

Products PCB

Diamond-patterned

Types 620, 624, 626



Spiral-patterned

Types 720, 724, 726, 756, 790



Contour-finishing

Type 876



1-Flute router

Types 817, 818, 892



2-Flute router

Types 821, 826, 827, 828, 891



3-Flute router

Type 836



V-Groove cutter

Types 801, 802, 803, 804, 806, 809



Countersink

Type 850



Ultra micro drills

Types 518, 218, 318, 418



Standard drills



Type 530



Type 532



Spade drills

Type 230



Multilayer drills

Types 212, 242, 243, 271, 540

Type 271



Type 543



Microvia drills

Type 596



Slot drills

Type 250



Flex drills

Type 512



Newest technology in
the Application Centers of

HP TEC

Application Center Ravensburg

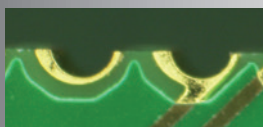
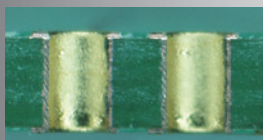
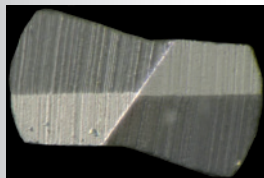
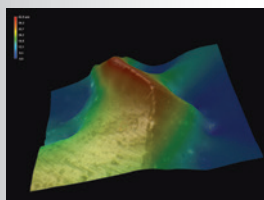
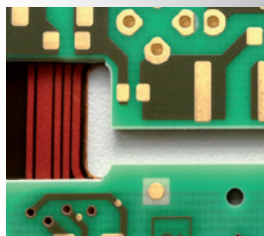
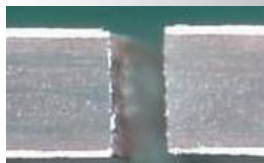
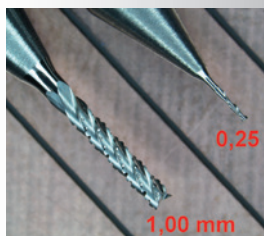
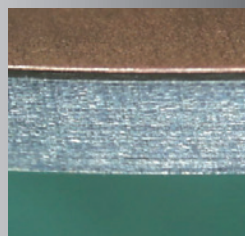
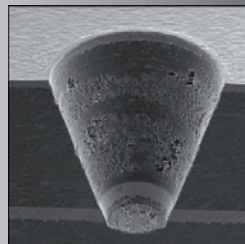
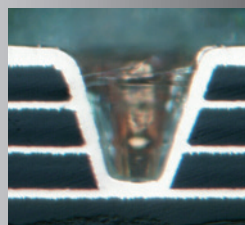
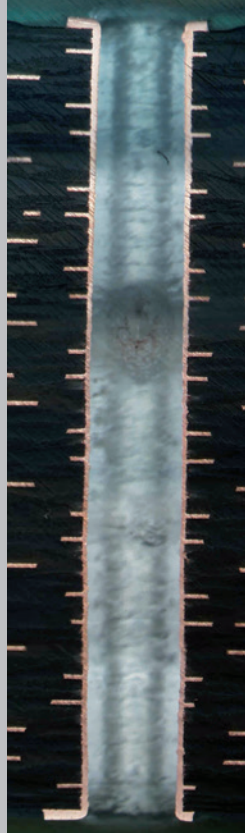
Drilling spindle 300.000 rpm

Routing spindle 125.000 rpm

Application Center China (Kunshan)

Drilling spindle 250.000 rpm

Routing spindle 125.000 rpm





HPTEC GmbH

Im Karrer 6
D-88214 Ravensburg, Germany
Hotline: +49 751-7669-0
Fax: +49 751-7669-139
E-Mail: sales@hptec.de
www.hptec.de

HPTEC China (Kunshan) Co., Ltd.

No. 88, ShuangMaRoad,
Oumei Industry Park
Dianshanhu, Kunshan, Jiangsu, P.R. China
Hotline: +86 512 57488396
Fax: +86 512 57488397
E-Mail: service001@hptec.cn
www.hptec.cn

HPTEC Korea Co., Ltd.

Room 502, 1784-6 Jungwang Dong,
Kyunggi-Do
Ko Shihung-City
Hotline: +82 313199400
Fax: +82 313194503
E-Mail: msjung@hptec.co.kr
www.hptec.co.kr



Vertretungen / Agencies

Australia

Precision Spindles Pty. Ltd.
579 Hampton St
AUS - Hampton, Victoria 3188
E-Mail: sales@spindles.com.au

Austria

Ing. Otto Hanneschläger GmbH
Höllmühlbachstr. 3
A-4040 Linz/Austria
E-Mail: info@hoh.co.at

Belgium

ViewSupport B. V.
Dorpsstraat 94 - 96
NL - 1733 AP Nieuwe Niedorp
E-Mail: eappel@viewsupport.nl

Canada

T. Friedl Enterprises (2000) Inc.
79 Milliken Blvd., Unit 4
CA - Ontario, M1V 1V3, Toronto
E-Mail: jeff@tfriedl.com

Denmark

Interflux Danmark ApS
Stenbro Allé 8
DK-6650 Broerup
E-Mail: interflux@interflux.dk

Finland

North East Trading Oy
Marjamäentie 1
FIN - 01820 Klaukkala
E-Mail: matti.malin@kolumbus.fi

France

Supratec Enomax
Z.I. La Marinière
1 rue Charles de Gaulle
F - 91070 BONDOUFLE
E-Mail: enomax@supratec.fr

Great Britain

HPtec GmbH
Im Karrer 6
D - 88214 Ravensburg
E-Mail: sales@hptec.de

Israel

Beith Dekel Ltd.
Etgarim Building, 16 Hatidhar Street
IL 43665 Ra'anana
E-Mail: orly@bd.co.il

Italy

Pagliara Prodotti Chimici SPA
Via Don Comotti, 7
I - 24050 Lurano (BG)
E-Mail: pagliara@pagliara.it

Luxembourg

ViewSupport B. V.
Dorpsstraat 94 - 96
NL - 1733 AP Nieuwe Niedorp
E-Mail: eappel@viewsupport.nl

Netherlands

ViewSupport B. V.
Dorpsstraat 94 - 96
NL - 1733 AP Nieuwe Niedorp
E-Mail: eappel@viewsupport.nl

New Zealand

Ken Pacific Electronics Supply
Unit 49, 130 Great South Road
P. O. Box 17325, Greenlane, Auckland
E-Mail: kenpacific@extra.co.nz

Singapore

Multi-Chem Limited
16H, Enterprise Road
627657 Singapore
E-Mail: salesmultichem@multichem.com.sg

South Africa

TRAILL Technologies (PTY) Ltd.
57 Turaco Street, Norscot Manor
Sandton, Johannesburg South Africa
E-Mail: ttech@icon.co.za

Sweden

North East Trading Oy
Marjamäentie 1
FIN - 01820 Klaukkala
E-Mail: matti.malin@kolumbus.fi

Switzerland

Zugana Handels AG
Oberligweg 8
CH - 8309 Nuerensdorf
E-Mail: info@zugana.ch

USA

T. Friedl Enterprises (2000) Inc.
79 Milliken Blvd., Unit 4
CA - Ontario, M1V 1V3, Toronto
E-Mail: jeff@tfriedl.com

Survey of HPTec drills / application field drills

tool type	description	Ø range [mm]	DS - ML 4 layers	ML 6-8 layers	ML ≥ 10 layers	ML ≥ 70 µm copper	Filled / HTG	Back- panels	Flex / Flex- rigid	Polyi- mide	Te- flon	Metal core ML	Copper / Brass	Plexi- glas	remark
530	Standard drill	0,30 - 0,50	●	●	●	●	○	●	○	●	●	●	●	●	Universal for all standard applications.
		0,55 - 1,95	●	●	●	●	●	○	●	○	○	○	●	●	
		2,00 - 6,35	●	●	●	●	●	●	●	●	●	●	●	●	
532	Chipbreaker / thinned web	3,20 - 6,35	●	●	●	●	●	●	●	●	●	●	●	●	
543	Standard Drill	0,20 - 0,50	●	●	●	●	●	●	●	●	●	●	●	●	Drill for high fre- quency applications
230	Multilayer drill	Spade type drill	●	●	●	●	●	●	●	●	●	●	●	●	Proved spade type drill for all multi- layer boards.
218 212			●	●	●	●	●	●	●	●	●	●	●	●	Highest demands on hole wall quality + chip transport.
242 243 271			●	●	●	●	●	●	●	●	●	●	●	●	High performance drill. Excellent po- sitioning accuracy and hole wall quality.
518 540			●	●	●	●	●	●	●	●	●	●	●	●	Highest demands on hole wall quality + chip transport.
250	Slot drill	0,50 - 3,00	●	●	●	●	●	●	●	●	●	●	●	●	Drilling slots
512	Flex drill	0,15 - 0,50	○	○	○	○	○	○	●	●	●	○	○	○	Excellent positi- oning accuracy, long tool life, more regrinding cycles possible.
596	Microvia drill	0,075 - 0,60	●	●	●	●	●	●	●	●	●	●	●	●	Drill for conical blind via holes.

Key: optimum ● suitable ○ not recommendable ○



ULTRAMICROBOHRER Typen und Spirallängen ULTRA MICRO DRILLS Types and Flute Lengths

Ø [mm]	512	518 / 418*	218 / 318*	596
	Flexbohrer	Standard-bohrer	Kopfbohrer	Microvia-Bohrer
	Flex Drill	Standard Drill	Spade Type Drill	Microvia Drill
0,050		0,6*		
0,075		1,0		
0,100		1,5		
0,105		1,8	1,6	
0,110		1,8	1,6	
0,120		2,0	2,0	0,5
0,150	2,5*	2,5	2,5	0,5*
0,20 / 0,25	3,5			1,0
0,30 / 0,35*	5,5			2,5
0,40	5,5*			2,5
0,45/0,50/0,60				2,5*

Ø > 0,15 mm siehe Übersicht Micro-/Standardbohrer

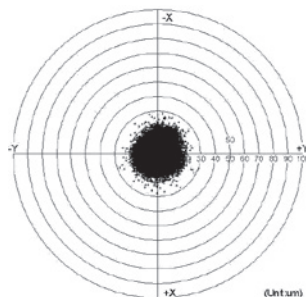
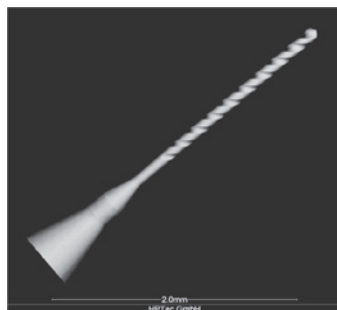
Ø > 0,15 mm see survey Micro/Standard Drills

* auf Anfrage

418 / 318 Schaftdurchmesser = 2 mm

* on request

418 / 318 shank diameter = 2 mm



BGA

BT-Material:

0.1 mm 2 x 6 μm Cu

Stack height:

6 up

Entry:

LE-800

Backup:

coated wood

Hits:

3000

Parameter:

s = 200.000rpm

F = 35 mm/s

R = 250 mm/s

MICRO-/STANDARDBOHRER Typen und Spirallängen**MICRO /STANDARD DRILLS** Types and Flute Lengths

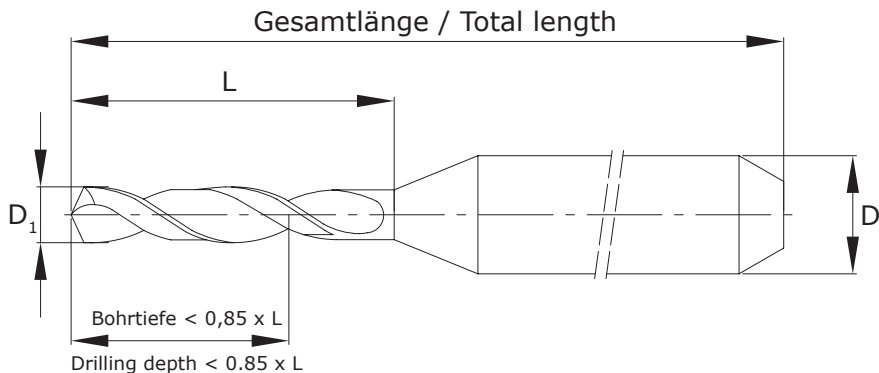
	512	530	532	543	230
	Flexbohrer	Standardbohrer	Spiral-bohrer	Standard-bohrer	Kopfbohrer
	Flex Drill	Standard Drill	Standard Drill	Standard Drill	Spade Type Drill
	$\emptyset \leq 0,2 \text{ mm}$ siehe Übersicht ULTRAMICROBOHRER $\emptyset \leq 0,2 \text{ mm}$ see survey ULTRA MICRO DRILLS				
$\emptyset$ [mm]	* auf Anfrage / * on request				
0,15	2,5*				
0,20	3,5	2,5*		3,5*	
0,25	3,5	2,5*		4,5*	
0,30	5,5	3,5 / 5,5		5,5*	
0,35	5,5*	3,5 / 5,5 / 7		6,5	
0,40	5,5*	3,5 / 5,5 / 7		7*	
0,45	7*	3,5 / 7		7*	
0,50	7*	3,5 / 7 / 8,5		7*	
0,55		7 / 8,5			
0,60		7 / 8,5			
0,65		7* / 8,5			
0,70		10,5			10
0,75		10,5			10
:		:			:
0,85		10,5			10
0,90		10,5			10
0,95		10,5			10
1,00		10,5			10
:		:			:
1,15		10,5			10
1,20		10,5			10
1,25		10,5			10
:		:			:
1,60		10,5			10
1,65		10,5			10
:		:			:
2,00		10,5			10
2,05		10,5			10*
:		:			:
2,50		10,5			10*
:		:			:
3,00		10,5			10*
3,175		10,5			
3,20		12	12		
:		:	:		
6,35		12	12		

MICRO-/STANDARDBOHRER Typen und Spirallängen

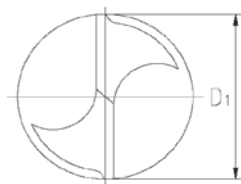
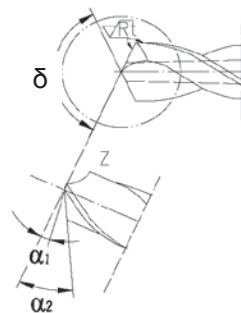
MICRO /STANDARD DRILLS Types and Flute Lengths

	212	242	243	271	540	250
Ø [mm]	Multilayerbohrer					Langloch-bohrer
	Multilayer Drill					Slot Drill
0,075				1,2*		
0,105				1,8		
0,11				1,8*		
0,12				1,8* / 2,0/2,2*		
0,15				2,5		
0,20	3,5	3,5 / 4,0	3,5 / 4,0	3,5 / 4,0	3,2 / 4,0*	
0,25	4	4,0 / 4,5	4,0 / 4,5 / 4,8*	4,0 / 4,5	3,2* / 4,0*	
0,30	5,5 / 6,5*	5,5 / 6,5*	5,5 / 6,5*	5,5	5,5*	1,8*
0,35	5,5 / 7	5,5/6,5/7	5,5/6,5*/7	5,5 / 6,5*	5,5* / 7*	4,0*
0,40	5,5/7/ 8,5*	7	5,5 / 7	7,0	5,5* / 7*	5,5*
0,45	7 / 8,5*	7 / 8,5*	7 / 8,5*	7,0	7*	5,0*
0,50	7 / 8,5	7 / 8,5*	7 / 8,5*	8,5	7*	5,5/7
0,55	8,5	7 / 8,5*	7 / 8,5*	8,5*	7* / 8,5*	5,5/7
0,60	8,5	8,5	8,5*	8,5*	7* / 8,5*	5,5/7
0,65	8,5	8,5	8,5*	8,5*	7* / 8,5*	5,5/7
0,70					8,5* / 10,5*	5,5*/7/8,5
0,75					8,5* / 10,5*	5,5*/7/8,5
:					:	:
0,85					8,5* / 10,5*	5,5*/7/8,5
0,90					9,5* / 10,5*	5,5*/7/8,5
0,95					9,5* / 10,5*	5,5*/7/8,5
1,00					10,5*	8,5
:					:	:
1,15					10,5*	8,5
1,20						8,5
1,25						8,5
:						:
1,60						8,5
1,65						8,5
:						:
2,00						8,5
2,05						8,5
:						:
2,50						8,5
2,55						8,5*
:						:
3,00						8,5*

Spezifikation für Spiralbohrer Specification for drills 212/218/230/242/243/250/271/ 512/518/530/532/540/543

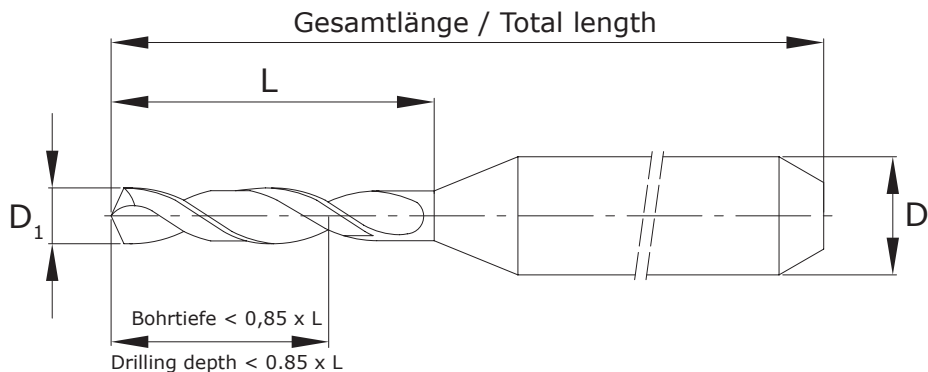


	0,05 < D ₁ < D	D ₁ > D
Gesamtlänge / Total length	38,2 -0,2	38,2 -0,3
Spirallänge / Flute length		
L ≤ 2	+0,2 / -0,1	+0,5 / -0,3
2 < L < 10	+0,4 / -0,2	
L ≥ 10	+0,4 / -0,2	
Schneidenrauhtiefe R _t Roughness R _t	< 0,003	< 0,005
Schaft- / shank Ø D	-0,001 / -0,007	-0,001 / -0,01
Nenn- / Nominal-Ø D ₁		
0,05 ≤ 0,25	+0,000 / +0,008	
0,26 ≤ 1,65	+0,000 / -0,008	
1,66 - 3,175	+0,000 / -0,012	
≥ 3,20	+0,000 / -0,015	
Angaben / Data in [mm]		
Spitzenwinkel δ Point angle δ		
0,05 > D1 ≤ 0,12	130° -5°	
0,13 ≥ D1 ≤ 0,20	120° -5°	
0,21 ≥ D1 ≤ 3,175	130° -5°	
D1 > 3,175	165° -5°	
Typ 250	150° -5°	
1. Freiwinkel α ₁ Primary face angle α ₁		
D ₁ 0,05 – 0,20	10° -3°	
0,21 – 6,50	15° -5°	
2. Freiwinkel α ₂ Secondary face angle α ₂		
D ₁ 0,05 – 6,50	30° -5°	
Angaben / Data in [mm]		

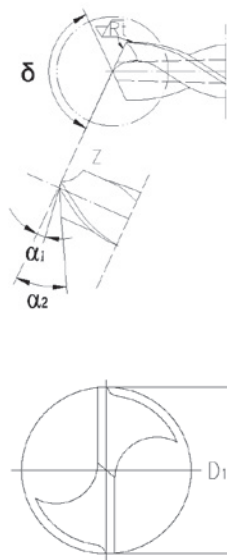


Spezifikation für Spiralbohrer Specification for drills

318/418



	0,05 < D ₁ < D	D ₁ > D
Gesamtlänge / Total length	31,85 -0,2	31,85 -0,3
Spirallänge / Flute length		
L ≤ 2 2 < L < 10 L ≥ 10	+0,2 / -0,1 +0,4 / -0,2 +0,4 / -0,2	+0,5 / -0,3
Schneidenrauhentiefe R _t Roughness R _t	< 0,003	< 0,005
Schaft- / shank Ø D	-0,001 / -0,007	-0,001 / -0,01
Nenn- / Nominal-Ø D ₁		
0,05 ≤ 0,25 0,26 ≤ 1,65 1,66 - 1.99 ≥ 2.00	+0,000 / +0,008 +0,000 / -0,008 +0,000 / -0,012 +0,000 / -0,015	
Angaben / Data in [mm]		
Spitzenwinkel δ Point angle δ		
0,05 > D1 ≤ 0,12 0,12 ≥ D1 ≤ 0,20 0,20 ≥ D1 ≤ 3,175 D1 > 3,175	130° -5° 120° -5° 130° -5° 165° -5°	
1. Freiwinkel α ₁ Primary face angle α ₁		
D ₁ 0,05 – 0,20 0,21 – 6,50	10° -3° 15° -5°	
2. Freiwinkel α ₂ Secondary face angle α ₂		
D ₁ 0,05 – 6,50	30° -5°	
Angaben / Data in [mm]		





212

Multilayerbohrer, Kopfbohrergeometrie

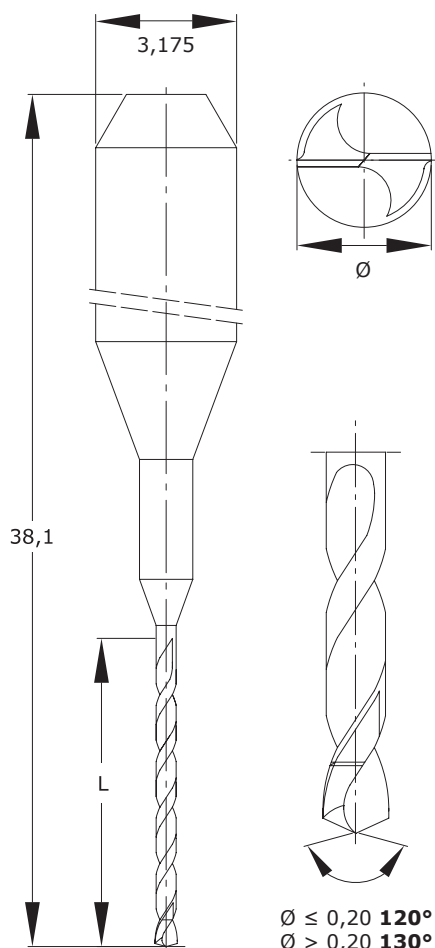
Anwendung/Vorteile:

- Bohren von hochlagigen Multilayern
- Verbesserung der Lochqualität

Multilayer drill, spade type version

Application/Advantages:

- drilling of high layer boards
- improvement of hole quality



212	L [mm]					
Ø [mm]	3,5	4,0	5,5	6,5	7,0	8,5
0,20	x					
0,25		x				
0,30			x	x*		
0,35			x		x	
0,40			x		x	x*
0,45					x	x*
0,50					x	x
0,55						x
0,60						x
0,65						x

* auf Anfrage * on request

Ø ≤ 0,20 **120°**
Ø > 0,20 **130°**



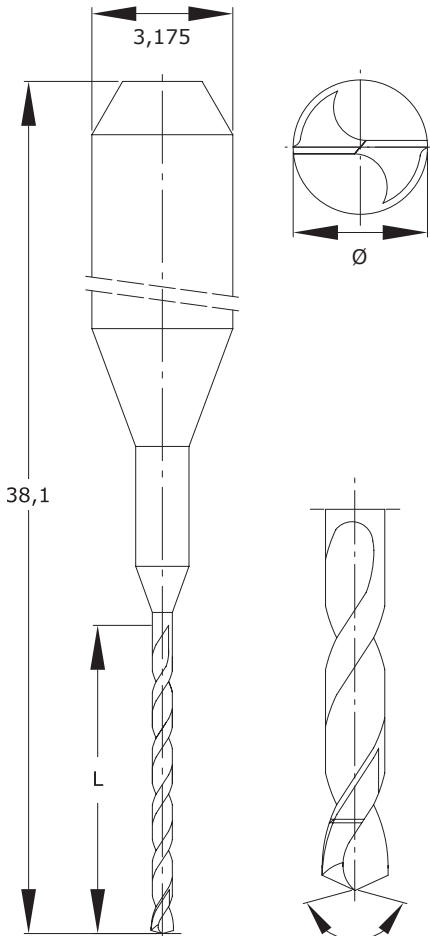
218
318

**Ultramicrobohrer,
Kopfbohrergeometrie
für hochdrehende Spindeln**
Anwendung/Vorteile:

- BGA / HDI
- höchste Stabilität
- höchste Bohrgenauigkeit

**Ultra micro drill,
spade type version
for high speed spindles**
Application/Advantages:

- BGA / HDI
- best stability
- best accuracy



218	L [mm]		
Ø [mm]	1,6	2,0	2,5
0,105	x		
0,110	x		
0,120		x	
0,150			x

Auf Anfrage Typ 318 mit
Schaftdurchmesser 2,0 mm /
Gesamtlänge 32 mm erhältlich.

On request type 318 with
shank diameter 2,0 mm /
total length 32 mm available.



230

Kopfbohrer

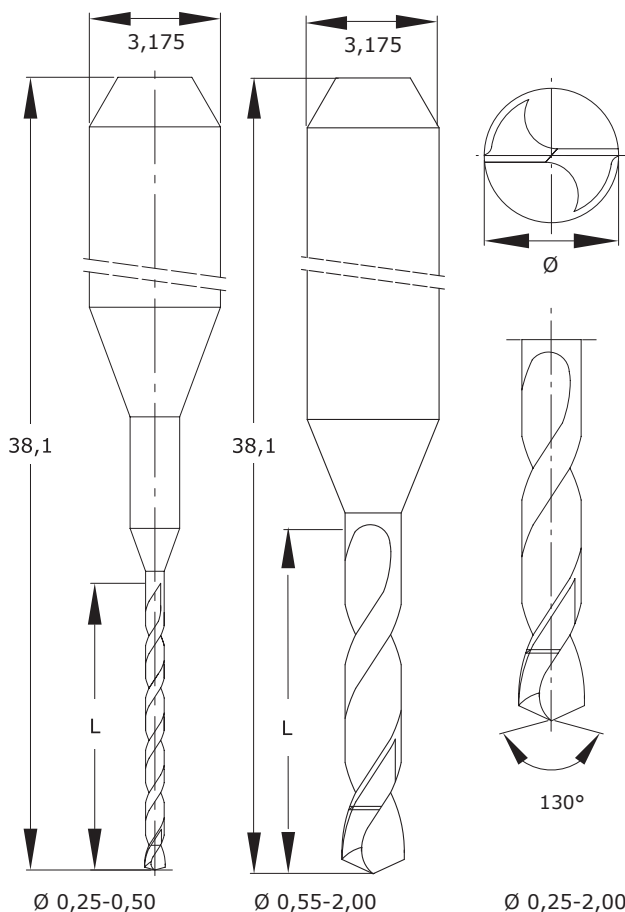
Anwendung/Vorteile:

- Bohren von anspruchsvollen Multilayern
- sehr gute Lochqualität bei geringem Bohrerwandel durch optimierte Geometrie

Spade type drill

Application/Advantages:

- drilling of high-quality multilayer boards
- excellent hole quality by less drill deflection due to optimised undercut geometry



230	L [mm]
Ø [mm]	10,0
0,70	x
0,75	x
0,80	x
:	:
1,60	x
1,65	x
:	:
2,00	x
2,05	x*
:	: *
3,00	x*

* auf Anfrage
* on request



242

Multilayerbohrer, Kopfbohrergeometrie

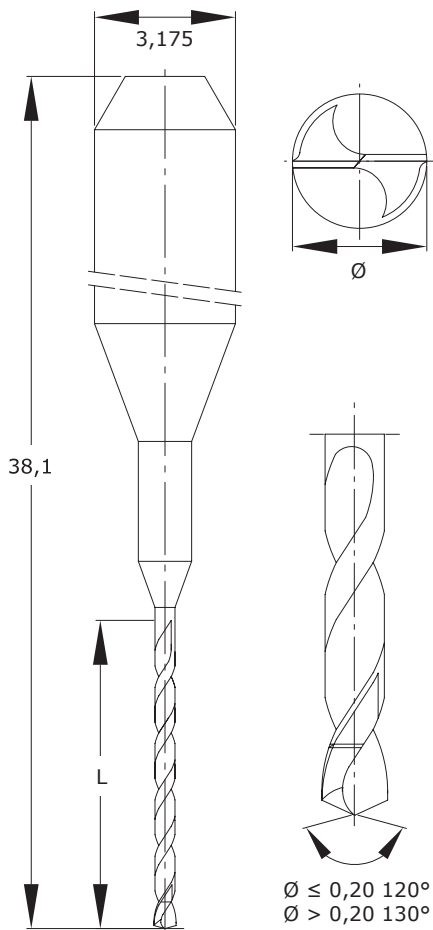
Anwendung/Vorteile:

- maximale Stabilität
- verbesserter Bohreranlauf
- geringere Bohrkosten durch mehrmaliges Nachschleifen

Multilayer drill, spade type version

Application/Advantages:

- maximum stability
- improved drill deviation
- less cost due to several regrounding cycles



242	L [mm]						
Ø [mm]	3,5	4,0	4,5	5,5	6,5	7,0	8,5
0,20	x	x					
0,25		x	x				
0,30				x	x*		
0,35				x	x	x	
0,40						x	
0,45						x	x*
0,50						x	x*
0,55						x	x*
0,60							x
0,65							x

* auf Anfrage

* on request



243

Multilayerbohrer, Kopfbohrergeometrie

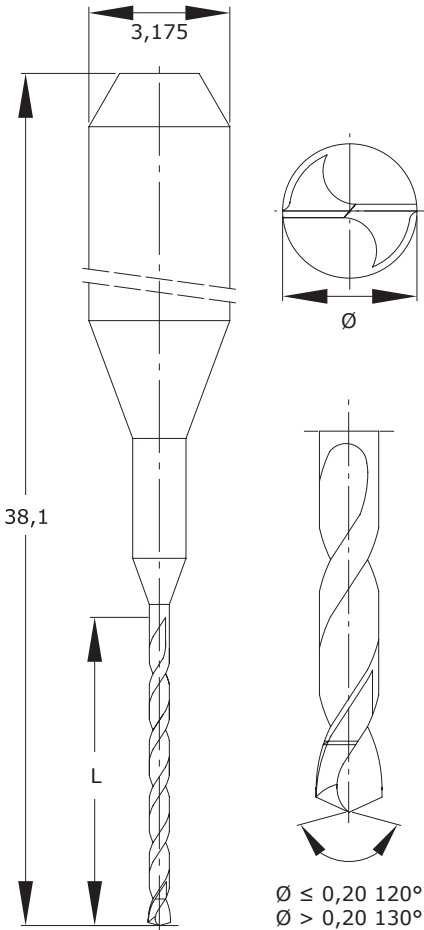
Anwendung/Vorteile:

- Positioniergenauigkeit
- maximale Stabilität
- verbesserter Bohrer Verlauf
- geringere Bohrkosten durch mehrmaliges Nachschleifen

Multilayer drill, spade type version

Application/Advantages:

- positioning accuracy
- maximum stability
- improved drill deviation
- less cost due to several regrinding cycles



243		L [mm]								
Ø [mm]	3,5	4,0	4,5	4,8	5,5	6,5	7,0	8,5		
0,20	x	x								
0,25		x	x	x*						
0,30					x	x*				
0,35					x	x*	x			
0,40					x		x			
0,45							x	x*		
0,50							x	x*		
0,55							x	x*		
0,60								x*		
0,65								x*		

* auf Anfrage * on request



250

Langlochbohrer

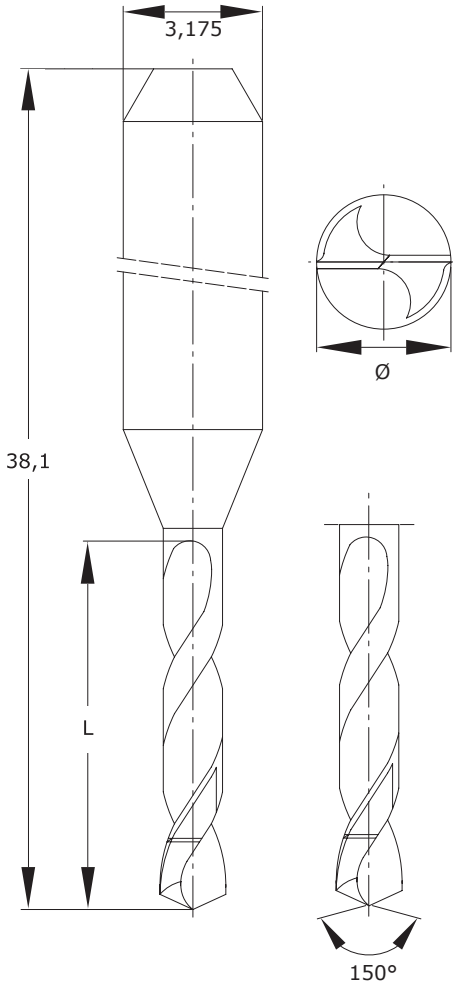
Anwendung/Vorteile:

- Bohren (Nippeln) von Langlöchern und Schlitten
- Reduzierung Verlauf

Slot drill

Application/Advantages:

- drilling slots
- reduction of deviation



250	L [mm]					
Ø [mm]	1,8	4,0	5,0	5,5	7,0	8,5
0,30	x*					
0,35		x*				
0,40				x*		
0,45			x*			
0,50				x	x	
0,55				x	x	
0,60				x	x	
0,65				x	x	
0,70				x*	x	x
0,75				x*	x	x
0,80				x*	x	x
0,85				x*	x	x
0,90				x*	x	x
0,95				x*	x	x
1,00						x
:						:
1,25						x
1,30						x
:						:
2,50						x
2,55						x*
:						:
3,00						x*

*weitere Durchmesser und Spirallängen auf Anfrage

*other diameters and flute lengths on request



271

**Multilayerbohrer, Kopfbohrergeometrie
2-in-1-Schneider**

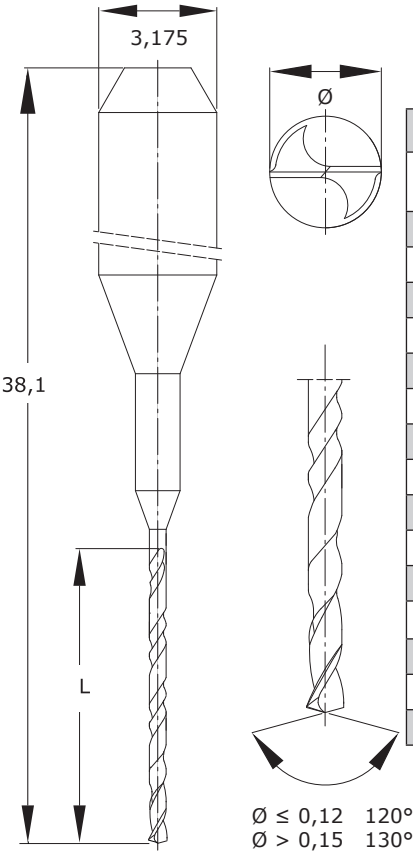
Anwendung/Vorteile:

- Reduzierter Bohrerbruch
- Verbesserter Bohrer Verlauf
- Höchste Bohrlochqualität
- geringere Bohrkosten durch mehrmaliges Nachschleifen

**Multilayer drill, spade type version
2-in-1-flute**

Application/Advantages:

- reduce breakage
- improved drill deviation
- highest hole wall quality
- less cost due to several regrinding cycles



271	L [mm]															
Ø [mm]	1,2	1,8	2,0	2,2	2,5	3,5	4,0	4,5	5,0	5,5	6,5	7,0	7,2	8,5		
0,075	x*															
0,105	x															
0,11	x*															
0,12	x* x x*															
0,15	x															
0,20	x x x															
0,25	x x x															
0,30	x x x															
0,35	x x x															
0,40	x															
0,45	x															
0,50	x x															
0,55	x x															
0,60	x x															
0,65	x x															

* auf Anfrage * on request



512

Flexbohrer

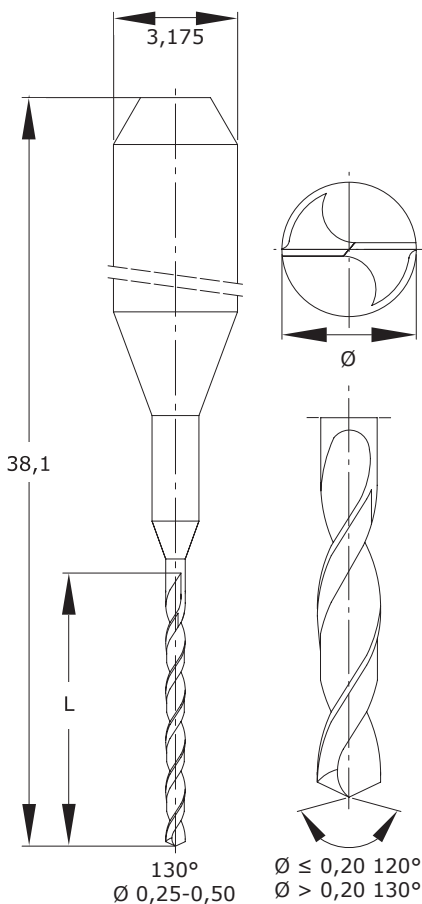
Anwendung/Vorteile:

- hoch produktive Bearbeitung von flexiblen und starr-flexiblen Multilayern
- optimale Bohrlochqualität
- Reduzierung von Nagelkopfbildung und Grat

Flex drill

Application/Advantages:

- drilling of flex and flex rigid boards
- improvement of hole quality
- reduction of nail heading and burring



512

L [mm]

Ø [mm]	2,5	3,5	5,5	7,0
0,15	x*			
0,20		x		
0,25		x		
0,30			x	
0,35			x*	
0,40			x*	
0,45				x*
0,50				x*

*weitere Durchmesser und Spirallängen auf Anfrage

*other diameters and flute lengths on request



518
418

**Ultramicrobohrer,
Standardbohrergeometrie
für hochdrehende Spindeln**

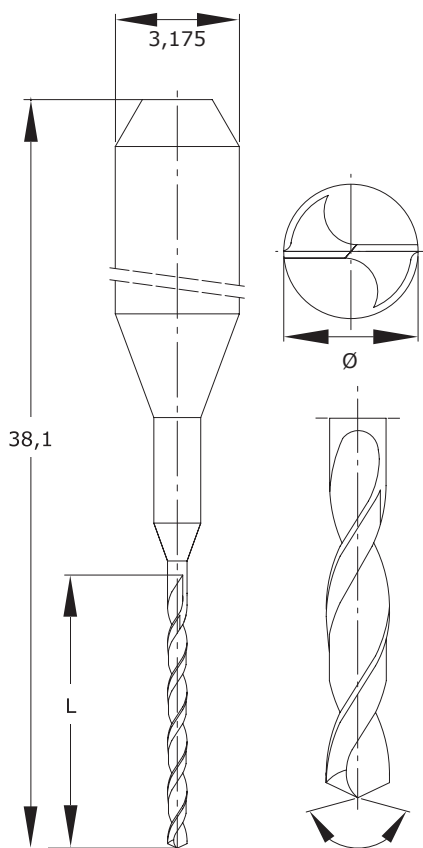
Anwendung/Vorteile:

- BGA / HDI
- höchste Stabilität
- höchste Bohrgenauigkeit

**Ultra micro drill,
standard geometry
for high speed spindles**

Application/Advantages:

- BGA / HDI
- best stability
- best accuracy



518	L [mm]					
Ø [mm]	0,6	1,0	1,5	1,8	2,0	2,5
0,050	x*					
0,075	x					
0,100	x					
0,105	x					
0,110	x					
0,120	x					
0,150	x					

* auf Anfrage * on request

Auf Anfrage Typ 418 mit
Schaftdurchmesser 2,0 mm /
Gesamtlänge 31,85 mm erhältlich.

On request type 418 with
shank diameter 2,0 mm /
total length 31.85 mm available.



530

Spiralbohrer

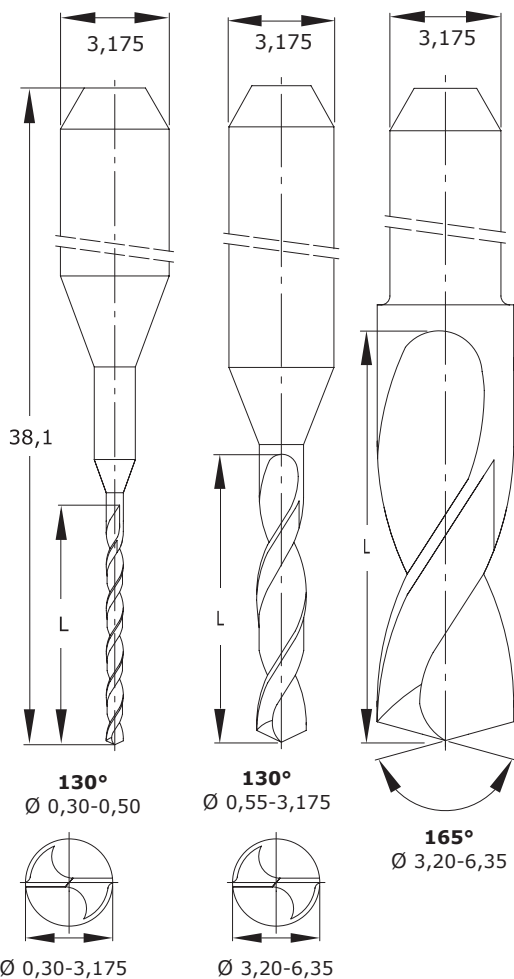
Anwendung:

- für alle Standardprodukte
- für Sacklochbohrungen (mit kurzer Spirallänge)

Standard drill

Application:

- for all standard products
- for blind via drilling (with short flute length)



530	L [mm]				
Ø [mm]	2,5	3,5	5,5	7,0	8,5
0,20	x*				
0,25	x*				
0,30		x	x		
0,35		x	x	x	
0,40		x	x	x	
0,45		x		x	
0,50		x		x	x
0,55				x	x
0,60				x	x
0,65				x*	x

	L [mm]	
Ø [mm]	10,5	12
0,70	x	
0,75	x	
0,80	x	
:	:	
3,15	x	
3,175	x	
3,20		x
3,25		x
:		:
6,35		x

* auf Anfrage
* on request



532

**Spiralbohrer mit ausgespitztem Kern,
Spanbrecher und
Durchmesserverjüngung**

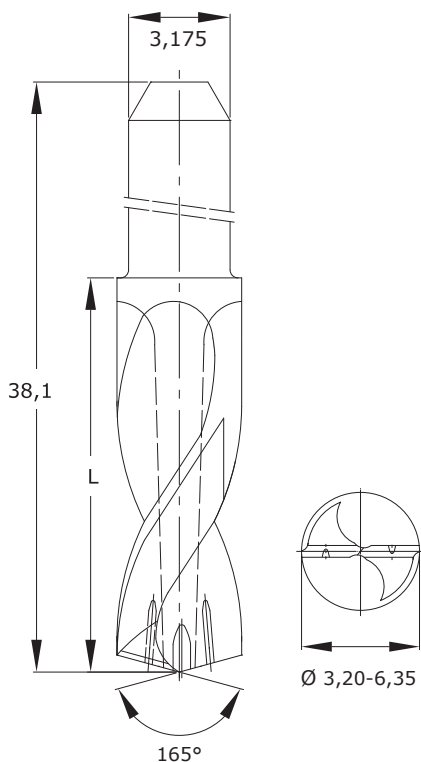
Anwendung/Vorteile:

- **Dick-Kupferanwendungen**
- **für langspanende Werkstoffe**
- **erhebliche Reduzierung der Spindelkräfte**

**Standard drill with thinned web,
chip breaker and
back-tapered diameter**

Application/Advantages:

- **thick copper applications**
- **long-chipping materials**
- **significant reduction of spindle forces**



532	L [mm]
Ø [mm]	12
3,20	x
3,25	x
3,30	x
3,35	x
3,40	x
3,45	x
3,50	x
3,55	x
3,60	x
3,65	x
:	:
4,00	x
4,05	x
4,10	x
:	:
5,00	x
5,05	x
5,10	x
:	:
6,20	x
6,25	x
6,30	x
6,35	x*

Bemerkung: Andere Durchmesser auf Anfrage.
Remark: Other diameters on request.

sales@hptec.de | www.hptec.de



540

Multilayer-/ Dickkupferbohrer

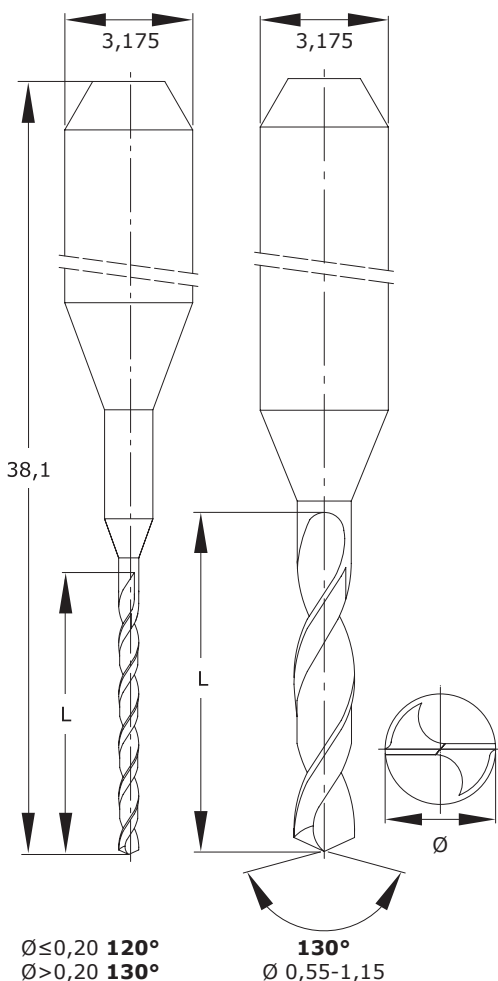
Anwendung/Vorteile:

- Bohren von hochlagigen / dicken Multilayern
- Bohren von Dickkupfer
- Verbesserung der Bohrlochqualität

Drill for multilayer and thick copper

Application/Advantages:

- drilling of high layer boards / thick panels
- drilling of thick copper
- improvement of hole quality



540

L [mm]

Ø [mm]	3,2	4,0	5,5	7,0
0,20	x	x*		
0,25	x*	x*		
0,30			x*	
0,35			x*	x*
0,40			x*	x*
0,45				x*
0,50				x*

L [mm]

Ø [mm]	7,0	8,5	9,5	10,5
0,55	x*	x*		
0,60	x*	x*		
0,65	x*	x*		
0,70		x*		x*
0,75		x*		x*
0,80		x*		x*
0,85		x*		x*
0,90			x*	x*
0,95			x*	x*
1,00				x*
1,05				x*
1,10				x*
1,15				x*

* auf Anfrage

* on request



543

Standardbohrer für Hochfrequenzanwendungen

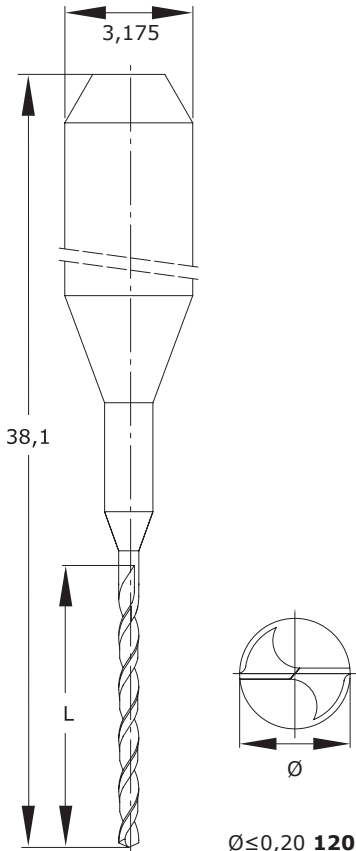
Anwendung/Vorteile:

- Bohren von Teflon, Polyimiden und Rogers-Anwendungen
- Verbesserung der Bohrlochqualität
- Reduzierung von Nagelkopf- und Gratabbildung
- geringere Bohrkosten durch mehrmaliges Nachschleifen

Standard drill for high frequency applications

Application/Advantages:

- drilling of Teflon, polyimids and Rogers applications
- improvement of hole quality
- reduction of nail heading and burring
- less cost due to several regrinding cycles



543	L [mm]					
Ø [mm]	3,5	4,5	5,5	6,5	7,0	
0,20	x*					
0,25	x*					
0,30	x*					
0,35	x					
0,40	x*					
0,45	x*					
0,50	x*					

* auf Anfrage * on request

Ø ≤ 0,20 120°
Ø > 0,20 130°



596

Microvia-Bohrer mit konischem Außendurchmesser

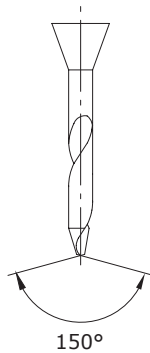
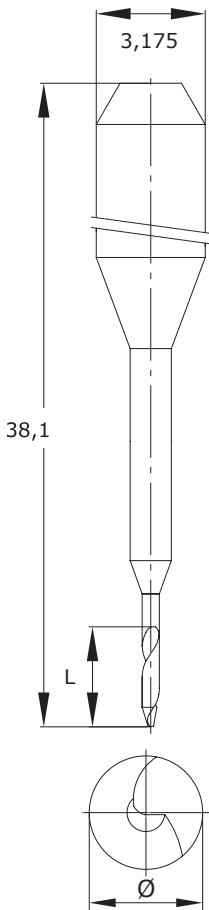
Anwendung/Vorteile:

- Bohren von Microvias (Sacklöchern)
- höchste Lochqualität und Positionsgenauigkeit
- Wirtschaftliches Bohren ggü. Laser auf Mehrspindel-Maschinen

Microvia drill with tapered outer diameter

Application/Advantages:

- drilling of microvias (blind holes)
- highest hole quality and high position accuracy
- economical drilling compared to laser on multispindle machines



Typ 596 Ø 0,12:
Maximale Bohrtiefe 120 µm
Type 596 Ø 0,12:
Maximum drilling depth 120 µm

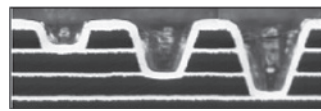
Typ 596 Ø 0,4:
Maximale Bohrtiefe 400 µm
Type 596 Ø 0,40:
Maximum drilling depth 400 µm

596	L [mm]		
Ø [mm]	0,5	1,0	2,5
0,12	x		
0,15	x*		
0,20		x	
0,25		x	
0,30			x
0,35			x
0,40			x
0,45			x*
0,50			x*
0,60			x*

Bemerkung: Andere Durchmesser auf Anfrage.
Remark: Other diameters on request.



Mechanisch gebohrtes Sackloch auf die erste Innenlage.
Mechanical drilled microvia to the first inner layer.

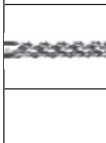
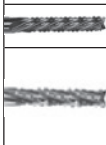
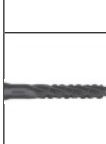
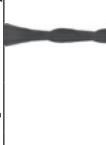
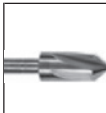


Mechanisch gebohrte Sacklöcher auf drei Innenlagen.
Mechanical drilled microvias to three inner layers.

Survey of HPTec routers / application fields routers

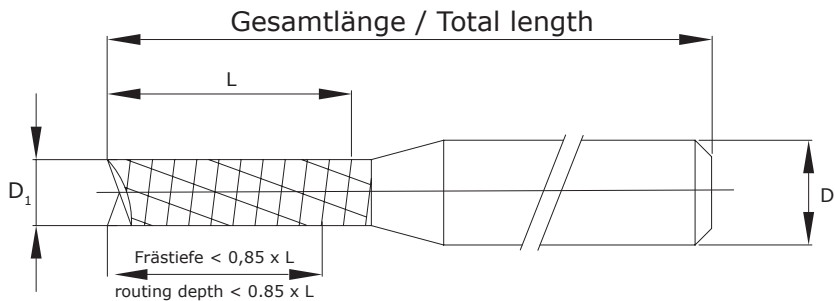
tool type	description	FR 4 oc	FR 2	CEM 1 CEM 3	Filled / HTG	Polyethylene	Teflon	Plexiglas	Polyimide	Flex / Rigid Flex	Al	Cu / brass	Metal composite laminates	remark	
626	diamond-patterned teeth	●	●	●	O								O	standard contour router	
726	spiral-patterned teeth	●	●	●	O					O			O	standard contour router good chip transport and edge quality	
790					●										
817	1-flute	●	O	O		●	●	●	●	●	O	●	O	very good edge quality, burr-free and for soft and flexible materials	
818											●	●			
821	2-flute					●	●	●	●	O	O	●	O	excellent edge and surface quality	
826	2-flute	●	O	O	O	●	●	●	●	●	●	●	O	all-purpose tool for working with plastics and metals	
828												●	●		
836	3-flute	●	O	O	O	O	O	O	●	O		O	O	for metallised slots	
80X	V-groove cutter	●	●	●	●	●	●	●	●	O	●	●	O	good chip transport and edge quality	
850	Countersink	●	●	●	●	●	●	●	●		●	●	O	chamfering of PCBs	
876	Contour finishing	O	O	O	O	O	O	O	O	O	O	O	●	burr free routing (goldfingers)	
891	2-flute	O	O	O		O	O	O	O		●	O	O	good chip transport and edge quality	
892	1-flute										O	●	O	good chip transport and edge quality	
parameters															
cutting speed v _s [m/min]		190-220	160-180	160-180	110-170	100-120	100-120	110-130	100-120	80-120	200-250	180-220	100-125	Cutting speed and chip load are basic recommendations depending on the material specification. Parameters have to be adjusted accordingly.	
Ø [mm]	oc	ic	chip load [µm/1]												
	1,0	8	10	10	8-12	10	10	20	10	8	3	3	2		
	1,2	12	10	14	12-16	14	14	30	14	12	5	5	3		
	1,6	20	15	25	22-26	25	25	40	25	23	8	8	4		
	2,0	38	30	45	40-48	35	35	50	35	32	12	12	4		
	2,4	48	34	55	50-60	40	40	60	40	35	15	15	5		
Key:		ic = inner contour oc = outer contour										Formula: spindle speed n [rpm] n = v _c * 1000 / (3.14 * Ø)			feed rate F [m/min] F = f * n f = F / n [µm/rev]
optimal material = ●															
possible alternative = O															

Standardfräser Übersicht / Survey of Standard Routers

																					
	diamant- verzahnt	spiralverzahnt			1-Schneider		2-Schneider			3- Schnei- der	Schlitt- fräser	Ritzstichel	Kegelsenker								
	diamond- patterned teeth	spiral-patterned teeth			1-flute		2-flute			3-flute	finishing router	V-groove cutter		Countersink							
Ø	626	726	756	790	818	817	892	821	826	828	827	891	836	876	801	802	803	804	806	809	850
in [mm]				"besch./ coated"	"Tiefenfräser/ depth router"	"Tiefenfräser/ depth router"	"besch./ coated"	"besch./ coated"	0,7*	0,7*	"Tiefenfräser/ depth router"	"besch./ coated"									
0,20									1*	1*											
0,25									1*	1*											
0,3									1*	1*											
0,4					1,5			1,5*	1,5*	1,5*											
0,5		3			3			3*	3	3											
0,6		3			3			3*	3	3											
0,7		3,5			3			3*	3	3											
0,8		5	5	3,5*	3			3	5	5	5*										
0,9		5		4*	3				5	5	5*										
1,0	7	7 / 8,5*	7	4* / 5* / 6,5*	3	3		3	5	5	5	3 / 4*	5*								
1,1	7	7 / 8,5*		6,5*	3*	3*			5	5	5*	3*	5*								
1,2	7	5* / 7 / 8,5*	7	4* / 7*	4	4			5	5	5	3* / 4*	5*								
1,3	7	7 / 8,5*		7*	4*	4*			5	5	5*	3*	5*								
1,4	7	7 / 8,5*		4* / 7*	4	4*			5	5	5*	3* / 4*	5*								
1,5	8	8,5	8,5	4* / 8,5*	4	4*			6	6	6*	4* / 6	7*								
1,6	8	8,5	8,5	8,5	5	5	4	6	6	6	6	4 / 6	7*	7*							
1,7	8	8,5		8,5*	5*	5*			6	6	6*	6*	7*								
1,8	8	8,5		4* / 8,5*	5*	5*			6	6	6*	4* / 6*	7*								
1,9	8	8,5		8,5*	5*	5*			6	6	6*	6*	7*								
2,0	8 / 10	9	9	4* / 9	8	8	4	6	8	8	8	4 / 6	9*	7*	x	x	x				
2,1	8	9		9*					8	8	8	6*	9*								
2,2	8	9		9*					8	8	8	6*	9*								
2,3	8	9		9*					8	8	8*	6*	9*								
2,4	8 / 10	9	9	9	8	8	6	6	8	8	8	4* / 6	9*	7*	* auf Anfrage				x		
2,5	8	9		9*					8	8	8*	6*	9*		* on request						
3,0	10	9			9	9			10	10	10	4* / 6	9*								
3,175	10*	9		9*	9*	9*	6		10	10	10*	6*	9*		x*				x		
6,0																					x

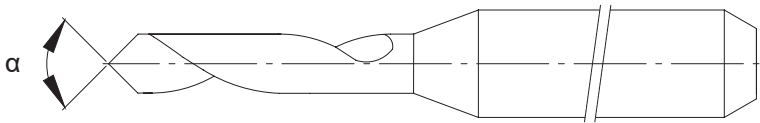
Spezifikation für Fräser 620/624/626

**Specification for routers 720/724/726/756/790
801/802/803/804/806/809
817/818/821/826/827/828
836/850/876/891/892**

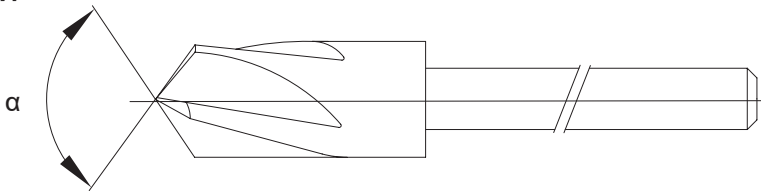


Gesamtlänge / Total Length	38,2 -0,4
Spirallänge / Flute Length L	+0,6 / -0,1
Schaft- / Shank-Ø D	-0,001/-0,007
Nenn- / Nominal-Ø D1 wenn / if D1 = D Typ / Type 836	+0,01/-0,02 0/-0,04 +0,01/-0,03
Schneidenschartigkeit / Roughness	≤ 0,006
Ausbrüche / Chips	≤ 0,030 max. 10 % der Einzelschneiden eines Fräasers / of the single cutting teeth of a router Angaben / Data in [mm]
Spitzenwinkel / Point Angle α Typ / Type 801/802/803/804/806/809	±3°

Typ / Type 801/802/803/804/806/809:



Typ / Type 850:





626
624
620

Fräser mit Diamantverzahnung

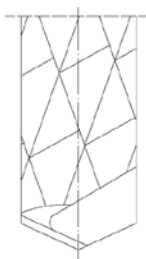
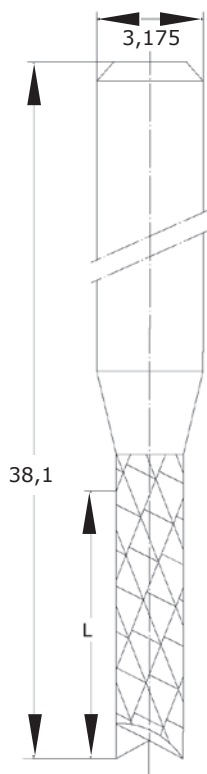
Anwendungen/Vorteile:

- Standardfräser für Innen- und Außenkonturen
- alle Basismaterialien aus Glasgewebe

Router with diamond-patterned teeth

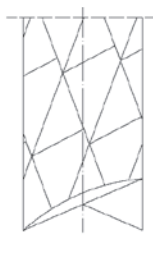
Applications/Advantages:

- standard router for inner and outer contours
- glass-epoxy based materials



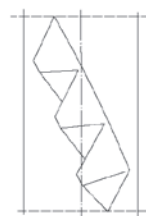
Bohrspitzen-
anschliff

drill point cut

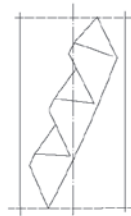


Fischschwanz-
anschliff

fishtail cut



linksspiralig
left twisted
(Schnittdruck
nach unten)
(down cut)



rechtsspiralig
right twisted
(Schnittdruck
nach oben)
(up cut)



626

L [mm]

Ø [mm]	7,0	8,0	10,0
1,0	x		
1,1	x		
1,2	x		
1,3	x		
1,4	x		
1,5		x	
1,6		x	
1,7		x	
1,8		x	
1,9		x	
2,0		x	x
2,1		x	
2,2		x	
2,3		x	
2,4		x	x
2,5		x	
3,0			x
3,175			x*

*auf Anfrage

*on request

626 Fischschwanzanschliff
rechtsspiralig

fishtail cut
up cut (right twisted)

624 *Bohrspitzenanschliff
rechtsspiralig

drill point cut
up cut (right twisted)

620 *Fischschwanzanschliff
linksspiralig

fishtail cut
down cut (left twisted)



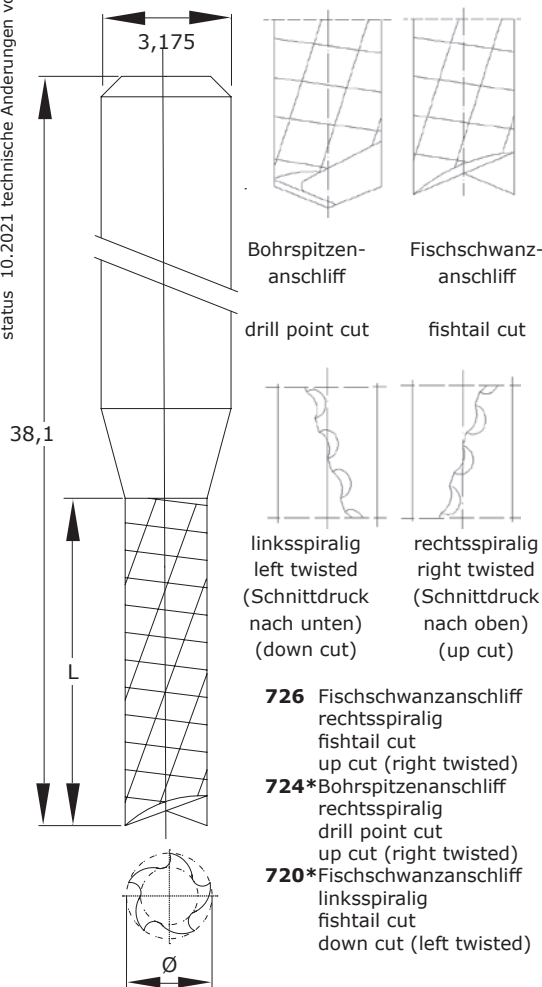
726
724
720

**Fräser mit
Spiralverzahnung**
Anwendungen/Vorteile:

- **Standardfräser für Innen- und Außenkonturen**
- **alle Basismaterialien aus Glasgewebe**
- **sehr guter Spantransport und sehr gute Oberflächenqualität**

**Router with
spiral-patterned teeth**
Applications/Advantages:

- **standard router for inner and outer contours**
- **all kind of glass-epoxy based materials**
- **excellent chip transport and surface finish**



726	L [mm]					
Ø [mm]	3,0	3,5	5,0	7,0	8,5	9,0
0,5	x					
0,6	x					
0,7		x				
0,8			x			
0,9			x			
1,0				x	x*	
1,1				x	x*	
1,2			x*	x	x*	
1,3				x	x*	
1,4				x	x*	
1,5					x	
1,6					x	
1,7					x	
1,8					x	
1,9					x	
2,0						x
2,1						x
2,2						x
2,3						x
2,4						x
2,5						x
3,0						x
3,175						x

* auf Anfrage * on request



756

**Fräser mit
Spiralverzahnung**

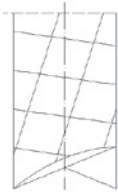
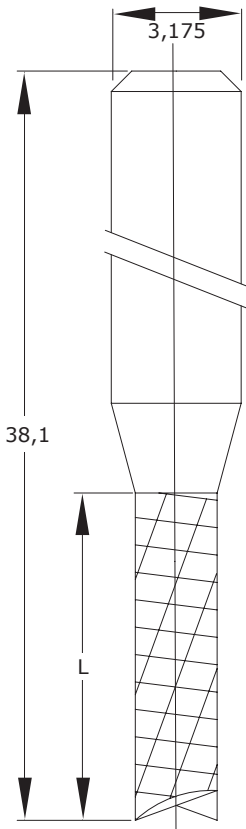
Anwendungen/Vorteile:

- Hochleistungsfräser für Innen- und Außenkonturen
- alle Basismaterialien aus Glasgewebe, Hoch Tg, gefüllte Materialien
- sehr guter Spantransport und sehr gute Oberflächenqualität

**Router with
spiral-patterned teeth**

Applications/Advantages:

- high performance router for inner and outer contours
- all kind of glass-epoxy based materials, HTG, filled materials
- excellent chip transport and surface finish



756 Fischschwanzanschliff

fishtail cut



rechtsspiralig
right twisted

(Schnittdruck
nach oben)

(up cut)

756 L [mm]				
Ø [mm]	5,0	7,0	8,5	9,0
0,8	x			
1,0		x		
1,2		x		
1,5			x	
1,6			x	
2,0				x
2,4				x

Bemerkung:
weitere Durchmesser /
Spirallänge auf Anfrage

Remark: other diameters /
flute lengths on request





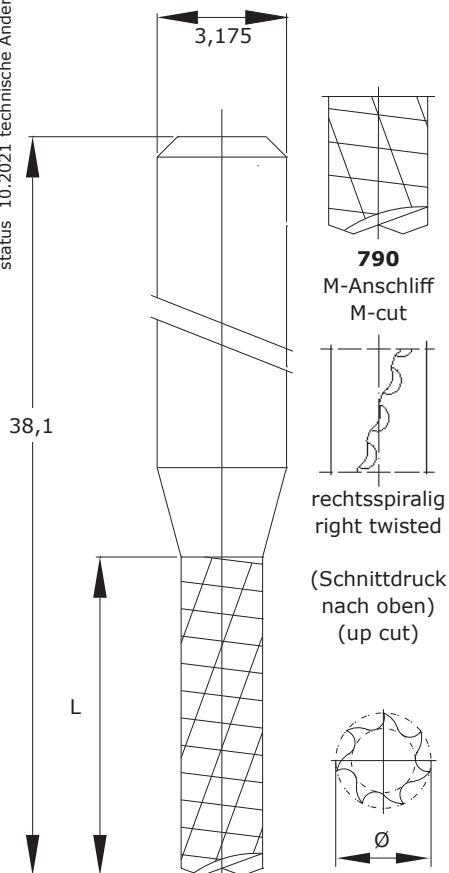
790

Diamantbeschichteter Fräser aus Vollhartmetall mit Spiralverzahnung
Anwendungen/Vorteile:

- Standardfräser für Innen- und Außenkonturen
- abrasive Basismaterialien
- guter Spantransport und sehr gute Oberflächenqualität
- engste Frästoleranzen

Diamond coated router made of solid carbide with spiral-patterned teeth
Applications/Advantages:

- standard router for inner and outer contours
- abrasive base materials
- good chip transport and excellent surface quality
- tightest routing tolerances



790	L [mm]						
Ø [mm]	3,5	4,0	5,0	6,5	7,0	8,5	9,0
0,8	x*						
0,9	x*						
1,0	x*	x*	x*				
1,1	x*						
1,2	x*					x*	
1,3						x*	
1,4	x*					x*	
1,5	x*						x*
1,6							x
1,7							x*
1,8	x*						x*
1,9							x*
2,0	x*						x
2,1							x*
2,2							x*
2,3							x*
2,4							x
2,5							x*
3,0							x
3,175							x*

* auf Anfrage

* on request



802

801

803

804

806

809

Frässtichel mit einer Spiralnute

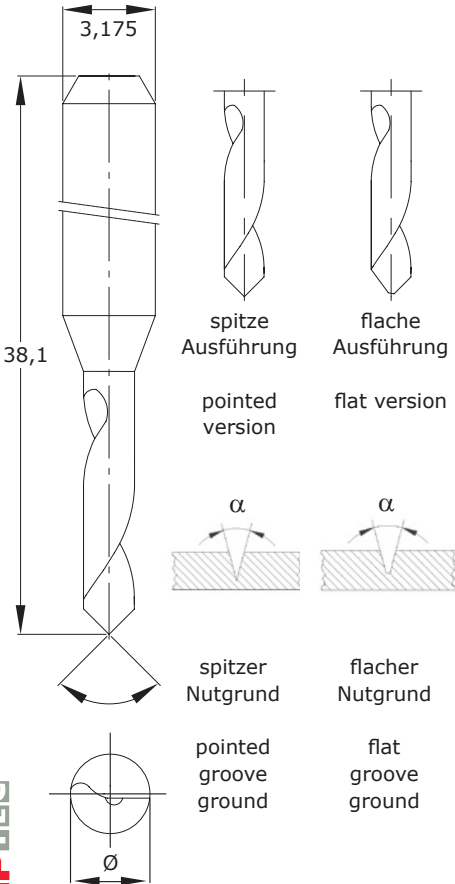
Anwendungen/Vorteile:

- Ritzten und Anfasen von Leiterplatten
- Fräsen von Isolationsabständen
- Ritzten von Bruchkanten
- Aluminium und Kupfer
- Kunststoffe
- Starrflex-Anwendungen

V-groove cutter with one spiral-twisted flute

Applications/Advantages:

- chamfering of circuit boards
- routing of dielectric spacing
- scribing of break-out edges
- aluminium and copper
- plastics
- flex rigid-applications



α					
$\emptyset$ [mm]	22°	30°	45°	60°	90°
2,0		x	x		
2,4				x	
3,175	x*				x
Standard	801	$\frac{802}{803}$	804	806	809

Bemerkung: andere Spitzenwinkel / Durchmesser auf Anfrage

Remark: other point angles / diameters on request

801 22° flache Ausführung
22° flat version

802 30° flache Ausführung
30° flat version

803 30° spitze Ausführung
30° pointed version

804 45° spitze Ausführung
45° pointed version

806 60° spitze Ausführung
60° pointed version

809 90° spitze Ausführung
90° pointed version



817

Fräser mit einer Hauptschneide

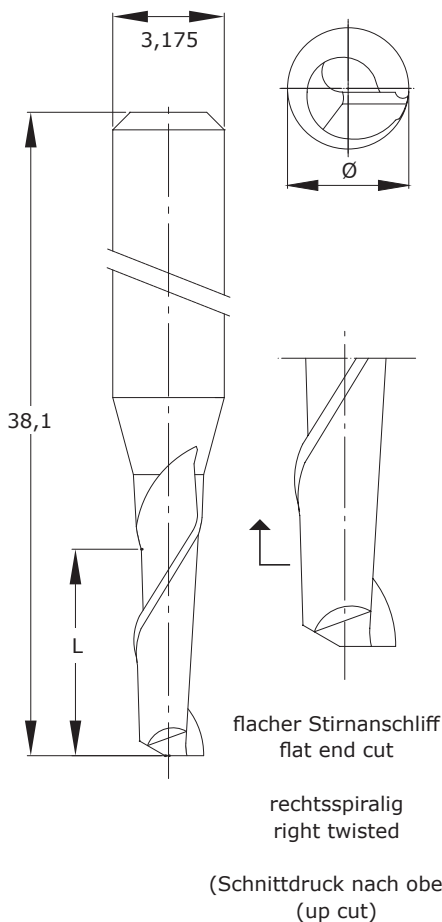
Anwendungen/Vorteile:

- für Tiefenfräsen, Innenkonturen, Schlitzte
- weiche Kunststoffe, Folien, PE, PTFE, PMMA, Polyimid
- Prepregs und FR4
- Flex-Anwendungen
- beste Oberflächen- und Kantenqualität

1-Flute router

Application/Advantages:

- for depth routing, inner contours, slots
- soft plastics, foils, PE, PTFE, PMMA, polyimide
- thin prepregs and FR4
- Flex-applications
- best surface and edge quality



817	L [mm]				
Ø [mm]	3,0	4,0	5,0	8,0	9,0
1,0	x				
1,1	x*				
1,2		x			
1,3		x*			
1,4		x*			
1,5		x*			
1,6			x		
1,7			x*		
1,8			x*		
1,9			x*		
2,0				x	
2,4				x	
3,0					x
3,175					x*

* auf Anfrage * on request

817 flacher Stirnanschliff
rechts spiralig
(Schnittdruck nach oben)
flat end cut
up cut (right twisted)



818

Fräser mit einer Hauptschneide

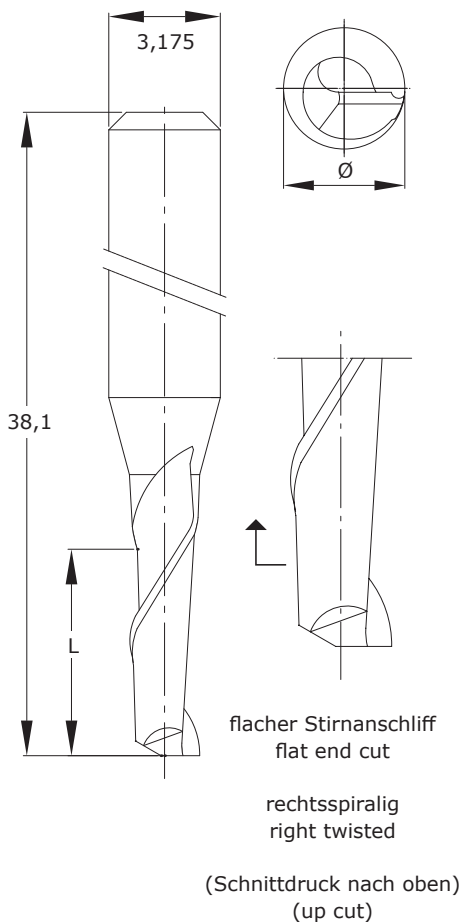
Anwendungen/Vorteile:

- für Tiefenfräsen, Innenkonturen, Schlitz
- weiche Kunststoffe, Folien
- Al, Cu, Messing, Metalle
- beste Oberflächen- und Kantenqualität

1-Flute router

Application/Advantages:

- for depth routing, inner contours, slots
- soft plastics, foils
- Al, Cu, brass, metals
- best surface and edge quality



818	L [mm]					
Ø [mm]	1,5	3,0	4,0	5,0	8,0	9,0
0,4	x					
0,5		x				
0,6		x				
0,7		x				
0,8		x				
0,9		x				
1,0		x				
1,1		x*				
1,2			x			
1,3			x*			
1,4			x			
1,5			x			
1,6				x		
1,7				x*		
1,8				x*		
1,9				x*		
2,0					x	
2,4					x	
3,0						x
3,175						x*

* auf Anfrage * on request

818 flacher Stirnanschliff
rechtsspiralig
(Schnittdruck nach oben)
flat end cut
up cut (right twisted)



821

Fräser mit 2 Hauptschneiden, beschichtet

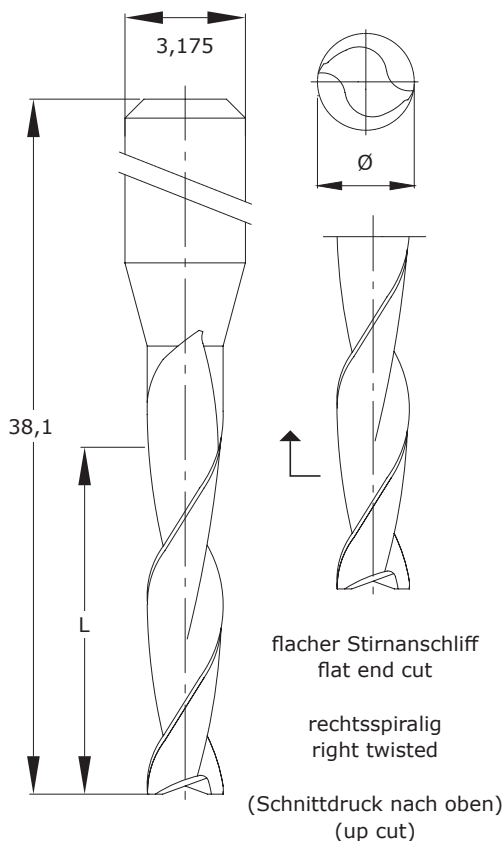
Anwendungen/Vorteile:

- Innenkonturen/Schlitzte mit sehr hohen Qualitätsanforderungen
- Tiefenfräsungen möglich
- Al, Cu, Messing, Nichteisenmetalle
- Reduzierte Zerspanungskräfte
- Reduzierte Temperaturen beim Zerspanen

2-Flute router, coated

Applications/Advantages:

- inner contours/slots with very high quality demands
- depth routing possible
- routing Al, Cu, brass, metals
- reduced cutting forces
- reduced temperature during routing process



821	L [mm]		
Ø [mm]	1,5	3,0	6,0
0,40	x*		
0,50	x*		
0,60	x*		
0,70	x*		
0,80	x		
1,00	x		
1,60	x		
2,00	x		
2,40	x		

*weitere Durchmesser auf Anfrage

*other diameters on request

821 flacher Stirnanschliff
rechtsspiralig
beschichtet

flat end cut
up cut (right twisted)
coated



826

828

Fräser mit 2 Hauptschneiden

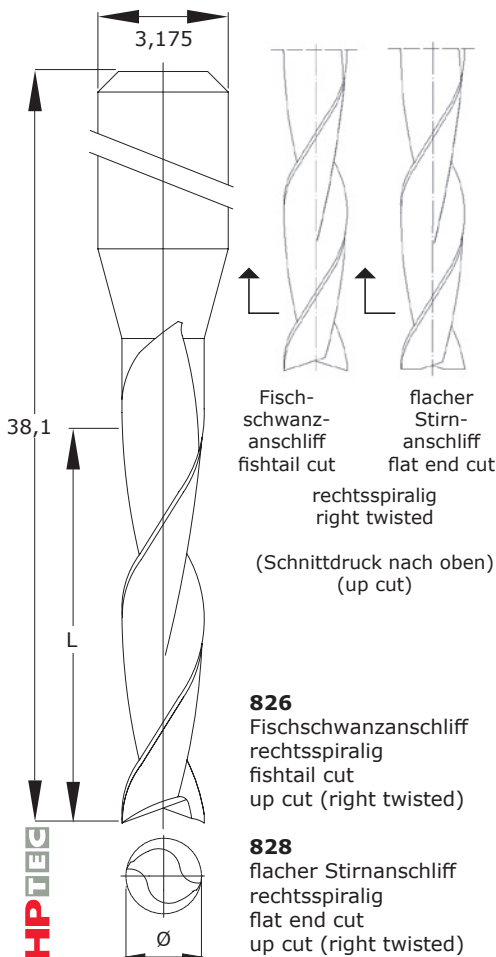
Anwendungen/Vorteile:

- für Tiefenfräsungen Typ 828
- Innenkonturen/Schlitz mit sehr hohen Qualitätsanforderungen
- Cu, Messing und Metalle
- beste Oberflächen- und Kantenqualität
- sehr guter Spantransport

2-Flute router

Applications/Advantages:

- for depth routing type 828
- inner contours/slots with high quality demands
- routing Cu, brass and metals
- best surface and edge quality
- excellent chip transport



826

L [mm]

Ø [mm]	0,7	1,0	1,5	3,0	5,0	6,0	8,0	10,0
0,20	x*							
0,25		x*						
0,30		x*						
0,40			x*					
0,50				x				
0,60				x				
0,70				x				
0,80					x			
0,90					x			
1,00					x			
1,10					x			
1,20					x			
1,30					x			
1,40					x			
1,50						x		
1,60						x		
1,70						x		
1,80						x		
1,90						x		
2,00							x	
2,10							x	
2,20							x	
2,30							x	
2,40							x	
2,50							x	
3,00								x
3,175								x

* auf Anfrage

* on request



827
825

Fräser mit 2 Hauptschneiden

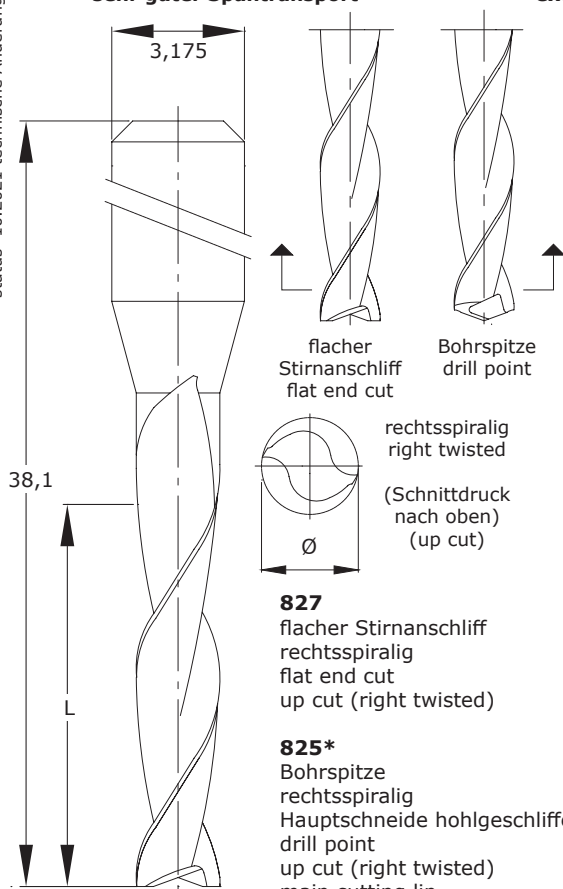
Anwendungen/Vorteile:

- für die Leiterplatte
- Tiefenfräsungen Typ 827
- Innenkonturen/Slitze mit sehr hohen Qualitätsanforderungen
- weiche Kunststoffe, Folien, PE, PTFE, PMMA und Polyimid
- Prepregs und FR4
- Flex-Anwendungen
- sehr guter Spantransport

2-Flute router

Applications/Advantages:

- for PCB
- depth routing type 827
- inner contours/slots with high quality demands
- routing plastics, foils, PE, PTFE, PMMA and polyimide
- prepregs and FR4
- flex-applications
- excellent chip transport



827
flacher Stirnanschliff
rechtsspiralig
flat end cut
up cut (right twisted)

825*
Bohrspitze
rechtsspiralig
Hauptschneide hohlgeschliffen
drill point
up cut (right twisted)
main cutting lip
hollow-grounded

Ø [mm]	L [mm]				
	3,0	5,0	6,0	8,0	10,0
0,6	x*				
0,7	x*				
0,8		x*			
0,9		x*			
1,0		x			
1,1		x*			
1,2		x			
1,3		x*			
1,4		x*			
1,5			x*		
1,6			x		
1,7			x*		
1,8			x*		
1,9			x*		
2,0				x	
2,1				x*	
2,2				x*	
2,3				x*	
2,4				x	
2,5				x*	
3,0					x
3,175					x*

* auf Anfrage

* on request



836

Fräser mit 3 Hauptschneiden

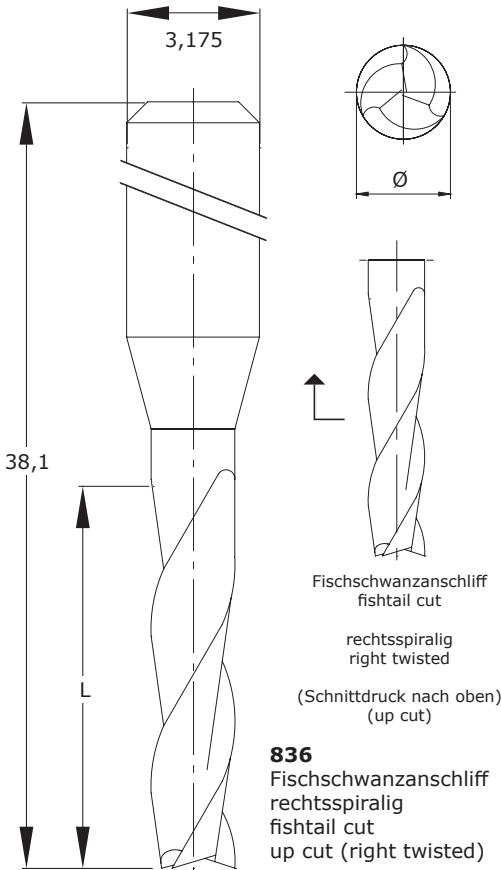
Anwendungen/Vorteile:

- für Innenkonturen und metallisierte Schlitzte
- Fräsen von Metalloberflächen
- weiche Kunststoffe, Folien, PE, PTFE, PMMA, Polyimid
- Prepregs und FR4
- Flex-Anwendungen
- beste Oberflächen- und Kantenqualität
- guter Spantransport

3-Flute router

Applications/Advantages:

- inner contours and slots
- routing metal surfaces
- soft plastics, foils, PE, PTFE, PMMA, polyimide
- thin prepregs and FR4
- flex-applications
- best surface and edge quality
- good chip transport



836 [mm]	L [mm]		
	5,0	7,0	9,0
1,0	x*		
1,1	x*		
1,2	x*		
1,3	x*		
1,4	x*		
1,5		x*	
1,6		x*	
1,7		x*	
1,8		x*	
1,9		x*	
2,0			x*
2,1			x*
2,2			x*
2,3			x*
2,4			x*
2,5			x*
3,0			x*
3,175			x*

* auf Anfrage

* on request



850

Kegelsenker mit 5 Schneiden

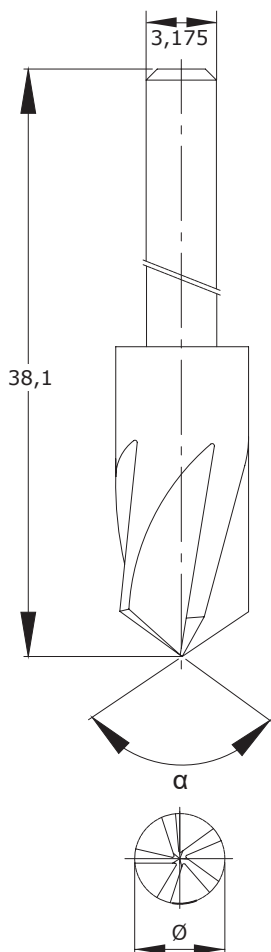
Anwendungen/Vorteile:

- Senken von Bohrungen
- Anfasen von Leiterplatten

Countersink with 5 flutes

Applications/Advantages:

- countersinking of drill holes
- chamfering of circuit boards



850	α		
$\emptyset$ [mm]	90°	120°	140°
6,0	x	x	x

Bemerkung:
Andere Spitzenwinkel /
Durchmesser auf Anfrage.

Remark:
Other point angles /
diameters on request.



876
870

Schlichtfräser

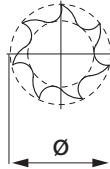
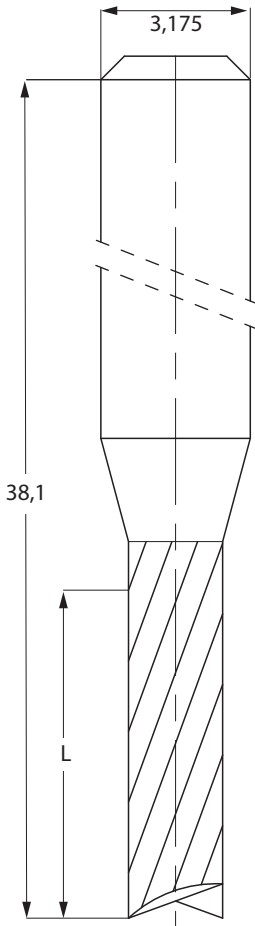
Anwendungen/Vorteile:

- gratfreies Fräsen von Galvanoanbindungen (Goldfingers) und Metalloberflächen

Contour finishing router

Applications/Advantages:

- burr-free routing of metal surfaces (goldfingers) and metal composite laminates



876 L [mm]

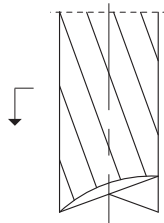
Ø [mm]	
1,6	x*
2,0	x*
2,4	x*

Bemerkung:

Andere Durchmesser auf Anfrage.

Remark:

Other diameters on request.



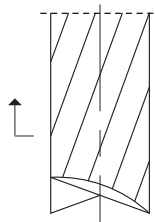
870

Fischschwanzanschiff

linksspiralig

fishtail cut

down cut (left twisted)



876

Fischschwanzanschiff

rechtsspiralig

fishtail cut

up cut (right twisted)



891

**Diamantbeschichteter Fräser
aus Vollhartmetall mit
2 Hauptschneiden**

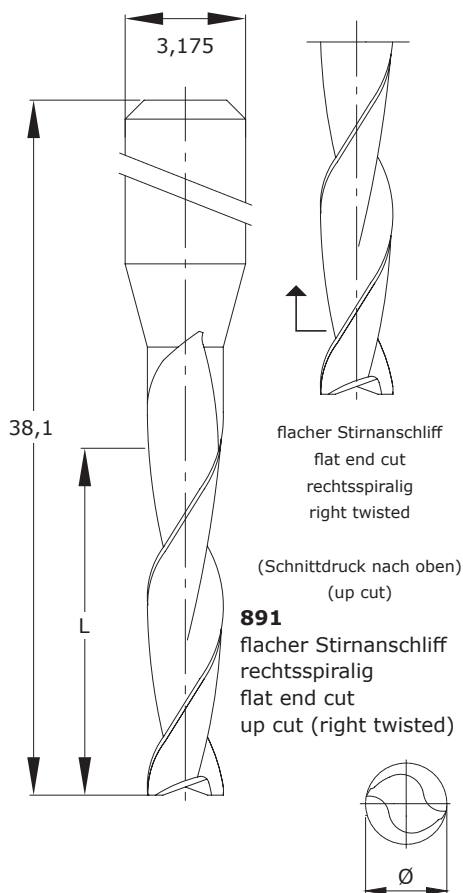
Anwendungen/Vorteile:

- Innenkonturen/Schlitze mit hohen Qualitätsanforderungen
- Geeignet zum Fräsen von Aluminium (trocken), Kupfer und GFK mit keramischen Füllstoffen
- sehr guter Spantransport
- Tiefenfräsungen möglich

**Diamond coated 2-flute router
made of solid carbide**

Applications/Advantages:

- inner contours/slots with high quality demands
- routing aluminium (dry), copper and GRP with ceramic fillers
- excellent chip transport
- depth routing possible



891	L [mm]		
Ø [mm]	3,0	4,0	6,0
1,0	x	x*	
1,1	x*		
1,2	x*	x*	
1,3	x*		
1,4	x*	x*	
1,5		x*	x
1,6		x	x
1,7			x*
1,8		x*	x*
1,9			x*
2,0		x	x
2,1			x*
2,2			x*
2,3			x*
2,4		x*	x
2,5			x*
3,0		x*	x
3,175			x*

* auf Anfrage * on request



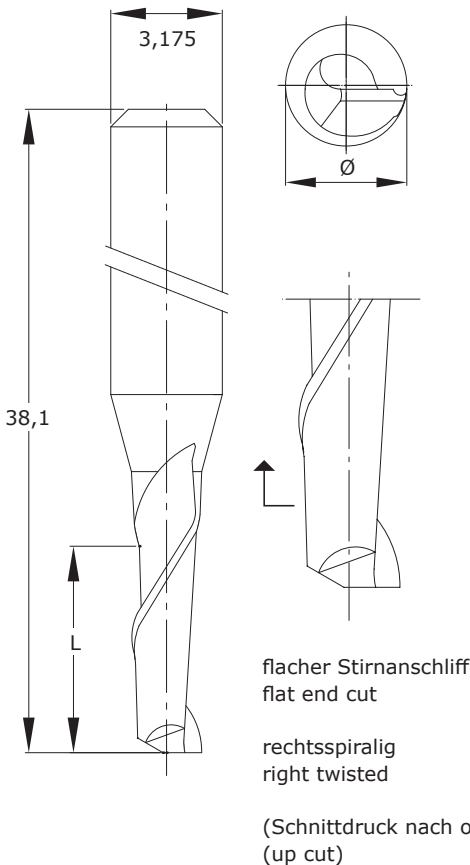
892

Diamantbeschichteter Fräser aus Vollhartmetall mit einer Hauptschneide
Anwendungen/Vorteile:

- Innenkonturen,/Außenkonturen mit sehr hohen Qualitätsanforderungen
- Geeignet zum Fräsen von Kupfer, Kupfer mit keramischen Füllstoffen sowie weiteren Knetlegierungen
- sehr guter Spantransport
- Tiefenfräsungen möglich

Diamond coated 1-flute router made of solid tungsten carbide
Application/Advantages:

- inner and outer contours with very high quality demands
- routing copper and copper with ceramic fillers as well as wrought alloy
- excellent chip transport
- depth routing possible



892	L [mm]	
Ø [mm]	4,0	6,0
1,6	x	
2,0	x	
2,4		x
3,175		x

* auf Anfrage

* on request

892 flacher Stirnanschliff
 rechtsspiralig
 (Schnittdruck nach oben)
 flat end cut
 up cut (right twisted)

Dienstleistungen / Service

Nachschleifen von Bohrern

Unser Service umfasst nicht nur das Neuwerkzeug, sondern auch das Nachschleifen von Gebrauchtwerkzeugen.

Regrinding of drills

Our service commitment does not only include new tools but also the regrinding of used tools.

Beringen von Werkzeugen

Alle von HPTec hergestellten Werkzeuge können nach Kundenspezifikation beringt werden.

Ring setting

All tools produced by HPTec can be set with rings acc. to customer's specification.

Toolmanagement

Level 1 – Terminalversion (Software STO)
PC mit Handscanner
Kapazität unbegrenzt
Lagerführung in Box und EM möglich

Tool Management

Level 1 – Terminal Version
PC with hand scanner
Capacity unlimited
Boxes and EM can be stocked

Level 2 – Small Tool Organizer (STO)
PC mit Handscanner und STO
Kombination von manueller und teilautomatischer Lagerführung
Kapazität von bis zu 15.600 Werkzeugen
bis zu 60 verschiedene Artikel

Level 2 – Small Tool Organizer (STO)
PC with hand scanner
Combination of manual and semi-automatic stock management
Capacity up to 15.600 tools
up to 60 different articles

Level 3 – Tool Organizer (TO)
Vollautomatische Lagerverwaltung
Kapazität von mehr als 71.000 Werkzeugen
mehr als 7.100 verschiedene Artikel

Level 3 – Tool Organizer (TO)
Fully automatic stock management
Capacity more than 71.000 tools
more than 7.100 different articles

Level 4 – Schubladensystem
Elektronische Werkzeugausgabesysteme
PC, 2D Scanner mit Monitor
Bis zu 76 elektronisch einzeln verriegelbare Boxen

Level 4 – Drawer system
Electronic tool dispensing systems
PC, 2D Scanner with monitor
Up to 76 electronically individually lockable boxes



Parameter Recommendation for Drills

Customer		HPTec Standard			Cutting Speed		$v_c=150[m/min]$		
Material¹:		FR 4 ≤ 6 layers			Spindle Speed		$n_{max}=125000 [rpm]$		
Spindle Type:		Air Bearing							
Diameter = D [mm]		Spindle Speed = n [rpm]					Infeed = F [m/min]		
Chip Load = f [μm/1]		Retract Feed = R [m/min]							
D	f	F	n	R	D	f	F	n	R
0.10	6	0.7	125000	2.0	2.30	86	1.8	21000	25.0
0.15	10	1.2	125000	3.0	2.35	86	1.7	20000	25.0
0.20	13	1.7	125000	4.0	2.40	86	1.7	20000	25.0
0.25	18	2.3	125000	5.0	2.45	86	1.7	20000	25.0
0.30	22	2.7	125000	6.0	2.50	86	1.7	20000	25.0
0.35	25	3.1	125000	7.0	2.55	86	1.7	20000	25.0
0.40	28	3.3	119000	8.0	2.60	86	1.7	20000	25.0
0.45	31	3.3	106000	9.0	2.65	86	1.7	20000	25.0
0.50	35	3.3	95000	10.0	2.70	86	1.7	20000	25.0
0.55	40	3.5	87000	15.0	2.75	86	1.7	20000	25.0
0.60	44	3.5	80000	20.0	2.80	86	1.7	20000	25.0
0.65	48	3.5	73000	25.0	2.85	86	1.7	20000	25.0
0.70	52	3.6	68000	25.0	2.90	86	1.7	20000	25.0
0.75	57	3.6	64000	25.0	2.95	86	1.7	20000	25.0
0.80	62	3.7	60000	25.0	3.00	86	1.7	20000	25.0
0.85	67	3.7	56000	25.0	3.05	86	1.7	20000	25.0
0.90	71	3.8	53000	25.0	3.10	86	1.7	20000	25.0
0.95	76	3.8	50000	25.0	3.15	86	1.7	20000	25.0
1.00	81	3.9	48000	25.0	3.175	86	1.7	20000	25.0
1.05	86	3.8	45000	25.0	3.20	43	0.9	20000	25.0
1.10	86	3.7	43000	25.0	3.30	43	0.9	20000	25.0
1.15	86	3.6	42000	25.0	3.40	43	0.9	20000	25.0
1.20	86	3.4	40000	25.0	3.50	43	0.9	20000	25.0
1.25	86	3.2	38000	25.0	3.60	43	0.9	20000	25.0
1.30	86	3.2	37000	25.0	3.70	43	0.9	20000	25.0
1.35	86	3.0	35000	25.0	3.80	43	0.9	20000	25.0
1.40	86	2.9	34000	25.0	3.90	43	0.9	20000	25.0
1.45	86	2.8	33000	25.0	4.00	40	0.8	20000	25.0
1.50	86	2.7	32000	25.0	4.10	40	0.8	20000	25.0
1.55	86	2.7	31000	25.0	4.20	40	0.8	20000	25.0
1.60	86	2.6	30000	25.0	4.30	40	0.8	20000	25.0
1.65	86	2.5	29000	25.0	4.40	40	0.8	20000	25.0
1.70	86	2.4	28000	25.0	4.50	40	0.8	20000	25.0
1.75	86	2.3	27000	25.0	4.60	40	0.8	20000	25.0
1.80	86	2.3	27000	25.0	4.70	40	0.8	20000	25.0
1.85	86	2.2	26000	25.0	4.80	40	0.8	20000	25.0
1.90	86	2.1	25000	25.0	4.90	33	0.7	20000	25.0
1.95	86	2.1	24000	25.0	5.00	33	0.7	20000	25.0
2.00	86	2.1	24000	25.0	5.20	33	0.7	20000	25.0
2.05	86	2.0	23000	25.0	5.40	33	0.7	20000	25.0
2.10	86	2.0	23000	25.0	5.60	33	0.7	20000	25.0
2.15	86	1.9	22000	25.0	5.80	33	0.7	20000	25.0
2.20	86	1.9	22000	25.0	6.00	33	0.7	20000	25.0
2.25	86	1.8	21000	25.0	6.50	33	0.7	20000	25.0

Parameter Recommendation for Slot Drills

Customer HPTec Standard Material¹: FR 4 Spindle Type: Air Bearing	Cutting Speed $v_c = 150$ [m/min] Spindle Speed¹ $n_{max} = 125000$ [rpm]
---	---

Diameter = D [mm]
Chip Load = f [μm/1]

Spindle Speed = n [rpm]
Infeed = F [m/min]

Retract Feed = R [m/min]

D	f	F	n	R	D	f	F	n	R
0.50	10	1.1	108000	10.0	1.90	76	1.9	25000	25.0
0.55	17	1.7	98000	15.0	1.95	78	1.9	24000	25.0
0.60	20	1.8	90000	20.0	2.00	80	1.9	24000	25.0
0.65	27	2.2	83000	25.0	2.05	80	1.8	23000	25.0
0.70	33	2.5	77000	25.0	2.10	80	1.8	23000	25.0
0.75	35	2.5	72000	25.0	2.15	80	1.8	22000	25.0
0.80	38	2.6	68000	25.0	2.20	80	1.8	22000	25.0
0.85	40	2.6	64000	25.0	2.25	80	1.7	21000	25.0
0.90	43	2.6	60000	25.0	2.30	80	1.7	21000	25.0
0.95	47	2.7	57000	25.0	2.35	80	1.6	20000	25.0
1.00	50	2.7	54000	25.0	2.40	80	1.6	20000	25.0
1.05	52	2.3	45000	25.0	2.45	80	1.6	20000	25.0
1.10	53	2.3	43000	25.0	2.50	80	1.6	20000	25.0
1.15	55	2.3	42000	25.0	2.55	70	1.4	20000	25.0
1.20	56	2.2	40000	25.0	2.60	70	1.4	20000	25.0
1.25	58	2.2	38000	25.0	2.65	70	1.4	20000	25.0
1.30	59	2.2	37000	25.0	2.70	70	1.4	20000	25.0
1.35	61	2.1	35000	25.0	2.75	70	1.4	20000	25.0
1.40	62	2.1	34000	25.0	2.80	70	1.4	20000	25.0
1.45	63	2.1	33000	25.0	2.85	70	1.4	20000	25.0
1.50	64	2.0	32000	25.0	2.90	70	1.4	20000	25.0
1.55	66	2.0	31000	25.0	2.95	70	1.4	20000	25.0
1.60	67	2.0	30000	25.0	3.00	60	1.2	20000	25.0
1.65	68	2.0	29000	25.0	3.05	60	1.2	20000	25.0
1.70	69	1.9	28000	25.0	3.10	60	1.2	20000	25.0
1.75	70	1.9	27000	25.0	3.15	60	1.2	20000	25.0
1.80	72	1.9	27000	25.0	3.175	60	1.2	20000	25.0
1.85	74	1.9	26000	25.0					

¹ other materials and spindle speeds on request

Parameter Recommendation for Routers

**Customer HPTec Standard
Material¹: FR 4
Spindle Type: Air Bearing
Tool Type: 726/756**

**Cutting Speed $v_c = 220$ [m/min]
Spindle Speed¹ $n_{max} = 60000$ [rpm]**

Diameter = D [mm]
Chip Load = f [μ m/1]
Infeed with / without pre-drilling = $F(Z)$ [m/min]
max. stack height = H [mm]

Table feed = $F(XY)$ [m/min]
Spindle Speed = n [rpm]
Retract Feed = R [m/min]

D	f	F (XY)	n	F (Z) without	F (Z) with	H
			type 726	pre-drilling	pre-drilling	
[mm]	[μ m/1]	[m/min]	rpm	[m/min]	[m/min]	[mm]
0.20	1	0.1	60000	0.1	0.2	0.5
0.30	2	0.1	60000	0.1	0.2	0.5
0.40	2	0.1	60000	0.1	0.5	1.0
0.50	3	0.2	60000	0.1	0.5	1.0
0.60	3	0.2	60000	0.1	0.5	1.6
0.70	4	0.2	60000	0.1	0.5	1.6
0.80	5	0.3	60000	0.2	0.5	3.5
0.90	6	0.4	60000	0.2	0.5	3.5
1.00	8	0.5	60000	0.4	2.0	5.0
1.10	9	0.5	60000	0.4	2.0	5.0
1.20	10	0.6	58000	0.4	2.0	5.0
1.30	12	0.6	54000	0.6	2.0	5.0
1.40	14	0.7	50000	0.6	2.0	5.0
1.50	16	0.8	47000	0.6	2.0	6.0
1.60	18	0.8	44000	0.8	5.0	6.0
1.70	22	0.9	41000	0.8	5.0	6.0
1.80	26	1.0	39000	0.8	5.0	6.0
1.90	30	1.1	37000	0.8	5.0	6.0
2.00	34	1.2	35000	1.3	5.0	6.5
2.10	38	1.3	33000	1.3	5.0	6.5
2.20	40	1.3	32000	1.3	5.0	6.5
2.30	42	1.3	30000	1.3	5.0	6.5
2.40	44	1.3	29000	1.3	5.0	6.5
2.50	46	1.3	28000	1.3	5.0	6.5
3.00	53	1.2	23000	1.3	5.0	6.5
3.175	55	1.2	22000	1.3	5.0	6.5

¹ other materials and spindle speeds on request

Formula for Cutting Parameters

Cutting Speed vs:

$$v_c = \frac{n \cdot D \cdot \pi}{1000}$$

v_c = cutting speed [m/min]
 n = spindle speed [rpm]
 D = nominal diameter [mm]
 $\pi = 3,14$

Chip load f:
(Feed per revolution)

$$f = \frac{F \cdot 1000}{n}$$

f = chip load [mm/rev.]
 F = feed rate [m/min]
 n = spindle speed [1/min]

Conversion formula:

Feed rate F: $F = \frac{f \cdot n}{1000}$

Spindle speed n: $n = \frac{v_c}{D \cdot \pi} \cdot 1000$

Example:

Given data:

cutting speed v_c : 150 m/min
chip load f: 0,055 mm/rev
diameter D: 0,7 mm

> **spindle speed** $n = \frac{150 \text{ m/min}}{(0,7 \text{ mm} \cdot 3,14)} \cdot 1000 = 68243 \text{ rpm}$

> **chosen spindle speed:** $n = 68000 \text{ rpm}$

> **feed rate** $F = \frac{(0,055 \text{ mm/rev} \cdot 68000 \text{ rpm})}{1000} = 3,74 \text{ m/min}$

> **chosen feed rate:** $F = 3,7 \text{ m/min}$

Trouble Shooting

Problem	Possible Causes	Remedy
drill breakage	- chips jam in flute space - cutting pressure too high - spindle run-out error - dirty/defect collet - drill deviation - chipping on cutting edges	- use drills suitable for the specific cutting conditions (geometry), check extraction system/parameters - adapt feed rate - check spindle run-out - clean/replace collet - minimising of drill deviation - ensure correct tool handling
inaccurate drill hole positioning (drill deviation)	- flute length too long - spindle run-out error - dirty/defect collet - pin hole inaccurate - drill wear too high or chipping on cutting edges	- adapt flute length - check spindle run-out - clean/replace collet - check pin hole - reduce hit counts/ no. of regrinding operations, check cutting conditions, check tool handling
poor surface quality of hole wall	- smear caused by inefficient chip removal - drill wear too high or chipping on cutting edges - board material insufficiently hardened	- improve chip removal by a) improved extraction system b) use tools with suitable geometry (spade type drills) c) modification of parameters - reduce hit counts/ no. of regrinding operations, check cutting conditions, check tool handling - check quality of the laminate (multilayer pressing conditions)
nail heading	- feed rate/retraction rate too high or too low - wrong cutting parameters - drill wear too high or chipping on cutting edges - dwell time of drill at cusp too long	- adapt feed rate/retraction rate - adapt cutting conditions to the laminate used - reduce hit count/ no. of regrinding operations, check cutting conditions, check tool handling - reduce dwell time

Trouble Shooting

Problem	Possible Causes	Remedy
smear of resin	- excessive drilling temperatures - laminate insufficiently hardened - drill wear too high or chipping on cutting edges - insufficient de-smear process	- increase feed rate, reduce cutting speed - check laminate - reduce hit count/ no. of regrounding operations, check cutting conditions, check tool handling - check de-smear process
burr on entry and/or exit side	- drill wear too high or chipping on cutting edges - feed rate/retraction rate too high - entry/backup material too soft - pressure foot power insufficient	- reduce hit count, check cutting conditions, check tool handling - reduce feed rate/retraction rate - use harder entry/backup material - check pressure and correct operation of pressure foot
contamination on the entry and/or exit side	- wrong cutting parameters - drill wear too high or chipping on cutting edges - pressure foot power insufficient - entry/backup material too soft - poor laminate bond	- use recommended parameters - reduce hit count/ no. of regrounding operations, check cutting conditions, check tool handling - increase pressure foot power - use harder entry/backup material - check pressing procedure
deformation of inner layers	- chips jam in flute space - drill wear too high or chipping on cutting edges - poor laminate bond	- use drills suitable for the specific cutting conditions (geometry), check extraction system/ parameters - reduce hit count/no. of regrounding operations, check cutting conditions, check tool handling - check pressing procedure
winding of chips on drill	- insufficient chip extraction - feed rate too low (chips get too long)	- clean and check extraction system, if necessary use more powerful extraction system - increase feed rate