botek®

DEEP HOLE DRILLING SYSTEMS
SOLID CARBIDE TOOLS

Single flute gundrills
Twin fluted drills

botek

Type 110, 112, 113, 113-HP, 114, 115, 120, 122, 123, 125

Solid drilling tools
Counterboring tools
Trepanning tools

botek Assistant

Google Play App Store

botek – the company

botek is a globally active specialist for cutting tools with around 750 employees at the main plant in Riederich at the foot of the Swabian Alb. With production facilities in France, Hungary and India as well as over 50 international sales and support partners worldwide, we are always at your side around the globe.

For almost 50 years, our focus has been on the development and production of drilling tools: deep hole drilling tools with diameters from 0.5 mm to 1500 mm, milling cutters and reaming tools as well as the associated services. Today, we continue this specialisation successfully, sustainably and keep our innovation-oriented values for the next generation as well.

In the age of technological change, however, new demands also require new thinking.

Our focus is no longer solely on tool development and production but is being meaningfully complemented by innovative and goal-oriented project management.

Our objectives are the design and conception of optimisation processes along with the development and implementation of complete turnkey projects, which we implement effectively with the cooperation of our experienced team of technician and project managers as well as our customers.

This is why botek technology leads the way – now and in the future.

- Please note our safety pointers at www.botek.de.
- Our General Standard Terms and Conditions, which we assume as known, apply.
- We reserve the right to make modifications in the interest of technical improvement.
  Such modifications cannot, in principle, be accepted as justifiable reasons for complaints.
- Subject to change. The manufacturer accepts no responsibility for misprints and other errors.

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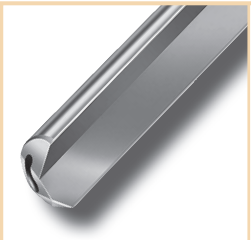
Type 113 / Type 113-HP / Type 110 / Type 112 / Type 114 / Type 115


Type 113


Type 113-01


Type 113-HP


Type 113-HP-M


Type 110


Type 112


Type 114


Type 115

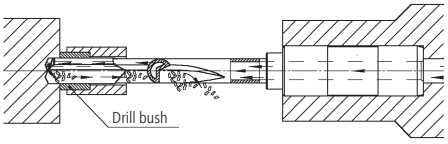
1. Cost effective and precise holemaking.
2. botek quality tools are synonymous with high cutting performance.
3. Minimum centerline deviation.
4. Outstanding drilling quality and trouble-free chip removal.
5. High process reliability.
6. Tool lengths up to 5,000 mm are available depending on tool type and tool dia.
7. Diametric tolerances up to IT 7 are possible under specific conditions.
8. Suitable for use on machining centres and turning machines with high pressure coolant system.
9. Minimum quantity lubrication (MQL) is possible under certain conditions.
10. Drills can be used horizontally or vertically with either tool, workpiece or counterrotation.
11. Tools can be reground at botek's factory or in your facility (see brochure: botek grinding machines and accessories).
12. Gundrills are optimally adapted by botek to machining requirements in close cooperation with the customer.
13. Each of our tools is the product of over 40 years' experience in deep hole drill production and applications.
14. We develop and manufacture tools for all deep hole drilling processes (Gundrilling, BTA and Ejector).
15. The solid carbide single flute gundrill (Type 113) was developed and manufactured by botek since 1982.
    This innovative technology made it possible, for the first time, gundrilling down to diameters less than 2 mm.
    This capability is, among other things, a prerequisite for the production of modern fuel injection systems.
16. botek is the world market leader in the field of single flute gundrills.

The characteristic of the single flute gundrilling process is that coolant is fed through the coolant hole in the tool and exits along with the chips in the V-shaped groove (flute) on the drill tube from the drilled hole. The coolant also provides lubrication to the drill periphery.

This is possible if coolant, i. e. deep-hole drilling oil or emulsion (min. 10 - 12 % concentration, with additives), is provided in sufficient quantity and pressure (coolant information see page 10 + 11 and page 20 + 21).

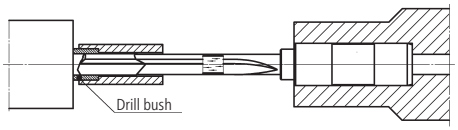
Minimum quantity lubrication (MQL) may be used under certain conditions.

High pressure coolant systems should already be integrated in the machine or can be provided as a separate unit by the machine's manufacturer. Economical deep-hole drilling is therefore, not only possible on special deep-hole drilling machines but also on CNC machining centres (lathes, horizontal boring machines, etc.).

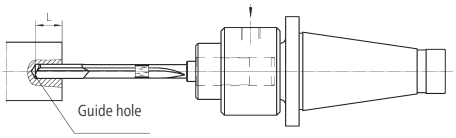


Information on the guide hole (pilot hole)

with drill bush



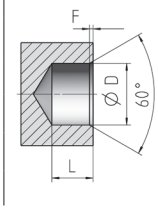
with pilot hole



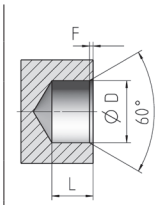
The gundrill is a single-edged tool without self-centering.
When positioning the drill, the tool must be guided through a drill bush or a pilot hole.

The quality of the pilot hole affects the drilling performance (tool life, centerline deviation, etc.).

Dimensions for the pilot hole Type 113 / 113-HP

	Drill diameter	Pilot hole diameter	Pilot hole depth matched to the tool length (without driver)				
			LxD drilling depth	Pilot hole depth			
				Ø 0.500 - 1.599	Ø 1.600 - 3.999	Ø 4.000 - 6.999	Ø 7.000 - 12.000
	0.500 mm - 4.000 mm	+ 0.005 to + 0.010	ap. 20xD	3.0 x D	2.0 x D	2.0 x D	2.5 x D
	4.001 mm - 12.000 mm	+ 0.010 to + 0.020	ap. 30xD		3.0 x D	3.0 x D	3.5 x D
			ap. 40xD		4.0 x D	4.0 x D	40 mm
			ap. 50xD	6.0 x D	6.0 x D	35 mm	
			ap. 60xD		30 mm*		
			> 60xD				

Dimensions for the pilot hole Type 110

	Drill diameter	Pilot hole diameter	Pilot hole depth matched to the tool length (without driver)							
			LxD drilling depth	Pilot hole depth						
				Ø 1.850 - 4.000	Ø 4.001 - 8.500	Ø 8.501 - 12.000	Ø 12.001 - 20.999	Ø 21.000 - 30.999	Ø 31.000 - 40.999	Ø 41.000 - 50.000
	1.85 mm - 4.00 mm	+ 0.005 to + 0.010	ap. 10xD	2.0 x D	1.0 x D	1.0 x D	1.0 x D	1 x D	1 x D	1 x D
	4.01 mm - 12.00 mm	+ 0.010 to + 0.020	ap. 20xD	3.0 x D	1.5 x D	1.5 x D	1.5 x D			
	12.01 mm - 50.00 mm	+ 0.015 to + 0.040	ap. 25xD	3.0 x D	2.0 x D	2.0 x D	1.5 x D			
			ap. 30xD	3.0 x D	3.0 x D	3.0 x D	1.5 x D			
			ap. 35xD	*	*	3.0 x D	1.5 x D			
			ap. 40xD							

* for long lengths to diameter ratios we recommend to contact our **Technical Hotline ELB**: **P** +49 7123 3808-300.

The dimensions specified in the table are guide values. To avoid chipping of the cutting edge, a chamfered pilot hole (F) is recommended depending on machining requirements.

→ Please read our application notes on page 34 + 35.
→ **Stock program pilot drills page 50.**

Solid carbide gundrill
Type 113 / Type 113-HP

Overview

Type	Tool dia.	
Type 113 Solid carbide gundrill	kidney-shaped coolant channel **for tool dia.: 0.500 - 12.000 mm**	
Type 113-HP Solid carbide gundrill	kidney-shaped coolant channel **for tool dia.: 0.700 - 12.000 mm**	
Type 113-01* Solid carbide stepped drill	kidney-shaped coolant channel **for tool dia.: 1.500 - ... mm**	
Type 113-02 Solid carbide counterboring tool	kidney-shaped coolant channel **for tool dia.: 0.500 - 12.000 mm**	

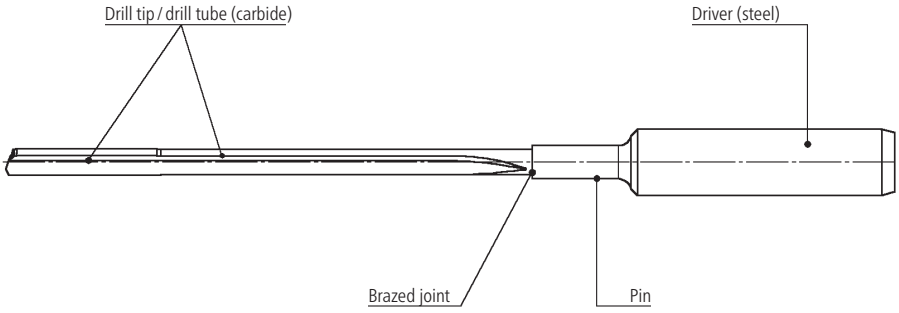
*Tool on request only

Information about the Stock Program / Express Production Line can be found on page 44 - 47.

Tool design

Drill tip and drill tube are manufactured from a single piece of carbide blank. The advantage of this tool is high process reliability and performance. Longer tool life is possible because of reduced torsional vibrations and higher rigidity.

With this tool type, the driver (steel) has a "pin". The driver and the drill tube are connected by a brazed joint.

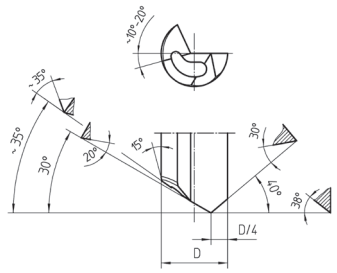
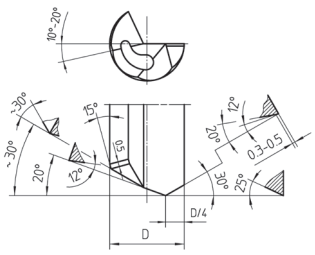


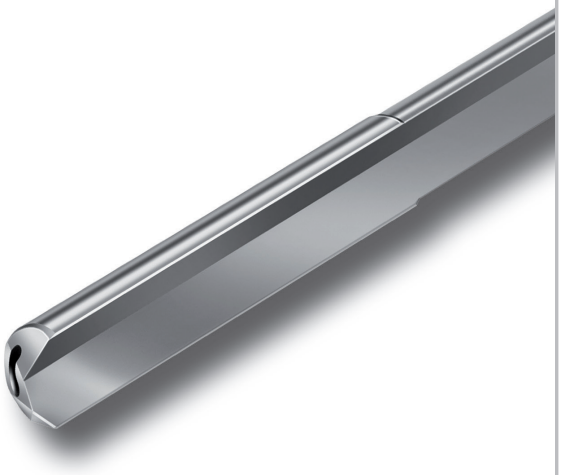
Nose grind geometry

The nose grind geometry affects the following, hole tolerance, chip formation, coolant pressure and flow, tool life, centerline deviation and surface quality. Over the years, botek has successfully tested a number of different nose grinds for drilling various materials.

botek`s experience has formed the foundation for the development of our standard nose grind geometries. This meets the requirements of most drilling applications. Deep hole drilling of especially long chipping materials and difficult to machine materials usually call for special nose grind geometries, and in some cases, made to order chip breakers, all available from botek.

Standard nose grinds for Type 113

	
SA-0009 **for drill range: 0.500 - 4.000 mm**	SA-0002 **for drill range: 4.001 - 12.000 mm**



Drilling Examples

Type 113-HP

Ø 0.700 - 12.000 mm

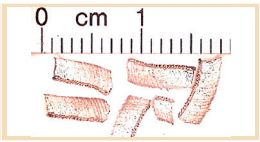
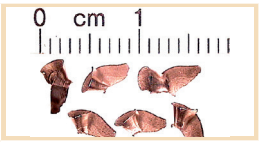
High performance tool design as alternative solution to carbide twist drills

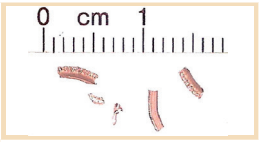
Advantages
- Maximum cutting performance
- Up to 800 % higher feed rates
- Very efficient for drilling long chipping steels
- Fast and cost effective regrinding

Suitable for drilling with cutting oil, MQL and high quality emulsion.

Information about the Stock Program can be found on page 44.

Drilling Examples

				
Material	**AlSi7Mg0,3 T73**	**42CrMo4**	**38MnSV4**	**50CrMo4**
Diameter x drilling depth	7.0 x 210 mm	5.0 x 100 mm	5.0 x 100 mm	3.0 x 95 mm
Coolant / pressure	Emulsion / 70 bar	MQL	Oil / 110 bar	Oil / 140 bar
Cutting speed	150 m / min	70 m / min	70 m / min	80 m / min
Feed f Vf	**f = 0.25 mm / rev Vf = 1700 mm / min**	**f = 0.18 mm / rev Vf = 800 mm / min**	**f = 0.22 mm / rev Vf = 1000 mm / min**	**f = 0.11 mm / rev Vf = 950 mm / min**

				
Material	**X46Cr13**	**Forged + tempered steel**	**Aluminium wrought alloy**	**Forged + tempered steel**
Diameter x drilling depth	5.0 x 120 mm	9.0 x 300 mm	2.5 x 60 mm	6.0 x 350 mm
Coolant	Oil	Oil	Oil	Oil
Cutting speed	90 m / min	70 m / min	110 m / min	70 m / min
Feed f Vf	**f = 0.115 mm / rev Vf = 660 mm / min**	**f = 0.16 mm / rev Vf = 400 mm / min**	**f = 0.36 mm / rev Vf = 5000 mm / min**	**f = 0.11 mm / rev Vf = 400 mm / min**

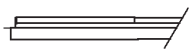
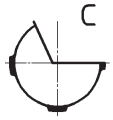
Comparison between carbide twist drill and solid carbide drill Type 113-HP

Work piece: **crank shaft, forged steel**
Diameter: 5.0 mm
Drilling depth: 90 mm
MQL: 8 bar
Vc: 76 m / min. (4800 rev / min)
Vf: **800 mm / min (0.17 mm / rev)**

Result	Solid carbide twist drill	Type 113-HP
Hole tolerance	IT9 / IT10	IT8
Surface finish Ra	1.5 - 3.0	0.8
Centerline deviation (drift)	> 0.15	< 0.1

Solid carbide gundrill
Type 113 / Type 113-HP

Solid drilling and counterboring tools

Design of drill head and shank	**Solid carbide design**			
Working method / tool type	**Solid drilling tools**			**Counterboring tools**
	Type 113	**Type 113-HP**	**Type 113-01**	**Type 113-02**
Illustration				
Drilling range from - to (mm)	**Ø = 0.500 - 12.000 mm**	**Ø = 0.700 - 12.000 mm**	**Ø = 1.500 - ... mm**	**Ø = 0.500 - 12.000 mm**
Tool length	Available up to 100 x diameter			
Coolant hole design	 Kidney-shaped coolant channel			
Advantages	- Deep holes with extremely small diameters can be drilled - Solid carbide design, drill head and drill shaft in one piece, allows greater rigidity reducing vibration and tensional flex during drilling - Higher feedrates are possible / greater penetration feed rates - Various peripheral contours for greater application flexibility - Even higher cutting speeds are possible compared to the gundrill with brazed carbide tip (Type 110) - Regrindable - Optimum coolant flow due to kidney shaped coolant channel - Minimized drift by higher tool rigidity			
Peripheral contours botek adapts the contour optimally to meet your drilling requirements!	G (Standard)  - All materials - Suitable for most drilling requirements - Close hole tolerance - Minimum drift		C  - Steel, stainless steel - Not easily machinable materials - Preferred for water soluble (emulsion) coolant	
Important: Contour EA and G are non-micable!	EA  - Cast iron, malleable materials - Crosshole drilling - Angular entrance and exit bores		A  - Aluminium, Copper - close hole tolerance	
Special contour	Also available upon special request			
Special nose grinds	All tools are also available with special nose grind			
Tool coatings	Please specify the coating you require			
Diamond / PCD	Also available with PCD cutting edge			

Drill shaft

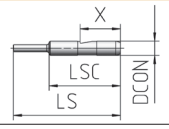
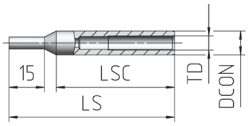
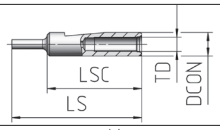
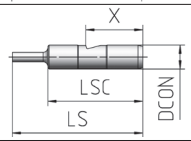
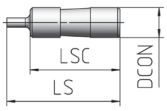
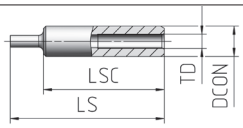
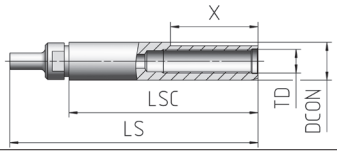
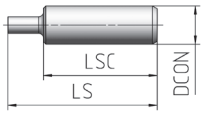
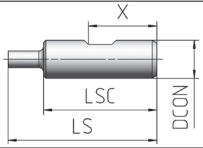
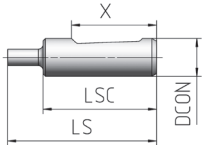
The drill tube and tip are made entirely of solid carbide with a kidney shaped coolant channel. Coolant and chips are flushed out of the drilled hole via the V-shaped groove, or flute, on the drill shank.
With standard tool designs, the V-shaped flute extends to the driver (pin). Solid carbide gundrills are available with a drill shank-length up to 100 x diameter.

Driver

botek solid carbide gundrills are made complete with drivers. Drivers transmit the torque from the machine to the drill. High rotational accuracy between the drill shank and the driver avoids additional vibration, thereby increasing the cutting performance and process reliability of the tools. In addition to a large number of standard drivers, botek manufactures drivers also to customer specifications.

Cylindrical drivers (DIN 6535 HA) used in hydraulic chucks or sealed collets achieve best true running, typical on machining centres.

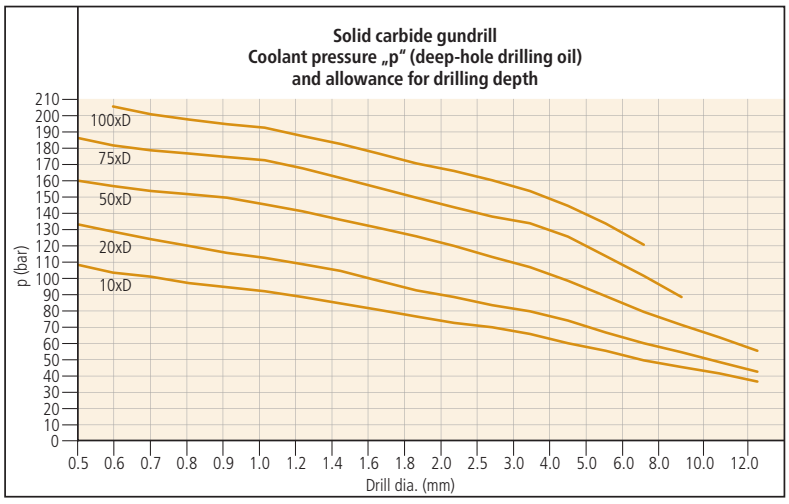
Standard drivers with pin for solid carbide gundrills – Overview

Designation		**Drawing**	**botek driver No.**	**for tool length calculation**			**X** = Notch location	**TD** = Thread size
Ø dia. (mm)	**Type**			**drill dia.** (mm) **from - to**	**LSC**	**LS** Driver with pin		
6			ZH6-03	0.500 - 4.649	30	45	17	
10	ideal for hydraulic chucks and collets		ZH10-15	0.500 - 6.349	55	70		M6x0.5
10			ZH10-37	0.500 - 5.249	40	55	32.7	M6x0.5
10			ZH10-42	0.500 - 7.249	40	55	24	
12.7			ZH12.7-01	0.500 - 6.349	38	48	25.4	
12.7	ideal for hydraulic chucks and collets		ZH12.7-09	0.500 - 6.349	51	65		M6x0.5
16			ZH16-75	0.500 - 8.049	80	105	37	M10x1
4	**DIN 6535-HA** ideal for hydraulic chucks and collets		ZH4-08	0.500 - 5.149	34	46		
6			ZH6-12	0.500 - 4.649	36	50		
10			ZH10-51	0.500 - 7.249	40	55		
12			ZH12-27-1	0.500 - 8.049	45	60		
16			ZH16-86-1	0.500 - 8.049	48	63		
6	**DIN 6535-HB**		ZH6-13	0.500 - 4.649	36	50	20	
10			ZH10-47	0.500 - 7.249	40	55	23.5	
12			ZH12-30	0.500 - 8.049	45	60	26.5	
16	**DIN 1835-B**		ZH16-78-1	0.500 - 8.049	48	63	29	
6	**DIN 6535-HE**		ZH6-01	0.500 - 4.649	36	50	25	
10			ZH10-49	0.500 - 7.249	40	55	28	
12			ZH12-28	0.500 - 8.049	45	60	33	
16	**DIN 1835-E**		ZH16-89-1	0.500 - 8.049	48	63	36	

Guide values for gundrilling of various materials with solid carbide gundrills
(Guide values Type 113-HP refer to page 12 and 13)

Material groups	Structural steel, Carbon steel, Low alloyed steel, Case hardening steel, (< 900 N / mm²) "free machining"	Alloyed tempered steel, Case hardening steel, Nitriding steel, Tool steel, (> 900 N / mm²)	Stainless steel, ferritic / martensitic 13-25% Cr (sulphurized)	Stainless steel, corrosion and heat resisting, austenitic Ni > 8%, 18-25% Cr
Cutting speed m / min	70 - 80	60 - 70	40 - 50	30 - 40
Drill dia. (mm)	**Feed rate** (mm) **/ rev.**			
	from - to	from - to	from - to	from - to
0.5 - 0.59	0.0002 - 0.0010	0.0003 - 0.0008	0.0004 - 0.0007	0.0002 - 0.0007
0.6 - 0.69	0.0002 - 0.0011	0.0005 - 0.0010	0.0004 - 0.0008	0.0003 - 0.0008
0.7 - 0.79	0.0003 - 0.0014	0.0007 - 0.0012	0.0006 - 0.0010	0.0005 - 0.0010
0.8 - 0.89	0.0004 - 0.0017	0.0010 - 0.0016	0.0007 - 0.0014	0.0007 - 0.0012
0.9 - 0.99	0.0007 - 0.0020	0.0009 - 0.0020	0.0009 - 0.0019	0.0011 - 0.0017
1.0 - 1.09	0.0010 - 0.0026	0.0010 - 0.0026	0.0012 - 0.0024	0.0014 - 0.0020
1.1 - 1.19	0.0014 - 0.0035	0.0013 - 0.0032	0.0015 - 0.0028	0.0016 - 0.0023
1.2 - 1.39	0.0018 - 0.0045	0.0015 - 0.0041	0.0020 - 0.0033	0.0020 - 0.0028
1.4 - 1.59	0.0021 - 0.0060	0.0021 - 0.0052	0.0025 - 0.0042	0.0025 - 0.0036
1.6 - 1.79	0.0028 - 0.0079	0.0024 - 0.0066	0.0031 - 0.0054	0.0032 - 0.0045
1.8 - 1.99	0.0030 - 0.0100	0.0030 - 0.0081	0.0039 - 0.0065	0.0040 - 0.0057
2.0 - 2.49	0.0040 - 0.0130	0.0040 - 0.0100	0.0050 - 0.0080	0.0050 - 0.0070
2.5 - 2.99	0.0060 - 0.0170	0.0050 - 0.0140	0.0080 - 0.0120	0.0080 - 0.0100
3.0 - 3.99	0.0080 - 0.0210	0.0070 - 0.0180	0.0120 - 0.0160	0.0110 - 0.0140
4.0 - 4.99	0.0120 - 0.0290	0.0080 - 0.0270	0.0170 - 0.0220	0.0160 - 0.0200
5.0 - 5.99	0.0150 - 0.0370	0.0120 - 0.0350	0.0240 - 0.0300	0.0230 - 0.0260
6.0 - 7.99	0.0200 - 0.0460	0.0170 - 0.0450	0.0330 - 0.0390	0.0310 - 0.0340
8.0 - 9.99	0.0240 - 0.0610	0.0210 - 0.0620	0.0430 - 0.0510	0.0400 - 0.0440
10.0 - 12.00	0.0300 - 0.0780	0.0270 - 0.0790	0.0550 - 0.0640	0.0500 - 0.0560
Deep-hole drilling oil	highly suitable			
Emulsion				unsuitable
MQL	suitable at limited degree			

Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of the drilling machine and workpiece clamping. All figures specified are guide values.



For measuring the exact coolant pressure we recommend the botek coolant pressure gauging kit. For information please refer to page 41.

Guide values for gundrilling of various materials with solid carbide gundrills

Spring steel, Hardened steel, Hardened steel, castings, Heat resisting steel, Titanium, Ti-alloys, Special alloys: Inconel, Nimonic, etc.	Cast iron, Grey cast iron (< 300 N / mm²), Nodular cast iron (< 400 N/mm²), Malleable cast iron	Cast iron, Grey cast iron (> 300 N / mm²), Nodular graphite iron (> 400 N / mm²), Steel castings	Copper, Bronze, Brass, Plastics	Aluminium + Aluminium alloys Si-content > 5% "easily workable"	Aluminium + Aluminium alloys Si-content < 5% "not hardened"
25 - 50	80 - 90	60 - 70	90 - 130	120 - 180	100 - 300
Feed rate (mm) **/ rev.**					
from - to	from - to	from - to	from - to	from - to	from - to
0.0001 - 0.0005	0.0005 - 0.0007	0.0004 - 0.0006	0.0001 - 0.0006	0.0003 - 0.0008	0.0002 - 0.0008
0.0002 - 0.0007	0.0006 - 0.0010	0.0005 - 0.0009	0.0003 - 0.0008	0.0004 - 0.0010	0.0002 - 0.0010
0.0004 - 0.0010	0.0007 - 0.0013	0.0007 - 0.0011	0.0004 - 0.0010	0.0006 - 0.0011	0.0003 - 0.0012
0.0004 - 0.0014	0.0010 - 0.0017	0.0009 - 0.0014	0.0007 - 0.0013	0.0007 - 0.0014	0.0003 - 0.0013
0.0006 - 0.0018	0.0014 - 0.0022	0.0013 - 0.0018	0.0010 - 0.0017	0.0010 - 0.0023	0.0004 - 0.0015
0.0007 - 0.0022	0.0018 - 0.0028	0.0018 - 0.0023	0.0015 - 0.0022	0.0013 - 0.0029	0.0005 - 0.0019
0.0009 - 0.0026	0.0023 - 0.0037	0.0024 - 0.0029	0.0020 - 0.0027	0.0017 - 0.0043	0.0007 - 0.0021
0.0012 - 0.0030	0.0031 - 0.0049	0.0031 - 0.0040	0.0024 - 0.0037	0.0022 - 0.0077	0.0009 - 0.0027
0.0016 - 0.0037	0.0039 - 0.0070	0.0047 - 0.0058	0.0030 - 0.0052	0.0027 - 0.0114	0.0011 - 0.0033
0.0020 - 0.0045	0.0048 - 0.0093	0.0064 - 0.0076	0.0035 - 0.0083	0.0037 - 0.0194	0.0013 - 0.0041
0.0025 - 0.0054	0.0058 - 0.0124	0.0070 - 0.0100	0.0041 - 0.0120	0.0050 - 0.0352	0.0016 - 0.0049
0.0030 - 0.0060	0.0080 - 0.0160	0.0100 - 0.0140	0.0050 - 0.0170	0.0080 - 0.0660	0.0020 - 0.0060
0.0050 - 0.0090	0.0100 - 0.0230	0.0130 - 0.0220	0.0070 - 0.0290	0.0110 - 0.0960	0.0030 - 0.0090
0.0080 - 0.0110	0.0150 - 0.0300	0.0150 - 0.0310	0.0090 - 0.0460	0.0180 - 0.1270	0.0050 - 0.0150
0.0110 - 0.0170	0.0200 - 0.0440	0.0200 - 0.0430	0.0110 - 0.0680	0.0250 - 0.1790	0.0080 - 0.0270
0.0140 - 0.0210	0.0250 - 0.0600	0.0250 - 0.0570	0.0140 - 0.0890	0.0340 - 0.2340	0.0110 - 0.0400
0.0190 - 0.0260	0.0360 - 0.0750	0.0300 - 0.0710	0.0190 - 0.1110	0.0500 - 0.2930	0.0180 - 0.0550
0.0250 - 0.0360	0.0480 - 0.1030	0.0400 - 0.0960	0.0240 - 0.1500	0.0690 - 0.4050	0.0250 - 0.0780
0.0300 - 0.0460	0.0600 - 0.1320	0.0600 - 0.1220	0.0290 - 0.1900	0.0900 - 0.5130	0.0340 - 0.1050
			highly suitable		
unsuitable					
			suitable at limited degree		suitable at limited degree

Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of drilling machine and workpiece clamping. All figures specified are guide values.

The required **viscosity of the deep-hole drilling oil** for a drill diameter of 0.5 to 1.5 mm is approx. 8 - 10 mm²/s (50 SUS) at 40°C and 10 - 15 mm²/s (60 SUS) at drill diameters > 1.5 mm.

When using emulsion, the specified pressures (p) may be reduced by 10 - 20 %.

Coolant filtration of 5 to 10 microns, or better, is required for drill diameters < 2.0 mm.
Coolant filtration of 5 to 20 microns, or better, is required for drill diameters ≥ 2.0 mm.

Guide values for minimum coolant quantity / volumetric flow rate "Q" at specified pressure "p" (bar):

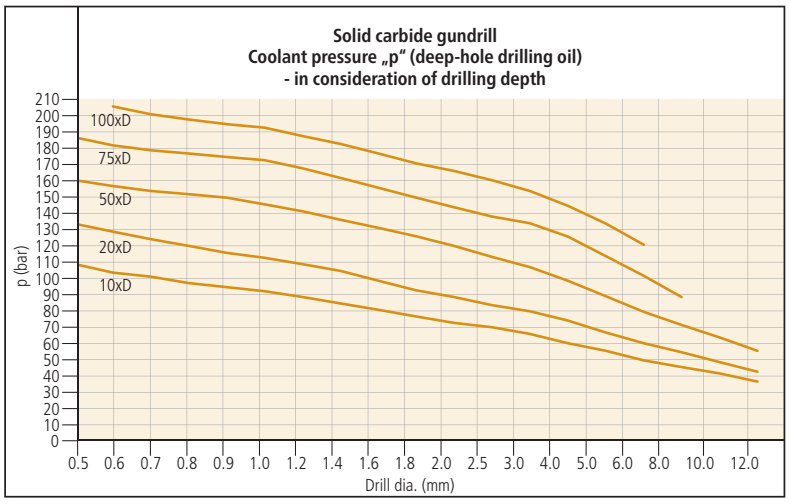
Flow capacity of coolant pump: drill dia. (mm) ≤ 2.0 → min. 4 l / min
Flow capacity of coolant pump: drill dia. (mm) 2.0 - 12.0 → min. 24 l / min

Reliable chip removal is only assured if sufficient coolant is supplied to the tool cutting tip. The diagram shows our recommendation with regards to coolant pressure as a function of drill diameter and drilling depth.

Guide values for gundrilling of various materials with solid carbide gundrills Type 113-HP

Material groups	Structural steel, Free-cutting steel, (< 750 N / mm²)	Alloyed steel, Case hardening steel, (< 900 N / mm²)	Tempered steel, Tool steel, Nitriding steel, (< 1200 N / mm²)	Stainless steel + steel castings, Ni < 8% "easy to machine"
Cutting speed m / min	80	70	65	50
Drill dia. (mm)	**Feed rate** (mm) **/ rev.**			
	to 25xD = 100%, **to 35xD** = 90%, **to 45xD** = 80%, **to 55xD** = 70%, **to 65xD** = 60%, **to 75xD** = 50%, **to 80xD** = 45%, **> 80xD** = 40%			
< 1.40	to 0.050	to 0.045	to 0.040	to 0.025
1.41 - 1.60	0.060	0.057	0.054	0.030
1.61 - 1.80	0.070	0.066	0.063	0.035
1.81 - 2.00	0.080	0.076	0.072	0.040
2.01 - 2.25	0.090	0.085	0.081	0.045
2.26 - 2.50	0.100	0.095	0.090	0.050
2.51 - 2.75	0.110	0.105	0.099	0.055
2.76 - 3.00	0.120	0.115	0.108	0.060
3.01 - 3.50	0.135	0.127	0.120	0.067
3.51 - 4.00	0.145	0.138	0.131	0.073
4.01 - 4.50	0.160	0.152	0.144	0.080
4.51 - 5.00	0.174	0.165	0.156	0.087
5.01 - 5.50	0.185	0.176	0.167	0.093
5.51 - 6.00	0.200	0.190	0.180	0.100
6.01 - 6.50	0.210	0.199	0.189	0.105
6.51 - 7.00	0.220	0.209	0.198	0.110
7.01 - 7.50	0.230	0.218	0.200	0.115
7.51 - 8.00	0.240	0.228	0.205	0.120
8.01 - 8.50	0.250	0.237	0.210	0.125
8.51 - 9.00	0.260	0.247	0.220	0.130
9.01 - 12.00	0.260	0.247	0.220	0.130
Deep-hole drilling oil	highly suitable			
Emulsion		suitable at limited degree		
MQL				

Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of the drilling machine and workpiece clamping. All figures specified are guide values.



For measuring the exact coolant pressure we recommend the botek coolant pressure gauging kit. For information please refer to page 41.

Guide values for gundrilling of various materials with solid carbide gundrills Type 113-HP

Stainless steel corrosion and heat resisting, austenitic Ni > 8%	Spring steel, Hardened steel, castings, Heat resisting steel, Special alloys: Inconel, Nimonic, Titanium	Cast iron, Steel castings	Copper, Bronze, Brass, Plastics	Aluminium, Aluminium alloys
40	40	90	120	150
Feed rate (mm) **/ rev.**				
to 25xD = 100%, **to 35xD** = 90%, **to 45xD** = 80%, **to 55xD** = 70%, **to 65xD** = 60%, **to 75xD** = 50%, **to 80xD** = 45%, **> 80xD** = 40%				
to 0.0100	to 0.0100	to 0.050	to 0.060	to 0.060
0.0150	0.0150	0.060	0.075	0.075
0.0175	0.0175	0.070	0.087	0.087
0.0200	0.0200	0.080	0.100	0.100
0.0225	0.0225	0.090	0.112	0.112
0.0250	0.0250	0.100	0.125	0.125
0.0275	0.0275	0.110	0.137	0.137
0.0300	0.0300	0.120	0.150	0.150
0.0335	0.0335	0.135	0.167	0.167
0.0365	0.0365	0.145	0.182	0.182
0.0400	0.0400	0.160	0.200	0.200
0.0435	0.0435	0.174	0.217	0.217
0.0465	0.0465	0.185	0.230	0.230
0.0500	0.0500	0.200	0.250	0.250
0.0525	0.0525	0.210	0.265	0.265
0.0550	0.0550	0.220	0.275	0.275
0.0575	0.0575	0.230	0.287	0.287
0.0600	0.0600	0.240	0.300	0.300
0.0625	0.0625	0.250	0.312	0.312
0.0650	0.0650	0.260	0.320	0.320
0.0650	0.0650	0.260	0.320	0.320
			highly suitable	
unsuitable				
		suitable at limited degree		
Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of drilling machine and workpiece clamping. All figures specified are guide values.				

The required **viscosity of the deep-hole drilling oil** for a drill diameter of 0.5 to 1.5 mm is approx. 8 - 10 mm^2/s (50 SUS) at 40°C and 10 - 15 mm^2/s (60 SUS) at drill diameters > 1.5 mm.

When using emulsion, the specified pressures (p) may be reduced by 10 - 20 %.

Coolant filtration of 5 to 10 microns, or better, is required for drill diameters < 2.0 mm.
Coolant filtration of 5 to 20 microns, or better, is required for drill diameters ≥ 2.0 mm.

Guide values for minimum coolant quantity / volumetric flow rate "Q" at specified pressure "p" (bar):

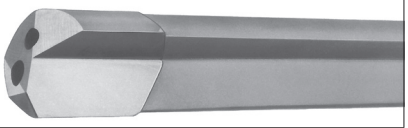
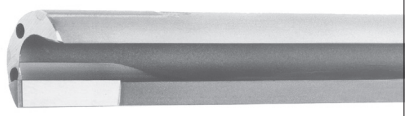
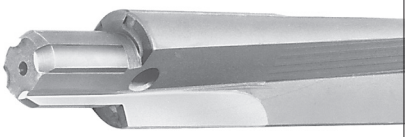
Flow capacity of coolant pump: drill dia. (mm) ≤ 2.0 → min. 4 l / min
Flow capacity of coolant pump: drill dia. (mm) 2.0 - 12.0 → min. 24 l / min

Reliable chip removal is only assured if sufficient coolant is supplied to the tool cutting tip. The diagram shows our recommendation with regards to coolant pressure as a function of drill diameter and drilling depth.

Single flute gundrills with brazed drill head

Type 110 / Type 111 / Type 112 / Type 114 / Type 115

Overview

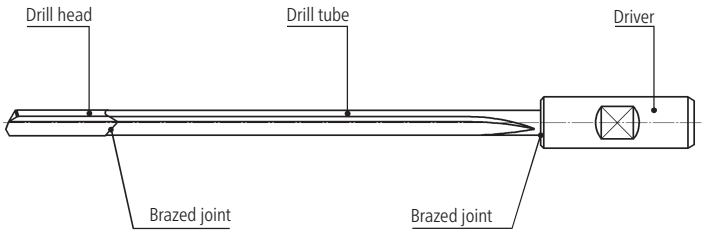
Type	Tool dia.	
Type 110 Single flute gundrill with brazed solid carbide tip	kidney-shaped coolant channel **for tool dia. 1.850 - 7.059 mm**	
	2 coolant holes **for tool dia. 7.060 - 51.200 mm**	
Type 112 Single flute stepped gundrill with solid carbide tip (to produce precise stepped holes in one operation)	kidney-shaped coolant channel or 2 coolant holes depending on diameters **tool dia. 2.000 - 51.200 mm**	
Type 114 Trepanning gundrill carbide tip for producing annular drill-holes	**tool outer dia. 11.000 - 50.000 mm**	
Type 115 Single flute counterboring tool with solid carbide tip	kidney-shaped coolant channel or 2 coolant holes depending on diameters **tool dia. 1.850 - 51.200 mm**	
Typ 115-01 Single flute stepped counterboring tool		
Type 115-03 Single flute counterboring tool with guiding pilot with solid carbide tip	**tool dia. 1.850 - 51.200 mm**	
Type 115-04 Single flute counterboring tool with guiding pilot steel body with inserted carbide cutting blade and bearing pads	**tool dia. 12.001 - 60.006 mm**	

With PCD cutting edge on request.

Information about the Stock Program / Express Production Line can be found on page 48 and 49.

Tool design

The typical gundrill is fabricated with a drill head section of solid carbide or a steel body with inserted carbide cutting blade and bearing pads. The head section is brazed to a heat treated tube (flute) section then fitted and brazed to a hardened and ground steel driver.

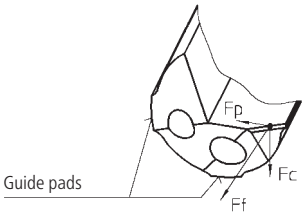


Drill head

a) Peripheral contour

The single flute gundrill is selfguided while drilling. Guide pads on the drill head act as supports. The layout of the guide pads often has a decisive influence on the surface quality and dimensional accuracy of the drilled hole. Cutting forces press the guide pads against the hole wall with force that a burnishing effect occurs, producing the surface quality and dimensional accuracy (roundness) typical of the gundrilling process.

Various contours (see page 16 + 17) are available to suit your drilling requirements.

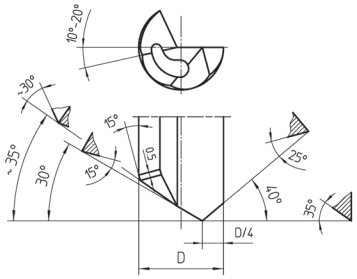
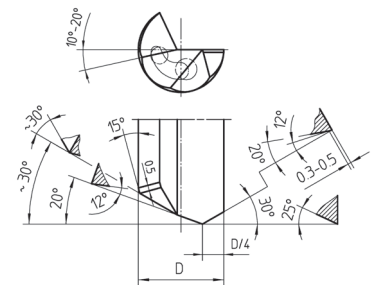
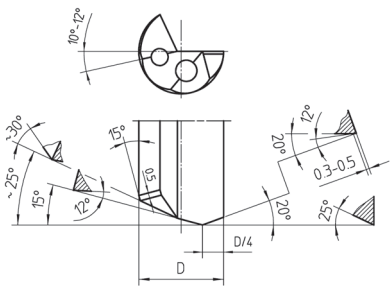


Ff = feed force
Fc = cutting force
Fp = passive force

b) Nose grind geometry

The nose grind geometry affect the following, hole tolerance, chip formation, coolant pressure and flow, tool life, centerline deviation and surface quality. Over the years, botek has successfully tested a number of different nose grinds for drilling various materials.

botek's experience has formed the foundation for the development of our standard nose grind geometries. This meets the requirements of most drilling applications. Deep-hole drilling of especially long chipping materials and difficult to machine materials usually call for special nose grind geometries, and in some cases, made to order chip breakers, all available from botek.

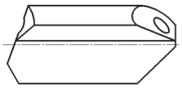
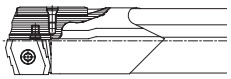
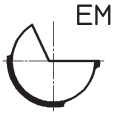
Standard nose grinds for Type 110	
SA-0001 **for drill range 1.850 - 4.000 mm**	
SA-0002 **for drill range 4.001 - 20.000 mm**	
SA-0003 **for drill range 20.001 - ... mm**	

We are pleased to provide regrinding instructions on request.

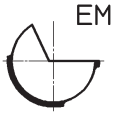
Single flute gundrills with brazed drill head

Type 110 / Type 112 / Type 01

Solid drilling tools

Drill head design	**Vollhartmetall**		**Steel body with indexable carbide inserts and guide pads**
Working method / tool type	**Solid drilling tools**		
	Type 110	**Type 112** (step drill)	**Type 01-000** **Type 01-010**
Illustration			
Drilling range from - to (mm)	**1.850 - 51.200**		**9.900 - 43.990**
Tool length	depending on diameter, max. 5000 mm		
Coolant hole design (standard)	kidney  **tool dia.** **1.850 - 7.059**	2-holes  **tool dia.** **7.060 - 51.200**	1-hole  **tool dia.** **9.900 - 43.990**
Advantages	- **Several peripheral contours** are available to suit your drilling applications - **Regrindable** - Optimum coolant flow due to various coolant channel designs - **Available with PCD cutting edge**		- **Cost effective for high production** - Variety of carbide grades and chip breaker designs available - Indexable insert eliminates resharpening - Indexable guide pads - **Inserts and guide pads are easily changed or replaced** - Extended guide pads with (Type 01-010) ideal for cross hole drilling applications
Peripheral contours botek adapts the contour optimally to meet your drilling requirements! Important: Contour EA, G and E are non-micable!	G (Standard)  - All materials - Suitable for nearly all drilling - Close hole tolerance - Minimal drift		C  - Stainless steel, wood - Not easily machinable materials - Preferred for water soluble (emulsion) coolants
	A  - Aluminium - Close hole tolerance	D  - Cast iron and graphite - Close hole tolerance in cast iron	EM  - Steel, cast iron - Soft materials
	EA  - Steel and aluminium - Crosshole drilling - Angular entrance and exit bores	S  - Steel - Close hole tolerance - Good surface quality - Ideal for short holes	**see botek brochure: Deep hole drilling tool Type 01 / 02 / 07 / 07A**
Special contour	Also available upon special request		
Special nose grinds	All tools are also available with special nose grind		
Tool coatings	Please specify the coating you require		
Diamond / PCD	Also available cutting edge with PCD		

Counterboring / Trepanning tools

Drill head design	**Solid carbide tip**			**Steel body with brazed carbide cutting blade and bearing pads**	
Working method / tool type	**Drilling tools**		**Counterboring tools** with guiding pilot		Trepanning tool
	Type 115	Type 115-01	Type 115-03	Type 115-04	Type 114
Illustration					
Drilling range from - to (mm)	**1.850 - 51.200**		**1.850 - 51.200**	**12.001 - 60.006**	**11.000 - 50.000**
Coolant hole design (standard)	kidney  **tool dia. 1.850 - 7.059**		2-holes  **tool dia. 7.060 - 51.200**	1-hole  **tool dia. 5.800 - 40.009**	2-holes  **tool dia. 40.010 - 60.009**	Defined by tool design
Special features	- with round drill tube (chip removal in drilling direction) - with fluted standard drill tube (chip removal against drilling direction)				
Peripheral contours botek adapts the contour optimally to meet your drilling requirements! Important: Contour EA, G and E are non-micable!	G (Standard)  - All materials - Suitable for nearly all drilling requirements - Close drilling tolerance - Minimal drift		C  - Stainless steel, wood - Not easily machinable materials - Preferred for water soluble (emulsion) coolants	Fixed peripheral contour due to tool design	Fixed peripheral contour due to tool design
	A  - Aluminium - Close drilling tolerance	D  - Cast iron and graphite - Close drilling tolerance in cast iron	EM  - Steel, cast iron - Soft materials		
	EA  - Steel and aluminium - Crosshole drilling operations - Unfavourable drilling conditions	S  - Steel - Close drilling tolerance - Good surface quality - Ideal for short holes			
Special contour	Also available upon special request			-	-
Special nose grinds	All tools are also available with special nose grind			-	-
Tool coatings	Please specify the coating you require			-	-
Diamant / PCD	Also available to order with PCD point			-	-

Drill shaft

Tempered alloy steel tubing is formed with a V-shaped groove (flute) to create the swarf (coolant) return channel required for the gundrilling operation. Design considerations for proper drill tube sizes include the ratio between the drill tube outside diameter and inside diameter for optimum torsional rigidity. This ensures exceptional cutting performance, coolant flow and tool life.

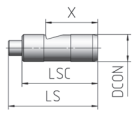
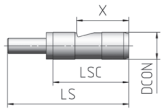
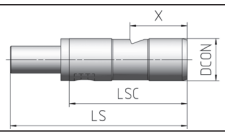
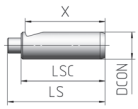
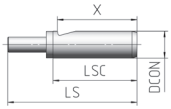
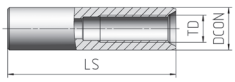
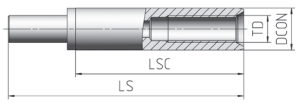
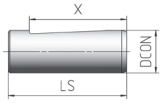
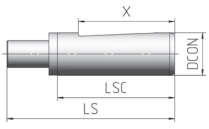
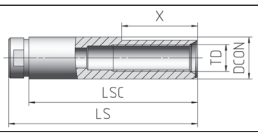
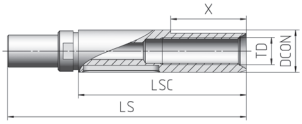
With standard gundrills the flute section is typically extended to the driver. For longer gundrills it is possible to have a round section of drill tube with a shorter flute length for added rigidity and strength.

Driver
Type 110 / Type 112 / Type 114 / Type 115

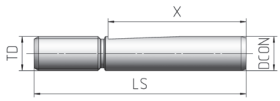
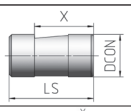
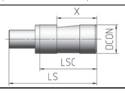
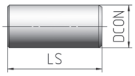
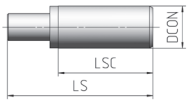
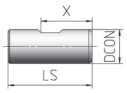
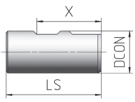
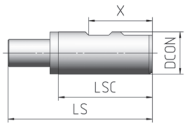
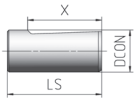
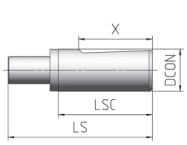
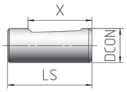
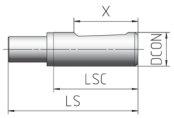
Driver

The single flute gundrill is typically provided with a driver for holding the tool in the machine spindle. The driver transmits the torque from the machine spindle. Besides a large variety of in-house standards botek also manufacturs per customer specifications.

Standard drivers for single flute gundrills with brazed drill head - Overview

Designation		Drawing	botek driver No.	for tool length calculation			X = Notch location	TD = Thread size
DCON Driver (mm)	Type			drill dia. range (mm) from - to	LSC	LS Driver with pin		
10			ZH10-00	1.850 - 7.299	40		24.0	
16			ZH16-03	1.850 - 12.399	45	53	31.0	
25			ZH25-00	6.000 - 19.509	70	78	34.0	
10	with pin		ZH10-01	7.300 - 12.399	40	57	24.0	
16			ZH16-04	12.400 - 20.509	45	72	31.0	
25	with pin and drive key		ZH25-01	19.510 - >	70	105	34.0	
16			ZH16-02	1.850 - 12.399	50	58	47.5	
16	with pin		ZH16-33	12.400 - 20.509	50	77	47.5	
10	GKT with metr. thread		ZH10-06	1.850 - 7.299	60			M6x0.5
16			ZH16-15	1.850 - 12.399	80			M10x1
25			ZH25-08	6.000 - 19.509	100			M16x1.5
10	GKT with metr. thread with pin		ZH10-28	7.300 - 12.399	60	77		M6x0.5
16			ZH16-22	12.400 - 20.509	80	105		M10x1
25			ZH25-10	19.509 - >	100	140		M16x1.5
12.7	½"		ZH12.7-00	1.850 - 9.699	38.1		25.3	
19.05	¾"		ZH19.05-01	3.960 - 14.899	70		45.0	
25.4	1"		ZH25.4-00	6.000 - 19.509	70		57.5	
31.7	1¼"		ZH31.7-00	9.700 - 25.609	70		57.5	
38.1	1½"		ZH38.1-00	9.700 - 32.609	70		57.5	
19.05	¾"		ZH19.05-11	14.900 - 24.609	70	97	45.0	
25.4	1"		ZH25.4-01	19.510 - >	70	100	57.5	
31.7	1¼"		ZH31.7-01	25.610 - >	70	110	57.5	
38.1	1½" inch dia. with pin		ZH38.1-01	32.610 - >	70	110	57.5	
10	VDI 3208		ZH10-44	1.850 - 6.749	60	68	35	M6x0.5
16			ZH16-31	1.850 - 10.799	80	90	37	M10x1
25			ZH25-34	6.000 - 19.509	100	112	45	M16x1.5
16	VDI 3208 with pin		ZH16-66	10.800 - 16.399	80	110	37	M10x1
25			ZH25-40	19.510 - 42.699	100	142	45	M16x1.5

Standard drivers for gundrills with brazed drill head - Overview

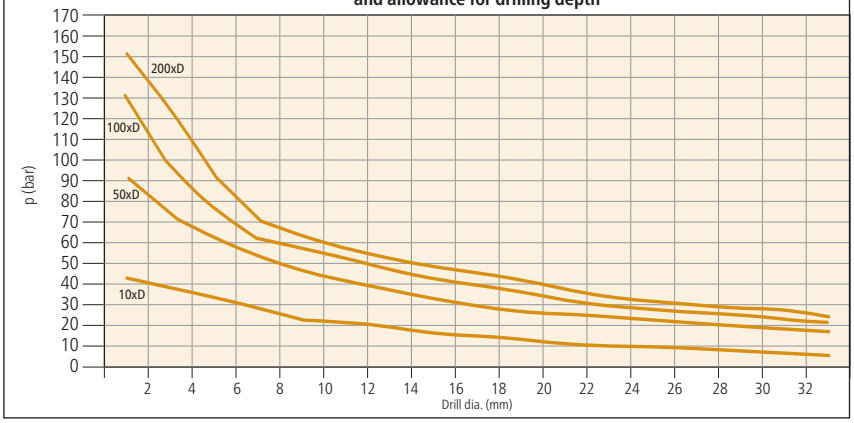
Designation		Drawing	botek driver No.	for tool length calculation			X = Notch location	TD = Thread size
DCON Driver (mm)	Type			drill dia. range (mm) from - to	LSC	LS Driver with pin		
16	Adjustable driver with acme thread		SH16-00	1.850 - 12.899	112		73.0	TR16x1.5
20			SH20-00	1.850 - 14.899	126		82.0	TR20x2
28			SH28-00	6.000 - 21.509	126		82.0	TR28x2
36			SH36-00	8.700 - 28.609	162		109.0	TR36x2
16	Speedbit		ZH16-21	1.850 - 12.399	40		28.0	
25			ZH25-16	6.750 - 19.509	50		35.0	
35			ZH35-00	9.700 - 28.609	60		40.0	
16	Speedbit with pin		ZH16-30	12.400 - 20.509	40	67	28.0	
25			ZH25-20	19.510 - 30.609	50	77	35.0	
35			ZH35-01	28.610 - >	60	100	40.0	
10	DIN 6535-HA		ZH10-40	1.850 - 7.299	40			
12			ZH12-18	1.850 - 8.999	45			
16			ZH16-11	1.850 - 12.399	48			
20			ZH20-01	5.000 - 15.899	50			
25			ZH25-11	6.000 - 19.509	56			
32			ZH32-24	9.700 - 25.600	60			
40	DIN 1835-A40		ZH40-03	9.700 - 32.609	70			
10	DIN 6535-HA or 1835-A with pin		ZH10-41	7.300 - 12.399	40	57		
12			ZH12-19	9.000 - 15.899	45	62		
16			ZH16-20	12.400 - 20.509	48	75		
20			ZH20-60	15.900 - 25.603	50	77		
25			ZH25-21	19.510 - 42.699	56	86		
32			ZH32-23	25.610 - 45.699	60	100		
40			ZH40-04	32.610 - >	70	110		
10	DIN 6535-HB		ZH10-11	1.850 - 7.299	40		23.5	
12			ZH12-07	1.850 - 8.999	45		26.5	
16			ZH16-32	1.850 - 12.399	48		29.0	
20			ZH20-29	1.850 - 15.899	50		30.5	
25	DIN 6535-HB		ZH25-22	6.000 - 19.509	56		38.0	
32	DIN 1835-B32		ZH32-10	9.700 - 25.609	60		43.0	
40	DIN 1835-B40		ZH40-13	9.700 - 32.609	70		47.0	
50	DIN 1835-B50		ZH50-05	15.900 - 42.699	80		54.0	
10	DIN 6535-HB or 1835-B with pin		ZH10-23	7.300 - 12.399	40	57	23.5	
12			ZH12-02	9.000 - 15.899	45	62	26.5	
16			ZH16-53	12.400 - 20.509	48	75	29.0	
20			ZH20-34	15.900 - 25.609	50	77	30.5	
25			ZH25-31	19.510 - >	56	86	38.0	
32			ZH32-11	25.610 - >	60	100	43.0	
40			ZH40-14	32.610 - >	70	110	47.0	
50			ZH50-06	42.700 - >	80	120	54.0	
10	DIN 1835-E		ZH10-20	1.850 - 7.299	40		28.0	
12			ZH12-08	1.850 - 8.999	45		33.0	
16			ZH16-47	1.850 - 12.399	48		36.0	
20			ZH20-40	1.850 - 15.899	50		38.0	
25			ZH25-36	6.000 - 19.509	56		44.0	
32			ZH32-12	9.700 - 25.609	60		48.0	
40			ZH40-18	9.700 - 32.609	70		66.0	
10	DIN 1835-E with pin		ZH10-24	7.300 - 12.399	40	57	28.0	
12			ZH12-05	9.000 - 15.899	45	62	33.0	
16			ZH16-51	12.400 - 20.509	48	75	36.0	
20			ZH20-43	15.900 - 29.609	50	77	38.0	
25			ZH25-37	19.510 - >	56	86	44.0	
32			ZH32-13	25.610 - >	60	100	48.0	
40			ZH40-17	32.610 - >	70	110	66.0	
10	DIN 6535-HE		ZH10-29	1.850 - 7.299	40		28.0	
12			ZH12-13	1.850 - 8.999	45		33.0	
16			ZH16-62	1.850 - 12.399	48		36.0	
20			ZH20-55	1.850 - 15.899	50		38.0	
10	DIN 6535-HE with pin		ZH10-30	7.300 - 12.399	40	57	28.0	
12			ZH12-14	9.000 - 15.899	45	62	33.0	
16			ZH16-70	12.400 - 20.509	48	75	36.0	
20			ZH20-56	15.900 - 29.609	50	77	38.0	

Guide values for gundrilling of various materials with carbide tipped gundrills

Material groups	Structural steel Carbon steel Low alloyed steel Case hardening steel < 900 N / mm² (265HB) "free machining"	Alloyed tempered steel Case hardening steel Nitriding steel Tool steel > 900 N / mm² (265HB)	Stainless steel (ferritic / martensitic) 13-25% Cr (sulphurized)	Stainless steel corrosion and heat resisting (austenitic) 18-25% Cr Ni > 8%
Cutting speed m / min	70 - 100	60 - 80	40 - 80	30 - 60
Drill dia. (mm)	**Feed rate** (mm) **/ rev.**			
	from - to	from - to	from - to	from - to
1.85 - 2.49	0.0019 - 0.0060	0.0019 - 0.0078	0.0019 - 0.0039	0.0016 - 0.0029
2.50 - 2.99	0.0025 - 0.0094	0.0033 - 0.0119	0.0038 - 0.0064	0.0025 - 0.0046
3.00 - 3.49	0.0034 - 0.0128	0.0053 - 0.0157	0.0049 - 0.0089	0.0037 - 0.0063
3.50 - 3.99	0.0045 - 0.0165	0.0070 - 0.0196	0.0070 - 0.0122	0.0050 - 0.0081
4.00 - 4.49	0.0056 - 0.0211	0.0089 - 0.0236	0.0080 - 0.0157	0.0070 - 0.0098
4.50 - 4.99	0.0069 - 0.0254	0.0102 - 0.0274	0.0098 - 0.0189	0.0089 - 0.0118
5.00 - 5.99	0.0089 - 0.0295	0.0125 - 0.0316	0.0118 - 0.0222	0.0113 - 0.0136
6.00 - 6.99	0.0110 - 0.0364	0.0150 - 0.0393	0.0143 - 0.0276	0.0140 - 0.0170
7.00 - 7.99	0.0133 - 0.0431	0.0175 - 0.0467	0.0163 - 0.0343	0.0160 - 0.0205
8.00 - 8.99	0.0157 - 0.0495	0.0200 - 0.0550	0.0183 - 0.0405	0.0180 - 0.0243
9.00 - 9.99	0.0184 - 0.0565	0.0225 - 0.0632	0.0212 - 0.0466	0.0200 - 0.0283
10.00 - 11.99	0.0230 - 0.0630	0.0250 - 0.0710	0.0260 - 0.0530	0.0250 - 0.0320
12.00 - 13.99	0.0270 - 0.0760	0.0310 - 0.0860	0.0320 - 0.0650	0.0300 - 0.0410
14.00 - 15.99	0.0320 - 0.0900	0.0350 - 0.1020	0.0380 - 0.0770	0.0350 - 0.0500
16.00 - 17.99	0.0360 - 0.1030	0.0390 - 0.1190	0.0450 - 0.0900	0.0410 - 0.0590
18.00 - 19.99	0.0410 - 0.1160	0.0440 - 0.1350	0.0530 - 0.1050	0.0480 - 0.0710
20.00 - 23.99	0.0510 - 0.1300	0.0490 - 0.1530	0.0680 - 0.1190	0.0600 - 0.0830
24.00 - 27.99	0.0600 - 0.1570	0.0540 - 0.1850	0.0830 - 0.1430	0.0730 - 0.1060
28.00 - 31.99	0.0700 - 0.1840	0.0590 - 0.2170	0.1000 - 0.1680	0.0870 - 0.1270
32.00 - >	0.0850 - 0.2110	0.0630 - 0.2470	0.1250 - 0.1930	0.1070 - 0.1510
Deep-hole drilling oil	highly suitable			
Emulsion				unsuitable
MQL	suitable at limited degree			

Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of the drilling machine and workpiece clamping. All figures specified are guide values.

Single flute gundrill with brazed drill head
Coolant pressure "p" (deep hole drilling oil)
and allowance for drilling depth



For measuring the exact coolant pressure we recommend the botek coolant pressure gauging kit. For information please refer to page 41.

Guide values for gundrilling of various materials with carbide tipped gundrills

Spring steel Hardened steel Hardened steel castings Heat resisting steel Titanium, Ti - alloys Special alloys: Inconel, Nimonic, etc.	Cast iron Grey cast iron < 300 N / mm² Nodular cast iron < 400 N / mm² Malleable cast iron	Cast iron Grey cast iron > 300 N / mm² Nodular graphite iron > 400 N / mm² Steel castings	Copper Bronze Brass Plastics	Aluminium + Aluminium alloys Si-content > 5% "easily workable"	Aluminium + Aluminium alloys Si-content < 5%
25 - 60	70 - 100	60 - 90	80 - 150	100 - 180	100 - 300
Feed rate (mm) **/ rev.**					
from - to	from - to	from - to	from - to	from - to	from - to
0.0013 - 0.0015	0.0046 - 0.0116	0.0023 - 0.0063	0.0028 - 0.0074	0.0019 - 0.0182	0.0019 - 0.0031
0.0019 - 0.0022	0.0068 - 0.0178	0.0034 - 0.0129	0.0041 - 0.0126	0.0029 - 0.0368	0.0033 - 0.0053
0.0026 - 0.0028	0.0086 - 0.0236	0.0049 - 0.0188	0.0060 - 0.0176	0.0055 - 0.0589	0.0049 - 0.0088
0.0038 - 0.0040	0.0105 - 0.0300	0.0073 - 0.0242	0.0070 - 0.0234	0.0078 - 0.0859	0.0063 - 0.0154
0.0052 - 0.0056	0.0127 - 0.0362	0.0092 - 0.0311	0.0080 - 0.0293	0.0106 - 0.1178	0.0078 - 0.0214
0.0071 - 0.0077	0.0145 - 0.0424	0.0112 - 0.0377	0.0088 - 0.0377	0.0127 - 0.1466	0.0094 - 0.0273
0.0092 - 0.0100	0.0185 - 0.0495	0,0141 - 0.0440	0.0106 - 0.0450	0.0165 - 0.1717	0.0122 - 0.0324
0.0120 - 0.0126	0.0235 - 0.0603	0.0172 - 0.0563	0.0123 - 0.0565	0.0192 - 0.2167	0.0154 - 0.0414
0.0147 - 0.0165	0.0280 - 0.0728	0.0201 - 0.0676	0.0144 - 0.0674	0.0235 - 0.2624	0.0176 - 0.0498
0.0176 - 0.0209	0.0343 - 0.0859	0.0231 - 0.0795	0.0166 - 0.0804	0.0282 - 0.3140	0.0198 - 0.0578
0.0207 - 0.0240	0.0394 - 0.0983	0.0261 - 0.0917	0.0188 - 0.0942	0.0333 - 0.3550	0.0220 - 0.0659
0.0240 - 0.0270	0.0500 - 0.1100	0.0310 - 0.1030	0.0230 - 0.1040	0.0420 - 0.3960	0.0260 - 0.0750
0.0280 - 0.0330	0.0600 - 0.1330	0.0370 - 0.1260	0.0270 - 0.1250	0.0520 - 0.4780	0.0310 - 0.0930
0.0340 - 0.0400	0.0700 - 0.1560	0.0420 - 0.1460	0.0320 - 0.1460	0.0630 - 0.5600	0.0350 - 0.1110
0.0380 - 0.0460	0.0790 - 0.1780	0.0470 - 0.1650	0.0370 - 0.1660	0.0710 - 0.6310	0.0400 - 0.1310
0.0430 - 0.0530	0.0870 - 0.2010	0.0520 - 0.1820	0.0420 - 0.1870	0.0780 - 0.6920	0.0440 - 0.1510
0.0510 - 0.0600	0.1060 - 0.2240	0.0630 - 0.1990	0.0510 - 0.2070	0.0940 - 0.7540	0.0530 - 0.1670
0.0630 - 0.0730	0.1230 - 0.2700	0.0730 - 0.2340	0.0600 - 0.2460	0.1100 - 0.8710	0.0620 - 0.2010
0.0720 - 0.0860	0.1410 - 0.3160	0.0840 - 0.2690	0.0700 - 0.2810	0.1260 - 0.9890	0.0700 - 0.2340
0.0860 - 0.1000	0.1690 - 0.3620	0.0990 - 0.3010	0.0850 - 0.3150	0.1490 - 1.0990	0.0840 - 0.2680

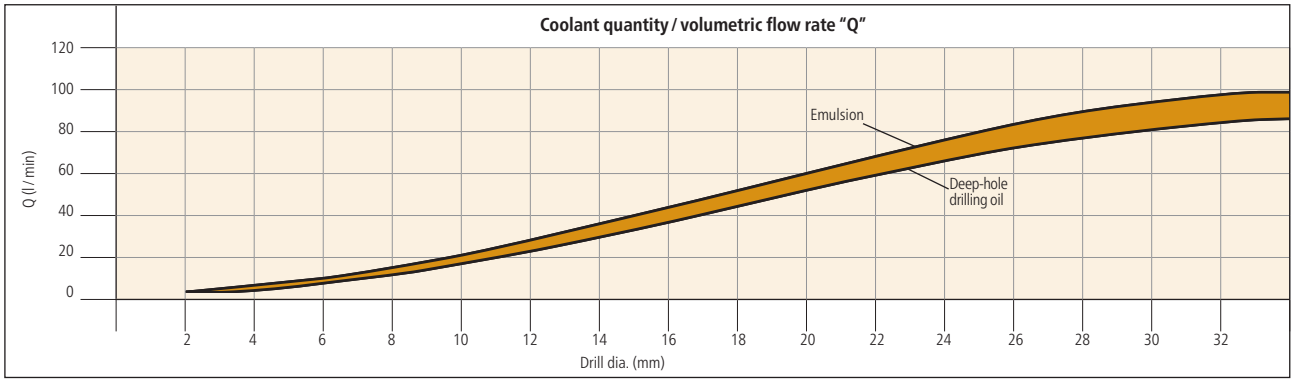
highly suitable

unsuitable

suitable at limited degree

suitable at limited degree

Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of the drilling machine and workpiece clamping. All figures specified are guide values.

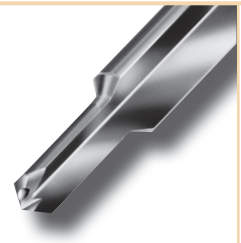


Reliable chip removal is only assured if sufficient coolant is supplied to the tool. The diagrams show our recommendation for coolant pressure and quantity by drill diameter and drilling depth.

Advantages

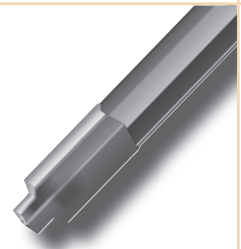
Type 123 / Type 123-01 / Type 123-02 / Type 120 / Type 122 / Type 125 / Type 125-03

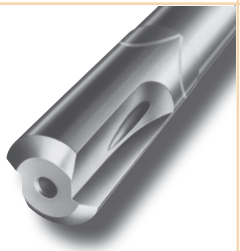

Type 123


Type 123-01


Type 123-02


Type 120


Type 122


Type 125


Type 125-03

1. Cost effective and precise holemaking.
2. Higher feed rate possible.
3. Best drilling quality.
4. High process reliability.
5. Tool lengths up to 1.200 mm – depending on tool type and tool diameter.
6. Suitable for use on machining centres and turning machines with high pressure coolant system.
7. Minimum quantity lubrication (MQL) possible under certain conditions.
8. Drills can be used horizontally or vertically with either tool, workpiece or counterrotation.
9. Tools can be reground – at botek or in your facility.
10. Ideally suited to drill short chipping materials like Alu-alloys and cast iron.
11. Nose grinds with chip breaker for optimum chip formation available.
12. With the botek „Axial-Pulsator" drill Type 120 and 123 are also suitable drilling steel and other long chipping materials.
13. With the „Axial-Pulsator" higher feed rates can be achieved.

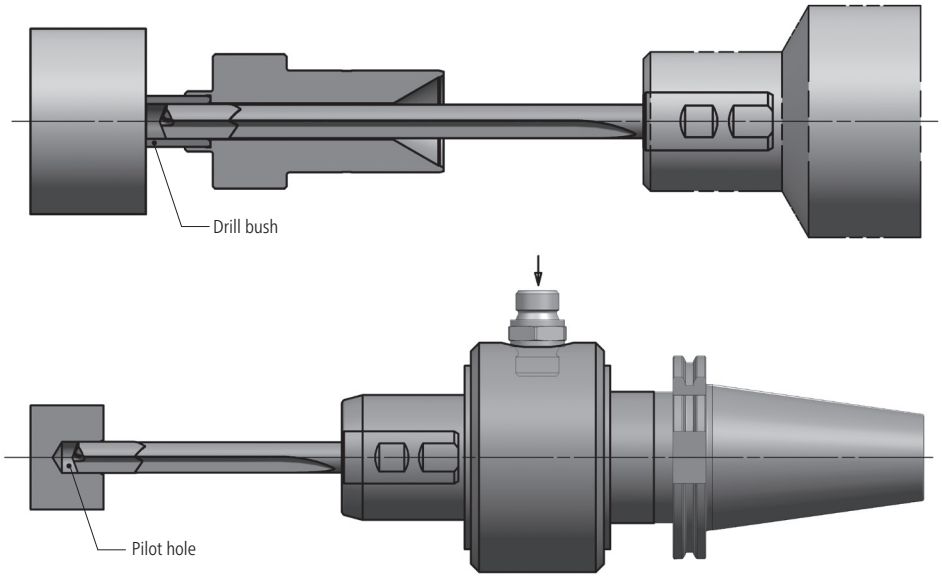
The characteristic of the 2-flute drilling process is that coolant is fed through the coolant holes in the tool and exits along with the chips in the flutes from the drilled hole. The coolant also provides lubrication to the drill periphery.

Conditions for successful deep hole drilling

1 An efficient coolant and filtration system with a filtration of 20 µm to 30 µm (the smaller the diameter, the better the coolant and filtration should be).

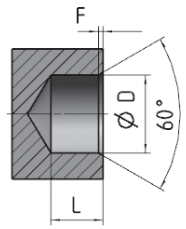
2. Suitable coolant, i. e. deep hole drilling oil or emulsion (min. 10-12 % concentration, with e. p. additives) has to be provided in sufficient quantity and pressure. Minimum quantity lubrication (MQL) may be used under certain conditions.

3. Drill guiding through drill bush or pilot hole in the workpiece.



The 2-flute gundrill is not self centering. When positioning the drill, the tool must be guided through a drill bush or a pilot hole. The quality of the pilot hole affects the drilling performance. Solid carbide 2-fluted drills (Type 123) can up to a length of 12 x D also be used without a pilot hole, but with reduced starting parameters (see page 27).

Dimensions for the guide hole

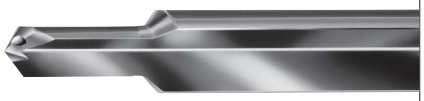
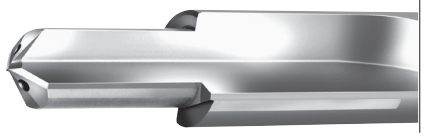
	Drill diameter (mm)	**Dimensions for guide hole (pilot hole)**	
		L (mm)	**D** (mm) **ISO Tolerance F7**
	2.800 - 6.000 mm	ca. 1.5 x D	+ 0.010 to 0.022
	6.001 - 10.000 mm		+ 0.013 to 0.028
	10.001 - 18.000 mm	ca. 1.0 x D	+ 0.016 to 0.034
	18.001 - 43.009 mm		+ 0.020 to 0.041

For precise holes we recommend to use the ISO tolerance G6. The dimensions specified in the table are guide values.
To avoid chipping to the cutting edge, a chamfered pilot hole (F) is recommended depending on the machining requirements.

→ Please note the application notes on page 34 + 35.
→ Stock Program pilot drills page 51.

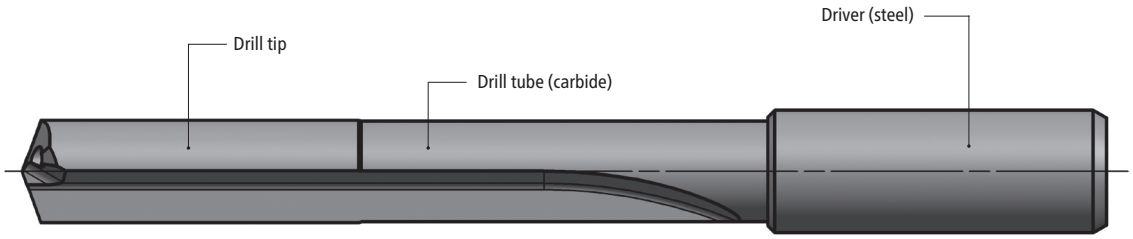
Solid carbide 2-flute drills
Type 123

Overview

Type	Tool diameter	
Type 123 Solid carbide 2-flute drill coolant fed double margin	tool diameter **2.800 – 32.000 mm**	
Type 123-01 Solid carbide 2-flute drill for taps, coolant fed, step angle 90°	tool diameter **2.800 – 32.000 mm**	
Type 123-02 Solid carbide 2-flute step drill for taps, coolant fed, step angle 180°	tool diameter **2.800 – 32.000 mm**	
Type 123 with PCD cutting edge available on request		

Tool design

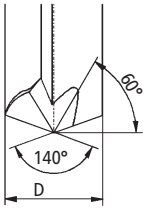
Drill and head shaft are manufactured from a single piece of carbide blank. The advantage of this tool is high process reliability and performance. Longer tool life is possible due to reduced torsional vibrations and higher rigidity.



Nose grind geometry

The nose grind geometry affect the following, hole tolerance, chip formation, coolant pressure and flow, tool life, centreline deviation and surface quality. Over the years, botek has successfully tested a number of different nose grinds for drilling various materials.

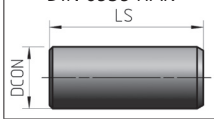
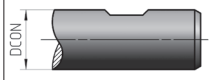
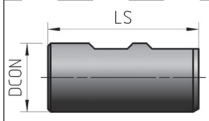
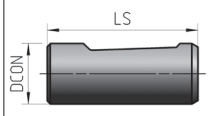
botek's experience has formed the foundation for the development of our standard nose grind geometries. This meets the requirements of most drilling applications. Drilling of especially long chipping materials and difficult to machine materials usually call for special nose grind geometries, and in some cases, made to order chip breakers, all available from botek.

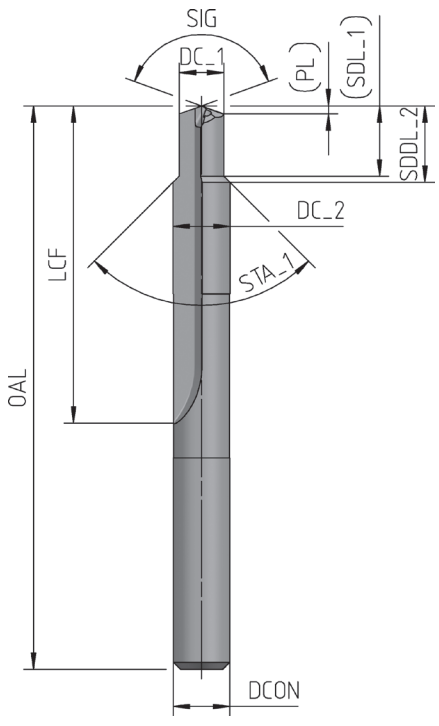


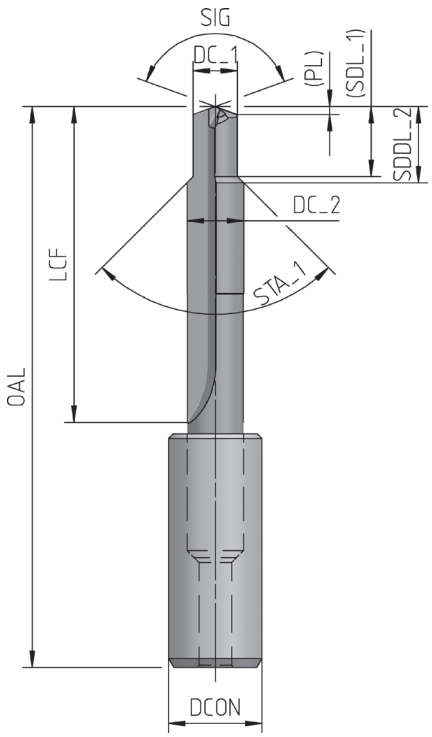
→ Instructions for regrinding: see page 31.

Shank / Driver

Shank	DCON
DIN 6535 HAK 	6 8 10 12 14 16 18 20 25 32
DIN 6535 HBK 	6 8 10 12 14 16 18 20
	25 32
DIN 6535 HEK 	6 8 10 12 14 16 18 20 25 32

Driver	DCON (mm)	LS Driver (mm)
DIN 6535 HAK 	10 12 16 20 25	40 45 48 50 56
DIN 6535 HBK 	10 12 16 20 25	40 45 48 50 56
	32 40	60 70
	10 12 16 20 25 32 40	40 45 48 50 56 60 70
Special driver	as per drawing	as per drawing





Cutting tool data according to ISO 13399

SIG	=	Point angle
DC	=	Cutting diameter
PL	=	Point length
LCF	=	Length chip flute
LS	=	Shank length
OAL	=	Overall length
DCON	=	Connection diameter

Please note:

- DIN 6535 HAK is standard. Other shank or driver designs on request only.
- All shaft forms with optimized tolerance suitable for hydraulic chucks.

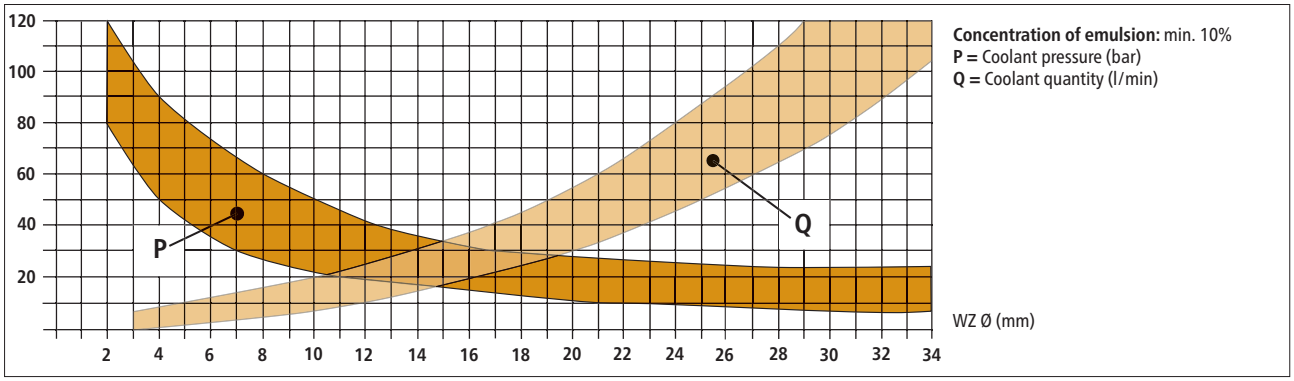
Guide values for drilling of various materials with solid carbide 2-flute drill Type 123

Material	Mechanical strength	Examples	Cutting speed Vc (m/min), Values for drill guided with pilot hole	Cutting speed Vc (m/min), Adjusted Values for drill used without pilot hole				Feed rate f (mm), referred to tool diameter				
				3 x D	5 x D	8 x D	12 x D	3.0-4.99	5.0-7.99	8.0-11.99	12.0-15.99	16.0-20.0
General steel castings	≤ 600 N/mm² ≤ 700 N/mm² > 700 N/mm²	GS 38 GS 52 GS 62	30 - 60 25 - 50 20 - 45	27.0 - 54.0 22.5 - 45.0 18.0 - 40.5	24 - 48 20 - 40 16 - 36	21.0 - 42.0 17.5 - 35.0 14.0 - 31.5	18 - 36 15 - 30 12 - 27	0.05 - 0.15 0.04 - 0.10 0.04 - 0.10	0.05 - 0.20 0.05 - 0.16 0.05 - 0.16	0.10 - 0.22 0.05 - 0.19 0.05 - 0.19	0.10 - 0.25 0.08 - 0.20 0.08 - 0.20	0.10 - 0.28 0.08 - 0.22 0.08 - 0.22
Cast iron/ Grey cast iron	≤ 200 HB	GG 30 GGG 50 GTW 40	70 - 115 70 - 115 70 - 115	63.0 - 103.5 63.0 - 103.5 63.0 - 103.5	56 - 92 56 - 92 56 - 92	49.0 - 80.5 49.0 - 80.5 49.0 - 80.5	42 - 69 42 - 69 42 - 69	0.10 - 0.25 0.10 - 0.25 0.10 - 0.25	0.15 - 0.32 0.15 - 0.32 0.15 - 0.32	0.20 - 0.40 0.20 - 0.40 0.20 - 0.40	0.25 - 0.45 0.25 - 0.45 0.25 - 0.45	0.30 - 0.50 0.30 - 0.50 0.30 - 0.50
	≤ 250 HB	GG 30 GGG 50 GTW 400	60 - 95 60 - 95 60 - 95	54.0 - 85.5 54.0 - 85.5 54.0 - 85.5	48 - 76 48 - 76 48 - 76	42.0 - 66.5 42.0 - 66.5 42.0 - 66.5	36 - 57 36 - 57 36 - 57	0.10 - 0.20 0.10 - 0.20 0.10 - 0.20	0.12 - 0.25 0.12 - 0.25 0.12 - 0.25	0.15 - 0.35 0.15 - 0.35 0.15 - 0.35	0.20 - 0.40 0.20 - 0.40 0.20 - 0.40	0.25 - 0.45 0.25 - 0.45 0.25 - 0.45
	> 250 HB	GG 40 GGG 70 GTS 70	50 - 80 50 - 80 50 - 80	45.0 - 72.0 45.0 - 72.0 45.0 - 72.0	40 - 64 40 - 64 40 - 64	35.0 - 56.0 35.0 - 56.0 35.0 - 56.0	30 - 48 30 - 48 30 - 48	0.10 - 0.20 0.10 - 0.20 0.10 - 0.20	0.12 - 0.25 0.12 - 0.25 0.12 - 0.25	0.15 - 0.35 0.15 - 0.35 0.15 - 0.35	0.20 - 0.40 0.20 - 0.40 0.20 - 0.40	0.25 - 0.45 0.25 - 0.45 0.25 - 0.45
Nodular cast iron	350 HB 450 HB		20 - 55 20 - 55	18.0 - 49.5 18.0 - 49.5	16 - 44 16 - 44	14.0 - 38.5 14.0 - 38.5	12 - 33 12 - 33	0.04 - 0.10 0.04 - 0.10	0.06 - 0.12 0.06 - 0.12	0.08 - 0.15 0.08 - 0.15	0.08 - 0.15 0.08 - 0.15	0.10 - 0.20 0.10 - 0.20
Copper Bronze Brass Plastics		Copper Bronze Brass	60 - 220 60 - 220 60 - 220	54.0 - 198.0 54.0 - 198.0 54.0 - 198.0	48 - 176 48 - 176 48 - 176	42.0 - 154.0 42.0 - 154.0 42.0 - 154.0	36 - 132 36 - 132 36 - 132	0.07 - 0.18 0.07 - 0.18 0.07 - 0.18	0.12 - 0.25 0.12 - 0.25 0.12 - 0.25	0.20 - 0.35 0.20 - 0.35 0.20 - 0.35	0.25 - 0.45 0.25 - 0.45 0.25 - 0.45	0.30 - 0.50 0.30 - 0.50 0.30 - 0.50
Aluminium		< 10% Si	80 - 300	72.0 - 270.0	64 - 240	56.0 - 210.0	48 - 180	0.20 - 0.40	0.20 - 0.40	0.20 - 0.40	0.20 - 0.40	0.20 - 0.40
Aluminium		> 10% Si	70 - 200	63.0 - 180.0	56 - 160	49.0 - 140.0	42 - 120	0.10 - 0.25	0.15 - 0.35	0.25 - 0.45	0.30 - 0.50	0.35 - 0.55

Please note:

- **The guide values mentioned in the cutting parameter tables apply only when using hydraulic chucks and providing good chip removal.**
- Coated drills may produce different chip formation (often longer chips).
- When restarting we recommend an average cutting force Vc (m/rev.), that can be optimized later.
- Use adequate feed rate to produce short but not compressed chips.
- Please see page 30 for further coolant and filtration information.
- High cutting efficiency is only possible if troublefree chip evacuation is guaranteed (see coolant diagram).

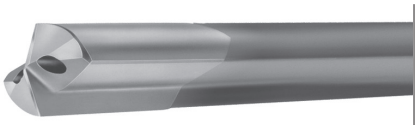
Coolant pressure and Coolant quantity



Please note:

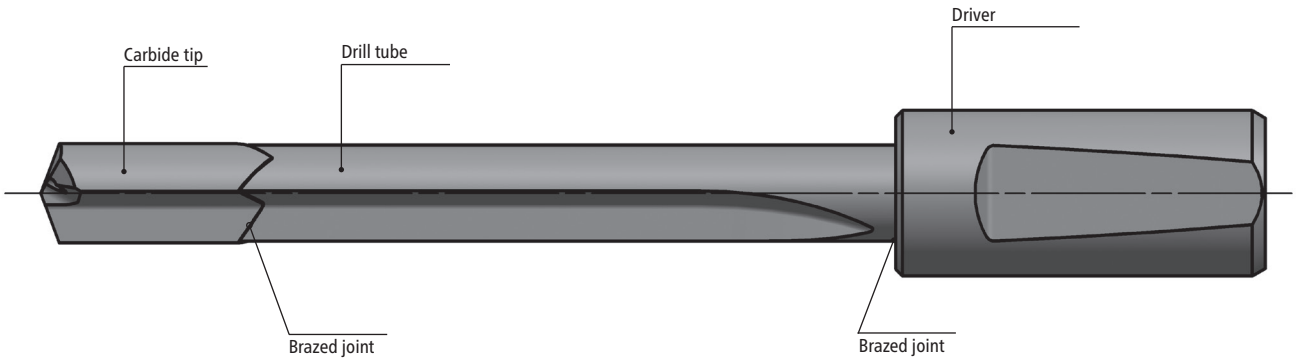
- High alignment precision and surface quality are only achievable, if the tool is clamped optimally (hydraulic chuck), which means the concentricity of the tool must not exceed 0.015 mm once clamped. Please check the concentricity regularly.
- Reduced feed rate during interrupted cut, cross holes and angle entry or exit.

Overview

Type	Tool diameter	
Type 120 2-flute drill with solid carbide tip	tool diameter **4.500 – 43.009 mm** larger dia. on request	
Type 122 Solid carbide 2-flute drill with solid carbide tip	tool diameter **4.500 – 43.009 mm**	
Type 125 2-flute counterboring tool with solid carbide tip	tool diameter **4.000 – 40.000 mm**	
Type 125-03 2-flute counterboring tool with guiding pilot with solid carbide tip and steel shank	tool diameter **5.000 – 40.000 mm**	
Type 120 with PCD cutting edge available on request		

Tool design

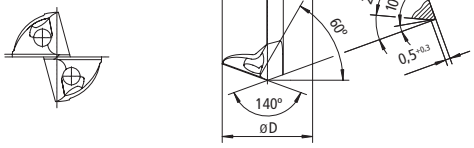
The botek 2-flute drill is fabricated with a drill head section of solid carbide tip, which is brazed to a heat treated tube (flute) section then fitted and brazed to a hardened and ground steel driver.



Standard nose grind

The nose grind geometry affect the following, hole tolerance, chip formation, coolant pressure and flow, tool life, centreline deviation and surface quality. Over the years, botek has successfully tested a number of different nose grinds for drilling various materials.

botek's experience has formed the foundation for the development of our standard nose grind geometries. This meets the requirements of most drilling applications. Deep-hole drilling of especially long chipping materials and difficult to machine materials usually call for special nose grind geometries, and in some cases, made to order chip breakers, all available from botek.



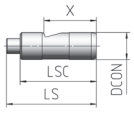
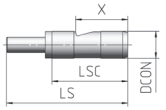
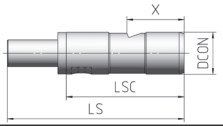
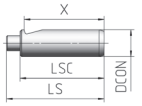
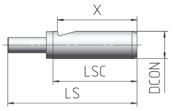
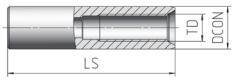
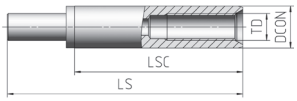
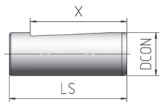
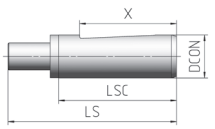
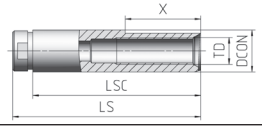
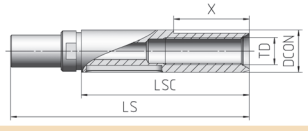
→ Instructions for regrinding: see page 31.

Driver
Type 120 / Type 122 / Type 125

Driver

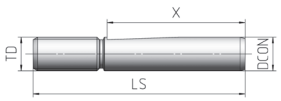
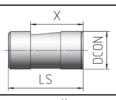
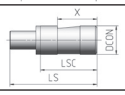
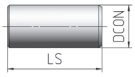
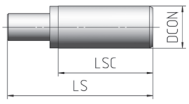
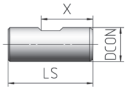
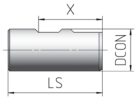
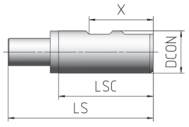
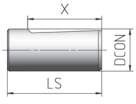
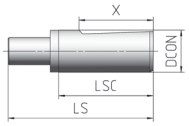
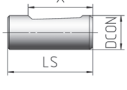
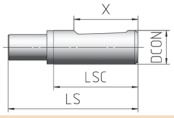
2-flute drills are typically provided with a driver for holding the tool in the machine spindle.
The driver transmits the torque from the machine spindle.
botek provides a variety of standard drivers from stock as well as customer specific configurations.

Standard drivers for 2-flute gundrills with brazed carbide tip – Overview

Designation		Drawing	botek Order No.	for tool length calculation			X = Notch location	M = Thread size
DCON Driver Ø (mm)	Type			Drill dia. range (mm) from - to	LSC Driver	LS Driver with pin		
10			ZH10-00	1.850 - 7.299	40		24.0	
16			ZH16-03	1.850 - 12.399	45	53	31.0	
25			ZH25-00	6.000 - 19.509	70	78	34.0	
10	with pin		ZH10-01	7.300 - 12.399	40	57	24.0	
16			ZH16-04	12.400 - 20.509	45	72	31.0	
25	with pin and drive key		ZH25-01	19.510 - >	70	105	34.0	
16			ZH16-02	1.850 - 12.399	50	58	47.5	
16	with pin		ZH16-33	12.400 - 20.509	50	77	47.5	
10	GKT with metr. thread		ZH10-06	1.850 - 7.299	60			M6x0.5
16			ZH16-15	1.850 - 12.399	80			M10x1
25			ZH25-08	6.000 - 19.509	100			M16x1.5
10	GKT with metr. thread with pin		ZH10-28	7.300 - 12.399	60	77		M6x0.5
16			ZH16-22	12.400 - 20.509	80	105		M10x1
25			ZH25-10	19.509 - >	100	140		M16x1.5
12.7	½"		ZH12,7-00	1.850 - 9.699	38,1		25.3	
19.05	¾"		ZH19,05-01	3.960 - 14.899	70		45.0	
25.4	1"		ZH25,4-00	6.000 - 19.509	70		57.5	
31.7	1¼"		ZH31,7-00	9.700 - 25.609	70		57.5	
38.1	1½"		ZH38,1-00	9.700 - 32.609	70		57.5	
19.05	¾"		ZH19,05-11	14.900 - 24.609	70	97	45.0	
25.4	1"		ZH25,4-01	19.510 - >	70	100	57.5	
31.7	1¼"		ZH31,7-01	25.610 - >	70	110	57.5	
38.1	1½" inch dia. with pin		ZH38,1-01	32.610 - >	70	110	57.5	
10	VDI 3208		ZH 10-44	1.850 - 6.749	60	68	35	M6x0.5
16			ZH 16-31	1.850 - 10.799	80	90	37	M10x1
25			ZH 25-34	6.000 - 19.509	100	112	45	M16x1.5
16	VDI 3208 with pin		ZH 16-66	10.800 - 16.399	80	110	37	M10x1
25			ZH 25-40	19.510 - 42.699	100	142	45	M16x1.5

DCON = Connection diameter LSC = Clamping length LS = Shank length

Standard drivers for 2-flute drills with brazed carbide tip – Overview

Designation		Drawing	botek Order No.	for tool length calculation			X = Notch location	TR = Thread size
DCON Driver Ø (mm)	Type			Drill dia. range (mm) from - to	LSC Driver	LS Driver with pin		
16	Adjustable driver with acme thread		SH16-00	1.850 - 12.899	112		73.0	TR16x1.5
20			SH20-00	1.850 - 14.899	126		82.0	TR20x2
28			SH28-00	6.000 - 21.509	126		82.0	TR28x2
36			SH36-00	8.700 - 28.609	162		109.0	TR36x2
16	Speedbit		ZH16-21	1.850 - 12.399	40		28.0	
25			ZH25-16	6.750 - 19.509	50		35.0	
35			ZH35-00	9.700 - 28.609	60		40.0	
16	Speedbit with pin		ZH16-30	12.400 - 20.509	40	67	28.0	
25			ZH25-20	19.510 - 30.609	50	77	35.0	
35			ZH35-01	28.610 - >	60	100	40.0	
10	DIN 6535-HA		ZH10-40	1.850 - 7.299	40			
12			ZH12-18	1.850 - 8.999	45			
16			ZH16-11	1.850 - 12.399	48			
20			ZH20-01	5.000 - 15.899	50			
25			ZH25-11	6.000 - 19.509	56			
32			ZH32-24	9.700 - 25.600	60			
40	DIN 1835-A40		ZH40-03	9.700 - 32.609	70			
10	DIN 6535-HA or 1835-A with pin		ZH10-41	7.300 - 12.399	40	57		
12			ZH12-19	9.000 - 15.899	45	62		
16			ZH16-20	12.400 - 20.509	48	75		
20			ZH20-60	15.900 - 25.603	50	77		
25			ZH25-21	19.510 - 42.699	56	86		
32			ZH32-23	25.610 - 45.699	60	100		
32			ZH40-04	32.610 - >	70	110		
10	DIN 6535-HB		ZH10-11	1.850 - 7.299	40		23.5	
12			ZH12-07	1.850 - 8.999	45		26.5	
16			ZH16-32	1.850 - 12.399	48		29.0	
20			ZH20-29	1.850 - 15.899	50		30.5	
25	DIN 6535-HB		ZH25-22	6.000 - 19.509	56		38.0	
32	DIN 1835-B32		ZH32-10	9.700 - 25.609	60		43.0	
40	DIN 1835-B40		ZH40-13	9.700 - 32.609	70		47.0	
50	DIN 1835-B50		ZH50-05	15.900 - 42.699	80		54.0	
10	DIN 6535-HB or 1835-B with pin		ZH10-23	7.300 - 12.399	40	57	23.5	
12			ZH12-02	9.000 - 15.899	45	62	26.5	
16			ZH16-53	12.400 - 20.509	48	75	29.0	
20			ZH20-34	15.900 - 25.609	50	77	30.5	
25			ZH25-31	19.510 - >	56	86	38.0	
32			ZH32-11	25.610 - >	60	100	43.0	
40			ZH40-14	32.610 - >	70	110	47.0	
50			ZH50-06	42.700 - >	80	120	54.0	
10	DIN 1835-E		ZH10-20	1.850 - 7.299	40		28.0	
12			ZH12-08	1.850 - 8.999	45		33.0	
16			ZH16-47	1.850 - 12.399	48		36.0	
20			ZH20-40	1.850 - 15.899	50		38.0	
25			ZH25-36	6.000 - 19.509	56		44.0	
32			ZH32-12	9.700 - 25.609	60		48.0	
40			ZH40-18	9.700 - 32.609	70		66.0	
10	DIN 1835-E with pin		ZH10-24	7.300 - 12.399	40	57	28.0	
12			ZH12-05	9.000 - 15.899	45	62	33.0	
16			ZH16-51	12.400 - 20.509	48	75	36.0	
20			ZH20-43	15.900 - 29.609	50	77	38.0	
25			ZH25-37	19.510 - >	56	86	44.0	
32			ZH32-13	25.610 - >	60	100	48.0	
40			ZH40-17	32.610 - >	70	110	66.0	
10	DIN 6535-HE		ZH10-29	1.850 - 7.299	40		28.0	
12			ZH12-13	1.850 - 8.999	45		33.0	
16			ZH16-62	1.850 - 12.399	48		36.0	
20			ZH20-55	1.850 - 15.899	50		38.0	
10	DIN 6535-HE with pin		ZH10-30	7.300 - 12.399	40	57	28.0	
12			ZH12-14	9.000 - 15.899	45	62	33.0	
16			ZH16-70	12.400 - 20.509	48	75	36.0	
20			ZH20-56	15.900 - 29.609	50	77	38.0	

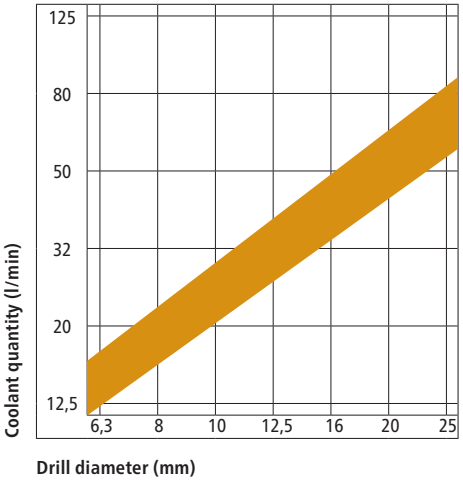
DCON = Connection diameter LSC = Clamping length LS = Shank length

Guide values for drilling of various materials

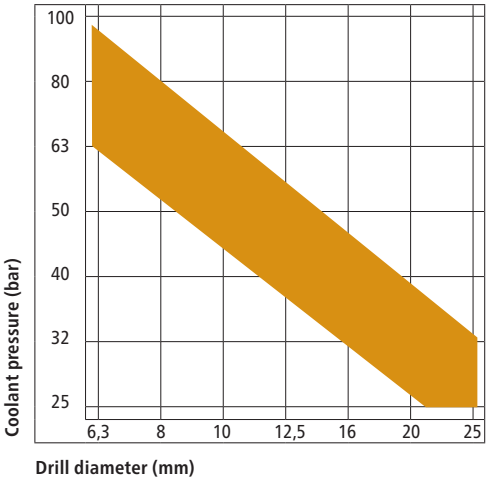
Material groups	Cast iron Grey cast iron (< 300 N/mm²) Nodular cast iron (< 400 N/mm²) Malleable cast iron	Cast iron Grey cast iron (> 300 N/mm²) Nodular cast iron (> 400 N/mm²) Steel castings	Copper Bronze Brass Plastics „short chipping“	Aluminium + Aluminium alloys Si-content > 5% „easily workable“
Cutting speed m/min	70 - 100	60 - 90	70 - 120	100 - 180
Drill diameter (mm)	**Feed rate** (mm) **/ rev.**			
	from - to	from - to	from - to	from - to
6.0 - 7.99	0.04 - 0.08	0.03 - 0.07	0.04 - 0.08	0.06 - 0.13
8.0 - 9.99	0.05 - 0.11	0.05 - 0.10	0.05 - 0.11	0.09 - 0.18
10.0 - 13.99	0.08 - 0.16	0.07 - 0.14	0.08 - 0.16	0.12 - 0.24
14.0 - 17.99	0.10 - 0.21	0.09 - 0.18	0.10 - 0.21	0.16 - 0.32
18.0 - 21.99	0.13 - 0.26	0.10 - 0.21	0.13 - 0.26	0.19 - 0.38
> 22.0	0.15 - 0.31	0.12 - 0.25	0.15 - 0.31	0.22 - 0.44

Cutting speed and feed rate are dependent on tool length, coolant type and materials. In addition, the stability of the machine and workpiece clamping. All figures specified are guide values.

Coolant quantity



Coolant pressure



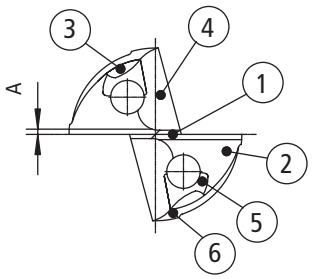
Reliable chip removal is only assured if sufficient coolant is supplied to the tool. The diagrams show our recommendation for coolant pressure and quantity by drill diameter.

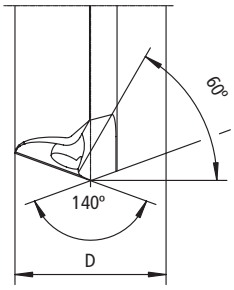
The ideal **viscosity of deep-hole drilling oil** should be 15 mm²/s (60 - 70 SUS) at 40°C for drilling diameters up to 18 mm.

When using emulsion, the specified pressures (p) may be reduced by up to ~ 20 %.

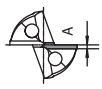
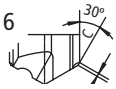
For all drill diameters filtering is required between 5 µm and 20 µm.

Regrinding instruction



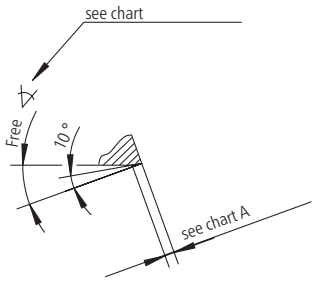


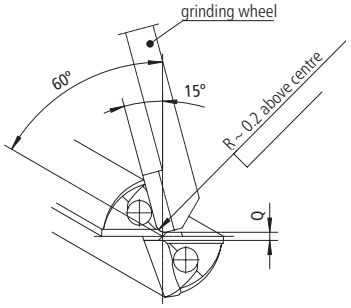
Fixture settings and grinding sequence

Arbeitsgang	Swing	Tilt	Torsion	Gage	Remarks
1 	20°	10°	0°	A	cutting land 2nd edge 180°
2 	20°	Ø 3.000 - 6.009 25° Ø 6.010 - 43.009 20°	0°		relief angle 2nd edge 180°
3 	10°	35°	0°		relief angle 2nd edge 180°
4 	60°	0°	grinding wheel 15°	Q	web thinning 2nd edge 180°
5 	15°	0°	0°		grinding into half of the coolant hole 2nd edge 180°
6 	60°	0°		C	grinding land hand chamfer

Dimensions (mm)

Drill-Ø	A Cutting land	Q Web thickness + 0.1	C Chamfer	R Radius
3.000 - 6.009	0.4	0.4	0.5	1.0
6.010 - 10.009	0.4	0.5	0.5	1.0
10.010 - 15.009	0.5	0.6	0.6	1.5
15.010 - 20.009	0.6	0.8	0.7	2.0
20.010 - 25.009	0.7	0.9	0.8	2.5
25.010 - 30.009	0.8	1.0	0.9	3.0
30.010 - 35.009	0.9	1.1	1.0	3.5
35.010 - 40.009	1.0	1.2	1.1	4.0
40.010 - 43.009	1.1	1.3	1.2	4.5





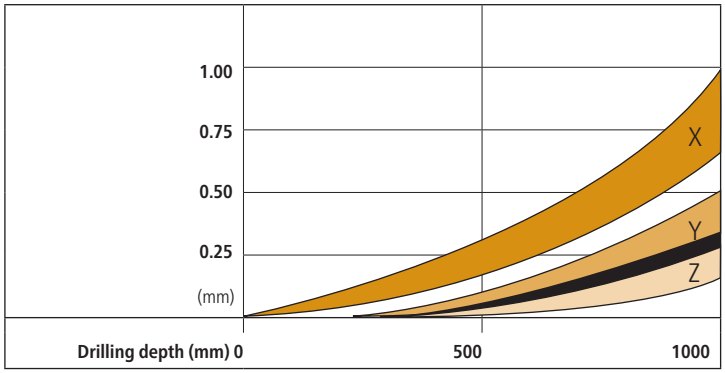
Centerline deviation (drift)

Counter-rotation: The optimum results are achieved with rotating tool and simultaneous workpiece counter-rotation: See "Z"

Workpiece rotating: The next best technique involves the workpiece rotating with the gundrill non-rotating: See "Y"
Tool rotating: See "X"

In all applications tool drift is minimized by using a close fitting pilot bore or guide bushing during gundrilling.
Angular alignment of pilot bore with desired gundrill bore is imperativ.

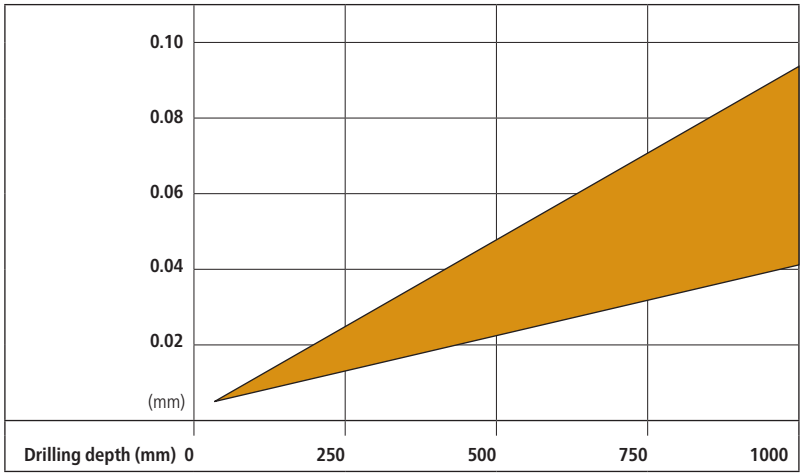
With a guide bushing, alignment and distance from the workpiece are also important.



The data above is based on single flute carbide tipped gundrills. Achieved results may be improved using single flute solid carbide gundrills.

Hole straightness

Whipping or deflection of the gundrill flute plays a decisive role in hole straightness and run out in the workpiece.
Carbide tipped gundrills must be supported by a steady rest or whip guide.
For further information, refer to page 34 and 35.



Roundness

Hole roundness is a primary advantage of gundrilling over conventional twist drilling.
Hole roundness measurements as low as 3 µm are possible.
Best values are at 3 µm (Type 110 ...) .

To achieve optimum drilling results when using carbide tipped or solid carbide gundrills, various criteria must be applied. In addition to tool design, key factors are machine design and construction, process techniques, pressurized and filtered deep hole drilling coolant. Selection of proper cutting parameters is also a significant factor.

The key factors botek considers when designing gundrills:

- Material type
- Diameter, tolerance and surface finish
- Peripheral contour
- Carbide grade and coating
- Nose grind geometry

In addition to our refined manufacturing and technology for consistent product quality, our application and technical experience help you realize optimal solutions.

Achievable drilling tolerances

Non ferrous metals	Material									
Aluminium alloys (depending on Si-content)										
Tool steel										
Cast iron (Grey + Nodular)										
Heat treatable steel										
Nitriding steel										
Free machining steel										
Case-hardening steel										
Drilling quality area	**IT**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**

(guide values)

under normal conditions
under favourable conditions

Surface quality

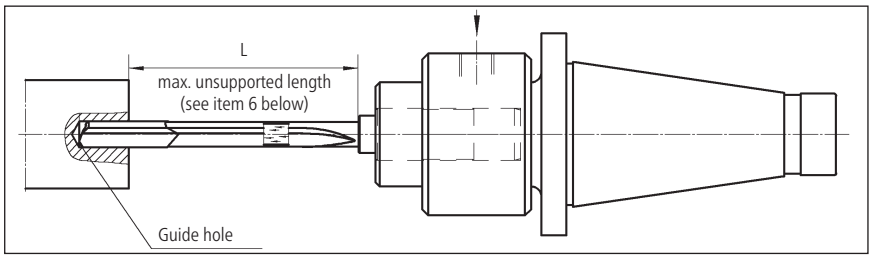
Roughness class		N8	N7	N6	N5	N4	N3
Quality area							
Surface roughness values	Rt µm	21	11.5	6.2	3.4	1.9	1.0
	Ra µm	3.2	1.6	0.8	0.4	0.2	0.1
	Rz µm	14	7.6	4.5	2.2	1.2	0.65

(guide values)

under normal conditions
under favourable conditions

1. **Before using the drills make sure the machine has the necessary equipment to do proper deep hole drilling. The machine should have suitable safety guarding for protection from cutting chips and coolant for operator.** Check with machine builder!
2. **Improper use or handling of deep hole drilling tools can cause serious injuries,** e. g. skin cuts from the cutting edge.
3. Deep hole drilling tools are not self centering and can be unbalanced. Therefore the drills must be guided **during the start of the drilling cycle** by means of a sufficiently long drill bush or pilot hole (see detail "Z" on below illustration).
   For information on the guide hole (pilot hole) see page 5.

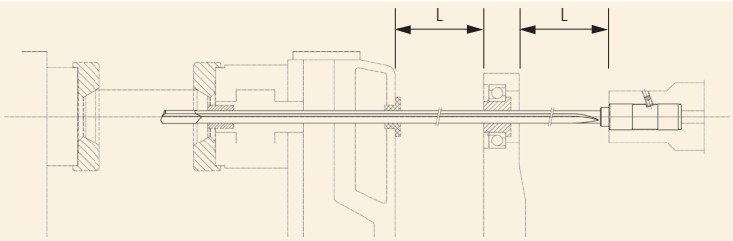
y



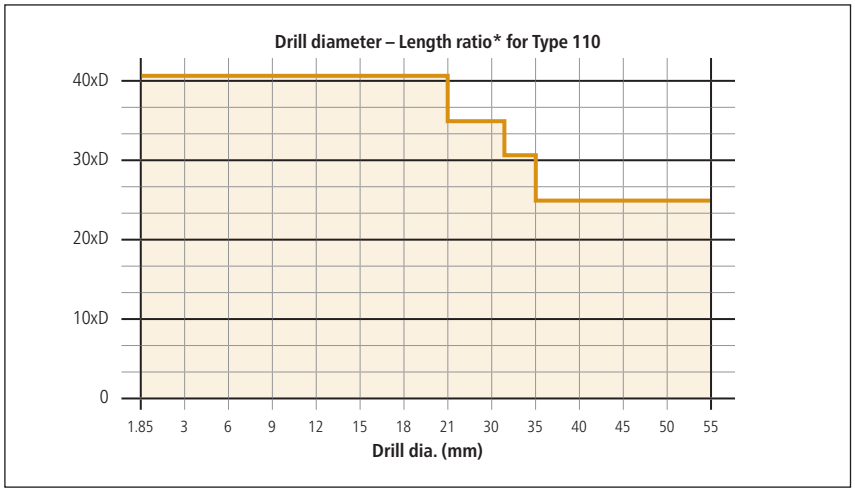
4. The gundrill is fed into drill bush or pilot hole **while non rotating** or rotated slowly at < 50 RPM. Then the coolant and the machine spindle should get started.
5. **After reaching the drilling depth** switch off the coolant and retract with the spindle stopped or slowly rotated at < 50 RPM.

6a. **Tool support: unsupported drill length** should **never** exceed the dimensions as shown on table (6a). If the unsupported drill length is exceeded the drill might cause injury.

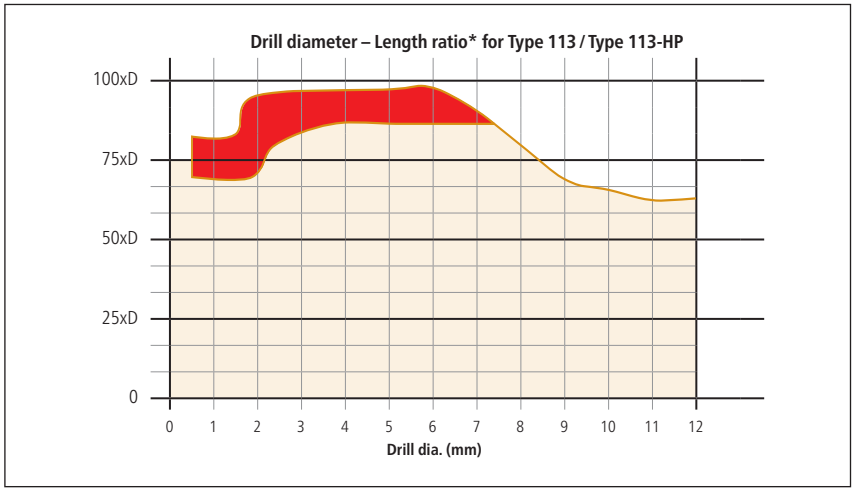
6b. **Guide values for tool support of botek deep hole drilling tools (gundrills):**

Maximum unsupported drill length (L) between the steady rests or in a guide hole		**Single flute gundrills:** Type 110 with brazed drill head Type 113 / Type 113-HP solid carbide gundrill

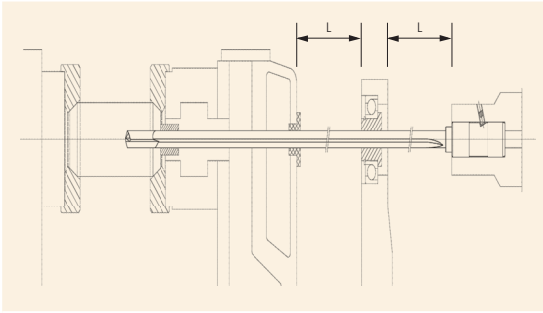
Example 1: Type 110: drill diameter D = 2.0 mm, unsupported drill length up to maximum 80 mm = 40 x D
Example 2: Type 110: drill diameter D = 2.0 mm, 1st whipguide bush at approx. 80 mm length (L), distance between 1st whipguide bush and chip box approx. 80 mm (L)



For applications with a pilot hole please refer to the recommendations on page 5 „dimensions for the guide hole".
* Length ratio ≙ max. unsupported length (see point 3)



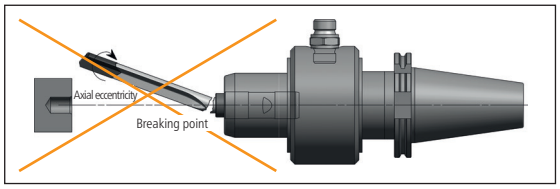
The area marked red indicates a critical zone, where feed rate (max. 25 % of value given in catalogue) and especially rotational speed (50 %) must be reduced.
That means: A tool with a dia. 1.6 mm can only be increased to the value given in the catalogue once the unsupported length is shorter as 70 x Dia.
From dia. 7.0 mm onwards the length – diameter ratio is within acceptable limits.
For applications with a pilot hole please refer to the recommendations on page 5 „dimensions for the guide hole".
* Length ratio ≙ max. unsupported length (see point 3).



2-flute drill	Drill dia. = D (mm)	Maximum unsupported drill length (L)
Solid carbide design	2.800 - 6.999	approx. 80 x D
	7.000 - 12.000	approx. 55 x D
	12.001 - 20.000	approx. 50 x D
with brazed drill head	4.000 - 9.999	approx. 60 x D
	10.000 - 19.999	approx. 55 x D
	20.000 - 43.009	approx. 50 x D

Brazed version: Up to Ø 17.5: maximum tool length of 2700 mm possible. From Ø 17.5: up to 4500 mm total length.

7. Grinding of carbide produces dust (cobalt, etc.) that may be potentially hazardous. Use adequate ventilation and safety glasses during grinding to make sure that the legal limit of pollution is given.
8. **Consequences of not following** our application notes No 1 – 6a



Using botek gundrills other than directed may cause personal injury.
Tool breakage and unsupported gundrills can be extremely dangerous.

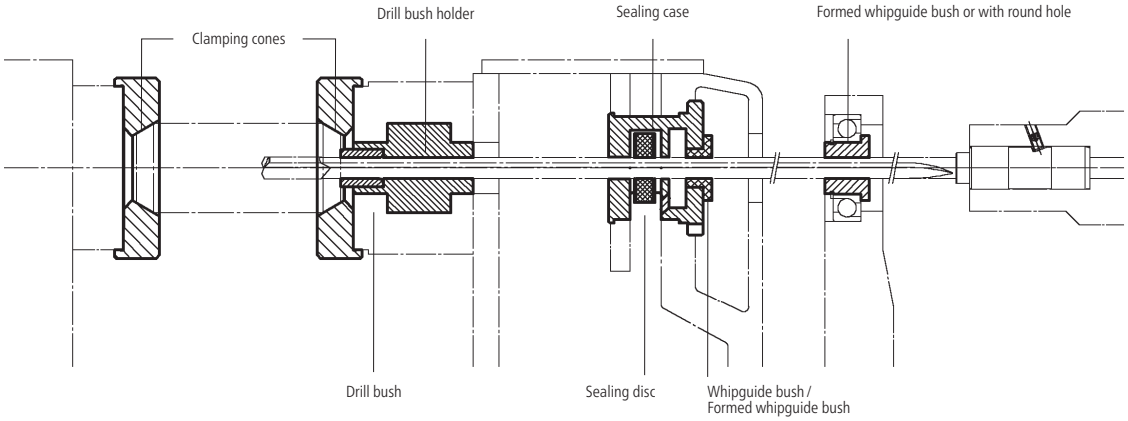
Please use with caution and care.

Please note that all application notes and values contained herein are intended as guidelines only. We do not accept any liability for damages caused by improper handling of botek deep hole drilling tools, operating errors, unsuitable machinery or misuse while using our tools!

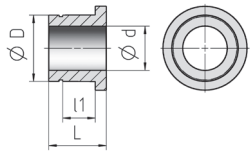
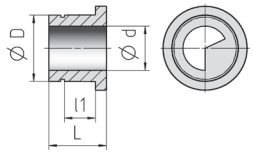
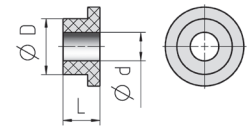
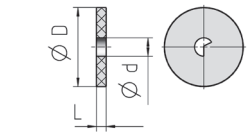
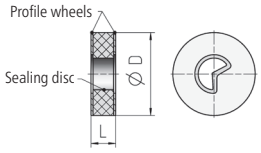
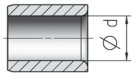
Do you have any further queries? **Please contact us via our Technical Hotline ELB: P +49 7123 3808-300.**
We will be pleased to offer you advice.

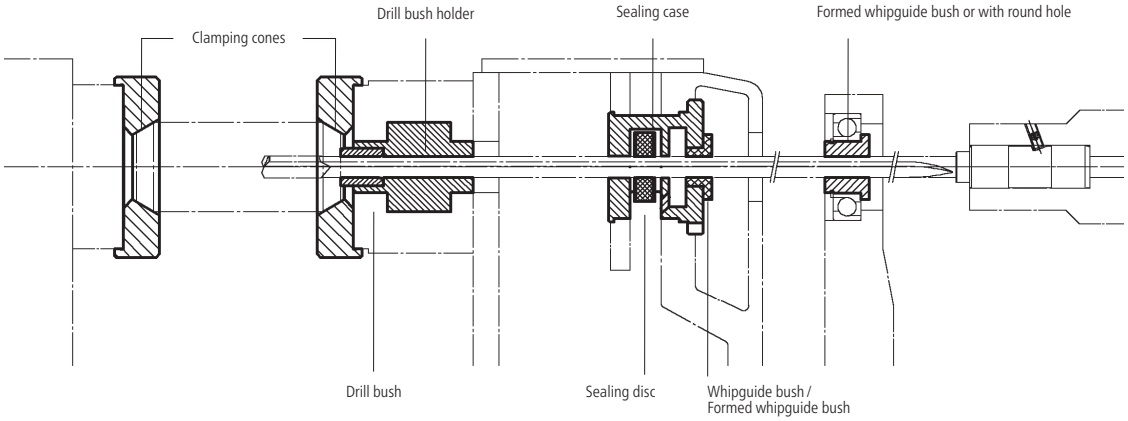
Consumable accessories

Type 113 / Type 113-HP / Type 110 / Type 112 / Type 114 / Type 115

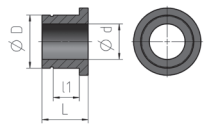
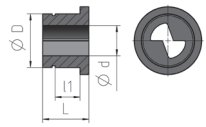
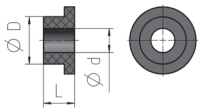
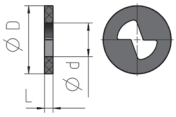
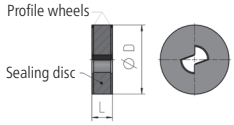
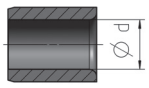


Clamping cones in various designs made from hardened tool steel available ex stock.

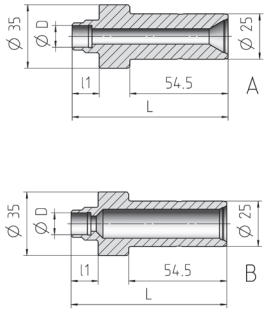
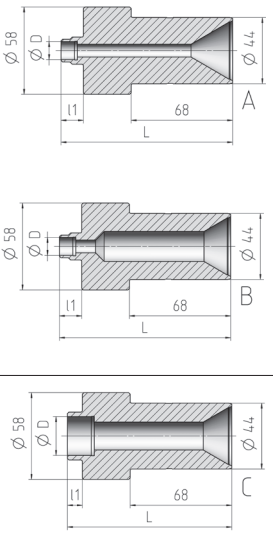
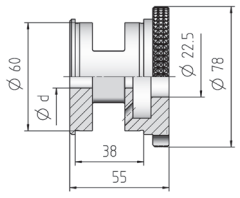
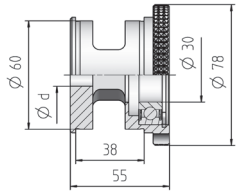
Whipguide bush	**Tool dia.** (mm)	D	L	l1	d	Drawing No.	**botek Order No.**
	1.850 - 11.799	20	22	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-2650	792 000 508
	1.850 - 15.399	25	22	12		170-05-4-1060	792 000 509
	1.850 - 25.609	30	26	16		170-05-4-1238	792 000 511
	1.850 - 36.699	45	26	14		170-05-4-1341	792 000 512
	1.850 - 25.609	35	26	14		170-05-4-2227	792 000 510
	1.850 - 25.609	30	26	13		170-05-4-2278	792 000 513
	1.850 - 36.699	45	26	16		170-05-4-2279	792 000 514
	1.850 - 32.600	40	26	15		170-05-4-3897	792 000 515
Formed whipguide bush	**Tool dia.** (mm)	D	L	l1	d	Drawing No.	**botek Order No.**
	3.960 - 12.399	20	20	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-1809	792 000 516
	4.750 - 22.609	30	26	14		170-05-4-1810	792 000 517
	4.750 - 22.609	30	26	16		170-05-4-1818	792 000 518
	7.800 - 36.699	45	26	16		170-05-4-1812	792 000 519
	29.610 - 50.000	75	40	20.3		170-05-4-1816	792 000 520
Whipguide bush	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	1.850 - 12.399	22.6	15		Please specify **tool dia.** when ordering	170-06-4-1180	792 000 535
Sealing disc	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	1.850 - 5.749	20	3		Please specify **tool dia. and outer dia. (D)** when ordering	170-07-1572	792 000 500
	3.960 - 5.749	32	3				792 000 501
	5.750 - 20.509	32	4				792 000 501
	5.750 - 25.609	40	4				792 000 502
	23.610 - 49.999	90	4				792 000 503
Special sealing disc	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	2.900 - 5.249	20	7		Please specify **tool dia.** when ordering	170-07-4-3885	792 000 504
	5.250 - 16.399	32	11			170-07-4-3886	792 000 505
	16.400 - 25.999	40	12			170-07-4-3887	792 000 506
	26.000 - 40.999	90	12			170-07-4-2708	792 000 507
Drill bushings					d	Drawing No.	**botek Order No.**
	Cylindrical drill bushings to DIN 179-A in middle version made from hardened tool steel **Special drill bushings on request**				Please specify **tool dia.** when ordering	170-04	



Clamping cones in various designs made from hardened tool steel available ex stock.

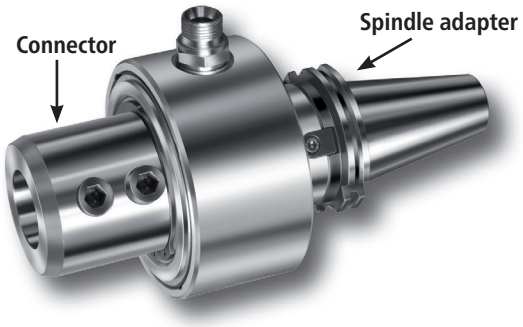
Whipguide bush	**Tool dia.** (mm)	D	L	l1	d	Drawing No.	**botek Order No.**
	1.850 - 11.799	20	22	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-2650	792 000 508
	1.850 - 15.399	25	22	12		170-05-4-1060	792 000 509
	1.850 - 25.609	30	26	16		170-05-4-1238	792 000 511
	1.850 - 36.699	45	26	14		170-05-4-1341	792 000 512
	1.850 - 25.609	35	26	14		170-05-4-2227	792 000 510
	1.850 - 25.609	30	26	13		170-05-4-2278	792 000 513
	1.850 - 36.699	45	26	16		170-05-4-2279	792 000 514
	1.850 - 32.600	40	26	15		170-05-4-3897	792 000 515
Formed whipguide bush	**Tool dia.** (mm)	D	L	l1	d	Drawing No.	**botek Order No.**
	5.000 - 12.399	20	20	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-1813	792 000 533
	5.000 - 22.899	30	26	14		170-05-4-1814	792 000 522
	7.800 - 27.000	45	26	16		170-05-4-1815	792 000 534
Whipguide bush	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	1.850 - 12.399	22.6	15		Please specify **tool dia.** when ordering	170-05-4-1180	792 000 535
Sealing disc	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	5.000 - 20.509	32	4		Please specify **tool dia. and outer dia. (D)** when ordering	170-07-4-1417	
	5.000 - 27.000	40	4				
Special sealing disc	**Tool dia.** (mm)	D	L		d	Drawing No.	**botek Order No.**
	5.000 - 5.749	32	12		Please specify **tool dia.** when ordering	170-07-4-142204	
	5.750 - 6.749					170-07-4-142205	
	6.750 - 7.599					170-07-4-142206	
	7.600 - 8.699					170-07-4-142207	
	8.700 - 9.999					170-07-4-142208	
	10.000 - 11.299					170-07-4-142209	
	11.300 - 12.899					170-07-4-142210	
	12.900 - 14.399					170-07-4-142211	
	14.400 - 16.399					170-07-4-142212	
	16.400 - 17.899	40				170-07-4-142213	
	17.900 - 20.799					170-07-4-142214	
	20.800 - 22.899					170-07-4-142215	
	22.900 - 24.899					170-07-4-142216	
	24.900 - 27.000					170-07-4-142217	
Drill bushings					d	Drawing No.	**botek Order No.**
	Cylindrical drill bushings to DIN 179-A in middle version made from hardened tool steel **Special drill bushings on request**				Please specify **tool dia.** when ordering	170-04	

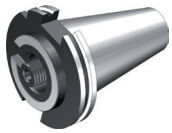
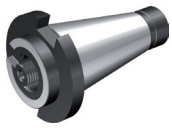
Consumable accessories

Drill bush holder (small) in versions A and B (depending on drilling range)	Drilling range (mm) from - to	L	l1	Version	d	botek Order No. and version
	**0.500 - 2.699**	88.5	17	**A or B**	Please specify **tool dia. and version** when ordering	170-03-3-2538 A, B
	2.700 - 5.099	87.5	16			
	5.100 - 8.099	86.5	15			
	8.100 - 12.099	88.5	14			
	12.100 - 15.099	83.5	12			
	15.100 - 18.099	81.5	10			
Drill bush holder (large) in versions A, B and C (depending on drilling range)	**Drilling range** (mm) **from - to**	**L**	**l1**	**Version**	**d**	**botek Order No. and version**
	**1.800 - 2.699**	117	17	**A or B**	Please specify **tool dia. and version** when ordering	170-03-3-2979 A, B or C
	2.700 - 5.099	116	16			
	5.100 - 8.099	115	15			
	8.100 - 12.099	114	14			
	12.100 - 15.099	112	12			
	15.100 - 18.099	110	10			
	18.100 - 30.099	106	6	**C**		
	30.100 - 35.099	103	-			
Sealing case	**Tool dia.** (mm)	d				**botek Order No.**
	Whipguide bush with round hole for **dia. 1.850 - 12.399**	Please specify **tool dia.** when ordering Note: **Tools with dia. 1.850-12.399 can be supported with a whipguide bushing.** **Whipguide bush and sealing disc to be ordered separately**				170-01-03-1570
Sealing case (with bearing)	**Tool dia.** (mm)	d				**botek Order No.**
	with whipguide bush for **dia. 1.850 - 25.609** formed whipguide bush for **dia. 5.750 - 22.609**	Please specify **tool dia.** when ordering **Whipguide bush with round hole or formed whipguide bush** (max. outer dia. 30 mm) **and sealing disc to be ordered separately**				170-01-4-1809

High pressure (on request)
93-014 / 93-015
Drill range Ø 2.5 - 25 mm
- to 100 bar
- High suitable for botek deep hole drilling tools Type 110 / Type 113 / Type 01

Low pressure / high amount
93-003
Drill range Ø 9.90 - 115.00 mm
- Coolant flow up to 250 l/min.
- High suitable for botek deep hole drilling tools Type 01 / 02 / 07 / 07A / 08 / 09



Connector for driver	Technical information	Spindle adapter	
Weldon 25 Order No. 93-003200-2563	**Rotational speed:** 4500 RPM **Coolant pressure:** 100 bar **Recommended filtration:** 30 µm **Coolant quantity:** 100 l/min	**DIN 69871-1 / ISO 7388-1 A40** Order No. 97-2001-4063050 **DIN 69871-1 / ISO 7388-1 A50** Order No. 97-2001-5063027 **MAS 403 BT ISO 50** Order No. 97-2006-5063040 **DIN 2080-1 A50** Order No. 97-2003-5063027 **DIN 69893-1 / ISO 12164-1 HSK A63** Order No. 97-2004-6363090 **DIN 69893-1 / ISO 12164-1 HSK A100** Order No. 97-2004-10063090 **Capto C6 / ISO 26623-1 PSC 63** Order No. 97-2005-C6-V63080	 
Weldon 25 Order No. 93-003400-2563	**Rotational speed:** max. 3000 RPM **Coolant pressure:** max. 20 bar **Recommended filtration:** 30 µm **Coolant quantity:** max. 160 l/min		
Weldon 32 Order No. 93-003400-3263			
Weldon 40 Order No. 93-003600-4080	**Rotational speed:** max. 2000 RPM **Coolant pressure:** max. 12 bar **Recommended filtration:** 30 µm **Coolant quantity:** max. 250 l/min	**DIN 69871-1 / ISO 7388-1 A50** Order No. 97-2001-5080027 **DIN 69871-1 / ISO 7388-1 A60** Order No. 97-2001-6080030 **MAS 403 BT ISO 50** Order No. 97-2006-5080040 **DIN 2080-1 A50** Order No. 97-2003-5080027 **DIN 69893-1 / ISO 12164-1 HSK A100** Order No. 97-2004-10080090 **Capto C8 / ISO 26623-1 PSC 80** Order No. 97-2005-C8-V80065	 
Weldon 50 Order No. 93-003600-5080			

additional spindle adapters on request

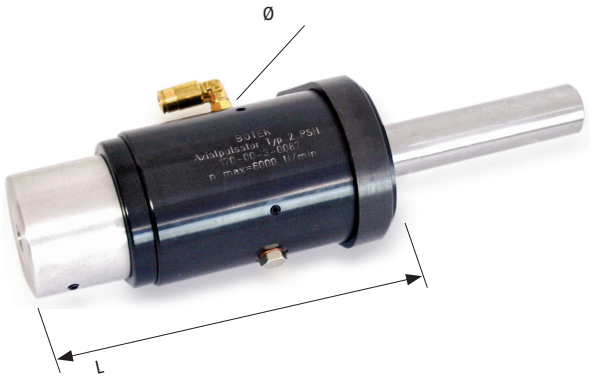
Axial-Pulsator

The botek „Axial Pulsator" has been developed to increase the feed rate of straight fluted deep hole drilling tools, particulary drilling steel and other long chipping materials.

The typical quality characteristics of single flute and 2-flute gundrills like excellent surface finish, minimum run out, hole straightness and hole roundness and high process reliability can be achieved very economical in combination with the „Axial Pulsator".

Large Pulsator

Drill diameter: 4.0 mm to 12.0 mm
Max. speed: 6,000 RPM
Adjustable only by manufacturer (only stroke)
Ø: 70 mm
Weight: 4.4 kg
L: 160 mm



Small Pulsator

Drill diameter: up to 4.0 mm
Max. speed: 11,000 RPM
Adjustable stroke
Ø: 50 mm
Weight: 1.3 kg
L: 137.5 mm

Alternative measurements on request.

Application example

Copper	without Pulsator	with Pulsator	with Pulsator
Tool	Single flute gundrill Type 110	Single flute gundrill Type 110	Solid carbide 2-flute drill Type 123
Diameter (mm)	8.0	8.0	8.0
V_f (mm/min)	40	120	200
Steel	**without Pulsator**	**with Pulsator**	**with Pulsator**
Tool	Single flute gundrill Type 110	Single flute gundrill Type 110	Solid carbide 2-flute drill Type 123
Diameter (mm)	8.0	8.0	8.0
V_f (mm/min)	90 - 100	150 - 180	200 - 1000

Above mentioned values are guide values which could differ from your application.

Do you have any questions?
Please call our **Technical Hotline ELB** +49 7123 3808-300 and we will be happy to assist you.

Coolant pressure gauging-kit for machining centres and deep hole drilling machines

Quite often the set value at the pressure gauge is not reflecting the value that actually reaches the tool.
Numerous sources for errors such as leaking valve parts, faulty rotating connectors or snapped hose lines are not visible on first sight. Leading to a decreased coolant pressure, this could influence the drilling result negatively.

The gauging-kit developed by botek measures the real pressure – directly at the spindle / tool (up to a max. of 160 bar).

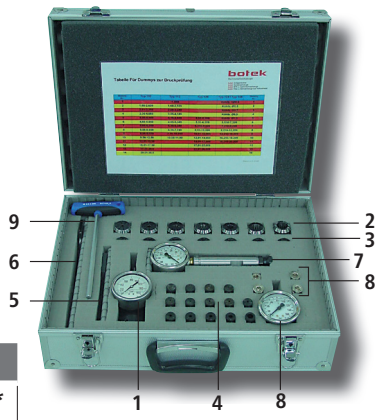
The following methods are available:

1. Measurement of the machine pump performance:

By means of a tool dummy a tool-independent check can be carried out – a big advantage.

2. Measurement with the tool:

The tool dummy is replaced by the actual drill.
The pressure can be checked directly at the tool.



For machining centres:		
Spindle adaptor for collect chuck ER-32 with cylindrical shaft Ø 16.0 (h5) mm / Ø 20.0 (h5) mm / Ø 25.0 (h5) mm, **incl. nut** for sealing disc assembly	1 pc.	**1***
Collet chucks ER 32 (4 / 6 / 8 / 10 / 12 / 16 / 20 mm)	7 pcs.	**2**
Sealing discs (4 / 6 / 8 / 10 / 12 / 16 / 20 mm)	7 pcs.	**3**
Dummies for tool simulation	14 pcs.	**4**
Open end wrench for adaptor	1 pc.	**5**
Wrench for nut	1 pc.	**6**
For deep hole drilling machine:		
Special adaptor for driver 25x100 / 112 as per VDI 3208 (ZH25-34)*. The adaptor can be modified to suit different drivers, **if required**.	1 pc.	**7***
Smaller lathe and machining centres:		
Dummy adaptor Ø 10.0 mm / Ø 45.0 mm incl. 4 dummies	adaptor and 4 dummies	**8***
Allen key, size 8	1 pc.	**9**
Aluminium case	1 pc.	

* Manometers with ″drag-indicator″ are available for an additional charge. (This device can be used when no line of sight is possible during the actual measurement)

Grinding machine

Single-station grinding machine Type MS-01

- for grinding small batches
- very stable and versatile machine
- can easily be installed on a table or cabinet at any time
- problem-free installation of the grinding stations Type ZS or PS

Order No.: 729000105

Technical data	
Longitudinal travel table	250 mm
Cross table travel	160 mm
Vertical adjustment of wheel head	160 mm
Speed of wheel	2850 rev/min
Maximum diameter of wheel	150 mm
Voltage*	380 V/50 Hz/3PH
Colours	RAL 7035 Lightgrey
*special voltage on request	

Multi-station grinding machine MS-12 and MS-12/3

Larger batches of tools with same point geometry can be ground highly efficiently on the **botek multi-station grinding machine MS-12.**

The machine is suitable for **tool dia. 1.850 to 12.000 mm and tool lengths up to approx. 1.000 mm.**

After a once-off adjustment of the stations you can – simple and fast – obtain consistent and economical regrinding results.

The botek grinding machine is available in two versions:

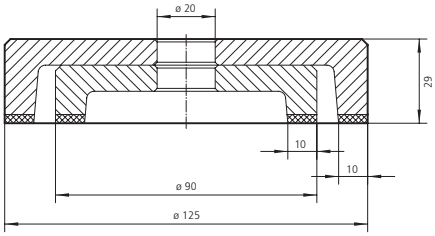
MS-12	MS-12/3
	
2 spindles Tool dia. 1.85 - 12.000 mm Tool length approx. 1.000 mm Order No. 729000117	**3 spindles** Tool dia. 1.85 - 12.000 mm Tool length approx. 1.000 m Order No. 729000262
Special voltage on request	

botek grinding fixture ZS / PS

Using **botek grinding fixtures,** single flute gundrills can be reground on any good tool grinding machine. Depending on tool diameter, botek grinding fixtures are available as Model ZS (see illustration above) or Model PS (for solid carbide gundrills).

Double grinding wheel

The double grinding wheel is ideal for re-sharpening single flute gundrills up to 45 mm diameter. The coarse grain of the outer wheel is for roughing the tool with high stock removal and minimum heating of the tool. The fine grain of the inner grinding wheel provides optimum surface finish with light stock removal.

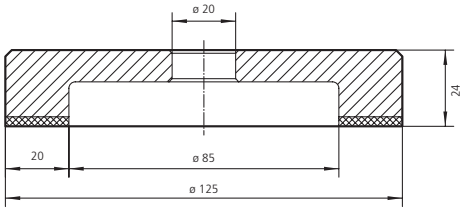


Remark: we recommend re-sharpening gundrill diameters **larger** than 32 mm on **bigger** machines.

Ø-range	Outside-Ø	Internal-Ø	Grinding pattern	Order No.
2.001 - 45.0 mm	125 mm	20.0 mm	for a normal surface	125000212
	90 mm			125000213
2.001 - 45.0 mm	125 mm	20.0 mm	for a finer surface	125000212
	90 mm			125000217

Cup wheel

For re-sharpening single flute gundrills within a diameter range from 0.5 to 2.0 mm a cup wheel is most suitable. The grain of the wheel is chosen to keep an excellent grinding quality and sufficient stock removal without overheating the tool.



Ø-range	Order No.
0.500 - 2.000 mm	125000218

You can find more information in the catalogue "Grinding machine / Grinding fixture".

Stock Program

Solid carbide gundrill – High Performance tool design Type 113-HP

Particularly suitable for the use on machining centers (with Emulsion) – Ex stock*

Carbide grade: HP1

Nose grind: < Ø 5.0 = SA-0504 ≥ Ø 5.0 = SA-0503

Peripheral contour: C

Driver: Ø 10 x 40 / 55 mm DIN 6535-HA10 (ZH10-51) from tool dia. 8 mm without driver
Tolerance for driver / toolshaft: h6 (suitable for hydraulic chucks and shrink fit holders)

TIN-coated

DC	Shaft	20 x D			30 x D			40 x D		
		OAL	Drilling depth	LCF	OAL	Drilling depth	LCF	OAL	Drilling depth	LCF
2.00					145	60	88	165	80	108
					702 002 100			702 002 101		
3.00		150	60	93	180	90	123	210	120	153
		702 002 102			702 002 103			702 002 104		
4.00		170	80	113	210	120	153	250	160	193
		702 002 105			702 002 106			702 002 107		
5.00		195	100	138	245	150	188	295	200	238
		702 002 108			702 002 109			702 002 110		
6.00		215	120	158	275	180	218	335	240	278
		702 002 111			702 002 112			702 002 113		
7.00					310	210	248			
					702 002 114					
8.00	Ø 8x40				340	260	300	420	340	380
					702 002 115			702 002 134		
9.00	Ø 8x40	260	180	220						
		702 002 116								
10.00	Ø 10x40				380	300	340	480	400	440
					702 002 117			702 002 135		

*While stock lasts – Subject to prior sale

Particularly suitable for the use on deep hole drilling machines (with drilling oil) – Ex stock*

Carbide grade: HP1

Nose grind: SA-0504

Peripheral contour: G

Driver: Ø 10 x 40 / 55 mm DIN 6535-HA10 (ZH10-51)

XT-coated

DC	20 x D			25 x D			40 x D			50 x D			55 x D			60 x D		
	OAL	Drill. depth	LCF	OAL	Drill. depth	LCF	OAL	Drill. depth	LCF	OAL	Drill. depth	LCF	OAL	Drill. depth	LCF	OAL	Drill. depth	LCF
1.5				110	38	53							195	83	138			
				702 002 118									702 002 119					
2.0	115	40	58													195	120	138
	702 002 120															702 002 121		
2.5	130	50	73													230	150	173
	702 002 122															702 002 123		
3.0	145	60	88													265	180	208
	702 002 124															702 002 125		
4.0	175	80	118													335	240	278
	702 002 126															702 002 127		
5.0	205	100	148				305	200	248				380	275	323			
	702 002 128						702 002 129						702 002 130					
6.0	235	120	178				355	240	298	405	300	348				475	360	418
	702 002 131						702 002 132			702 002 133						702 002 136		

*While stock lasts – Subject to prior sale

Nose grind: Standard nose grind
Peripheral contour: G
Driver: Ø 10 x 40 / 55 mm DIN 6535-HA10 (ZH10-51)
Uncoated
Ex stock*

DC	25 x D			35 x D			55 x D		
	OAL		LCF	OAL		LCF	OAL		LCF
	Over all length	Drilling depth	Flute length	Over all length	Drilling depth	Flute length	Over all length	Drilling depth	Flute length
1.50	115	38	58	130	53	73	160	83	103
	702 001 100			702 001 101			702 001 102		
1.60	115	40	58	130	56	73	160	88	103
	702 001 103			702 001 104			702 001 105		
2.00	130	50	73	150	70	93	190	110	133
	702 001 106			702 001 107			702 001 108		
2.50	145	63	88	170	88	113	220	138	163
	702 001 109			702 001 110			702 001 111		

*While stock lasts – Subject to prior sale

Nose grind: Standard nose grind
Peripheral contour: G
Driver: Ø 10 x 40 / 55 mm DIN 6535-HA10 (ZH10-51)
XT-coated
Ex stock*

DC	25 x D			35 x D			45 x D			55 x D		
	OAL		LCF	OAL		LCF	OAL		LCF	OAL		LCF
	Over all length	Drilling depth	Flute length	Over all length	Drilling depth	Flute length	Over all length	Drilling depth	Flute length	Over all length	Drilling depth	Flute length
3.00	160	75	103	190	105	133				250	165	193
	702 001 112			702 001 113						702 001 114		
3.50	175	88	118	210	123	153	245	158	188			
	702 001 115			702 001 116			702 001 117					
4.00	185	100	128	225	140	168	265	180	208			
	702 001 118			702 001 119			702 001 120					
5.00	215	125	158	265	175	208	315	225	258			
	702 001 121			702 001 122			702 001 123					
6.00	240	150	183	300	210	243	360	270	303			
	702 001 124			702 001 125			702 001 126					

*While stock lasts – Subject to prior sale

The stock program of express line includes the following tools*:

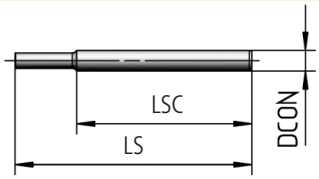
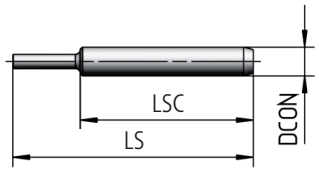
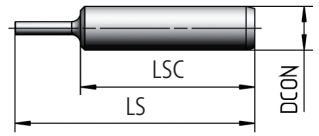
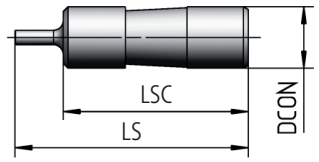
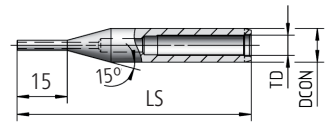
DC	Flute length LCF (mm)					
	20 - 52	53 - 77	78 - 100	101 - 157	158 - 237	238 - 327
0.50	X	X	X			
0.55	X	X	X			
0.60	X	X	X			
0.65	X	X	X			
0.70	X	X	X			
0.75	X	X	X			
0.80	X	X	X			
0.85	X	X	X			
0.90	X	X	X	X		
0.95		X	X	X	X	
1.00		X	X	X	X	
1.05		X	X	X	X	
1.10		X	X	X	X	
1.15		X	X	X	X	
1.20		X	X	X	X	
1.25		X	X	X	X	
1.30		X	X	X	X	
1.35		X	X	X	X	
1.40		X	X	X	X	
1.45		X	X	X	X	
1.50		X	X	X	X	
1.55		X	X	X	X	
1.60		X	X	X	X	
1.65		X	X	X	X	
1.70		X	X	X	X	
1.75		X	X	X	X	
1.80		X	X	X	X	
1.85		X	X	X	X	
1.90		X	X	X	X	
1.95		X	X	X	X	
2.00		X	X	X	X	
2.05		X	X	X	X	
2.10		X	X	X	X	
2.15		X	X	X	X	
2.20		X	X	X	X	
2.25		X	X	X	X	
2.30		X	X	X	X	
2.35		X	X	X	X	
2.40		X	X	X	X	
2.45		X	X	X	X	
2.50		X	X	X	X	
2.55		X	X	X	X	
2.60		X	X	X	X	
2.65		X	X	X	X	
2.70		X	X	X	X	
2.75		X	X	X	X	
2.80		X	X	X	X	
2.85		X	X	X	X	
2.90		X	X	X	X	
2.95		X	X	X	X	
3.00		X	X	X	X	X
3.05		X	X	X	X	
3.10		X	X	X	X	X
3.15		X	X	X	X	
3.20		X	X	X	X	X
3.25		X	X	X	X	

Intermediate dimensions on request
*While stock lasts – Subject to prior sale

DC	Flute length LCF (mm)					
	20 - 52	53 - 77	78 - 100	101 - 157	158 - 237	238 - 327
3.30		X	X	X	X	X
3.35		X	X	X	X	
3.40		X	X	X	X	X
3.45		X	X	X	X	
3.50		X	X	X	X	X
3.55		X	X	X	X	
3.60		X	X	X	X	X
3.65		X	X	X	X	
3.70		X	X	X	X	X
3.75		X	X	X	X	
3.80		X	X	X	X	X
3.85		X	X	X	X	
3.90		X	X	X	X	X
3.95		X	X	X	X	
4.00		X	X	X	X	X
4.05		X	X	X	X	
4.10		X	X	X	X	X
4.15		X	X	X	X	
4.20		X	X	X	X	X
4.25		X	X	X	X	
4.30		X	X	X	X	X
4.35		X	X	X	X	
4.40		X	X	X	X	X
4.45		X	X	X	X	
4.50		X	X	X	X	X
4.55		X	X	X	X	
4.60		X	X	X	X	X
4.65		X	X	X	X	
4.70		X	X	X	X	X
4.75		X	X	X	X	
4.80		X	X	X	X	X
4.85		X	X	X	X	
4.90		X	X	X	X	X
4.95		X	X	X	X	
5.00		X	X	X	X	X
5.05		X	X	X	X	
5.10		X	X	X	X	X
5.15		X	X	X	X	
5.20		X	X	X	X	X
5.25		X	X	X	X	
5.30		X	X	X	X	X
5.35		X	X	X	X	
5.40		X	X	X	X	X
5.45		X	X	X	X	
5.50		X	X	X	X	X
5.55		X	X	X	X	
5.60		X	X	X	X	X
5.65		X	X	X	X	
5.70		X	X	X	X	X
5.75		X	X	X	X	
5.80		X	X	X	X	X
5.85		X	X	X	X	
5.90		X	X	X	X	X
5.95		X	X	X	X	
6.00		X	X	X	X	X
6.05		X	X	X	X	

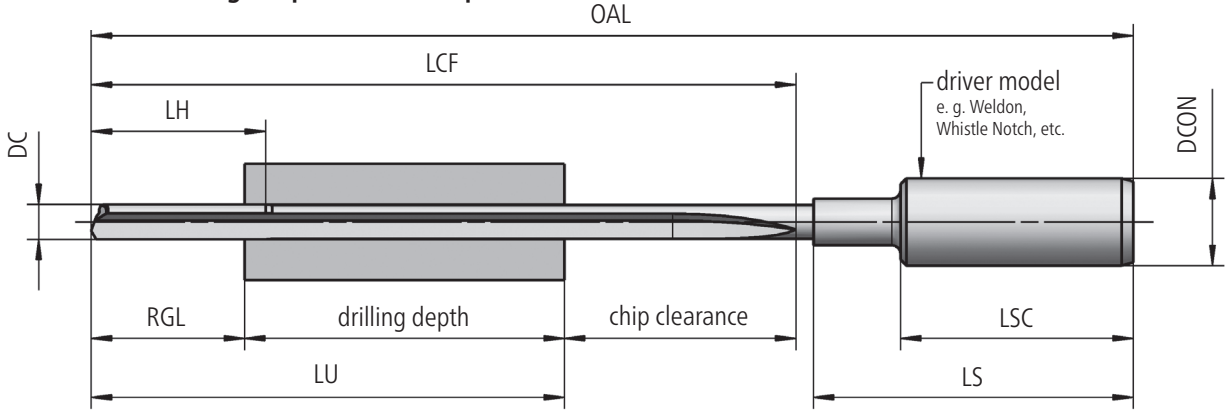
Intermediate dimensions on request
*While stock lasts – Subject to prior sale

Carbide grade: S20
Nose grind: Standard nose grind
Peripheral contour: G
Driver:

Illustration	Dimension DCONxLSC / LS (mm)	Design	botek-driver	Tool dia. (mm)
	Ø 4 x 34 / 46	particularly suitable for hydraulic chucks and collets	ZH4-08	0.5 - 5.0 mm
	Ø 6 x 36 / 50		ZH6-12	0.5 - 4.5 mm
	Ø 10 x 40 / 55		ZH10-51	0.5 - 6.0 mm
	Ø 12.7 x 38 / 48		ZH12,7-01	0.5 - 6.0 mm
	Ø 10 x 115 / 130		VH10-04	0.5 - 6.0 mm
More drivers on request				

Delivery time: **Uncoated: max. 5 working days**
TIN-coated: max. 10 working days
XT-coated: max. 10 working days
(more coatings on request)

Higher quantities on request



Single flute gundrill brazed carbide tip Type 110

Version: Single flute gundrill Type 110 **with driver Ø 10 x 40 mm (ZH10-00)**
Carbide grade: K15
Guide form: G
Standard nose grind: SA-0001 (40º / 30º)

DC / OAL	Order No. for over all length					
	200 mm	300 mm	400 mm	500 mm	600 mm	800 mm
2.50				702 000 211	702 000 212	702 000 213
3.00	702 000 100	702 000 102	702 000 205	702 000 206	702 000 207	702 000 208
3.50					702 000 210	

While stock lasts – Subject to prior sale

Version: Single flute gundrill Type 110 **with driver Ø 25 x 70 / 78 mm (ZH25-00)**
For the * marked items the flute length changes due to the use of a driver with brazing pin (25 x 70 / 105 [ZH25-01])
Carbide grade: K15
Guide form: G
Standard nose grind: SA-0001 (40º / 30º) for drills Ø 4.0 mm
SA-0002 (30º / 20º) for drills Ø 5.0 mm up to 20.0 mm
SA-0003 (20º / 15º) for drills from Ø 22.0 mm

DC / OAL	Order No. for over all length					
	200 mm	300 mm	400 mm	500 mm	600 mm	800 mm
4.00	702 000 101	702 000 103	702 000 107	702 000 123	702 000 214	702 000 215
5.00	702 000 217	702 000 104	702 000 108	702 000 124	702 000 133	702 000 150
6.00	702 000 219	702 000 105	702 000 109	702 000 125	702 000 134	702 000 151
6.50			702 000 110			702 000 152
7.00	702 000 221	702 000 106	702 000 111	702 000 126	702 000 135	702 000 153
8.00	702 000 223	702 000 224	702 000 112	702 000 127	702 000 136	702 000 154
8.50			702 000 113			702 000 155
9.00		702 000 227	702 000 114	702 000 128	702 000 137	702 000 156
10.00		702 000 230	702 000 115	702 000 129	702 000 138	702 000 157
11.00		702 000 233	702 000 116	702 000 130	702 000 139	702 000 158
11.50			702 000 264	702 000 265	702 000 266	702 000 267
12.00		702 000 234	702 000 117	702 000 131	702 000 140	702 000 159
13.00		702 000 238	702 000 118	702 000 132	702 000 141	702 000 239
14.00		702 000 240	702 000 119		702 000 142	702 000 160
15.00			702 000 120		702 000 143	702 000 161
16.00		702 000 245	702 000 121	702 000 246	702 000 144	702 000 162
17.00			702 000 260	702 000 261	702 000 262	
18.00			702 000 122	702 000 247	702 000 145	702 000 163
19.00					702 000 146	702 000 164
20.00			702 000 249	702 000 250	702 000 147	702 000 251
22.00				702 000 252	702 000 148	
24.00			702 000 254	702 000 255	702 000 256	702 000 257
25.00			702 000 253		702 000 149	

While stock lasts – Subject to prior sale

Order No. for over all length					
1000 mm	1200 mm	1300 mm	1500 mm	1800 mm	2000 mm
702 000 209					

Express Production Line

We can manufacture tools that are not included in the Stock Program within **24 hours**, if all components are in stock or by arrangement.

Please contact us: P: +49 7123 3808-121 · eilfertigung@botek.de

Order No. for over all length					
1000 mm	1200 mm	1300 mm	1500 mm	1800 mm	2000 mm
702 000 216					
702 000 165	702 000 218				
702 000 166	702 000 220				
702 000 167	702 000 184				
702 000 168	702 000 222		702 000 195		
702 000 169	702 000 185	702 000 225	702 000 196	702 000 226	
702 000 170	702 000 186				
702 000 171	702 000 228		702 000 229		
702 000 172	702 000 187	702 000 189	702 000 197	702 000 231	702 000 232
702 000 173					
702 000 268		702 000 269	702 000 270		702 000 271
702 000 174	702 000 235	702 000 190	702 000 198	702 000 236	702 000 237
702 000 175		702 000 191			
702 000 176	702 000 241	702 000 192	702 000 242		
702 000 177		702 000 193	702 000 199	702 000 243	702 000 244
702 000 178	702 000 188	702 000 194	702 000 200		
702 000 263					
702 000 179			702 000 201		
702 000 180	702 000 248		702 000 202		
702 000 181			702 000 203		
702 000 182					
702 000 258	702 000 259				
702 000 183			702 000 204		

Stock Program

Pilot drill coolant fed Type 153-03

Coating: XT
Shank: DIN 6535 HA
Point angle: 140°
Nose grind: SA-0174

DC h5	3 x D			
	OAL	LCF	DCON h6	Order No.
	Over all length	Flute length	Ø Shank	
2.000	50	12	6	702 004 100
2.500	50	12	6	702 004 101
3.000	62	15	6	702 004 102
3.500	62	17	6	702 004 103
4.000	62	20	6	702 004 104
5.000	62	25	6	702 004 105
6.000	66	28	6	702 004 106
6.500	79	34	8	702 004 107
7.000	79	34	8	702 004 108
8.000	79	41	8	702 004 109
8.500	89	47	10	702 004 110
9.000	89	47	10	702 004 111
10.000	89	47	10	702 004 112
11.000	102	55	12	702 004 113
12.000	102	55	12	702 004 114
12.020	107	60	14	702 004 115
12.500	107	60	14	702 004 116
12.520	107	60	14	702 004 117
12.700	107	60	14	702 004 118
13.000	107	60	14	702 004 119
13.500	107	60	14	702 004 120
14.000	107	60	14	702 004 121
14.020	115	65	16	702 004 122
14.500	115	65	16	702 004 123
15.000	115	65	16	702 004 124
15.020	115	65	16	702 004 125
15.500	115	65	16	702 004 126
16.000	115	65	16	702 004 127
16.020	123	73	18	702 004 128
16.500	123	73	18	702 004 129
17.000	123	73	18	702 004 130
17.500	123	73	18	702 004 131
18.000	123	73	18	702 004 132
18.020	131	79	20	702 004 133
18.500	131	79	20	702 004 134
19.000	131	79	20	702 004 135
19.500	131	79	20	702 004 136
20.000	131	79	20	702 004 137
20.020	131	79	20	702 004 138

botek®

Inquiry / Order Type 113 / Type 113-HP / Type 110

verkauf@botek.de

☐ **Inquiry** ☐ **Order** (please mark with a cross where applicable)

Customer ID: _____ Order No.: _____

Address: _____ Shipping address: _____

_____ _____

_____ _____

Name of buyer: _____ Phone: _____

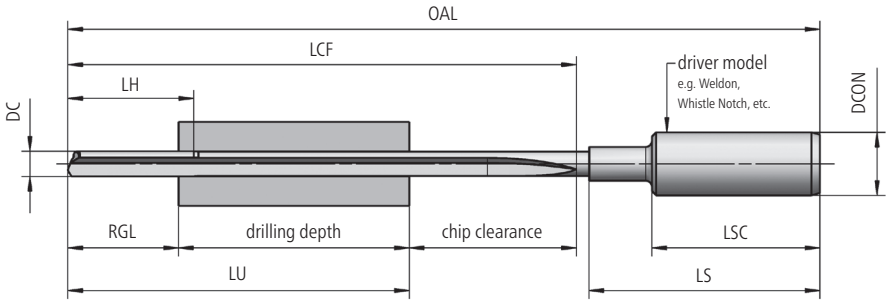
Drilling method: ☐ Solid drilling ☐ Counterboring

Material: ☐ Steel ☐ GG / GGG ☐ AL-Leg ☐ _____

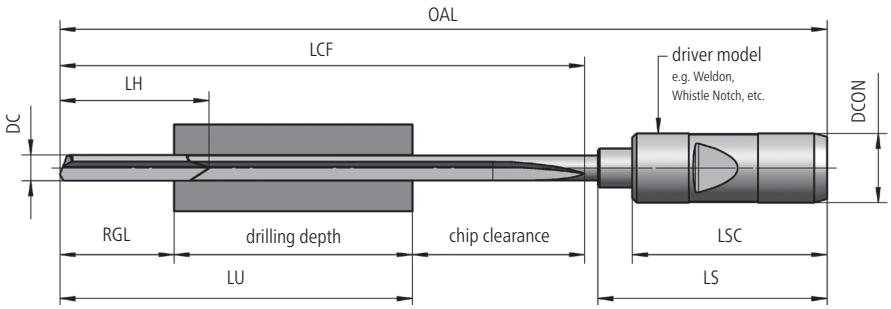
Machine: ☐ Machining center ☐ Deep hole drilling machine

Ø (DC)	Length (OAL)	Drilling depth (mm)	Driver dimensions (DCONxLSC / LS)	Driver No.	Coating	Pieces	Delivery date

Type 113-HP / Type 113



Type 110



☐ Type 113 Single flute gundrill in solid carbide design - Standard version

☐ Type 113-HP Solid carbide gundrill - High performance tool design

☐ Type 110 Single flute gundrill with brazed carbide tip

Note: _____

Mode of shipment: ☐ UPS (delivery within 2 working days) ☐ ...

☐ UPS 12:00 a.m. ☐ Pick up

A surcharge will be applied depending on delivery requirement. You will be notified to this change prior to production.The number of tools for express orders is limited.

Date: _____ Signature _____

You will find a special inquiry sheet for new tool design or tool redesign under **www.botek.de**.
Stock program: While stock lasts - Subject to prior sale

Inquiry / Order Type 123 / Type 120

verkauf@botek.de

☐ **Inquiry** ☐ **Order** (please mark with a cross where applicable)

Customer ID: _____ Order No.: _____

Address: _____ Shipping address: _____

_____ _____

_____ _____

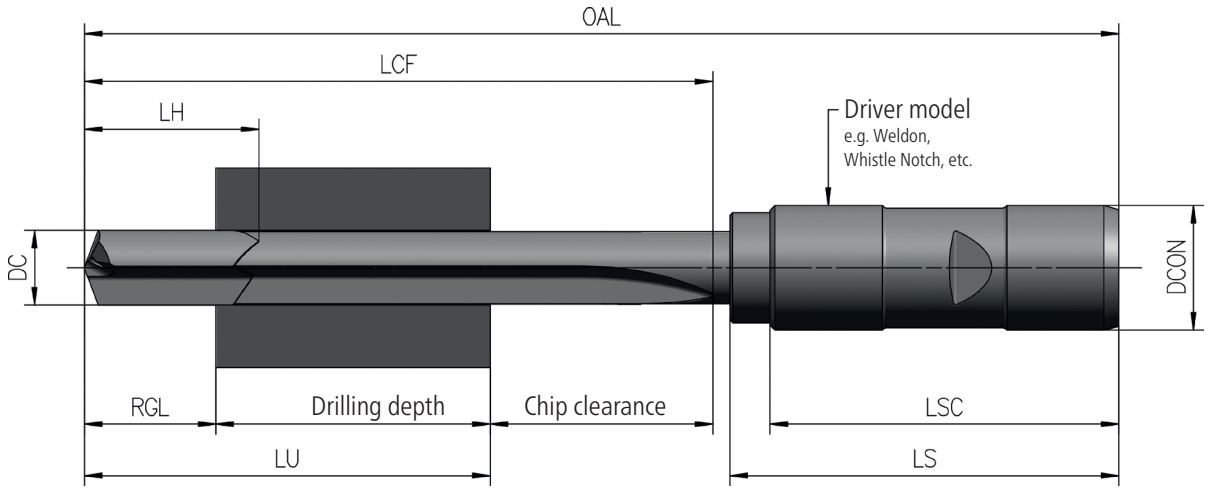
Name Customer: _____ Phone: _____

Drilling method: ☐ Solid drilling ☐ Counterboring

Material: ☐ Steel ☐ GG / GGG ☐ AL-Leg ☐ _____

Machine: ☐ Machining center ☐ Deep hole drilling machine

Ø (DC)	Length (OAL)	Drilling depth (mm)	Driver dimensions (DCONxLSC / LS)	Driver No.	Coating	Pieces	Delivery date



☐ Type 123 Single flute gundrill in solid carbide design - Standard version

☐ Type 120 Single flute gundrill with brazed carbide tip

Note: _____

Mode of shipment: ☐ UPS (delivery within 2 working days) ☐ ...

☐ UPS 12:00 a.m. ☐ Pick up

A surcharge will be applied depending on delivery requirement. You will be notified to this change prior to production.The number of tools for express orders is limited.

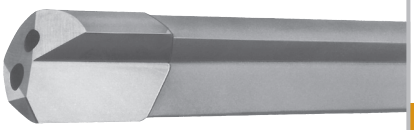
Date: _____ Signature _____

You will find a special inquiry sheet for new tool design or tool redesign under **www.botek.de**.
Stock program: While stock lasts - Subject to prior sale

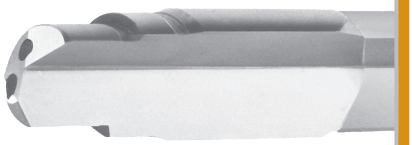
With the "botek EXPRESS PRODUCTION LINE" we can manufacture tools, which are not included in our Stock Program, in a very short time.

Type 113
Solid carbide gundrill
kidney-shaped coolant channel
diameter range: 0.500 - 12.000 mm

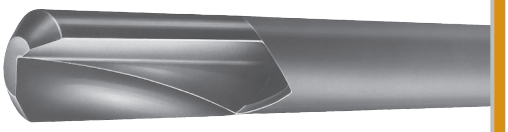
Type 110
Single flute gundrill
with brazed solid carbide tip kidney-shaped coolant channel
1 coolant hole – diameter range: 1.850 - 7.059 mm
2 coolant holes – diameter range: 7.060 - 51.200 mm



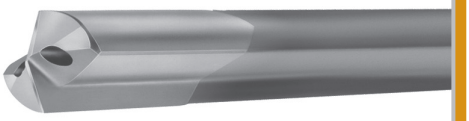
Type 112
Single flute stepped gundrill
with solid carbide tip (to produce precise stepped holes in one operation),
Kidney-shaped coolant channel or 2 coolant holes depending on tool diameter
diameter range: 2.000 - 51.200 mm



Type 115
Single flute counterboring tool
with solid carbide tip, chips forward (round tube)
diameter range: 2.000 - 51.200 mm



Type 120
Twin fluted drills
with drill head made of solid carbide
diameter range: 6.000 - 43.009 mm



Type 01 / 07
Gundrill for solid drilling
diameter range: 9.900 - 43.99 mm
diameter range: 25.000 - 50.99 mm

You can find more information in the catalogue "Deep hole drilling tools Type 01, 02, 07, 07A".

→ **You can order by fax or e-mail**

→ **Please see our order form on page 51 / 52.**

Customer trials in our research and development department:

- tool development specifically tailored to suit your application
- supportive when introducing the latest technology
- solving processing problems

We are looking forward to meet your challenge – please contact us.

Produce deep and precise bores with high process reliability – we support you with:

Process layout: You provide us with your drilling application and we will lay out the complete drilling process for you and accompany you from planning to succesful implementation.

Process optimization: Our team of Application Engineers analyse and improve the whole process in your facility and coordinate all technical details.

Reduced manufacturing costs by:

- optimized cutting values
- improved tool life
- shortened auxiliary process time
- maximized process capacity

The botek trial department assists you in all stages of the process with:

- Feasability tests
- Optimization
- Instruction and training for your technicians

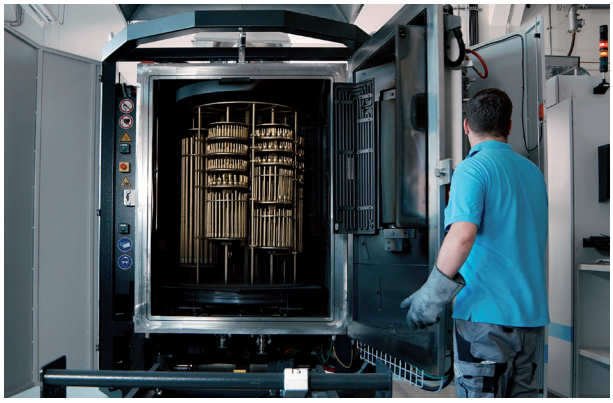
We are looking forward to meet your technical challenge.

After-Sales Service

Supporting our customers
does not end after the delivery of the tools –
IT BEGINS WITH IT.

Coating

botek offers prompt and cost effective in house coating service.



Regrinding

botek offers prompt and cost effective in house regrinding service.

Re-tipping

Tools get equipped with a new drill head (requirement is that drill tube and driver can be used).

Express Production Line

With our botek Express Production Line
tools can be manufactured that are
not in our stock program.

The delivery program includes following tools:

- Single flute and two fluted gundrills with brazed drillhead Type 110 / Type 120
- Solid carbide gundrills – Type 113
- Single flute gundrills with inserts – Type 01

Please send us your inquiry.

DEEP HOLE DRILLING SYSTEMS
SOLID CARBIDE TOOLS

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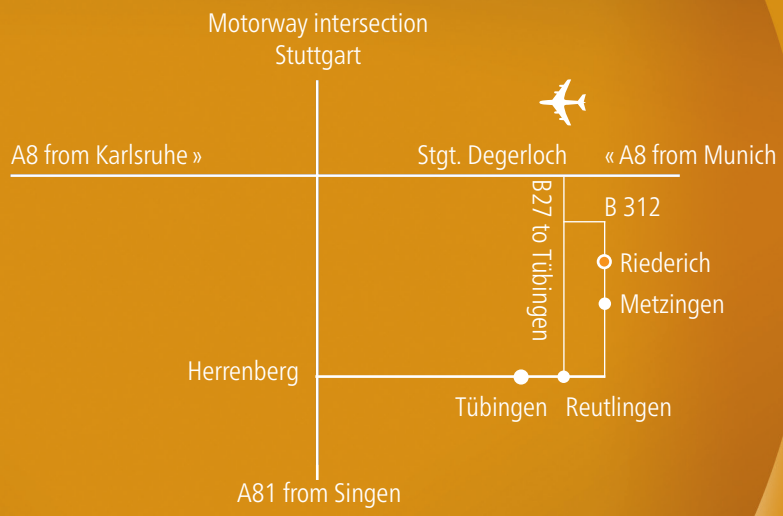
www.botek.de



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