botek

DEEP HOLE DRILLING SYSTEMS
SOLID CARBIDE TOOLS

Single flute gundrills

botek Type 110, 111, 112
113, 114, 115

Solid drilling tools
Counterboring tools
Trepanning tools

The botek company

Manufacturing deep and precise holes is a technical challenge when processing metal. Accordingly specializing on deep hole drilling technology had been the founding idea in 1974 of botek Präzisionsbohrtechnik GmbH in Riederich.

botek grew to an international operating deep hole drilling tools supplier. Over 350 employees in the main company develop and manufacture single and two fluted drills, deep hole drilling tools system BTA and Ejector as well as special tools.

A complete product program, regarding all deep hole drilling aspects and a team of highly qualified and dedicated cutting specialists make botek being a competent partner for the automobile industry and their suppliers, shipbuilding industry, hydraulic industry as well as motor, gear and machine building companies.

- Our General Standard Terms and Conditions, which we assume as known, apply.
- We reserve the right to make modifications in the interests of technical improvement.
  Such modifications cannot, in principle, be accepted as justificable reasons for complaint.
- Subject to chance. The manufacturer accepts no responsibility for misprints and other errors.

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Type 113

Single flute gundrill with brazed carbide head
Type 110 / Type 111 / Type 112 / Type 114 / Type 115

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botek advantages

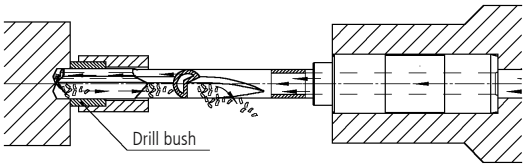
1. Cost effective and precise holemaking.
2. botek quality tools are synonymous with high cutting performance.
3. Minimum centerline deviation.
4. Outstanding drilling quality and trouble-free chip removal.
5. High process reliability.
6. Tool lengths up to 5,000 mm are available depending on tool type 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 30 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 18 - 21).

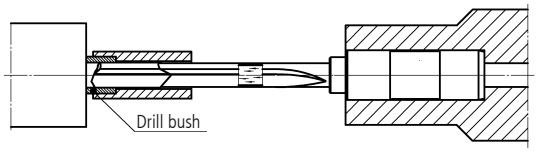
Minimum quantity lubrication (MQL) may be used under certain conditions.

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)

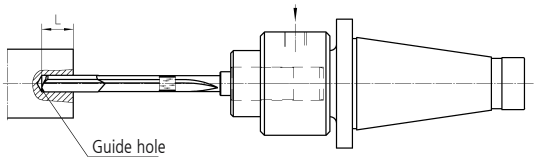
with drill bush



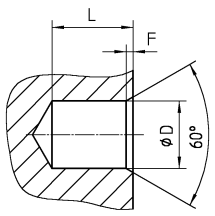
The gundrill is a single-edged tool without self-centering.
When positioning the drill, the tool must be guided through a drill bush or a pilot hole.

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

with pilot hole



Dimensions for the guide hole

	Drill diameter (mm)	**Dimensions for guide hole (pilot hole)**	
		L (mm)	**D** (mm)
	0.50 - 2.50	approx. 2 x D	+ 0.005 to + 0.015
	2.60 - 8.90	approx. 1.5 x D	+ 0.010 to + 0.020
	9.00 - 50.00	approx. 1 x D	+ 0.015 to + 0.040

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 22.

A detailed description of the single flute gundrilling process can be found on our information CD-ROM:
„botek Deep Hole Drilling Systems – Tools and Applications"
Please contact your botek representative.

Solid carbide single flute gundrill
Type 113

Overview

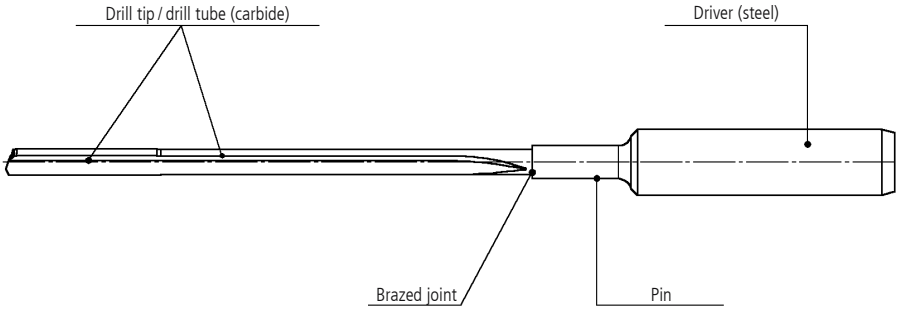
Type	Tool dia.	
Type 113 Solid carbide gundrill	kidney-shaped coolant channel **for tool dia.: 0.500 - 12.000 mm**	
Type 113-01* solid carbide stepped drill	kidney-shaped coolant channel **for tool dia.: 1.500 - ... mm**	
Type 113-02 solid carbide counterboring tool	kidney-shaped coolant channel **for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

*Tool on request only

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.

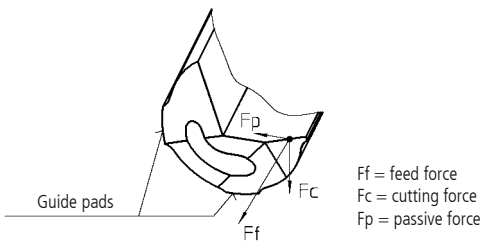


1. Drill head

a) Peripheral contour

The solid carbide 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 8) are available to suit your drilling requirements.

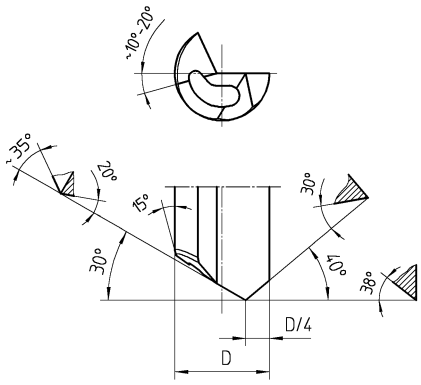


b) Nose grind geometry

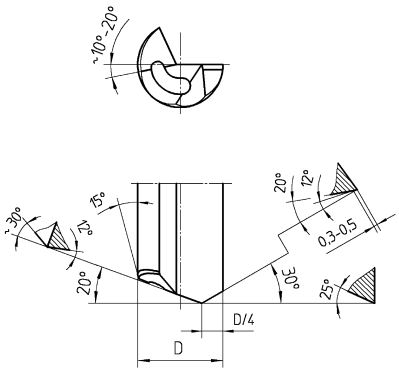
The nose grind geometry affect the following, hole tolerance, chip formation, coolant pressure and flow, tool life, centerline deviation and surface quality. Over the years, botek has successfully tested a number of different nose grinds for drilling various materials.

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 113



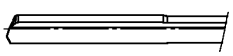
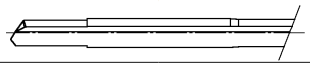
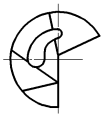
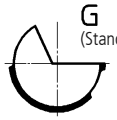
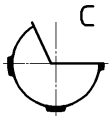
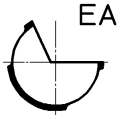
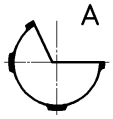
Nose grind no. 001/1 (SA-0009)
for drill range: 0.500 - 4.000 mm



Nose grind no. 002 (SA-0002)
for drill range: 4.001 - 12.000 mm

Solid carbide gundrill
Type 113

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 113-01**	**Type 113-02**
Illustration			
Drilling range from - to (mm)	**Ø = 0.500 - 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 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!	 - All materials - Suitable for most drilling requirements - Close hole tolerance - Minimum drift		 - Steel, stainless steel - Not easily machinable materials - Preferred for water soluble (emulsion) coolant
Important: Contour EA and G are non-micable!	 - Cast iron, malleable materials - Crosshole drilling - Angular entrance and exit bores		 - 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		

2. 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.

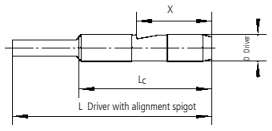
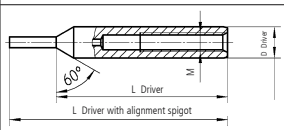
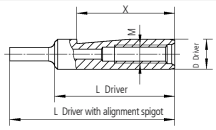
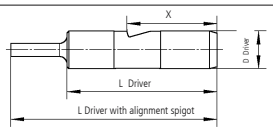
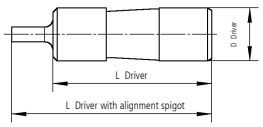
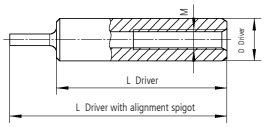
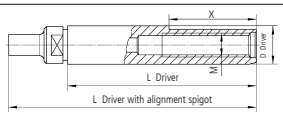
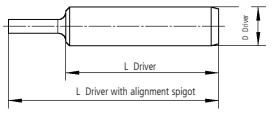
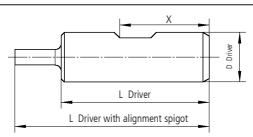
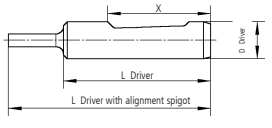
With standard tool designs, the V-shaped flute extends to the driver (pin). Solid carbide gundrills are available with a drill shank length up to 100 x diameter, however maximum flute length is 300 mm depending on diameter.

3. 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 for solid carbide gundrills – Overview

Designation		**Drawing**	**botek order no.**	**for tool length calculation**			**X** = Notch location	**M** = Thread size
Ø dia. (mm)	**Type**			**drill dia. range** (mm) **from - to**	**L** Driver = clamping area	**L** 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 - 6.349	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	0.500 - 6.349	45	60		
16			ZH16-86	0.500 - 8.049	48	63		
6	**DIN 6535-HB**		ZH6-13	0.500 - 4.649	36	50	20	
10			ZH10-47	0.500 - 6.349	40	55	23.5	
12			ZH12-30	0.500 - 8.049	45	60	26.5	
16	**DIN 1835-B**		ZH16-78	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 - 6.349	40	55	28	
12			ZH12-28	0.500 - 6.349	45	60	33	
16	**DIN 1835-E**		ZH16-84	0.500 - 8.049	48	63	36	

Single flute gundrills with brazed drill head

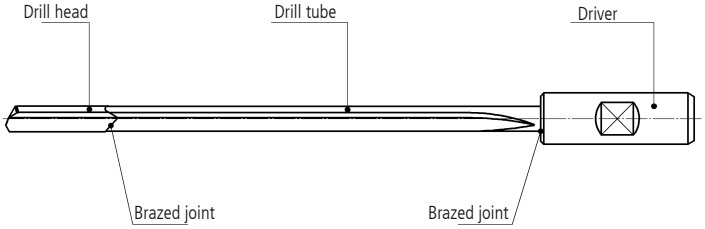
Type 110 / Type 111 / Type 112 / Type 114 / Type 115

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 111 Single flute gundrill drill head made of a steel body with inserted carbide cutting blade and bearing pads	1 coolant hole **for tool dia. 5.800 - 40.009 mm** 2 coolant holes **for tool dia. 40.010 - 60.009 mm** (not shown)	
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 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. 2.000 - 51.200 mm**	
Type 115-01 Single flute stepped counterboring tool		
Type 115-03 Single flute counterboring tool with guiding pilot with solid carbide tip	**tool dia. 4.000 - 60.006 mm**	
Type 115-04 Single flute counterboring tool with guiding pilot steel body with inserted carbide cutting blade and bearing pads	**tool dia. 30.000 - 60.006 mm**	

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.

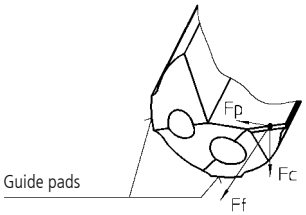


1. Drill head

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 12 +13) are available to suit your drilling requirements.



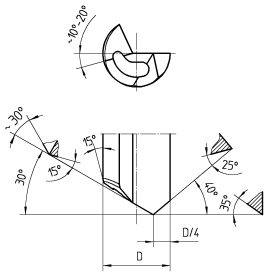
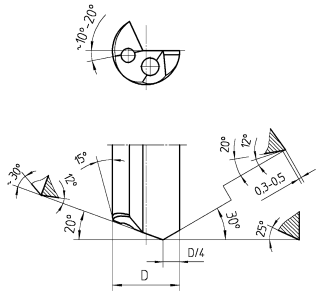
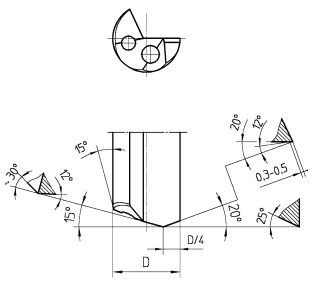
Ff = feed force
Fc = cutting force
Fp = passive force

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 / 111

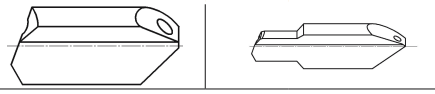
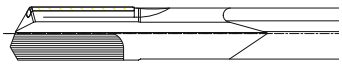
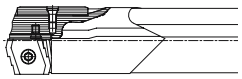
Nose grind no. 001 (SA-0001) **for drill range 1.850 - 4.000 mm**	
Nose grind no. 002 (SA-0002) **for drill range 4.001 - 20.000 mm**	
Nose grind no. 003 (SA-0003) **for drill range 20.001 - ... mm**	

We are pleased to provide you with regrinding instructions on request.

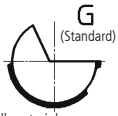
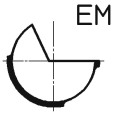
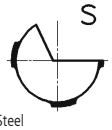
Single flute gundrills with brazed drill head

Type 110 / Type 111 / Type 112 / Type 01

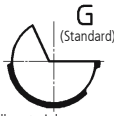
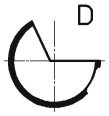
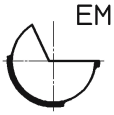
Solid drilling tools

<table>
<tr><td>Drill head design</td><td colspan="2">Solid carbide tip</td><td colspan="2">Steel body with brazed carbide cutting blade and bearing pads</td><td>Steel body with indexable carbide inserts and guide pads</td></tr>
<tr><td rowspan="2">Working method/ tool type</td><td colspan="5">Solid drilling tools</td></tr>
<tr><td>Type 110</td><td>Type 112
(Step drill)</td><td colspan="2">Type 111</td><td>Type 01-000
Type 01-010</td></tr>
<tr><td>Illustration</td><td colspan="2">  </td><td colspan="2">  </td><td>  </td></tr>
<tr><td>Drilling range from - to (mm)</td><td colspan="2">1.850 - 51.200</td><td colspan="2">5.800-60.009</td><td>13.500 - 43.990</td></tr>
<tr><td>Tool length</td><td colspan="5">depending on diameter, max. 5000 mm</td></tr>
<tr><td>Coolant hole design (standard)</td><td>kidney
 
tool dia.
1.850 - 7.059</td><td>2-hole
 
tool dia.
7.060 - 51.200</td><td>1-hole
 
tool dia.
5.800 - 40.009</td><td>2-hole
 
tool dia.
40.010 - 60.009</td><td>1-hole
 
tool dia.
13.500 - 43.990</td></tr>
<tr><td>Advantages</td><td colspan="2">- 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</td><td colspan="2">- Carbide grade of cutting blades may be different than guide pads to suit specific drilling applications
- Regrindable
- Drill breakage is minimized by the damping effect of drill head body section</td><td rowspan="2">- 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</td></tr>
<tr><td rowspan="4">Peripheral contours

botek adapts the contour optimally to meet your drilling requirements!

Important:
Contour EA, G and E are non-micable</td><td>G (Standard)
 
- All materials
- Suitable for nearly all drilling
- Close hole tolerance
- Minimal drift</td><td>E
 
- All materials and plastics
- Preferred for Speedbit devices</td><td>C
 
- Stainless steel, wood
- Not easily machinable materials
- Preferred for water soluble (emulsion) coolants</td><td colspan="2" rowspan="3">Fixed peripheral contour due to tool design</td></tr>
<tr><td>A
 
- Aluminium
- Close hole tolerance</td><td>D
 
- Cast iron and graphite
- Close hole tolerance in cast iron</td><td>EM
 
- Steel, cast iron,
- soft materials</td></tr>
<tr><td>EA
 
- Steel and aluminium
- Crosshole drilling
- Angular entrance and exit bores</td><td>S
 
- Steel
- Close hole tolerance
- Good surface quality
- Ideal for short holes</td><td></td><td rowspan="4">see botek brochure:
Deep hole drilling tool
Type 01/02/07</td></tr>
<tr><td>Special contour</td><td colspan="2">Also available upon special request</td><td colspan="2">-</td></tr>
<tr><td>Special nose grinds</td><td colspan="4">All tools are also available with special nose grind</td></tr>
<tr><td>Tool coatings</td><td colspan="4">Please specify the coating you require</td></tr>
<tr><td>Diamond/PCD</td><td colspan="2">Also available cutting edge with PCD</td><td colspan="2">-</td><td>Also available with PCD cutting edge</td></tr>
</table>

Counterboring / Trepanning tools

Drill head design	**Solid carbide tip**			**Steel body with brazed carbide cutting blade and bearing pads**		**Steel body with indexable carbide inserts and guide pads**
Working method/ tool	**Drilling tools**		**Counterboring tools** with guiding pilot			**Trepanning tool**
	Type 115	**Type 115-01**	**Type 115-03**	**Type 115-04**		**Type 114**
Illustration						
Drilling ranges from - to (mm)	**2.000 - 51.200**		**4.000 - 60.006**	**30.000 - 60.006**		**11.000 - 50.000**
Coolant hole design (Standard)	kidney  **tool dia. 1.850 - 7.059**		2-hole  **tool dia. 7.060 - 51.200**	1-hole  **tool dia. 5.800 - 40.009**	2-hole  **tool dia. 40.010 - 60.009**	Determined 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	E  - All materials and plastics - Preferred for Speedbit devices	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 - 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			-		-
Diamond/PCD	Also available to order with PCD point			-		-

2. Drill shaft

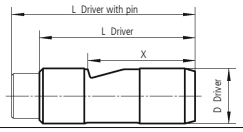
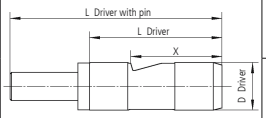
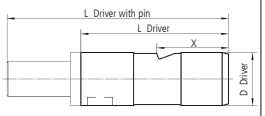
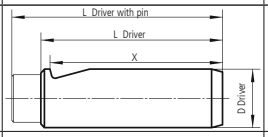
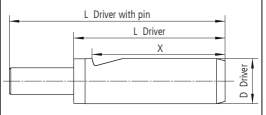
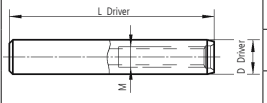
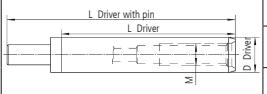
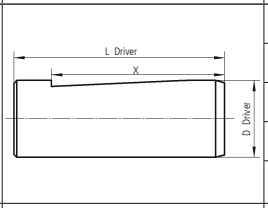
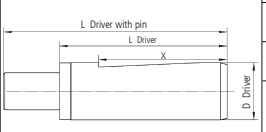
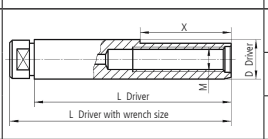
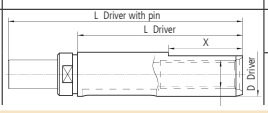
Tempered alloy steel tubing is formed with a V-shaped groove (flute) to create the swarf (coolant) return channel required for the gundrilling operation. Design considerations for proper drill tube sizes include the ratio between the drill tube outside diameter and inside diameter for optimum torsional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

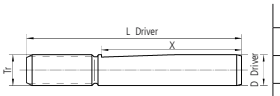
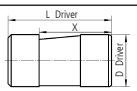
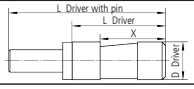
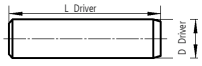
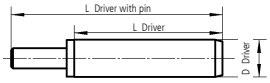
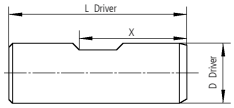
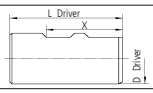
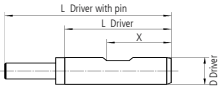
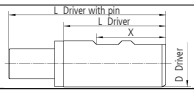
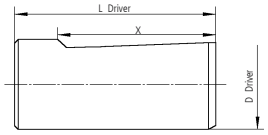
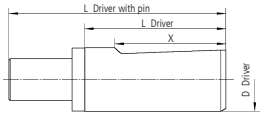
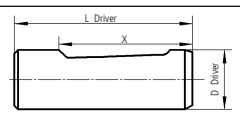
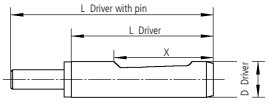
3. Driver

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. botek manufactures a variety of standard drivers from stock as well as customer specific configurations.

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

Designation		Drawing	botek driver no.	for tool length calculation			X = Notch location	M = Thread size
ø dia. (mm)	Type			drill dia. range (mm) from - to	L Driver = clamping area	L 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	7.300 - 19.509	70	78	34.0	
10	with pin		ZH10-01	7.300 - 12.399	40	57	24.0	
16			ZH16-04	12.400 - 20.500	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 - 20.500	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 - 20.509	100			M16x1.5
10	GKT with metr. thread with pin		ZH10-28	7.300 - 12.390	60	77		M6x0.5
16			ZH16-22	12.400 - 20.500	80	105		M10x1
25			ZH25-10	20.510 - >	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	M = Thread size
ø dia. (mm)	Type			drill dia. range (mm) from - to	L Driver = clamping area	L 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 - 25.609	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 - 34.699	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	
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 - 20.500	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	
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 - 20.500	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 - 12.390	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 - 12.399	45	62	33.0	
16			ZH16-70	12.400 - 20.500	48	75	36.0	
20			ZH20-56	15.900 - 29.609	50	77	38.0	

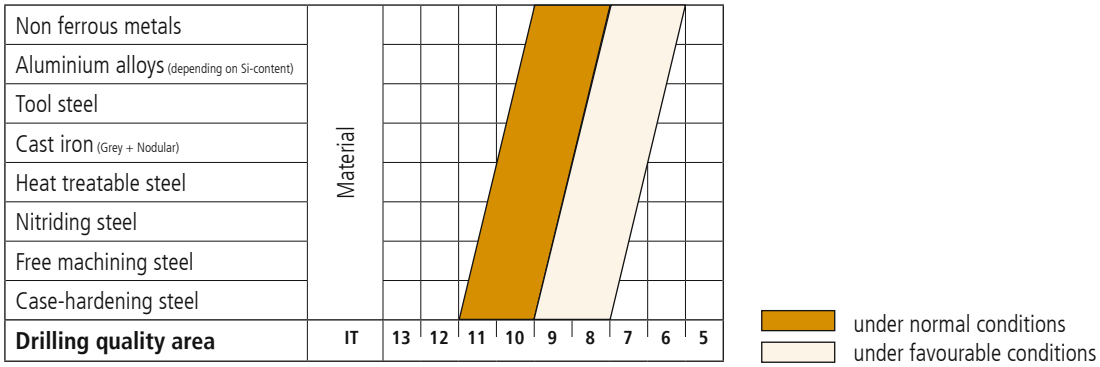
To achieve optimum drilling results when using carbide tipped or solid carbide gundrills, various criteria must be applied. In addition to tool design, key factors are machine design and construction, process techniques, pressurized and filtered deep hole drilling coolant. Selection of proper cutting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

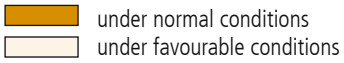
Achievable drilling tolerances



(guide values)

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)

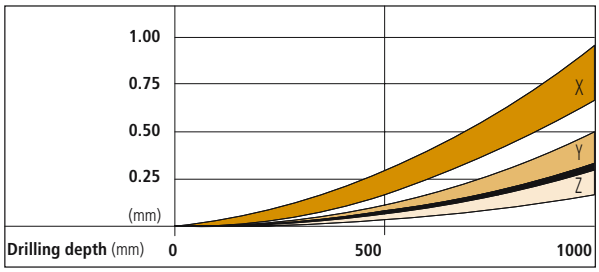
Centerline deviation (drift)

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"

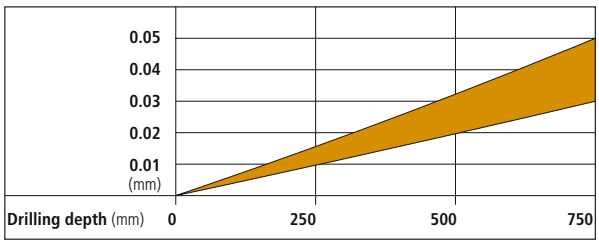
In all applications tool drift is minimized by using a close fitting pilot bore or guide bushing during gundrilling.
Angular alignment of pilot bore with desired gundrill bore is imperativ.
With a guide bushing, alignment and distance from the workpiece are also important.



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 every 40 diameters.
For further information, refer to page 22.



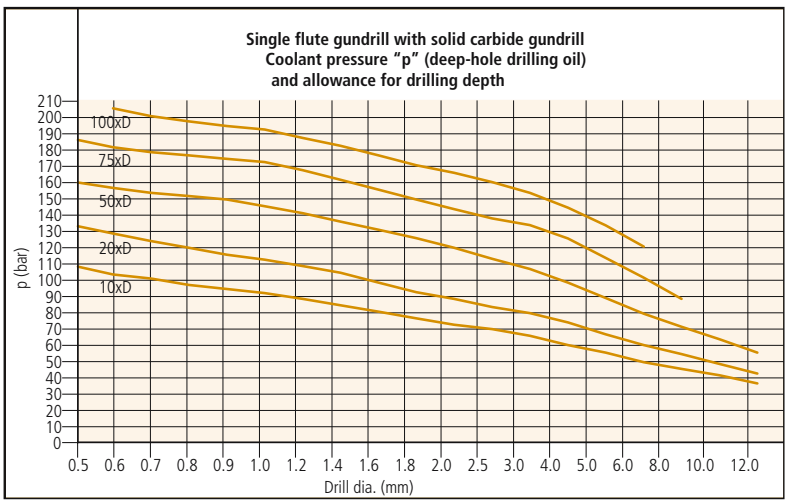
Roundness

Hole roundness is a primary advantage of gundrilling over conventional twist drilling.
Hole roundness measurements as low as 3 µm are possible.

Guide values for gundrilling of various materials with solid carbide 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) Ni > 8%, 18-25% Cr
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
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.



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 - 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
0.0001 - 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 clambing. 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.

Coolant filtration of 5 to 15 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):

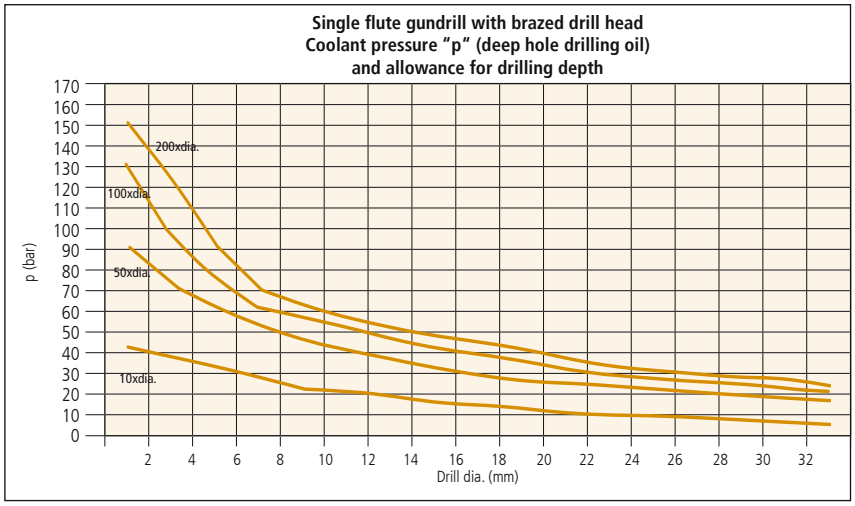
Flow capacity of coolant pump: drill dia. (mm) ≤ 2.0 = min. 4 l/min
Flow capacity of coolant pump: drill dia. (mm) 2.0 - 12.0 = min. 24 l/min

Reliable chip removal is only assured if sufficient coolant is supplied to the tool cutting tip. The diagram on page 18 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 carbide tipped gundrill

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.



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 mm²/s.

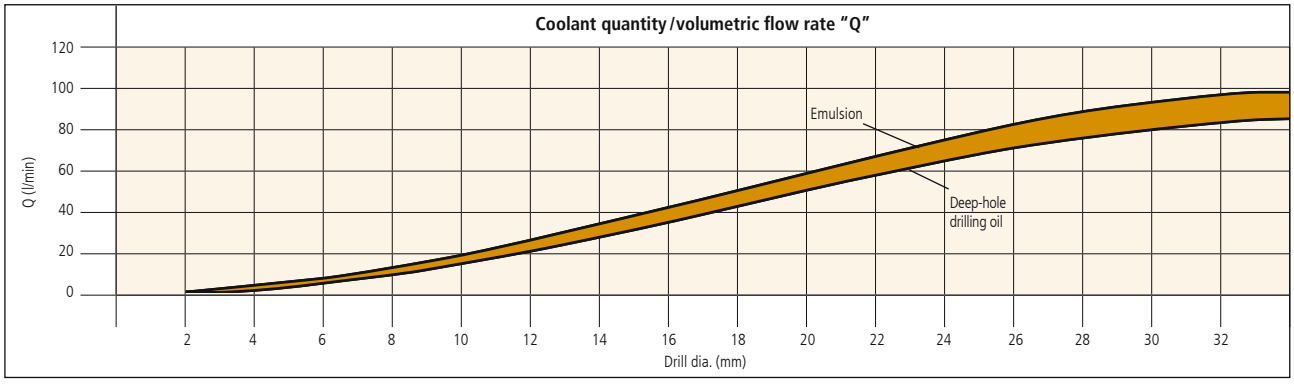
When using emulsion, the specified pressures (p) may be reduced by up to 20 %.

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

Guide values for gundrilling of various materials with carbide tipped gundrill

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% "free machining"	Aluminium + Aluminium alloys Si-content < 5% "not hardened"
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
0.0040 - 0.0038	0.0105 - 0.0300	0.0073 - 0.0242	0.0070 - 0.0234	0.0078 - 0.0859	0.0063 - 0.0154
0.0056 - 0.0052	0.0127 - 0.0362	0.0092 - 0.0311	0.0080 - 0.0293	0.0106 - 0.1178	0.0078 - 0.0214
0.0077 - 0.0071	0.0145 - 0.0424	0.0112 - 0.0377	0.0088 - 0.0377	0.0127 - 0.1466	0.0094 - 0.0273
0.0100 - 0.0092	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 - 0.0234
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

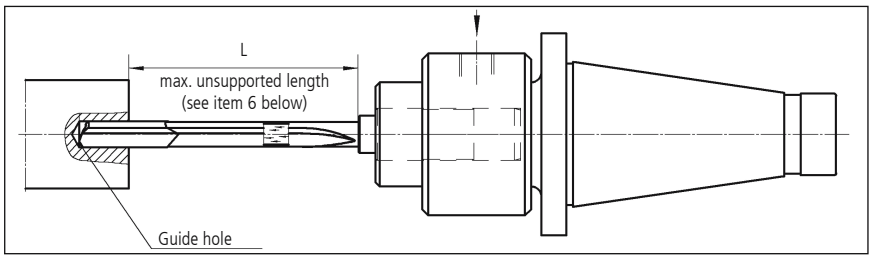
Cutting speed and feed rate are dependent on tool length, coolant type and material being drilled, as well as the stability of the drilling machine and workpiece clamping. All figures specified are guide values.



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.

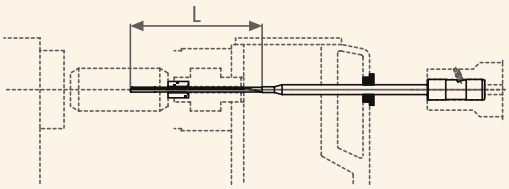
Technical Information
Application notes for botek deep hole drilling tools (single flute gundrills)

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.



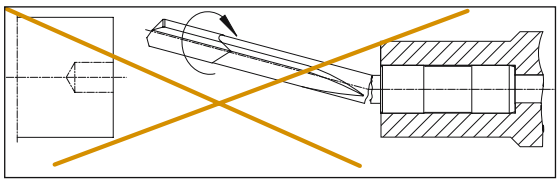
4. The gundrill is fed into drill bush or pilot hole **while non rotating** or rotated slowly at < 50 RPM. Then the coolant and the machine spindle should get started.
5. **After reaching the drilling depth** switch off the coolant and retract with the spindle stopped or slowly rotated at < 50 RPM.
6. **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.
   Do not exceed 40 times diameter unsupported!

6a. **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		**Gundrill**	**Drill dia. = D** (mm)	**Maximum unsupported drill length (L)**
		Solid carbide	0.500 - 0.999	approx. 80 x D
			1.000 - 1.999	approx. 100 x D
			2.000 - 6.999	approx. 80 x D
			7.000 - 12.000	approx. 60 x D
		with brazed drill head	1.850 - 20.999	approx. 40 x D
			21.000 - 30.999	approx. 35 x D
			31.000 - 40.999	approx. 30 x D
			41.000 - 55.000	approx. 25 x D

Example 1: drill diameter, D = 2.0 mm, unsupported drill length up to maximum 80 mm = 40 x D
Example 2: drill diameter, D = 2.0 mm x 200 mm OAL, 1st support at 80 mm and 2nd support at 160 mm

7. Grinding of carbide produces dust (cobalt, etc.) that may be potentially hazardous. Use adequate ventilation and safety glasses during grinding.
8. **Consequences of not following** our application notes No. 1 - 7

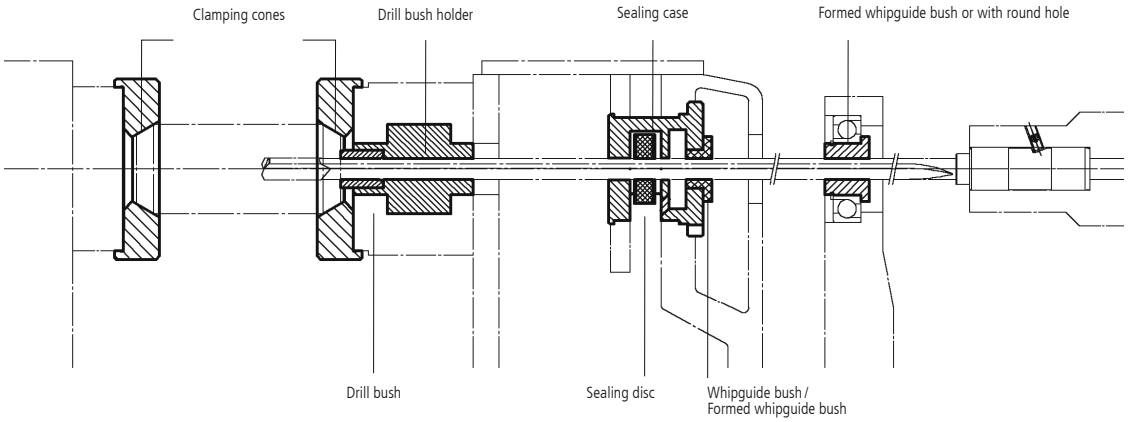


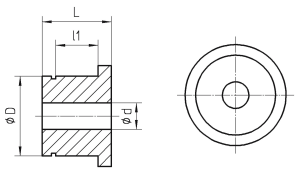
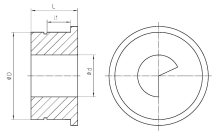
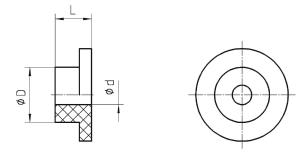
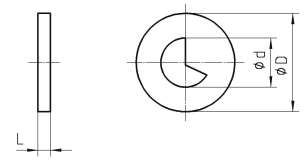
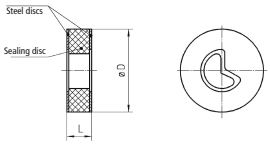
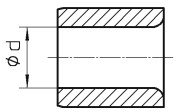
Using botek gundrills other than directed may cause personal injury. Tool breakage and unsupported gundrills can be extremely dangerous.

Please use with caution and care.

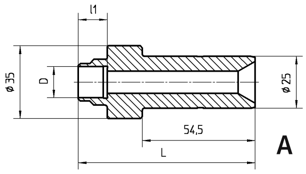
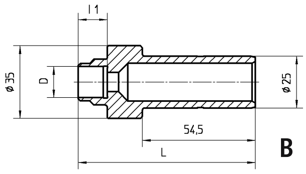
Please note that all application notes and values contained herein are intended as guidelines only. We do not accept any liability for damages caused by improper handling of botek deep hole drilling tools, operating errors, unsuitable machinery or misuse while using our tools!

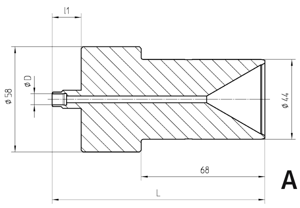
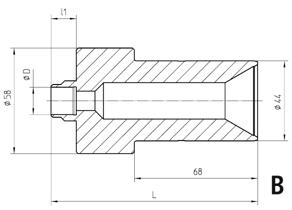
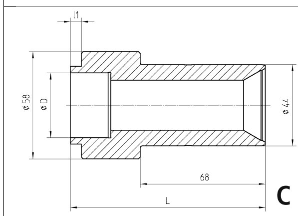
Do you have any further queries? Please call up at +49-(0)-7123-3808-0. We will be pleased to offer you advice.

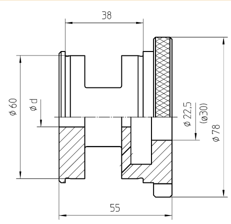


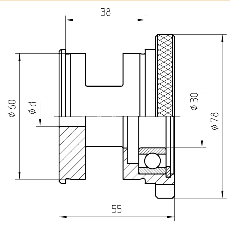
Whipguide bush with round hole	Tool dia. (mm)	D	L	l1	d	botek order no.
	1.850 - 15.399	25	22	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-1060
	1.850 - 25.609	30	26	16		170-05-4-1238
	1.850 - 36.699	45	26	14		170-05-4-1341
	1.850 - 25.609	35	26	14		170-05-4-2227
	1.850 - 25.609	30	26	13		170-05-4-2278
	1.850 - 36.699	45	26	16		170-05-4-2279
	1.850 - 11.799	20	22	12		170-05-4-2650
	1.850 - 32.600	40	26	15		170-05-4-3897
Formed whipguide bush	**Tool dia.** (mm)	**D**	**L**	**l1**	**d**	**botek order no.**
	3.960 - 12.509	20	20	12	Please specify **tool dia. and outer dia. (D)** when ordering	170-05-4-1809
	4.750 - 22.609	30	26	14		170-05-4-1810
	7.800 - 36.699	45	26	16		170-05-4-1812
	29.610 - 50.000	75	40	20.3		170-05-4-1816
Whipguide bush	**Tool dia.** (mm)	**D**	**L**		**d**	**botek order no.**
	1.850 - 12.399	22.6	15		Please specify **tool dia.** when ordering	170-05-4-1180
Sealing disc	**Tool dia.** (mm)	**D**	**L**		**d**	**botek order no.**
	1.850 - 5.749	20	3		Please specify **tool dia. and outer dia. (D)** when ordering	170-07-1572
	3.960 - 5.749	32	3			
	5.750 - 20.509	32	4			
	5.750 - 25.609	40	4			
	23.610 - 49.999	90	4			
Special sealing disc	**Tool dia.** (mm)	**D**	**L**		**d**	**botek order no.**
	2.900 - 5.249	20	7		Please specify **tool dia.** when ordering	170-07-4-3885
	5.250 - 16.399	32	11			170-07-4-3886
	16.400 - 25.999	40	12			170-07-4-3887
	26.000 - 40.999	90	12			170-07-4-2708
Drill bushings to DIN 179A					**d**	**botek order no.**
	Cylindrical drill bushings to DIN 179A in long version made from hardened tool steel				Please specify **tool dia.** when ordering	170-04

Accessories

Drill bush (small) in versions A and B (depending on drilling range)	**Drilling range** (mm) **from - to**	**L**	**l1**	**Version**	**d**	**botek order no. and version**
 A	**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			
 B	**8.100 - 12.099**	88.5	14			
	12.100 - 15.099	83.5	12			
	15.100 - 18.099	81.5	10			

Drill bush (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**
 A	**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			
 B	**8.100 - 12.099**	114	14			
	12.100 - 15.099	112	12			
	15.100 - 18.099	110	10			
 C	**18.100 - 30.099**	106	6	**C**		
	30.100 - 35.099	103	-			

Sealing case	**Tool dia.** (mm)	**d**	**botek order no.**
	with whipguide bush for **dia. 1.850 - 12.399**	Please specify **tool dia.** when ordering **Whipguide bush 170-05-4-1150 and sealing disc to be ordered separately**	170-01-03-1570

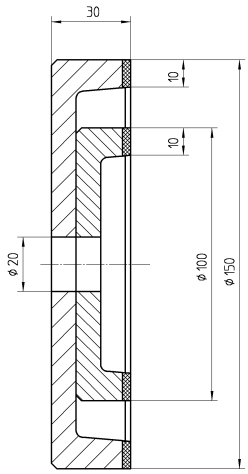
Sealing case (with bearing)	**Tool dia.** (mm)	**d**	**botek order no.**
	Whipguide bush with round hole for **dia. 1.850 - 25.609** formed whipguide bush for **dia. 5.750 - 22.609**	Please specify **tool dia.** when ordering **Whipguide bush with round hole or formed whipguide bush** (max. outer dia. 30 mm) **and sealing disc to be ordered separately**	170-01-4-1809

Regrinding of botek single flute gundrills

Gundrills must be reground with great care using a diamond grinding wheel. Drills with a diameter greater than 10 mm, in particular drills with inserted carbide cutting blade and guide pads should be wet ground when possible.

botek provides a customized regrinding service, and will be pleased to carry out this work for you.

We also supply special grinding machines and accessories which enable you to regrind single flute gundrills easily and quickly at your facility.



botek twin grinding wheels for pre- and finish-grinding have a proven record of performance. These grinding wheels allow our customers to economically regrind our gundrills.

Various grinding wheels are available from stock.

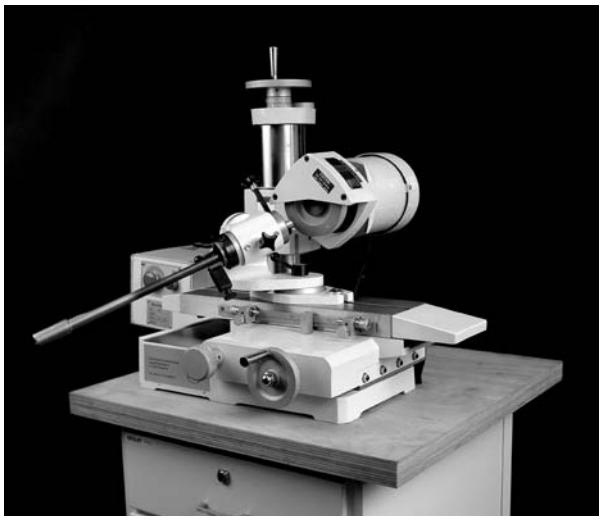
It is important that the carbide tip does not become overheated during grinding. Overheated carbide can cause thermal cracking and premature tool life.

Under no circumstances should the ground surface show any signs of discoloration.

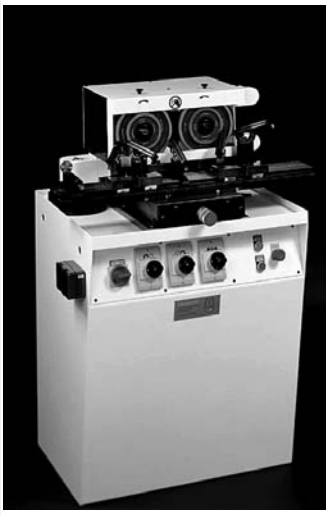
Accessories

Using **botek grinding fixtures**, single flute gundrills can be reground on any good tool grinding machine.
botek grinding fixtures are
- depending on tool dia.
- available as Model ZS (see ill. on left) or Model PS (for solid carbide gundrills).

For grinding **small** batches, we supply the **botek MS-01 single station grinding machine** (with worktop).



You can easily install the above-mentioned botek grinding fixtures on this machine.



For highly efficient grinding of **large batches** of tools with the same point geometry, we recommend **botek MS-12 multi-station grinding machine**.

The machine is suitable for **tool diameters from 1.850 to 12.000 mm** and **tool lengths up to approx. 1,000 mm**, and is available with either 2 spindles (MS-12) or 3 spindles (MS-12/3) (standard version without lamp).

After you have set the fixture, you will obtain consistent and economical regrinding results easily and quickly with botek machines.

For detailed information, refer to brochure 'botek Grinding Machines and Accessories'

botek

☐ **Inquiry**

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

FAX to +49-(0)-7123-3808-138

1) Drilling method

- ☐ Solid drilling
- ☐ Stepped drilling
- ☐ Counterboring
- ☐ Trepanning

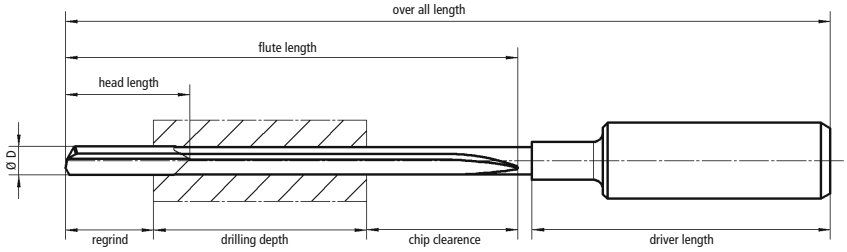
2) Tool type: single flute gundrill

- ☐ in solid carbide Type113
- ☐ with solid carbide drill head
- ☐ drill head with inserted carbide bearing pads + cutting tip / Type 111
- ☐ with indexable inserts and guide pads / Type 01

3) Driver

- ☐ Driver no.: _____ (see botek order no. in catalogues)
- ☐ without driver
- ☐ Special driver (please supply information on dimensions and version)

4) Tool dimensions (please fill in)



5) Calculation of tool length (mm):

Drill dia.	0.5 - 0.899	0.9 - 1.899	1.9 - 2.499	2.5 - 3.099	3.1 - 5.099	5.1 - 8.099	8.1 - 18.099	18.1 - 30.0
Regrind approx.	10.0	12.0	12.0	14.0	15.0	20.0	30.0	30.0
Clearance approx.	15.0	20.0	22.0	25.0	30.0	35.0	55.0	70.0

6) Nose Grinds

- ☐ Standard nose grind
  You will find details of botek grindings in our gundrill brochure and under www.botek.de. You can also request this information directly from botek.
- ☐ Special grind (as per drawing)

7) Coating

Coating type: _____

8) Drill hole dia.

_____ mm

9) Material

Material no.: _____ Description: _____ Hardness: _____

10) Machine / coolant

- ☐ Gundrilling machine
- ☐ Machining centre
- ☐ Deep-hole drilling oil
- ☐ Emulsion (min. 10%)

coolant pressure (p):_____ bar

11) Notes, additional information (on machining, use, material, etc.)

12) Quantity

_____ piece(s)

13) Delivery date

week _____

14) Customer info

Customer: _____

Phone / Fax: _____

E-mail: _____

Contact: _____

Date / Signature: _____

15) Company stamp

You will find a special inquiry sheet for new tool design or tool redesign under **www.botek.de**

DEEP HOLE DRILLING SYSTEMS
SOLID CARBIDE TOOLS

botek
Präzisionsbohrtechnik GmbH

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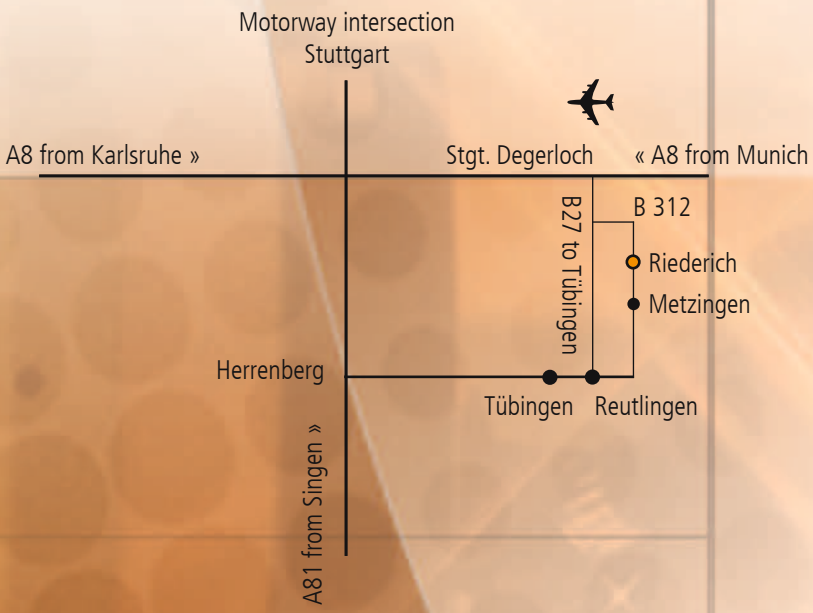
F +49-(0)-7123-3808-138

E-Mail Info@botek.de
www.botek.de



botek Präzisionsbohrtechnik GmbH

250 000 011/04-2009

LACONdesign L.A.