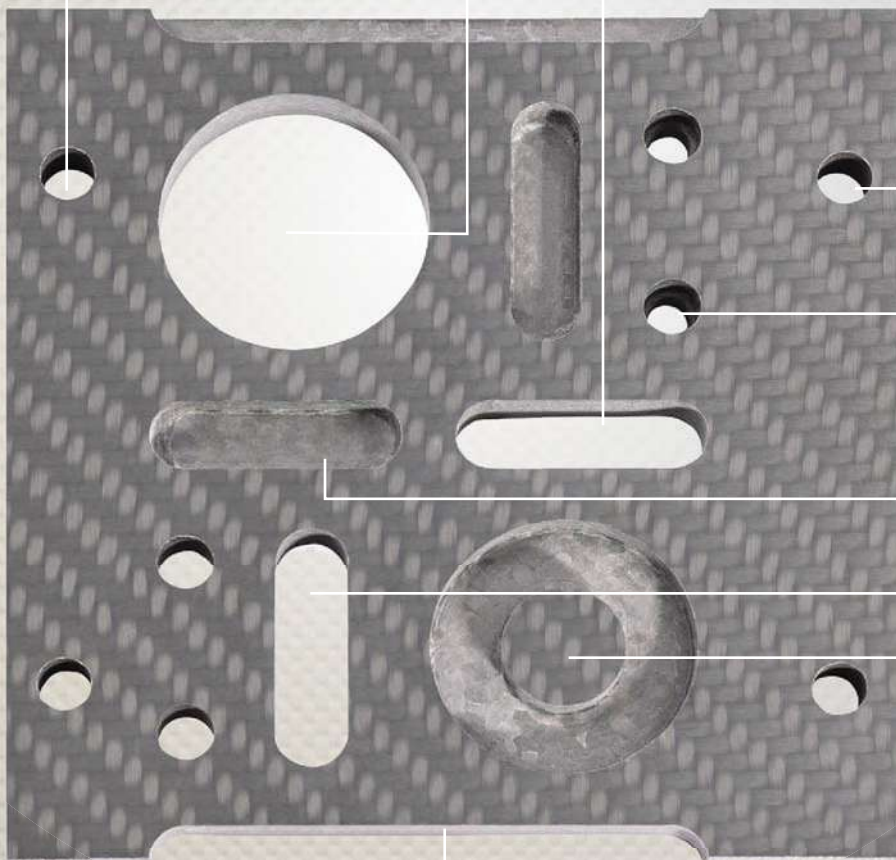
PCD



END MILLS Z=1

from Ø 2.00 mm to Ø 16.00 mm
see page 9

Solid carbide





PCD DRILLS

from Ø 2.70 mm to Ø 12.70 mm
see pages 16–17

PCD



TAPS

from M3 mm to M16 mm
see page 15

Solid carbide



KEVLAR END MILLS FR 100

from Ø 4.00 mm to Ø 12.70 mm
see pages 13–14

Solid carbide



KEVLAR END MILLS CR 100

from Ø 4.00 mm to Ø 16.00 mm
see pages 10–12

Solid carbide



SLOT DRILLS Z=2

from Ø 4.00 mm to Ø 20.00 mm
see pages 18–19

PCD



SLOT DRILLS Z=3

from Ø 14.00 mm to Ø 20.00 mm
see pages 20–21

PCD



PCD COMPRESSION MILLING CUTTERS

from Ø 12.70 mm to Ø 16.00 mm
see page 23

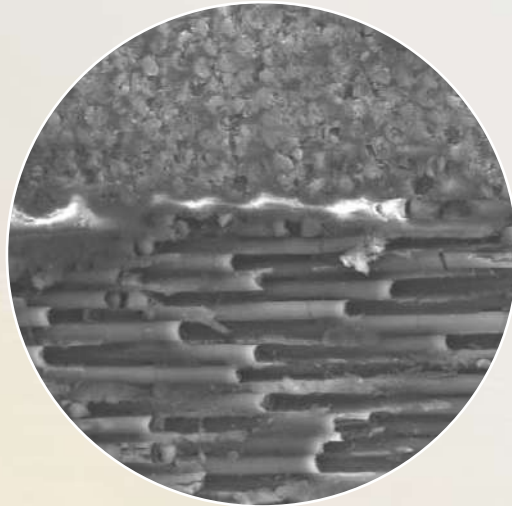
PCD



RESULT OF A DRILLING OPERATION WITH SPECIALISED GUHRING TOOLING SOLUTIONS



Machining with a Guhring tool retains the structure and direction of the fibres in the component, as the REM examination shows. The fibres are neither pressed into the matrix nor ripped out of the composite.



CRFP cut surface with 500-fold magnification

Optimal machining results in CFRP

no peel-up – no push-out



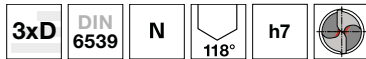
hole exit in CFRP
with woven cover layer
hole D=6.35 mm



hole exit in
unidirectional CFRP
hole D=6.35 mm



Stub drills



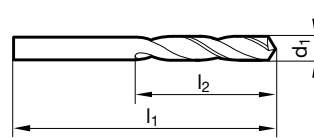
Tool material

solid carbide

Surface finish



Cutting direction



Article no.

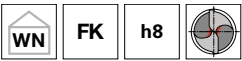
730

d1	d1	l1	l2	Availability
mm	inch	mm	mm	
2.50		43.00	14.00	●
3.00		46.00	16.00	●
3.20		49.00	18.00	●
3.26		49.00	18.00	●
3.30		49.00	18.00	●
3.50		52.00	20.00	●
3.57	9/64	52.00	20.00	●
3.60		52.00	20.00	●
4.00		55.00	22.00	●
4.10		55.00	22.00	●
4.50		58.00	24.00	●
4.76	3/16	62.00	26.00	●
4.80		62.00	26.00	●
5.00		62.00	26.00	●
5.50		66.00	28.00	●
6.00		66.00	28.00	●
6.35		70.00	31.00	●
6.40		70.00	31.00	●
6.50		70.00	31.00	●
7.00		74.00	34.00	●
7.50		74.00	34.00	●
8.00		79.00	37.00	●
8.50		79.00	37.00	●
9.00		84.00	40.00	●
9.50		84.00	40.00	●
10.00		89.00	43.00	●

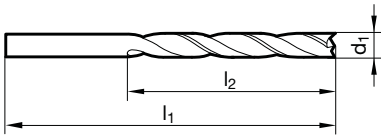
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		40-130 m/min	0.03 - 0.15 f (mm/rev)



Kevlar drills



Tool material	solid carbide
Surface finish	
Cutting direction	



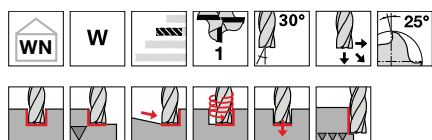
Article no. 1149

d1	d1	l1	l2	Availability
mm	inch	mm	mm	
2.50		43.00	14.00	●
3.20		49.00	18.00	●
3.57	9/64	52.00	20.00	●
4.00		55.00	22.00	●
4.76	3/16	62.00	26.00	●
5.00		62.00	26.00	●
6.00		66.00	28.00	●
8.00		79.00	37.00	●
10.00		89.00	43.00	●

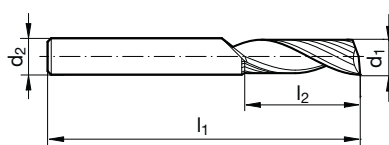
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		40-130 m/min	0.03 - 0.15 f (mm/rev.)



End mills Z=1

Tool material **solid carbide**Surface finish **D**Cutting direction **R**

polished flutes, centre cutting

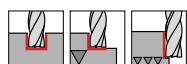
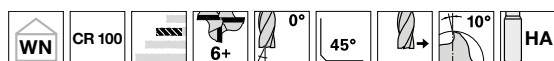
Article no. **6793**

d1 h10 mm	d2 h6 mm	l1 mm	l2 mm	Z	Availability
2.00	2.00	38	10.0	1	●
3.00	3.00	39	12.0	1	●
4.00	4.00	40	15.0	1	●
5.00	5.00	50	16.0	1	●
6.00	6.00	57	20.0	1	●
8.00	8.00	63	22.0	1	●
10.00	10.00	73	25.0	1	●
12.00	12.00	83	30.0	1	●
16.00	16.00	92	35.0	1	●

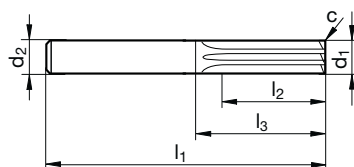
Material	Process	Cutting speed	Feed rate
CFK GFK aramid		100-250 m/min	0,03 - 0,12 fz (mm/z)
CFK GFK aramid		80-150 m/min	0,03 - 0,2 f (mm/rev.)



Kevlar CR 100 end mills

Tool material **solid carbide**Surface finish **(D)**Cutting direction **(R)**

Solid carbide ultra-fine grain, diamond-coated,
without face cutting, for slotting and trimming

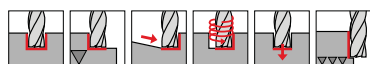
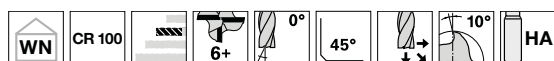
Article no. **6717**

d1 e10	d2 h6	l1	l2	l3	c	Z	Availability
mm	mm	mm	mm	mm	mm x 45°		
4.00	6.00	57.00	10.00	19.40	0.10	6	●
6.00	6.00	65.00	15.00	29.00	0.15	8	●
8.00	8.00	75.00	20.00	39.00	0.15	10	●
10.00	10.00	80.00	25.00	40.00	0.15	12	●
12.00	12.00	93.00	32.00	48.00	0.15	14	●
16.00	16.00	108.00	34.00	60.00	0.15	14	●

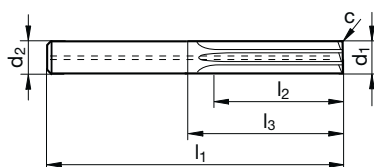
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)



CR 100 Kevlar end mills

Tool material **solid carbide**Surface finish **D**Cutting direction **R**

Solid carbide ultra-fine grain, diamond-coated,
with centre cutting, for slotting and trimming as well as oblique plunging

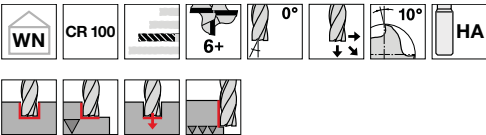
Article no. **6719**

d1 e10	d2 h6	l1	l2	l3	c	Z	Availability
mm	mm	mm	mm	mm	mm x 45°		
4.00	6.00	57.00	10.00	19.40	0.32	6	●
6.00	6.00	65.00	15.00	29.00	0.48	8	●
8.00	8.00	75.00	20.00	39.00	0.64	10	●
10.00	10.00	80.00	25.00	40.00	0.80	12	●
12.00	12.00	93.00	32.00	48.00	0.96	14	●
16.00	16.00	108.00	34.00	60.00	1.28	14	●

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		100-250 m/min	0.05 - 0.2 f (mm/rev.)



CR 100 Kevlar end mills

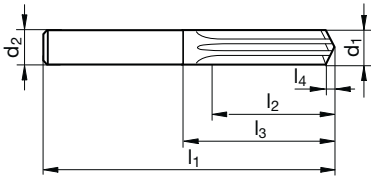


Tool material **solid carbide**

Surface finish **D**

Cutting direction **R**

Solid carbide ultra-fine grain, diamond-coated, with drill point, especially for plunging and subsequent milling



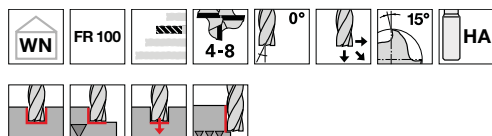
Article no. **6720**

d1 (e10)	d2 (h6)	l1	l2	l3	l4	Z	Availability
mm	mm	mm	mm	mm	mm		
4,00	6,00	57.00	10.00	27.00	1.3	6	●
6,00	6,00	65.00	15.00	29.00	1.9	8	●
8,00	8,00	75.00	20.00	39.00	2.5	10	●
10,00	10,00	80.00	25.00	40.00	3.1	12	●
12,00	12,00	93.00	32.00	48.00	3.7	14	●
16,00	16,00	108.00	34.00	60.00	4.9	14	●

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		100-250 m/min	0.05 - 0.20 f (mm/rev.)



FR 100 Kevlar end mills



Tool material

solid carbide

Surface finish

D

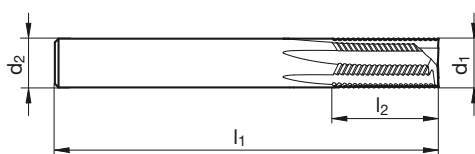
O

Cutting direction

R

R

Solid carbide ultra-fine grain, diamond-coated,
with drill centre cutting, for slotting and trimming as well as oblique plunging



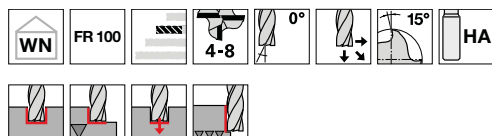
6769

6805

d1 (e10)	d1 (e10)	d2 (h6)	l1	l1	l2	l2	Z	Availability	
mm	inch	mm	mm	inch	mm	inch			
4.000		6.000	66.00		15.00		4	●	●
4.762	3/16	4.762	63.50	2.5	15.00	37/64	4	●	●
6.000		6.000	70.00		20.00		4	●	●
6.350	1/4	6.350	63.50	2.5	15.00	37/64	4	●	●
8.000		8.000	75.00		25.00		6	●	●
9.525	3/8	9.525	76.20	2.5	18.00	45/64	6	●	●
12.700	1/2	12.700	88.90	3.5	25.40	1	8	●	●

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-150 m/min	0.05 - 0.20 f (mm/rev.)

FR 100 Kevlar end mills



Tool material

solid carbide

Surface finish

D

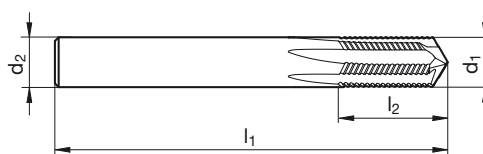
O

Cutting direction

R

R

Solid carbide ultra-fine grain, diamond-coated,
with drill point, specially for plunging and subsequent milling

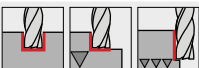


Article no.

6770

6806

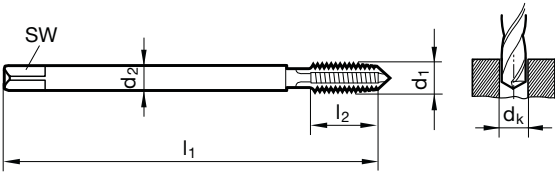
d1 (e10) mm	d1 (e10) inch	d2 (h6) mm	l1 mm	l1 inch	l2 mm	l2 inch	Z	Availability	
4.000		6.000	66.00		15.00		4	●	●
4.762	3/16	4.762	63.50	2.5	15.00	37/64	4	●	●
6.000		6.000	70.00		20.00		4	●	●
6.350	1/4	6.350	63.50	2.5	15.00	37/64	4	●	●
8.000		8.000	75.00		25.00		6	●	●
9.525	3/8	9.525	76.20	2.5	18.00	45/64	6	●	●
12.700	1/2	12.700	88.90	3.5	25.40	1	8	●	●

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)

Machine taps for ISO metric threads



Tool material	solid carbide
Surface finish	
Tolerance on Ø	ISO2/6H



Article no.							2944
d1	P	d2	SW	dk	l1	l2	Availability
	mm	mm	mm	mm	mm	mm	
M3	0,500	3,50	2,700	2,60	56,00	12,00	●
M4	0,700	4,50	3,400	3,40	63,00	14,00	●
M5	0,800	6,00	4,900	4,30	70,00	17,00	●
M6	1,000	6,00	4,900	5,10	80,00	20,00	●
M8	1,250	8,00	6,200	6,90	90,00	20,00	●
M10	1,500	10,00	8,000	8,60	100,00	24,00	●
M12	1,750	12,00	9,000	10,40	110,00	28,00	●
M16	2,000	16,00	12,000	14,10	110,00	40,00	●

Material	Process	Cutting speed
CFK GFK	blind hole through hole	15 - 25 m/min



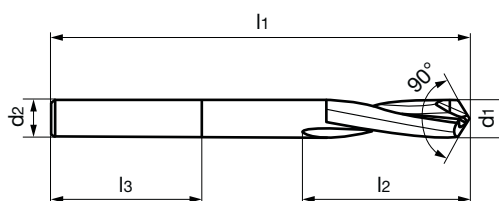
90° PCD drills



Tool material

PCD

Cutting direction



d1	d1	d2 h6	l1	l2	l3	Material number
mm	inch	mm	mm	mm	mm	
2.700		4.00	60.00	18.00	28.00	303 209 684
3.000		4.00	60.00	18.00	28.00	303 209 685
3.250		4.00	60.00	18.00	28.00	303 420 038
3.572	9/64	4.00	60.00	18.00	28.00	303 209 686
4.000		5.00	60.00	20.00	28.00	303 209 802
4.170		5.00	75.00	25.00	28.00	303 420 039
4.762	3/16	5.00	75.00	25.00	28.00	303 209 803
4.830		5.00	75.00	25.00	28.00	303 420 040
5.000		6.00	75.00	25.00	36.00	303 209 804
6.000		8.00	75.00	30.00	36.00	303 209 805
6.350	1/4	8.00	75.00	35.00	36.00	303 209 806
7.937	5/16	10.00	75.00	40.00	40.00	303 209 807
8.000		10.00	75.00	40.00	40.00	303 209 808
9.525	3/8	10.00	100.00	50.00	40.00	303 209 809
10.000		12.00	125.00	50.00	45.00	303 209 810
12.000		14.00	125.00	60.00	45.00	303 209 811
12.700	1/2	14.00	150.00	65.00	45.00	303 209 812

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		75-200 m/min	0.05 - 0.2 f (mm/rev.)



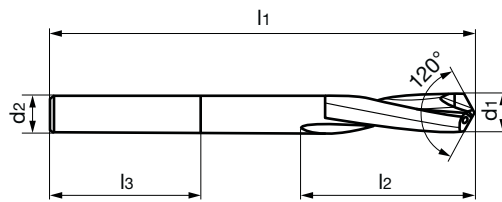
120° PCD drills



Tool material

PCD

Cutting direction

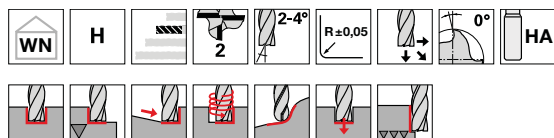


d1	d1	d2 h6	l1	l2	l3	Material number
mm	inch	mm	mm	mm	mm	
2.700		4.00	60.00	18.00	28.00	303 209 813
3.000		4.00	60.00	18.00	28.00	303 209 814
3.250		4.00	60.00	18.00	28.00	303 420 041
3.572	9/64	4.00	60.00	18.00	28.00	303 209 815
4.000		5.00	60.00	20.00	28.00	303 209 816
4.170		5.00	75.00	25.00	28.00	303 420 047
4.762	3/16	5.00	75.00	25.00	28.00	303 209 817
4.830		5.00	75.00	25.00	28.00	303 420 048
5.000		6.00	75.00	25.00	36.00	303 209 818
6.000		8.00	75.00	30.00	36.00	303 209 819
6.350	1/4	8.00	75.00	35.00	36.00	303 209 820
7.937	5/16	10.00	75.00	40.00	40.00	303 209 821
8.000		10.00	75.00	40.00	40.00	303 209 822
9.525	3/8	10.00	100.00	50.00	40.00	303 209 823
10.000		12.00	125.00	50.00	45.00	303 209 824
12.000		14.00	125.00	60.00	45.00	303 209 825
12.700	1/2	14.00	150.00	65.00	45.00	303 209 826

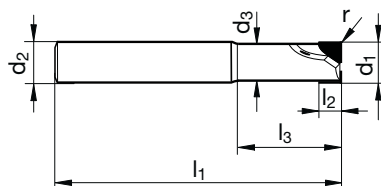
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		100-250 m/min	0.05 - 0.20 f (mm/rev.)



PCD slot drills Z=2



Tool material	PCD
Surface finish	○
Cutting direction	Ⓜ



Article no.

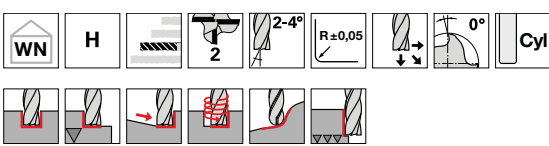
5492

d1	d1	d2 h6	d3	l1	l2	l3	r	Z	Availability
mm		mm	mm	mm	mm	mm	mm		
4.000	± 0.02	6.00	3.70	51	6.0	14.0	0.1	2	●
5.000	± 0.02	6.00	4.70	51	8.0	14.5	0.1	2	●
6.000	± 0.02	6.00	5.70	57	8.0	20.0	0.1	2	●
8.000	± 0.02	8.00	7.40	63	8.0	26.0	0.1	2	●
8.001	± 0.02	8.00	7.40	63	12.0	26.0	0.1	2	●
10.000	± 0.02	10.00	9.40	72	8.0	30.0	0.1	2	●
10.001	± 0.02	10.00	9.40	72	16.0	30.0	0.1	2	●
12.000	± 0.02	12.00	11.20	83	8.0	36.0	0.1	2	●
12.001	± 0.02	12.00	11.20	83	16.0	36.0	0.1	2	●
14.000	± 0.02	14.00	13.00	83	8.0	36.0	0.1	2	●
14.001	± 0.02	14.00	13.00	83	16.0	36.0	0.1	2	●
16.000	± 0.02	16.00	15.00	100	12.0	50.0	0.1	2	●
16.001	± 0.02	16.00	15.00	100	20.0	50.0	0.1	2	●
18.000	± 0.02	18.00	17.00	100	12.0	50.0	0.1	2	●
18.001	± 0.02	18.00	17.00	100	20.0	50.0	0.1	2	●
20.000	± 0.02	20.00	19.00	100	12.0	48.0	0.1	2	●
20.001	± 0.02	20.00	19.00	100	20.0	48.0	0.1	2	●

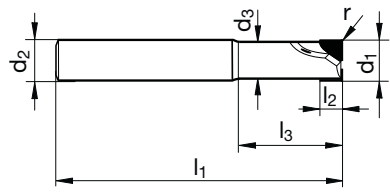
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



PCD slot drills Z=2



Tool material	PCD
Surface finish	○
Cutting direction	Ⓜ



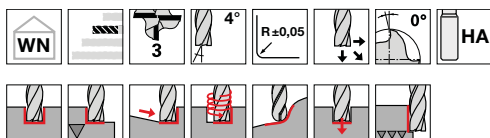
Article no. 5493

d1	d1	d2 h6	d3	l1	l2	l3	r	Z	Availability
mm		mm	mm	mm	mm	mm	mm		
4.00	± 0.02	6.00	3.70	70	6.0	14.0	0.1	2	●
5.00	± 0.02	6.00	4.70	70	8.0	14.5	0.1	2	●
6.00	± 0.02	6.00	5.70	75	8.0	20.0	0.1	2	●
8.00	± 0.02	8.00	7.40	100	8.0	26.0	0.1	2	●
8.00	± 0.02	8.00	7.40	100	12.0	26.0	0.1	2	●
10.00	± 0.02	10.00	9.40	100	8.0	30.0	0.1	2	●
10.00	± 0.02	10.00	9.40	100	16.0	30.0	0.1	2	●
12.00	± 0.02	12.00	11.20	100	8.0	36.0	0.1	2	●
12.00	± 0.02	12.00	11.20	100	16.0	36.0	0.1	2	●
14.00	± 0.02	14.00	13.00	100	8.0	36.0	0.1	2	●
14.00	± 0.02	14.00	13.00	100	16.0	36.0	0.1	2	●
16.00	± 0.02	16.00	15.00	150	12.0	50.0	0.1	2	●
16.00	± 0.02	16.00	15.00	150	20.0	50.0	0.1	2	●
18.00	± 0.02	18.00	17.00	125	12.0	50.0	0.1	2	●
18.00	± 0.02	18.00	17.00	125	20.0	50.0	0.1	2	●
18.00	± 0.02	18.00	17.00	150	12.0	50.0	0.1	2	●
18.00	± 0.02	18.00	17.00	150	20.0	50.0	0.1	2	●
20.00	± 0.02	20.00	19.00	150	12.0	48.0	0.1	2	●
20.00	± 0.02	20.00	19.00	150	20.0	48.0	0.1	2	●

Material	Process	Cutting speed	Feed rate
CFK GFK aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFK GFK aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



PCD slot drills Z=3



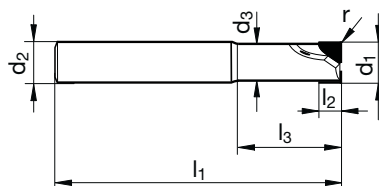
Tool material

PCD

Surface finish



Cutting direction



Article no.

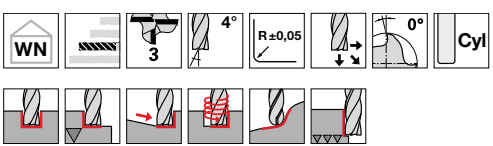
5495

d1	d1	d2 h6	d3	l1	l2	l3	r	Z	Availability
mm		mm	mm	mm	mm	mm	mm		
14.00	± 0.02	14.00	13.00	83	8.0	38.0	0.1	3	●
14.00	± 0.02	14.00	13.00	83	16.0	38.0	0.1	3	●
16.00	± 0.02	16.00	15.00	100	12.0	52.0	0.1	3	●
16.00	± 0.02	16.00	15.00	100	20.0	52.0	0.1	3	●
18.00	± 0.02	18.00	17.00	100	12.0	52.0	0.1	3	●
18.00	± 0.02	18.00	17.00	100	20.0	52.0	0.1	3	●
20.00	± 0.02	20.00	19.00	100	12.0	50.0	0.1	3	●
20.00	± 0.02	20.00	19.00	100	20.0	50.0	0.1	3	●

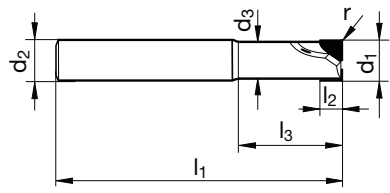
Material	Process	Cutting speed	Feed rate
CFK GFK aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFK GFK aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



PCD Slot drills Z=3



Tool material	PCD
Surface finish	○
Cutting direction	Ⓜ



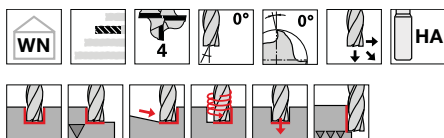
Article no. 5496

d1	d1	d2 h6	d3	l1	l2	l3	r	Z	Availability
mm		mm	mm	mm	mm	mm	mm		
14.00	± 0.02	14.00	13.00	100	8.0	38.0	0.1	3	●
14.00	± 0.02	14.00	13.00	100	16.0	38.0	0.1	3	●
16.00	± 0.02	16.00	15.00	150	12.0	52.0	0.1	3	●
16.00	± 0.02	16.00	15.00	150	20.0	52.0	0.1	3	●
18.00	± 0.02	18.00	17.00	150	12.0	52.0	0.1	3	●
18.00	± 0.02	18.00	17.00	150	20.0	52.0	0.1	3	●
20.00	± 0.02	20.00	19.00	150	12.0	50.0	0.1	3	●
20.00	± 0.02	20.00	19.00	150	20.0	50.0	0.1	3	●

Material	Process	Cutting speed	Feed rate
CFK GFK aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFK GFK aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



PCD End mills



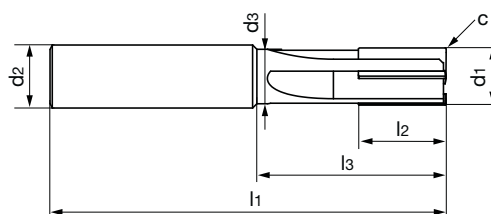
Tool material

PCD

Surface finish



Cutting direction

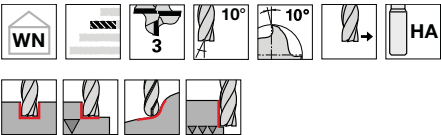


d1	d1	d2 h6	d3	l1	l2	l3	c	Z	Material number
mm	inch	mm	mm	mm	mm	mm	mm x 45°		
8.000		8.00	7.40	75.00	19.50	38.50	0.20	4	303 206 512
9.525	3/8	10.00	8.92	80.00	19.50	39.26	0.20	4	303 206 513
10.000		10.00	9.40	80.00	19.50	39.50	0.20	4	303 206 514
12.000		12.00	11.40	88.00	19.50	42.50	0.20	4	303 206 515
12.700	1/2	14.00	12.10	88.00	19.50	41.85	0.20	4	303 211 229
12.700	1/2	14.00	11.10	88.00	19.50	41.35	0.20	2+1	303 211 230

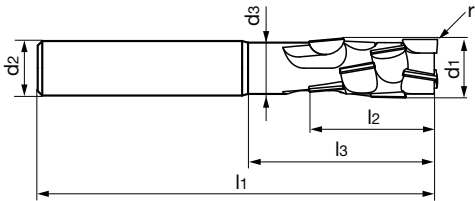
Material	Process	Cutting speed	Feed rate
CFK GFK aramid		150-500 m/min	0.03 - 0.12 fz (mm/z)
CFK GFK aramid		125-200 m/min	0.05 - 0.20 f (mm/rev.)



PCD Compression milling cuttersz=3



Tool material	PCD
Cutting direction	



d1	d1	d2 h6	d3	l1	l2	l3	r	Material number
mm	inch	mm	mm	mm	mm	mm	mm	
12,700	1/2	12,00	11,30	88,00	28,00	41,49	0,10	303 211 231
14,000		14,00	12,60	88,00	28,00	40,19	0,10	303 211 257
16,000		16,00	14,60	91,00	28,00	40,19	0,10	303 211 258

Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-500 m/min	0.03 - 0.12 fz (mm/z)



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