

GUHRING

DRILLING AND MILLING WITH SOLID CARBIDE AND PCD TOOLS



















- without fibre projections and delamination
- for optimal component surface finish quality



Machining modern composite materials

GUHRING - YOUR WORLD WIDE PARTNER

Pictograms

Tool material	VHM Solid carbide	PKD Polycrystalline diamond
Surface finish	 Diamond	
Ø-tolerance		
Shank form	 to DIN 6535	
Standard	 to Guhring std.	
Type		
Cutting direction	 right-hand	
Applications	 slotting  roughing  drilling  finishing	
Lenght	 long (DIN)	
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 composite plastics (FCP'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. FCP's or multi-material combinations, ie. a mixture of FCP 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.

FCP'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 (CFRP-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 fibre projections
- 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 2.5 mm to Ø 10.0 mm
see pages 7–8

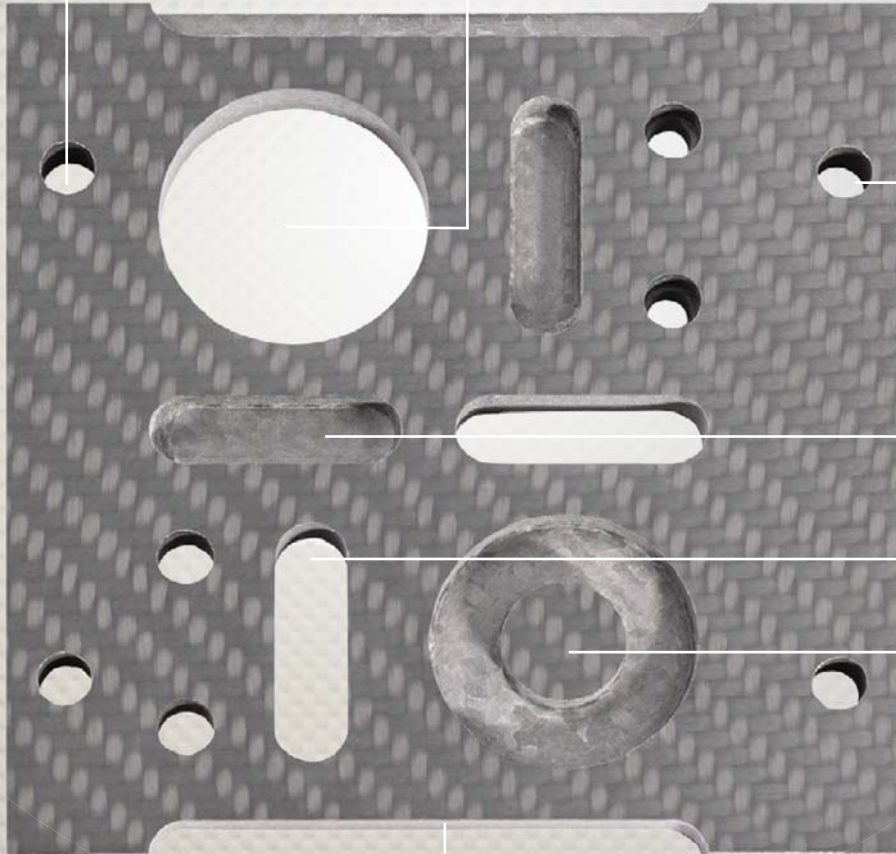
Solid carbide



SLOT DRILLS z=4

from Ø 8,00 mm to Ø 12,70 mm
see page 18

PCD





PCD DRILLS

from Ø 2,70 mm to Ø 12,70 mm
see pages 15–16

PCD 



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 9–12

Solid carbide



SLOT DRILLS z=2

from Ø 4,00 mm to Ø 20,00 mm
see page 17

PCD 



PCD COMPRESSION MILLING CUTTERS

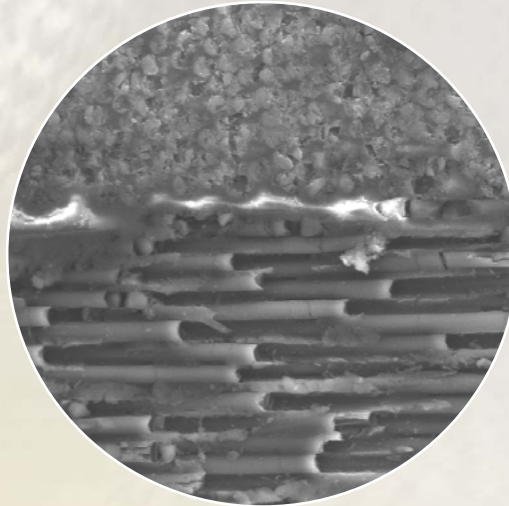
from Ø 12,70 mm to Ø 16,00 mm
see page 19

PCD 

RESULT OF A DRILLING OPERATION WITH SPECIALISED GUHRING TOOLING SOLUTIONS



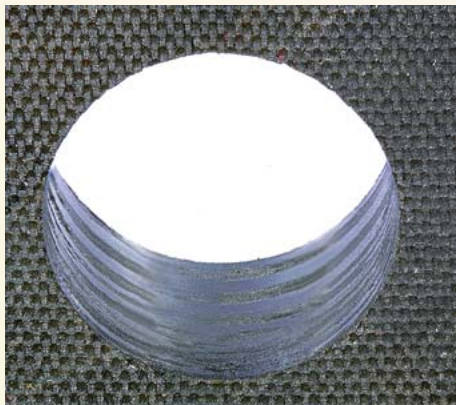
Machining with a Guhring tool retains the structure and direction of the fibres in the component, as the REM examination shows. The fibres are neither pressed into the matrix or ripped out of the composite.



CFRP cut surface with 500-fold magnification

Optimal machining results in CFRP

no peel-up – no push-out



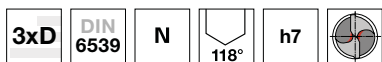
with webbing cover layer
hole D=6.35 mm



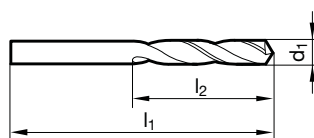
unidirectional CFRP
hole D=6.35 mm



Stub drills



Tool material	solid carbide
Surface finish	○
Cutting direction	Ⓜ



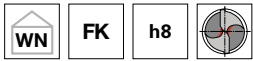
Guhring no. 730

d1	d1	l1	l2	Availability
mm	inch	mm	mm	
2.500		43.00	14.00	●
3.200		49.00	18.00	●
3.570	9/64	52.00	20.00	●
4.000		55.00	22.00	●
4.760	3/16	62.00	26.00	●
5.000		62.00	26.00	●
6.000		66.00	28.00	●
8.000		79.00	37.00	●
10.000		89.00	43.00	●

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

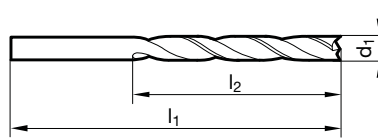


Kevlar drills

Tool material **solid carbide**

Surface finish

Cutting direction



Guhring no.

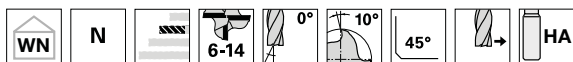
1149

d1	d1	l1	l2	Availability
mm	inch	mm	mm	
2.500		43.00	14.00	●
3.200		49.00	18.00	●
3.570	9/64	52.00	20.00	●
4.000		55.00	22.00	●
4.760	3/16	62.00	26.00	●
5.000		62.00	26.00	●
6.000		66.00	28.00	●
8.000		79.00	37.00	●
10.000		89.00	43.00	●

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

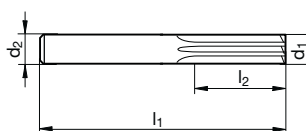


Kevlar CR 100 end mills



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

Tool material	solid carbide
Surface finish	ⓓ
Cutting direction	Ⓜ

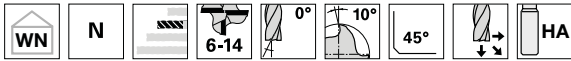


Guhring no. 6717

d1 (e10)	d2 (h6)	l1	l2	z	Availability
mm	mm	mm	mm		
4.000	6.000	57.00	10.00	6	●
6.000	6.000	65.00	15.00	8	●
8.000	8.000	75.00	20.00	10	●
10.000	10.000	80.00	25.00	12	●
12.000	12.000	93.00	32.00	14	●
16.000	16.000	108.00	34.00	14	●

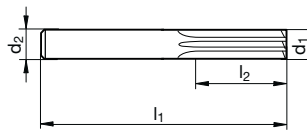
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)

Kevlar CR 100 end mills



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

Tool material	solid carbide
Surface finish	ⓓ
Cutting direction	Ⓜ



Guhring no. 6719

d1 (e10)	d2 (h6)	l1	l2	z	Availability
mm	mm	mm	mm		
4.000	6.000	57.00	10.00	6	●
6.000	6.000	65.00	15.00	8	●
8.000	8.000	75.00	20.00	10	●
10.000	10.000	80.00	25.00	12	●
12.000	12.000	93.00	32.00	14	●
16.000	16.000	108.00	34.00	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.)

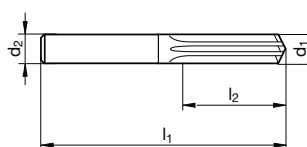


Kevlar CR 100 end mills



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

Tool material	solid carbide
Surface finish	ⓓ
Cutting direction	Ⓜ

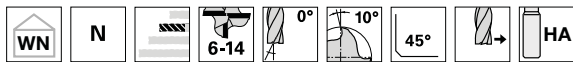


Guhring no. 6720

d1 (e10) mm	d2 (h6) mm	l1 mm	l2 mm	z	Availability
4.000	6.000	57.00	10.00	6	●
6.000	6.000	65.00	15.00	8	●
8.000	8.000	75.00	20.00	10	●
10.000	10.000	80.00	25.00	12	●
12.000	12.000	93.00	32.00	14	●
16.000	16.000	108.00	34.00	14	●

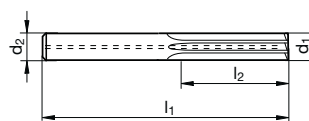
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		100-250 m/min	0.05 - 0.20 f (mm/rev.)

Kevlar end mills CR 100 Air with internal cooling



Solid carbide ultra-fine grain, diamond-coated, with rear coolant exits, without face cutting, special, rear air cooling exits ensure an optimal evacuation of CFRP dust

Tool material	solid carbide
Surface finish	ⓓ
Cutting direction	Ⓜ



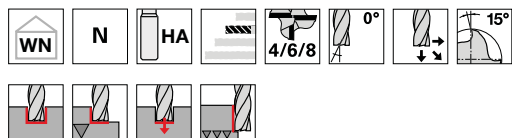
Guhring no. 6718

d1 (e10)	d2 (h6)	l1	l2	z	Availability
mm	mm	mm	mm		
6.000	6.000	65.00	15.00	8	●
8.000	8.000	75.00	20.00	10	●
10.000	10.000	80.00	25.00	12	●
12.000	12.000	93.00	32.00	14	●
16.000	16.000	108.00	34.00	14	●

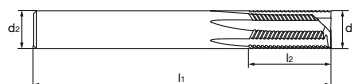
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		250-500 m/min	0.03 - 0.12 fz (mm/z)



Kevlar FR 100 end mills

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

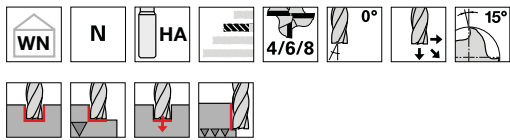
Solid carbide ultra-fine grain, diamond-coated, with drill centre cutting, for slotting and trimming as well as oblique plunging



d1 (e10)	d1 (e10)	d2 (h6)	l1	l1	l2	l2	z	Material number
mm	inch	mm	mm	inch	mm	inch		
4.000		6.000	66.00		15.00		4	303 054 052
4.775	3/16	4.775	63.50	2.5	15.00	37/64	4	303 054 053
6.000		6.000	70.00		20.00		4	303 054 054
6.350	1/4	6.350	63.50	2.5	15.00	37/64	4	303 054 055
8.000		8.000	75.00		25.00		6	303 054 056
9.525	3/8	9.525	76.20	2.5	18.00	45/64	6	303 054 057
12.700	1/2	12.700	88.90	3.5	25.40	1	8	303 054 058

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.)

Kevlar FR 100 end mills

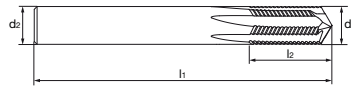


Tool material **solid carbide**

Surface finish **(D)**

Cutting direction **(R)**

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



d1 (e10) mm	d1 (e10) inch	d2 (h6) mm	l1 mm	l1 inch	l2 mm	l2 inch	z	Material number
4.000		6.000	66.00		15.00		4	303 054 059
4.775	3/16	4.775	63.50	2.5	15.00	37/64	4	303 054 060
6.000		6.000	70.00		20.00		4	303 054 061
6.350	1/4	6.350	63.50	2.5	15.00	37/64	4	303 054 062
8.000		8.000	75.00		25.00		6	303 054 063
9.525	3/8	9.525	76.20	2.5	18.00	45/64	6	303 054 064
12.700	1/2	12.700	88.90	3.5	25.40	1	8	303 054 065

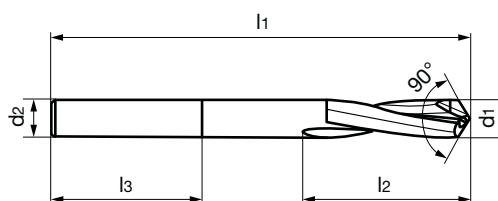
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



90° PCD drills



Tool material **PCD**
Cutting direction



d1	d1	d2	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
3.570	9/64	4.00	60.00	18.00	28.00	303 209 686
4.000		4.00	60.00	18.00	28.00	303 209 802
4.760	3/16	6.00	75.00	30.00	36.00	303 209 803
5.000		6.00	75.00	30.00	36.00	303 209 804
6.000		6.00	75.00	30.00	36.00	303 209 805
6.350	1/4	8.00	75.00	35.00	36.00	303 209 806
7.930	5/16	8.00	75.00	35.00	36.00	303 209 807
8.000		8.00	75.00	35.00	36.00	303 209 808
9.520	3/8	12.00	100.00	40.00	45.00	303 209 809
10.000		12.00	125.00	40.00	45.00	303 209 810
12.000		12.00	125.00	50.00	45.00	303 209 811
12.700	1/2	14.00	150.00	80.00	45.00	303 209 812

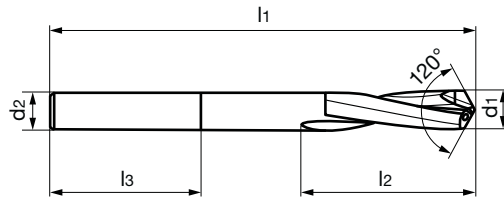
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		75-200 m/min	0.05 - 0.2 f (mm/rev.)



120° PCD drills



Tool material **PCD**
Cutting direction

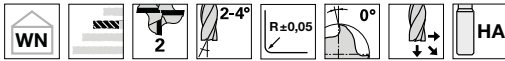


d1	d1	d2	l1	l2	l3	Material number
mm	inch	mm	mm	mm	mm	
2.700		4.00	60.00	18.00	28.00	303 209 813
3.000		4.00	60.00	18.00	28.00	303 209 814
3.570	9/64	4.00	60.00	18.00	28.00	303 209 815
4.000		4.00	60.00	18.00	28.00	303 209 816
4.760	3/16	6.00	75.00	30.00	36.00	303 209 817
5.000		6.00	75.00	30.00	36.00	303 209 818
6.000		6.00	75.00	30.00	36.00	303 209 819
6.350	1/4	8.00	75.00	35.00	36.00	303 209 820
7.930	5/16	8.00	75.00	35.00	36.00	303 209 821
8.000		8.00	75.00	35.00	36.00	303 209 822
9.520	3/8	12.00	100.00	40.00	45.00	303 209 823
10.000		12.00	125.00	40.00	45.00	303 209 824
12.000		12.00	125.00	50.00	45.00	303 209 825
12.700	1/2	14.00	150.00	80.00	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.)



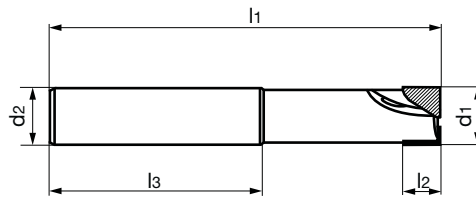
PCD slot drills z=2



Tool material

PCD

Cutting direction



Guhring no.

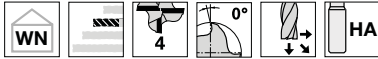
5492

d1	d2	l1	l2	l3	Availability
mm	mm	mm	mm	mm	
4.000	6.00	51.00	6.00	36.00	●
5.000	6.00	51.00	8.00	36.00	●
6.000	6.00	57.00	8.00	36.00	●
8.000	8.00	63.00	8.00	36.00	●
8.001	8.00	63.00	12.00	36.00	●
10.000	10.00	72.00	8.00	40.00	●
10.001	10.00	72.00	16.00	40.00	●
12.000	12.00	83.00	8.00	45.00	●
12.001	12.00	83.00	16.00	45.00	●
14.000	14.00	83.00	8.00	45.00	●
14.001	14.00	83.00	16.00	45.00	●
16.000	16.00	100.00	12.00	48.00	●
16.001	16.00	100.00	20.00	48.00	●
18.000	18.00	100.00	12.00	48.00	●
18.001	18.00	100.00	20.00	48.00	●
20.000	20.00	100.00	12.00	50.00	●
20.001	20.00	100.00	20.00	50.00	●

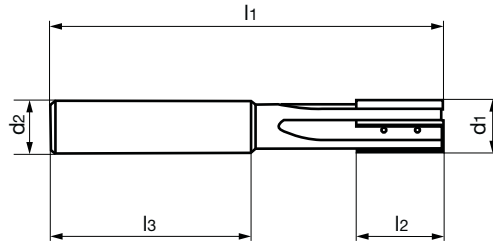
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-450 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-150 m/min	0.05 - 0.18 f (mm/rev.)



PCD slot drills z=4



Tool material **PCD**
Cutting direction

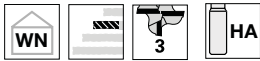


d1	d1	d2	l1	l2	l3	Material number
mm	inch	mm	mm	mm	mm	
8.000		8.00	75.00	19.50	36.00	303 206 512
9.525	3/8	10.00	80.00	19.50	40.00	303 206 513
10.000		10.00	80.00	19.50	40.00	303 206 514
12.000		12.00	88.00	19.50	45.00	303 206 515
12.700	1/2	14.00	88.00	19.50	45.00	303 211 229
12.700	1/2	14.00	88.00	19.50	45.00	303 211 230
Compression						

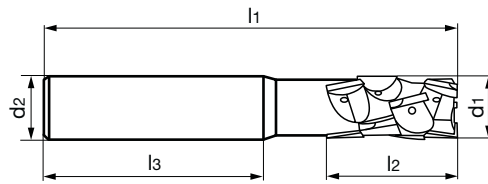
Material	Process	Cutting speed	Feed rate
CFRP GFRP aramid		150-500 m/min	0.03 - 0.12 fz (mm/z)
CFRP GFRP aramid		125-200 m/min	0.05 - 0.20 f (mm/rev.)



PCD compression milling cutters z=3



Tool material **PCD**
 Cutting direction



d1	d1	d2	l1	l2	l2	Material number
mm	inch	mm	mm	mm	mm	
12.700	1/2	12.000	88.00	25.00	45.00	303 211 231
14.000		14.000	88.00	25.00	45.00	303 211 257
16.000		14.000	88.00	25.00	48.00	303 211 258

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

DRILLING

TAPPING/ THREAD
MILLING/FLUTELESS
TAPPING

MILLING

REAMING

PCD



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