botek®

DEEP HOLE DRILLING SYSTEMS
SOLID CARBIDE TOOLS

Deep hole drilling tools

Ejector System

botek

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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.

Contents

Tools

Tool Type 15: Ø 18.40 - 65.00 mm

Tool Type 60: Ø 18.40 - 36.20 mm

Tool Type 62: Ø 28.71 - 74.99 mm

Tool Type 70E: Ø 25.00 - 65.00 mm

Tool Type 43E: Ø 60.00 - 149.99 mm

Tool Type 43E: Ø 149.00 - 188.99 mm

Tool Type 13E: Ø 28.71 - 74.99 mm

Tool Type 35E: Ø 61.00 - 198.99 mm

Accessories

Technical appendix

Safety notes

Overview of types

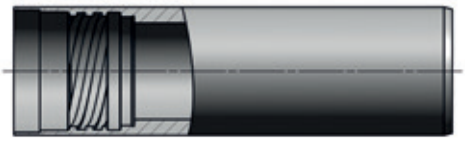
	**Type 15 solid drill head** - High cutting capacity coupled with ease of operation - Stable tool - Suitable for extremely close tolerances - Low up-front costs for small batches
	**Type 60 solid drill head** - Very economical, with optimal cutting capacity - Indexable inserts with various chip breakers available to suit processed material - Tool adjustment range up to 0.5 mm using suitable replacement parts - Ø-fine adjustment with stop plate - No adjustment required when changing wear parts, no readjustment within +/- 0,01 mm
	**Type 62 solid drill head** - New chip breakers for high feed rates and high productivity - No adjustment required when changing wear parts, no readjustment within +/- 0.01 mm - Tool adjustment range up to 0.5 mm using suitable replacement ports - Minimal axis deviation at large drilling depths - Ø-fine adjustment with stop plate
	**Type 70E solid drill head** - Very few wear parts over the whole drilling range - New chip breakers for high feed rates and high productivity - No adjustment after a change of indexable inserts - We keep wear parts in stock - Newly designed tool shape for optimum cooling lubricant flow - Reinforced drill head body in the area of the peripheral insert - Maximum protection of guide pads against damage due to enhanced embedding - Highly wear-resistant drill head body
	**Type 43E solid drill head** - Simplest operation, change of wear parts without readjustment within +/- 0.01 mm - Wear parts can be exchanged on the machine - Tool adjustment range of up to 5 mm with replacement parts - New cutting geometries for high cutting capacity - Minimal axis deviation at large drilling depths - Ø-fine adjustment with stop plate
	**Type 13E counterboring head** - New chip breakers for high feed rates and high productivity - No adjustment required when changing wear parts, no readjustment within +/- 0.01 mm - Tool adjustment range of up to 0.5 mm with replacement parts - Maximum shape accuracy and straightness in the drilled hole - Ø-fine adjustment with stop plate
	**Type 35E counterboring head** - New chip breakers for high feed rates and high productivity - No adjustment required when changing wear parts, no readjustment within +/- 0.01 mm - Tool adjustment range of up to 25 mm with replacement parts - Maximum shape accuracy and hole straightness even at large drilling depths - Ø-fine adjustment with stop plate

Page	Surface quality Ra	Drilling tolerance	Workpiece material				
			Steel	Stainless steel	Cast iron	Aluminium alloys	Heat resisting alloys
8	2 µm	IT 8	● ● ●	● ●	● ● ●	● ●	●
10	1 µm	IT 8 (IT 7)	● ● ●	● ●	● ● ●	● ● ●	● ●
12	2 µm	IT 8	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
14	2 µm	IT 10	● ● ●	●	● ● ●	● ● ●	●
16+18	2 µm	IT 8	● ● ●	● ● ●	● ● ●	● ● ●	● ● ●
20	1 µm	IT 7	● ● ●	● ● ●	● ● ●	● ● ●	● ●
22	2 µm	IT 8 (IT 7)	● ● ●	● ● ●	● ● ●	● ● ●	● ●

● ● ● = good ● = on average

- The values given in the table refer to deep drilling oil as cooling lubricant.
- When using emulsion as a cooling lubricant, the above values cannot be achieved.
- Difficulties may arise when machining stainless steels, please contact our technical sales department: **Tools with interchangeable cutting inserts T +49 7123 3808-200.**

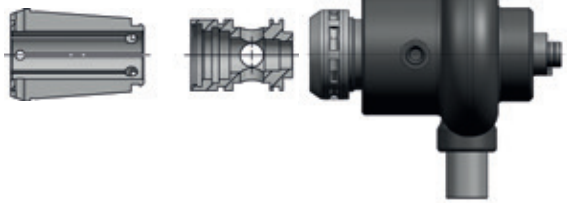
Deep-hole drilling
Ejector system

Drill head		Drill tube, inner tube
Diameter range (mm)	**Solid drilling tools**	
18.40 – 65.00	**Type 15** 	 **Drilling range:** 18.40 – 65.00 mm
18.40 – 36.20	**Type 60** 	 **Drilling range:** 18.40 – 65.00 mm
28.71 – 74.99	**Type 62** 	
25.00 – 65.00	**Type 70E** 	
60.00 – 149.99	**Type 43E** 	 **Drilling range:** 65.00 – 188.99 mm
149.00 – 188.99	**Type 43E** 	
Diameter range (mm)	**Counterboring tools**	
28.71 – 74.99	**Type 13E** 	 **Drilling range:** 65.00 – 79.99 mm
61.00 – 198.99	**Type 35E** 	 **Drilling range:** 80.00 – 188.99 mm

Vibration damper	Collet	Sealing sleeve	Connector	Basic toolholder

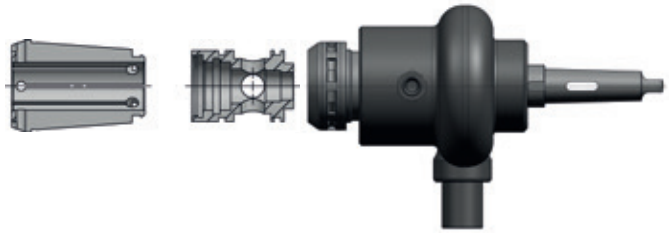
Vibration damper,
rotating
91-028100-000 (Size 1)
91-028200-000 (Size 2)
91-028300-000 (Size 3)

97-2055-400M-V63
(Ø 18.40 - 65.00)



- **ISO 50 DIN 69871**
- **ISO 50 DIN 2080**
- **HSK 100**
- **Capto C8**

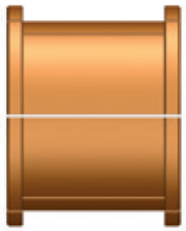
97-2055-400M
(Ø 18.40 - 65.00)



- **MK5**

97-2055-402
(Ø 65.00 - 123.99)

- **ISO 50 DIN 2080**
- **DIN 69871**



Vibration damper
non-rotating
91-030000-000 (Size 0)
91-030100-000 (Size 1)
91-030200-000 (Size 2)
91-030300-000 (Size 3)

97-2055-410
(Ø 18.40 - 65.00)

97-2055-412
(Ø 65.00 - 123.99)

97-2055-413
(Ø 124.00 - 188.99)

Type 15
Solid drill head, brazed type
Ø 18.40 - 65.00 mm

Advantages:

- High cutting capacity coupled with ease of operation
- Stable tool
- Suitable for extremely close tolerances
- Low up-front costs for small batches

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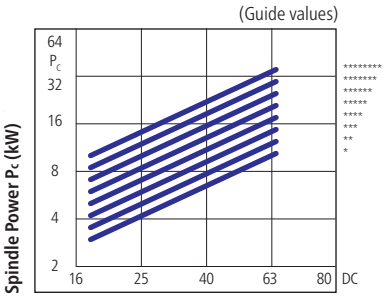
Power requirements

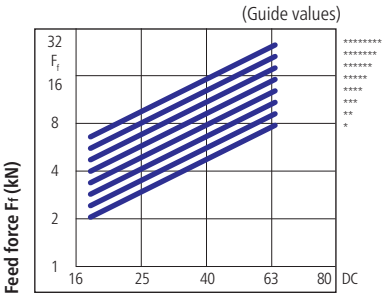
The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

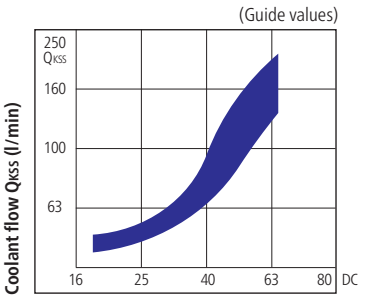
********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

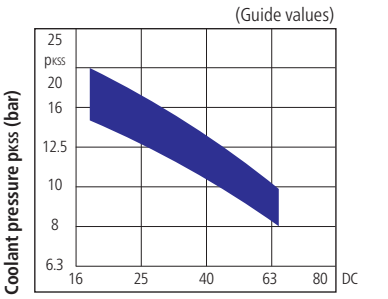
Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.









Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

Materials / mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)				Carbide grade
		18.40 - 20.00	20.01 - 31.00	31.01 - 43.00	43.01 - 65.00	
**Structural steel Rm ≤ 700 N/mm²	70 - 120	0.10 - 0.20	0.15 - 0.25	0.15 - 0.30	0.18 - 0.32	020
Case hardening steel Rm ≤ 750 N/mm²	70 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	
Case hardening steel Rm ≤ 1100 N/mm²	55 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	
Heat treatable steel Rm ≤ 700 N/mm²	70 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	
Nitriding steel Rm ≤ 1100 N/mm²	55 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	
**Ferritic steel Rm ≤ 900 N/mm²	40 - 85	0.12 - 0.20	0.18 - 0.25	0.22 - 0.30	0.24 - 0.36	029*/020
**Austenitic steel	40 - 85	0.10 - 0.20	0.18 - 0.25	0.22 - 0.30	0.24 - 0.36	
**Heat resisting steel Tool steel	50 - 100	0.10 - 0.20	0.17 - 0.25	0.20 - 0.30	0.24 - 0.32	022
Steel castings Rm ≤ 700 N/mm²	50 - 100	0.12 - 0.20	0.15 - 0.25	0.20 - 0.30	0.24 - 0.36	029*/020
Nodular cast iron Rm ≤ 1000 N/mm²	50 - 100	0.10 - 0.18	0.15 - 0.22	0.20 - 0.28	0.24 - 0.32	022
Cast iron	60 - 100	0.10 - 0.18	0.15 - 0.22	0.20 - 0.28	0.24 - 0.32	
**Aluminium Aluminium alloys	65 - 130	0.10 - 0.20	0.16 - 0.25	0.20 - 0.28	0.20 - 0.45	
**Copper Cu-content < 99%	65 - 130	0.05 - 0.20	0.05 - 0.25	0.05 - 0.30	0.05 - 0.45	

* first recommendation (Guide values) ** limited suitability for ejector drilling

Type 60
Solid drill head with indexable inserts and guide pads
Ø 18.40 - 36.20 mm

Advantages:

- Very economical, with optimal cutting capacity
- Indexable inserts with various chip breakers available to suit processed material
- Tool adjustment range up to 0.5 mm using suitable replacement parts
- Ø-fine adjustment with stop plate
- No adjustment required when changing wear parts, no re-adjustment within +/- 0.01 mm

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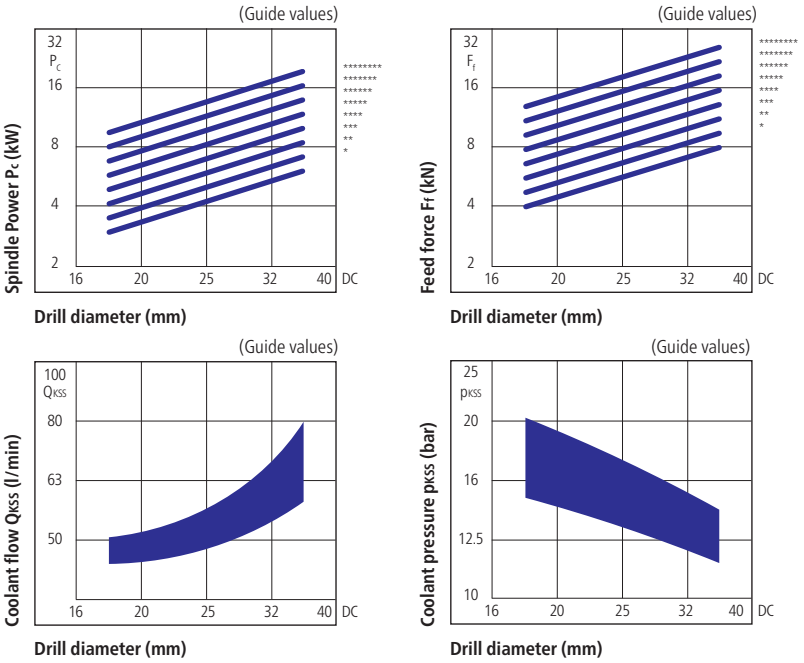
Power requirements

The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.



Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

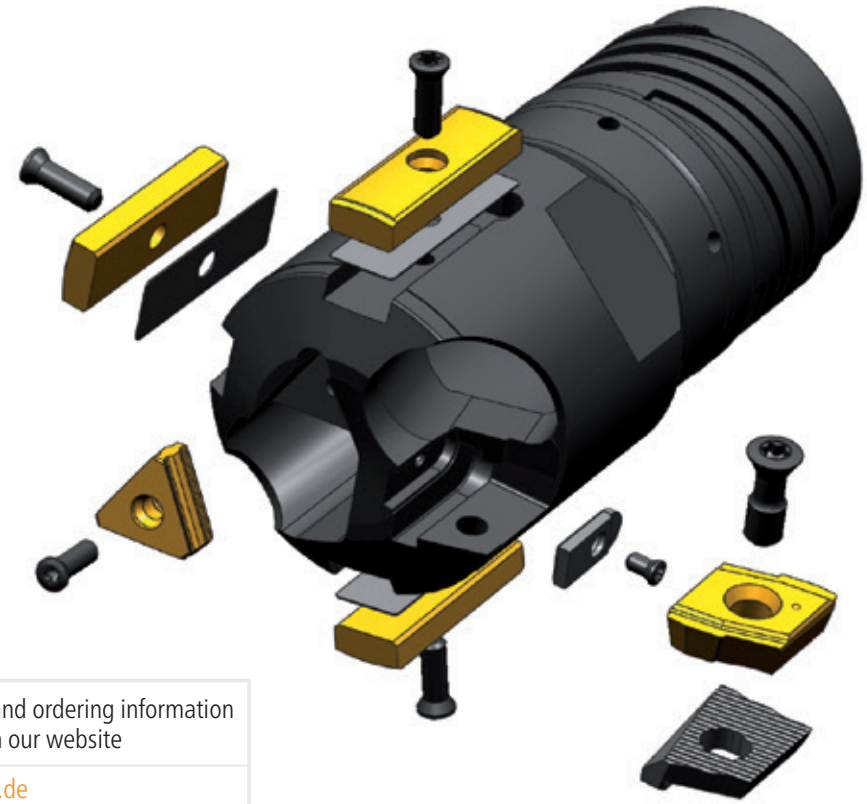
Materials / mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)			Carbide grade	
		18.40 - 24.99	25.00 - 31.99	32.00 - 36.20	Insert	Guide pads
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.08 - 0.11	0.10 - 0.14	0.13 - 0.16	P 25 B - 2	P 20 B
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.08 - 0.11	0.10 - 0.14	0.13 - 0.16		
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.08 - 0.11	0.10 - 0.13	0.12 - 0.15	P 25 BX - 91	
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.08 - 0.11	0.10 - 0.14	0.13 - 0.16		
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.08 - 0.11	0.10 - 0.13	0.12 - 0.15		
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.08 - 0.10	0.09 - 0.12	0.11 - 0.14		
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.08 - 0.11	0.10 - 0.14	0.13 - 0.16	K 10 B - 2	
**Austenitic steel	60 - 80	0.08 - 0.10	0.10 - 0.12	0.12 - 0.14		
**Heat resisting steel Tool steel	50 - 70	0.08 - 0.10	0.10 - 0.12	0.12 - 0.14	P 25 BX - 91	
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.08 - 0.11	0.10 - 0.14	0.13 - 0.16		
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.10 - 0.13	0.12 - 0.15	0.14 - 0.18		
Cast iron alloyed and unalloyed	70 - 100	0.10 - 0.13	0.12 - 0.15	0.14 - 0.18	K 10 - 1	
**Aluminium Aluminium alloys	100 - 200	0.09 - 0.12	0.10 - 0.14	0.12 - 0.18		
**Copper Cu-content < 99%	120 - ...	0.06 - 0.10	0.08 - 0.12	0.10 - 0.14		

** limited suitability for ejector drilling

Type 62
Solid drill head with indexable inserts and guide pads
Ø 28.71 - 74.99 mm

Advantages:

- New chip breakers for high feed rates and high productivity
- No adjustment required when changing wear parts, no readjustment within +/- 0.01 mm
- Tool adjustment range up to 0.5 mm using suitable replacement ports
- Minimal axis deviation at large drilling depths
- Ø-fine adjustment with stop plate



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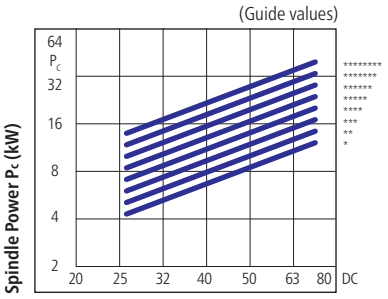
Power requirements

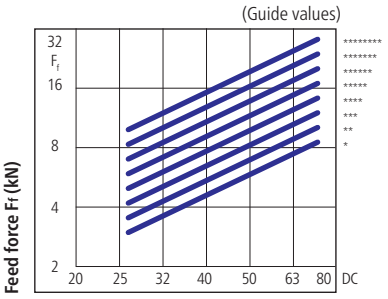
The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

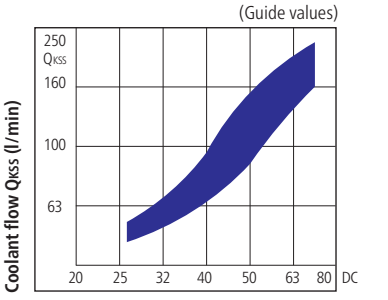
********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

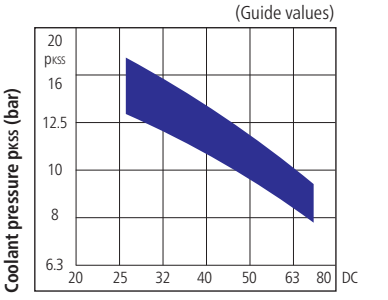
Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.









Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

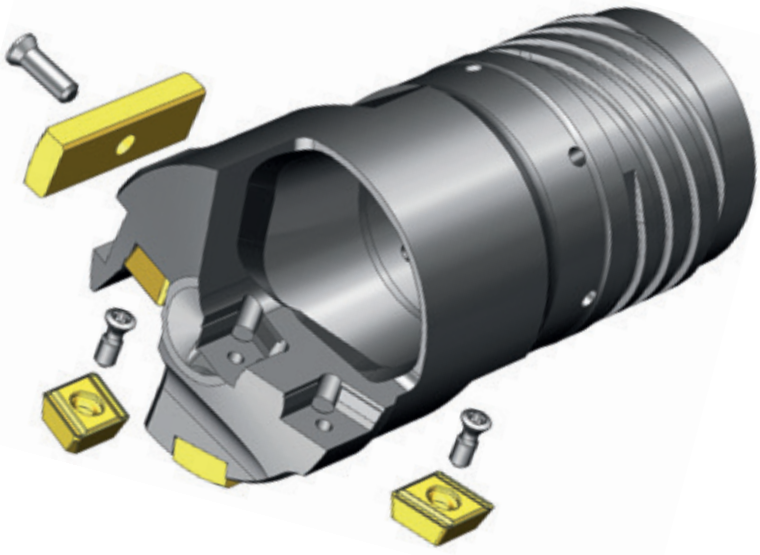
Materials / mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)			Carbide grade		
		28.71 - 39.99	40.00 - 51.99	52.00 - 74.99	Outer insert	Centre insert	Guide pads
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.12 - 0.18	0.15 - 0.20	0.15 - 0.22	P 25 B - 2	P 40 B - 1	P 20 B
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.12 - 0.18	0.15 - 0.20	0.15 - 0.22	P 25 B - 1		
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.20 - 0.25	0.20 - 0.30	0.20 - 0.35	P 25 B - 5		
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.28	0.20 - 0.35	0.20 - 0.40			
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.25	0.20 - 0.30	0.20 - 0.30			
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.25	0.20 - 0.30	0.20 - 0.30	P 25 B - 1		
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.15 - 0.25	0.15 - 0.30	0.20 - 0.30	K 10 BX - 2	K 10 BX - 1	
**Austenitic steel	60 - 80	0.08 - 0.12	0.10 - 0.18	0.10 - 0.22			
**Heat resisting steel Tool steel	50 - 70	0.15 - 0.25	0.20 - 0.25	0.20 - 0.30	P 25 B - 5	P 40 B - 1	
Cast iron alloyed and unalloyed	60 - 80	0.20 - 0.25	0.20 - 0.35	0.20 - 0.35			
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.20 - 0.35	0.25 - 0.40	0.25 - 0.50			
Steel castings Rm ≤ 700 N/mm²	70 - 100	0.20 - 0.35	0.20 - 0.40	0.20 - 0.50			
**Aluminium Aluminium alloys	100 - 200	0.08 - 0.25	0.10 - 0.30	0.10 - 0.45	K 10 B - 5	K 10 BX - 1	
**Copper Cu-content < 99%	120 - ...	0.07 - 0.15	0.10 - 0.25	0.10 - 0.25	K 10 - 1		

** limited suitability for ejector drilling

Typ 70E
Solid drill head with indexable inserts and guide pads
Ø 25.00 - 65.00 mm

Advantages:

- Very few wear parts over the whole drilling range
- New chip breakers for high feed rates and high productivity
- No adjustment after a change of indexable inserts
- We keep wear parts in stock
- Newly designed tool shape for optimum cooling lubricant flow
- Reinforced drill head body in the area of the peripheral insert
- Maximum protection of guide pads against damage due to enhanced embedding
- Highly wear-resistant drill head body



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New:
Stock program Type 70

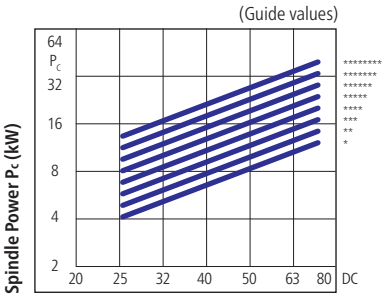
Power requirements

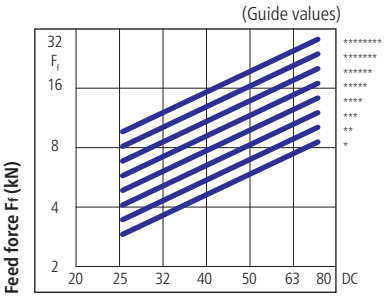
The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

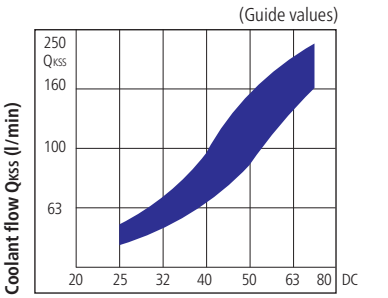
********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

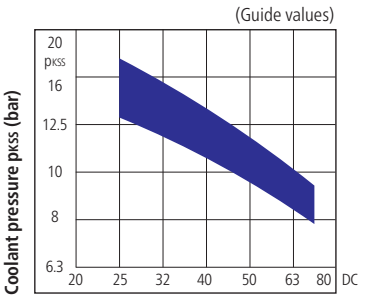
Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.









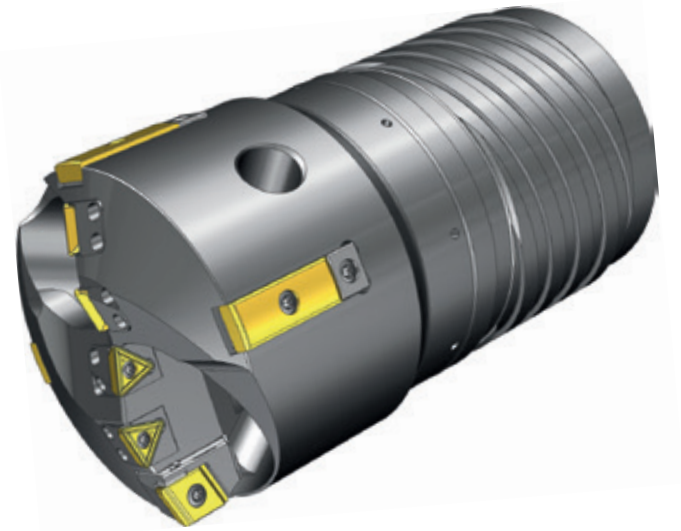
Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary. Other materials on request. When using emulsion, we recommend to reduce cutting speed by 15 - 30 % and to use guide pads P 20 B.

Materials/mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)			Carbide grade			
		25.00 - 29.99	30.00 - 44.99	45.00 - 65.00	Outer Insert/ Intermediate insert	Intermediate insert	Centre insert	Guide pads
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.10 - 0.20	0.10 - 0.25	0.15 - 0.30	U 225 BX - 2	U 225 BX - 5	U 440 BX - 5	P 20 B
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.10 - 0.25	0.10 - 0.35	0.15 - 0.40	U 225 BX - 5			
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.20 - 0.25	0.20 - 0.30	0.20 - 0.35				
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.25	0.25 - 0.30	0.25 - 0.40				
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.25	0.25 - 0.30	0.25 - 0.30				
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.15 - 0.20	0.15 - 0.20	0.15 - 0.25				
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.10 - 0.20	0.10 - 0.25	0.15 - 0.25	U 225 BX - 2			
**Austenitic steel	60 - 80	0.10 - 0.20	0.10 - 0.25	0.15 - 0.25				
Heat resisting steel Tool steel	50 - 70	0.15 - 0.20	0.15 - 0.20	0.15 - 0.25	U 225 BX - 5			
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.20 - 0.25	0.25 - 0.30	0.20 - 0.35				
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.20 - 0.35	0.25 - 0.40	0.30 - 0.40				
Cast iron alloyed and unalloyed	70 - 100	0.20 - 0.35	0.30 - 0.40	0.30 - 0.40				
Aluminium Aluminium alloys	100 - 200	0.10 - 0.25	0.15 - 0.30	0.15 - 0.45				
**Copper Cu-content < 99%	120 - ...	0.05 - 0.15	0.05 - 0.15	0.05 - 0.15	U 225 BX - 2			

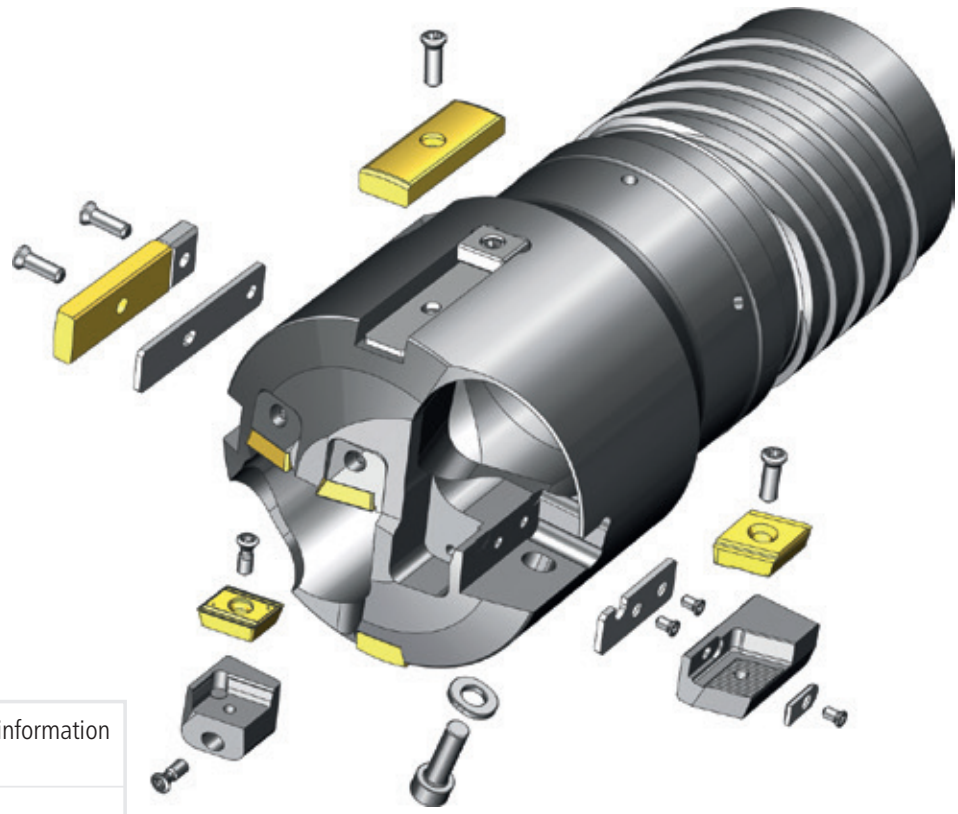
** limited suitability for ejector drilling

Type 43E
Solid drill head with indexable inserts and guide pads
Ø 60.00 - 149.99 mm



Advantages:

- Simplest operation, change of wear parts without readjustment within +/- 0.01 mm
- Wear parts can be exchanged on the machine
- Tool adjustment range of up to 10 mm with replacement parts
- New cutting geometries for high cutting capacity
- Minimal axis deviation at large drilling depths
- Ø-fine adjustment with stop plate



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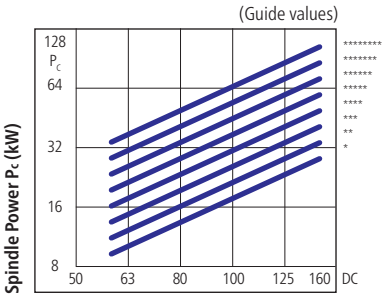
Power requirements

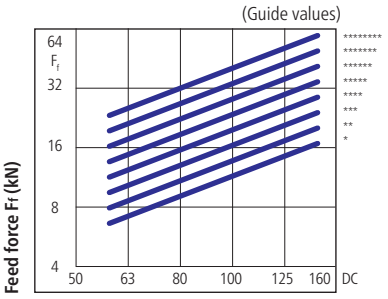
The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

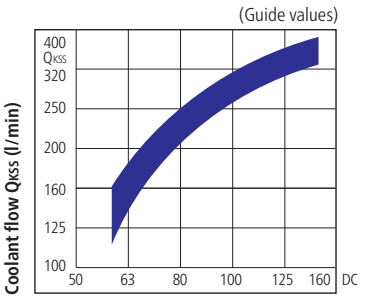
********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

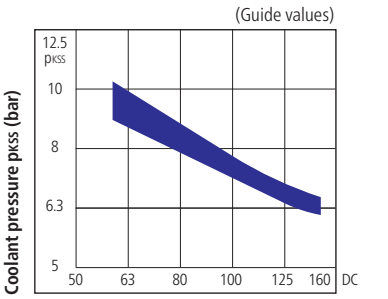
Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.









Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

Materials/mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)	Carbide grade / chip breaker							
			dia.60.00 - 149.99		dia.60.00 - 69.99		dia.70.00 - 94.99		dia.95.00 - 149.99	
		60.00 - 149.99	Outer Insert	Guide pads	Intermediate insert	Centre insert	Intermediate insert	Centre insert	Intermediate insert	Centre insert
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.15 - 0.35	P 25 B - 1	P 20 B	U 225 BX - 6	U 225 BX - 6	U 225 BX - 5	U 440 BX - 6	P 25 B - 5	P 25 B - 5
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.15 - 0.35								
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.15 - 0.35	P 25 B - 5							
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.40								
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.15 - 0.30								
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.15 - 0.30	P 25 B - 1							
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.12 - 0.30	K 10 BX - 2		U 225 BX - 2	U 225 BX - 2	U 225 BX - 2		K 10 BX - 2	K 10 BX - 2
**Austenitic steel	60 - 80	0.12 - 0.25								
**Heat resisting steel Tool steel	50 - 70	0.15 - 0.30	P 25 B - 5		U 225 BX - 6	U 225 BX - 6	U 225 BX - 5		P 25 B - 5	P 25 B - 5
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.15 - 0.35								
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.20 - 0.50								
Cast iron alloyed and unalloyed	70 - 100	0.15 - 0.50								
**Aluminium Aluminium alloys	80 - 150	0.15 - 0.45	K 10 BX - 1						K 10 BX - 2	K 10 BX - 2
**Copper Cu-content < 99%	120 - ...	0.05 - 0.25								

** limited suitability for ejector drilling

Type 43E
Solid drill head with indexable inserts and guide pads
Ø 149.00 - 188.99 mm

Advantages:

- Simplest operation, change of wear parts without readjustment within +/- 0.01 mm
- Wear parts can be exchanged on the machine
- Tool adjustment range of up to 10 mm with replacement parts
- New cutting geometries for high cutting capacity
- Minimal axis deviation at large drilling depths
- Ø-fine adjustment with stop plate

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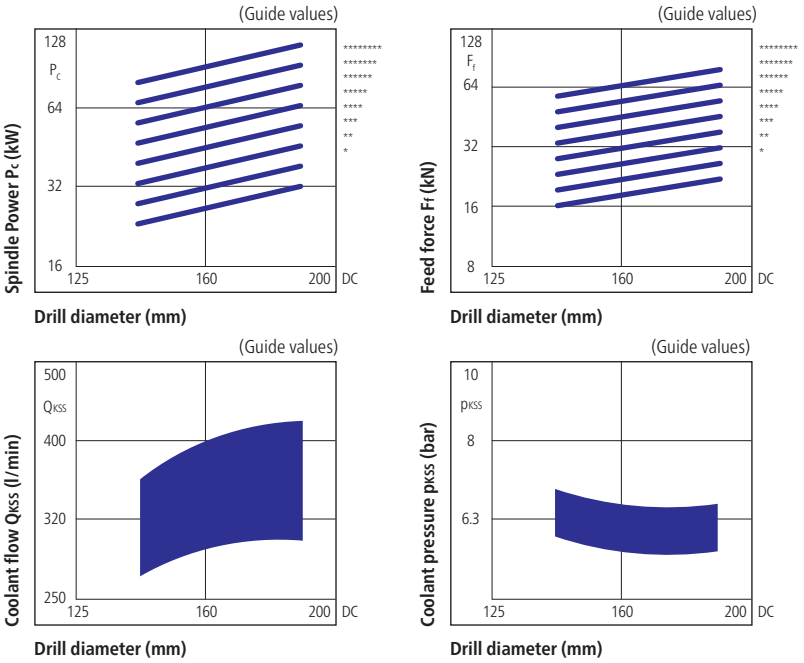
Power requirements

The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

********	f=0.4 (mm/rev)
*******	f=0.32 (mm/rev)
******	f=0.25 (mm/rev)
*****	f=0.2 (mm/rev)
****	f=0.16 (mm/rev)
***	f=0.125 (mm/rev)
**	f=0.1 (mm/rev)
*	f=0.08 (mm/rev)

Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.



Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

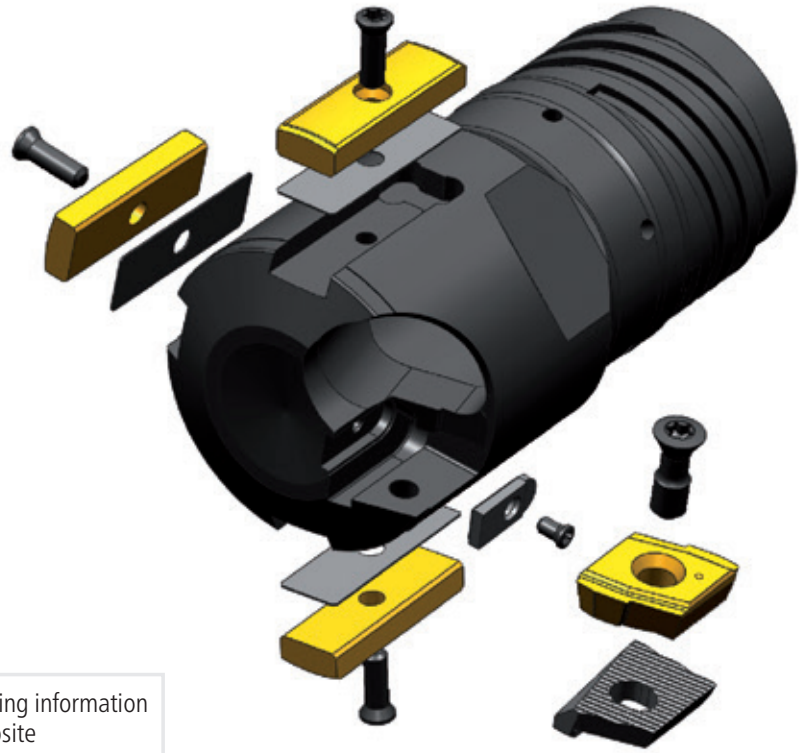
Materials/mechanical strength properties	**Vc** (m/min)	**f** (mm/rev) **for DC** (mm)	**Carbide grade / chip breaker**			
			dia.149.00 - 189.99			
		149.00 - 189.99	**Outer Insert**	**Guide pads**	**Intermediate insert**	**Centre insert**
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.20 - 0.40	P 25 B - 1	P 20 B	P 25 B - 5	P 40 B - 1
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.25 - 0.40				
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.20 - 0.35	P 25 B - 5			
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.40				
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.35				
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.35	P 25 B - 1			
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.18 - 0.30	K 10 BX - 2		K 10 BX - 2	K 10 BX - 1
**Austenitic steel	60 - 80	0.15 - 0.25				
**Heat resisting steel Tool steel	50 - 70	0.18 - 0.30	P 25 B - 5		P 25 B - 5	P 40 B - 1
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.20 - 0.35				
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.20 - 0.50				
Cast iron alloyed and unalloyed	70 - 100	0.25 - 0.50				
**Aluminium Aluminium alloys	80 - 150	0.15 - 0.50	K 10 BX - 1		K 10 BX - 2	K 10 BX - 1
**Copper Cu-content < 99%	120 - ...	0.10 - 0.25				

** limited suitability for ejector drilling

Type 13E
Counterboring head with indexable inserts and guide pads
Ø 28.71 - 74.99 mm

Advantages:

- New chip breakers for high feed rates and high productivity
- No adjustment required when changing wear parts, no re-adjustment within +/- 0.01 mm
- Tool adjustment range of up to 0.5 mm with replacement parts
- Maximum shape accuracy and straightness in the drilled hole
- Ø-fine adjustment with stop plate



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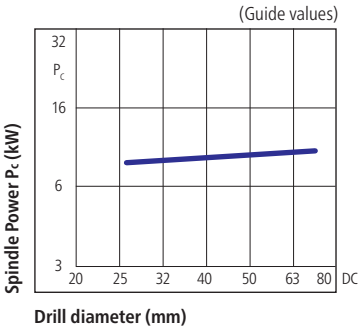
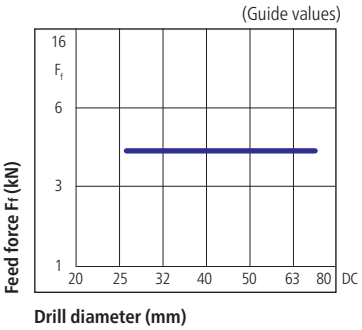
Power requirements

The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

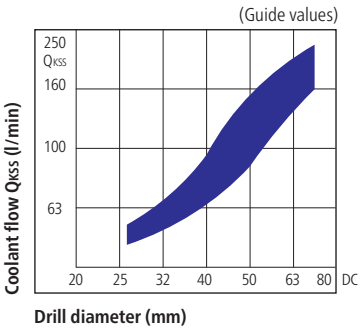
APMX = 6 mm

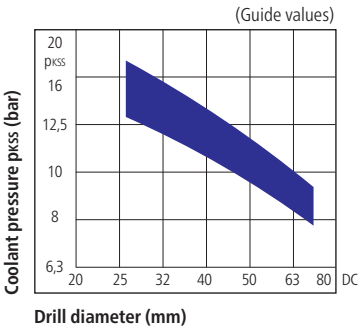




Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.





Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

Materials / mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)			Carbide grade / chip breaker	
		28.71 - 39.99	40.00 - 51.99	52.00 - 74.99	Outer insert	Guide pads
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.20 - 0.30	0.20 - 0.35	0.20 - 0.45	P 25 B - 1	P 20 B
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.20 - 0.30	0.20 - 0.35	0.20 - 0.40	P 25 B - 5	
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.20 - 0.30	0.20 - 0.35	0.20 - 0.35		
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.30	0.20 - 0.35	0.20 - 0.40		
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.30	0.20 - 0.30	0.20 - 0.30		
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.20 - 0.30	0.20 - 0.35	0.20 - 0.35		
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.15 - 0.25	0.15 - 0.30	0.20 - 0.30	K 10 BX - 2	
**Austenitic steel	60 - 80	0.12 - 0.15	0.12 - 0.20	0.12 - 0.20		
**Heat resisting steel Tool steel	50 - 70	0.15 - 0.25	0.20 - 0.30	0.20 - 0.30	P 25 B - 5	
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.15 - 0.25	0.20 - 0.35	0.20 - 0.35		
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.25 - 0.35	0.25 - 0.40	0.25 - 0.45		
Cast iron alloyed and unalloyed	70 - 100	0.20 - 0.35	0.20 - 0.40	0.25 - 0.40		
**Aluminium Aluminium alloys	100 - 200	0.05 - 0.10	0.05 - 0.15	0.05 - 0.15	K 10 B - 5	
**Copper Cu-content < 99%	120 - ...	0.05 - 0.10	0.05 - 0.15	0.05 - 0.15	K 10 - 1	

** limited suitability for ejector drilling

Type 35E
Counterboring head with large adjustment range
Ø 61.00 - 198.99 mm

Advantages:

- New chip breakers for high feed rates and high productivity
- No adjustment required when changing wear parts, no re-adjustment within +/- 0.01 mm
- Tool adjustment range depending on tool diameter up to 25 mm with replacement parts
- Maximum shape accuracy and hole straightness even at large drilling depths
- Ø-fine adjustment with stop plate

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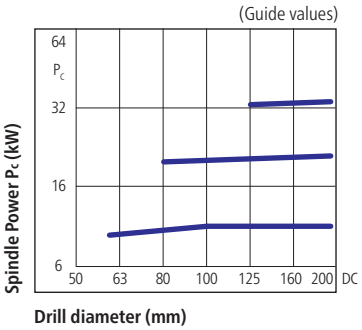
Power requirements

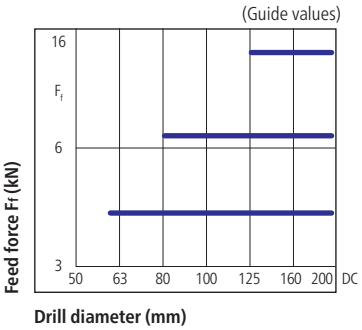
The guide values are for drilling alloyed steel (800 - 1000 N/mm²) and can vary for other workpiece materials and tool conditions (wear).

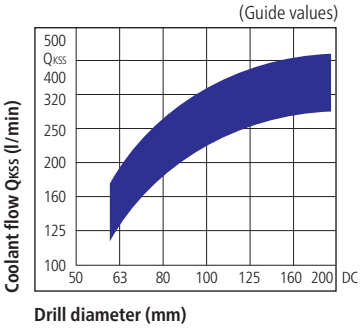
1. APMX = 6 mm
2. APMX = 10 mm
3. APMX = 14 mm

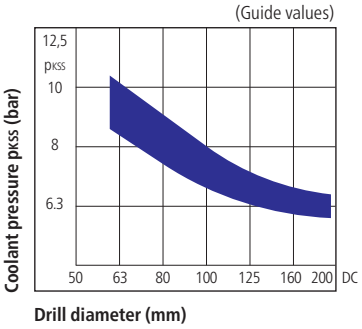
Coolant values

Sufficient coolant must be supplied to the tool for troublefree chip removal.









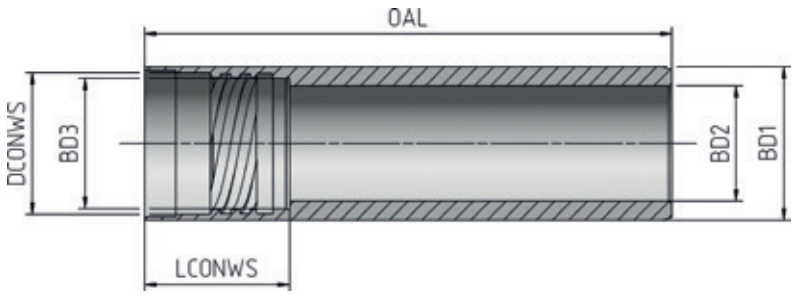
Guide values for deep hole drilling of different materials

Guide values for cutting speed and feed rate are shown in the table.
As there are many factors that can affect the results of deep-hole drilling, these values must be corrected if necessary.

Materials / mechanical strength properties	Vc (m/min)	f (mm/rev) for DC (mm)			Carbide grade / chip breaker	
		61.00 - 80.99	81.00 - 123.99	124.00 - 198.99	Outer insert	Guide pads
**Structural steel Rm ≤ 700 N/mm²	80 - 100	0.15 - 0.20	0.20 - 0.30	0.20 - 0.45	P 25 B - 1	P 20 B
Case hardening steel Rm ≤ 750 N/mm²	80 - 100	0.15 - 0.20	0.20 - 0.30	0.20 - 0.45		
Case hardening steel Rm ≤ 1100 N/mm²	70 - 80	0.20 - 0.30	0.20 - 0.35	0.25 - 0.40	P 25 B - 5	
Heat treatable steel Rm ≤ 700 N/mm²	70 - 90	0.20 - 0.30	0.20 - 0.40	0.30 - 0.50		
Heat treatable steel Rm ≤ 1100 N/mm²	55 - 75	0.15 - 0.25	0.20 - 0.30	0.25 - 0.40		
Nitriding steel Rm ≤ 1100 N/mm²	55 - 75	0.15 - 0.25	0.20 - 0.25	0.25 - 0.32		
**Ferritic steel Rm ≤ 900 N/mm²	60 - 80	0.15 - 0.20	0.20 - 0.25	0.20 - 0.30	K 10 BX - 2	
**Austenitic steel	60 - 80	0.12 - 0.18	0.15 - 0.22	0.15 - 0.25		
**Heat resisting steel Tool steel	50 - 70	0.15 - 0.25	0.20 - 0.30	0.20 - 0.32	P 25 B - 5	
Steel castings Rm ≤ 700 N/mm²	60 - 80	0.15 - 0.25	0.20 - 0.30	0.20 - 0.35		
Nodular cast iron Rm ≤ 1000 N/mm²	65 - 80	0.20 - 0.35	0.25 - 0.40	0.25 - 0.50		
Cast iron alloyed and unalloyed	70 - 100	0.15 - 0.25	0.20 - 0.35	0.20 - 0.40		
**Aluminium Aluminium alloys	100 - 200	0.05 - 0.20	0.05 - 0.20	0.05 - 0.20	K 10 B - 1	
**Copper Cu-content < 99%	120 - ...	0.06 - 0.15	0.06 - 0.20	0.06 - 0.20	K 10 - 1	

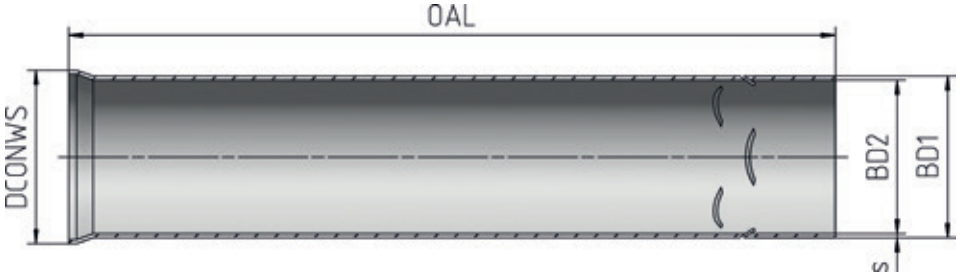
** limited suitability for ejector drilling

Accessories
Type 55 outer and inner tubes



Order no.	Drilling range	$BD1_{h8}$	BD2	DCONWS	BD3	LCONWS	TP
55-0110-L	18.40 - 19.99	18.0	12.0	16.0	14.0	27.5	10
55-0210-L	20.00 - 21.80	19.5	14.0	18.0	16.0	30.0	12
55-0310-L	21.81 - 23.99	21.5	15.0	19.5	17.5		
55-0410-L	24.00 - 26.49	23.5	16.0	21.0	19.0		
55-0510-L	26.50 - 28.70	26.0	18.0	23.5	21.0	33.0	16
55-0610-L	28.71 - 31.00	28.0	20.0	25.5	23.0		
55-0710-L	31.01 - 33.30	30.5	22.0	28.0	25.5		
55-0810-L	33.31 - 36.20	33.0	24.0	30.0	27.0	40.0	20
55-0910-L	36.21 - 39.60	35.5	26.0	33.0	30.0		
55-1010-L	39.61 - 43.00	39.0	29.0	36.0	33.0		
55-1110-L	43.01 - 47.00	42.5	32.0	39.0	36.0		
55-1210-L	47.01 - 51.70	46.5	35.0	43.0	39.5	44.0	24
55-1310-L	51.71 - 56.20	51.0	39.0	47.0	43.5		
55-1410-L	56.21 - 65.00	55.5	43.0	51.0	47.5		

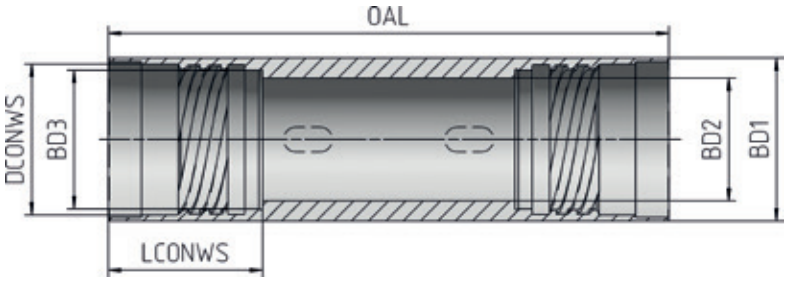
Dimensions in mm



Please note!
The inner tube must be 30 mm longer than the outer tube.

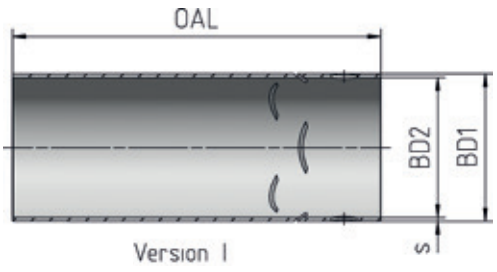
Order no.	Drilling range	DCONWS	BD1	BD2	s
55-0150-L	18.40 - 19.99	12.0	10.0	9.0	0.5
55-0250-L	20.00 - 21.80	14.0	12.0	11.0	0.5
55-0350-L	21.81 - 23.99	15.0	13.0	12.0	0.5
55-0450-L	24.00 - 26.49	16.0	14.0	13.0	0.5
55-0550-L	26.50 - 28.70	18.0	16.0	14.0	1.0
55-0650-L	28.71 - 31.00	20.0	18.0	16.0	1.0
55-0750-L	31.01 - 33.30	22.0	20.0	18.0	1.0
55-0850-L	33.31 - 36.20	24.0	22.0	20.0	1.0
55-0950-L	36.21 - 39.60	26.0	24.0	22.0	1.0
55-1050-L	39.61 - 43.00	29.0	27.0	25.0	1.0
55-1150-L	43.01 - 47.00	32.0	30.0	28.0	1.0
55-1250-L	47.01 - 51.70	35.0	32.0	30.0	1.0
55-1350-L	51.71 - 56.20	39.0	36.0	34.0	1.0
55-1450-L	56.21 - 65.00	43.0	40.0	38.0	1.0

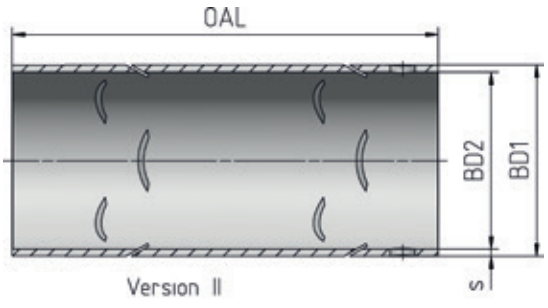
Dimensions in mm



Order no.	Drilling range	BD1$_{h8}$	BD2	DCONWS	BD3	LCONWS	TP
55-1620-L	65.00 - 66.99	56.0	43.0	52.0	47.0	75	32
55-1720-L	67.00 - 72.99	62.0	48.0	58.0	53.0		
55-1820-L	73.00 - 79.99	68.0	53.0	63.0	58.0		
55-1920-L	80.00 - 86.99	75.0	59.0	70.0	64.0	97	44
55-2020-L	87.00 - 99.99	82.0	66.0	77.0	71.0		
55-2120-L	100.00 - 111.99	94.0	78.0	89.0	83.0		
55-2220-L	112.00 - 123.24	106.0	88.0	101.0	95.0	118	60
55-2320-L	123.25 - 136.74	118.0	94.0	113.0	107.0		
55-2420-L	136.75 - 147.99	130.0	104.0	125.0	119.0		
55-2520-L	148.00 - 159.24	142.0	116.0	137.0	131.0	139	72
55-2620-L	159.25 - 171.99	154.0	128.0	149.0	143.0		
55-2720-L	172.00 - 188.99	166.0	140.0	161.0	155.0		

Dimensions in mm





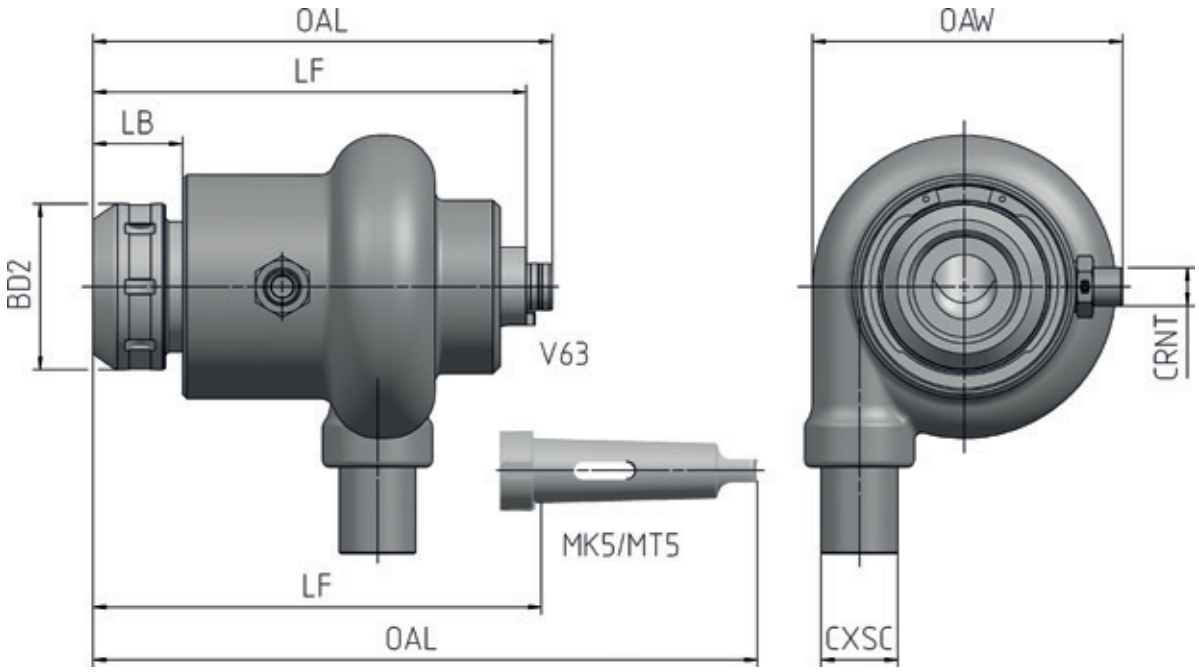
Please note!
From order no. 55-1620-L to 55-2220-L the inner tube must be 190 mm longer than the outer tube.

Please note!
From order no. 55-2320-L to 55-2720-L the inner tube must be 220 mm longer than the outer tube.

Order no.	Drilling range	BD1	BD2	s	Version
55-1650-L	65.00 - 66.99	40.0	38.0	1.0	Version I
55-1750-L	67.00 - 72.99	44.0	41.0	1.5	
55-1850-L	73.00 - 79.99	48.0	45.0	1.5	
55-1950-L	80.00 - 86.99	54.0	50.0	2.0	Version II
55-2050-L	87.00 - 99.99	60.0	56.0	2.0	
55-2150-L	100.00 - 111.99	70.0	66.0	2.0	
55-2250-L	112.00 - 123.24	80.0	76.0	2.0	
55-2350-L	123.25 - 136.74	80.0	76.0	2.0	
55-2450-L	136.75 - 147.99	95.0	91.0	2.0	
55-2550-L	148.00 - 159.24	100.0	96.0	2.0	
55-2650-L	159.25 - 171.99	120.0	116.0	2.0	
55-2750-L	172.00 - 188.99	130.0	126.0	2.0	

Dimensions in mm

Accessories
Ejector rotating connector
Ø 18.40 - 65.00 mm



Pos.	Drill Ø	Order no.	Tool holder	BD2	CXSC	OAW	LF	OAL	LB	CRNT
1	18.40 - 65.00	97-2055-400M-V63	Varilock V63	115	53	210	305	323	67	R3/4"
2		97-2055-400M	MK5 / MT5				315.5	465		R3/4"

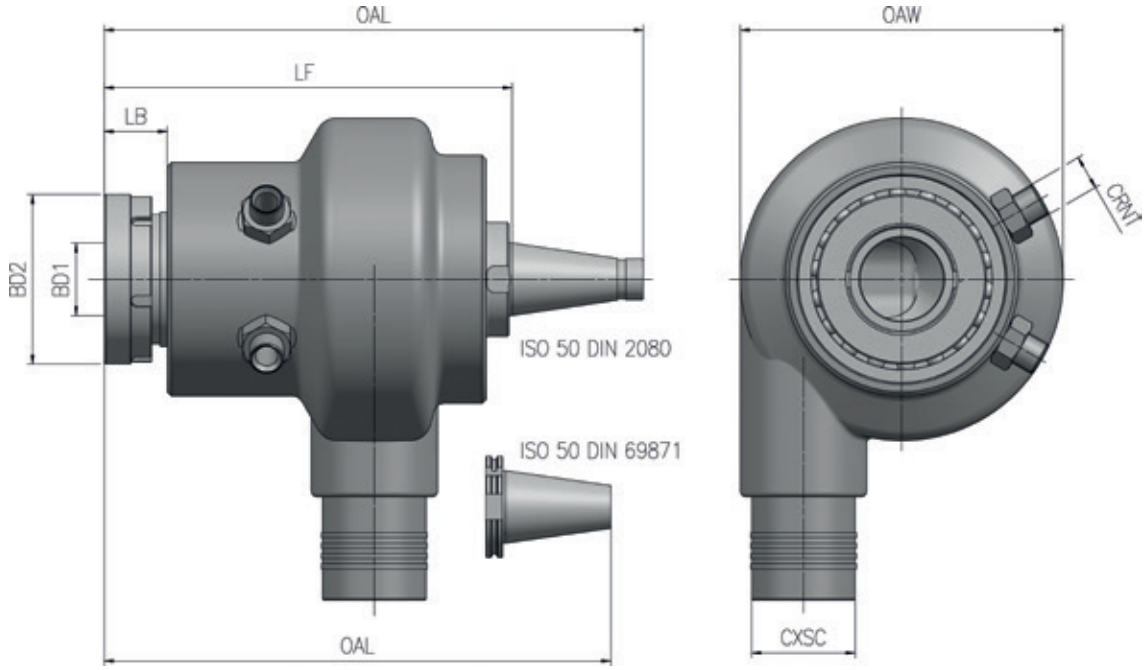
Dimensions in mm

Accessories

Drill Ø	Chuck	Sealing sleeve	Outer O-ring	Inner O-ring
			 2 pieces	 1 piece
18.40 - 20.00	97-2055-420-00	97-2055-430-00	OR 60 x 3	OR 18.0 x 3
20.01 - 21.80	97-2055-420-01	97-2055-430-01	OR 60 x 3	OR 19.2 x 3
21.81 - 24.10	97-2055-420-02	97-2055-430-02	OR 60 x 3	OR 21.2 x 3
24.11 - 26.40	97-2055-420-03	97-2055-430-03	OR 60 x 3	OR 23.0 x 3
26.41 - 28.70	97-2055-420-04	97-2055-430-04	OR 60 x 3	OR 26.0 x 3
28.71 - 31.00	97-2055-420-05	97-2055-430-05	OR 60 x 3	OR 28.0 x 3
31.01 - 33.30	97-2055-420-06	97-2055-430-06	OR 60 x 3	OR 30.2 x 3
33.31 - 36.20	97-2055-420-07	97-2055-430-07	OR 60 x 3	OR 32.2 x 3
36.21 - 39.60	97-2055-420-08	97-2055-430-08	OR 60 x 3	OR 35.2 x 3
39.61 - 43.00	97-2055-420-09	97-2055-430-09	OR 60 x 3	OR 39.0 x 3
43.01 - 47.00	97-2055-420-10	97-2055-430-10	OR 60 x 3	OR 42.5 x 3
47.01 - 51.70	97-2055-420-11	97-2055-430-11	OR 60 x 3	OR 46.5 x 3
51.71 - 56.20	97-2055-420-12	97-2055-430-12	OR 60 x 3	OR 50.2 x 3
56.21 - 65.00	97-2055-420-13	97-2055-430-13	OR 60 x 3	OR 55.2 x 3

Dimensions in mm

Please refer to our safety instructions on page 46 + 47.



Pos.	Drill Ø	Order no.	Tool holder	BD2	CXSC	OAW	LF	OAL	LB	CRNT
1	65.00 - 123.99	97-2055-402-2080	ISO 50 DIN 2080	164	100	312	394.2	521	61	R1″
2		97-2055-402-69871	ISO 50 DIN 69871					495.95		

Dimensions in mm

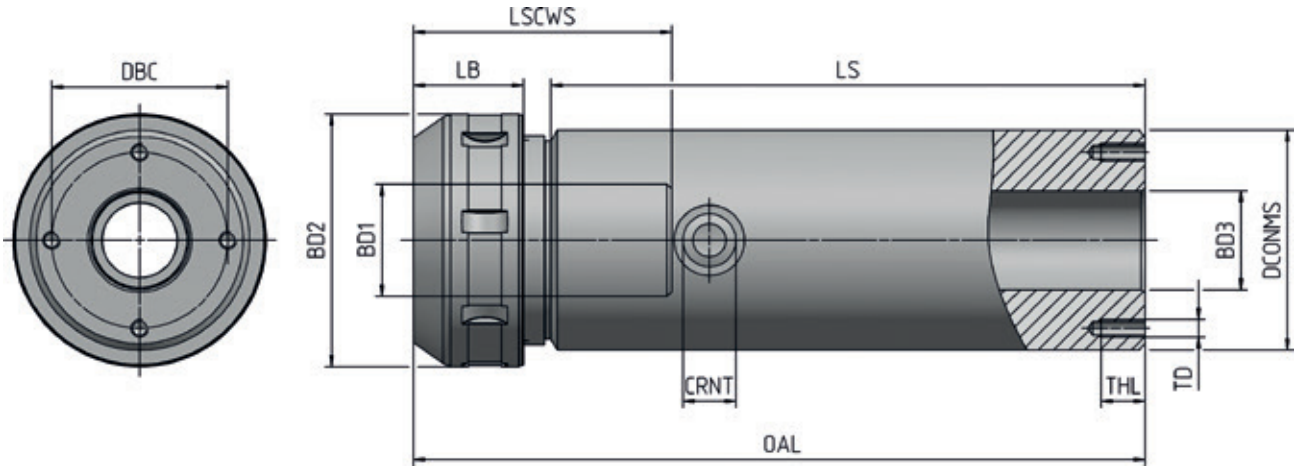
Accessories

Drill Ø	Connecting sleeve	Sealing sleeve	Outer O-ring
			 1 piece
65.00 - 66.90	97-2055-422-14	97-2055-432-14	OR 94.5 x 3
67.00 - 72.90	97-2055-422-15	97-2055-432-15	OR 94.5 x 3
73.00 - 79.90	97-2055-422-16	97-2055-432-16	OR 94.5 x 3
80.00 - 86.90	97-2055-422-17	97-2055-432-17	OR 94.5 x 3
87.00 - 99.90	97-2055-422-18	97-2055-432-18	OR 94.5 x 3
100.00 - 111.90	97-2055-422-19	97-2055-432-19	OR 94.5 x 3
112.00 - 123.99	97-2055-422-20	97-2055-432-20	OR 94.5 x 3

Dimensions in mm

Please refer to our safety instructions on page 46 + 47.

Accessories
Ejector non-rotating connector
Ø 18.40 - 65.00 mm



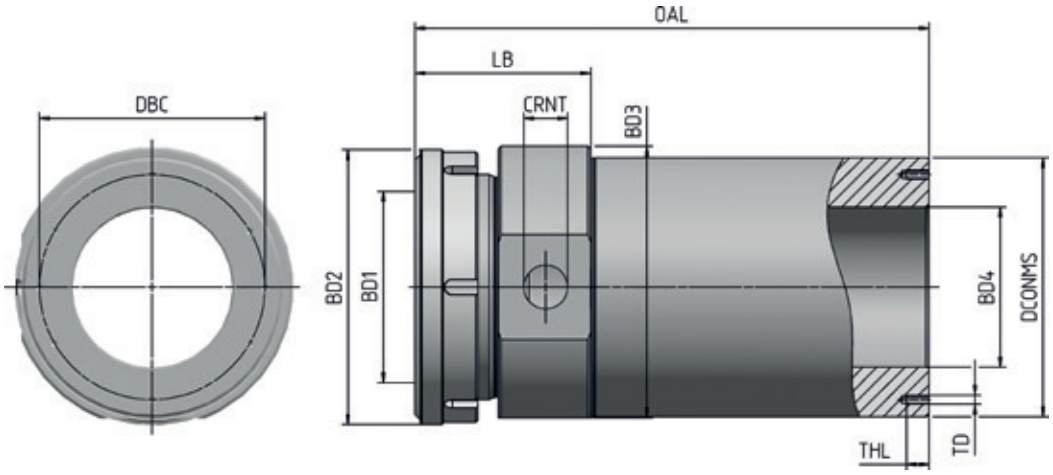
Drill Ø	DCONMS	Order no.	BD2	BD3	OAL	LSCWS	LS	LB	TD	THL	CRNT	DBC 4x90°
18.40 - 65.00	100 g6	97-2055-410	115	45	330	120	267	50	M8	20	R3/4	80

Dimensions in mm

Accessories

Drill Ø	Chuck	Sealing sleeve	Outer O-ring	Inner O-ring
			 2 pieces	 1 piece
18.40 - 20.00	97-2055-420-00	97-2055-430-00	OR 60 x 3	OR 18.0 x 3
20.01 - 21.80	97-2055-420-01	97-2055-430-01	OR 60 x 3	OR 19.2 x 3
21.81 - 24.10	97-2055-420-02	97-2055-430-02	OR 60 x 3	OR 21.2 x 3
24.11 - 26.40	97-2055-420-03	97-2055-430-03	OR 60 x 3	OR 23.0 x 3
26.41 - 28.70	97-2055-420-04	97-2055-430-04	OR 60 x 3	OR 26.0 x 3
28.71 - 31.00	97-2055-420-05	97-2055-430-05	OR 60 x 3	OR 28.0 x 3
31.01 - 33.30	97-2055-420-06	97-2055-430-06	OR 60 x 3	OR 30.2 x 3
33.31 - 36.20	97-2055-420-07	97-2055-430-07	OR 60 x 3	OR 32.2 x 3
36.21 - 39.60	97-2055-420-08	97-2055-430-08	OR 60 x 3	OR 35.2 x 3
39.61 - 43.00	97-2055-420-09	97-2055-430-09	OR 60 x 3	OR 39.0 x 3
43.01 - 47.00	97-2055-420-10	97-2055-430-10	OR 60 x 3	OR 42.5 x 3
47.01 - 51.70	97-2055-420-11	97-2055-430-11	OR 60 x 3	OR 46.5 x 3
51.71 - 56.20	97-2055-420-12	97-2055-430-12	OR 60 x 3	OR 50.2 x 3
56.21 - 65.00	97-2055-420-13	97-2055-430-13	OR 60 x 3	OR 55.2 x 3

Dimensions in mm



Drill Ø	DCONMS	Order no.	BD2	BD3	BD4	OAL	LB	TD	THL	CRNT	DBC 6x60°
65.00 - 123.99	140 g6	97-2055-412	164	160	81	416	116	M8	20	R1"	120
124.00 - 188.99	230 g6	97-2055-413	244	250	142	456	156	M8	20	R1 1/4"	200

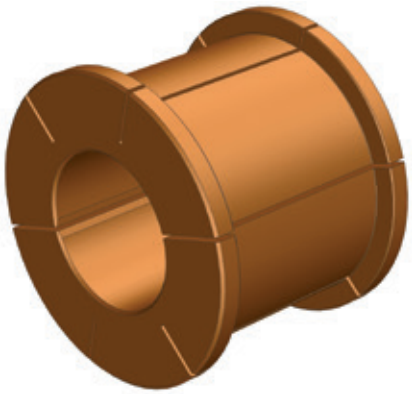
Dimensions in mm

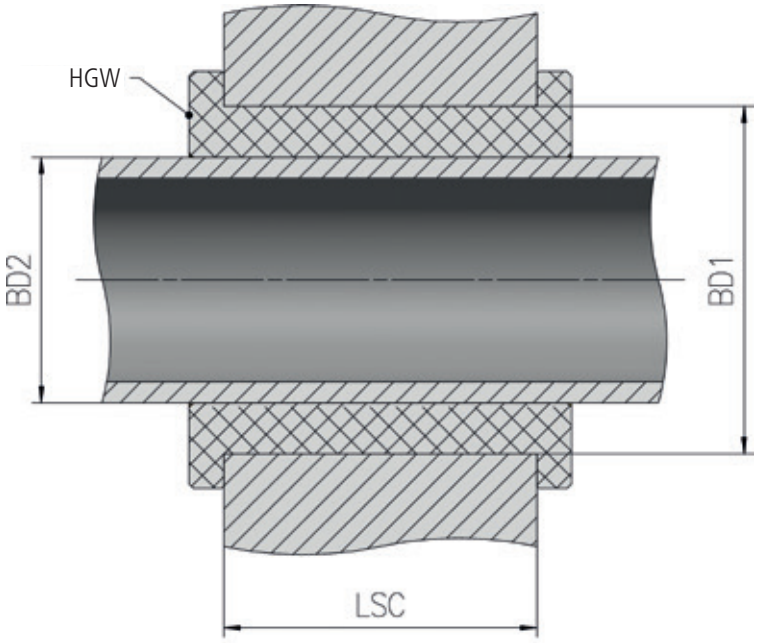
Accessories

Drill Ø	Connecting sleeve	Sealing sleeve	Outer O-ring
			 1 piece
65.00 - 66.90	97-2055-422-14	97-2055-432-14	OR 94.5 x 3
67.00 - 72.90	97-2055-422-15	97-2055-432-15	OR 94.5 x 3
73.00 - 79.90	97-2055-422-16	97-2055-432-16	OR 94.5 x 3
80.00 - 86.90	97-2055-422-17	97-2055-432-17	OR 94.5 x 3
87.00 - 99.90	97-2055-422-18	97-2055-432-18	OR 94.5 x 3
100.00 - 111.90	97-2055-422-19	97-2055-432-19	OR 94.5 x 3
112.00 - 123.99	97-2055-422-20	97-2055-432-20	OR 94.5 x 3
124.00 - 135.90	97-2055-423-21	97-2055-433-21	OR 149.3 x 5.7
136.00 - 147.90	97-2055-423-22	97-2055-433-22	OR 149.3 x 5.7
148.00 - 159.90	97-2055-423-23	97-2055-433-23	OR 149.3 x 5.7
160.00 - 171.90	97-2055-423-24	97-2055-433-24	OR 149.3 x 5.7
172.00 - 188.90	97-2055-423-25	97-2055-433-25	OR 149.3 x 5.7

Dimensions in mm

Stationary tools



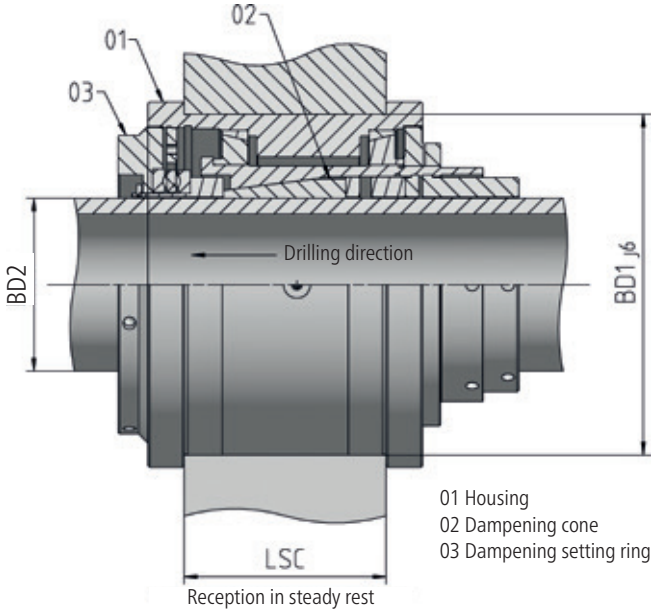


Reception in steady rest

The vibration dampers are built into a steady rest.
The steady rest is clamped in its upper part. The vibration dampers for stationary tools consist of **two-piece damping sleeves**.
These can also be supplied in a combination of steel and plastic.

BD2 max. (mm)	Size	Damper BD1 (j6) x LSC (mm)	Order no.
130	0	150 x 135	91-030000-000
154	1	180 x 135	91-030100-000
250	2	280 x 165	91-030200-000
310	3	355 x 165	91-030300-000

Rotating tools



The vibration dampers are built into a steady rest. The damping pressure can be set using a key on the dampening setting ring **during the drilling process**. A damping cone is required for each size of boring tube.

BD2 (mm)	Size	Damper BD1 (j6) x LSC (mm)	Order no.	max. speed (rpm)
11 - 68	1	180 x 135	91-028100-000	1200
56 - 142	2	280 x 165	91-028200-000	500
118 - 226	3	355 x 165	91-028300-000	250

Accessories

Basic toolholder versions for rotating tools 97-2055-400M-V63

ISO 50 DIN 69871-A
Basic toolholder
ISO 7388/1 (DIN 69871-A)
230 000 109

ISO 50 DIN 2080
Basic toolholder
DIN 2080
230 000 123

HSK 100
HSK basic toolholder
HSK-A/C
230 000 119

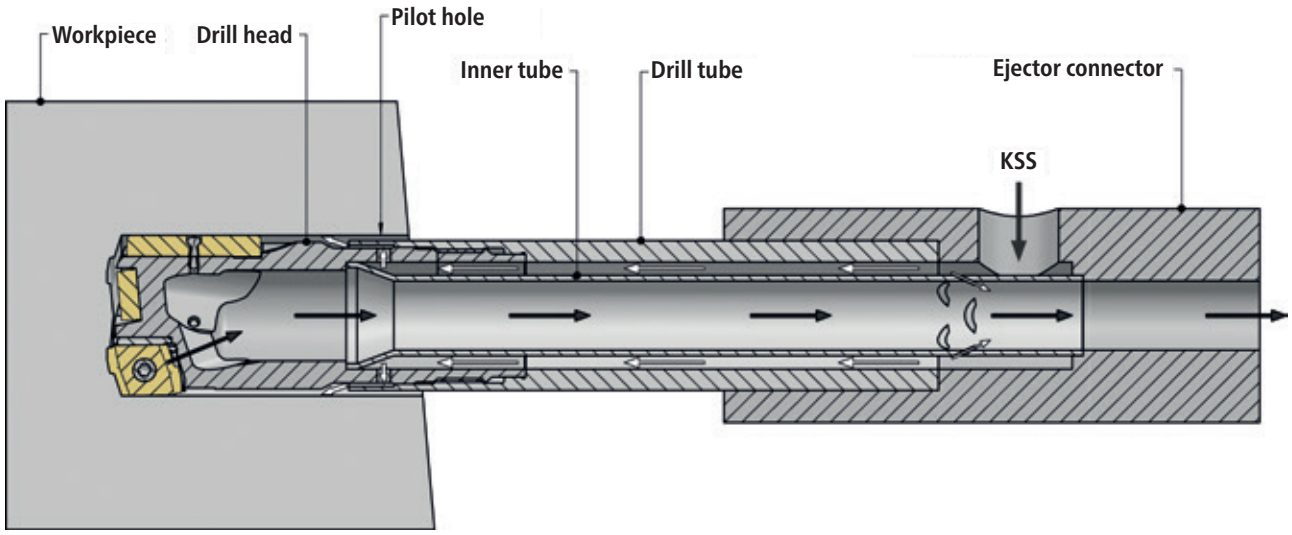
Capto C8
Coromant Capto holder
for Varilock tools
230 000 122

Guide bush

Guide bush 170-04
Cylindrical in accordance with DIN 179 A
or custom-made on request

Drill head setting gauge
For simple and reliable adjustment of drilling tools Ø 1 - 200 mm. Special dimensions up to Ø 600 mm possible.

The set diameter of the tool is to be checked before use every time. Correct tool adjustment increases process safety while machining: rejects are prevented, while wear on the drilling head, indexable inserts and guide pads is substantially reduced.



The ejector drilling system is a variant of the BTA drilling system. Ejector deep-hole drilling is mainly used on conventional machine tools and machining centres, however, since unlike BTA deep-hole drilling there is no sealing to prevent the exit of the cooling lubricant at the workpiece. This drilling system can thus be used if it is not possible to seal the cooling lubricant circuit, e.g. for oblique boring or discontinuous workpieces. Drilling depths of up to 100 x D are possible with this process.

The cooling lubricant is fed through an annular space between the drill tube and an inner tube (double-tube system). The cooling lubricant exits from the side of the drilling head, flows over it and then flows back into the inner tube along with the chips. Some of the cooling lubricant is introduced into the inner tube via a ring nozzle. The resulting underpressure at the chip mouth enables backflow (the ejector effect). An ejector cooling-lubricant feed system is required for generating the ejector effect.

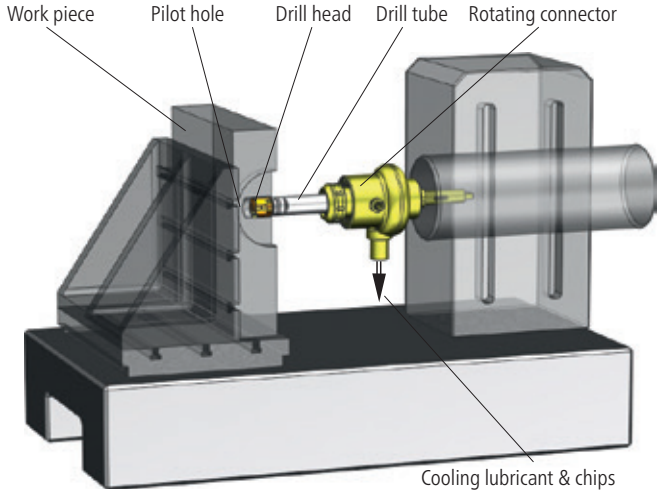
The smooth functioning of the chip return flow depends on the process delivering an optimal chip form.

botek deep drilling tools for the ejector drilling system are available in a range of diameters D = 18.40 to approximately 200 mm.

The Figure shows the essential characteristics of the ejector drilling system.

Technical appendix
Application on a machining centre and lathe

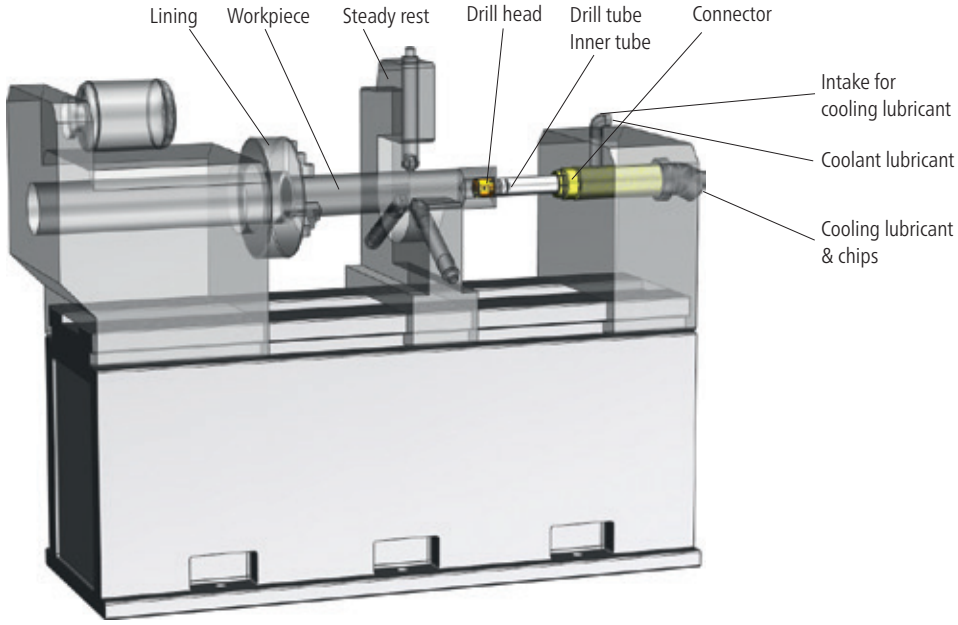
Machining centre:



The ejector system on a machining centre

1. The ejector system is easy to set up and can be used on conventional machining centres and boring machines.
2. A pilot hole made into the workpiece serves as a guidance for the drill head.
3. Throughout the machining process, no sealing is required between the workpiece and the drill tube.

Lathe:

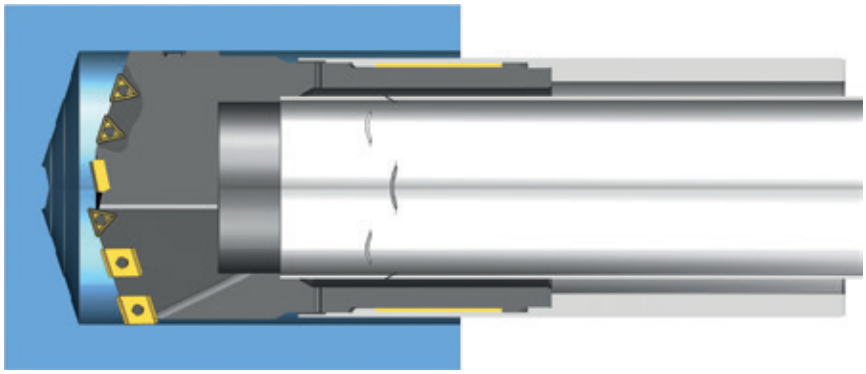


The ejector system on a lathe:

1. The ejector system is easy to set up on a lathe: it can be used on conventional lathes and machining centres.
2. It is a cost-effective alternative to a deep-hole drilling machine.
3. A pilot hole made into the workpiece serves as a guidance for the drill head. A guide bush can alternatively be used.
4. No sealing is required between the workpiece and the drill tube, for only a little cooling lubricant leaks out throughout the machining process.

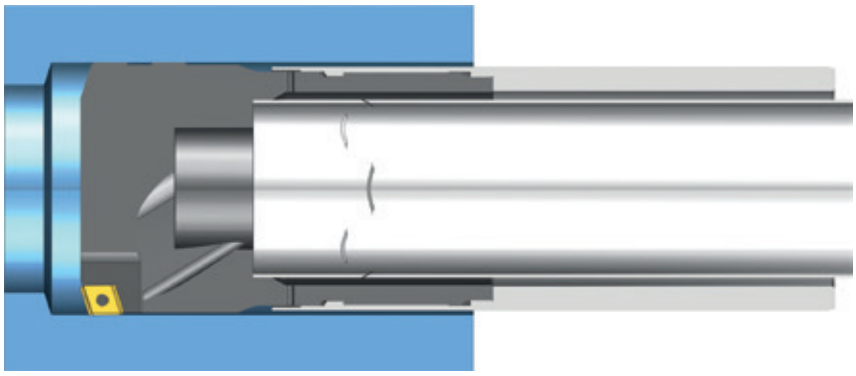
Please refer to our safety instructions on page 46 + 47.

Solid drilling



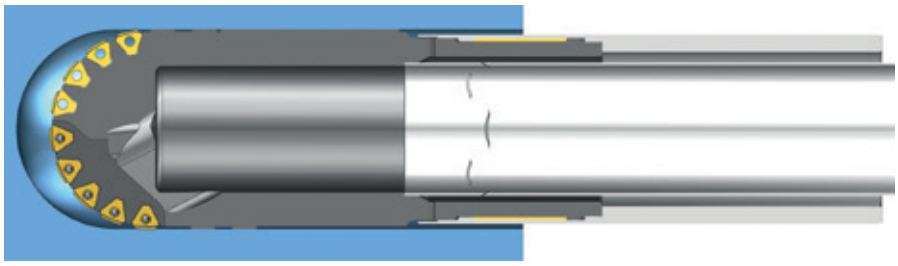
To drill a hole into solid material. Solid drilling is the most commonly used method for drilling operations. Drill hole diameters using the Ejector deep-hole drilling system range from approx. Ø 18.40 - 188.99 mm.

Counterboring



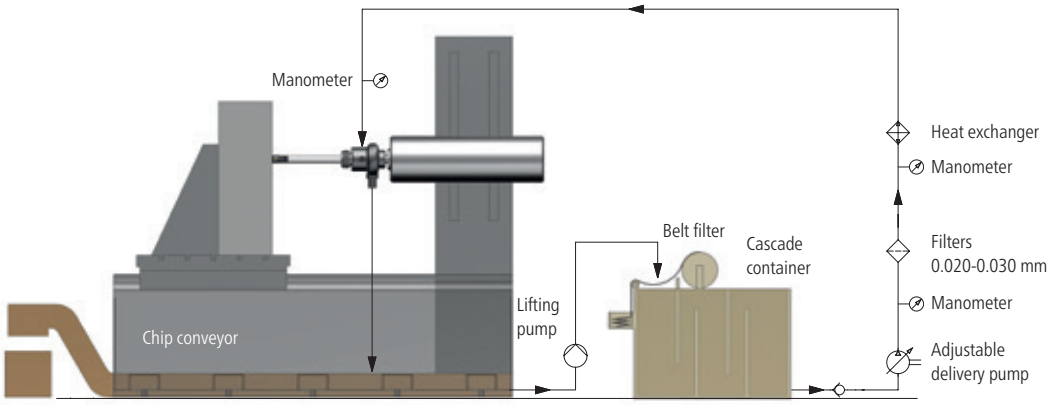
Counter-boring is used for increasing the diameter of predrilled holes, cast holes (e.g. tubes and pipes) or rolled tubes and bores made by other methods. Generally, the work method counter-boring improves the hole quality.
By counter-boring gradually the necessary drive power and feed force can be reduced. This is useful, when the desired drilling diameter cannot be produced in one work step because the spindle power of the machine is insufficient.
Single or multi-edged BTA tools can be used as counterboring tools.

Form counter-boring



Drilling contour sections that are incorporated into the tool.

Schematic diagram of the coolant system



Cooling lubricant system

The purpose of a cooling lubricant in a drilling system is:

- Extend tool life
- Lubricate the guide pads
- Extract the chips
- Dissipate the heat

The cooling system must ensure an adequate supply to the tool of clean cooling lubricant at the correct pressure and temperature. Many workpieces can be drilled with the ejector process, using an emulsion that contains EP (extreme pressure) additives.

Tank size / tank volume

Tanks must be designed to have a volume approximately equivalent to ten times the maximum pump output per minute. This allows dirt in the tank to settle and heat to be dissipated.

In many cases the tank has a chip container above the chamber holding dirty cooling lubricant.
The compartment holding clean cooling lubricant has baffle plates to allow any air present to escape from the cooling lubricant.

The tank is heated by

90% of the driving energy for the drill is converted into heat energy.
95% of the pumping energy of all pressure and circulation pumps is converted into heat energy.
The frictional energy in the lines/fans/filters is converted into heat energy.

All this energy is absorbed by the cooling lubricant.

The tank is cooled by

The tank giving off heat as soon as the temperature of the cutting fluid is higher than that of the surroundings.
If the tank is enclosed, heat loss is greatly reduced.

The workpiece is generally at ambient temperature and has a cooling effect.

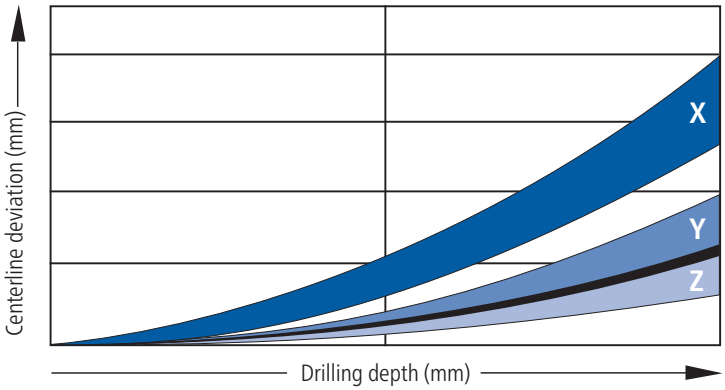
Centre-line deviation

Centre-line deviation means the deviation of the drilling axis from the ideal axis. The centre-line deviation does not follow a straight line; the size of the deviation depends on many factors and cannot be predicted systematically.
Guidelines are according to VDI 3210 Sheet 1 / Part 1 Page 5.

Decisive influencing variables:

- Working method
- Drilling process
- Machine geometry
- Homogeneity of workpiece material
- Workpiece orientation
- Tool adjustment
- Cutting values
- Wear and tear of tools and inserts

Graphic representation: Working method and drilling process



Working method

X Only tool rotating
Y Tool and workpiece rotating (counter rotation)
Z Only workpiece rotating

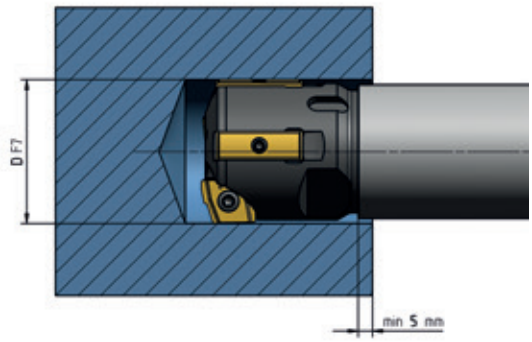
Drilling process

X Solid drilling
Y Counter-boring
Z Pull-boring

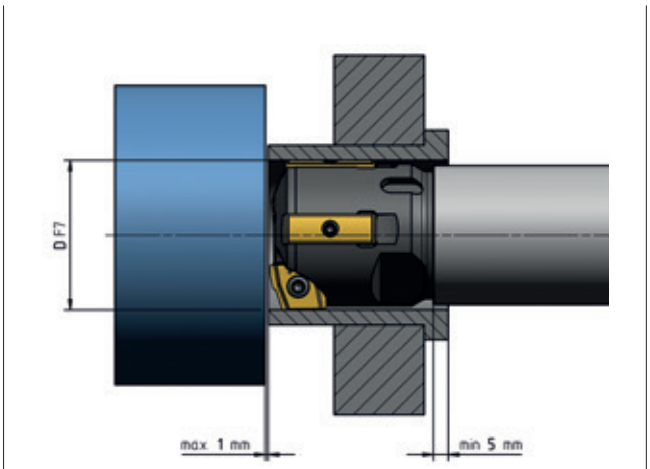
(Please do not combine working method and drilling process.)

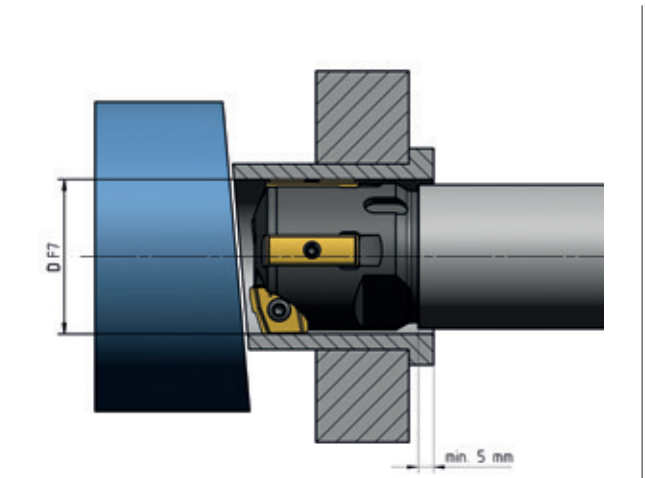
Dimensions for the guide hole

If no drill bush is used, a pilot hole is necessary.
The pilot hole should be slightly larger as the diameter of the drill head (recommended tolerance: F7).
CAUTION: The drill tube must enter into the pilot hole by at least 5 mm.



Positioning of the guide bush for ejector drilling

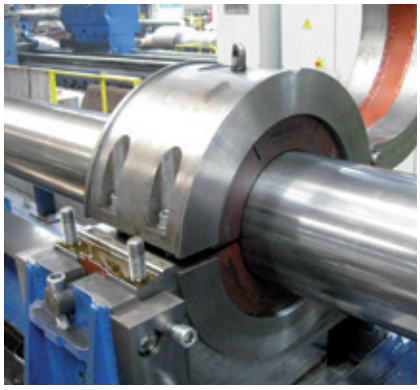




No sealing is required between the workpiece and the guide bush in the ejector system. This guide bush should be as close as possible to the workpiece. To guarantee good boring, the distance should not exceed 1.0 mm.
For efficiant coolant supply the drill bush should be at least 5 mm longer than the length to which the drill head extends in front of the drill tube.
If necessary, the angle of workpiece and drill bush should correspond.

Vibration dampers

Rotating and non-rotating tools



Non-rotating tools

The job of the vibration damper is both to support the drill tube and also to reduce the longitudinal and torsional vibrations occurring during the drilling process. By reducing the vibration amplitude the quality of the hole surface is improved and cutting wear is reduced.

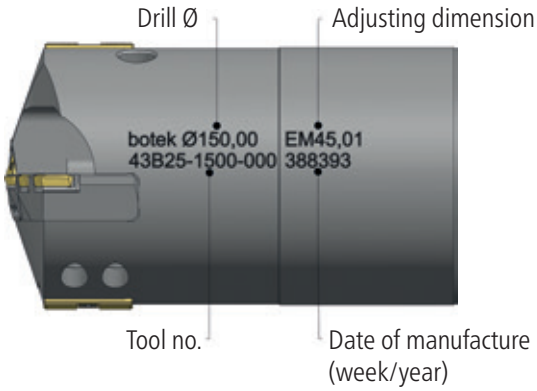
The botek vibration damper works purely mechanically and can be used for both rotating and non-rotating applications. A pre-loaded spring presses the damping cone with constant force against the counter-bearing and balances any slight diameter differences the continuous drill tube might have. The damper is also used for **enclosed machines** or machines which are not accessible during drilling. If the vibration damper is not set correctly, it must be readjusted during the drilling process. Also applied for **pull-boring**. Since with pull-boring the tensile forces are low and the feed rate is small, the vibrations are reduced very well by the pressurized counter-bearing. The spring assembly can be fully loaded for this application.

Technical appendix

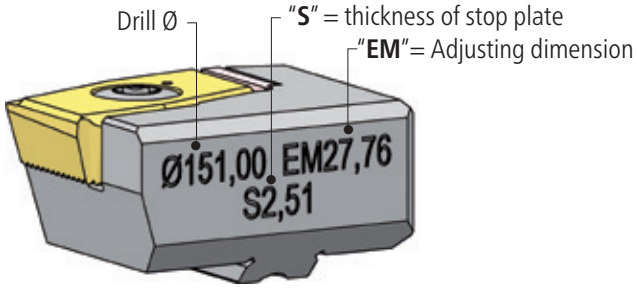
Adjusting tools

When they leave the factory, tools are preset to the diameter stated in the order, and all **important** data (drill diameter, setting gauge and thickness of the stop plate) are engraved on the body or on the cartridge.

Example: Labelling – drill head



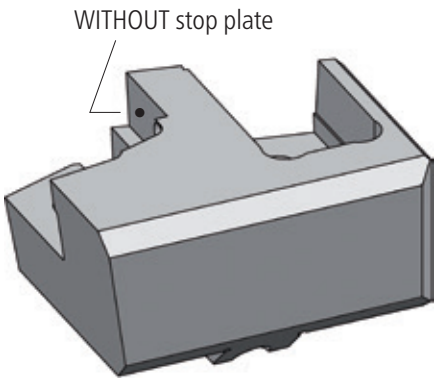
Example: Labelling – cartridge peripheral insert



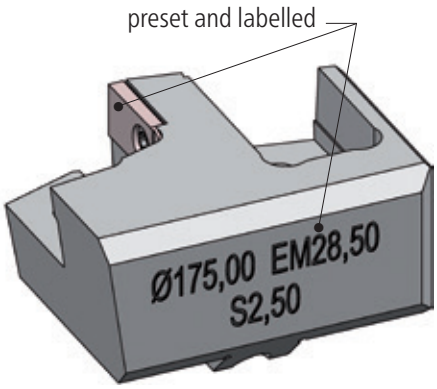
Cartridges – replacement orders

When ordering replacement cartridges, always quote the information engraved on the body.
Preset cartridges will then be supplied (please quote adjusting dimension "EM" and drill-Ø).

Example: If cartridges are ordered **without** stating the setting gauge, they will be supplied **without** fittings.



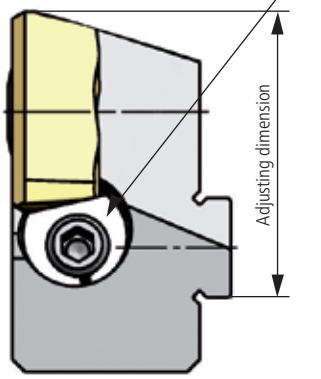
Example: If cartridges are ordered **stating** the "EM" size, they will be supplied **preset** and **labelled**.



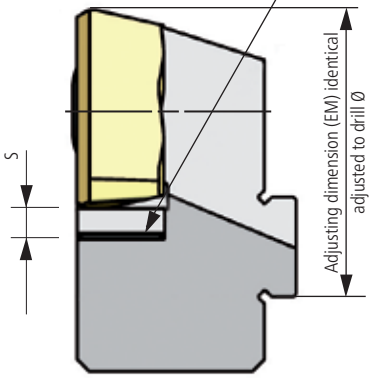
Ordering information for type A cartridges

The following must be ensured when changing the outer cartridge from the version with adjusting wedge to the Type A design with stop plate (this also applies to exchange/replacement of Type A cartridges).

Outer cartridges with adjusting wedge set to Ø



Outer cartridges Type A *with stop plate



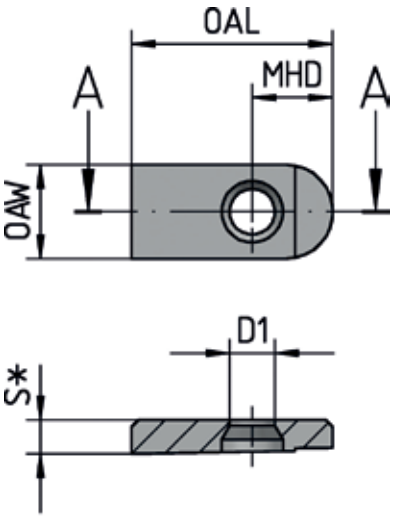
- When changing from cartridge with adjusting wedge to type A cartridges with stop plate, please quote order number and in addition the adjusting dimension ("EM") (take size from cartridge with adjusting wedge).
  The thickness of the stop plate (size "S") can thereby be determined and suitably supplied.

- When a drill head with type A outer cartridge is supplied, the adjusting dimension ("EM") for the drill head diameter supplied is engraved on the drill head and on the cartridge.

- When ordering a type A cartridge, quote adjusting dimensions ("EM") and drill Ø.

- Stop plates are available in thickness steps (dimension "S") of 0.01 mm.
  The respective thickness is engraved on the stop plate. For available S dimensions see VU-01-0056-B.

- It is advisable to store a certain assortment of these stop plates so that any diameter adjustments required can be made without delay.



Cut A-A

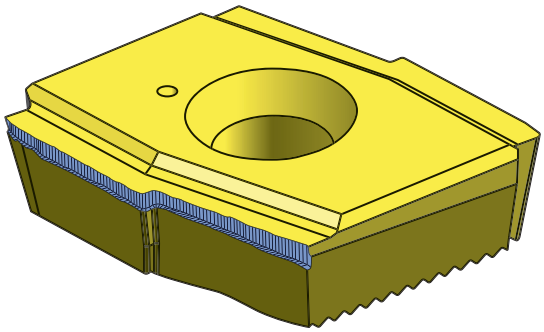
* Stop plates are available in thickness steps (dimension "S") of 0.01 mm.
For range, see table.
The respective thickness is engraved on the part.
When reordering, quote the order number and in addition the dimension "S".

Order no.	S	OAW	OAL	MHD	d	Screw	
						Order No.	Dimensions
01-2050-610-S...	1.30 - 2.00	5.0	11.0	4.8	2.8	01-0200-860	M2.5 x 4.3
01-2400-610-S...	1.80 - 2.50	6.0	13.5	6.0	2.7	21-0200-860	M2.5 x 4.7
01-3750-610-S...	2.20 - 3.00	7.0	15.0	6.0	3.4	21-0600-860	M3.0 x 6.7

Dimensions in mm

Types of wear

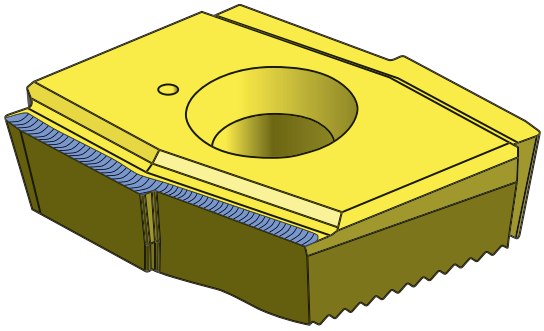
Flank wear



Abrasion of the cutting material almost parallel to the direction of cut because of the sliding abrasion at the cutting surface. Flank wear is normal wear that increases constantly over the operating lifetime.

To extend lifetime:
- use cutting material more resistant to wear
- lower cutting speed

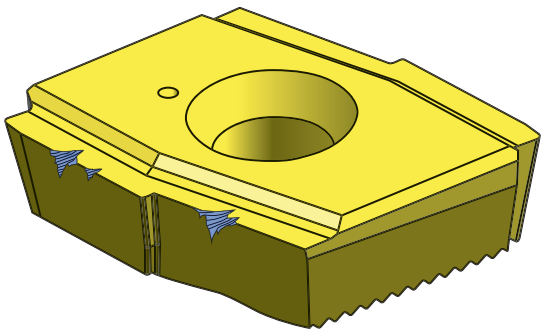
Crater wear



Erosion of the cutting material in the form of depressions behind the cutting edge caused by sliding wear from the chips exiting. Crater wear is normal wear that increases constantly over the operating lifetime.

To extend lifetime:
- suitable chip pilot stage
- greater cutting material strength
- alternative coating

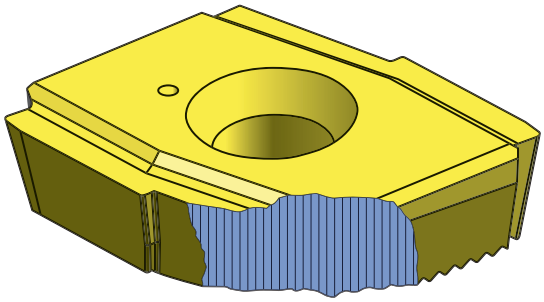
Notch wear



Erosion of the cutting material in the form of notches. Frequently occurs with counter-boring and is caused by a hard surface layer.

To extend lifetime:
- greater cutting material strength
- alternative coating
- regular exchange of indexable inserts

Breakage



Forced breakage of the cutting material in the cutting plane caused by chip congestion, chip breakers too short, drill bush play and vibrations.

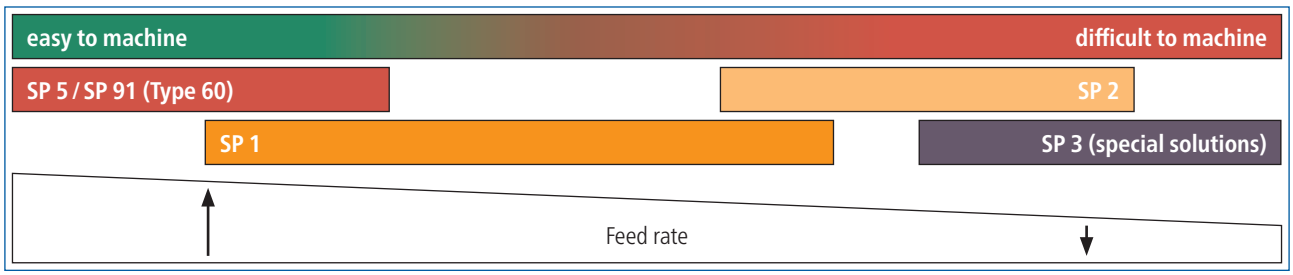
Remedial action:

- Chip congestion: Shorter chip breakers
  Adjust suitable quantity of cooling lubricant
- Chip breaker too short: Use longer chip breaker
- Drill bush play: Drill bush nominal dimension F7
- Vibrations: Unsupported drill tube length too long
  Setting of vibration damper
  Carbide selection

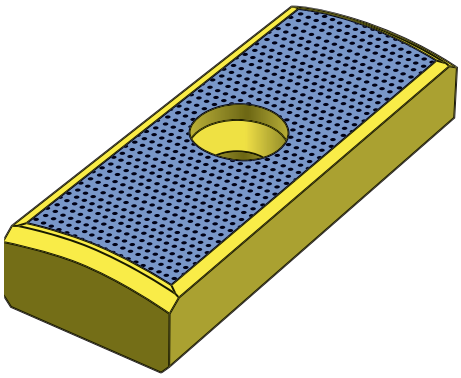
Chip breaker

1. The chip breaker has a decisive part to play with the chip formation.
2. To obtain trouble-free chip flow along with optimum tool life, it is essential to aim for the most ideal chip formation possible.
3. The chips should be broken just short enough to ensure that there is no chip congestion in the flute of the drill.
4. Excessively short, crushed chips place strain on the cutting edges and lead to premature wear and will destroy the cutting edge.
5. For processing commonly used materials, indexable inserts are available from stock with chip breakers in accordance with model SP 1, SP 5 or model SP 2.

Materials to be processed



Cobalt leaching

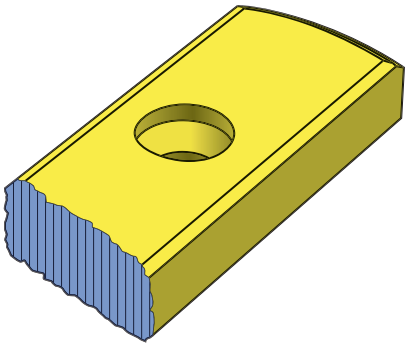


Material fatigue due to unsuitable lubricant.

Remedial action:

- Use deep hole drilling oil
- Use emulsion with high EP additive content

Breakage

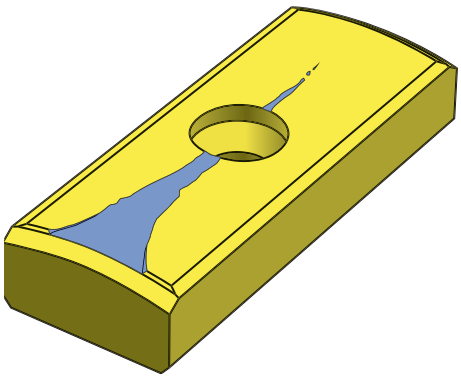


Overload breakage of the guide pad caused by chip congestion or rifling.

Remedial action:

- Chip congestion — Optimize process
- Rifling — Optimize process

Material abrasion



Surface abrasion of hard metal. This appearance is a normal wear, which increases continuously with the duration of use.

Remedial action:

- Observe max. tool life
- Remove dirt particles from cooling lubricant (scale acts like emery)
- Increase lubricating effect of cooling lubricant (EP additives)

Changing the drill head diameter

By replacing the accessories the diameter can be changed.
Depending on the type of tool stop plate, guide pads, shims and the cartridge of the peripheral insert must be replaced.

Stop plate - Increments of 0.01 mm
Cartridges - Please choose according to information given in our catalogues
Guide pads - Are produced on diameter, alternatively shims can be supplied in thickness of 0.025; 0.05; 0.1 and 0.25 mm. Other dimensions must be sourced in locally.

When re-ordering accessories please always state technical details.

Drill heads without cartridge (e.g. Type 60) ⟶ dimension "S" and drill Ø
Drill heads with cartridge (e.g. Type 43) ⟶ adjusting dimension "EM" and drill Ø

Examination
Please check the correct setting before using the tool and after every diameter change by using the botek head setting gauge.

botek setting gauge, measurement range 1 - 200 mm.
Special dimensions up to Ø 600 mm possible.

Cutting tool data according to ISO 13399

Short name	Preferred Name
APMX	Depth of cut maximum
BD	Body diameter
CRNT	Coolant radial entry thread size
CXSC	Coolant exit style code
DBC	Diameter bolt circle
DC	Cutting diameter
DCON	Connection diameter
DCONMS	Connection diameter machine side
DCONWS	Connection diameter workpiece side
LB	Body length
LCF	Length chip flute
LCON	Connection length
LCONMS	Connection length machine side

Short name	Preferred Name
LCONWS	Connection length workpiece side
LF	Functional length
LS	Shank length
LSC	Clamping length
LSCWS	Clamping length workpiece side
LU	Usable length (max. recommended)
MHD	Mounting hole distance
OAL	Overall length
OAW	Overall width
PL	Point length
TD	Thread diameter
THL	Thread length
TP	Thread pitch

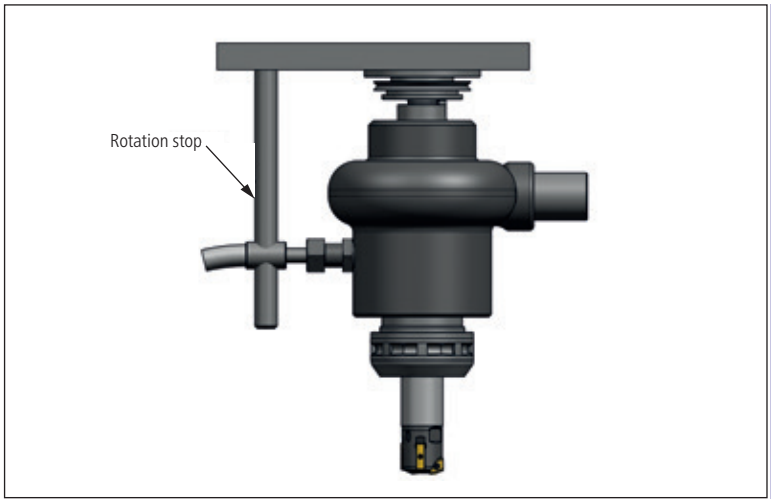
Safety notes

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.

4. The tool is fed into the drill bush or pilot hole while non rotating. Then the coolant and the machine spindle should be started.
5. After reaching the drilling depth switch off the coolant and retract with the spindle stopped.
6. **Warning when drilling with Ejector tools**

   All machines being used with a rotating Ejector coolant connector must have a rotation stop to prevent the housing from rotating. Smallest chips in the coolant liquid can cause the bearings to stop moving. Consequently the housing can be pulled round with the supply tubing to follow this movement. This may cause a serious accident. A rotation stop must therefore always be used.

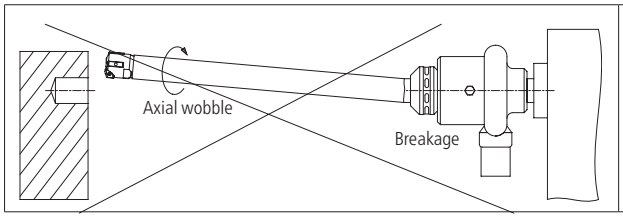
   If the rotating connector has not been used for some time, it is necessary to check by hand if the drive shaft can be moved inside the housing before the machine is started.



WARNING
A rotation stop for the ejector connector must be fitted to the machine. Before work begins, ensure that the shaft can be rotated in the housing.

WARNING
It is necessary to have a coolant filtration with 30 µm or less.

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 us on our **Hotline BTA: T +49 7123 3808-200**.
We will be pleased to offer you advice.

Guide values:
The data given in this brochure are approximate values which may differ from your application.

DEEP HOLE DRILLING SYSTEMS
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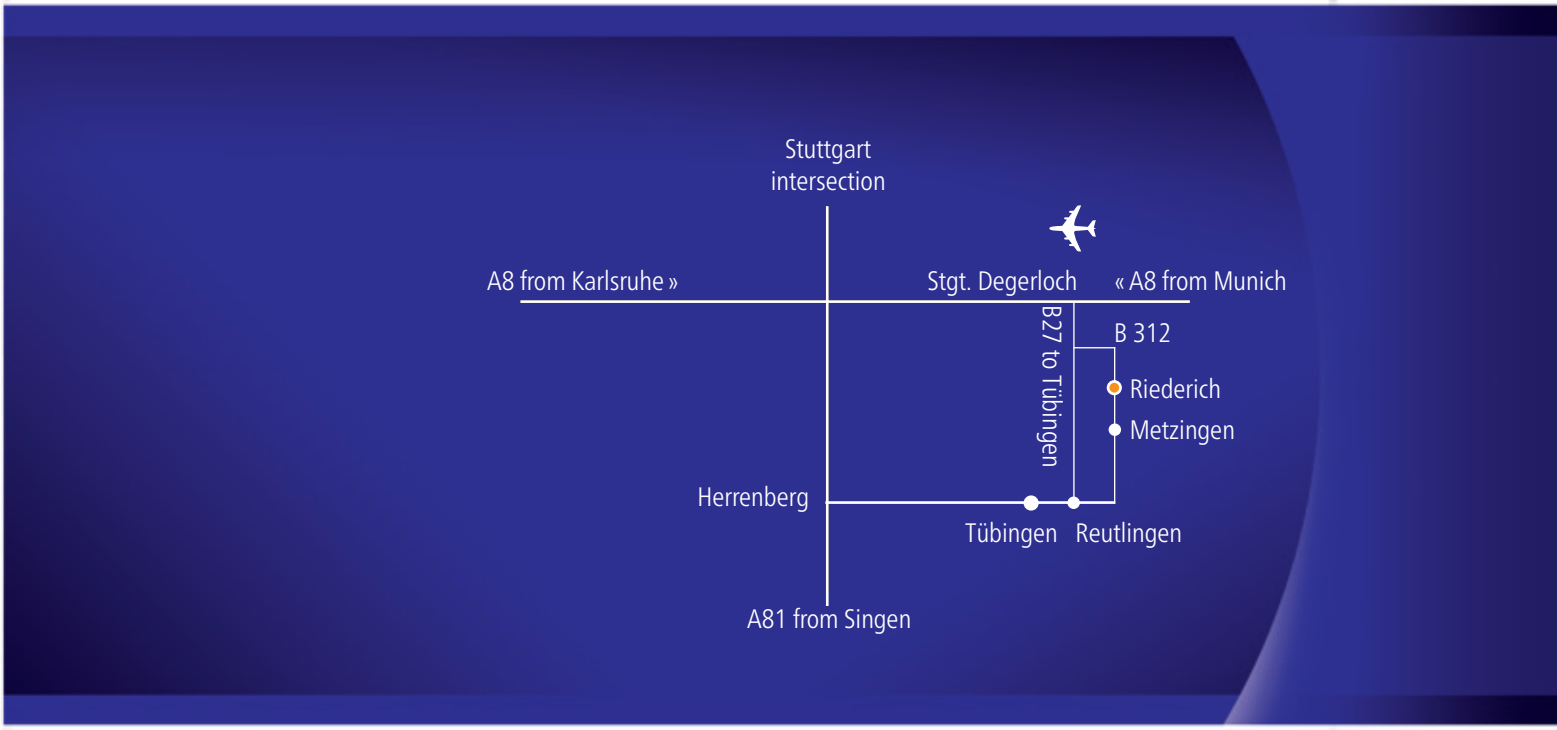

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