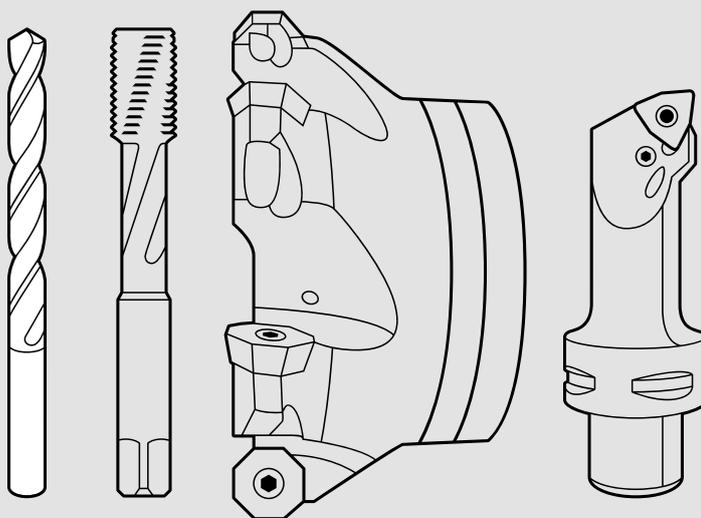


– METAL IS OUR WHOLE WORLD

# Technical Compendium

## Holemaking





*Krato-tec™*

# Technical Compendium – Holemaking

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## Technologies at Walter (continued)

### **((( Accure-tec®**

The patented Walter Accure-tec® technology ensures maximum vibration damping on boring bars for turning and adaptors for milling. Ideal for turning, milling and drilling operations involving extended tool applications.

### **Drivox-tec™**

Drivox-tec™ drilling tools made of solid carbide or HSS are characterized by high performance, quality, and process reliability. They combine many decades of technological developments at Walter and represent the latest evolution in holemaking. Both in terms of macro and micro geometries, such as flute profiles and edge preparation, and in terms of manufacturing and coating technologies.

### **Drion-tec®**

Drion-tec® is the name for Walter's drilling and reaming tool solutions with a replaceable cutting edge – both with indexable inserts and exchangeable inserts. Drion-tec® drills are set apart by their cost-efficiency, high precision and versatility. Thanks to a wide product range, they are suitable for specialised mass production as well as for specific applications and mixed-mode manufacturing.

### **Groov-tec™**

Groov-tec™ is the latest generation of Walter high-performance cutting tools. These are characterised by maximum stability, which enables high process parameters (feeds/speeds/depth of cut) and leads to maximum toolholder and indexable insert service life. At the same time, the systems maximise process reliability by means of controlled chip breaking.

### **Krato-tec®**

Krato-tec® is a unique Walter coating technology for solid carbide tools. The core of this consists of an extraordinarily fracture-resistant AlTiN multi-layer coating with a textured top layer. The special layer architecture is highly wear- and adhesion-resistant, even at high cutting speeds, and ensures the tools have universal application.

### **Tiger-tec® Gold**

Tiger-tec® Gold, the new Walter generation platform for unique indexable insert coatings, enables maximum tool life and process reliability. The new grades are based on PVD, CVD or ULP technology, depending on the application. Unique coating properties, protected by multiple patents, guarantee the best protection against tool life-limiting types of wear and ensure outstanding performance.

### **Tiger-tec® Silver**

With Tiger-tec® Silver, Walter is offering a world first in coating technology for indexable inserts. The special aluminium oxide layer with optimised microstructure reduces wear during turning, milling and drilling operations, and increases toughness and temperature resistance for significantly higher cutting data.

### **Thread-tec™**

Thread-tec™ refers to Walter threading tools with high performance and process reliability. Combining the most recent technical developments and proven properties in tool geometries and coatings, Thread-tec™ is a comprehensive product range featuring a variety of lengths and dimensions. This makes the assortment suitable for any application – whether for thread milling, forming, or tapping.

### **Thrill-tec®**

Thrill-tec® circular drill/thread mills combine three functions in one tool and operation: Chamfering, drilling core holes and producing threads. The tools boast a special combination of substrate, coating and geometry, resulting in long tool life. Bringing together multiple machining steps makes incredibly short machining times possible and reduces the number of tools used and machine slots required.

# Technologies at Walter (continued)

## Walter BLAXX

Walter BLAXX is the benchmark for a new generation of milling cutters: The milling bodies are extremely robust thanks to their special surface treatment. The milling systems, which are mainly positioned tangentially, are equipped with Tiger-tec® indexable inserts. Tools with the "Walter BLAXX" designation combine high wear resistance with unbeatable performance data.

## Walter Xpress

Walter Xpress is the rapid ordering and delivery service offered by Walter Multiply for high-quality special tools. It is available for around 10,000 tool varieties, with a maximum delivery time of two to four weeks from the order date. The ordering process is clearly structured and guarantees absolute planning security. Quotations for all enquiries are calculated and provided within 24 hours.

## Walter Precision XT

Precision boring tools are always used to finish an existing bore or to improve the precision of existing bores, for instance by correcting their position, narrowing the hole tolerance, or enhancing the surface quality. Precision boring is typically performed using a depth of cut < 0.5 mm (0.02 inches).

## Walter Boring XT

Tools for rough boring are used to expand existing bores. Material removal is a key element of this process. The bore to be enlarged is machined in advance or created using casting or forging processes. The rough boring tools themselves can also be used for radial offsetting and multi-edge boring.

## XD Technology

Walter Titex solid carbide drilling and reaming tools stand for precision, high performance and cost-efficiency when drilling in practically any material. Walter Titex XD Technology offers the greatest precision and cost-efficiency in deep-hole drilling operations up to 70 × Dc without pecking.

## Xill-tec®

With Xill-tec®, the solid carbide milling cutters from the MC230 Advance product range, Walter offers a uniquely wide range, with different dimensions, numbers of teeth and shank versions. This means that users are well-equipped for all conceivable milling operations and ISO materials. Universal use – with excellent quality.

## Xtra-tec®

Xtra-tec® indexable insert milling cutters and drills guarantee extremely soft cutting action and optimal surface quality on almost all materials. Indexable inserts with highly positive geometries and the Tiger-tec® coating have a particularly beneficial hardness/toughness ratio. For maximum productivity and process reliability.

## Xtra-tec® XT

Xtra-tec® XT is the latest generation of Walter milling tools. As the "Xtended" Xtra-tec® technology, it offers a completely new perspective on productivity and process reliability. It can cover nearly all milling operations in every common material group: More reliable, productive, cost-efficient than ever before – all while compensating for the CO<sub>2</sub> emissions through Walter Green.

## X-treme Evo

For Walter, the X-treme Evo DC260 & DC160 Advance solid carbide drills as well as the X-treme Evo Plus DC180 Supreme and X-treme Evo 3 DC183 Supreme are the embodiment of the "next generation of drilling", offering versatility for a wide range of materials and machine concepts – with outstanding tool life, productivity and process reliability.

## Technologies at Walter (continued)



Walter Capto™ is a modular tool adaptor system. It is suitable for all turning, milling, drilling and threading processes. Its ISO-standardised polygon taper absorbs torsional moments and bending moments extremely well and ensures optimal repeat accuracy.



Walter ConeFit is an extremely flexible solid carbide milling system with a wide range of high-performance exchangeable heads and shaft variants. Its conical thread can self-centre, thereby guaranteeing maximum stability and concentricity.



Walter ScrewFit users benefit from maximum flexibility. Its modular interface is suitable for a wide variety of boring bars and adaptors and a wide range of tool diameters and lengths for milling and drilling.



The precision-ground QuadFit interface with taper and support face characterises the precision of the vibration-damped boring bars for turning and thread turning with Walter Accure-tec® technology. The exchangeable head system, which can be rotated by 180°, makes it possible to rapidly replace tools with high indexing accuracy.



In turning and grooving operations, the Walter precision cooling system provides cooling at the centre of the chip formation. Its dual coolant jets are directed precisely onto the flank and rake faces. In drilling operations, the coolant jets exit close to the cutting edge. This system provides significantly increased tool life, improved chip breaking and chip removal, greater efficiency and higher quality.



Walter DeVibe is an anti-vibration technology for thread milling cutters. At its core, it consists of a »calming chamfer« that reduces the clearance angle on the flank face. This supports the tool; vibrations are minimised. DeVibe enables higher surface qualities and cutting data, particularly for metric fine threads – regardless of clamping conditions, changing cutting data or the milling strategy.



“Flash” refers to specialised solid carbide milling cutters for high-feed milling. Their end-face geometry reduces the chip thickness “h” and therefore enables an extremely high feed per tooth. Forces that occur are diverted axially towards the centre of the tool, which helps to stabilise the machining process.



On Walter turning toolholders with “SmartLock”, the clamping screw can be operated from the side of the tool. This makes it possible to index the inserts in the machine quickly and easily. Tool change times are reduced as a result. Ideal for use on CNC lathe and multi-spindle machines.



WedgeFit is an interface for grooving and turning applications. Its double wedge enables the cutting forces to be absorbed not only by the clamping screw, but also by the two wedges. In addition to simple, fast handling, this ensures exceptionally high stability and rigidity. Over 1,000 possible combinations of module and support tool maximise the flexibility of the System.

## Tools for drilling from solid, boring, precision boring and reaming

The Walter and Walter Titex competence brands provide a full range of products for efficient bore machining. The standard range of solid drills starts at a diameter of 0.05 mm and goes up to a diameter of 80 mm. There is a choice of many different systems with indexable inserts or exchangeable inserts, as well as systems made from solid carbide or HSS.

In addition to analogue tools, digital solutions are available for boring and precision boring operations. Maximum precision and easy handling increase process reliability and productivity. For reaming operations, Walter offers various versions of solid carbide or HSS tools with multiple cutting edges.

### 1 XD Technology

- Drilling without pecking up to  $50 \times D_c$  as a standard tool and up to  $70 \times D_c$  as a special tool
- For versatile use in many different materials

### 2 D4140 exchangeable insert drill

- Tool for drilling from solid with exchangeable insert for all holes up to  $10 \times D_c$
- Patented clamping provides maximum process reliability

### 3 UFL® XPL high-performance drill made from HSS-E

- UFL® XPL tools offer long tool life for universal application
- HSS-E provides good temperature resistance and the XPL coating ensures maximum wear resistance

### 4 X-treme Evo – DC260 Advance

- Pilot hole drilling and countersinking can be performed in a single operation
- Other dimensions and steps can be supplied by the Walter Xpress Service within two weeks

### 5 Solid carbide and HSS centre drills

- Our product range includes dimensions in accordance with DIN 333 and the associated Forms A, B and R

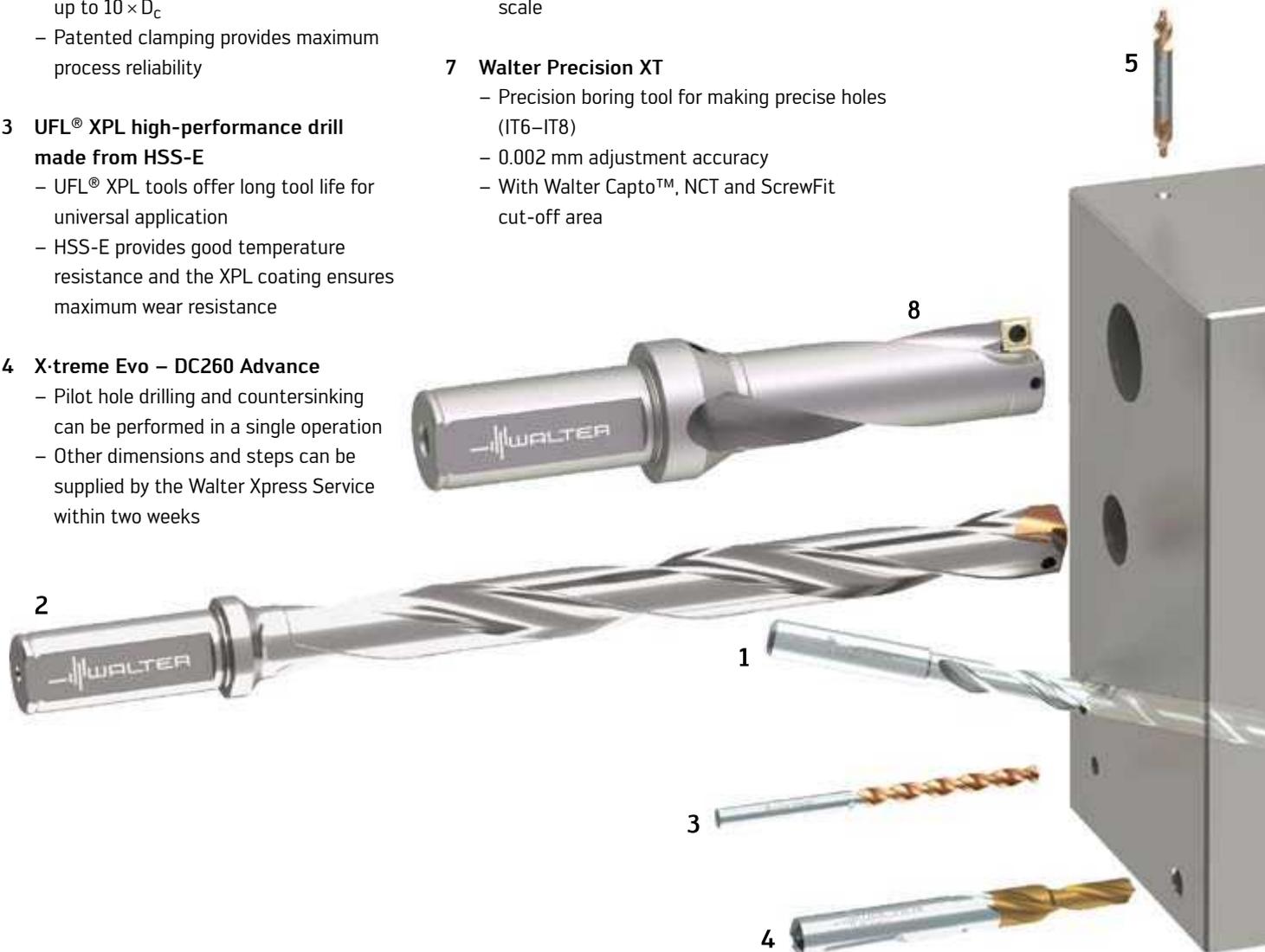
### 6 DC170 Supreme – The ikon of drilling

- Innovative new land design for maximum performance and component quality
- Reliable thanks to  $360^\circ$  coolant coverage
- Visible cost-efficiency due to the regrinding scale

### 7 Walter Precision XT

- Precision boring tool for making precise holes (IT6–IT8)
- 0.002 mm adjustment accuracy
- With Walter Capto™, NCT and ScrewFit cut-off area

5



### 8 D4120 indexable insert drill

- Indexable insert drill which can be used universally for high productivity with excellent hole quality

### 9 Walter Boring XT

- Boring tool for efficient boring of existing holes (IT9)

### 10 X-treme Evo – DC160 Advance

- Can be used universally with a range of materials
- Very large standard range from 3 to 30 × D<sub>c</sub>

### 11 Walter Titex reaming

- Our comprehensive range of reaming tools made from solid carbide and HSS includes cylindrical and tapered versions
- 1/100 increments available from stock

### 12 D4580 + DC160 Advance chamfering tools

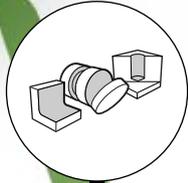
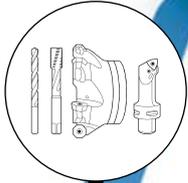
- Xtra-tec®
- Can be used with various solid carbide drills



# How to use Walter GPS

As the market's leading software solution for finding tools and calculating cutting data, Walter GPS offers you many functions that will help you in your day-to-day work: For production on the machine, as good starting values for programming, for process and component planning and much more – the journey from component to production couldn't be quicker. The reason?

➤ **With the GPS cutting data, you can start production immediately!**



## SEARCH PRODUCT-RELATED

A

Would you like to use a specific tool or an existing tool? Do you know the application and material, but don't know what cutting data you should work with? Or do you want to know whether your tool can do this?

Walter GPS gives you the answer in just a few clicks: In the form of cutting data, data models and much more.



Enter specific **tool**

## SEARCH APPLICATION-RELATED

B

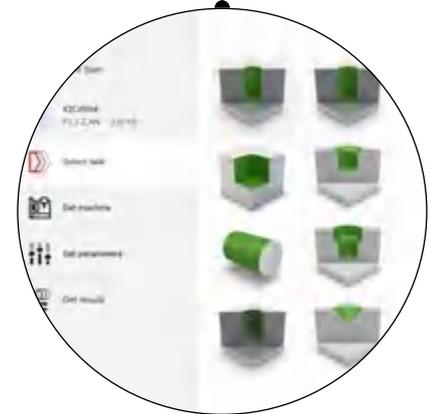
Do you know your application and your material, but don't know which tool solution is best for it?

Walter GPS suggests one or more solutions – and you choose the best one for you. And that's not all – this also works for indexable insert tools; Walter GPS even puts together different combinations of body and inserts for these!



Select **material** and ...

Select **material** and ...



... **application**

... **application**

## HOW WALTER GPS BENEFITS YOU

- > **Find the right tool solution for your machining task** – quickly and based on your machining objective (e.g. maximum cost-efficiency).
- > **Get reliable cutting data for your tool** – calculated according to your specifications: For your tool, your application and your material.
- > **Ideal for calculating profitability** – this allows you to determine the estimated costs in the shortest possible time.
- > **Benefit from helpful additional information** – e.g. in the form of 2D and 3D models which you can use directly for your machine programming.
- > **CO<sub>2</sub> values for your application** – divided according to machining operation and machine basic load.

### Launch Walter GPS now

Your navigation system for the best machining solution



[www.walter-tools.com/gps](http://www.walter-tools.com/gps)

## RESULT



Enter **application parameters**

**Tool selection**

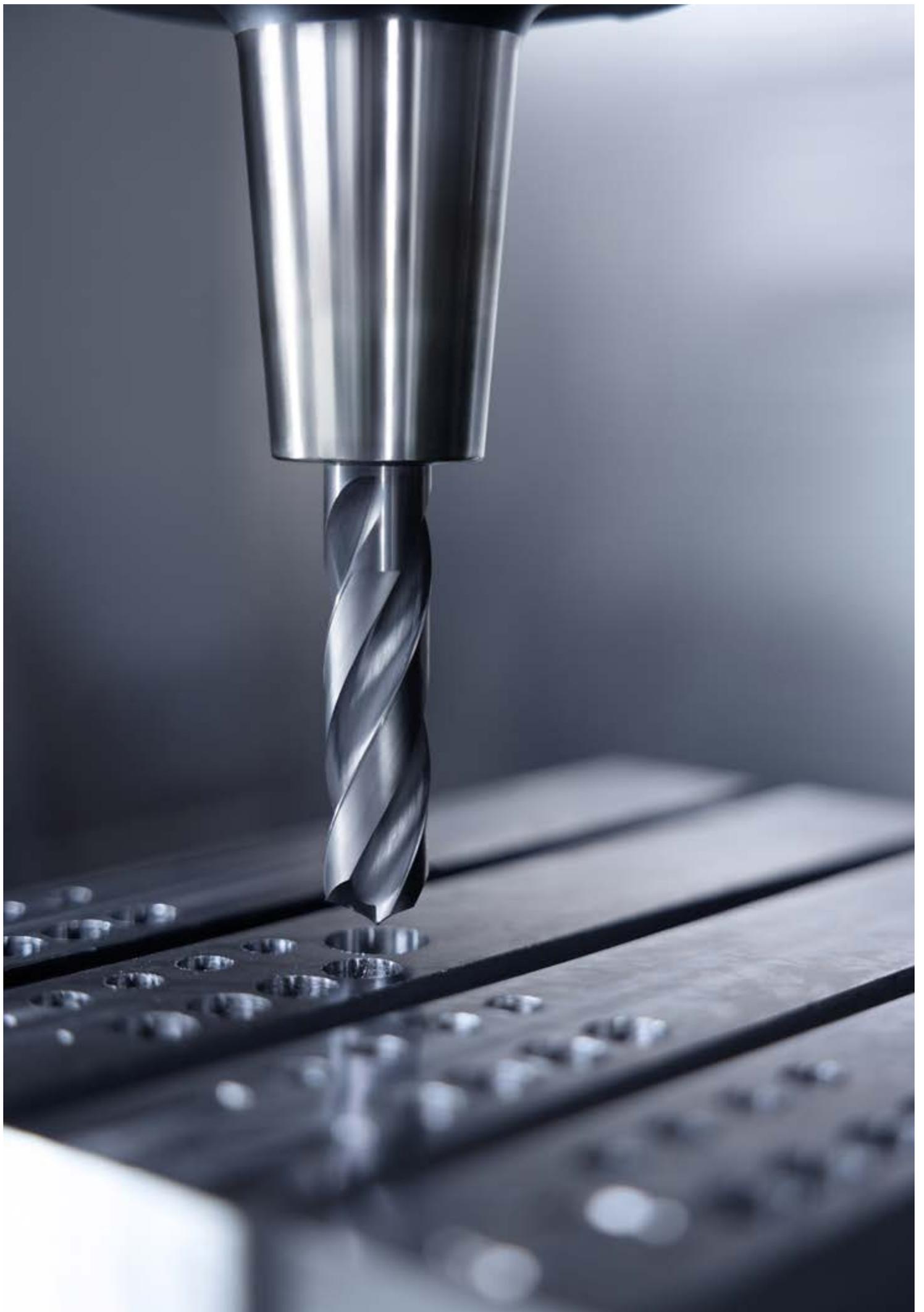


Enter **application parameters**

**Tool selection**

Walter offers you one or more possible tool solutions to choose from. In the default settings, the most cost-efficient solution is displayed. If you have a different priority (e.g. the most productive solution, the best surface quality, etc.), you can define it in advance and the tool selection will be adapted accordingly!

Walter offers you the ideal cutting data for your tool, your application and your material! So precise that you can use it immediately for your application or programming! And, of course, you can find out whether your tool is suitable for the application. If it isn't, use the "Application-related search" to immediately find a suitable alternative – in no time at all and with the option to order it directly!



## Calculation formulae for drilling from solid

### Speed

$$n = \frac{v_c \times 1000}{D_c \times \pi} \quad [\text{min}^{-1}]$$

### Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{1000} \quad [\text{m/min}]$$

### Feed rate

$$v_f = f \times n \quad [\text{mm/min}]$$

### Metal removal rate (drilling from solid)

$$Q = \frac{v_f \times \pi \times D_c^2}{4 \times 1000} \quad [\text{cm}^3/\text{min}]$$

### Power requirement

$$P_{\text{mot}} = \frac{Q \times k_c}{60000 \times \eta} \quad [\text{kW}]$$

### Torque

$$M_c = \frac{D_c^2 \times k_c \times f}{8000} = \frac{P_c \times 9500}{n} \quad [\text{Nm}]$$

### Feed force

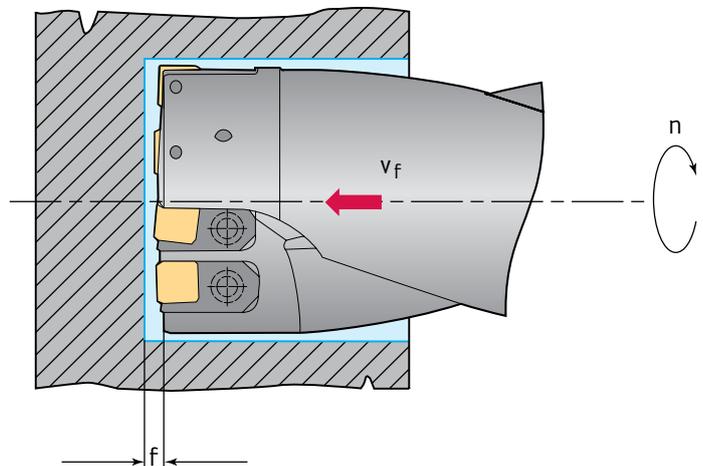
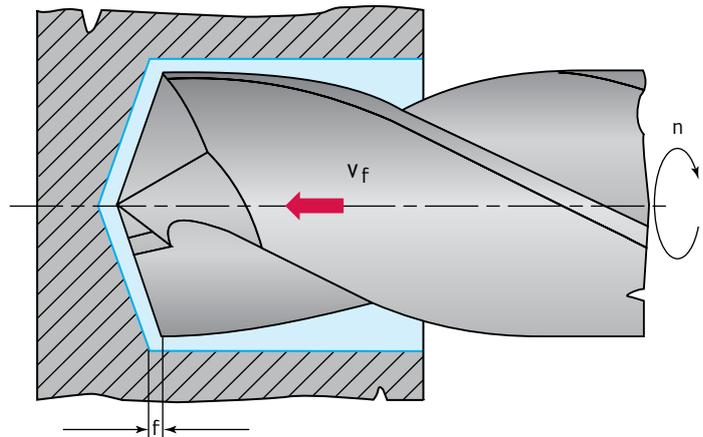
$$F_f = 0,63 \times \frac{f \times D_c \times k_c}{2} \quad [\text{N}]$$

### Specific cutting force

$$k_c = \frac{k_{c1.1}}{h^{m_c}}$$

### Chip thickness

$$h = f_z \times \sin \kappa \quad [\text{mm}]$$



n	Speed	rpm
D <sub>c</sub>	Cutting diameter	mm
v <sub>c</sub>	Cutting speed	m/min
v <sub>f</sub>	Feed rate	mm/min
f <sub>z</sub>	Feed per tooth	mm
f	Feed per revolution	mm
A	Chip cross section	mm <sup>2</sup>
Q	Metal removal rate	cm <sup>3</sup> /min
P <sub>mot</sub>	Drive power	kW
M <sub>c</sub>	Torque	Nm
F <sub>f</sub>	Feed force	N
h	Chip thickness	mm
k <sub>c</sub>	Specific cutting force	N/mm <sup>2</sup>
η	Machine efficiency (0.7–0.95)	
κ	Lead angle	°
k <sub>c1.1</sub> *	Specific cutting force for 1 mm <sup>2</sup> chip cross section with h = 1 mm	N/mm <sup>2</sup>
m <sub>c</sub> *	Increase in the k <sub>c</sub> curve	

\* For m<sub>c</sub> and k<sub>c1.1</sub>; see the "General" section of the Technical Compendium, page F7.

## Cutting data for solid carbide drilling and reaming tools Solid carbide drills – with internal coolant

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart VCRR = v <sub>c</sub> -Richtreihe			Drilling depth			3 × D <sub>c</sub>						
				Designation			DC260 Advance X-treme Evo		DC180 Supreme X-treme Evo Plus				
				Standard			Walter		DIN 6537 K				
				Coating/grade			WJ30ET		WJ30EZ				
				Dia. range [mm]			3,3–14		3–20				
Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>								
						v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	140	10	E O	210	16	E O	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	140	12	E O	189	12	E O	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	140	12	E O	168	12	E O	
		C > 0,55 %	Annealed	190	640	P4	140	9	E O	168	12	E O	
		C > 0,55 %	Heat-treated	300	1010	P5	120	10	E O	147	12	E O	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	160	12	E O	210	16	E O	
P	Low-alloy steel	Annealed		175	590	P7	140	10	E O	189	12	E O	
		Heat-treated		285	960	P8	100	10	E O	115	12	E O	
		Heat-treated		380	1280	P9	63	8	E O	94	8	E O	
		Heat-treated		430	1480	P10	71	5	E O	74	6	E O	
		Hochlegierter Stahl and hochlegierter Werkzeugstahl	Annealed	200	680	P11	100	9	E O	126	9	E O	
P	Hochlegierter Stahl and hochlegierter Werkzeugstahl	Hardened and tempered		300	1010	P12	120	10	E O	147	12	E O	
		Hardened and tempered		380	1280	P13	56	7	E O	58	8	E O	
		Stainless steel	Ferritic/martensitic, annealed	200	680	P14	120	12	E O	147	12	E O	
P	Stainless steel	Martensitic, heat-treated		330	1110	P15	63	10	E O	66	12	E O	
		M	Stainless steel	Austenitic, quench hardened	200	680	M1	56	6	E O	47	6	E O
Austenitic, precipitation hardened (PH)	300	1010		M2	50	6	E O	66	6	E O			
Austenitic/ferritic, duplex	230	780		M3	40	5	E O	47	6	E O			
K	Malleable cast iron	Ferritic		200	400	K1	110	16	E O	126	16	E O	
		Pearlitic		260	700	K2	100	16	E O	126	16	E O	
	Grey cast iron	Low strength		180	200	K3	140	16	E O	168	16	E O	
		High strength/austenitic		245	350	K4	110	16	E O	126	16	E O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	160	20	E O	147	20	E	
Pearlitic			265	700	K6	100	16	E O	126	16	E O		
CGI			230	400	K7	110	16	E O	126	16	E O		
N	Wrought aluminium alloys	Not hardenable		30	-	N1	450	16	E O M	472	16	E O M	
		Hardenable, hardened		100	340	N2	450	16	E O M	472	16	E O M	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	280	16	E O M	336	16	E O M	
		≤ 12% Si, hardenable, hardened		90	310	N4	250	16	E O M	336	16	E O M	
		> 12% Si, not hardenable		130	450	N5	200	16	E O M	262	16	E O M	
	Magnesium-based alloys <sup>2</sup>			70	250	N6							
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7	200	9	E O	262	12	E O	
Brass, bronze, red brass			90	310	N8	180	10	E O	231	16	E O		
Copper alloys, short-chipping			110	380	N9	200	12	E O	262	20	E O		
High tensile, Ampco			300	1010	N10	50	5	E O	66	7	E O		
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	45	4	E O	37	5	E O	
			Hardened	280	940	S2	32	4	E O	26	3	E O	
		Ni- or Co-based	Annealed	250	840	S3	36	5	E O	42	5	E O	
			Hardened	350	1180	S4	14	4	E O	18	4	E O	
	Cast	320	1080	S5	28	4	E O	29	4	E O			
Titanium alloys	Pure titanium		200	680	S6	63	6	E O	66	6	E O		
	α and β alloys, hardened		375	1260	S7	40	4	E O	42	4	E O		
	β alloys		410	1400	S8	36	4	E O	37	4	E O		
Tungsten alloys		300	1010	S9	50	5	E O	29	4	E O			
Molybdenum alloys		300	1010	S10	50	5	E O	29	4	E O			
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	50	3	O E	52	4	O E		
		Hardened and tempered	55 HRC	-	H2				42	4	O E		
		Hardened and tempered	60 HRC	-	H3				29	4	O E		
Hardened cast iron	Hardened and tempered	55 HRC	-	H4				42	4	O E			
O	Thermoplastics	Without abrasive fillers			O1	110	16	E O	147	16	E O		
	Thermosetting plastics	Without abrasive fillers			O2								
	Plastic, glass-fibre reinforced	GFRP			O3								
	Plastic, carbon-fibre reinforced	CFRP			O4								
	Plastic, aramid-fibre reinforced	AFRP			O5								
	Graphitee (technical)		80 Shore			O6							

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

3 × D <sub>c</sub>																5 × D <sub>c</sub>															
DC175 Supreme				DD170 Supreme				DC170 Supreme				DC160 Advance X-treme Evo				DC150 Perform				A3289DPL X-treme Plus				DB133 Supreme							
DIN 6537 K WJ30RZ				DIN 6537 K WJ30EY				DIN 6537 K WJ30EJ				DIN 6537 K WJ30ET				DIN 6537 K WJ30RE				DIN 6537 K DPL				Walter WJ30EL							
3-20				3-20				3-20				3-20				3-20				3-20				0,7-2,95							
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			VCRR	VRR		
140	10	EO		212	16	EO	M	200	16	EO	M	140	12	EO		120	12	EO		200	16	EO		C100	12	EO					
				191	12	EO	M	180	12	EO	M	140	12	EO		100	10	EO		180	12	EO		C80	12	EO					
				170	12	EO	M	160	12	EO	M	120	12	EO		80	9	EO		160	12	EO		C80	12	EO					
				191	12	EO	M	180	12	EO	M	140	9	EO		90	9	EO		160	12	EO		C80	12	EO					
				148	12	EO	M	140	12	EO	M	110	10	EO		71	8	EO		140	12	EO		C63	10	EO					
140	12	EO		212	16	EO	M	200	16	EO	M	160	12	EO		120	12	EO		200	16	EO									
120	10	EO		191	12	EO	M	180	12	EO	M	140	10	EO		100	12	EO		180	12	EO		C80	12	EO					
				148	12	EO	M	120	16	EO	M	100	10	EO		71	9	EO		110	12	EO		C50	10	EO					
				95	9	EO	M	100	12	EO	M	63	8	EO		45	6	EO		90	8	EO		C40	7	EO					
				75	7	EO	M	80	8	EO	M	50	5	EO		40	4	EO		71	6	EO		C40	6	EO					
				148	9	EO	M	140	9	EO	M	90	9	EO		80	9	EO		120	9	EO		C80	10	EO					
				148	12	EO	M	140	12	EO	M	110	10	EO		63	10	EO		140	12	EO		C63	10	EO					
				59	8	EO	M	56	8	EO	M	50	7	EO		50	6	EO		56	8	EO		C40	7	EO					
				120	10	EO		170	12	EO	M	160	12	EO	M	120	12	EO		80	10	EO		C80	12	EO					
				75	10	EO	M	71	12	EO	M	56	10	EO		50	9	EO		63	12	EO		C63	10	EO					
63	6	EO										50	6	EO		40	5	EO		45	6	EO		C40	8	EO					
63	6	EO										45	6	EO		56	6	EO		63	6	EO		C50	6	EO					
45	5	EO										36	5	EO		32	4	EO		45	6	EO		C25	6	EO					
				148	16	EO	M	140	16	EO	M	110	16	EO		100	16	EO		120	16	EO		C80	16	EO					
				148	16	EO	M	140	16	EO	M	100	16	EO		71	16	EO		120	16	EO		C63	12	EO					
				170	16	EO	M	160	16	EO	M	120	16	EO		110	16	EO		160	16	EO		C100	16	EO					
				148	16	EO	M	140	16	EO	M	110	16	EO		90	16	EO		120	16	EO		C80	12	EO					
				191	20	EO	M	180	20	EO	M	140	20	EO		110	16	EO		140	20	E		C100	16	EO					
				148	16	EO	M	140	16	EO	M	100	16	EO		71	16	EO		120	16	EO		C63	12	EO					
				148	16	EO	M	140	16	EO	M	110	16	EO		80	16	EO		120	16	EO		C80	12	EO					
450	16	EO	M									400	16	EO	M	400	16	EO		450	16	EO	M	C125	20	EO	M				
450	16	EO	M									400	16	EO	M	400	16	EO		450	16	EO	M	C125	20	EO	M				
250	16	EO	M									250	16	EO	M	250	16	EO	M	320	16	EO	M	C125	20	EO	M				
220	16	EO	M									250	16	EO	M	220	16	EO	M	320	16	EO	M	C125	20	EO	M				
180	16	EO	M									200	16	EO	M	200	16	EO	M	250	16	EO	M	C125	16	EO	M				
200	10	EO										200	9	EO		180	8	EO		250	12	EO		C80	6	EO					
												180	10	EO		160	10	EO		220	16	EO		C100	9	EO					
200	16	EO										200	12	EO		180	16	EO		250	20	EO		C100	16	EO					
45	5	EO										50	5	EO		45	5	EO		63	7	EO		C40	5	EO					
50	5	EO										40	4	EO		32	4	EO		36	5	EO		C32	6	EO					
36	4	EO										28	4	EO		22	3	EO		25	3	EO		C20	4	EO					
40	5	EO										32	5	EO		32	4	EO		40	5	EO		C25	6	EO					
22	4	EO										14	4	EO		11	3	EO		18	4	EO		C16	5	EO					
32	4	EO										25	4	EO		18	3	EO		28	4	EO		C16	6	EO					
50	6	EO										56	6	EO		45	6	EO		63	6	EO		C50	6	EO					
36	4	EO										40	4	EO		32	4	EO		40	4	EO		C25	4	EO					
32	4	EO										36	4	EO		28	4	EO		36	4	EO		C32	4	EO					
32	4	EO										50	5	EO		18	3	EO		28	4	EO		C16	6	EO					
32	4	EO										50	5	EO		18	3	EO		28	4	EO		C16	6	EO					
				42	3	OE	M	40	3	OE	M	45	3	OE		28	3	OE		50	4	OE		C32	3	EO					
																				40	4	OE									
																				28	4	OE									
																				40	4	OE									
100	16	EO										110	16	EO		90	16	EO		140	16	EO		C100	20	EO					

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

## Cutting data for solid carbide drilling and reaming tools Solid carbide drills – with internal coolant

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart VCRR = v <sub>c</sub> -Richtreihe			Drilling depth			5 × D <sub>c</sub>							
				Designation			DC183 Supreme X-treme Evo 3		DC180 Supreme X-treme Evo Plus					
				Standard			DIN 6537 L		DIN 6537 L					
				Coating/grade			WJ30RZ		WJ30RZ					
				Dia. range [mm]			3–16		3–20					
Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	v <sub>c</sub>		VRR						
						v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	200	17	E O	210	16	E O		
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	160	13	E O	168	12	E O		
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	160	13	E O	168	12	E O		
		C > 0,55 %	Annealed	190	640	P4	160	13	E O	168	12	E O		
		C > 0,55 %	Heat-treated	300	1010	P5	120	13	E O	126	12	E O		
		Free-machining steel (short-chipping)	Annealed	220	750	P6	200	17	E O	210	16	E O		
P	Low-alloy steel	Annealed		175	590	P7	180	13	E O	189	12	E O		
		Heat-treated		285	960	P8	110	13	E O	115	12	E O		
		Heat-treated		380	1280	P9	90	9	E O	94	8	E O		
		Heat-treated		430	1480	P10	70	7	E O	74	6	E O		
P	Hochlegierter Stahl and hochlegierter Werkzeugstahl	Annealed		200	680	P11	120	10	E O	126	9	E O		
		Hardened and tempered		300	1010	P12	120	13	E O	126	12	E O		
		Hardened and tempered		380	1280	P13	55	9	E O	58	8	E O		
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	140	13	E O	147	12	E O		
		Martensitic, heat-treated		330	1110	P15	63	13	E O	66	12	E O		
M	Stainless steel	Austenitic, quench hardened		200	680	M1	45	7	E O	47	6	E O		
		Austenitic, precipitation hardened (PH)		300	1010	M2	63	7	E O	66	6	E O		
		Austenitic/ferritic, duplex		230	780	M3	45	7	E O	47	6	E O		
K	Malleable cast iron	Ferritic		200	400	K1	120	17	E O	126	16	E O		
		Pearlitic		260	700	K2	110	17	E O	115	16	E O		
	Grey cast iron	Low strength		180	200	K3	140	17	E O	147	16	E O		
		High strength/austenitic		245	350	K4	120	17	E O	126	16	E O		
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	140	21	E	147	20	E		
		Pearlitic		265	700	K6	110	17	E O	115	16	E O		
CGI			230	400	K7	110	17	E O	115	16	E O			
N	Wrought aluminium alloys	Not hardenable		30	-	N1	450	17	E O	M 472	16	E O	M	
		Hardenable, hardened		100	340	N2	450	17	E O	M 472	16	E O	M	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	320	17	E O	M 336	16	E O	M	
		≤ 12% Si, hardenable, hardened		90	310	N4	320	17	E O	M 336	16	E O	M	
		> 12% Si, not hardenable		130	450	N5	250	17	E O	M 262	16	E O	M	
	Magnesium-based alloys <sup>2</sup>			70	250	N6								
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7	220	13	E O	231	12	E O		
Brass, bronze, red brass			90	310	N8	200	17	E O	210	16	E O			
Copper alloys, short-chipping			110	380	N9	250	21	E O	262	20	E O			
High tensile, Ampco			300	1010	N10	63	8	E O	66	7	E O			
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1	35	6	E O	37	5	E O	
			Hardened		280	940	S2	25	4	E O	26	3	E O	
		Ni- or Co-based	Annealed		250	840	S3	40	6	E O	42	5	E O	
			Hardened		350	1180	S4	17	5	E O	18	4	E O	
	Titanium alloys	Cast		320	1080	S5	28	5	E O	29	4	E O		
		Pure titanium		200	680	S6	55	7	E O	58	6	E O		
Tungsten alloys	α and β alloys, hardened		375	1260	S7	40	5	E O	42	4	E O			
	β alloys		410	1400	S8	35	5	E O	37	4	E O			
Molybdenum alloys			300	1010	S9	28	5	E O	29	4	E O			
H	Hardened steel			300	1010	S10	28	5	E O	29	4	E O		
		Hardened and tempered		50 HRC	-	H1	50	5	O E	52	4	O E		
		Hardened and tempered		55 HRC	-	H2	35	5	O E	37	4	O E		
H	Hardened cast iron	Hardened and tempered		60 HRC	-	H3	25	5	O E	26	4	O E		
		Hardened and tempered		55 HRC	-	H4	35	5	O E	37	4	O E		
O	Thermoplastics	Without abrasive fillers				O1	140	17	E O	147	16	E O		
	Thermosetting plastics	Without abrasive fillers				O2								
	Plastic, glass-fibre reinforced	GFRP				O3								
	Plastic, carbon-fibre reinforced	CFRP				O4								
	Plastic, aramid-fibre reinforced	AFRP				O5								
	Graphitee (technical)			80 Shore			O6							

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

5 × D<sub>c</sub>

DC175 Supreme		DD170 Supreme				DC170 Supreme				DC166 Supreme				DC165 Advance				DC160 Advance X-treme Evo					
Walter WJ30RZ		DIN 6537 L WJ30EY				DIN 6537 L WJ30EJ				DIN 6537 L WJ30UU				Walter WJ30UU				DIN 6537 L WJ30ET					
3-20		3-20				3-20				3-12				4-16				3-25					
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
120	10	E0		208	16	E0	M	200	16	E0	M									140	12	E0	
				187	12	E0	M	180	12	E0	M									140	12	E0	
				166	12	E0	M	160	12	E0	M									110	12	E0	
				187	12	E0	M	180	12	E0	M									140	9	E0	
				146	12	E0	M	140	12	E0	M									110	10	E0	
140	12	E0		208	16	E0	M	200	16	E0	M									160	12	E0	
120	10	E0		187	12	E0	M	180	12	E0	M									140	10	E0	
				146	12	E0	M	120	16	E0	M									100	10	E0	
				94	8	E0	M	100	12	E0	M									63	8	E0	
				74	7	E0	M	80	8	E0	M									50	5	E0	
				146	9	E0	M	140	9	E0	M									90	9	E0	
				146	12	E0	M	140	12	E0	M									110	10	E0	
				58	8	E0	M	56	8	E0	M									50	7	E0	
120	10	E0		166	12	E0	M	160	12	E0	M									120	12	E0	
				74	10	E0	M	71	12	E0	M									56	10	E0	
63	6	E0																		50	6	E0	
63	6	E0																		45	6	E0	
45	5	E0																		36	5	E0	
				146	16	E0	M	140	16	E0	M					100	12	E0		110	16	E0	
				146	16	E0	M	140	16	E0	M									100	16	E0	
				166	16	E0	M	160	16	E0	M					120	12	E0		120	16	E0	
				146	16	E0	M	140	16	E0	M					100	12	E0		110	16	E0	
				187	20	E0	M	180	20	E0	M					110	8	E0		140	20	E0	
				146	16	E0	M	140	16	E0	M									100	16	E0	
				146	16	E0	M	140	16	E0	M					45	3	E0		110	16	E0	
450	16	E0	M									472	17	E0	M	450	9	E0		400	16	E0	M
450	16	E0	M									472	17	E0	M	450	9	E0		400	16	E0	M
250	16	E0	M									336	17	E0	M	250	9	E0		250	16	E0	M
220	16	E0	M									336	17	E0	M	400	9	E0		250	16	E0	M
180	16	E0	M									262	17	E0	M	200	9	E0		200	16	E0	M
180	10	E0										231	13	E0						200	9	E0	
												210	17	E0						180	10	E0	
200	16	E0										262	21	E0		220	16	E0		200	12	E0	
45	5	E0										66	8	E0						50	5	E0	
50	5	E0																		40	4	E0	
32	4	E0																		28	4	E0	
40	5	E0																		32	5	E0	
22	4	E0																		12	4	E0	
28	4	E0																		25	4	E0	
50	6	E0																		50	6	E0	
32	4	E0																		40	4	E0	
28	4	E0																		36	4	E0	
28	4	E0																		50	5	E0	
28	4	E0																		50	5	E0	
				42	3	OE	M	40	3	OE	M									40	3	OE	
100	16	E0																		110	16	E0	

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for solid carbide drilling and reaming tools

## Solid carbide drills – with internal coolant

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart VCRR = v <sub>c</sub> -Richtreihe			Drilling depth		5 × D <sub>c</sub>							
				Designation		DC150 Perform				A3389DPL X-treme Plus			
				Standard		DIN 6537 L				DIN 6537 L			
				Coating/grade		WJ30RE				DPL			
				Dia. range (mm)		3–20				3–20			
Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	DC150 Perform				A3389DPL X-treme Plus			
						v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	110	12	E O	200	16	E O	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	100	10	E O	160	12	E O	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	80	9	E O	160	12	E O	
		C > 0,55 %	Annealed	190	640	P4	90	9	E O	160	12	E O	
		C > 0,55 %	Heat-treated	300	1010	P5	71	8	E O	120	12	E O	
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	110	12	E O	200	16	E O	
		Annealed	175	590	P7	100	12	E O	180	12	E O		
		Heat-treated	285	960	P8	71	9	E O	110	12	E O		
		Heat-treated	380	1280	P9	45	6	E O	90	8	E O		
		Heat-treated	430	1480	P10	36	4	E O	71	6	E O		
Hochlegierter Stahl und hochlegierter Werkzeugstahl	Annealed	200	680	P11	80	9	E O	120	9	E O			
	Hardened and tempered	300	1010	P12	63	10	E O	120	12	E O			
	Hardened and tempered	380	1280	P13	50	6	E O	56	8	E O			
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	80	10	E O	140	12	E O			
	Martensitic, heat-treated	330	1110	P15	50	9	E O	63	12	E O			
M	Stainless steel	Austenitic, quench hardened	200	680	M1	40	5	E O	45	6	E O		
		Austenitic, precipitation hardened (PH)	300	1010	M2	56	6	E O	63	6	E O		
		Austenitic/ferritic, duplex	230	780	M3	32	4	E O	45	6	E O		
K	Malleable cast iron	Ferritic	200	400	K1	100	16	E O	120	16	E O		
		Pearlitic	260	700	K2	71	16	E O	110	16	E O		
	Grey cast iron	Low strength	180	200	K3	110	16	E O	140	16	E O		
		High strength/austenitic	245	350	K4	90	16	E O	120	16	E O		
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	100	16	E O	140	20	E		
Pearlitic		265	700	K6	71	16	E O	110	16	E O			
CGI		230	400	K7	80	16	E O	110	16	E O			
N	Wrought aluminium alloys	Not hardenable	30	-	N1	400	16	E O	450	16	E O	M	
		Hardenable, hardened	100	340	N2	400	16	E O	450	16	E O	M	
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	250	16	E O	M	320	16	E O	M
		≤ 12% Si, hardenable, hardened	90	310	N4	220	16	E O	M	320	16	E O	M
		> 12% Si, not hardenable	130	450	N5	200	16	E O	M	250	16	E O	M
	Magnesium-based alloys <sup>2</sup>		70	250	N6								
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper	100	340	N7	180	8	E O		220	12	E O	
Brass, bronze, red brass		90	310	N8	160	10	E O		200	16	E O		
Copper alloys, short-chipping		110	380	N9	180	16	E O		250	20	E O		
High tensile, Ampco		300	1010	N10	45	5	E O		63	7	E O		
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	32	4	E O	36	5	E O	
			Hardened	280	940	S2	22	3	E O	25	3	E O	
		Ni- or Co-based	Annealed	250	840	S3	32	4	E O	40	5	E O	
			Hardened	350	1180	S4	11	3	E O	18	4	E O	
			Cast	320	1080	S5	18	3	E O	28	4	E O	
	Titanium alloys	Pure titanium	200	680	S6	45	6	E O	56	6	E O		
		α and β alloys, hardened	375	1260	S7	32	4	E O	40	4	E O		
		β alloys	410	1400	S8	25	4	E O	36	4	E O		
	Tungsten alloys		300	1010	S9	18	3	E O	28	4	E O		
	Molybdenum alloys		300	1010	S10	18	3	E O	28	4	E O		
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	28	3	O E	50	4	O E		
		Hardened and tempered	55 HRC	-	H2				36	4	O E		
		Hardened and tempered	60 HRC	-	H3				25	4	O E		
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4				36	4	O E		
O	Thermoplastics	Without abrasive fillers			O1	90	16	E O	140	16	E O		
	Thermosetting plastics	Without abrasive fillers			O2								
	Plastic, glass-fibre reinforced	GFRP			O3								
	Plastic, carbon-fibre reinforced	CFRP			O4								
	Plastic, aramid-fibre reinforced	AFRP			O5								
	Graphitee (technical)		80 Shore			O6							

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

		8 × D <sub>c</sub>																																
		DB133 Supreme				DC183 Supreme X-treme Evo 3				DC180 Supreme X-treme Evo Plus				DC175 Supreme				DD170 Supreme				DC170 Supreme				DC160 Advance X-treme Evo								
		Walter WJ30ER				Walter WJ30RY				Walter WJ30ET				Walter WJ30RY				Walter WJ30EY				Walter WJ30EJ				Walter WJ30ET								
		0,7-2,95				3-16				3-20				3-16				3-20				3-20				3-20								
		VCR	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			
C100	12	E	O		180	17	E	O		189	16	E	O		120	10	E	O		204	16	E	O	M	200	16	E	O	M	140	12	E	O	
C80	12	E	O		160	13	E	O		168	12	E	O								184	12	E	O	M	180	12	E	O	M	120	12	E	O
C80	12	E	O		160	13	E	O		168	12	E	O								163	12	E	O	M	160	12	E	O	M	110	12	E	O
C80	12	E	O		160	13	E	O		168	12	E	O								184	12	E	O	M	180	12	E	O	M	140	9	E	O
C63	10	E	O		120	13	E	O		126	12	E	O								143	12	E	O	M	140	12	E	O	M	110	10	E	O
					180	17	E	O		189	16	E	O		140	12	E	O			204	16	E	O	M	200	16	E	O	M	140	12	E	O
C80	12	E	O		160	13	E	O		168	12	E	O		120	10	E	O			184	12	E	O	M	180	12	E	O	M	140	10	E	O
C50	10	E	O		110	13	E	O		116	12	E	O								122	10	E	O	M	120	16	E	O	M	90	10	E	O
C40	7	E	O		80	9	E	O		84	8	E	O								82	8	E	O	M	100	12	E	O	M	56	8	E	O
C32	6	E	O		63	7	E	O		66	6	E	O								72	6	E	O	M	80	8	E	O	M	45	5	E	O
C63	10	E	O		120	10	E	O		126	9	E	O								143	9	E	O	M	140	9	E	O	M	90	9	E	O
C63	10	E	O		120	13	E	O		126	12	E	O								143	12	E	O	M	140	12	E	O	M	110	10	E	O
C40	7	E	O		50	9	E	O		53	8	E	O								57	8	E	O	M	56	8	E	O	M	45	7	E	O
C63	12	E	O		140	13	E	O		147	12	E	O		120	10	E	O			163	12	E	O	M	160	12	E	O	M	110	12	E	O
C63	10	E	O		63	13	E	O		66	12	E	O								72	10	E	O	M	71	12	E	O	M	56	10	E	O
C32	8	E	O		45	7	E	O		47	6	E	O		56	6	E	O																
C40	6	E	O		56	7	E	O		59	6	E	O		63	6	E	O																
C25	6	E	O		40	7	E	O		42	6	E	O		40	5	E	O																
C80	16	E	O		120	17	E	O		122	16	E	O								143	16	E	O	M	140	16	E	O	M	110	16	E	O
C63	12	E	O		110	17	E	O		112	16	E	O								143	16	E	O	M	140	16	E	O	M	90	16	E	O
C100	16	E	O		140	17	E	O		143	16	E	O								163	16	E	O	M	160	16	E	O	M	120	16	E	O
C80	12	E	O		120	17	E	O		123	16	E	O								143	16	E	O	M	140	16	E	O	M	100	16	E	O
C100	16	E	O		160	21	E	O		145	20	E	O								184	20	E	O	M	180	20	E	O	M	140	20	E	O
C63	12	E	O		110	17	E	O		112	16	E	O								143	16	E	O	M	140	16	E	O	M	90	16	E	O
C63	12	E	O		120	17	E	O		112	16	E	O								143	16	E	O	M	140	16	E	O	M	100	16	E	O
C125	20	E	O	M	450	17	E	O	M	465	16	E	O	M	400	16	E	O	M															
C125	20	E	O	M	450	17	E	O	M	465	16	E	O	M	400	16	E	O	M															
C125	20	E	O	M	320	17	E	O	M	330	16	E	O	M	220	16	E	O	M															
C125	20	E	O	M	320	17	E	O	M	330	16	E	O	M	220	16	E	O	M															
C125	16	E	O	M	250	17	E	O	M	258	16	E	O	M	180	16	E	O	M															
C80	6	E	O		200	13	E	O		210	12	E	O		160	10	E	O																
C80	9	E	O		180	17	E	O		189	16	E	O																					
C80	16	E	O		250	21	E	O		258	20	E	O		200	16	E	O																
C40	5	E	O		63	8	E	O		65	7	E	O		45	5	E	O																
C25	6	E	O		36	6	E	O		37	5	E	O		45	5	E	O																
C20	4	E	O		25	4	E	O		26	3	E	O		32	4	E	O																
C25	6	E	O		36	6	E	O		38	5	E	O		40	5	E	O																
C16	5	E	O		16	5	E	O		17	4	E	O		20	4	E	O																
C16	6	E	O		25	5	E	O		26	4	E	O		28	4	E	O																
C40	6	E	O		50	7	E	O		53	6	E	O		40	6	E	O																
C25	4	E	O		36	5	E	O		38	4	E	O		28	4	E	O																
C25	4	E	O		32	5	E	O		34	4	E	O		25	4	E	O																
C16	6	E	O		25	5	E	O		26	4	E	O		28	4	E	O																
C16	6	E	O		25	5	E	O		26	4	E	O		28	4	E	O																
C32	3	E	O		40	5	O	E		45	4	O	E								41	3	O	E	M	40	3	O	E	M				
					32	5	O	E		34	4	O	E																					
					22	5	O	E		23	4	O	E																					
					32	5	O	E		34	4	O	E																					
C100	20	E	O		140	17	E	O		145	16	E	O		100	16	E	O																

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for solid carbide drilling and reaming tools

## Solid carbide drills – with internal coolant

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart VCRR = v <sub>c</sub> -Richtreihe			Drilling depth			8 × D <sub>c</sub>							
				Designation			DC150 Perform				A6489DPP X-treme D8			
				Standard			Walter				Walter			
				Coating/grade			WJ30TA				DPP			
				Dia. range [mm]			3–20				3–20			
Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>									
			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR						
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	110	12	E O	180	16	E O		
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	90	10	E O	160	12	E O		
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	71	9	E O	160	12	E O		
		C > 0,55 %	Annealed	190	640	P4	80	9	E O	160	12	E O		
		C > 0,55 %	Heat-treated	300	1010	P5	71	9	E O	120	12	E O		
	M	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	110	12	E O	180	16	E O	
			Annealed	175	590	P7	90	12	E O	160	12	E O		
			Heat-treated	285	960	P8	63	9	E O	110	12	E O		
			Heat-treated	380	1280	P9	36	7	E O	80	8	E O		
			Heat-treated	430	1480	P10	28	6	E O	63	6	E O		
Hochlegierter Stahl and hochlegierter Werkzeugstahl		Annealed	200	680	P11	80	9	E O	120	9	E O			
		Hardened and tempered	300	1010	P12	50	10	E O	120	12	E O			
		Hardened and tempered	380	1280	P13	45	7	E O	50	8	E O			
Stainless steel		Ferritic/martensitic, annealed	200	680	P14	90	10	E O	140	12	E O			
		Martensitic, heat-treated	330	1110	P15	45	9	E O	63	12	E O			
M	Stainless steel	Austenitic, quench hardened	200	680	M1	40	5	E O	45	6	E O			
		Austenitic, precipitation hardened (PH)	300	1010	M2	50	6	E O	56	6	E O			
		Austenitic/ferritic, duplex	230	780	M3	32	4	E O	40	6	E O			
K	Malleable cast iron	Ferritic	200	400	K1	90	16	E O	120	16	E O			
		Pearlitic	260	700	K2	71	16	E O	110	16	E O			
	Grey cast iron	Low strength	180	200	K3	110	16	E O	140	16	E O			
		High strength/austenitic	245	350	K4	90	16	E O	120	16	E O			
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	90	16	E O	160	20	E O			
		Pearlitic	265	700	K6	63	16	E O	110	16	E O			
CGI		230	400	K7	71	16	E O	120	16	E O				
N	Wrought aluminium alloys	Not hardenable	30	-	N1	400	16	E O M	450	16	E O M			
		Hardenable, hardened	100	340	N2	400	16	E O M	450	16	E O M			
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	250	16	E O M	320	16	E O M			
		≤ 12% Si, hardenable, hardened	90	310	N4	220	16	E O M	320	16	E O M			
		> 12% Si, not hardenable	130	450	N5	200	16	E O M	250	16	E O M			
	Magnesium-based alloys <sup>2</sup>		70	250	N6									
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper	100	340	N7	160	8	E O	200	12	E O			
		Brass, bronze, red brass	90	310	N8	140	10	E O	180	16	E O			
		Copper alloys, short-chipping	110	380	N9	180	12	E O	250	20	E O			
		High tensile, Ampco	300	1010	N10	45	5	E O	63	7	E O			
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	36	4	E O	36	5	E O		
			Hardened	280	940	S2	22	3	E O	25	3	E O		
		Ni- or Co-based	Annealed	250	840	S3	32	4	E O	36	5	E O		
			Hardened	350	1180	S4				16	4	E O		
			Cast	320	1080	S5	18	3	E O	25	4	E O		
	Titanium alloys	Pure titanium	200	680	S6	45	6	E O	50	6	E O			
		α and β alloys, hardened	375	1260	S7	28	4	E O	36	4	E O			
		β alloys	410	1400	S8	22	4	E O	32	4	E O			
	Tungsten alloys		300	1010	S9	18	3	E O	25	4	E O			
	Molybdenum alloys		300	1010	S10	18	3	E O	25	4	E O			
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	25	3	O E	40	4	O E			
		Hardened and tempered	55 HRC	-	H2				32	4	O E			
		Hardened and tempered	60 HRC	-	H3				22	4	O E			
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4				32	4	O E			
O	Thermoplastics	Without abrasive fillers			O1	90	16	E O	140	16	E O			
	Thermosetting plastics	Without abrasive fillers			O2									
	Plastic, glass-fibre reinforced	GFRP			O3									
	Plastic, carbon-fibre reinforced	CFRP			O4									
	Plastic, aramid-fibre reinforced	AFRP			O5									
	Graphitee (technical)		80 Shore			O6								

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

8 × D <sub>c</sub>				12 × D <sub>c</sub>																											
A3486TIP Alpha® 44				DB133 Supreme				DC180 Supreme X-treme Evo Plus				DD170 Supreme				DC170 Supreme				DC160 Advance X-treme Evo				DC150 Perform							
Walter TIP				Walter WJ30ER				Walter WJ30ET				Walter WJ30EY				Walter WJ30EJ				Walter WJ30EU				Walter WJ30TA							
5-9				0,7-2,9				3-20				3-20				3-20				3-20				3-20							
v <sub>c</sub>	VRR			VCRR	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
90	10	EO		C80	12	EO		168	16	EO		189	12	EO	M	180	16	EO	M	120	10	EO		100	12	EO					
71	10	EO		C80	12	EO		147	12	EO		168	12	EO	M	160	12	EO	M	120	12	EO		80	10	EO					
63	8	EO		C63	12	EO		147	12	EO		147	12	EO	M	140	12	EO	M	110	12	EO		63	9	EO					
80	8	EO		C63	12	EO		147	12	EO		168	10	EO	M	160	12	EO	M	120	9	EO		71	9	EO					
50	7	EO		C50	10	EO		116	12	EO		126	10	EO	M	120	12	EO	M	90	10	EO		63	9	EO					
90	12	EO		C80	12	EO		168	16	EO		189	12	EO	M	180	16	EO	M	140	12	EO		100	12	EO					
90	10	EO		C80	12	EO		147	12	EO		168	12	EO	M	160	12	EO	M	120	10	EO		80	12	EO					
50	8	EO		C50	10	EO		105	12	EO		116	10	EO	M	110	16	EO	M	80	10	EO		50	9	EO					
28	3	EO		C40	7	EO		66	8	EO		66	7	EO	M	90	12	EO	M	50	8	EO		25	7	EO					
				C32	6	EO		53	6	EO		53	6	EO	M	71	8	EO	M	36	5	EO		22	6	EO					
56	8	EO		C63	10	EO		105	9	EO		126	8	EO	M	120	9	EO	M	80	9	EO		71	9	EO					
71	10	EO		C50	10	EO		116	12	EO		126	10	EO	M	120	12	EO	M	90	10	EO		36	10	EO					
20	3	EO		C40	7	EO		48	8	EO		53	7	EO	M	50	8	EO	M	36	7	EO		40	7	EO					
63	9	EO		C63	12	EO		126	12	EO		147	12	EO	M	140	12	EO	M	100	12	EO		80	10	EO					
56	9	EO		C50	10	EO		59	12	EO		66	10	EO	M	63	12	EO	M	50	10	EO		36	9	EO					
28	5	EO		C32	8	EO		42	6	EO										45	6	EO		36	5	EO					
36	5	EO		C40	6	EO		53	6	EO										40	6	EO		45	6	EO					
18	4	EO		C25	6	EO		38	6	EO										32	5	EO		28	4	EO					
63	16	EO		C80	16	EO		116	16	EO		126	16	EO	M	120	16	EO	M	100	16	EO		80	16	EO					
50	12	EO		C63	12	EO		105	16	EO		126	12	EO	M	120	16	EO	M	80	16	EO		63	16	EO					
80	16	EO		C80	16	EO		126	16	EO		147	16	EO	M	140	16	EO	M	110	16	EO		90	16	EO					
63	16	EO		C80	12	EO		116	16	EO		126	16	EO	M	120	16	EO	M	90	16	EO		80	16	EO					
71	16	EO		C80	16	EO		143	20	EO		168	16	EO	M	160	20	EO	M	120	20	EO		71	16	EO					
50	12	EO		C63	12	EO		105	16	EO		126	12	EO	M	120	16	EO	M	80	16	EO		50	16	EO					
56	12	EO		C63	12	EO		105	16	EO		126	12	EO	M	120	16	EO	M	90	16	EO		50	16	EO					
280	12	EO	M	C125	20	EO	M	420	16	EO	M									360	16	EO	M	360	16	EO	M				
280	12	EO	M	C125	20	EO	M	420	16	EO	M									360	16	EO	M	360	16	EO	M				
220	12	EO	M	C125	20	EO	M	294	16	EO	M									220	16	EO	M	220	16	EO	M				
200	12	EO	M	C125	20	EO	M	294	16	EO	M									220	16	EO	M	200	16	EO	M				
160	12	EO	M	C100	16	EO	M	231	16	EO	M									160	16	EO	M	180	16	EO	M				
140	6	EO		C63	6	EO		168	12	EO										160	9	EO		120	8	EO					
110	9	EO		C80	9	EO		147	16	EO										140	10	EO		110	10	EO					
120	16	EO		C80	16	EO		253	20	EO										160	12	EO		160	12	EO					
				C40	5	EO		64	7	EO										40	5	EO		40	5	EO					
22	4	EO		C25	6	EO		34	5	EO										36	4	EO		32	4	EO					
				C20	4	EO		26	3	EO										25	4	EO		22	3	EO					
16	4	EO		C20	6	EO		34	5	EO										28	5	EO		28	4	EO					
				C12	5	EO		15	4	EO										11	4	EO									
				C12	6	EO		22	4	EO										22	4	EO									
32	5	EO		C40	6	EO		50	6	EO										40	6	EO		36	6	EO					
22	3	EO		C20	4	EO		36	4	EO										32	4	EO		20	4	EO					
18	3	EO		C25	4	EO		32	4	EO										28	4	EO		16	4	EO					
				C12	6	EO		24	4	EO										40	5	EO		16	3	EO					
				C12	6	EO		24	4	EO										40	5	EO		16	3	EO					
				C32	3	EO		42	4	OE		38	2	OE	M	36	3	OE	M					18	3	OE					
								31	4	OE																					
								21	4	OE																					
								32	4	OE																					
100	16	EO		C100	20	EO		140	16	EO										100	16	EO		80	16	EO					

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.

## Cutting data for solid carbide drilling and reaming tools Solid carbide drills – with internal coolant

Material group	Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Drilling depth			12 × D <sub>c</sub>				16 × D <sub>c</sub>			
				Designation			A6589DPP X-treme D12				DB133 Supreme			
				Standard			Walter				Walter			
				Coating/grade			DPP				WJ30ER			
Dia. range (mm)			3–20				2–2,9							
			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	v <sub>c</sub>	VRR			VCRR	VRR			
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	160	16	E	O	C125	12	E	O
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	140	12	E	O	C125	12	E	O
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	140	12	E	O	C100	12	E	O
		C > 0,55 %	Annealed	190	640	P4	140	12	E	O	C125	12	E	O
		C > 0,55 %	Heat-treated	300	1010	P5	110	12	E	O	C100	12	E	O
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	160	16	E	O	C125	12	E	O
		Annealed	175	590	P7	140	12	E	O	C125	12	E	O	
		Heat-treated	285	960	P8	100	12	E	O	C100	12	E	O	
		Heat-treated	380	1280	P9	63	8	E	O	C80	12	E	O	
		Heat-treated	430	1480	P10	50	6	E	O	C63	6	E	O	
Hochlegierter Stahl and hochlegierter Werkzeugstahl	Annealed	200	680	P11	100	9	E	O	C125	10	E	O		
	Hardened and tempered	300	1010	P12	110	12	E	O	C100	12	E	O		
	Hardened and tempered	380	1280	P13	45	8	E	O	C80	12	E	O		
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	120	12	E	O	C100	12	E	O		
	Martensitic, heat-treated	330	1110	P15	56	12	E	O	C80	10	E	O		
M	Stainless steel	Austenitic, quench hardened	200	680	M1	40	6	E	O	C32	8	E	O	
		Austenitic, precipitation hardened (PH)	300	1010	M2	50	6	E	O	C40	12	E	O	
		Austenitic/ferritic, duplex	230	780	M3	36	6	E	O	C25	6	E	O	
K	Malleable cast iron	Ferritic	200	400	K1	110	16	E	O	C63	25	E	O	
		Pearlitic	260	700	K2	100	16	E	O	C63	20	E	O	
	Grey cast iron	Low strength	180	200	K3	120	16	E	O	C80	25	E	O	
		High strength/austenitic	245	350	K4	110	16	E	O	C63	25	E	O	
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	140	20	E	O	C63	30	E	O	
Pearlitic		265	700	K6	100	16	E	O	C63	20	E	O		
CGI		230	400	K7	100	16	E	O	C50	20	E	O		
N	Wrought aluminium alloys	Not hardenable	30	-	N1	400	16	E	O	M	C125	25	E	O
		Hardenable, hardened	100	340	N2	400	16	E	O	M	C125	25	E	O
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	280	16	E	O	M	C125	25	E	O
		≤ 12% Si, hardenable, hardened	90	310	N4	280	16	E	O	M	C125	25	E	O
		> 12% Si, not hardenable	130	450	N5	220	16	E	O	M	C100	20	E	O
	Magnesium-based alloys <sup>2</sup>		70	250	N6									
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper	100	340	N7	160	12	E	O		C63	6	E	O
Brass, bronze, red brass		90	310	N8	140	16	E	O		C80	10	E	O	
Copper alloys, short-chipping		110	380	N9	250	20	E	O		C80	20	E	O	
High tensile, Ampco		300	1010	N10	63	7	E	O		C40	6	E	O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	32	5	E	O	C25	6	E	O
			Hardened	280	940	S2	25	3	E	O	C20	6	E	O
		Ni- or Co-based	Annealed	250	840	S3	32	5	E	O	C25	5	E	O
			Hardened	350	1180	S4	12	4	E	O	C12	5	E	O
	Titanium alloys	Cast	320	1080	S5	20	4	E	O	C12	6	E	O	
		Pure titanium	200	680	S6	36	6	E	O	C40	6	E	O	
		α and β alloys, hardened	375	1260	S7	25	4	E	O	C20	4	E	O	
Tungsten alloys	β alloys	410	1400	S8	22	4	E	O	C20	4	E	O		
Molybdenum alloys		300	1010	S9	20	4	E	O	C12	6	E	O		
H	Hardened steel		300	1010	S10	20	4	E	O	C12	6	E	O	
		Hardened and tempered	50 HRC	-	H1	32	4	O	E		C32	3	E	O
		Hardened and tempered	55 HRC	-	H2	22	4	O	E					
Hardened cast iron	Hardened and tempered	60 HRC	-	H3	16	4	O	E						
	Hardened and tempered	55 HRC	-	H4	22	4	O	E						
O	Thermoplastics	Without abrasive fillers			O1	120	16	E	O		C80	25	E	O
	Thermosetting plastics	Without abrasive fillers			O2									
	Plastic, glass-fibre reinforced	GFRP			O3									
	Plastic, carbon-fibre reinforced	CFRP			O4									
	Plastic, aramid-fibre reinforced	AFRP			O5									
	Graphitee (technical)		80 Shore			O6								

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

16 × D <sub>c</sub>																20 × D <sub>c</sub>																																							
DC170 Supreme								DC160 Advance X-treme Evo								DB133 Supreme				DC170 Supreme				DC160 Advance X-treme Evo				A6794TFP X-treme DH20																											
Walter WJ30EJ								Walter WJ30EU								Walter WJ30ER				Walter WJ30EJ				Walter WJ30EU				Walter TFP																											
3-16								3-16								2-2,9				3-16				3-16				3-10																											
v <sub>c</sub>	VRR							v <sub>c</sub>	VRR							VCRR	VRR							v <sub>c</sub>	VRR							v <sub>c</sub>	VRR							v <sub>c</sub>	VRR							v <sub>c</sub>	VRR						
140	12	E	O	M				120	12	E	O					C125	12	E	O					140	12	E	O	M	120	12	E	O																							
120	12	E	O	M				110	12	E	O					C125	12	E	O					120	12	E	O	M	110	12	E	O																							
100	10	E	O	M				80	10	E	O					C100	12	E	O					100	10	E	O	M	80	10	E	O																							
110	10	E	O	M				90	10	E	O					C125	12	E	O					110	10	E	O	M	90	10	E	O																							
80	10	E	O	M				71	10	E	O					C100	12	E	O					80	10	E	O	M	71	10	E	O			71	10	E	O																	
140	12	E	O	M				120	12	E	O					C125	12	E	O					140	12	E	O	M	120	12	E	O																							
120	12	E	O	M				110	12	E	O					C125	12	E	O					120	12	E	O	M	110	12	E	O																							
71	10	E	O	M				63	10	E	O					C100	12	E	O					71	10	E	O	M	63	10	E	O			63	10	E	O																	
56	8	E	O	M				56	8	E	O					C80	12	E	O					56	8	E	O	M	56	8	E	O			56	8	E	O																	
40	7	E	O	M				36	7	E	O					C63	6	E	O					40	7	E	O	M	36	7	E	O			40	7	E	O																	
100	9	E	O	M				90	9	E	O					C125	10	E	O					100	9	E	O	M	90	9	E	O			90	9	E	O																	
80	10	E	O	M				80	10	E	O					C100	12	E	O					80	10	E	O	M	80	10	E	O			71	10	E	O																	
56	8	E	O	M				56	8	E	O					C80	12	E	O					56	8	E	O	M	56	8	E	O			56	8	E	O																	
100	10	E	O	M				90	10	E	O					C100	12	E	O					100	10	E	O	M	90	10	E	O			90	10	E	O																	
63	9	E	O	M				63	9	E	O					C80	10	E	O					63	9	E	O	M	63	9	E	O			71	10	E	O																	
								45	6	E	O					C32	8	E	O									45	6	E	O																								
								56	6	E	O					C32	12	E	O									56	6	E	O			56	6	E	O																		
								40	4	E	O					C25	6	E	O									40	4	E	O			40	4	E	O																		
120	16	E	O	M				110	16	E	O					C50	25	E	O					120	16	E	O	M	110	16	E	O																							
100	16	E	O	M				80	16	E	O					C50	20	E	O					100	16	E	O	M	80	16	E	O			80	16	E	O																	
140	16	E	O	M				140	16	E	O					C63	25	E	O					140	16	E	O	M	140	16	E	O																							
120	16	E	O	M				110	16	E	O					C50	25	E	O					120	16	E	O	M	110	16	E	O																							
140	16	E	O	M				120	16	E	O					C63	30	E	O					140	16	E	O	M	120	16	E	O																							
100	16	E	O	M				80	16	E	O					C50	20	E	O					100	16	E	O	M	80	16	E	O			80	16	E	O																	
100	16	E	O	M				90	16	E	O					C50	20	E	O					100	16	E	O	M	90	16	E	O			36	7	E	O																	
								220	20	E	O	M					C125	25	E	O	M							180	20	E	O	M																							
								220	20	E	O	M					C125	25	E	O	M							180	20	E	O	M																							
								220	20	E	O	M					C125	25	E	O	M							180	20	E	O	M																							
								220	20	E	O	M					C125	25	E	O	M							180	20	E	O	M																							
								220	16	E	O	M					C100	20	E	O	M							180	16	E	O	M																							
								180	8	E	O						C50	6	E	O							160	8	E	O																									
								160	10	E	O						C63	10	E	O							140	10	E	O																									
								180	12	E	O						C63	20	E	O							160	12	E	O																									
								56	5	E	O						C40	6	E	O							56	5	E	O			50	5	E	O																			
								36	4	E	O						C25	6	E	O							36	4	E	O																									
								22	2	E	O						C16	6	E	O							22	2	E	O			20	2	E	O																			
								32	4	E	O						C20	5	E	O							32	4	E	O																									
								12	3	E	O						C12	5	E	O							12	3	E	O			12	3	E	O																			
								22	3	E	O						C12	6	E	O							22	3	E	O			20	3	E	O																			
								56	6	E	O						C32	6	E	O							56	6	E	O																									
								40	4	E	O						C20	4	E	O							40	4	E	O																									
								36	4	E	O						C16	4	E	O							36	4	E	O																									
								22	3	E	O						C12	6	E	O							22	3	E	O			20	3	E	O																			
								22	3	E	O						C12	6	E	O							22	3	E	O			20	3	E	O																			
								40	3	O	E	M					C32	3	E	O					40	3	O	E	M	36	3	O	E			36	3	O	E																
								110	16	E	O							C80	25	E	O							110	16	E	O																								

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for solid carbide drilling and reaming tools

## Solid carbide drills – with internal coolant

Material group	Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Drilling depth			25 × D <sub>c</sub>								
				Designation			DB133 Supreme				DC170 Supreme				
				Standard			Walter				Walter				
				Coating/grade			WJ30ER				WJ30EJ				
				Dia. range (mm)			2–2,9				3–12				
			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	VCRR	VRR			v <sub>c</sub>	VRR				
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	C125	12	E O		140	12	E O	M	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	C125	12	E O		120	12	E O	M	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	C100	12	E O		100	10	E O	M	
		C > 0,55 %	Annealed	190	640	P4	C125	12	E O		110	10	E O	M	
		C > 0,55 %	Heat-treated	300	1010	P5	C100	12	E O		80	10	E O	M	
	P	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	C125	12	E O		140	12	E O	M
			Annealed	175	590	P7	C125	12	E O		120	12	E O	M	
			Heat-treated	285	960	P8	C100	12	E O		71	10	E O	M	
			Heat-treated	380	1280	P9	C80	12	E O		56	8	E O	M	
		Hochlegierter Stahl and hochlegierter Werkzeugstahl	Heat-treated	430	1480	P10	C63	6	E O		40	7	E O	M	
Annealed			200	680	P11	C125	10	E O		100	9	E O	M		
Hardened and tempered			300	1010	P12	C100	12	E O		80	10	E O	M		
Stainless steel		Hardened and tempered	380	1280	P13	C80	12	E O		56	8	E O	M		
		Ferritic/martensitic, annealed	200	680	P14	C100	12	E O		100	10	E O	M		
M		Stainless steel	Martensitic, heat-treated	330	1110	P15	C80	10	E O		63	9	E O	M	
	Austenitic, quench hardened		200	680	M1	C25	8	E O							
	Austenitic, precipitation hardened (PH)		300	1010	M2	C25	12	E O							
K	Malleable cast iron	Austenitic/ferritic, duplex	230	780	M3	C20	6	E O							
		Ferritic	200	400	K1	C50	25	E O		120	16	E O	M		
	Grey cast iron	Pearlitic	260	700	K2	C40	20	E O		100	16	E O	M		
		Low strength	180	200	K3	C50	25	E O		140	16	E O	M		
		High strength/austenitic	245	350	K4	C50	25	E O		120	16	E O	M		
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	C50	30	E O		140	16	E O	M		
		Pearlitic	265	700	K6	C40	20	E O		100	16	E O	M		
CGI		230	400	K7	C40	20	E O		100	16	E O	M			
N	Wrought aluminium alloys	Not hardenable	30	-	N1	C100	25	E O	M						
		Hardenable, hardened	100	340	N2	C100	25	E O	M						
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	C100	25	E O	M						
		≤ 12% Si, hardenable, hardened	90	310	N4	C100	25	E O	M						
		> 12% Si, not hardenable	130	450	N5	C80	20	E O	M						
	Copper and copper alloys (bronze/brass)	Magnesium-based alloys <sup>2</sup>	70	250	N6										
		Unalloyed, electrolytic copper	100	340	N7	C32	6	E O							
		Brass, bronze, red brass	90	310	N8	C63	10	E O							
Copper alloys, short-chipping		110	380	N9	C63	20	E O								
S	Heat-resistant alloys	High tensile, Ampco	300	1010	N10	C32	6	E O							
		Fe-based	Annealed	200	680	S1	C20	6	E O						
			Hardened	280	940	S2	C16	6	E O						
		Ni- or Co-based	Annealed	250	840	S3	C20	5	E O						
			Hardened	350	1180	S4	C12	5	E O						
	Cast		320	1080	S5	C12	6	E O							
	Titanium alloys	Pure titanium	200	680	S6	C32	6	E O							
		α and β alloys, hardened	375	1260	S7	C16	4	E O							
		β alloys	410	1400	S8	C16	4	E O							
	Tungsten alloys		300	1010	S9	C12	6	E O							
Molybdenum alloys		300	1010	S10	C12	6	E O								
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	C25	3	E O		40	3	O E	M		
		Hardened and tempered	55 HRC	-	H2										
		Hardened and tempered	60 HRC	-	H3										
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4										
O	Thermoplastics	Without abrasive fillers			O1	C63	25	E O							
	Thermosetting plastics	Without abrasive fillers			O2										
	Plastic, glass-fibre reinforced	GFRP			O3										
	Plastic, carbon-fibre reinforced	CFRP			O4										
	Plastic, aramid-fibre reinforced	AFRP			O5										
	Graphitee (technical)		80 Shore			O6									

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

25 × D <sub>c</sub>				30 × D <sub>c</sub>								40 × D <sub>c</sub>				50 × D <sub>c</sub>								
DC160 Advance X-treme Evo				DB133 Supreme		DC170 Supreme		DC160 Advance X-treme Evo				A6994TFP X-treme DH30				A7495TTP X-treme D40				A7595TTP X-treme D50				
Walter				Walter		Walter		Walter				Walter				Walter								
WJ30EU				WJ30ER		WJ30EJ		WJ30EU				TFP				TTP				TTP				
3-12				2-2,9		3-12		3-12				3-10				3-11				3-9				
v <sub>c</sub>	VRR			VCRR	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			
120	12	E	O	C125	12	E	O	140	12	E	O	M	120	12	E	O					90	10	E	O
110	12	E	O	C125	12	E	O	120	12	E	O	M	110	12	E	O					90	10	E	O
80	10	E	O	C100	12	E	O	100	10	E	O	M	80	10	E	O					90	10	E	O
90	10	E	O	C125	12	E	O	110	10	E	O	M	90	10	E	O					90	10	E	O
71	10	E	O	C100	12	E	O	80	10	E	O	M	71	10	E	O	71	10	E	O	71	10	E	O
120	12	E	O	C125	12	E	O	140	12	E	O	M	120	12	E	O					90	10	E	O
110	12	E	O	C125	12	E	O	120	12	E	O	M	110	12	E	O					90	10	E	O
63	10	E	O	C100	12	E	O	71	10	E	O	M	63	10	E	O	63	10	E	O	63	8	E	O
56	8	E	O	C80	12	E	O	56	8	E	O	M	56	8	E	O	50	8	E	O				
36	7	E	O	C63	6	E	O	40	7	E	O	M	36	7	E	O	40	7	E	O				
90	9	E	O	C125	10	E	O	100	9	E	O	M	90	9	E	O	90	9	E	O	90	10	E	O
80	10	E	O	C100	12	E	O	80	10	E	O	M	80	10	E	O	71	10	E	O	71	10	E	O
56	8	E	O	C80	12	E	O	56	8	E	O	M	56	8	E	O	50	8	E	O				
90	10	E	O	C100	12	E	O	100	10	E	O	M	90	10	E	O	90	10	E	O	90	9	E	O
63	9	E	O	C80	10	E	O	63	9	E	O	M	63	9	E	O	71	10	E	O	56	8	E	O
45	6	E	O	C40	8	E	O						45	6	E	O					63	6	E	O
56	6	E	O	C50	12	E	O						56	6	E	O	56	6	E	O				
40	4	E	O	C32	6	E	O						40	4	E	O								
110	16	E	O	C80	25	E	O	120	16	E	O	M	110	16	E	O					90	12	E	O
80	16	E	O	C63	20	E	O	100	16	E	O	M	80	16	E	O	80	16	E	O	80	9	E	O
140	16	E	O	C100	25	E	O	140	16	E	O	M	140	16	E	O					90	12	E	O
110	16	E	O	C80	25	E	O	120	16	E	O	M	110	16	E	O					90	12	E	O
120	16	E	O	C80	30	E	O	140	16	E	O	M	120	16	E	O					90	12	E	O
80	16	E	O	C63	20	E	O	100	16	E	O	M	80	16	E	O	80	16	E	O	80	9	E	O
90	16	E	O	C63	20	E	O	100	16	E	O	M	90	16	E	O	36	7	E	O	80	9	E	O
120	20	E	O	M	C125	25	E	O	M				120	20	E	O	M				90	12	E	O
120	20	E	O	M	C125	25	E	O	M				120	20	E	O	M				90	12	E	O
120	20	E	O	M	C125	25	E	O	M				120	20	E	O	M				90	12	E	O
120	20	E	O	M	C125	25	E	O	M				120	20	E	O	M				90	12	E	O
120	16	E	O	M	C100	20	E	O	M				120	16	E	O	M				90	12	E	O
120	8	E	O		C63	6	E	O					120	8	E	O					90	12	E	O
110	10	E	O		C80	10	E	O					110	10	E	O					90	12	E	O
120	12	E	O		C80	20	E	O					120	12	E	O					90	12	E	O
56	5	E	O		C40	6	E	O					56	5	E	O	50	5	E	O	50	5	E	O
36	4	E	O		C32	6	E	O					36	4	E	O								
22	2	E	O		C20	6	E	O					22	2	E	O	20	2	E	O				
32	4	E	O		C25	5	E	O					32	4	E	O								
12	3	E	O		C16	5	E	O					12	3	E	O	12	3	E	O				
22	3	E	O		C16	6	E	O					22	3	E	O	20	3	E	O				
56	6	E	O		C40	6	E	O					56	6	E	O								
40	4	E	O		C25	4	E	O					40	4	E	O								
36	4	E	O		C20	4	E	O					36	4	E	O								
22	3	E	O		C16	6	E	O					22	3	E	O	20	3	E	O				
22	3	E	O		C16	6	E	O					22	3	E	O	20	3	E	O				
36	3	O	E		C32	3	E	O	40	3	O	E	M	36	3	O	E	36	3	O	E			
110	16	E	O		C100	25	E	O					110	16	E	O								

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

## Cutting data for solid carbide drilling and reaming tools Solid carbide drills – with internal coolant

Material group	Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben			Drilling depth			2 × D <sub>c</sub>			
				Designation			DB131 Supreme			
				Standard			Walter			
				Coating/grade			WJ30EL			
			Dia. range [mm]			2–2,95				
			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>					
						VCCR	VRR			
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	C100	12	E	O
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	C100	12	E	O
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	C80	12	E	O
		C > 0,55 %	Annealed	190	640	P4	C100	12	E	O
		C > 0,55 %	Heat-treated	300	1010	P5	C80	16	E	O
		Free-machining steel (short-chipping)	Annealed	220	750	P6	C100	12	E	O
	Low-alloy steel	Annealed	175	590	P7	C100	12	E	O	
		Heat-treated	285	960	P8	C63	16	E	O	
		Heat-treated	380	1280	P9	C63	12	E	O	
		Heat-treated	430	1480	P10	C50	6	E	O	
Hochlegierter Stahl and hochlegierter Werkzeugstahl	Annealed	200	680	P11	C100	10	E	O		
	Hardened and tempered	300	1010	P12	C80	16	E	O		
	Hardened and tempered	380	1280	P13	C63	12	E	O		
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	C63	12	E	O		
	Martensitic, heat-treated	330	1110	P15	C80	16	E	O		
M	Stainless steel	Austenitic, quench hardened	200	680	M1	C50	8	E	O	
		Austenitic, precipitation hardened (PH)	300	1010	M2	C63	1	E	O	
		Austenitic/ferritic, duplex	230	780	M3	C32	6	E	O	
K	Malleable cast iron	Ferritic	200	400	K1	C200	25	E	O	
		Pearlitic	260	700	K2	C160	20	E	O	
	Grey cast iron	Low strength	180	200	K3	C200	25	E	O	
		High strength/austenitic	245	350	K4	C200	25	E	O	
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	C200	30	E	O	
Pearlitic		265	700	K6	C160	20	E	O		
CGI		230	400	K7	C160	20	E	O		
N	Wrought aluminium alloys	Not hardenable	30	-	N1	C160	25	E	O	M
		Hardenable, hardened	100	340	N2	C160	25	E	O	M
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	C160	25	E	O	M
		≤ 12% Si, hardenable, hardened	90	310	N4	C160	25	E	O	M
		> 12% Si, not hardenable	130	450	N5	C125	20	E	O	M
	Magnesium-based alloys <sup>2</sup>		70	250	N6					
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper	100	340	N7	C100	6	E	O	
Brass, bronze, red brass		90	310	N8	C100	10	E	O		
Copper alloys, short-chipping		110	380	N9	C100	20	E	O		
High tensile, Ampco		300	1010	N10	C50	6	E	O		
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	C40	6	E	O
			Hardened	280	940	S2	C25	6	E	O
		Ni- or Co-based	Annealed	250	840	S3	C32	5	E	O
			Hardened	350	1180	S4	C20	5	E	O
			Cast	320	1080	S5	C20	6	E	O
	Titanium alloys	Pure titanium	200	680	S6	C50	6	E	O	
		α and β alloys, hardened	375	1260	S7	C32	4	E	O	
		β alloys	410	1400	S8	C25	4	E	O	
	Tungsten alloys		300	1010	S9	C20	6	E	O	
	Molybdenum alloys		300	1010	S10	C20	6	E	O	
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	C40	3	O	E	
		Hardened and tempered	55 HRC	-	H2					
		Hardened and tempered	60 HRC	-	H3					
Hardened cast iron	Hardened and tempered	55 HRC	-	H4						
O	Thermoplastics	Without abrasive fillers			O1	C125	25	E	O	
	Thermosetting plastics	Without abrasive fillers			O2					
	Plastic, glass-fibre reinforced	GFRP			O3					
	Plastic, carbon-fibre reinforced	CFRP			O4					
	Plastic, aramid-fibre reinforced	AFRP			O5					
	Graphitee (technical)		80 Shore			O6				

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium.

<sup>2</sup> Water-miscible coolants must not be used when machining magnesium-based alloys.

2×D <sub>c</sub>												
A6181TFT XD Pilot				DC118 Supreme				K5191TFT X-treme Pilot 180 C				
Walter				Walter				Walter				
TFT				WJ30ET				TFT				
3-16				3-20				4-7				
												
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			
120	12	E 0		120	9	E 0		120	9	E 0		
100	10	E 0		100	8	E 0		100	8	E 0		
80	9	E 0		80	7	E 0		80	7	E 0		
90	9	E 0		90	7	E 0		90	7	E 0		
71	8	E 0		71	6	E 0		71	6	E 0		
120	12	E 0		120	9	E 0		120	9	E 0		
100	12	E 0		100	8	E 0		100	8	E 0		
71	9	E 0		63	6	E 0		63	6	E 0		
45	6	E 0		50	4	E 0		50	4	E 0		
40	4	E 0		40	2	E 0		40	2	E 0		
80	9	E 0		90	6	E 0		90	6	E 0		
63	10	E 0		71	6	E 0		71	6	E 0		
50	6	E 0		50	4	E 0		50	4	E 0		
80	10	E 0		90	7	E 0		90	7	E 0		
50	9	E 0		71	6	E 0		71	6	E 0		
40	5	E 0		45	4	E 0		45	4	E 0		
56	6	E 0		56	4	E 0		56	4	E 0		
32	4	E 0		36	3	E 0		36	3	E 0		
100	16	E 0		100	12	E 0		100	12	E 0		
71	16	E 0		80	10	E 0		80	10	E 0		
120	16	E 0		120	12	E 0		120	12	E 0		
100	16	E 0		100	12	E 0		100	12	E 0		
90	25	E		110	12	E 0		110	12	E 0		
71	16	E 0		80	10	E 0		80	10	E 0		
71	16	E 0		80	10	E 0		80	10	E 0		
400	16	E 0	M	400	12	E 0	M	400	12	E 0	M	
400	16	E 0	M	400	12	E 0	M	400	12	E 0	M	
250	16	E 0	M	250	12	E 0	M	250	12	E 0	M	
220	16	E 0	M	220	12	E 0	M	220	12	E 0	M	
200	16	E 0	M	200	10	E 0	M	200	10	E 0	M	
180	8	E 0		220	6	E 0		220	6	E 0		
160	10	E 0		200	7	E 0		200	7	E 0		
200	16	E 0		200	12	E 0		200	12	E 0		
50	5	E 0		50	4	E 0		50	4	E 0		
32	4	E 0		36	3	E 0		36	3	E 0		
				11	3	E 0		11	3	E 0		
32	4	E 0		32	3	E 0		32	3	E 0		
11	3	E 0		12	2	E 0		12	2	E 0		
18	3	E 0		20	2	E 0		20	2	E 0		
45	6	E 0		56	5	E 0		56	5	E 0		
32	4	E 0		40	3	E 0		40	3	E 0		
28	4	E 0		32	3	E 0		32	3	E 0		
18	3	E 0		20	2	E 0		20	2	E 0		
18	3	E 0		20	2	E 0		20	2	E 0		
32	3	O E		36	2	O E		36	2	O E		
100	16	E 0		100	12	E 0		100	12	E 0		

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.

# Cutting data for solid carbide drilling and reaming tools

## Solid carbide drills – without internal coolant

Material group	Overview of the main material groups and code letters Brinell hardness HB Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ] Machining group <sup>1</sup>			Drilling depth		3 × D <sub>c</sub>									
				Designation		DC260 Advance X-treme Evo				DC160 Advance X-treme Evo					
				Standard		Walter				DIN 6537 K					
				Coating/grade		WJ30ET				WJ30ET					
				Dia. range [mm]		3,3–14,5				3–20					
			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR							
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	120	12	E O		100	12	E O		
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	120	12	E O		110	12	E O		
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	120	12	E O		110	12	E O		
		C > 0,55 %	Annealed	190	640	P4	120	10	E O		110	10	E O		
		C > 0,55 %	Heat-treated	300	1010	P5	100	10	E O		80	10	E O		
	M	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	120	16	E O		110	16	E O	
			Annealed	175	590	P7	120	12	E O		110	12	E O		
			Heat-treated	285	960	P8	90	10	E O		71	10	E O		
			Heat-treated	380	1280	P9	71	7	E O		56	7	E O		
			Heat-treated	430	1480	P10	50	5	E O		40	5	E O		
High-alloy steel and high-alloy tool steel		Annealed	200	680	P11	90	9	E O		71	9	E O			
		Hardened and tempered	300	1010	P12	100	10	E O		80	10	E O			
		Hardened and tempered	380	1280	P13	45	7	E O		45	7	E O			
		Stainless steel	Ferritic/martensitic, annealed	200	680	P14	110	12	E O		100	12	E O		
			Martensitic, heat-treated	330	1110	P15	71	10	E O		56	10	E O		
K	Stainless steel	Austenitic, quench hardened	200	680	M1										
		Austenitic, precipitation hardened (PH)	300	1010	M2										
		Austenitic/ferritic, duplex	230	780	M3										
N	Malleable cast iron	Ferritic	200	400	K1	90	16	E O		80	16	E O			
		Pearlitic	260	700	K2	90	12	E O		80	12	E O			
	Grey cast iron	Low strength	180	200	K3	110	16	E O		100	16	E O			
		High strength/austenitic	245	350	K4	90	16	E O		90	16	E O			
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	120	16	E O		110	16	E O			
		Pearlitic	265	700	K6	90	12	E O		80	12	E O			
CGI		230	400	K7	110	2	E O		100	2	E O				
S	Wrought aluminium alloys	Not hardenable	30	-	N1										
		Hardenable, hardened	100	340	N2										
		Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	250	16	E O	M	250	16	E O	M	
			≤ 12% Si, hardenable, hardened	90	310	N4	220	16	E O	M	220	16	E O	M	
	> 12% Si, not hardenable		130	450	N5	180	12	E O	M	180	12	E O	M		
	Magnesium-based alloys		70	250	N6										
		Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7	200	6	E O		180	6	E O		
			Brass, bronze, red brass	90	310	N8	180	10	E O		160	10	E O		
Copper alloys, short-chipping			110	380	N9	200	16	E O		200	16	E O			
High tensile, Ampco	300		1010	N10	45	5	E O		45	5	E O				
H	Heat-resistant alloys	Fe-based	Annealed	200	680	S1									
			Hardened	280	940	S2									
		Ni- or Co-based	Annealed	250	840	S3									
			Hardened	350	1180	S4									
			Cast	320	1080	S5									
	Titanium alloys	Pure titanium	200	680	S6	45	5	E O		36	5	E O			
α and β alloys, hardened		375	1260	S7	32	3	E O		25	3	E O				
β alloys		410	1400	S8	28	3	E O		22	3	E O				
Tungsten alloys		300	1010	S9											
Molybdenum alloys		300	1010	S10											
O	Hardened steel	Hardened and tempered	50 HRC	-	H1	36	3	O E		28	3	O E			
		Hardened and tempered	55 HRC	-	H2										
		Hardened and tempered	60 HRC	-	H3										
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4										
Thermoplastics	Without abrasive fillers				O1	100	16	E O		100	16	E O			
					O2										
					O3										
					O4										
					O5										
					O6										

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.



## Cutting data for solid carbide drilling and reaming tools Solid carbide drills – without internal coolant

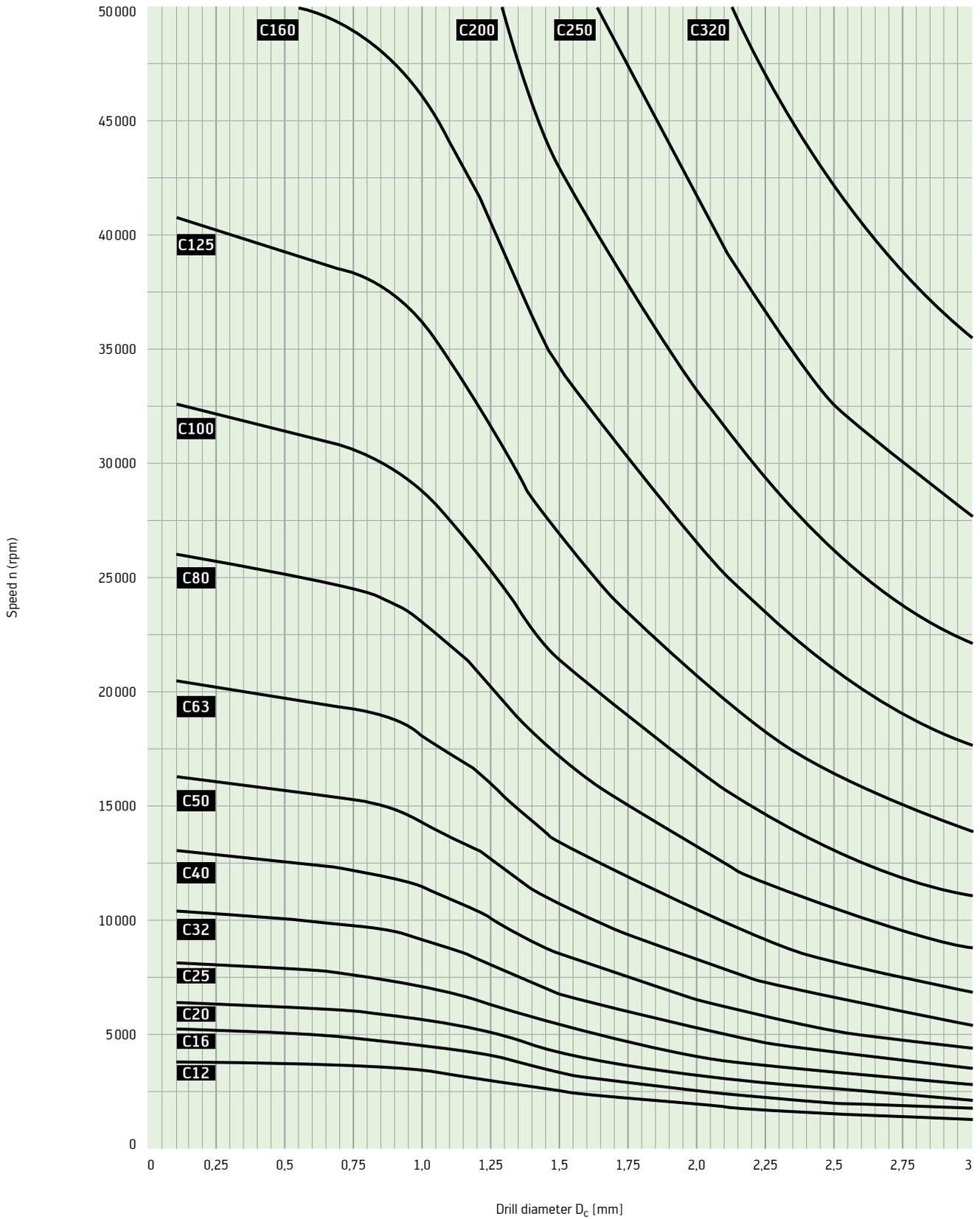
Material group	Overview of the main material groups and code letters Brinell hardness HB Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ] Machining group <sup>1</sup>			Drilling depth		5 × D <sub>c</sub>									
				Designation		DC160 Advance X-treme Evo				DC150 Perform					
				Standard		DIN 6537 L				DIN 6537 L					
				Coating/grade		WJ30ET				WJ30TA					
				Dia. range [mm]		3–25				3–20					
															
			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR							
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	100	12	E0		80	12	E0		
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	110	12	E0		80	10	E0		
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	100	12	E0		71	10	E0		
		C > 0,55 %	Annealed	190	640	P4	110	10	E0		71	9	E0		
		C > 0,55 %	Heat-treated	300	1010	P5	71	10	E0		56	8	E0		
	P	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	100	16	E0		80	12	E0	
			Annealed		175	590	P7	110	12	E0		80	12	E0	
			Heat-treated		285	960	P8	63	10	E0		45	8	E0	
			Heat-treated		380	1280	P9	50	7	E0		32	6	E0	
		High-alloy steel and high-alloy tool steel	Heat-treated		430	1480	P10	36	5	E0		25	4	E0	
Annealed				200	680	P11	71	9	E0		63	9	E0		
Hardened and tempered				300	1010	P12	71	10	E0		56	8	E0		
Hardened and tempered				380	1280	P13	45	7	E0		40	6	E0		
Stainless steel		Ferritic/martensitic, annealed		200	680	P14	90	12	E0		71	10	E0		
		Martensitic, heat-treated		330	1110	P15	50	10	E0		50	8	E0		
M	Stainless steel	Austenitic, quench hardened		200	680	M1									
		Austenitic, precipitation hardened (PH)		300	1010	M2					40	5	E0		
		Austenitic/ferritic, duplex		230	780	M3									
K	Malleable cast iron	Ferritic		200	400	K1	80	16	E0		71	16	E0		
		Pearlitic		260	700	K2	80	12	E0		56	12	E0		
	Grey cast iron	Low strength		180	200	K3	100	16	E0		80	16	E0		
		High strength/austenitic		245	350	K4	80	16	E0		71	16	E0		
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	100	16	E0		71	16	E0		
Pearlitic			265	700	K6	80	12	E0		56	12	E0			
	CGI		230	400	K7	90	2	E0		56	12	E0			
N	Wrought aluminium alloys	Not hardenable		30	-	N1					250	10	E0	M	
		Hardenable, hardened		100	340	N2					250	10	E0	M	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	250	16	E0	M	220	16	E0	M	
		≤ 12% Si, hardenable, hardened		90	310	N4	220	16	E0	M	200	16	E0	M	
		> 12% Si, not hardenable		130	450	N5	180	12	E0	M	160	12	E0	M	
	Magnesium-based alloys			70	250	N6									
		Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	180	6	E0		160	6	E0	
			Brass, bronze, red brass		90	310	N8	160	10	E0		140	10	E0	
Copper alloys, short-chipping				110	380	N9	200	16	E0		180	16	E0		
High tensile, Ampco			300	1010	N10	45	5	E0		45	5	E0			
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1									
			Hardened	280	940	S2									
		Ni- or Co-based	Annealed	250	840	S3									
			Hardened	350	1180	S4									
			Cast	320	1080	S5									
	Titanium alloys	Pure titanium		200	680	S6	32	5	E0		28	5	E0		
		α and β alloys, hardened		375	1260	S7	22	3	E0		20	3	E0		
β alloys			410	1400	S8	20	3	E0		18	3	E0			
Tungsten alloys		300	1010	S9											
Molybdenum alloys		300	1010	S10											
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	28	3	OE		20	3	OE		
		Hardened and tempered		55 HRC	-	H2									
		Hardened and tempered		60 HRC	-	H3									
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4									
O	Thermoplastics	Without abrasive fillers				O1	100	16	E0		90	16	E0		
	Thermosetting plastics	Without abrasive fillers				O2									
	Plastic, glass-fibre reinforced	GFRP				O3									
	Plastic, carbon-fibre reinforced	CFRP				O4									
	Plastic, aramid-fibre reinforced	AFRP				O5									
	Graphite (technical)		80 Shore				O6								

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

5 × D <sub>c</sub>				8 × D <sub>c</sub>								2 × D <sub>c</sub>							
A3367 BSX				DB133 Supreme				A1276TFL Alpha® 22				A1263				DB131 Supreme			
DIN 6537 L				Walter				DIN 338				DIN 338				Walter			
Uncoated				WJ30ER				TFL				Uncoated				WJ30EL			
3-16				0,5-2,95				3-10,2				0,6-12				0,5-1,984			
v <sub>c</sub>	VRR			VCRR	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			VCRR	VRR		
				C100	12	EO		71	10	EO						C100	12	EO	
				C100	12	EO		63	10	EO						C80	12	EO	
				C63	8	EO		50	8	EO						C80	12	EO	
				C80	8	EO		63	8	EO						C80	12	EO	
				C63	8	EO		63	8	EO						C63	16	EO	
				C100	12	EO		71	12	EO						C100	12	EO	
				C100	12	EO		63	10	EO						C80	12	EO	
				C50	8	EO		56	8	EO						C63	16	EO	
				C40	5	EO										C50	12	EO	
				C32	4	EO										C40	6	EO	
				C63	7	EO		63	9	EO						C80	10	EO	
				C63	8	EO		63	8	EO						C63	16	EO	
				C40	5	EO										C50	12	EO	
				C80	10	EO		56	10	EO						C63	12	EO	
				C50	7	EO		56	8	EO						C63	16	EO	
																C40	8	EO	
																C63	1	EO	
																C32	6	EO	
				C80	20	EO		63	16	EO		32	7	EO		C160	25	EO	
				C63	20	EO		50	12	EO		25	5	EO		C125	20	EO	
				C100	20	EO		71	16	EO		40	7	EO		C160	25	EO	
				C80	20	EO		63	16	EO		32	7	EO		C160	25	EO	
				C100	25	EO		63	16	EO		36	8	EO		C160	30	EO	
				C63	20	EO		50	12	EO		25	5	EO		C125	20	EO	
				C63	20	EO		50	12	EO		25	6	EO		C125	20	EO	
				C125	16	EO	M					180	9	EO	M	C160	25	EO	M
				C125	16	EO	M					180	9	EO	M	C160	25	EO	M
				C125	20	EO	M	220	16	EO	M	140	9	EO	M	C160	25	EO	M
				C125	20	EO	M	160	16	EO	M	120	9	EO	M	C160	25	EO	M
				C125	20	EO	M	120	12	EO	M	80	8	EO	M	C125	20	EO	M
												140	9		ML				
				C125	10	EO		120	6	EO		100	6	EO		C100	6	EO	
				C100	12	EO		110	10	EO		80	8	EO		C100	10	EO	
				C100	20	EO		120	16	EO		80	10	EO		C100	20	EO	
				C40	9	EO		32	5	EO		22	3	EO		C50	6	EO	
				C25	4	EO										C32	6	EO	
				C20	4	EO										C25	6	EO	
				C20	3	EO										C32	5	EO	
												4	3	EO		C16	5	EO	
																C16	6	EO	
				C50	9	EO		32	5	EO		18	3	EO		C50	6	EO	
				C32	6	EO		20	3	EO		10	2	EO		C25	4	EO	
				C25	6	EO		25	3	EO		8	1	EO		C25	4	EO	
												4	3	EO		C16	6	EO	
												4	3	EO		C16	6	EO	
				C32	3	OE										C32	3	OE	
				C63	20	EO						32	12	EO		C100	25	EO	
				C63	20	EO						56	8		L				
												56	8		L				
												56	8		L				
				C80	20		L					56	8		L				

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

### VCRR: Speed diagram Micro drill



## VRR: Feed rate charts for solid carbide drilling and reaming tools

VRR	Feed f [mm] for diameter [mm]								
	2,5	4	5	6	8	10	12	15	20
1	0,008	0,013	0,017	0,018	0,021	0,024	0,026	0,029	0,033
2	0,017	0,027	0,033	0,037	0,042	0,047	0,052	0,058	0,067
3	0,025	0,040	0,050	0,055	0,063	0,071	0,077	0,087	0,10
4	0,033	0,053	0,067	0,073	0,084	0,094	0,10	0,12	0,13
5	0,042	0,067	0,083	0,091	0,11	0,12	0,13	0,14	0,17
6	0,050	0,080	0,10	0,11	0,13	0,14	0,15	0,17	0,20
7	0,058	0,093	0,12	0,13	0,15	0,16	0,18	0,20	0,23
8	0,067	0,11	0,13	0,15	0,17	0,19	0,21	0,23	0,27
9	0,075	0,12	0,15	0,16	0,19	0,21	0,23	0,26	0,30
10	0,083	0,13	0,17	0,18	0,21	0,24	0,26	0,29	0,33
12	0,10	0,16	0,20	0,22	0,25	0,28	0,31	0,35	0,40
16	0,13	0,21	0,27	0,29	0,34	0,38	0,41	0,46	0,53
20	0,17	0,27	0,33	0,37	0,42	0,47	0,52	0,58	0,67
25	0,21	0,33	0,42	0,46	0,53	0,59	0,65	0,72	0,83
30	0,25	0,40	0,50	0,55	0,63	0,71	0,77	0,87	1,00



## Grade description

Coated Carbide																				
Walter grade description	Standard designation	Material groups						Application range						Coating process	Coating composition	Tool example				
		P	M	K	N	S	H	O	01	05	10	15	20				25	30	35	40
		Steel	Stainless steel	Cast iron	NF metals	Materials with difficult cutting properties	Hard materials	Other												
WJ30EJ	HC – P 30	●●																		
	HC – K 30			●●																
WJ30RE	HC – 30	●●	●●	●●	●●	●●	●	●●												
WJ30TA	HC – 30	●●	●●	●●	●●	●●	●	●●												
WJ30EL	HC – 30	●●		●●	●●	●	●	●												
WJ30ER	HC – 30	●●		●●	●●	●	●	●												
WJ30ET	HC – 30	●●	●	●●	●●	●●	●	●												
WJ30EU	HC – 30	●●	●	●●	●●	●●	●	●												
WJ30UU	HW – 30	●●	●●	●●	●●	●●		●●												
WJ30RZ	HC – 30	●	●●		●	●●		●												
WJ30RY	HC – 30	●	●●		●	●●		●												
WJ30EZ	HC – 30	●●	●●	●●	●●	●●	●●	●												<b>Krato-tec™</b>
WJ30EY	HC – 30	●●	●	●●	●●	●														<b>Krato-tec™</b>

HC = Coated carbide  
HW = Uncoated carbide

●● Primary application  
● Additional application

## Type description

Product line	Product family	Coolant supply	Material groups						
			P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials difficult to machine	H Hardness of materials	O Other
Supreme	Micro-holemaking	DB133 internal	●●	●●	●●	●●	●	●	●
		DB133 external	●●		●●	●●	●	●	●
		DB131 internal	●●	●●	●●	●●	●	●	●
		DB131 external	●●	●●	●●	●●	●	●	●
Advance	DB130	DB130 external	●●	●●	●●	●●	●●		●●
Supreme	DC183 X-treme Evo 3 <b>Krato-tec™</b>	DC183 internal	●●		●●	●●	●		●
	DC180 X-treme Evo Plus <b>Krato-tec™</b>	DC180 internal	●●	●●	●●	●●	●●	●●	●
	DC175	DC175 internal	●	●●	●	●	●●		●
	DD170 <b>Krato-tec™</b>	DD170 internal	●●		●●	●		●	
	DC170	DC170 internal	●●		●●	●		●	
	DC166	DC166 internal	●●		●●	●●		●	
	DC118	DC118 internal	●●	●●	●●	●●	●●	●	●
Advance	DC165	DC165 internal	●●		●●	●●		●	●
	DC160 X-treme Evo	DC160 internal	●●	●	●●	●●	●●	●	●
		DC260 internal	●●		●●	●	●	●	●
		DC260 external	●●		●●	●	●	●	●
Perform	DC150	DC150 internal	●●	●	●●	●●	●●	●	●
		DC150 external	●●	●	●●	●	●	●	●
X-treme	XD Pilot	XD Pilot internal	●●	●●	●●	●●	●●	●	●
	X-treme Pilot 180C	X-treme Pilot 180C internal	●●		●●	●			
	X-treme D40...D50	X-treme D40...D50 internal	●●	●	●●	●●			
	X-treme DH20 – DH30	X-treme DH20 – DH30 internal	●●	●	●	●	●	●	

- Primary application
- Additional application

	2×D <sub>c</sub>	3×D <sub>c</sub>	5×D <sub>c</sub>	8×D <sub>c</sub>	12×D <sub>c</sub>	16×D <sub>c</sub>	20×D <sub>c</sub>	25×D <sub>c</sub>	30×D <sub>c</sub>	40×D <sub>c</sub>	50×D <sub>c</sub>
			DB133-05-A1	DB133-08-A1	DB133-12-A1	DB133-16-A1	DB133-20-A1	DB133-25-A1	DB133-30-A1		
			DB133-05-A0	DB133-08-A0							
DB131-02-A1											
DB131-02-A0											
			DB130-05-U0								
			DC183-05-A1	DC183-08-A1							
		DC180-03-A1	DC180-05-A1	DC180-08-A1	DC180-12-A1						
		DC175-03-A1	DC175-05-A1	DC175-08-A1							
		DD170-03-A1	DD170-05-A1	DD170-08-A1	DD170-12-A1						
		DC170-03-A1	DC170-05-A1	DC170-08-A1	DC170-12-A1	DC170-16-A1	DC170-20-A1	DC170-25-A1	DC170-30-A1		
			DC166-05-A1								
DC118-02-A1											
			DC165-05-A1								
		DC160-03-A1 DC160-03-F1 DC260-03-A1 DC260-03-F1	DC160-05-A1 DC160-05-F1	DC160-08-A1	DC160-12-A1	DC160-16-A1	DC160-20-A1	DC160-25-A1	DC160-30-A1		
		DC160-03-A0 DC160-03-F0 DC260-03-A0 DC260-03-F0	DC160-05-A0 DC160-05-F0								
		DC150-03-A1 DC150-03-D1	DC150-05-A1 DC150-05-D1	DC150-08-A1	DC150-12-A1						
		DC150-03-U0 DC150-03-A0 DC150-03-D0	DC150-05-A0								
A6181TFT K5191TFT											
										A7495TTP	A7595TTP
							A6794TFP		A6994TFP		

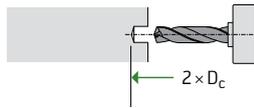
## Drilling strategies

### XD Technology ≤ 30 × D<sub>c</sub>

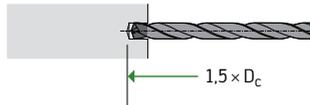
P	M	K	N	S	H	O
✓	✓	✓		✓	✓	✓

Pilot drilling 10–50 bar  
145–725 psi  
**On**

2 × D<sub>c</sub>  
A6181TFT  
DC118  
K5191TFT

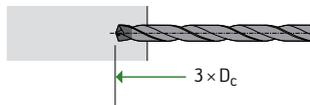


Running in **Off**



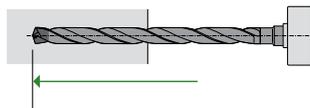
$n_{max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

Spot drilling 10–50 bar  
145–725 psi  
**On**



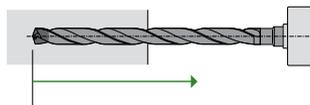
$v_c = 100\%$   
 $v_f = 25\text{--}50\%$

Deep-hole drilling 10–50 bar  
145–725 psi  
**On**



$v_c = 100\%$   
 $v_f = 100\%$

Retracting **Off**



$n_{max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

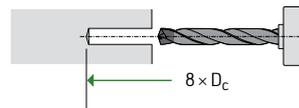
Recommended cutting data can be found in Walter GPS.

### XD Technology ≤ 30 × D<sub>c</sub>

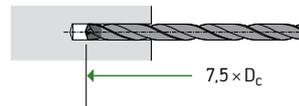
P	M	K	N	S	H	O
			✓			

Pilot drilling 10–50 bar  
145–725 psi  
**On**

8 × D<sub>c</sub>  
DC160-08-A1

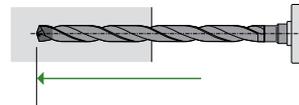


Running in **Off**



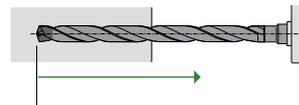
$n_{max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

Deep-hole drilling 10–50 bar  
145–725 psi  
**On**



$v_c = 100\%$   
 $v_f = 100\%$

Retracting **Off**



$n_{max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

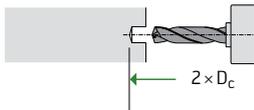
Recommended cutting data can be found in Walter GPS.

## Drilling strategies (continued)

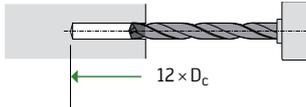
### XD Technology $\leq 50 \times D_c$

P	M	K	N	S	H	O
✓		✓	✓			

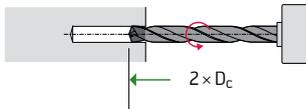
Pilot drilling no. 1 10–50 bar  
145–725 psi  $2 \times D_c$   
A6181TFT  
DC118-02-A1  
On



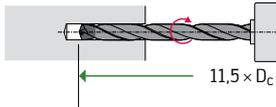
Pilot drilling no. 2 10–50 bar  
145–725 psi  $12 \times D_c$   
DC160-12-A1  
On



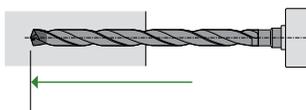
Running in Off  
With anticlockwise rotation:  
 $n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min



Running in Off  
Continue operation with clockwise rotation:  
 $n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min

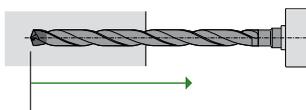


Deep-hole drilling 10–50 bar  
145–725 psi  
On



$v_c = 100\%$   
 $v_f = 100\%$

Retracting Off



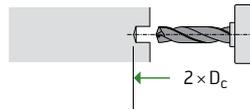
$n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min

Recommended cutting data can be found in Walter GPS.

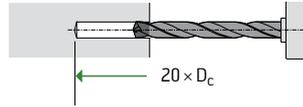
### XD Technology $\geq 50 \times D_c$

P	M	K	N	S	H	O
✓		✓	✓			

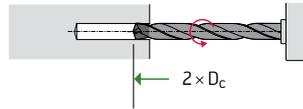
Pilot drilling no. 1 10–50 bar  
145–725 psi  $2 \times D_c$   
A6181TFT  
DC118-02-A1  
On



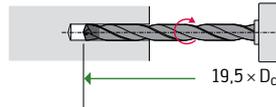
Pilot drilling no. 2 10–50 bar  
145–725 psi  $20 \times D_c$   
DC160-20-A1  
On



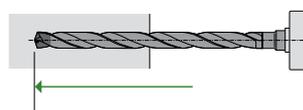
Running in Off  
With anticlockwise rotation:  
 $n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min



Running in Off  
Continue operation with clockwise rotation:  
 $n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min

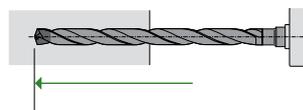


Deep-hole drilling 10–50 bar  
145–725 psi  
On



$v_c = 100\%$   
 $v_f = 100\%$

Retracting Off



$n_{max} = 100$  rpm  
 $v_f = 1000$  mm/min

Recommended cutting data can be found in Walter GPS.

## Drilling strategies (continued)

XD Technology micro  $\leq 30 \times D_c$

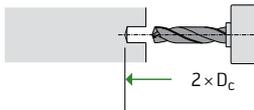
P	M	K	N	S	H	O
✓	✓	✓	✓	✓	✓	✓

Pilot drilling



10–50 bar  
145–725 psi  
On

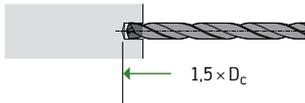
$2 \times D_c$   
DB131-02-A0 / A1



Running in



Off

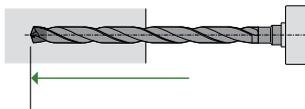


$n_{\max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

Deep-hole drilling



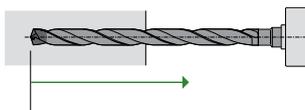
30–70 bar  
435–1015 psi  
On



Retracting



Off



$n_{\max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

Recommended cutting data can be found in Walter GPS.

## Application information DC118 Supreme

ISO material groups:

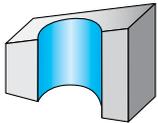
P	M	K	N	S	H	O
••	••	••	••	••	•	•

Cooling: Emulsion 5–12%  
Oil

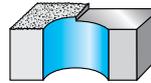
Coolant pressure: 10–40 bar/ 145–580 psi



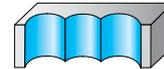
### Areas of use



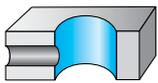
**For inclined entrance,**  
e.g. for pilot drilling on crankshafts  
 $\leq 15^\circ$ : Reduce the feed by **15–50%**  
until the full diameter is engaged  
 $\leq 30^\circ$ : Reduce the feed by **30–50%**  
until the full diameter is engaged  
 $\leq 50^\circ$ : Reduce the feed by **50%**  
until the full diameter is engaged



**For rough and uneven surfaces,**  
such as forged skin



**For chain drilling:**  
First make the complete holes  
and then drill the root faces



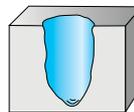
**For interrupted cuts,**  
such as cross holes



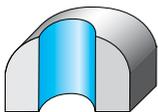
**For pipes and thin-walled components:**  
Reduced burr formation



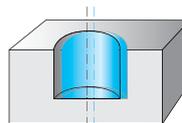
**For a flat hole face**



**For pre-cast conical holes**



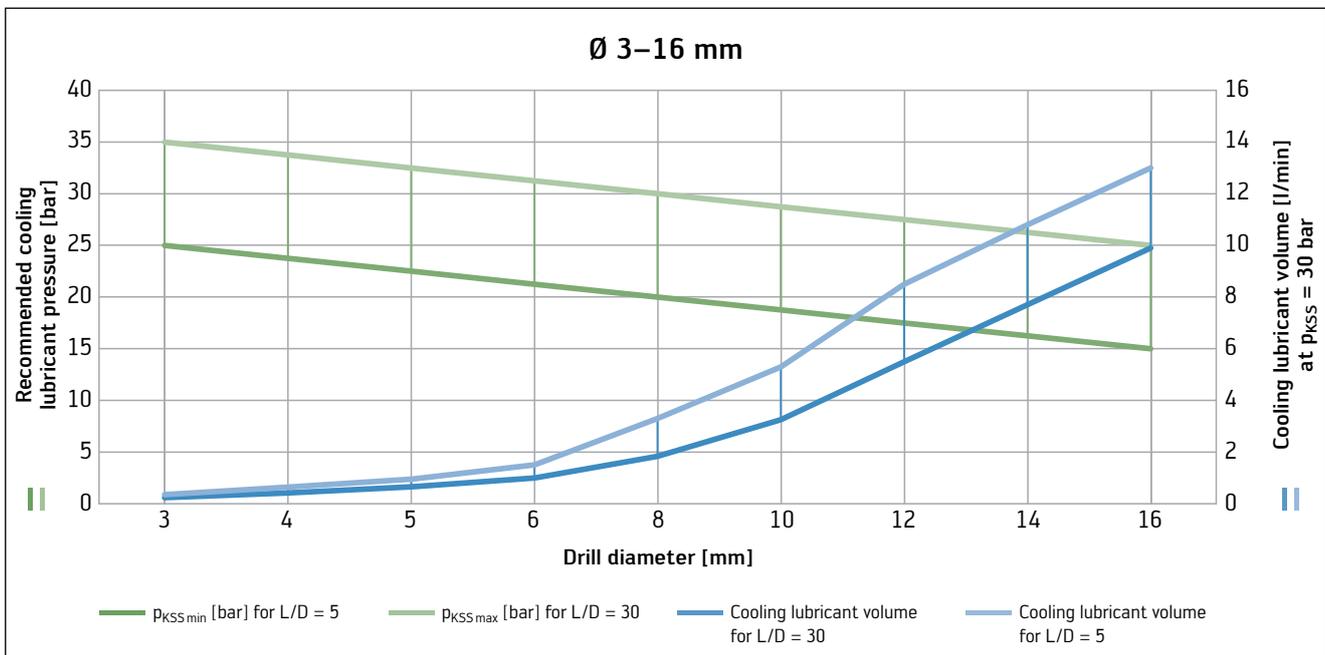
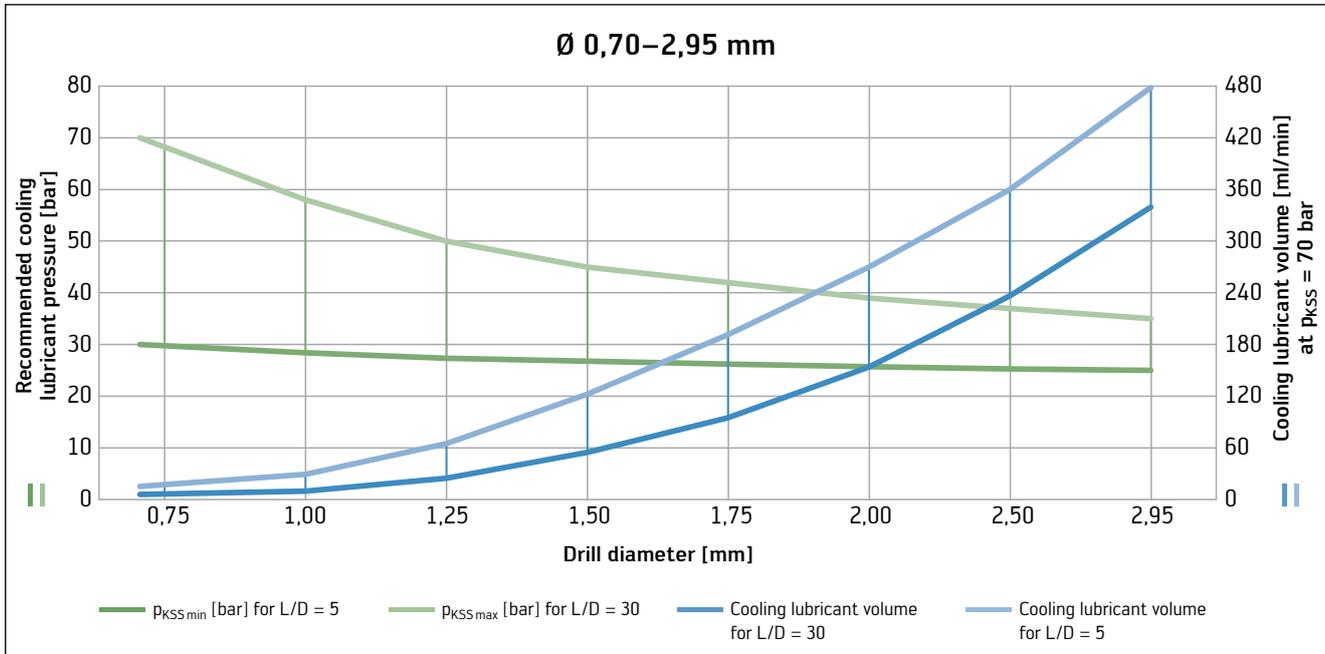
**For convex surfaces**



**For correcting holes  
with axial offset**

## Standard value diagrams for coolant pressure/flow rate information

### Solid carbide drilling



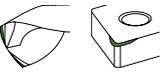
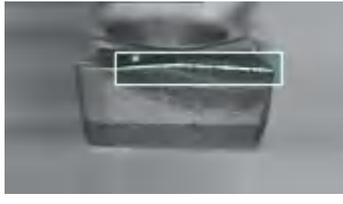
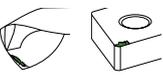
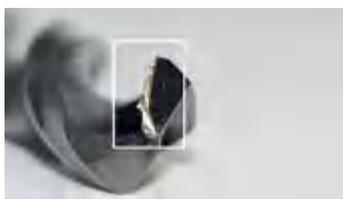
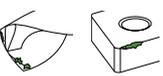
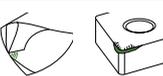
**Note**

The standard values shown were determined under laboratory conditions. During use, deviations may occur due to factors including the machine type being used, the coolant, the coolant preparation or the coolant pump.

**Abbreviations**

L/D Length/Diameter  
 p<sub>KSS</sub> Coolant pressure  
 p<sub>KSSmax</sub> Maximum coolant pressure  
 p<sub>KSSmin</sub> Minimum coolant pressure

## Problem-solving expertise: Wear patterns from drilling

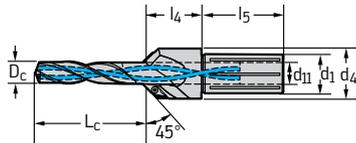
Wear patterns	Description		Measures
 <p><b>Flank face wear</b> Abrasion on the flank face</p>	<p>Abrasion between the workpiece and the flank face leads to flank face wear.</p>	 	<p><b>Solid carbide drilling</b></p> <ol style="list-style-type: none"> <li>1.1 Reduce the cutting speed</li> <li>1.2 Increase the feed</li> <li>1.3 Increase the coolant volume (e.g. by increasing the coolant pressure)</li> </ol> <p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>2.1 Reduce the cutting speed</li> <li>2.2 Increase the feed</li> <li>2.3 Use a more wear-resistant cutting tool material</li> </ol>
 <p><b>Build-up on the cutting edge</b> Adhesion of material along the cutting edge on the rake face</p>	<p>Micro galling of the workpiece material on the cutting edge leads to build-up on the cutting edge.</p>	 	<p><b>Solid carbide drilling</b></p> <ol style="list-style-type: none"> <li>1.1 Increase the cutting speed</li> <li>1.2 Increase the coolant volume (e.g. by increasing the coolant pressure)</li> </ol> <p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>2.1 Increase the cutting speed</li> <li>2.2 Increase the coolant pressure</li> <li>2.3 Increase the amount of oil in the coolant</li> <li>2.4 Use a more positive geometry</li> </ol>
 <p><b>Fractures</b> Fractures along the cutting edge</p>	<p>Hairline cracks, chip impacts, vibration and the cutting tool material having excessively high wear resistance lead to fractures.</p>	 	<p><b>Solid carbide drilling</b></p> <ol style="list-style-type: none"> <li>1.1 Replace and recondition the tool sooner</li> <li>1.2 Improve stability (of the workpiece/tool)</li> </ol> <p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>2.1 Reduce the feed</li> <li>2.2 Increase the coolant volume (e.g. by increasing the coolant pressure)</li> <li>2.3 Improve stability (of the workpiece/tool)</li> <li>2.4 Use a tougher cutting tool material</li> <li>2.5 Use a more stable geometry</li> </ol>
 <p><b>Plastic deformation</b> Deformation on the cutting edge (particularly on the chisel edge and corner radius)</p>	<p>High build-up of heat and mechanical stress cause plastic deformation.</p>	 	<p><b>Solid carbide drilling</b></p> <ol style="list-style-type: none"> <li>1.1 Reduce the feed</li> <li>1.2 Increase the coolant volume (e.g. by increasing the coolant pressure)</li> </ol> <p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>2.1 Reduce the cutting speed</li> <li>2.2 Reduce the feed</li> <li>2.3 Increase the coolant pressure</li> <li>2.4 Use a more wear-resistant cutting tool material</li> </ol>

## Problem-solving expertise: Wear patterns from drilling (continued)

Wear patterns	Description	Measures
 <p><b>Crater wear</b> Erosion or hollowing on the rake face</p>	<p>Crater wear is caused by diffusion and abrasion on the rake face.</p>	<p><b>Solid carbide drilling</b></p> <ol style="list-style-type: none"> <li>1.1 Increase the cutting speed</li> <li>1.2 Increase the feed</li> <li>1.3 Increase the coolant pressure</li> </ol>
		<p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>2.1 Reduce the cutting speed</li> <li>2.2 Reduce the feed</li> <li>2.3 Increase the coolant volume (e.g. by increasing the coolant pressure)</li> <li>2.4 Use a more wear-resistant cutting tool material</li> <li>2.5 Use a more positive geometry</li> </ol>
 <p><b>Thermal cracks</b> Small cracks perpendicular to the cutting edge</p>	<p>Fluctuations in temperature (thermal shock) cause hairline cracks.</p>	<p><b>Indexable insert drilling</b></p> <ol style="list-style-type: none"> <li>1. Reduce the cutting speed</li> <li>2. Dry machining (switch off coolant)</li> <li>3. Use a tougher cutting tool material</li> </ol>
		

## Application information for D4580 Xtra-tec®

### Dimensions



D <sub>c</sub> mm	L <sub>c</sub> [min-max] metric		
	DIN 6537 K 3 × D <sub>c</sub> mm	DIN 6537 L 5 × D <sub>c</sub> mm	8 × D <sub>c</sub> mm
4,00–4,75	4,0–16,0	4,0–24,0	8,0–35,0
4,75–6,00	5,0–16,0	5,0–32,0	20,0–47,0
6,00–7,00	6,0–24,0	13,0–39,0	28,0–54,0
7,00–8,00	7,0–27,0	13,0–39,0	38,0–64,0
8,00–10,00	8,0–35,0	21,0–49,0	57,0–80,0
10,00–12,00	14,0–40,0	30,0–56,0	75,0–96,0
12,00–14,00	19,0–43,0	36,0–60,0	94,0–119,0
14,00–16,00	14,0–45,0	30,0–63,0	101,0–136,0

Maximum chamfer depth l<sub>4</sub>: 2.8 mm/0.110"

### Assembly instructions



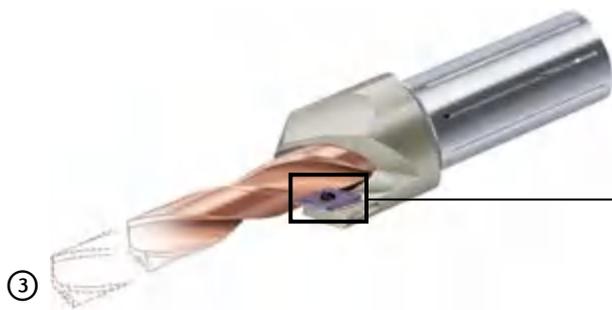
① Release the indexable insert, insert the drill



② Position the drill



④ Slightly tighten the fastening screw, slide the indexable insert up to the drill and tighten it



③ The indexable insert cutting edge must be fitted far below and behind the land



correct



incorrect

# Cutting data for D4120

Material group	Overview of the main material groups and code letters		Brinell hardness HB	Tensile strength R <sub>m</sub> (N/mm <sup>2</sup> )	Machining group*		Indexable insert geometry							
							Starting values for feed f (mm/rev)							
							A 57							
							Size 1	Size 2	Size 3	Size 4	Size 5 Size 6	Size 7 Size 8		
D <sub>c</sub> (mm)							13,5-16,4	16,5-20,4	20,5-24,4	24,5-29,4	29,5-42,4	42,5-59,4		
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●	0,05	0,06	0,06	0,09	0,12	0,13	
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●	0,07	0,09	0,10	0,13	0,18	0,19	
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●	0,07	0,09	0,10	0,13	0,18	0,19	
		C > 0,55 %	Annealed	190	640	P4	●●	0,07	0,09	0,10	0,13	0,18	0,19	
		C > 0,55 %	Heat-treated	300	1010	P5	●●	0,07	0,09	0,10	0,13	0,18	0,19	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	●● ●	0,07	0,09	0,10	0,13	0,18	0,19	
	Low-alloy steel	Annealed	175	590	P7	●●	0,08	0,10	0,12	0,15	0,20	0,21		
		Heat-treated	285	960	P8	●●	0,07	0,09	0,10	0,13	0,15	0,16		
		Heat-treated	380	1280	P9	●●	0,07	0,09	0,10	0,13	0,15	0,16		
		Heat-treated	430	1480	P10	●●	0,05	0,06	0,06	0,09	0,12	0,13		
	High-alloy steel and high-alloy tool steel	Annealed	200	680	P11	●●	0,08	0,10	0,12	0,15	0,18	0,19		
		Hardened and tempered	300	1010	P12	●●	0,07	0,09	0,10	0,13	0,15	0,16		
		Hardened and tempered	380	1280	P13	●●	0,06	0,08	0,09	0,12	0,14	0,15		
	Stainless steel	Ferritic/martensitic, annealed	200	680	P14	●●	0,07	0,09	0,10	0,13	0,15	0,16		
		Martensitic, heat-treated	330	1110	P15	●●	0,06	0,08	0,09	0,12	0,14	0,15		
M	Stainless steel	Austenitic, quench hardened		200	680	M1	●●	0,06	0,07	0,08	0,10	0,13	0,14	
		Austenitic, precipitation hardened (PH)		300	1010	M2	●●	0,06	0,07	0,08	0,10	0,13	0,14	
		Austenitic/ferritic, duplex		230	780	M3	●●	0,06	0,07	0,08	0,10	0,13	0,14	
K	Malleable cast iron	Ferritic		200	400	K1	●● ●	0,09	0,12	0,14	0,17	0,22	0,23	
		Pearlitic		260	700	K2	●● ●	0,07	0,09	0,11	0,14	0,19	0,20	
K	Grey cast iron	Low strength		180	200	K3	●● ●	0,10	0,13	0,15	0,18	0,23	0,24	
		High strength/austenitic		245	350	K4	●● ●	0,08	0,10	0,12	0,15	0,20	0,21	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●● ●	0,10	0,13	0,15	0,18	0,23	0,24	
		Pearlitic		265	700	K6	●●	0,08	0,10	0,12	0,18	0,23	0,24	
	CGI		230	400	K7	●● ●	0,09	0,12	0,14	0,17	0,22	0,23		
N	Wrought aluminium alloys	Not hardenable		30	-	N1								
		Hardenable, hardened		100	340	N2	●●							
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●●							
		≤ 12% Si, hardenable, hardened		90	310	N4	●●							
		> 12% Si, not hardenable		130	450	N5	●● ●							
	Magnesium-based alloys			70	250	N6	●●							
		Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7							
			Brass, bronze, red brass		90	310	N8	●●						
			Copper alloys, short-chipping		110	380	N9	●● ●						
	High tensile, Ampco			300	1010	N10	●● ●	0,06	0,07	0,08	0,10	0,13	0,14	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	●●							
			Hardened	280	940	S2	●●							
		Ni- or Co-based	Annealed	250	840	S3	●●							
			Hardened	350	1180	S4	●●							
			Cast	320	1080	S5	●●							
	Titanium alloys	Pure titanium		200	680	S6								
		α and β alloys, hardened		375	1260	S7	●●							
		β alloys		410	1400	S8	●●							
	Tungsten alloys		300	1010	S9	●●	0,05	0,06	0,06	0,09	0,11	0,12		
	Molybdenum alloys		300	1010	S10	●●	0,05	0,06	0,06	0,09	0,11	0,12		
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	●●	0,05	0,06	0,06	0,09	0,10	0,10		
		Hardened and tempered	55 HRC	-	H2	●●	0,05	0,06	0,06	0,09	0,10	0,10		
		Hardened and tempered	60 HRC	-	H3									
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4	●●	0,05	0,06	0,06	0,09	0,10	0,10		
O	Thermoplastics	Without abrasive fillers			O1	●● ●								
	Thermosetting plastics	Without abrasive fillers			O2	●● ●								
	Plastic, glass-fibre reinforced	GFRP			O3									
	Plastic, carbon-fibre reinforced	CFRP			O4									
	Plastic, aramid-fibre reinforced	AFRP			O5									
	Graphite (technical)		80 Shore		O6	●● ●	0,09	0,12	0,14	0,17	0,22	0,23		

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. Limited to 2 × D<sub>c</sub> drilling depth. MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D<sub>c</sub>, the following reductions are recommended:  
 > 3 × D<sub>c</sub>: Cutting speed v<sub>c</sub> -20%, feed f -30% when spot drilling, feed f -50% when spot drilling on inclined surfaces.  
 > 4 × D<sub>c</sub>: Cutting speed v<sub>c</sub> -30%, feed f -40% when spot drilling.

Indexable insert geometry																	
Starting values for feed f [mm/rev]																	
E 57						E 67						E 77					
Size 1	Size 2	Size 3	Size 4	Size 5 Size 6	Size 7 Size 8	Size 1	Size 2	Size 3	Size 4	Size 5 Size 6	Size 7 Size 8	Size 1	Size 2	Size 3	Size 4	Size 5 Size 6	Size 7 Size 8
D <sub>c</sub> [mm]						D <sub>c</sub> [mm]						D <sub>c</sub> [mm]					
13,5– 16,4	16,5– 20,4	20,5– 24,4	24,5– 29,4	29,5– 42,4	42,5– 59,4	13,5– 16,4	16,5– 20,4	20,5– 24,4	24,5– 29,4	29,5– 42,4	42,5– 59,4	13,5– 16,4	16,5– 20,4	20,5– 24,4	24,5– 29,4	29,5– 42,4	42,5– 59,4
0,05	0,06	0,06	0,09	0,12	0,13	0,05	0,06	0,06	0,09	0,12	0,13						
0,06	0,07	0,08	0,11	0,17	0,18	0,06	0,07	0,08	0,11	0,17	0,18						
0,06	0,07	0,08	0,11	0,17	0,18												
0,06	0,07	0,08	0,11	0,17	0,18												
0,06	0,07	0,08	0,11	0,17	0,18												
0,06	0,08	0,10	0,13	0,19	0,20	0,06	0,08	0,10	0,14	0,20	0,21						
0,06	0,07	0,08	0,11	0,14	0,15												
0,06	0,07	0,08	0,11	0,14	0,15												
0,05	0,06	0,06	0,09	0,11	0,12												
0,06	0,08	0,10	0,13	0,17	0,18	0,06	0,08	0,10	0,12	0,16	0,17						
0,06	0,07	0,08	0,11	0,14	0,15												
0,05	0,06	0,07	0,10	0,13	0,14												
0,06	0,07	0,08	0,11	0,14	0,15	0,06	0,07	0,08	0,11	0,14	0,15						
0,05	0,06	0,07	0,10	0,13	0,14	0,05	0,06	0,07	0,10	0,13	0,15						
0,06	0,07	0,08	0,10	0,13	0,14	0,06	0,07	0,09	0,12	0,14	0,15						
0,06	0,07	0,08	0,10	0,13	0,14	0,06	0,07	0,09	0,12	0,14	0,15						
0,06	0,07	0,08	0,10	0,13	0,14	0,06	0,07	0,09	0,12	0,14	0,15						
0,07	0,09	0,11	0,14	0,21	0,22	0,07	0,09	0,11	0,14	0,21	0,22						
0,05	0,07	0,08	0,11	0,18	0,19	0,05	0,07	0,09									
0,08	0,10	0,12	0,15	0,22	0,23	0,08	0,10	0,12	0,15	0,22	0,23						
0,06	0,08	0,09	0,12	0,19	0,20												
0,08	0,10	0,12	0,15	0,22	0,23	0,08	0,10	0,12	0,15	0,22	0,23						
0,06	0,08	0,09	0,12	0,22	0,23	0,06	0,08										
0,07	0,09	0,11	0,14	0,21	0,22	0,07	0,09	0,11	0,14	0,21	0,22						
												0,07	0,09	0,11	0,12	0,17	0,18
												0,08	0,10	0,12	0,15	0,17	0,18
												0,08	0,10	0,12	0,15	0,17	0,18
												0,08	0,10	0,12	0,15	0,17	0,18
												0,08	0,10	0,12	0,15	0,17	0,18
												0,10	0,12	0,14	0,17	0,22	0,23
												0,10	0,12	0,14	0,17	0,22	0,23
												0,06	0,07	0,09	0,12	0,14	0,15
0,05	0,06	0,07	0,10	0,13	0,14	0,05	0,06	0,07	0,10	0,13	0,14						
0,05	0,06	0,06	0,09	0,11	0,12	0,05	0,06	0,06	0,09	0,11	0,12						
0,05	0,06	0,07	0,10	0,12	0,13	0,05	0,06	0,07	0,10	0,12	0,13						
0,05	0,06	0,06	0,09	0,11	0,12	0,05	0,06	0,06	0,09	0,11	0,12						
0,05	0,06	0,06	0,09	0,11	0,12	0,05	0,06	0,06	0,09	0,11	0,12						
0,05	0,06	0,06	0,09	0,11	0,12	0,05	0,06	0,06	0,09	0,11	0,12						
0,05	0,06	0,06	0,09	0,10	0,10												
0,05	0,06	0,06	0,09	0,10	0,10												
0,05	0,06	0,06	0,09	0,10	0,10												
0,16	0,18	0,20	0,25	0,30	0,30	0,16	0,18	0,20	0,25	0,30	0,30						
0,12	0,14	0,18	0,20	0,25	0,25	0,12	0,14	0,18	0,20	0,25	0,25						
0,07	0,09	0,11	0,14	0,21	0,22												

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.

# Cutting data for D4120

(continued)

Material group	Overview of the main material groups and code letters				Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group *		Cutting material grade Outer insert [P484.P...]			
									Starting values for cutting speed v <sub>c</sub> [m/min]			
									HC WKP255 f [mm/rev]			
				0,06	0,10	0,16						
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●		350	320		
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●		260	240	220	
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●		240	220	200	
		C > 0,55 %	Annealed	190	640	P4	●●		220	200	180	
		C > 0,55 %	Heat-treated	300	1010	P5	●●		190	170	150	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	●● ●		220	200	180	
	Low-alloy steel		Annealed	175	590	P7	●●		260	240	220	
			Heat-treated	285	960	P8	●●		230	210	190	
			Heat-treated	380	1280	P9	●●		210	190	170	
			Heat-treated	430	1480	P10	●●		190	170	160	
		High-alloy steel and high-alloy tool steel		Annealed	200	680	P11	●●		220	200	180
				Hardened and tempered	300	1010	P12	●●		200	170	150
	Stainless steel		Hardened and tempered	380	1280	P13	●●		190	160	140	
		Ferritic/martensitic, annealed		200	680	P14	●●					
				330	1110	P15	●●					
M	Stainless steel	Austenitic, quench hardened	200	680	M1	●●						
		Austenitic, precipitation hardened (PH)	300	1010	M2	●●						
		Austenitic/ferritic, duplex	230	780	M3	●●						
K	Malleable cast iron	Ferritic	200	400	K1	●● ●		210	190	170		
		Pearlitic	260	700	K2	●● ●		190	140	120		
	Grey cast iron	Low strength	180	200	K3	●● ●		220	200	180		
		High strength/austenitic	245	350	K4	●● ●		180	150	130		
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	●● ●		150	140	130		
		Pearlitic	265	700	K6	●●		140	130	120		
	CGI		230	400	K7	●● ●		180	150	130		
N	Wrought aluminium alloys	Not hardenable	30	-	N1							
		Hardenable, hardened	100	340	N2	●●						
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	●●						
		≤ 12% Si, hardenable, hardened	90	310	N4	●●						
		> 12% Si, not hardenable	130	450	N5	●● ●						
	Magnesium-based alloys		70	250	N6	●●						
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7							
		Brass, bronze, red brass	90	310	N8	●●						
		Copper alloys, short-chipping	110	380	N9	●● ●						
		High tensile, Ampco	300	1010	N10	●● ●						
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	●●		100	100		
			Hardened	280	940	S2	●●		80	80		
		Ni- or Co-based	Annealed	250	840	S3	●●		60	60		
			Hardened	350	1180	S4	●●		50	50		
			Cast	320	1080	S5	●●		50	50		
	Titanium alloys	Pure titanium	200	680	S6							
		α and β alloys, hardened	375	1260	S7	●●						
		β alloys	410	1400	S8	●●						
	Tungsten alloys		300	1010	S9	●●		70	60			
	Molybdenum alloys		300	1010	S10	●●		70	60			
H	Hardened steel	Hardened and tempered	50 HRC	-	H1	●●		70	60	50		
		Hardened and tempered	55 HRC	-	H2	●●		60	50	50		
		Hardened and tempered	60 HRC	-	H3							
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4	●●		60	50	50		
O	Thermoplastics	Without abrasive fillers			O1	●● ●						
	Thermosetting plastics	Without abrasive fillers			O2	●● ●	300	300	300			
	Plastic, glass-fibre reinforced	GFRP			O3							
	Plastic, carbon-fibre reinforced	CFRP			O4							
	Plastic, aramid-fibre reinforced	AFRP			O5							
	Graphite (technical)		80 Shore		O6	●● ●	300	250	200			

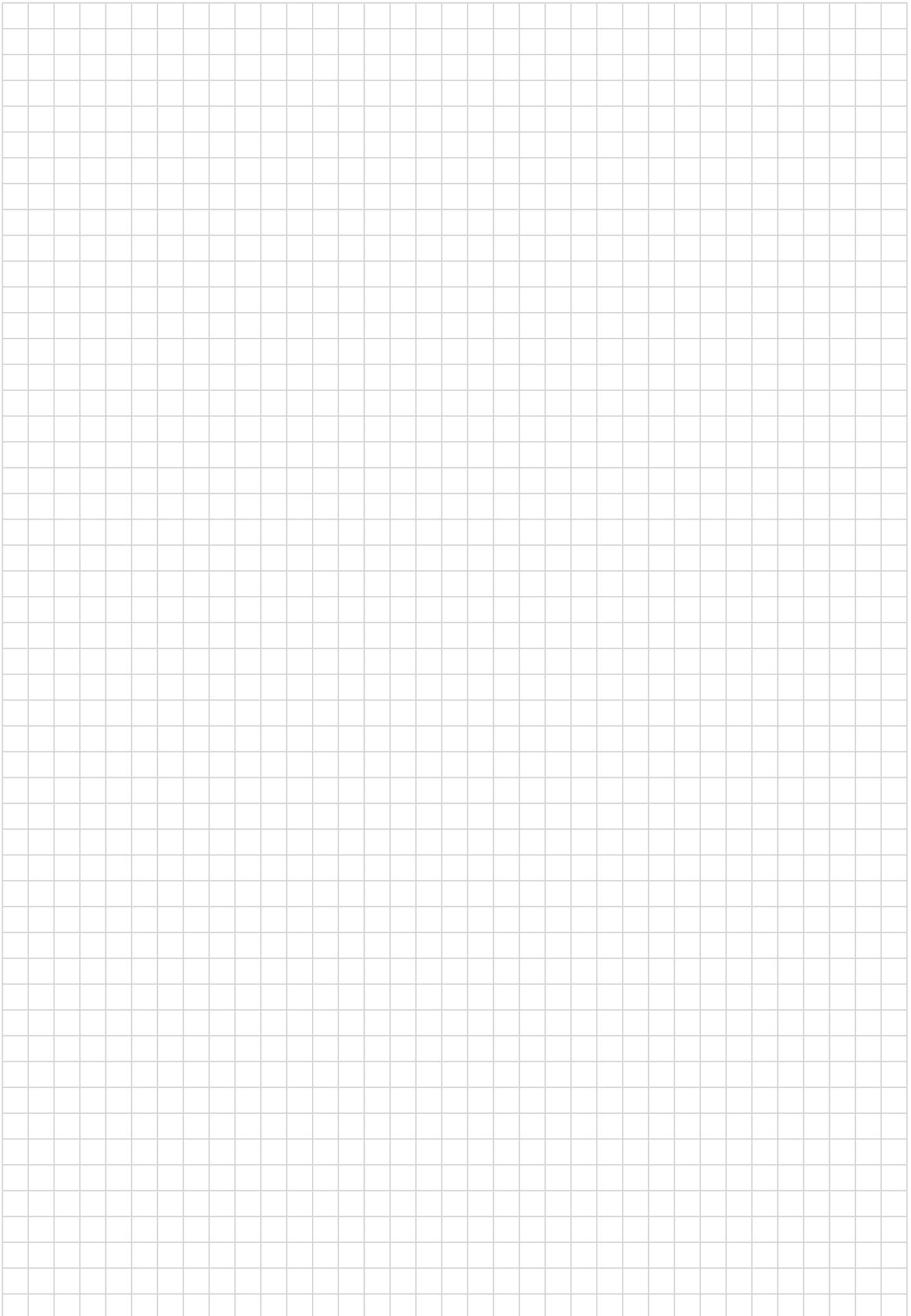
- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. Limited to 2 × D<sub>c</sub> drilling depth. MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D<sub>c</sub>, the following reductions are recommended:  
 > 3 × D<sub>c</sub>: Cutting speed v<sub>c</sub> -20%, feed f -30% when spot drilling, feed f -50% when spot drilling on inclined surfaces.  
 > 4 × D<sub>c</sub>: Cutting speed v<sub>c</sub> -30%, feed f -40% when spot drilling.

Cutting material grade Outer insert [P484.P..]															
Starting values for cutting speed v <sub>c</sub> [m/min]															
HC															
WKP35S f [mm/rev]			WNN15 f [mm/rev]			WN15 f [mm/rev]			WSP45G f [mm/rev]			WXP40 f [mm/rev]			
0,06	0,10	0,16	0,06	0,10	0,16	0,06	0,10	0,16	0,06	0,10	0,16	0,06	0,10	0,16	
300	270								250	220		200	180	160	
220	200	180							170	160	150	150	140	130	
200	180	150							150	140	130	150	140	120	
180	150	140							140	130	120	150	140	130	
150	130	120							130	120	110	120	110	100	
180	150	140							140	130	120	120	110	130	
220	200	180							170	160	160	150	140	130	
190	170	140							140	130	120	140	120	110	
180	160	130							140	120	110	140	120	90	
170	140	130							140	120	110	120	110	80	
200	170	150							140	130	120	130	120	110	
180	140	130							130	120	110	120	110	100	
170	130	120							120	110	100	110	100	80	
190	170	150							140	130	120	130	120	110	
150	130	120							120	110	100	110	100	90	
220	200	180							180	170	150	160	150	120	
150	130	110							130	110	100	110	100	75	
120	100	80							100	80	70	80	70	60	
190	180	160							170	140	120	160	140	140	
130	120	110							130	120	110	130	120	120	
200	190	170							180	160	130	160	140	120	
150	130	110							150	130	110	130	120	100	
140	120	110							150	130	120	130	120	110	
120	110	100							120	110	110	110	100	100	
150	130	110							150	130	110	130	120	100	
			450	450	450	450	450	450	450	450	450				
			300	300	300	300	300	300	300	300	300				
			250	250	250	250	250	250	250	250	250				
			200	200	200	200	200	200	200	200	200				
			300	300	300	300	300	300	300	300	300				
			300	250	200	300	250	200	300	250	200				
			350	300	250	350	300	250	350	300	250				
150	130	110	130	110	100	130	110	100	130	110	100				
100	100								90	90		80	80	70	
80	80								70	70		60	60	50	
60	60								50	50		50	50	40	
50	50								40	40		40	40	35	
50	50								40	40		40	40	35	
50	50								50	45					
50	50								40	40					
400	400	400							400	400	400	400	400	400	
300	300	300							300	300	300	300	300	300	
250	200	150							250	200	150	250	200	150	

HC = Coated carbide

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.



# Cutting data for D4170

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

Material group	Overview of the main material groups and code letters		Brinell hardness HB	Tensile strength R <sub>m</sub> N/mm <sup>2</sup>	Machining group *		Indexable insert geometries				
							Starting values for feed f [mm/rev]				
							A57 Gr.-5 Gr.-6	E57 Gr.-5 Gr.-6	E67 Gr.-5 Gr.-6		
							D <sub>c</sub> [mm]				
							60,3–95,3	60,3–95,3	60,3–95,3		
P	Unalloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●	0,12	0,12	0,12	
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●	0,18	0,17	0,17	
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●	0,18	0,17		
		C > 0,55 %	Annealed	190	640	P4	●●	0,18	0,17		
		C > 0,55 %	Heat-treated	300	1010	P5	●●	0,18	0,17		
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	●● ●	0,18	0,17		
		Annealed		175	590	P7	●●	0,20	0,19	0,20	
		Heat-treated		285	960	P8	●●	0,15	0,14		
		Heat-treated		380	1280	P9	●●	0,15	0,14		
	Hoch legierter Stahl and hoch legierter Werkzeugstahl	Heat-treated		430	1480	P10	●●	0,12	0,11		
Annealed			200	680	P11	●●	0,18	0,17	0,16		
Hardened and tempered			300	1010	P12	●●	0,15	0,14			
Stainless steel	Hardened and tempered		380	1280	P13	●●	0,14	0,13			
	Ferritic/martensitic, annealed		200	680	P14	●●	0,15	0,14	0,14		
	Martensitic, heat-treated		330	1110	P15	●●	0,14	0,13	0,13		
M	Stainless steel	Austenitic, quench hardened		200	680	M1	●●	0,13	0,13	0,14	
		Austenitic, precipitation hardened (PH)		300	1010	M2	●●	0,13	0,13	0,14	
		Austenitic/ferritic, duplex		230	780	M3	●●	0,13	0,13	0,14	
K	Malleable cast iron	Ferritic		200	400	K1	●● ●	0,22	0,21	0,21	
		Pearlitic		260	700	K2	●● ●	0,19	0,18		
	Grey cast iron	Low strength		180	200	K3	●● ●	0,23	0,22	0,22	
		High strength/austenitic		245	350	K4	●● ●	0,20	0,19		
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●● ●	0,23	0,22	0,22	
Pearlitic			265	700	K6	●●	0,23	0,22			
	CGI		230	400	K7	●● ●	0,22	0,21	0,21		
N	Wrought aluminium alloys	Not hardenable		30	–	N1					
		Hardenable, hardened		100	340	N2	●●		0,17	0,17	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●●		0,17	0,17	
		≤ 12% Si, hardenable, hardened		90	310	N4	●●		0,17	0,17	
		> 12% Si, not hardenable		130	450	N5	●● ●		0,17	0,17	
	Magnesium-based alloys			70	250	N6	●●		0,17	0,17	
		Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7				
Brass, bronze, red brass			90	310	N8	●●		0,22	0,22		
Copper alloys, short-chipping			110	380	N9	●● ●		0,22	0,22		
High tensile, Ampco			300	1010	N10	●● ●	0,13	0,13	0,14		
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1	●●		0,13	0,13
			Hardened		280	940	S2	●●		0,11	0,11
		Ni- or Co-based	Annealed		250	840	S3	●●		0,12	0,12
			Hardened		350	1180	S4	●●		0,11	0,11
			Cast		320	1080	S5	●●		0,11	0,11
	Titanium alloys	Pure titanium		200	680	S6					
		α and β alloys, hardened		375	1260	S7	●●		0,12	0,12	
		β alloys		410	1400	S8	●●		0,11	0,11	
	Tungsten alloys		300	1010	S9	●●	0,11	0,11	0,11		
	Molybdenum alloys		300	1010	S10	●●	0,11	0,11	0,11		
H	Hardened steel	Hardened and tempered		50 HRC	–	H1	●●	0,10	0,10		
		Hardened and tempered		55 HRC	–	H2	●●	0,10	0,10		
		Hardened and tempered		60 HRC	–	H3					
	Hardened cast iron	Hardened and tempered		55 HRC	–	H4	●●	0,10	0,10		
O	Thermoplastics	Without abrasive fillers				O1	●● ●	0,30	0,30		
	Thermosetting plastics	Without abrasive fillers				O2	●● ●	0,25	0,25		
	Plastic, glass-fibre reinforced	GFRP				O3					
	Plastic, carbon-fibre reinforced	CFRP				O4					
	Plastic, aramid-fibre reinforced	AFRP				O5					
	Graphitee (technical)		80 Shore			O6	●● ●	0,22	0,21		

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application, limited to 2 × D<sub>c</sub> drilling depth, MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D<sub>c</sub>, the following reductions are recommended:  
 > 3 × D<sub>c</sub>: Cutting speed v<sub>c</sub> –20%, feed f –30% when spot drilling, feed f –50% when spot drilling on inclined surfaces.  
 > 4 × D<sub>c</sub>: Cutting speed v<sub>c</sub> –30%, feed f –40% when spot drilling.



Wendeschneidplatten-Geometrie														
Startwerte für Vorschub f [mm/U]														
E 57					E 67					E 77				
Gr.-1	Gr.-2	Gr.-3	Gr.-4	Gr.-5	Gr.-1	Gr.-2	Gr.-3	Gr.-4	Gr.-5	Gr.-1	Gr.-2	Gr.-3	Gr.-4	Gr.-5
D <sub>c</sub> [mm]					D <sub>c</sub> [mm]					D <sub>c</sub> [mm]				
16-20	21-25	26-30	31-36	37-42	16-20	21-25	26-30	31-36	37-42	16-20	21-25	26-30	31-36	37-42
0,05	0,06	0,06	0,09	0,12	0,05	0,06	0,06	0,09	0,12					
0,06	0,07	0,08	0,11	0,17	0,06	0,07	0,08	0,11	0,17					
0,06	0,07	0,08	0,11	0,17										
0,06	0,07	0,08	0,11	0,17										
0,06	0,07	0,08	0,11	0,17										
0,06	0,08	0,10	0,13	0,19	0,06	0,08	0,10	0,14	0,20					
0,06	0,07	0,08	0,11	0,14										
0,06	0,07	0,08	0,11	0,14										
0,05	0,06	0,06	0,09	0,11										
0,06	0,08	0,10	0,13	0,17	0,06	0,08	0,10	0,12	0,16					
0,06	0,07	0,08	0,11	0,14										
0,05	0,06	0,07	0,10	0,13										
0,06	0,07	0,08	0,11	0,14	0,06	0,07	0,08	0,11	0,14					
0,05	0,06	0,07	0,10	0,13	0,05	0,06	0,07	0,10	0,13					
0,06	0,07	0,08	0,10	0,13	0,06	0,07	0,09	0,12	0,14					
0,06	0,07	0,08	0,10	0,13	0,06	0,07	0,09	0,12	0,14					
0,06	0,07	0,08	0,10	0,13	0,06	0,07	0,09	0,12	0,14					
0,07	0,09	0,11	0,14	0,21	0,07	0,09	0,11	0,14	0,21					
0,05	0,07	0,08	0,11	0,18	0,05	0,07	0,09							
0,08	0,10	0,12	0,15	0,22	0,08	0,10	0,12	0,15	0,22					
0,06	0,08	0,09	0,12	0,19										
0,08	0,10	0,12	0,15	0,22	0,08	0,10	0,12	0,15	0,22					
0,06	0,08	0,09	0,12	0,22	0,06	0,08								
0,07	0,09	0,11	0,14	0,21	0,07	0,09	0,11	0,14	0,21					
										0,07	0,09	0,11	0,12	0,17
										0,08	0,10	0,12	0,15	0,17
										0,08	0,10	0,12	0,15	0,17
										0,08	0,10	0,12	0,15	0,17
										0,08	0,10	0,12	0,15	0,17
										0,10	0,12	0,14	0,17	0,22
										0,10	0,12	0,14	0,17	0,22
										0,06	0,07	0,09	0,12	0,14
0,05	0,06	0,07	0,10	0,13	0,05	0,06	0,07	0,10	0,13					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,07	0,10	0,12	0,05	0,06	0,07	0,10	0,12					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,07	0,10	0,12	0,05	0,06	0,07	0,10	0,12					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,06	0,09	0,11	0,05	0,06	0,06	0,09	0,11					
0,05	0,06	0,06	0,09	0,10										
0,05	0,06	0,06	0,09	0,10										
0,05	0,06	0,06	0,09	0,10										
0,16	0,18	0,20	0,25	0,30	0,16	0,18	0,20	0,25	0,30					
0,12	0,14	0,18	0,20	0,25	0,12	0,14	0,18	0,20	0,25					
0,07	0,09	0,11	0,14	0,21										

Die vorgegebenen Schnittwerte sind mittlere Richtwerte. Eine Anpassung in speziellen Einsatzfällen ist zu empfehlen.

# Schnittdaten für D3120

(Fortsetzung)

Werkstoffgruppe	Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben		Brinell-Härte HB	Zugfestigkeit R <sub>m</sub> [N/mm <sup>2</sup> ]	Zerspanungsgruppe*		Schneidstoffsorte								
							Startwerte für Schnittgeschwindigkeit v <sub>c</sub> [m/min]								
							HC								
							WKP255 f [mm/U]			WKP355 f [mm/U]					
			0,06	0,10	0,16	0,06	0,10	0,16							
P	Unlegierter Stahl	C ≤ 0,25 %	geglüht	125	430	P1	●●								
		C > 0,25 ... ≤ 0,55 %	geglüht	190	640	P2	●●								
		C > 0,25 ... ≤ 0,55 %	vergütet	210	710	P3	●●								
		C > 0,55 %	geglüht	190	640	P4	●●								
		C > 0,55 %	vergütet	300	1010	P5	●●								
		Automatenstahl (kurzspanend)	geglüht	220	750	P6	●●	●	220	200	180	180	150	140	
	Niedrig legierter Stahl		geglüht	175	590	P7	●●		260	240	220	220	200	180	
			vergütet	285	960	P8	●●		230	210	190	190	170	140	
			vergütet	380	1280	P9	●●		210	190	170	180	160	130	
			vergütet	430	1480	P10	●●		190	170	160	170	140	130	
Hochlegierter Stahl und hochlegierter Werkzeugstahl		geglüht	200	680	P11	●●		220	200	180	200	170	150		
		gehärtet und angelassen	300	1010	P12	●●		200	170	150	180	140	130		
		gehärtet und angelassen	380	1280	P13	●●		190	160	140	170	130	120		
Nichtrostender Stahl		ferritisch / martensitisch, geglüht	200	680	P14	●●					190	170	150		
		martensitisch, vergütet	330	1110	P15	●●					150	130	120		
		austenitisch, abgeschreckt	200	680	M1	●●					220	200	180		
M	Nichtrostender Stahl	austenitisch, ausscheidungsgehärtet (PH)		300	1010	M2	●●					150	130	110	
		austenitisch-ferritisch, Duplex		230	780	M3	●●					120	100	80	
K	Temperguss	ferritisch		200	400	K1	●●	●	210	190	170	190	180	160	
		perlitisch		260	700	K2	●●	●	190	140	120	130	120	110	
	Grauguss	niedrige Festigkeit		180	200	K3	●●	●	220	200	180	200	190	170	
		hohe Festigkeit / austenitisch		245	350	K4	●●	●	180	150	130	150	130	110	
	Gusseisen mit Kugelgraphit	ferritisch		155	400	K5	●●	●	150	140	130	140	120	110	
		perlitisch		265	700	K6	●●	●	140	130	120	120	110	100	
	GGV (CGI)			230	400	K7	●●	●	180	150	130	150	130	110	
N	Aluminium-Knetlegierungen	nicht aushärtbar		30	-	N1									
		aushärtbar, ausgehärtet		100	340	N2	●●								
	Aluminium-Gusslegierungen	≤ 12 % Si, nicht aushärtbar		75	260	N3	●●								
		≤ 12 % Si, aushärtbar, ausgehärtet		90	310	N4	●●								
		> 12 % Si, nicht aushärtbar		130	450	N5	●●	●							
	Magnesiumlegierungen		70	250	N6	●●									
	Kupfer und Kupferlegierungen (Bronze/Messing)	unlegiert, Elektrolytkupfer		100	340	N7									
		Messing, Bronze, Rotguss		90	310	N8	●●								
		Cu-Legierungen, kurzspanend		110	380	N9	●●	●							
		hochfest, Ampco		300	1010	N10	●●	●				150	130	110	
S	Warmfeste Legierungen	Fe-Basis	geglüht	200	680	S1	●●		100	100		100	100		
			ausgehärtet	280	940	S2	●●		80	80		80	80		
		Ni- oder Co-Basis	geglüht	250	840	S3	●●		60	60		60	60		
			ausgehärtet	350	1180	S4	●●		50	50		50	50		
			gegossen	320	1080	S5	●●		50	50		50	50		
	Titanlegierungen	Reintitan		200	680	S6									
		α- und β-Legierungen, ausgehärtet		375	1260	S7	●●					50	50		
		β-Legierungen		410	1400	S8	●●					50	50		
	Wolframlegierungen		300	1010	S9	●●		70	60						
	Molybdänlegierungen		300	1010	S10	●●		70	60						
H	Gehärteter Stahl	gehärtet und angelassen		50 HRC	-	H1	●●		70	60	50				
		gehärtet und angelassen		55 HRC	-	H2	●●		60	50	50				
		gehärtet und angelassen		60 HRC	-	H3	●●								
	Gehärtetes Gusseisen	gehärtet und angelassen		55 HRC	-	H4	●●		60	50	50				
O	Thermoplaste	ohne abrasive Füllstoffe				O1	●●	●				400	400	400	
	Duroplaste	ohne abrasive Füllstoffe				O2	●●	●	300	300	300	300	300	300	
	Kunststoff, glasfaserverstärkt	GFRP				O3									
	Kunststoff, kohlefaserverstärkt	CFRP				O4									
	Kunststoff, aramidfaserverstärkt	AFRP				O5									
	Graphit (technisch)			80 Shore			O6	●●	●	300	250	200	250	200	150

- Empfohlene Anwendung (die angegebenen Schnittdaten gelten als Startwerte für die empfohlene Anwendung)
- Mögliche Anwendung, limitiert auf 2 × D<sub>c</sub> Bohrtiefe, MMS (Mindermengenschmierung) oder Druckluft ist empfohlen.

Beim Einsatz von Bohrern > 3 × D<sub>c</sub> sind folgende Reduktionen empfohlen:  
 > 3 × D<sub>c</sub>: Schnittgeschwindigkeit v<sub>c</sub> -20 %, Vorschub f -30 % beim Anbohren, Vorschub f -50 % beim Anbohren auf schrägen Flächen.  
 > 4 × D<sub>c</sub>: Schnittgeschwindigkeit v<sub>c</sub> -30 %, Vorschub f -40 % beim Anbohren.



### Schnittdaten für B321.

Werkstoffgruppe	Gliederung der Werkstoff-Hauptgruppen und Kennbuchstaben		Brinell-Härte HB	Zugfestigkeit R <sub>m</sub> [N/mm <sup>2</sup> ]	Zerspanungsgruppe*	= Nassbearbeitung (E = Emulsion, O = Öl) = Trockenbearbeitung möglich (M = MMS, L = Trocken) Schnittdaten sind aus Walter GPS zu wählen	Wendeschneidplatten-Geometrie						
							Startwerte für Vorschub f [mm/U]						
							LCMX...-B57		LCMX...-D57				
							D <sub>c</sub> [mm]		D <sub>c</sub> [mm]				
						10,0-12,0	12,1-18,0	10,0-12,0	12,1-18,0				
P	Unlegierter Stahl	C ≤ 0,25 %	geglüht	125	430	P1	●●		0,05	0,06	0,06	0,07	
		C > 0,25 ... ≤ 0,55 %	geglüht	190	640	P2	●●		0,06	0,08	0,06	0,08	
		C > 0,25 ... ≤ 0,55 %	vergütet	210	710	P3	●●				0,06	0,08	
		C > 0,55 %	geglüht	190	640	P4	●●				0,06	0,08	
		C > 0,55 %	vergütet	300	1010	P5	●●				0,05	0,06	
		Automatenstahl (kurzspanend)	geglüht	220	750	P6	●● ●				0,05	0,06	
	Niedrig legierter Stahl		geglüht	175	590	P7	●●		0,06	0,07	0,07	0,08	
			vergütet	285	960	P8	●●				0,07	0,08	
			vergütet	380	1280	P9	●●				0,07	0,08	
			vergütet	430	1480	P10	●●				0,05	0,06	
	Hochlegierter Stahl und hochlegierter Werkzeugstahl		geglüht	200	680	P11	●●				0,06	0,08	
			gehärtet und angelassen	300	1010	P12	●●				0,05	0,07	
			gehärtet und angelassen	380	1280	P13	●●				0,06	0,07	
	Nichtrostender Stahl		ferritisch / martensitisch, geglüht	200	680	P14	●●				0,06	0,08	
			martensitisch, vergütet	330	1110	P15	●●				0,06	0,07	
M	Nichtrostender Stahl	austenitisch, abgeschreckt		200	680	M1	●●		0,05	0,06	0,06	0,07	
		austenitisch, ausscheidungsgehärtet (PH)		300	1010	M2	●●		0,05	0,06	0,06	0,07	
		austenitisch-ferritisch, Duplex		230	780	M3	●●		0,05	0,06	0,06	0,07	
K	Temperguss	ferritisch		200	400	K1	●● ●		0,09	0,10	0,10	0,12	
		perlitisch		260	700	K2	●● ●		0,07	0,08	0,08	0,10	
	Grauguss	niedrige Festigkeit		180	200	K3	●● ●		0,09	0,10	0,10	0,12	
		hohe Festigkeit / austenitisch		245	350	K4	●● ●		0,07	0,08	0,08	0,10	
	Gusseisen mit Kugelgraphit	ferritisch		155	400	K5	●● ●		0,07	0,09	0,08	0,10	
		perlitisch		265	700	K6	●●		0,06	0,08	0,07	0,08	
	GGV (CGI)			230	400	K7	●● ●		0,09	0,10	0,10	0,12	
N	Aluminium-Knetlegierungen	nicht aushärtbar		30	-	N1							
		aushärtbar, ausgehärtet		100	340	N2	●●				0,08	0,10	
	Aluminium-Gusslegierungen	≤ 12 % Si, nicht aushärtbar		75	260	N3	●●				0,08	0,10	
		≤ 12 % Si, aushärtbar, ausgehärtet		90	310	N4	●●				0,08	0,10	
		> 12 % Si, nicht aushärtbar		130	450	N5	●● ●				0,08	0,10	
	Magnesiumlegierungen			70	250	N6	●●				0,08	0,10	
		Kupfer und Kupferlegierungen (Bronze/Messing)	unlegiert, Elektrolytkupfer		100	340	N7						
			Messing, Bronze, Rotguss		90	310	N8	●●				0,08	0,10
			Cu-Legierungen, kurzspanend		110	380	N9	●● ●				0,07	0,09
	hochfest, Ampco			300	1010	N10	●● ●				0,06	0,08	
S	Warmfeste Legierungen	Fe-Basis	geglüht		200	680	S1	●●		0,05	0,06	0,05	0,06
			ausgehärtet		280	940	S2	●●				0,04	0,05
		Ni- oder Co-Basis	geglüht		250	840	S3	●●				0,04	0,05
			ausgehärtet		350	1180	S4	●●				0,04	0,05
			gegossen		320	1080	S5	●●				0,04	0,05
			Reintitan		200	680	S6						
	Titanlegierungen	α- und β-Legierungen, ausgehärtet		375	1260	S7	●●		0,05	0,06	0,05	0,06	
		β-Legierungen		410	1400	S8	●●		0,05	0,06	0,05	0,06	
	Wolframlegierungen		300	1010	S9	●●					0,05	0,06	
	Molybdänlegierungen		300	1010	S10	●●					0,05	0,06	
H	Gehärteter Stahl	gehärtet und angelassen		50 HRC	-	H1	●●				0,04	0,05	
		gehärtet und angelassen		55 HRC	-	H2	●●				0,04	0,05	
		gehärtet und angelassen		60 HRC	-	H3							
	Gehärtetes Gusseisen	gehärtet und angelassen		55 HRC	-	H4	●●				0,04	0,05	
O	Thermoplaste	ohne abrasive Füllstoffe				O1	●● ●				0,12	0,14	
	Duroplaste	ohne abrasive Füllstoffe				O2	●● ●				0,10	0,12	
	Kunststoff, glasfaserverstärkt	GFRP					O3						
		Kunststoff, kohlefaserverstärkt	CFRP				O4						
	Kunststoff, aramidfaserverstärkt	AFRP				O5							
	Graphit (technisch)			80 Shore		O6	●● ●		0,07	0,09	0,06	0,08	

- Empfohlene Anwendung (die angegebenen Schnittdaten gelten als Startwerte für die empfohlene Anwendung)
- Mögliche Anwendung. Limitiert auf 2 × D<sub>c</sub> Bohrtiefe. MMS (Mindermengenschmierung) oder Druckluft ist empfohlen.

Beim Einsatz von Bohrern > 3 × D<sub>c</sub> sind folgende Reduktionen empfohlen:  
 > 3 × D<sub>c</sub>: Schnittgeschwindigkeit v<sub>c</sub> -20 %, Vorschub f -30 % beim Anbohren, Vorschub f -50 % beim Anbohren auf schrägen Flächen.

Wendeschneidplatten-Geometrie				Schneidstoffsorten											
Startwerte für Vorschub f [mm/U]				Startwerte für Schnittgeschwindigkeit v <sub>c</sub> [m/min]											
LCMX...-E57		LCGX...-E77		HC											
D <sub>c</sub> [mm]		D <sub>c</sub> [mm]		WKP25S f [mm/U]		WKP35S f [mm/U]		WNN15 f [mm/U]		WN15 f [mm/U]		WSP45G f [mm/U]		WXP40 f [mm/U]	
10,0- 12,0	12,1- 18,0	10,0- 12,0	12,1- 18,0	0,06	0,1	0,06	0,1	0,06	0,1	0,06	0,1	0,06	0,1	0,06	0,1
0,07	0,10			290	260	260	240					220	200	200	180
0,08	0,12			260	240	220	200					160	150	150	140
0,08	0,12			260	240	220	200					160	150	150	140
0,08	0,12			260	240	220	200					160	150	150	140
0,07	0,10			200	180	150	130					130	120	120	110
0,07	0,10			200	180	150	130					130	120	120	110
0,08	0,12			260	240	220	200					180	170	150	140
0,08	0,10			220	200	190	170					150	130	140	120
0,08	0,10			220	200	190	170					150	130	140	120
0,06	0,08			200	180	150	130					130	120	120	110
0,07	0,10			220	200	180	170					140	130	130	120
0,06	0,08			180	170	150	140					130	120	120	110
0,07	0,09			170	160	140	130					120	110	110	100
0,07	0,10					180	170					140	130	130	120
0,07	0,09			170	160	140	130					120	110	110	100
						220	200					180	160	160	150
						150	130					130	110	110	100
						120	100					100	80	80	70
0,10	0,14			240	220	220	200					170	150	160	140
0,08	0,12			180	170	180	150					140	130	130	120
0,10	0,14			240	220	220	200					170	150	160	140
0,08	0,12			180	170	180	150					140	130	130	120
0,10	0,12			170	150	150	140					140	130	130	120
0,08	0,10			140	130	140	130					120	110	110	100
0,10	0,14			180	170	180	150					140	130	130	120
								450	450	450	450	450	450		
								300	300	300	300	300	300		
								250	250	250	250	250	250		
								200	200	200	200	200	200		
								300	300	300	300	300	300		
		0,08	0,10												
		0,07	0,09												
0,05	0,06					100	100							80	80
0,04	0,05					80	80							60	60
0,04	0,05					60	60							50	50
0,04	0,05					50	50							40	40
0,04	0,05					50	50							40	40
												50	40		
						50	50					40	40		
						70	60								
						70	60								
						70	60								
						60	50								
						60	50								
0,12	0,14					400	400					400	400	400	400
0,10	0,12					300	300					300	300	300	300
0,06	0,08					300	250	250	200			250	200	250	200

HC = beschichtetes Hartmetall

Die vorgegebenen Schnittwerte sind mittlere Richtwerte.  
Eine Anpassung in speziellen Einsatzfällen ist zu empfehlen.

# Cutting data for solid drilling with Drion-tec® interchangeable insert drills D4240 and D4140

Material group	Overview of the main material groups and code letters			Drilling depth			2,5 × D <sub>c</sub>								
				Designation			D4240								
				Dia. range [mm]			12–29,99								
				Binnell hardness HB	Tensile strength R <sub>m</sub> N/mm <sup>2</sup>	Machining group *	vc	VRR							
P	Unalloyed steel	C ≤ 0,25%	Annealed	125	430	P1	120	7	E	O					
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	120	7	E	O					
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	120	7	E	O					
		C > 0,55 %	Annealed	190	640	P4	110	6	E	O					
		C > 0,55 %	Heat-treated	300	1010	P5	90	7	E	O					
		Free-machining steel (short-chipping)	Annealed	220	750	P6	120	7	E	O					
	Low-alloy steel	Annealed		175	590	P7	120	7	E	O					
		Heat-treated		285	960	P8	71	7	E	O					
		Heat-treated		380	1280	P9	32	3	O	E					
		Heat-treated		430	1480	P10									
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	90	6	E	O					
		Hardened and tempered		300	1010	P12	90	7	E	O					
		Hardened and tempered		380	1280	P13	63	5	E	O					
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	100	7	E	O					
		Martensitic, heat-treated		330	1110	P15	80	7	E	O					
M	Stainless steel	Austenitic, quench hardened		200	680	M1									
		Austenitic, precipitation hardened (PH)		300	1010	M2									
		Austenitic/ferritic, duplex		230	780	M3									
K	Malleable cast iron	Ferritic		200	400	K1	120	8	E	O					
		Pearlitic		260	700	K2	120	8	E	O					
	Grey cast iron	Low strength		180	200	K3	140	9	E	O					
		High strength/austenitic		245	350	K4	140	9	E	O					
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	140	8	E	O					
Pearlitic			265	700	K6	120	8	E	O						
	CGI		230	400	K7	110	7	E	O						
N	Wrought aluminium alloys	Not hardenable		30	–	N1									
		Hardenable, hardened		100	340	N2									
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3									
		≤ 12% Si, hardenable, hardened		90	310	N4									
		> 12% Si, not hardenable		130	450	N5									
	Magnesium-based alloys			70	250	N6									
		Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7								
	Brass, bronze, red brass			90	310	N8									
	Copper alloys, short-chipping			110	380	N9									
	High tensile, Ampco			300	1010	N10									
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1				56	3	E	O	
			Hardened		280	940	S2								
		Ni- or Co-based	Annealed		250	840	S3					32	5	E	O
			Hardened		350	1180	S4					12	2	E	O
			Cast		320	1080	S5					20	5	E	O
	Titanium alloys	Pure titanium		200	680	S6					71	4	E	O	
		α and β alloys, hardened		375	1260	S7					63	4	E	O	
β alloys			410	1400	S8					63	3	E	O		
Tungsten alloys		300	1010	S9					20	5	E	O			
Molybdenum alloys		300	1010	S10					20	5	E	O			
H	Hardened steel	Hardened and tempered		50 HRC	–	H1									
		Hardened and tempered		55 HRC	–	H2									
		Hardened and tempered		60 HRC	–	H3									
	Hardened cast iron		55 HRC	–	H4										
O	Thermoplastics	Without abrasive fillers											01		
	Thermosetting plastics	Without abrasive fillers											02		
	Plastic, glass-fibre reinforced	GFRP											03		
	Plastic, carbon-fibre reinforced	CFRP											04		
	Plastic, aramid-fibre reinforced	AFRP											05		
	Graphite (technical)			80 Shore									06		

\* The assignment of the machining groups can be found in the "General" section of the Technical Compendium.  
The specified cutting data represents average standard values. For specific applications, adjustment is recommended.



# Cutting data for solid drilling with Drion-tec® interchangeable insert drills D4140

(continued)

Material group	= Wet machining (E = Emulsion, O = Oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart			Drilling depth		3 × D <sub>c</sub>											
				Designation		D4140											
				Dia. range [mm]		12–37,99											
Overview of the main material groups and code letters				Binnell hardness HB	Tensile strength R <sub>m</sub> N/mm <sup>2</sup>	Machining group *	vc	VRR			vc	VRR					
P	Unalloyed steel	C ≤ 0,25%	Annealed	125	430	P1	110	7	E O			110	7	E O			
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	110	7	E O			110	7	E O			
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	100	7	E O			100	7	E O			
		C > 0,55 %	Annealed	190	640	P4	100	6	E O			100	6	E O			
		C > 0,55 %	Heat-treated	300	1010	P5	80	7	E O			80	7	E O			
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	110	7	E O			110	7	E O			
		Annealed		175	590	P7	110	7	E O			110	7	E O			
		Heat-treated		285	960	P8	71	7	E O			71	7	E O			
		Heat-treated		380	1280	P9	32	3	O E			32	3	O E			
	High-alloy steel and high-alloy tool steel	Heat-treated		430	1480	P10											
Annealed			200	680	P11	80	6	E O			80	6	E O				
Hardened and tempered			300	1010	P12	80	7	E O			80	7	E O				
Stainless steel	Hardened and tempered		380	1280	P13	63	5	E O			63	5	E O				
	Ferritic/martensitic, annealed		200	680	P14	90	7	E O			90	7	E O				
M	Stainless steel	Martensitic, heat-treated		330	1110	P15	71	7	E O			71	7	E O			
		Austenitic, quench hardened		200	680	M1						63	4	E O			
		Austenitic, precipitation hardened (PH)		300	1010	M2											
K	Malleable cast iron	Austenitic/ferritic, duplex		230	780	M3						28	5	E O			
		Ferritic		200	400	K1	110	8	E O			110	8	E O			
	Grey cast iron	Pearlitic		260	700	K2	110	8	E O			110	8	E O			
		Low strength		180	200	K3	140	9	E O			140	9	E O			
	Cast iron with spheroidal graphite	High strength/austenitic		245	350	K4	120	9	E O			120	9	E O			
		Ferritic		155	400	K5	120	8	E O			120	8	E O			
CGI	Pearlitic		265	700	K6	110	8	E O			110	8	E O				
N	Wrought aluminium alloys	Pearlitic		230	400	K7	110	7	E O			110	7	E O			
		Not hardenable		30	–	N1											
	Cast aluminium alloys	Hardenable, hardened		100	340	N2											
		≤ 12% Si, not hardenable		75	260	N3											
		≤ 12% Si, hardenable, hardened		90	310	N4											
	Magnesium-based alloys	> 12% Si, not hardenable		130	450	N5											
				70	250	N6											
	Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7											
		Brass, bronze, red brass		90	310	N8											
		Copper alloys, short-chipping		110	380	N9											
High tensile, Ampco			300	1010	N10												
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1						50	3	E O			
		Hardened		280	940	S2											
		Annealed		250	840	S3							28	5	E O		
		Hardened		350	1180	S4							11	2	E O		
	Titanium alloys	Ni- or Co-based	Cast		320	1080	S5						18	5	E O		
		Pure titanium		200	680	S6							63	4	E O		
		α and β alloys, hardened		375	1260	S7							56	4	E O		
Tungsten alloys	β alloys		410	1400	S8						56	3	E O				
Molybdenum alloys			300	1010	S9						18	5	E O				
H	Hardened steel			300	1010	S10						18	5	E O			
		Hardened and tempered		50 HRC	–	H1											
		Hardened and tempered		55 HRC	–	H2											
	Hardened cast iron	Hardened and tempered		60 HRC	–	H3											
Hardened and tempered			55 HRC	–	H4												
O	Thermoplastics	Without abrasive fillers															
	Thermosetting plastics	Without abrasive fillers															
	Plastic, glass-fibre reinforced	GFRP															
	Plastic, carbon-fibre reinforced	CFRP															
	Plastic, aramid-fibre reinforced	AFRP															
	Graphite (technical)			80 Shore													

\* The assignment of the machining groups can be found in the "General" section of the Technical Compendium.  
 The specified cutting data represents average standard values. For specific applications, adjustment is recommended.



# Cutting data for solid drilling with Drion-tec® interchangeable insert drills D4140

(continued)

Material group	Overview of the main material groups and code letters			Drilling depth			7 × D <sub>c</sub>								
				Designation			D4140								
				Dia. range [mm]			12–37,99								
				Binnell hardness HB	Tensile strength R <sub>m</sub> N/mm <sup>2</sup>	Machining group *	vc		VRR		Wet machining (E = Emulsion, O = Oil)		Dry machining is possible (M = MQL, L = dry)		
							WPP45C		WMP35		vc		VRR		M
P	Unalloyed steel	C ≤ 0,25%	Annealed	125	430	P1	100	7	E	O	100	7	E	O	
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	100	7	E	O	100	7	E	O	
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	100	7	E	O	100	7	E	O	
		C > 0,55 %	Annealed	190	640	P4	90	6	E	O	90	6	E	O	
		C > 0,55 %	Heat-treated	300	1010	P5	71	7	E	O	71	7	E	O	
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	100	7	E	O	100	7	E	O	
		Annealed		175	590	P7	100	7	E	O	100	7	E	O	
		Heat-treated		285	960	P8	63	7	E	O	63	7	E	O	
		Heat-treated		380	1280	P9	32	3	O	E	32	3	O	E	
		Heat-treated		430	1480	P10									
High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	80	6	E	O	80	6	E	O		
	Hardened and tempered		300	1010	P12	71	7	E	O	71	7	E	O		
	Hardened and tempered		380	1280	P13	63	5	E	O	63	5	E	O		
Stainless steel	Ferritic/martensitic, annealed		200	680	P14	90	7	E	O	90	7	E	O		
	Martensitic, heat-treated		330	1110	P15	71	7	E	O	71	7	E	O		
M	Stainless steel	Austenitic, quench hardened		200	680	M1					63	4	E	O	
		Austenitic, precipitation hardened (PH)		300	1010	M2									
		Austenitic/ferritic, duplex		230	780	M3					28	5	E	O	
K	Malleable cast iron	Ferritic		200	400	K1	110	8	E	O	110	8	E	O	
		Pearlitic		260	700	K2	110	8	E	O	110	8	E	O	
	Grey cast iron	Low strength		180	200	K3	120	9	E	O	120	9	E	O	
		High strength/austenitic		245	350	K4	120	9	E	O	120	9	E	O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	120	8	E	O	120	8	E	O	
Pearlitic			265	700	K6	110	8	E	O	110	8	E	O		
CGI			230	400	K7	110	7	E	O	110	7	E	O		
N	Wrought aluminium alloys	Not hardenable		30	–	N1									
		Hardenable, hardened		100	340	N2									
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3									
		≤ 12% Si, hardenable, hardened		90	310	N4									
		> 12% Si, not hardenable		130	450	N5									
	Magnesium-based alloys			70	250	N6									
		Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper		100	340	N7								
	Brass, bronze, red brass			90	310	N8									
	Copper alloys, short-chipping			110	380	N9									
	High tensile, Ampco			300	1010	N10									
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1				50	3	E	O	
			Hardened		280	940	S2								
		Ni- or Co-based	Annealed		250	840	S3					25	5	E	O
			Hardened		350	1180	S4					10	2	E	O
			Cast		320	1080	S5					18	5	E	O
	Titanium alloys	Pure titanium		200	680	S6					63	4	E	O	
		α and β alloys, hardened		375	1260	S7					50	4	E	O	
β alloys			410	1400	S8					50	3	E	O		
Tungsten alloys			300	1010	S9					18	5	E	O		
Molybdenum alloys			300	1010	S10					18	5	E	O		
H	Hardened steel	Hardened and tempered		50 HRC	–	H1									
		Hardened and tempered		55 HRC	–	H2									
		Hardened and tempered		60 HRC	–	H3									
	Hardened cast iron			55 HRC	–	H4									
O	Thermoplastics	Without abrasive fillers											01		
	Thermosetting plastics	Without abrasive fillers											02		
	Plastic, glass-fibre reinforced	GFRP											03		
	Plastic, carbon-fibre reinforced	CFRP											04		
	Plastic, aramid-fibre reinforced	AFRP											05		
	Graphite (technical)			80 Shore									06		

\* The assignment of the machining groups can be found in the "General" section of the Technical Compendium.  
The specified cutting data represents average standard values. For specific applications, adjustment is recommended.



# Cutting data for solid drilling with Drion-tec® D-Spade double-sided replaceable insert drill D5142

Material group	= Wet machining (E = Emulsion, O = Oil) = Dry machining is possible (M = MQL, L = dry) The cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart		Drilling depth		3 × D <sub>c</sub>				
			Designation		D5142				
			Dia. range [mm]		12–25,99				
Overview of the main material groups and code letters			Binnell hardness HB	Tensile strength R <sub>m</sub> N/mm <sup>2</sup>	Machining group *	vc	VRR		
P	Unalloyed steel	C ≤ 0,25%	125	430	P1	80	6	E O	
		C > 0,25 ... ≤ 0,55 %	190	640	P2	110	7	E O	
		C > 0,25 ... ≤ 0,55 %	210	710	P3	100	7	E O	
		C > 0,55 %	190	640	P4	100	6	E O	
		C > 0,55 %	300	1010	P5	80	7	E O	
	Free-machining steel (short-chipping)	Annealed	220	750	P6	110	7	E O	
	Low-alloy steel	Annealed	175	590	P7	110	7	E O	
		Heat-treated	285	960	P8	71	7	E O	
		Heat-treated	380	1280	P9				
		Heat-treated	430	1480	P10				
High-alloy steel and high-alloy tool steel	Annealed	200	680	P11	80	6	E O		
	Hardened and tempered	300	1010	P12	80	7	E O		
	Hardened and tempered	380	1280	P13					
Stainless steel	Ferritic/martensitic, annealed	200	680	P14					
	Martensitic, heat-treated	330	1110	P15					
M	Stainless steel	Austenitic, quench hardened	200	680	M1				
		Austenitic, precipitation hardened (PH)	300	1010	M2				
		Austenitic/ferritic, duplex	230	780	M3				
K	Malleable cast iron	Ferritic	200	400	K1	110	8	E O	
		Pearlitic	260	700	K2	100	8	E O	
	Grey cast iron	Low strength	180	200	K3	160	9	E O	
		High strength/austenitic	245	350	K4	140	9	E O	
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	120	8	E O	
Pearlitic		265	700	K6	100	8	E O		
CGI		230	400	K7	100	7	E O		
N	Wrought aluminium alloys	Not hardenable	30	–	N1				
		Hardenable, hardened	100	340	N2				
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3				
		≤ 12% Si, hardenable, hardened	90	310	N4				
		> 12% Si, not hardenable	130	450	N5				
	Magnesium-based alloys		70	250	N6				
		Copper and copper alloys (bronze/brass)	Unalloyed, electrolytic copper	100	340	N7			
Brass, bronze, red brass	90		310	N8					
Copper alloys, short-chipping	110		380	N9					
	High tensile, Ampco	300	1010	N10					
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1			
			Hardened	280	940	S2			
		Ni- or Co-based	Annealed	250	840	S3			
			Hardened	350	1180	S4			
			Cast	320	1080	S5			
	Titanium alloys	Pure titanium	200	680	S6				
		α and β alloys, hardened	375	1260	S7				
Tungsten alloys		410	1400	S8					
Molybdenum alloys		300	1010	S9					
		300	1010	S10					
H	Hardened steel	Hardened and tempered	50 HRC	–	H1				
		Hardened and tempered	55 HRC	–	H2				
		Hardened and tempered	60 HRC	–	H3				
	Hardened cast iron	Hardened and tempered	55 HRC	–	H4				
O	Thermoplastics	Without abrasive fillers			O1				
	Thermosetting plastics	Without abrasive fillers			O2				
	Plastic, glass-fibre reinforced	GFRP			O3				
	Plastic, carbon-fibre reinforced	CFRP			O4				
	Plastic, aramid-fibre reinforced	AFRP			O5				
	Graphite (technical)		80 Shore			O6			

\* The assignment of the machining groups can be found in the "General" section of the Technical Compendium.  
 The specified cutting data represents average standard values. For specific applications, adjustment is recommended.



## VRR: Feed rate charts for Drion-tec® exchangeable-tip drills D4140, D4240, D5142

VRR	Feed f [mm] for diameter [mm]						
	8	10	12	15	20	25	40
1	0,021	0,024	0,026	0,029	0,033	0,037	0,047
2	0,042	0,047	0,052	0,058	0,067	0,075	0,094
3	0,063	0,071	0,077	0,087	0,10	0,11	0,14
4	0,084	0,094	0,10	0,12	0,13	0,15	0,19
5	0,11	0,12	0,13	0,14	0,17	0,19	0,24
6	0,13	0,14	0,15	0,17	0,20	0,22	0,28
7	0,15	0,16	0,18	0,20	0,23	0,26	0,33
8	0,17	0,19	0,21	0,23	0,27	0,30	0,38
9	0,19	0,21	0,23	0,26	0,30	0,34	0,42
10	0,21	0,24	0,26	0,29	0,33	0,37	0,47
12	0,25	0,28	0,31	0,35	0,40	0,45	0,57
16	0,34	0,38	0,41	0,46	0,53	0,60	0,75
20	0,42	0,47	0,52	0,58	0,67	0,75	0,94
25	0,53	0,59	0,65	0,72	0,83	0,93	1,18
30	0,63	0,71	0,77	0,87	1,00	1,12	1,41

### Cutting tool material application charts – Drilling

Grades for drilling from solid																				
Walter grade designation	Standard designation	Material groups							Application range							Coating process	Coating composition	Example of indexable insert		
		P	M	K	N	S	H	O	01	05	10	15	20	25	30				35	40
		Steel	Stainless steel	Cast iron	NF metals	Materials with difficult cutting properties	Hard materials	Other												
WKP25S	HC – P 25	●●																		
	HC – K 25	●●		●●																
WKP35S	HC – P 35	●●																		
	HC – K 35	●●		●●																
WN15	HW – N 15				●●															
	HW – S 15					●														
WNN15	HC – N 15				●●															
WSP45G	HC – P 45	●●																		
	HC – M45		●●																	
	HC – S 45					●●														
	HC – N 30				●															
WXP40	HC – P 40	●●																		
	HC – M30		●●																	
	HC – K 40			●●																
	HC – S 30					●														
WXP30	HC – P 30	●●																		
	HC – M30		●																	
	HC – K 30			●●																
	HC – N 30				●															
	HC – S 30					●														
WPP45C	HC – P 45	●●																		
	HC – K 45			●																
WKK45C	HC – P 45	●																		
	HC – K 45			●●																
WMP35	HC – P 35	●●																		
	HC – M35		●●																	
	HC – S 35					●●														
WNN25	HC – N 25				●●															
	HC – O 25							●												
WPP25	HC – P 25	●●																		
	HC – N 25				●															

HC = Coated carbide  
 HW = Uncoated carbide

●● Primary application  
 ● Additional application

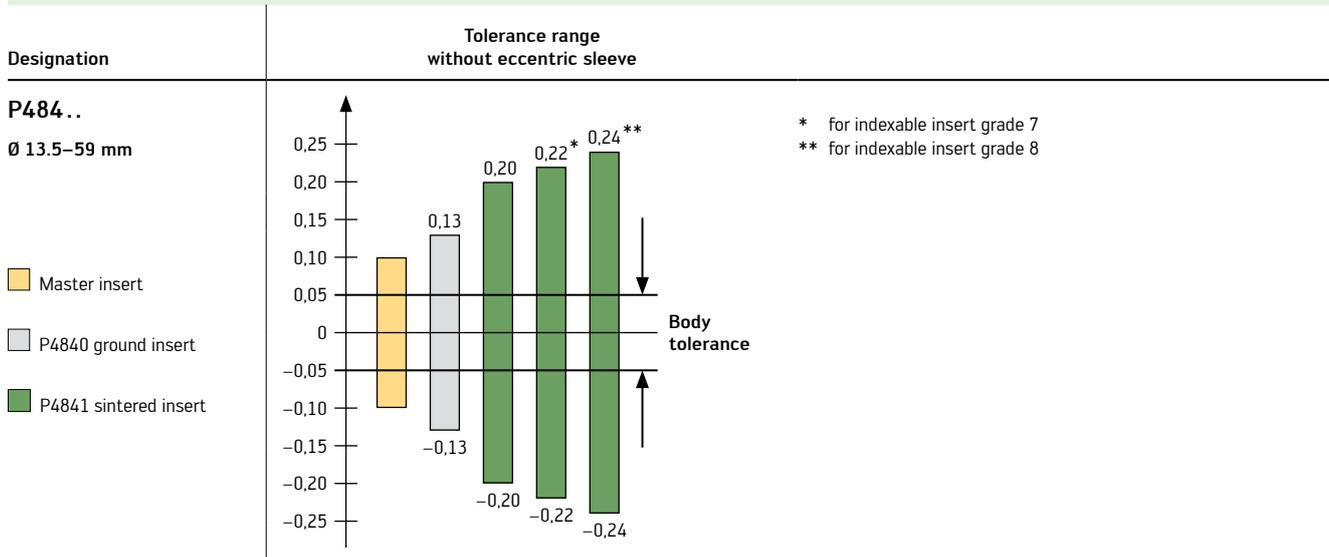
## Geometry overview – Indexable inserts

Solid drilling		Material group							Cut Main cutting edge
		P	M	K	N	S	H	O	
Geometry	Remarks on field of applications	Steel	Stainless steel	Cast iron	NF metals	Materials with difficult cutting properties	Hard materials	Other	
	<b>A57 – The stable one</b> – 0° rake angle – For unfavourable machining conditions, mainly for cast iron and steel materials	●●	●	●●		●			
	<b>E57 – The universal one</b> – 13° rake angle – For medium machining – For cast iron and steel, but also for stainless materials and materials with difficult cutting properties	●●	●●	●●	●	●			
	<b>E67 – The easy-cutting one</b> – 13° rake angle – Special geometry for optimum chip formation – For long-chipping materials, e.g. St37 and stainless materials as well as materials with difficult cutting properties and aluminium	●●	●●		●	●●			
	<b>LCMX-B57 – The stable one</b> – 6° rake angle – For unfavourable machining conditions – For long-chipping materials	●●		●●					
	<b>LCMX-D57 – The universal one</b> – 12° rake angle – For medium machining	●●	●●	●●	●	●			
	<b>LCMX-E57 – The easy-cutting one</b> – 15° rake angle – For good machining conditions – For short-chipping materials	●●	●●		●●	●●			

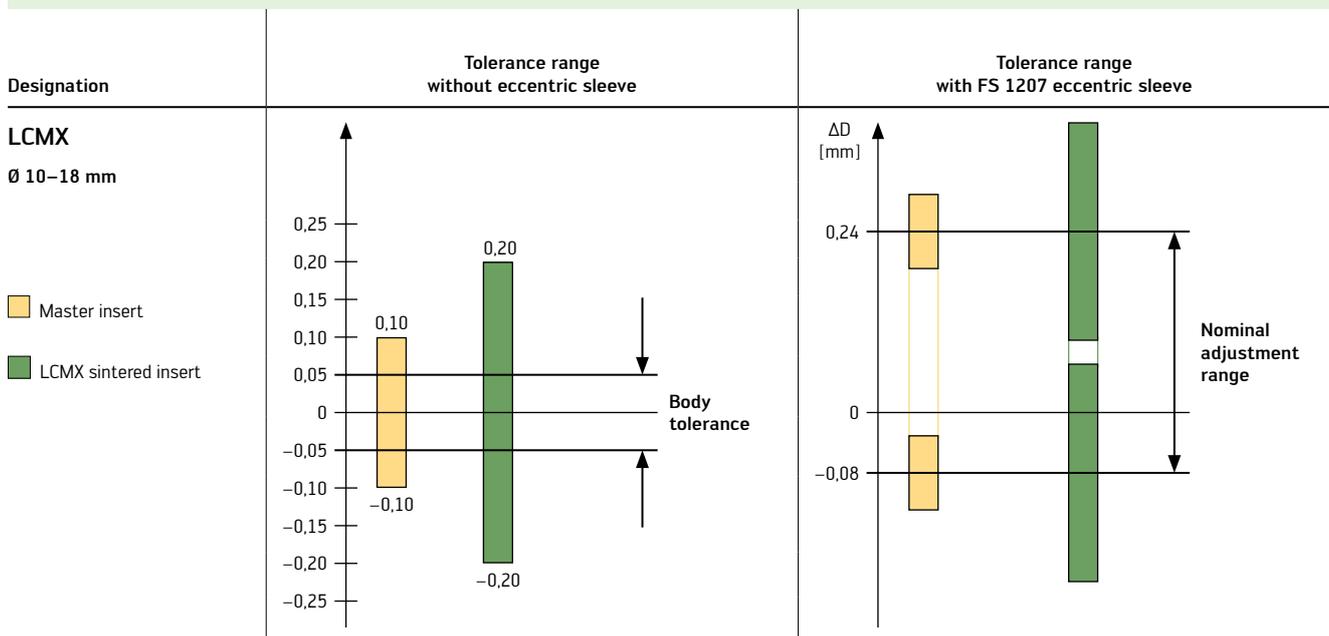
●● Primary application  
 ● Additional application

## Tool diameter tolerance ranges

### 1. For the D4120 indexable insert drill



### 2. For B321..DF.. indexable insert drills



The resulting workpiece diameter may differ due to the drilling depth, workpiece material, feed and chip removal conditions, etc.

## Tool diameter tolerance ranges

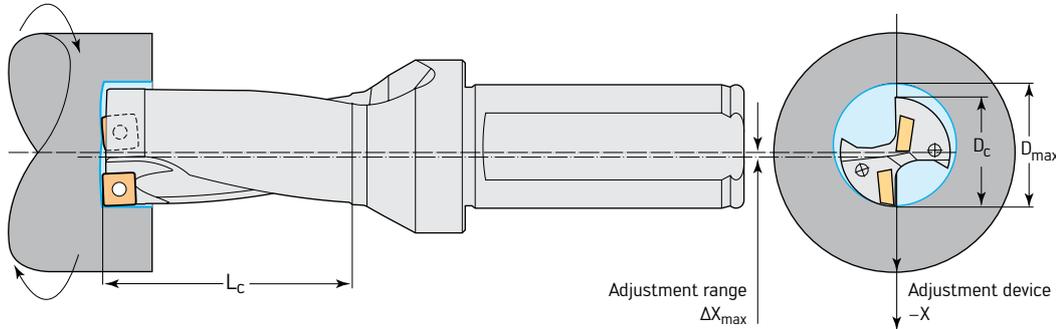
(continued)

### 3. For the D3120 indexable insert drill

Designation	Tolerance range without eccentric sleeve	Tolerance range with FS 1208 eccentric sleeve
<b>P284..</b> Ø 16–25 mm  Master insert P2840 ground insert P2841 sintered insert		
<b>P284..</b> Ø 25–58 mm  Master insert P2840 ground insert P2841 sintered insert		

The resulting workpiece diameter may differ due to the drilling depth, workpiece material, feed and chip removal conditions, etc.

**Application information:**  
**Drilling with X offset for D4120 using a stationary drill with rotating workpiece**

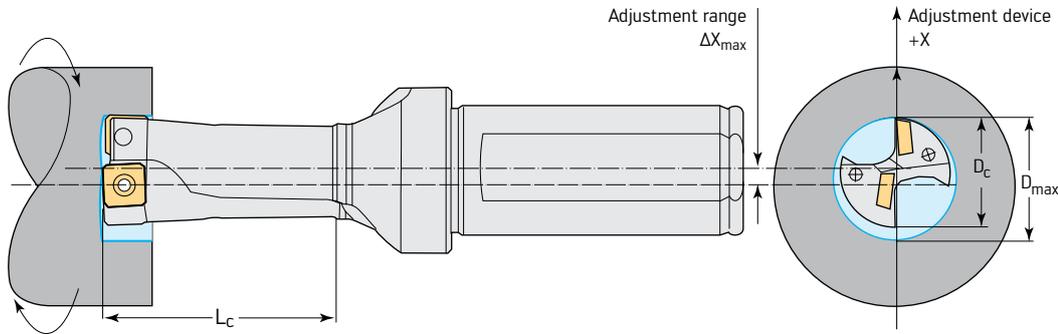


Indexable insert size	$(L_c/D_c) \geq 4$			$(L_c/D_c) < 4$	
	$D_c$ [mm]	$\Delta X$ [mm]	$D_{max}$ [mm]	$\Delta X_{max}$ [mm]	$D_{max}$ [mm]
<b>1</b>	13,5	0,5	14,5	0,7	14,9
	14	0,35	14,7	0,6	15,2
	14,5	0,3	15,1	0,5	15,5
	15	0,2	15,4	0,45	15,9
	15,5	0,15	15,8	0,35	16,2
	16	0,05	16,1	0,3	16,6
	16,4	0	-	0,2	16,8
	16,5	0,6	17,7	0,9	18,3
<b>2</b>	17	0,5	18	0,75	18,5
	17,5	0,35	18,2	0,6	18,7
	18	0,3	18,6	0,55	19,1
	18,5	0,2	18,9	0,45	19,4
	19	0,15	19,3	0,4	19,8
	19,5	0,07	19,64	0,3	20,1
	20	0	20	0,25	20,5
	20,4*	0	-	0,15	20,7
<b>3</b>	20,5	0,35	21,2	0,7	21,9
	21	0,3	21,6	0,6	22,2
	21,5	0,17	21,84	0,45	22,4
	22	0,15	22,3	0,45	22,9
	22,5	0,02	22,54	0,3	23,1
	23	0	-	0,3	23,6
	23,5*	0	-	0,18	23,86
	24*	0	-	0,15	24,3
<b>4</b>	24,4*	0	-	0	-
	24,5	0,5	25,5	0,85	26,2
	25	0,35	25,7	0,75	26,5
	25,5	0,25	26	0,6	26,7
	26	0,15	26,3	0,55	27,1
	26,5	0,05	26,6	0,4	27,3
	27	0	-	0,4	27,8
	27,5	0	-	0,25	28
	28*	0	-	0,25	28,5
	28,5*	0	-	0,12	28,74
29*	0	-	0,1	29,2	
29,4*	0	-	0	-	

Indexable insert size	$(L_c/D_c) \geq 4$			$(L_c/D_c) < 4$	
	$D_c$ [mm]	$\Delta X$ [mm]	$D_{max}$ [mm]	$\Delta X_{max}$ [mm]	$D_{max}$ [mm]
<b>5</b>	29,5	0,7	30,9	1,1	31,7
	30	0,6	31,2	1	32
	31	0,45	31,9	0,8	32,6
	32	0,3	32,6	0,7	33,4
	33	0,15	33,3	0,5	34
	34	0	-	0,4	34,8
	35*	0	-	0,3	35,6
	35,4*	0	-	0,2	35,8
	35,5	0,8	37,1	1,4	38,3
	36	0,7	37,4	1,25	38,5
<b>6</b>	37	0,55	38,1	1,1	39,2
	38	0,4	38,8	0,95	39,9
	39	0,25	39,5	0,8	40,6
	40	0,1	40,2	0,65	41,3
	41	0	-	0,55	42,1
	42	0	-	0,4	42,8
	42,4	0	-	0,3	43
	42,5	0,95	44,4	1,65	45,8
	43	0,85	44,7	1,5	46
	44	0,7	45,4	1,35	46,7
<b>7</b>	45	0,55	46,1	1,2	47,4
	46	0,4	46,8	1,1	48,2
	47	0,25	47,5	0,95	48,9
	48	0,15	48,3	0,8	49,6
	49	0	-	0,65	50,3
	50	0	-	0,55	51,1
	50,4	0	-	0,45	51,3
	50,5	1,05	52,6	1,85	54,2
	51	0,95	52,9	1,75	54,5
	52	0,8	53,6	1,6	55,2
<b>8</b>	53	0,65	54,3	1,45	55,9
	54	0,55	55,1	1,35	56,7
	55	0,4	55,8	1,2	57,4
	56	0,3	56,6	1,1	58,2
	57	0,15	57,3	0,95	58,9
	58	0	-	0,8	59,6
	59	0	-	0,7	60,4
	59,4	0	-	0,6	60,6

\* Outer insert with wiper edge (P4840P. ) can only be used twice.

**Application information:**  
**Drilling with X offset for D3120 using a stationary drill with rotating workpiece**



Indexable insert size	$(L_c/D_c) \geq 4$			$(L_c/D_c) < 4$	
	$D_c$ [mm]	$\Delta X$ [mm]	$D_{max}$ [mm]	$\Delta X_{max}$ [mm]	$D_{max}$ [mm]
<b>1</b>	16	1.0	18,0	1.8	19,6
	17	0.8	18,6	1.5	20,0
	17,5	0.7	18,9	1.3	20,1
	18	0.7	19,4	1.3	20,6
	19	0.5	20,0	1.0	21,0
	19,5	0.3	20,1	0.8	21,1
	20	0.3	20,6	0.8	21,6
<b>2</b>	21	1.1	23,2	2,0	25,0
	22	0.9	23,8	1,7	25,4
	23	0.8	24,6	1,5	26,0
	24	0.6	25,2	1,2	26,4
	25	0.4	25,8	1,0	27,0
<b>3</b>	26	1.0	28,0	1,7	29,4
	26,5	0.8	28,1	1,4	29,3
	27	0.8	28,6	1,4	29,8
	28	0.6	29,2	1,2	30,4
	29	0.4	29,8	0,9	30,8
	29,5	0.3	30,1	0,7	30,9
<b>4</b>	30	0.3	30,6	0,7	31,4
	31	1.1	33,2	1,9	34,8
	32	0.9	33,8	1,6	35,2
	33	0.7	34,4	1,4	35,8
	34	0.5	35,0	1,1	36,2
	35	0.3	35,6	0,8	36,6
	36	0.2	36,4	0,6	37,2
<b>5</b>	37	0.9	38,8	1,8	40,6
	37,5	0.7	38,9	1,5	40,5
	38	0.7	39,4	1,5	41,0
	39	0.5	40,0	1,2	41,4
	40	0.5	41,0	1,2	42,4
	40,5	0.4	41,3	0,9	42,3
	41	0.4	41,8	0,9	42,8
42	0.2	42,4	0,6	43,2	

Indexable insert size	$(L_c/D_c) \geq 4$			$(L_c/D_c) < 4$	
	$D_c$ [mm]	$\Delta X$ [mm]	$D_{max}$ [mm]	$\Delta X_{max}$ [mm]	$D_{max}$ [mm]
<b>6</b>	43	0.7	44,4	1,5	46,0
	44	0.5	45,0	1,2	46,4
	45	0.5	46,0	1,2	47,4
	46	0.4	46,8	0,9	47,8
	47	0.2	47,4	0,6	48,2
	48	0.0	48,0	0,0	48,0
	49	0.0	49,0	0,0	49,0
	50	0.0	50,0	0,0	50,0
	50,5	0.9	52,3	1,8	54,1
	51	0.9	52,8	1,8	54,6
	52	0.7	53,4	1,5	55,0
<b>7</b>	53	0.5	54,0	1,2	55,4
	54	0.5	55,0	1,2	56,4
	54,5	0.4	55,3	0,9	56,3
	55	0.4	55,8	0,9	56,8
	56	0.2	56,4	0,6	57,2
	57	0.0	57,0	0,0	57,0
	58	0.0	58,0	0,0	58,0

## Eccentric sleeves for the D3120 indexable insert drill

### Eccentric sleeve

		Eccentric sleeve designation	D <sub>c</sub> D3120 [mm]	D <sub>2</sub> [mm]	D <sub>3</sub> [mm]	X <sub>1</sub> [mm]
	Adjustment range: -0.1 mm to +0.3 mm compared to nominal diameter	FS 1208	16-25	25	32	4
	Adjustment range: -0.2 mm to +0.55 mm compared to nominal diameter	FS 722	16-25	25	32	4
FS 723		26-36	32	40	4	
FS 724		37-42	40	50	4	
	DIN 911 hex key	For D <sub>3</sub> = 32-40 mm = WAF 10			For D <sub>3</sub> = 50 mm = WAF 12	

### Adaptor

Designation	D <sub>1</sub> [mm]	D <sub>3</sub> [mm]	D <sub>4</sub> [mm]	X <sub>1</sub> [mm]	kg
A 170 M.0.63.079.32.EX	63	32	72	79	2,0
A 170 M.0.80.079.32.EX	80	32	72	79	2,2
A 170 M.0.80.087.40.EX	80	40	78	87	2,7
A 170 M.0.80.096.50.EX	80	50	85	96	3,0

### Assembly parts

		D <sub>3</sub> = 32-40 mm	D <sub>3</sub> = 50 mm
	Screw DIN 1835-B	M 20 × 2 × 20 (SW 10)	M 24 × 2 × 25 (SW 12)

## Drilling strategies for the D4140 exchangeable insert drill

P6001–P6005 7–10 × D<sub>c</sub>

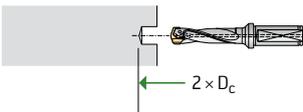
P	M	K	N	S	H	O
✓	✓	✓	✓	✓		✓

Pilot drilling



10–50 bar  
145–725 psi  
On

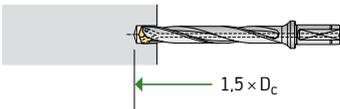
D4140-03  
D4140.03



Running in



Off

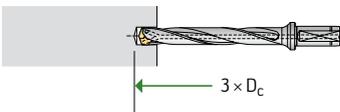


$n_{max} = 100 \text{ rpm}$   
 $v_f = 100\%$

Spot drilling



10–50 bar  
145–725 psi  
On

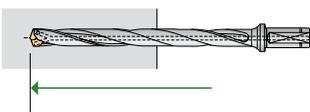


$v_c = 75\%$   
 $v_f = 50\%$

Deep-hole drilling



10–50 bar  
145–725 psi  
On

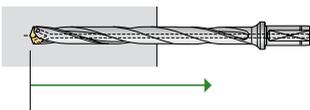


$v_c = 100\%$   
 $v_f = 100\%$

Retracting



Off



$n_{max} = 100 \text{ rpm}$   
 $v_f = 1000 \text{ mm/min}$

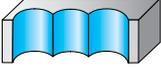
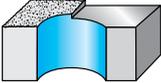
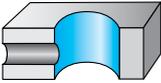
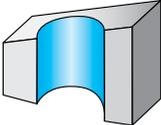
Recommended cutting data can be found in Walter GPS.

P6006 7–10 × D<sub>c</sub>

P	M	K	N	S	H	O
✓		✓				

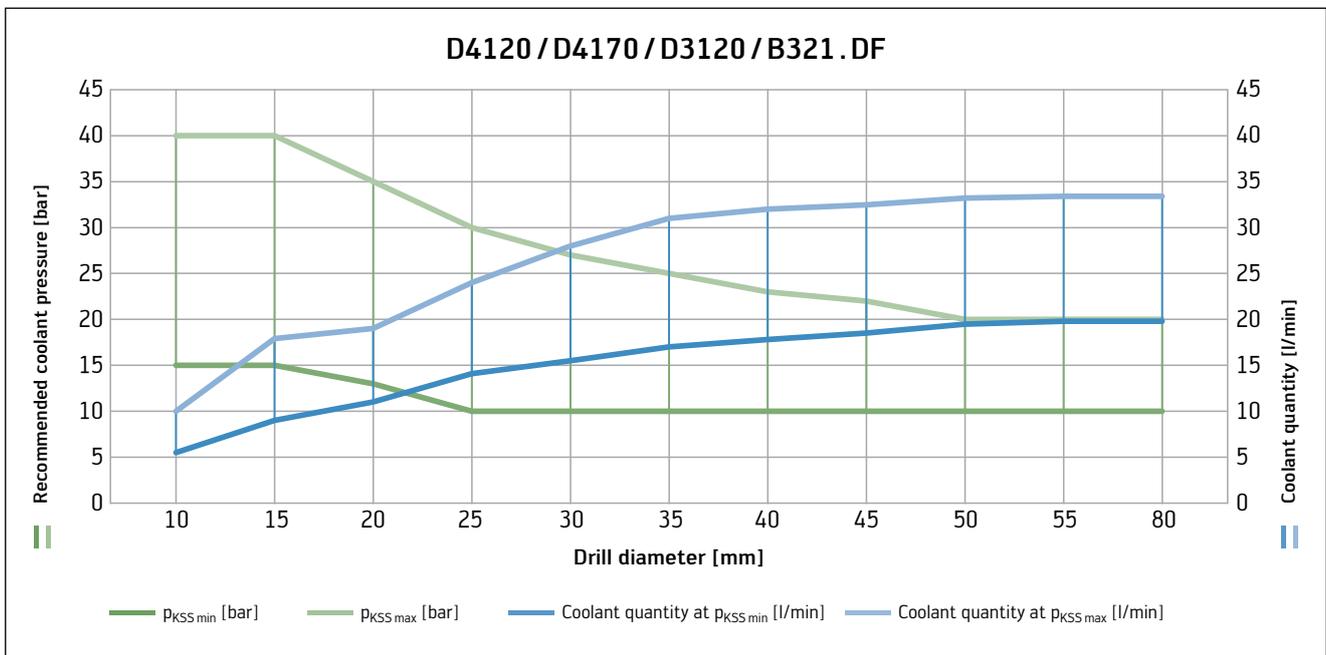
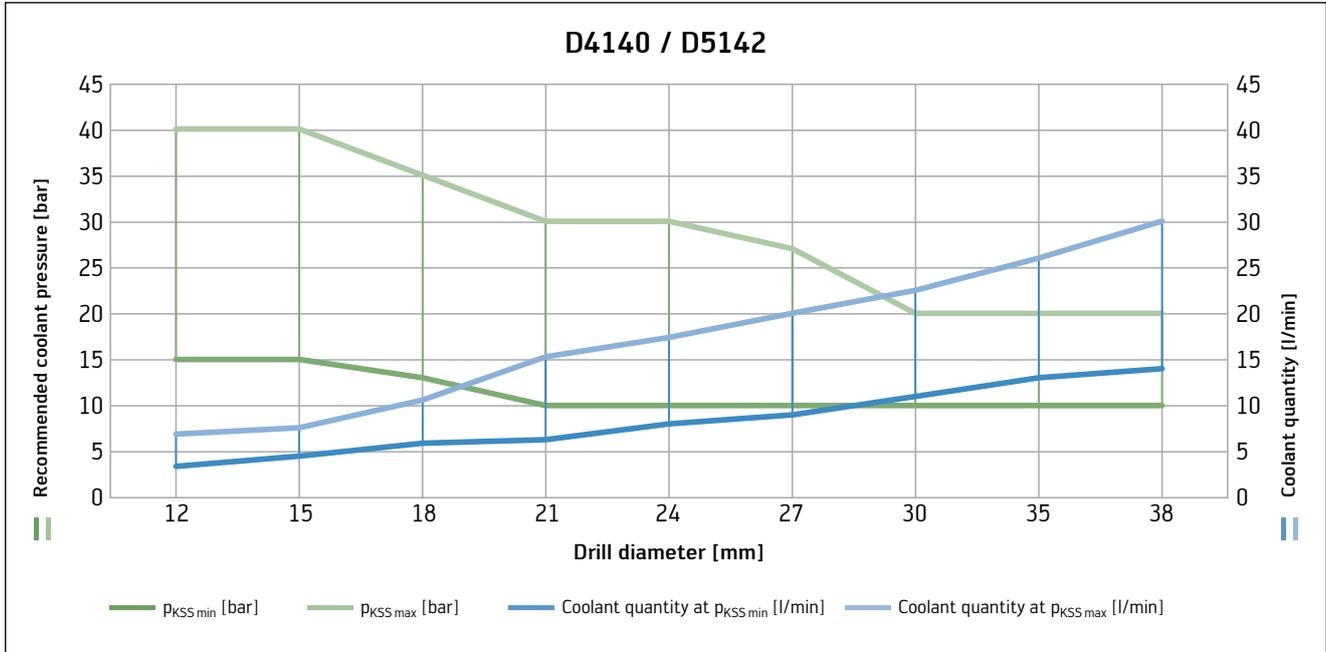
No pilot drilling strategy necessary

## Possible uses for D4170, D4120 and D3120 indexable insert drills

Machining	Possible use	
	<b>Chain drilling</b>	If problems occur – reduce the feed by 30%
	<b>Raw and non-level surfaces</b>	If the drill entry angle is $> 30^\circ$ – reduce the feed by 50%
	<b>Interrupted cuts</b>	Problems with interrupted cuts – feed $< 30\%$
	<b>Angled entry drilling</b>	Reduce the feed by 30% on entry
	<b>Cross holes</b>	For best results, reduce the feed by 30%

## Guide value diagrams for coolant pressure / flow rate specifications

### Indexable insert drilling



**Note:**

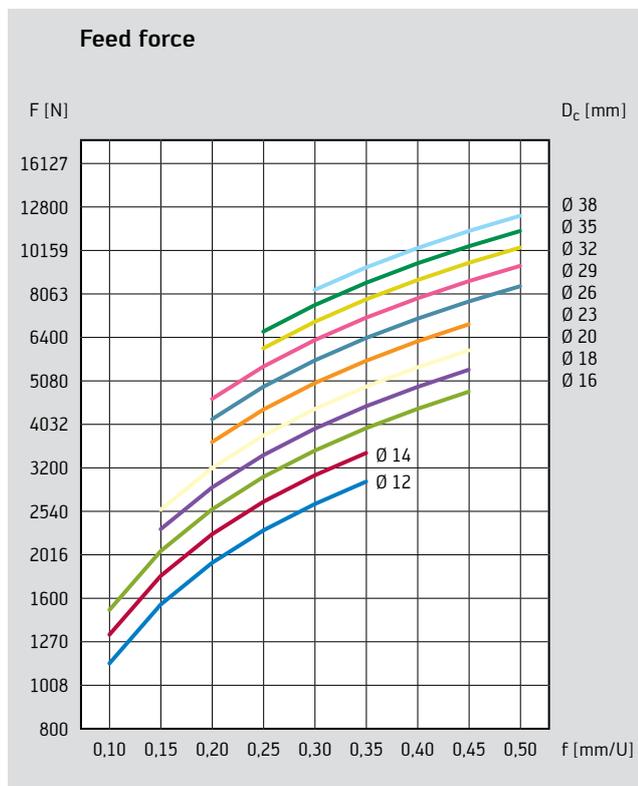
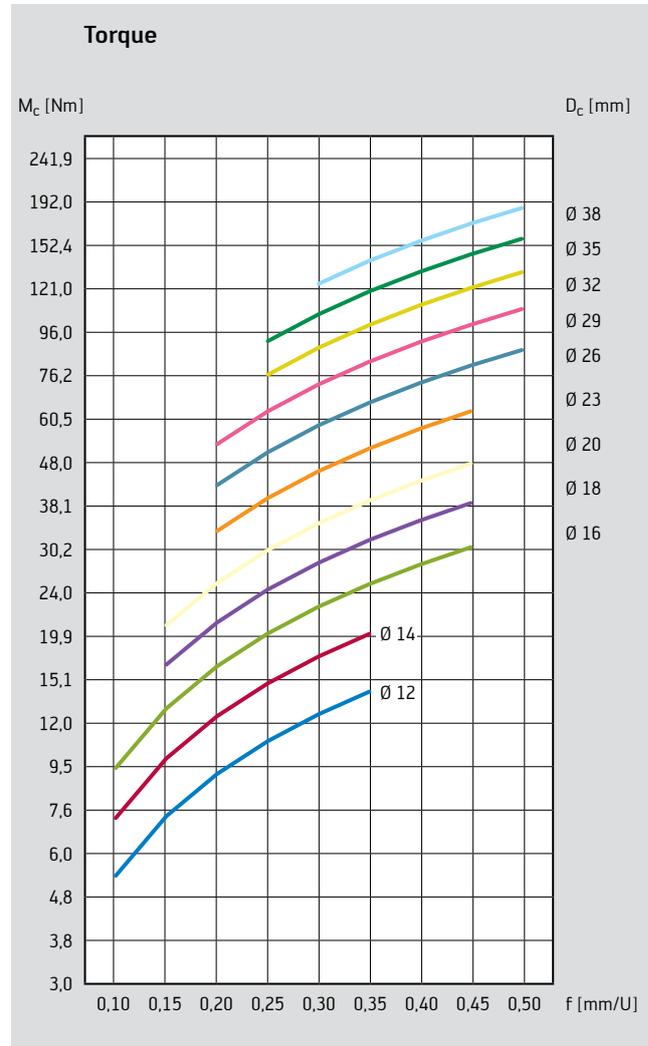
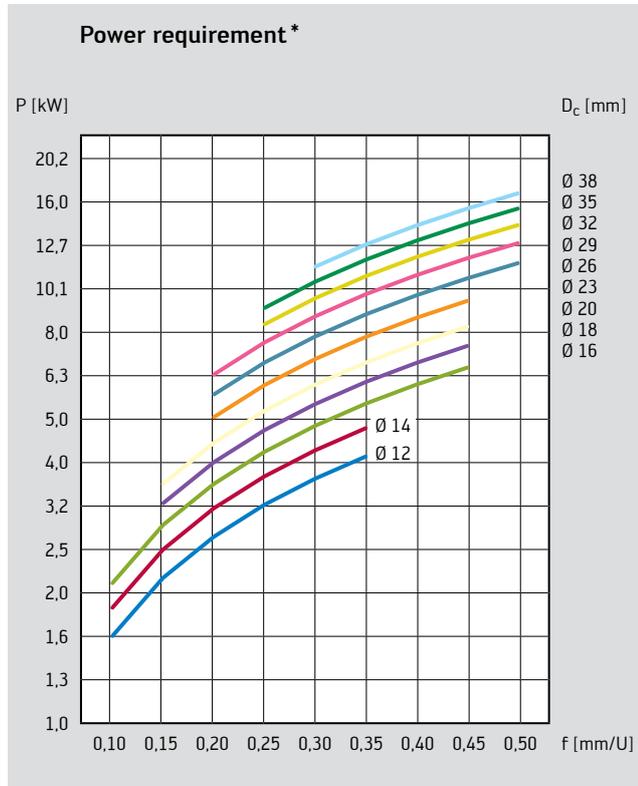
The Standard values shown were determined under laboratory conditions. Deviations may occur during application due to the type of machine used, the coolant, the coolant preparation or the coolant pump.

**Abbreviations**

KSS Lubricant  
 $p_{KSS}$  Coolant pressure  
 $p_{KSS\ max}$  Maximum Coolant pressure  
 $p_{KSS\ min}$  Minimum Coolant pressure

## Standard values for Drilling from solid-tip drill with Drion-tec® exchangeable-tip drill D4140, D4240 and D5142

Material: C45 – (1.0503) Steel, cast steel [ $R_m = 650 \text{ N/mm}^2$ ]



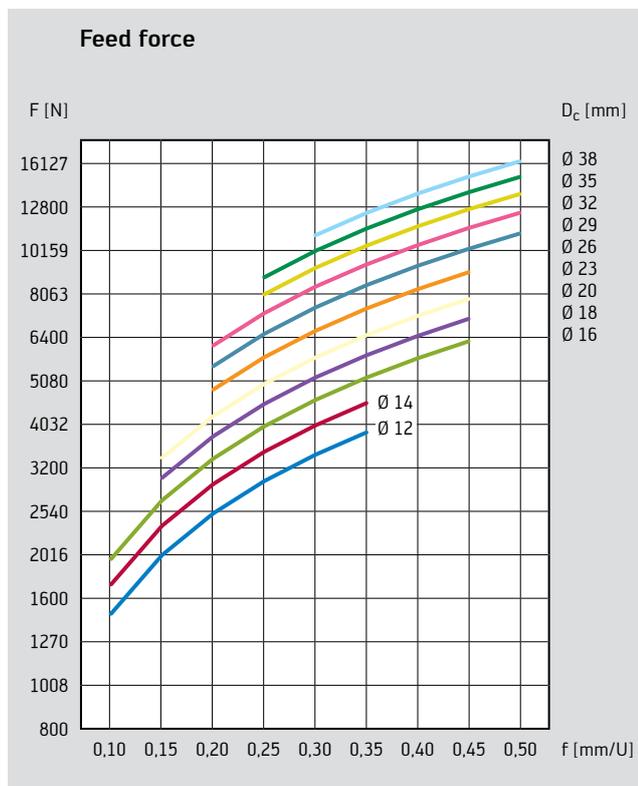
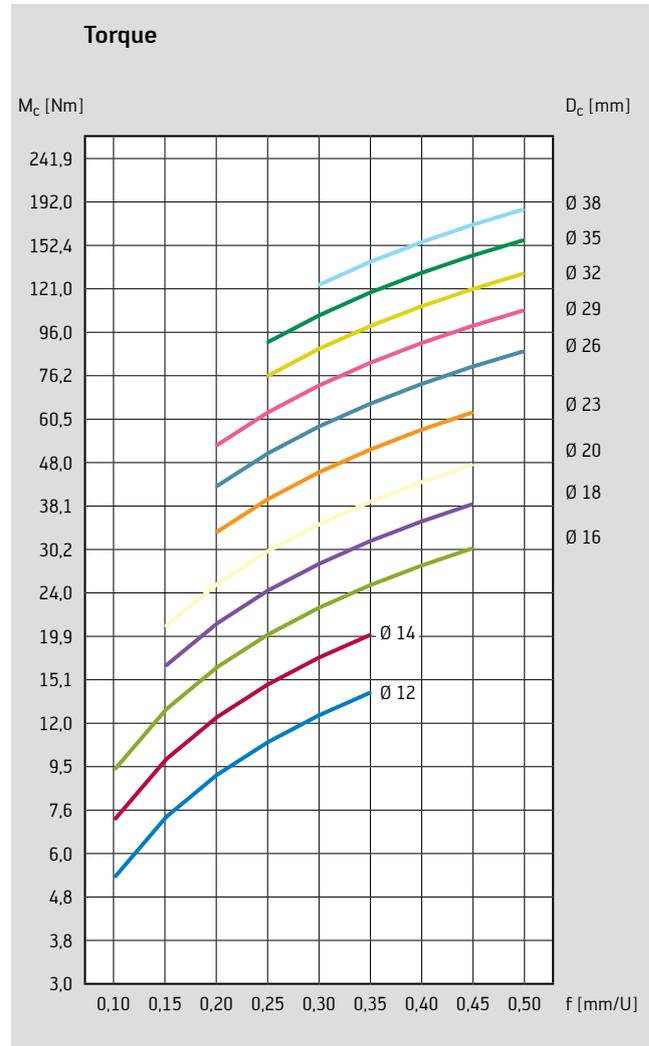
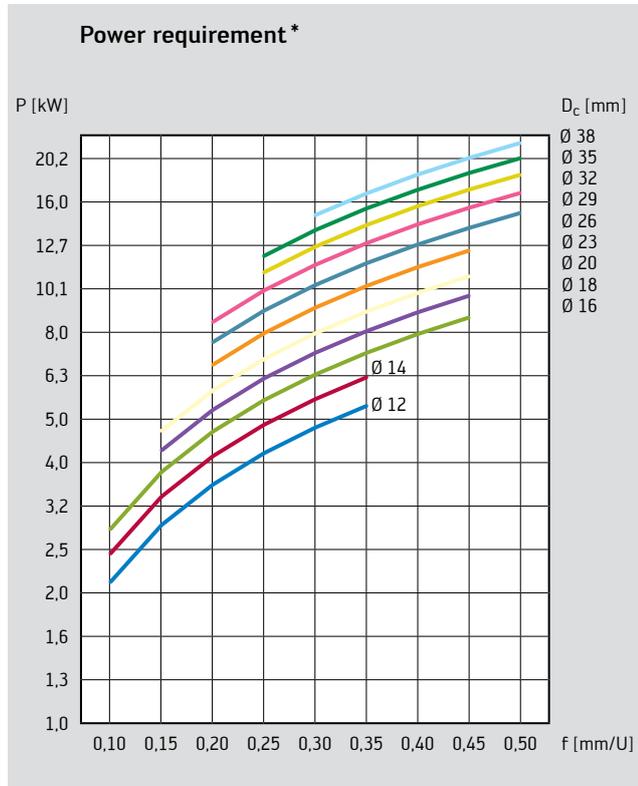
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement is also doubled, i.e. the power requirement is directly proportional to the cutting speed.

For steels with higher tensile strength, the required output and torque are correspondingly higher.

## Standard values for Drilling from solid-tip drill with Drion-tec® exchangeable-tip drill D4140, D4240 and D5142 (continued)

Material: 42CrMo<sub>4</sub> – Cr-Mo-alloyed quenched and tempered steel [ $R_m = 750-900 \text{ N/mm}^2$ ]



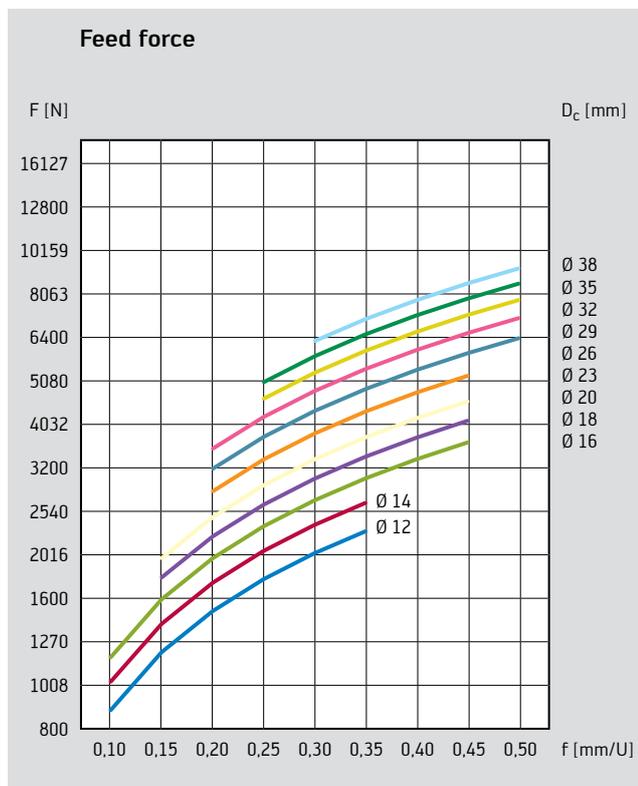
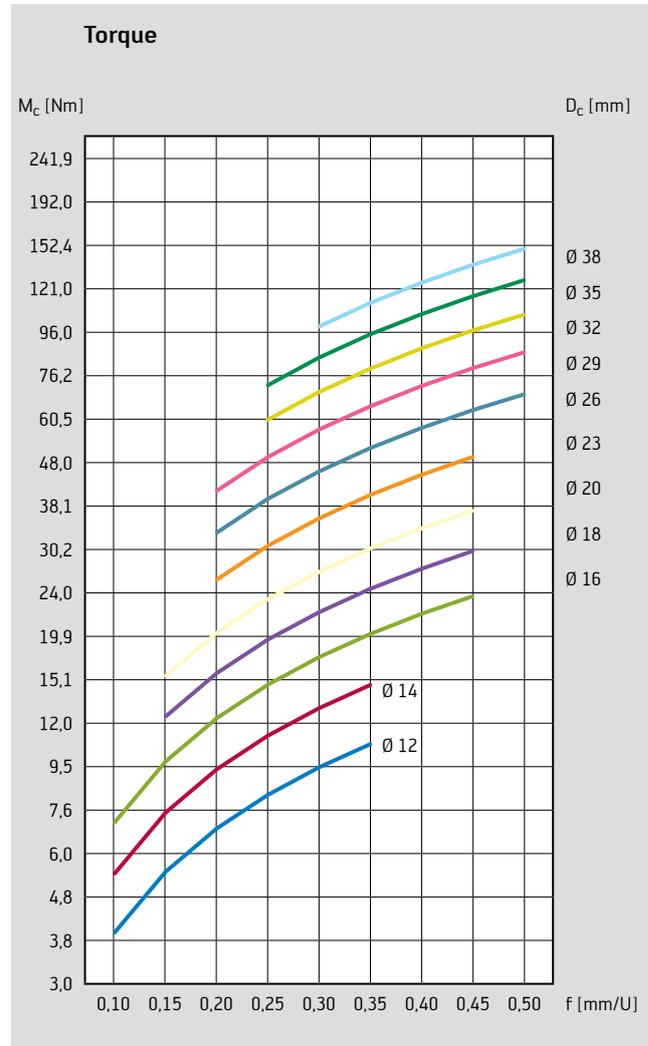
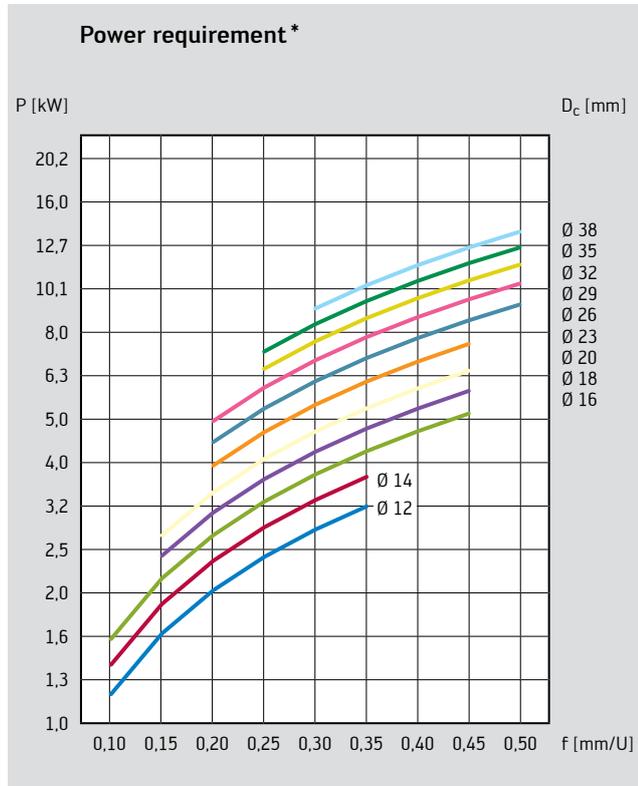
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement is also doubled, i.e. the power requirement is directly proportional to the cutting speed.

For steels with higher tensile strength, the required output and torque are correspondingly higher.

## Standard values for Drilling from solid-tip drill with Drion-tec® exchangeable-tip drill D4140, D4240 and D5142 (continued)

Material: GG25 – (0.6025) Cast iron, ferritic [180–200 HB]



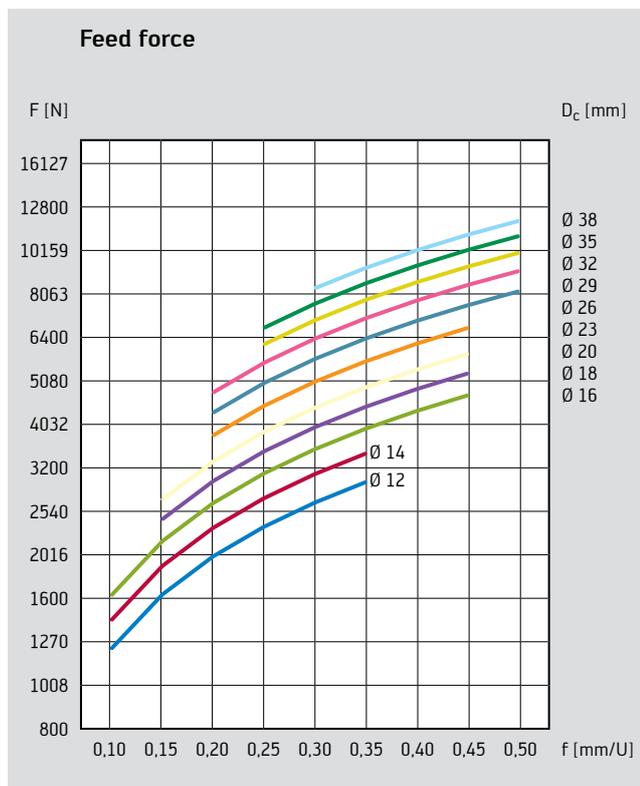
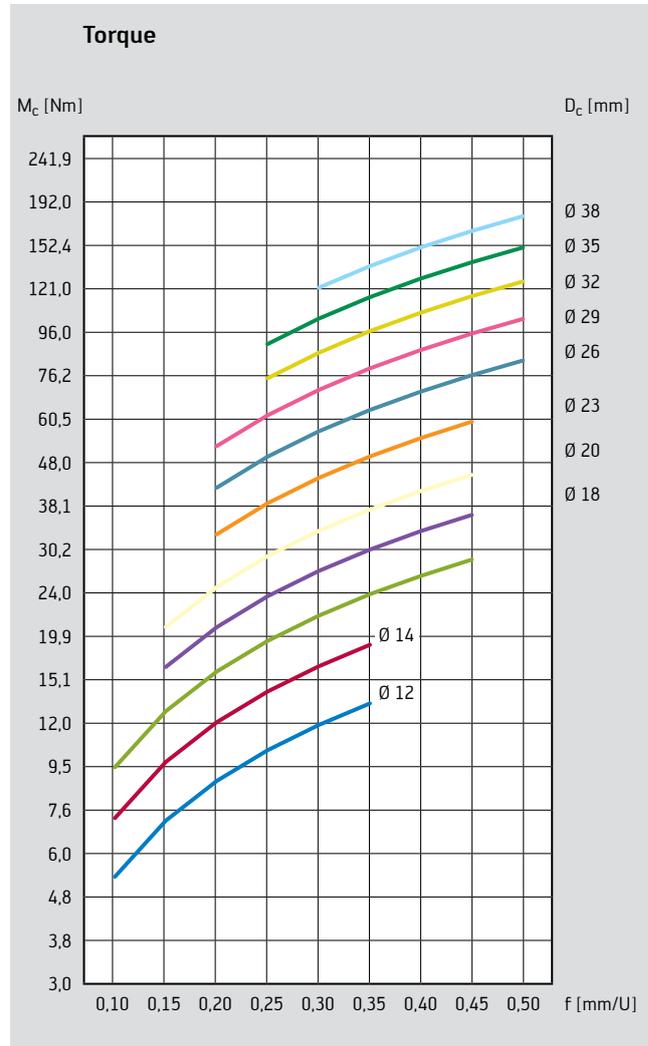
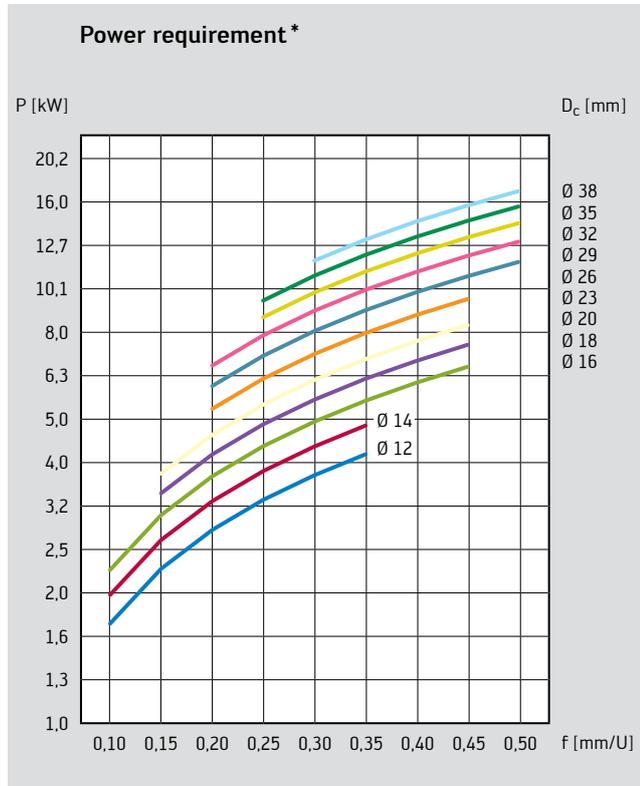
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement is also doubled, i.e. the power requirement is directly proportional to the cutting speed.

For Cast iron with higher hardness, the required output and torque are correspondingly higher.

## Standard values for Drilling from solid-tip drill with Drion-tec® exchangeable-tip drill D4140, D4240 and D5142 (continued)

Material: GGG70 – (0.7070) Cast iron with nodular graphite [ $R_m = 690 \text{ N/mm}^2$ ]



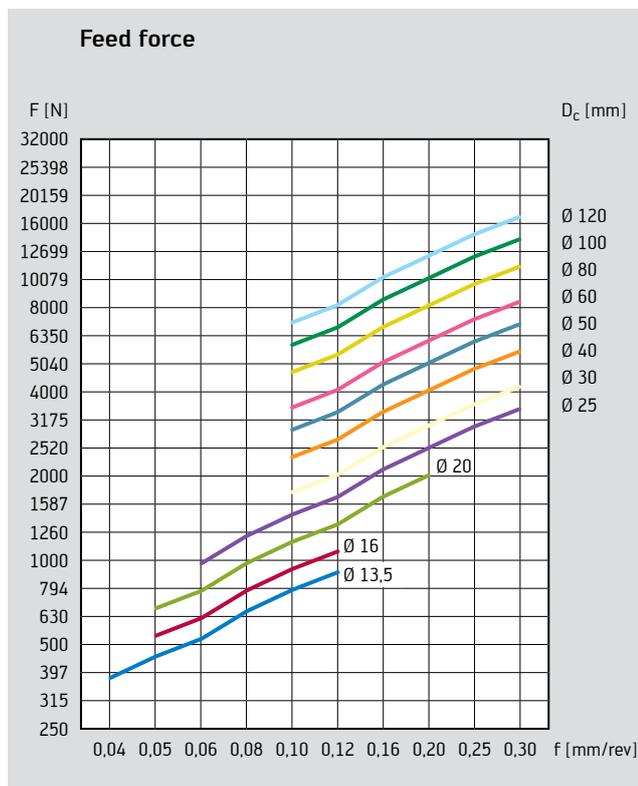
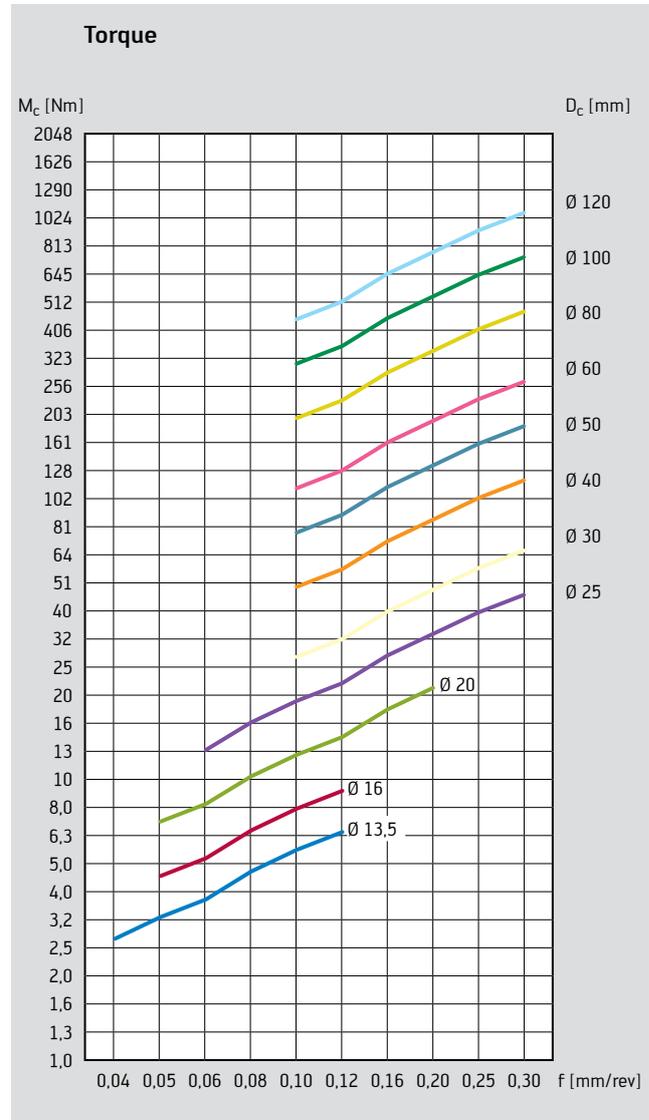
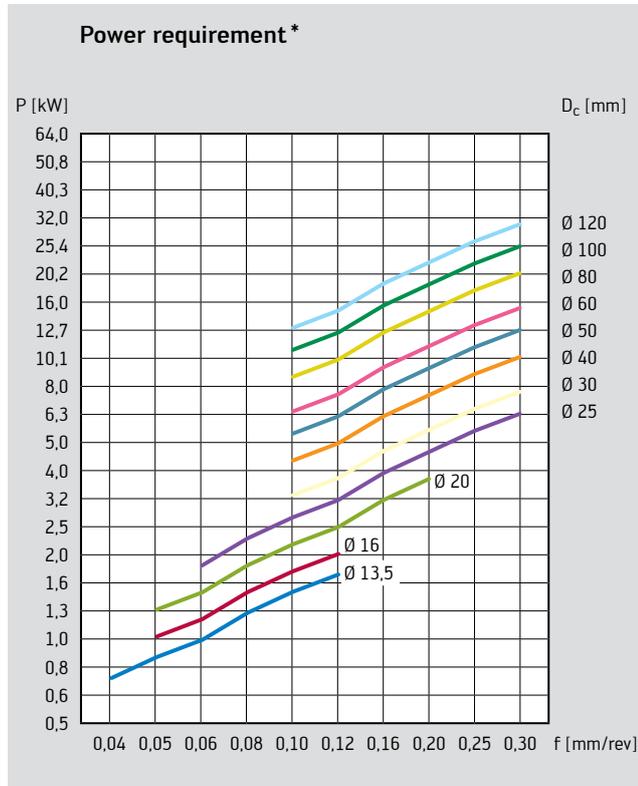
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement is also doubled, i.e. the power requirement is directly proportional to the cutting speed.

For cast iron with higher hardness, the required output and torque are correspondingly higher.

## Standard values for drilling from solid D4120 and D4170 indexable insert drills

Material: C45 – (1.0503) steel, steel casting [ $R_m = 650 \text{ N/mm}^2$ ]



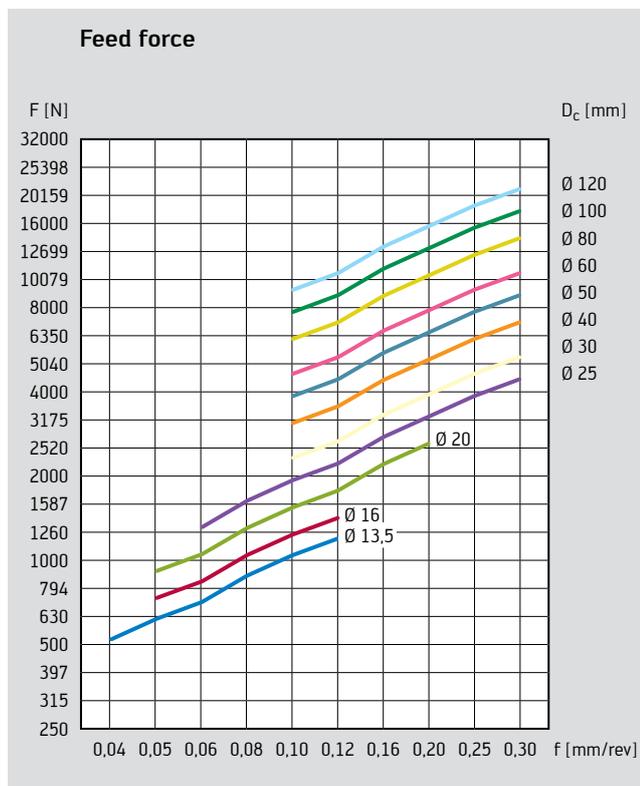
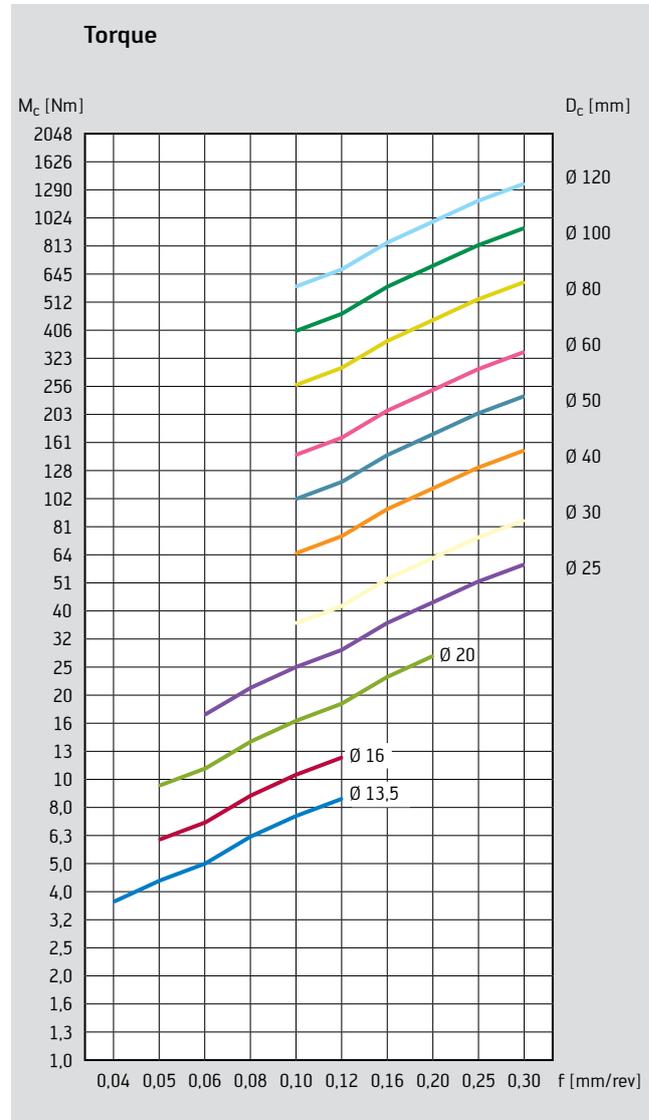
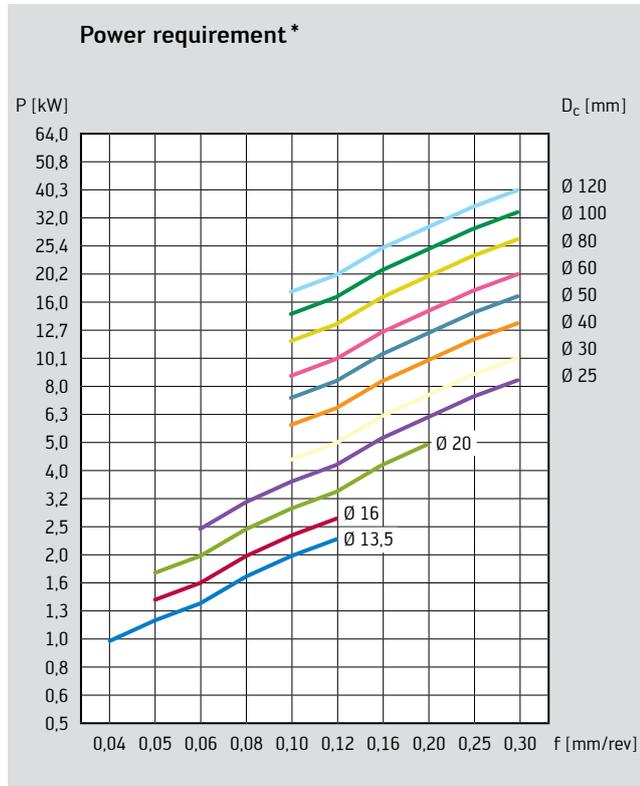
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

For steels with a higher tensile strength, the power and torque required are correspondingly higher.

## Standard values for drilling from solid D4120 and D4170 indexable insert drills (continued)

Material: 42CrMo<sub>4</sub> – chromium-molybdenum alloy heat treatable steel [ $R_m = 750-900 \text{ N/mm}^2$ ]



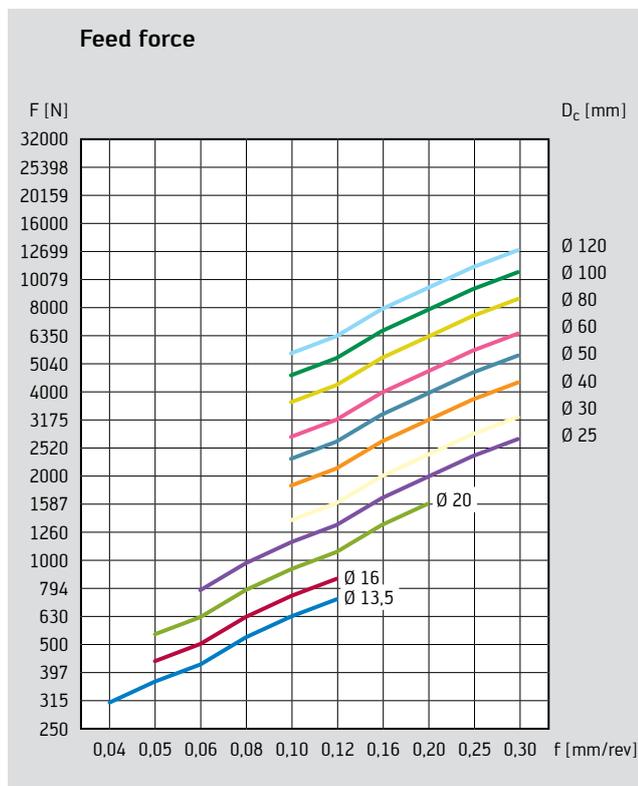
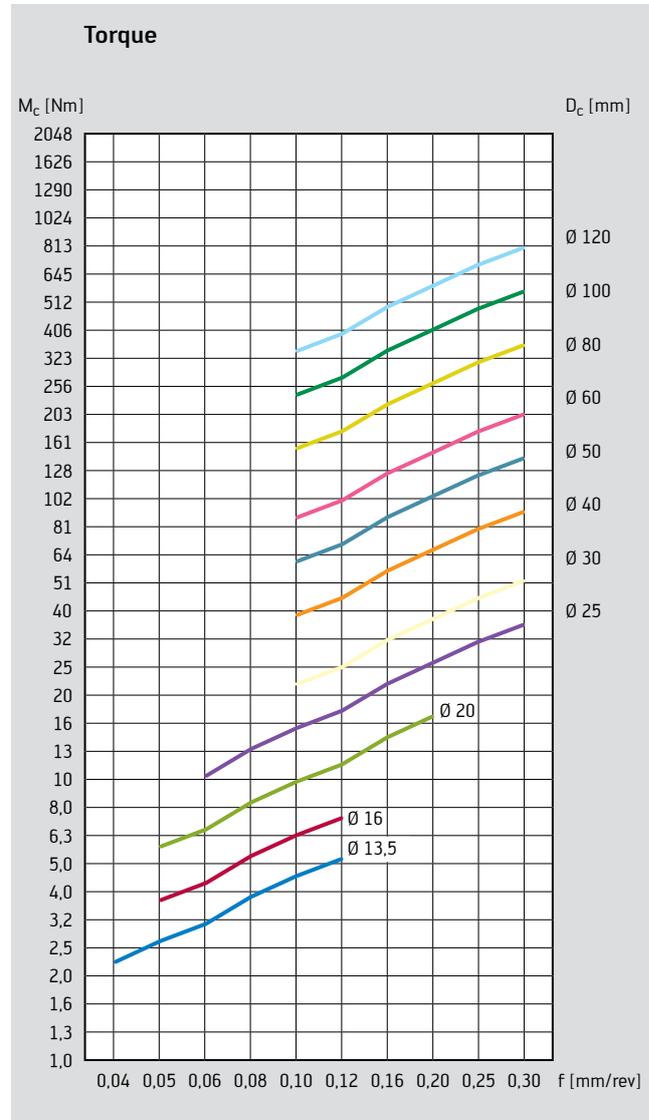
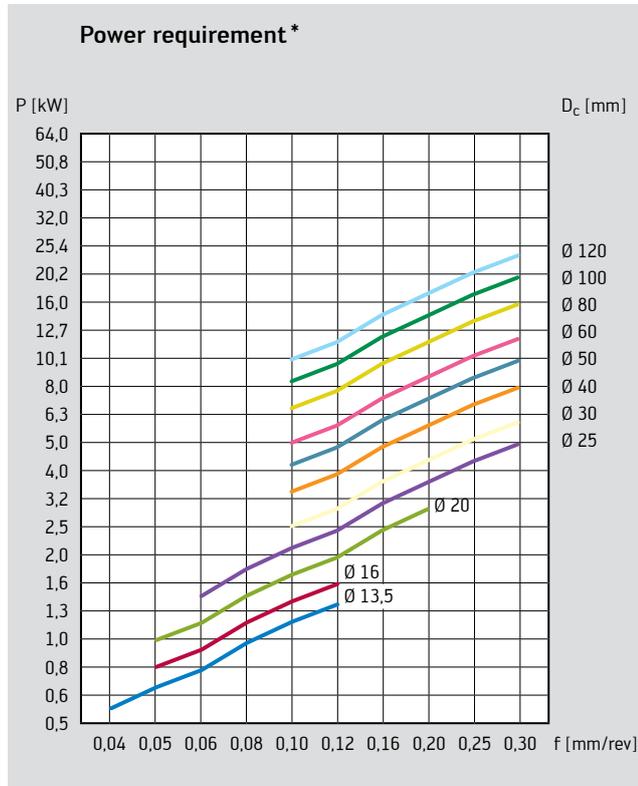
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

For steels with a higher tensile strength, the power and torque required are correspondingly higher.

## Standard values for drilling from solid D4120 and D4170 indexable insert drills (continued)

Material: GG25 – (0.6025) cast iron, ferritic [180–200 HB]



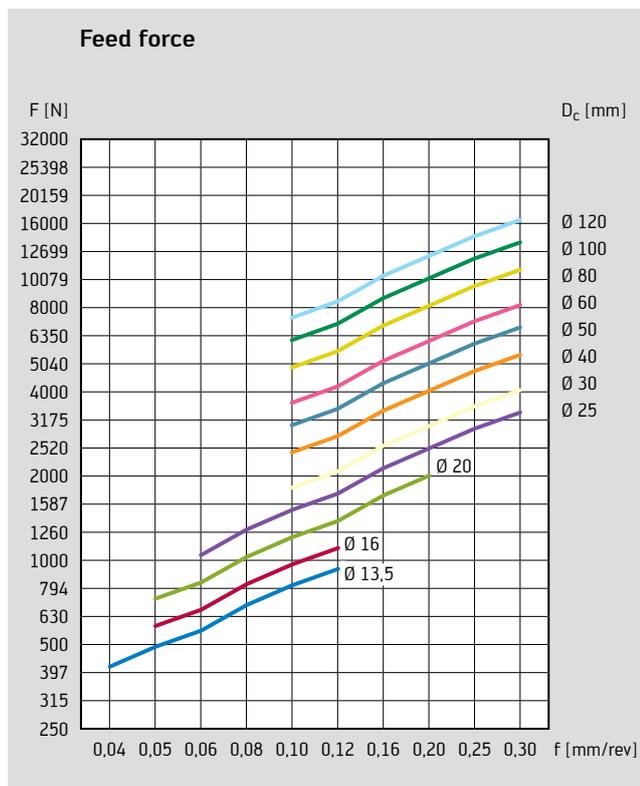
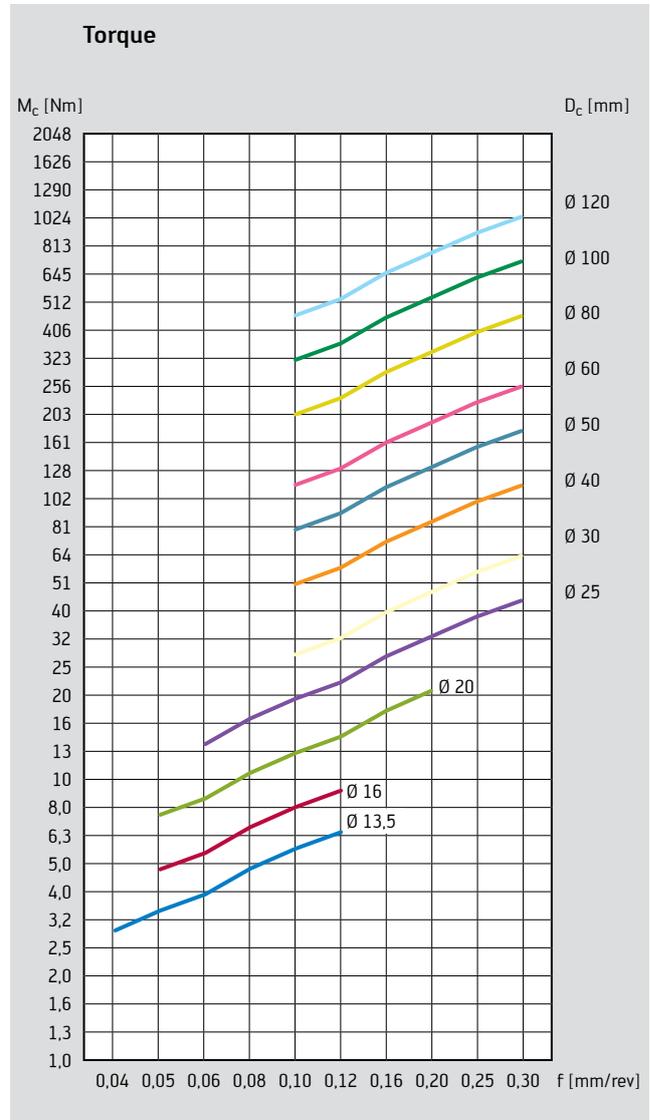
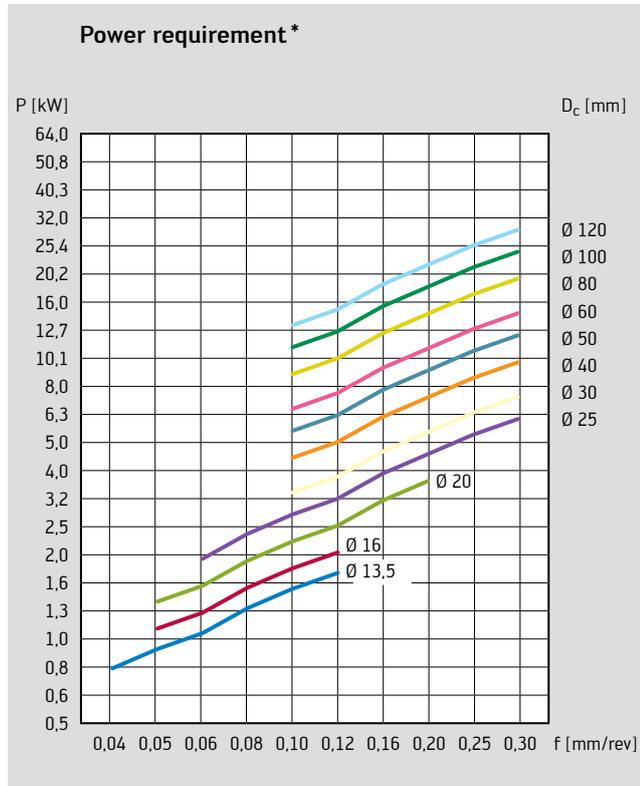
The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

For harder cast iron, the power and torque required are correspondingly higher.

## Standard values for drilling from solid D4120 and D4170 indexable insert drills (continued)

Material: GGG70 – (0.7070) cast iron with spheroidal graphite [ $R_m = 690 \text{ N/mm}^2$ ]



The power requirement\* data is based on a cutting speed of 100 m/min.

If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

For harder cast iron, the power and torque required are correspondingly higher.

## Right positioning of the new DS42 tip in the D5142 drill body

First press **the exchangeable tip centrally with your thumb downwards** into the seat. Then tighten the two screws to the correct torque, **continuing to press the tip downwards!**

Only turn or change the exchangeable tip when the drill body is located in the adaptor.

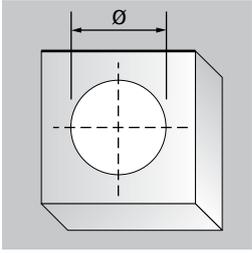
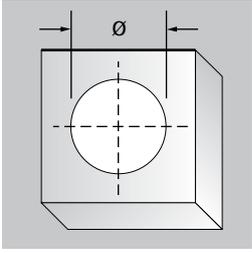
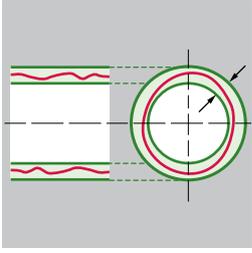
Avoid applying lateral pressure to the exchangeable tip during installation under any circumstances! If the exchangeable tip is fixed wrongly at an angle with the first screw due to single-sided pressure, the second screw will no longer be able to balance it back.



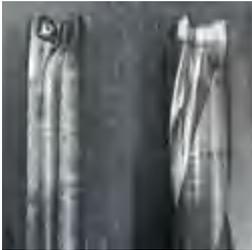
## Problem-solving expertise for D4140 and D4240 exchangeable insert drills

Wear patterns	Characteristics	Measures
<b>Wear at the corners</b> 	<ol style="list-style-type: none"> <li>1. Incorrect drill</li> <li>2. Poor cutting conditions</li> <li>3. Insufficient coolant</li> <li>4. Workpiece moving</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the drill type, drilling depth, cooling system and workpiece material</li> <li>2a. Reduce the cutting speed and increase the feed</li> <li>2b. Check the cutting parameters on entry and exit. Reduce the feed by 15–20% before finishing</li> <li>3. Check the cooling lubricant. For an internal coolant supply, increase the coolant pressure. For an external coolant supply, adjust the position of the coolant jet. Ensure cooling from both sides</li> <li>4. Stabilise the workpiece clamping and check the stability of the machine tool</li> </ol>
<b>Breakage at the corners</b> 	<ol style="list-style-type: none"> <li>1. Fault in the chuck</li> <li>2. Workpiece moving</li> <li>3. Incorrect drill</li> <li>4. Insufficient coolant</li> <li>5. Poor cutting conditions</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the torque transmission. Use a hydraulic chuck or a high-precision clamping system</li> <li>2. Stabilise the workpiece clamping and check the stability of the machine tool</li> <li>3. Check the drill type, drilling depth, cooling system and workpiece material; if necessary, use a longer drill</li> <li>4. Check the cooling lubricant. For an internal coolant supply, increase the coolant pressure. For an external coolant supply, adjust the position of the coolant jet. Ensure cooling from both sides</li> <li>5. Check the cutting parameters and reduce the feed if necessary</li> </ol>
<b>Breakage on the chisel edge</b> 	<ol style="list-style-type: none"> <li>1. Fault in the chuck</li> <li>2. Cutting conditions</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the accuracy of the clamping. Use a hydraulic chuck or a high-precision clamping system</li> <li>2. Increase the feed</li> </ol>
<b>Breakage on the cutting edges</b> 	<ol style="list-style-type: none"> <li>1. Fault in the chuck</li> <li>2. Poor application conditions due to a built-up edge</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the accuracy of the clamping and the transmission torque. Use a hydraulic chuck or a high-precision clamping system</li> <li>2a. Check the cutting parameters and increase the cutting speed if required</li> <li>2b. Regularly check for built-up edges</li> </ol>
<b>Build-up on the cutting edge</b> 	<ol style="list-style-type: none"> <li>1. Insufficient coolant</li> <li>2. Poor cutting conditions</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the cooling lubricant. For an internal coolant supply, increase the coolant pressure. For an external coolant supply, adjust the position of the coolant jet. Ensure cooling from both sides</li> <li>2. Increase the cutting speed by 20–30%</li> </ol>

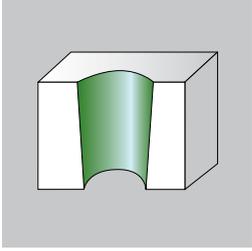
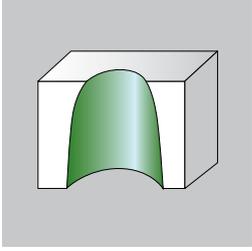
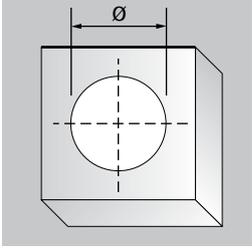
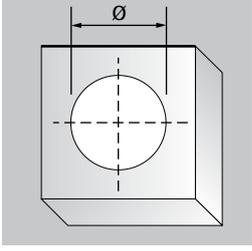
## Problem-solving expertise for D4140 and D4240 exchangeable insert drills (continued)

Wear patterns	Characteristics	Measures
<p><b>Formation of hairline cracks</b></p> 	<ol style="list-style-type: none"> <li>Poor cutting conditions</li> </ol>	<ol style="list-style-type: none"> <li>Inconsistent/insufficient coolant supply</li> </ol>
<p><b>Hole too large</b></p> 	<ol style="list-style-type: none"> <li>Poor cutting conditions</li> <li>Fault in the chuck</li> <li>Incorrect drill</li> </ol>	<ol style="list-style-type: none"> <li>Check the cutting data, increase the cutting speed or reduce the feed</li> <li>Check the accuracy of the clamping and the torque transmission. Use a hydraulic chuck or a high-precision clamping system</li> <li>3a. Check the drill diameter</li> <li>3b. Check the drill tolerance</li> <li>3c. Check whether the drill is running concentrically</li> </ol>
<p><b>Hole too small</b></p> 	<ol style="list-style-type: none"> <li>Insufficient coolant</li> <li>Poor cutting conditions</li> <li>Incorrect drill</li> </ol>	<ol style="list-style-type: none"> <li>Check the cooling lubricant. For an internal coolant supply, increase the coolant pressure. For an external coolant supply, adjust the position of the coolant jet. Ensure cooling from both sides</li> <li>Reduce the cutting speed and increase the feed</li> <li>Check the drill diameter</li> </ol>
<p><b>Hole is not cylindrical</b></p> 	<ol style="list-style-type: none"> <li>Fault in the chuck</li> <li>Workpiece moving</li> <li>Incorrect drill</li> <li>Poor cutting conditions</li> </ol>	<ol style="list-style-type: none"> <li>Check the accuracy of the clamping and the torque transmission. Use a hydraulic chuck or a high-precision clamping system</li> <li>Stabilise the workpiece clamping and check the stability of the machine tool</li> <li>Check the drill type and drilling depth and use a longer drill</li> <li>Reduce the feed during entry</li> </ol>

## Problem-solving expertise for D4170, D4120 and D3120 indexable insert drills

Wear patterns	Characteristics	Measures
<p><b>Low tool edge life, high wear on indexable inserts</b></p>	<ol style="list-style-type: none"> <li>1. Incorrect cutting parameters</li> <li>2. The cutting tool material has insufficient wear resistance</li> <li>3. Insufficient coolant</li> <li>4. Damaged insert seat</li> <li>5. The drill body is longer than necessary</li> <li>6. Unstable clamping</li> <li>7. Setting error (on lathes)</li> </ol>	<ol style="list-style-type: none"> <li>1. Correct the cutting parameters</li> <li>2. Select a more wear-resistant grade</li> <li>3. Check the coolant pressure. If it is too low, increase the volume flow rate</li> <li>4. Check the drill body and replace it if necessary</li> <li>5. If possible, use a shorter tool</li> <li>6. Increase the stability of the clamping fixture</li> <li>7. Check the machine alignment</li> </ol>
<p><b>Fracture on the inner indexable insert</b></p> 	<ol style="list-style-type: none"> <li>1. The centre height of the tool is too high/too low (on lathes)</li> <li>2. The feed is too high</li> <li>3. The cutting edge grade is too hard</li> <li>4. The indexable insert geometry encourages high forces</li> <li>5. Unstable clamping</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and adjust the centre height</li> <li>2. Reduce the feed</li> <li>3. Use a tougher cutting tool material</li> <li>4. Use a geometry with a sharper cutting edge</li> <li>5. Check the accuracy. If it is not possible to improve the drill clamping and/or it is not possible to ensure optimum stability: Reduce the feed</li> </ol>
<p><b>Fracture on the outer indexable inserts</b></p> 	<ol style="list-style-type: none"> <li>1. The feed is too high</li> <li>2. Interrupted cuts</li> <li>3. The indexable insert geometry encourages high forces</li> </ol>	<ol style="list-style-type: none"> <li>1. Reduce the feed</li> <li>2. Use a tougher cutting edge grade and a stronger geometry</li> <li>3. Use an indexable insert with sharper geometry</li> </ol>
<p><b>Build-up on the cutting edge</b></p> 	<ol style="list-style-type: none"> <li>1. Insufficient coolant</li> <li>2. Incorrect cutting parameters</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the coolant pressure. If it is too low, increase the volume flow rate</li> <li>2. Increase the cutting speed and reduce the feed</li> </ol>
<p><b>Chip removal and/or chip breaking is not ideal</b></p> 	<ol style="list-style-type: none"> <li>1. Insufficient coolant</li> <li>2. Incorrect cutting parameters</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the coolant pressure and volume (for better chip removal and cooling of the cutting edges)</li> <li>2. Improve the cutting parameters and chip control to suit the specified application. Increase the cutting speed and reduce the feed</li> </ol>
<p><b>Friction marks on the drill body</b></p> 	<ol style="list-style-type: none"> <li>1. The drilling diameter is too small</li> <li>2. Poor chip removal</li> <li>3. High bending forces due to rounded cutting edge</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the setting</li> <li>2. Improve the cutting parameters and check the indexable insert geometry</li> <li>3. Select a sharper geometry</li> </ol>

## Problem-solving expertise for D4170, D4120 and D3120 indexable insert drills (continued)

Wear patterns	Characteristics	Measures
<p>Poor hole quality</p> 	<ol style="list-style-type: none"> <li>1. Insufficient coolant</li> <li>2. Incorrect cutting parameters</li> <li>3. Unstable clamping</li> <li>4. Setting error (on lathes)</li> </ol>	<ol style="list-style-type: none"> <li>1. Increase the coolant pressure and volume</li> <li>2a. Increase the cutting speed and reduce the feed</li> <li>2b. Check the clamping accuracy (of the tool and the workpiece) and improve it if necessary</li> <li>3. Improve the clamping stability</li> <li>4. Check the machine alignment</li> </ol>
<p>The hole tapers off</p> 	<ol style="list-style-type: none"> <li>1. Chips accumulating in the external indexable insert groove</li> <li>2. The material is very soft</li> </ol>	<ol style="list-style-type: none"> <li>1. Select an alternative chip breaking geometry and increase the feed if necessary</li> <li>2a. Increase the cutting speed and reduce the feed</li> <li>2b. Use a different cutting geometry</li> </ol>
<p>The hole is bell-shaped</p> 	<ol style="list-style-type: none"> <li>1. Chips accumulating in the central indexable insert groove</li> </ol>	<ol style="list-style-type: none"> <li>1. Select a different geometry and increase the feed if necessary</li> </ol>
<p>The hole is too small/too large</p> 	<ol style="list-style-type: none"> <li>1. The machine is not running at the zero position (on lathes)</li> <li>2. The machine axis has shifted (on lathes)</li> <li>3. Incorrect setting on the eccentric sleeve</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and correct the setting</li> <li>2. Check and correct the setting</li> <li>3. Check and correct the setting</li> </ol>
<p>The hole is too small/too large for cartridge-type drills</p> 	<ol style="list-style-type: none"> <li>1. Setting error (on the outer cartridge)</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and correct the setting</li> </ol>

## Cutting data for HSS drilling and reaming tools

Material group	<p>  = Wet machining (E = emulsion, O = oil)   = Dry machining possible (M = MQL, L = dry)                      Cutting data must be selected from Walter GPS   <math>v_c</math> = Cutting speed                      VRR = Feed rate chart                      VCRR = <math>v_c</math> rate chart                       * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.                 </p>			Drilling depth			~3 × D <sub>c</sub>							
				Designation			A1149XPL UFL®			A1154TFT VA Inox				
				Standard			DIN 1897			DIN 1897				
				Coating			XPL			TFT				
				Dia. range [mm]			1–20			2–16				
				Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group *					
			$v_c$	VRR			$v_c$	VRR						
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	56	12	E O					
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	63	12	E O					
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	63	12	E O					
		C > 0,55 %	Annealed	190	640	P4	63	10	E O					
		C > 0,55 %	Heat-treated	300	1010	P5	50	10	E O					
	P	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	56	12	E O		56	12	E O
			Annealed	175	590	P7	56	12	E O			56	12	E O
			Heat-treated	285	960	P8	45	10	E O					
			Heat-treated	380	1280	P9	28	7	E O					
		High-alloy steel and high-alloy tool steel	Heat-treated	430	1480	P10	18	5	E O					
Annealed			200	680	P11	32	5	E O						
Hardened and tempered			300	1010	P12	50	10	E O						
Hardened and tempered			380	1280	P13	25	7	E O						
Stainless steel		Ferritic/martensitic, annealed	200	680	P14	50	12	E O						
		Martensitic, heat-treated	330	1110	P15	50	10	E O						
M	Stainless steel	Austenitic, quench hardened		200	680	M1	14	5	O E		16	9	O E	
		Austenitic, precipitation hardened (PH)		300	1010	M2	22	6	O E					
		Austenitic/ferritic, duplex		230	780	M3	18	4	O E		14	7	O E	
K	Malleable cast iron	Ferritic		200	400	K1	45	16	E O					
		Pearlitic		260	700	K2	40	12	E O					
	Grey cast iron	Low strength		180	200	K3	56	16	E O					
		High strength/austenitic		245	350	K4	45	16	E O					
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	50	16	E O					
		Pearlitic		265	700	K6	40	12	E O					
CGI		230	400	K7	40	12	E O							
N	Wrought aluminium alloys	Not hardenable		30	-	N1					110	12	E O	M
		Hardenable, hardened		100	340	N2					110	12	E O	M
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	71	12	E O	M	63	12	E O	M
		≤ 12% Si, hardenable, hardened		90	310	N4	71	12	E O	M				
		> 12% Si, not hardenable		130	450	N5								
	Magnesium-based alloys			70	250	N6								
		Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	80	5	E O		71	5	E O
Brass, bronze, red brass				90	310	N8	80	12	E O		71	12	E O	
Copper alloys, short-chipping			110	380	N9	120	12	E O						
High tensile, Ampco			300	1010	N10									
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	11	4	O E		14	7	O E	
			Hardened	280	940	S2	6,3	3	E O					
		Ni- or Co-based	Annealed	250	840	S3	16	4	E O					
			Hardened	350	1180	S4								
			Cast	320	1080	S5								
	Titanium alloys	Pure titanium		200	680	S6					16	4	O E	
		α and β alloys, hardened		375	1260	S7								
		β alloys		410	1400	S8								
	Tungsten alloys		300	1010	S9									
	Molybdenum alloys		300	1010	S10									
H	Hardened steel	Hardened and tempered		50 HRC	-	H1								
		Hardened and tempered		55 HRC	-	H2								
		Hardened and tempered		60 HRC	-	H3								
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4								
O	Thermoplastics	Without abrasive fillers				O1	45	12	E O		40	12	E O	
	Thermosetting plastics	Without abrasive fillers				O2	45	8		L	40	8		L
	Plastic, glass-fibre reinforced	GFRP				O3								
	Plastic, carbon-fibre reinforced	CFRP				O4								
	Plastic, aramid-fibre reinforced	AFRP				O5								
	Graphite (technical)		80 Shore			O6								



# Cutting data for HSS drilling and reaming tools

(continued)

Material group	<p>  = Wet machining (E = emulsion, O = oil)   = Dry machining possible (M = MQL, L = dry)                      Cutting data must be selected from Walter GPS                      v<sub>c</sub> = Cutting speed                      VRR = Feed rate chart                      * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.                 </p>			Drilling depth			~8 × D <sub>c</sub>							
				Designation			A1222 UFL®			DA110 Perform				
				Standard			DIN 338			DIN 338				
				Coating			Uncoated			WZ90AJ				
				Dia. range [mm]			1-16			1-16				
				Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group*					
			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR						
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	28	9	E O		29	9	E O	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	28	10	E O		29	10	E O	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	25	10	E O		23	10	E O	
		C > 0,55 %	Annealed	190	640	P4	20	9	E O		22	8	E O	
		C > 0,55 %	Heat-treated	300	1010	P5	14	8	E O		15	8	E O	
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	28	10	E O		29	10	E O	
		Annealed		175	590	P7	28	10	E O		29	10	E O	
		Heat-treated		285	960	P8	12	8	E O		13	8	E O	
		Heat-treated		380	1280	P9	6,3	3	O E		9	3	E O	
		Heat-treated		430	1480	P10								
High-alloy steel and high-alloy tool steel		Annealed		200	680	P11	10	5	E O		9	4	E O	
		Hardened and tempered		300	1010	P12	14	8	E O		15	8	E O	
Stainless steel	Hardened and tempered		380	1280	P13	4	3	O E		7	3	E O		
	Ferritic/martensitic, annealed		200	680	P14	22	10	E O		24	10	E O		
	Martensitic, heat-treated		330	1110	P15	14	8	E O		15	8	E O		
M	Stainless steel	Austenitic, quench hardened		200	680	M1	5	4	O E		5	4	O E	
		Austenitic, precipitation hardened (PH)		300	1010	M2	5,6	5	E O		8	5	E O	
		Austenitic/ferritic, duplex		230	780	M3	3,6	3	O E					
K	Malleable cast iron	Ferritic		200	400	K1	16	16	E O		22	12	E O	
		Pearlitic		260	700	K2	12	12	E O		17	10	E O	
	Grey cast iron	Low strength		180	200	K3	20	16	E O		28	12	E O	
		High strength/austenitic		245	350	K4	16	16	E O		22	12	E O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	18	16	E O		25	12	E O	
Pearlitic			265	700	K6	12	12	E O		17	10	E O		
CGI			230	400	K7	14	12	E O		20	10	E O		
N	Wrought aluminium alloys	Not hardenable		30	-	N1	56	12	E O M					
		Hardenable, hardened		100	340	N2	56	12	E O M					
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	36	12	E O M					
		≤ 12% Si, hardenable, hardened		90	310	N4	25	10	E O M					
	Magnesium-based alloys	> 12% Si, not hardenable		130	450	N5								
				70	250	N6	50	12		M L				
				100	340	N7	36	5	E O		41	5	E O	
Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		90	310	N8	28	10	E O						
	Brass, bronze, red brass		110	380	N9	45	12	E O		51	12	E O		
	Copper alloys, short-chipping		300	1010	N10									
	High tensile, Ampco													
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1	4	3	O E		4	3	O E
			Hardened		280	940	S2	4	2	O E				
		Ni- or Co-based	Annealed		250	840	S3	3,2	3	E O				
			Hardened		350	1180	S4							
			Cast		320	1080	S5							
	Titanium alloys	Pure titanium		200	680	S6								
Tungsten alloys	α and β alloys, hardened		375	1260	S7									
	β alloys		410	1400	S8									
Molybdenum alloys			300	1010	S9									
H	Hardened steel			300	1010	S10								
		Hardened and tempered		50 HRC	-	H1								
		Hardened and tempered		55 HRC	-	H2								
	Hardened cast iron	Hardened and tempered		60 HRC	-	H3								
O	Thermoplastics	Hardened and tempered		55 HRC	-	H4								
		Without abrasive fillers				O1	25	12	E O		25	12	E O	
		Without abrasive fillers				O2	18	8		L	28	8	L	
		Plastic, glass-fibre reinforced	GFRP			O3								
		Plastic, carbon-fibre reinforced	CFRP			O4								
		Plastic, aramid-fibre reinforced	AFRP			O5								
Graphite (technical)			80 Shore		O6									

~8 × D <sub>c</sub>				~12 × D <sub>c</sub>																			
A1211TIN		A1211		A1549TFP UFL®				A1547 Alpha® XE				A1544 VA				A1522 A4422 UFL®							
DIN 338 / DIN 345		DIN 338 / DIN 345		DIN 340				DIN 340				DIN 340				DIN 340 / DIN 341							
TIN		Uncoated		TFP				Uncoated				Uncoated				Uncoated							
0,5-30		0,2-100		1-12				1-12,7				1-12				1-31							
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR						
32	9	E0		25	8	E0		32	12	E0		25	9	E0				22	9	E0			
32	10	E0		25	9	E0		32	12	E0		25	10	E0		18	7	E0		22	10	E0	
25	10	E0		20	9	E0		25	12	E0		18	10	E0		18	7	E0		22	10	E0	
25	8	E0		18	7	E0		25	9	E0		18	9	E0		16	7	E0		18	9	E0	
18	8	E0		12	8	E0		20	10	E0		10	8	E0		10	8	E0		10	8	E0	
32	10	E0		25	9	E0		32	12	E0		25	10	E0						22	10	E0	
32	10	E0		25	9	E0		32	12	E0		25	10	E0						22	10	E0	
16	8	E0		10	8	E0		18	10	E0		9	8	E0		9	8	E0		9	8	E0	
12	3	E0		4,5	6	OE		6,3	7	E0		4,5	6	OE		4	5	OE		6,3	3	OE	
				3,2	5	OE		4	5	OE		3,2	5	OE		3,2	5	OE					
9	4	E0		8	4	E0		12	5	E0		10	5	E0		10	4	E0		8	5	E0	
18	8	E0		12	8	E0		20	10	E0		10	8	E0		10	8	E0		10	8	E0	
7,1	3	E0		5,6	6	OE		9	7	E0		6,3	6	OE		5,6	5	OE		2,8	3	OE	
25	10	E0		22	9	E0		32	12	E0		22	10	E0						20	10	E0	
18	8	E0		11	8	E0		20	10	E0		10	8	E0		9	8	E0		10	8	E0	
5,6	4	OE		4	3	OE		5,6	5	OE		4,5	4	OE		4,5	4	OE		3,6	4	OE	
10	5	E0		5	5	E0		7,1	5	E0		5	5	E0		5	5	E0		4,5	5	E0	
				3,6	3	OE		6,3	4	OE		4	4	OE		4	4	OE		2,5	3	OE	
28	12	E0		16	12	E0		25	16	E0		16	16	E0						14	16	E0	
22	10	E0		12	10	E0		20	12	E0		11	12	E0						11	12	E0	
36	12	E0		20	12	E0		32	16	E0		20	16	E0						18	16	E0	
28	12	E0		16	12	E0		25	16	E0		16	16	E0						14	16	E0	
32	12	E0		18	12	E0		28	16	E0		18	16	E0						16	16	E0	
22	10	E0		12	10	E0		20	12	E0		11	12	E0						11	12	E0	
25	10	E0		14	10	E0		22	12	E0		12	12	E0						12	12	E0	
				50	12	E0	M	63	12	E0	M									45	12	E0	M
				50	12	E0	M	63	12	E0	M									45	12	E0	M
				32	12	E0	M	36	12	E0	M	32	12	E0	M					32	12	E0	M
				22	10	E0	M	28	12	E0	M	25	10	E0	M					22	10	E0	M
												45	12		ML					40	12		ML
45	5	E0		36	5	E0		40	5	E0		36	5	E0						32	5	E0	
				28	10	E0		45	12	E0		28	10	E0						25	10	E0	
56	12	E0		45	12	E0		56	12	E0		45	12	E0						40	12	E0	
				9	5	E0						8	5	E0		8	5	E0					
4,5	3	OE		3,2	2	OE		4,5	4	OE		3,6	3	OE		3,6	3	OE		3,2	3	OE	
				5	2	OE		4	2	OE		5	2	OE		5	2	OE		4	2	OE	
				3,2	3	E0		5,6	4	E0		3,6	4	E0		3,6	4	E0		2,5	3	E0	
												1	3	E0		1	3	E0					
												1,4	3	E0		1,4	3	E0					
				5,6	4	E0						4,5	4	OE		4,5	4	OE					
				2,8	3	E0						3,2	3	E0		3,2	3	E0					
				2,2	3	OE						2,5	3	OE		2,5	3	OE					
												1,4	3	E0		1,4	3	E0					
												1,4	3	E0		1,4	3	E0					
25	12	E0		25	12	E0		20	12	E0		20	10	E0						20	12	E0	
28	8		L	18	8		L													16	8		L

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for HSS drilling and reaming tools

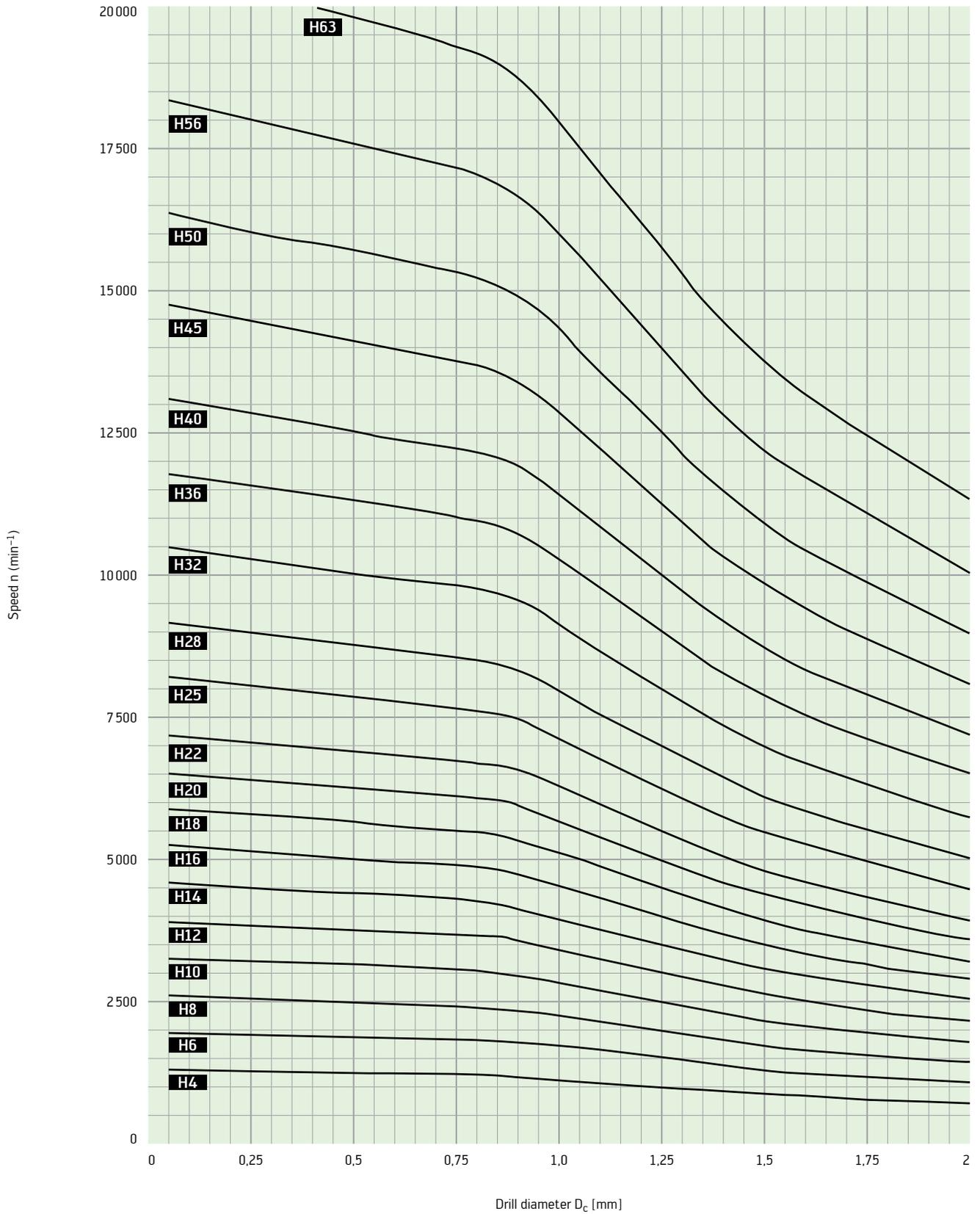
(continued)

Material group	Overview of the main material groups and code letters Brinell hardness HB Tensile strength $R_m$ [N/mm <sup>2</sup> ] Machining group*			Drilling depth				~12 × D <sub>c</sub>				~16 × D <sub>c</sub>			
				Designation				A1511				A1622 A4622 UFL®			
				Standard				DIN 340 / DIN 341				DIN 1869 I / DIN 1870 I			
				Coating				Uncoated				Uncoated			
Dia. range [mm]				0,5–50				2–30							
															
				v <sub>c</sub>	VRR			v <sub>c</sub>	VRR						
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	22	8	EO	20	9	EO			
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	22	9	EO	20	10	EO			
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	16	9	EO	20	10	EO			
		C > 0,55 %	Annealed	190	640	P4	14	7	EO	16	9	EO			
		C > 0,55 %	Heat-treated	300	1010	P5	8	8	EO	9	8	EO			
	Low-alloy steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	22	9	EO	20	10	EO			
		Annealed	175	590	P7	22	9	EO	20	10	EO				
		Heat-treated	285	960	P8	7,1	8	EO	8	8	EO				
		Heat-treated	380	1280	P9	2,8	6	OE	5,6	3	OE				
		Heat-treated	430	1480	P10	2	5	OE							
High-alloy steel and high-alloy tool steel		Annealed	200	680	P11	6,3	4	EO	7,1	5	EO				
		Hardened and tempered	300	1010	P12	8	8	EO	9	8	EO				
	Hardened and tempered	380	1280	P13	4,5	6	OE	2,2	3	OE					
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	18	9	EO	18	10	EO					
	Martensitic, heat-treated	330	1110	P15	8	8	EO	9	8	EO					
M	Stainless steel	Austenitic, quench hardened	200	680	M1	2,8	3	OE	2,8	4	OE				
		Austenitic, precipitation hardened (PH)	300	1010	M2	3,6	5	EO	3,2	5	EO				
		Austenitic/ferritic, duplex	230	780	M3	2,5	3	OE	2	3	OE				
K	Malleable cast iron	Ferritic	200	400	K1	14	12	EO	12	16	EO				
		Pearlitic	260	700	K2	11	10	EO	9	12	EO				
	Grey cast iron	Low strength	180	200	K3	18	12	EO	16	16	EO				
		High strength/austenitic	245	350	K4	14	12	EO	12	16	EO				
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	16	12	EO	14	16	EO				
Pearlitic		265	700	K6	11	10	EO	9	12	EO					
CGI		230	400	K7	12	10	EO	10	12	EO					
N	Wrought aluminium alloys	Not hardenable	30	-	N1	45	12	EO M	40	12	EO M				
		Hardenable, hardened	100	340	N2	45	12	EO M	40	12	EO M				
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	28	12	EO M	28	12	EO M				
		≤ 12% Si, hardenable, hardened	90	310	N4	20	10	EO M	20	10	EO M				
	Magnesium-based alloys	> 12% Si, not hardenable	130	450	N5										
			70	250	N6				36	12	ML				
Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7	32	5	EO	28	5	EO					
	Brass, bronze, red brass	90	310	N8	25	10	EO	22	10	EO					
	Copper alloys, short-chipping	110	380	N9	40	12	EO	36	12	EO					
	High tensile, Ampco	300	1010	N10	6,3	5	EO								
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	2,2	2	OE	2,5	3	OE			
			Hardened	280	940	S2	4,5	2	OE	3,6	2	OE			
		Ni- or Co-based	Annealed	250	840	S3	2,5	3	EO	1,8	3	EO			
			Hardened	350	1180	S4									
			Cast	320	1080	S5									
	Titanium alloys	Pure titanium	200	680	S6	3,6	4	EO							
β alloys	α and β alloys, hardened	375	1260	S7	1,8	3	EO								
		410	1400	S8	1,6	3	OE								
Tungsten alloys		300	1010	S9											
Molybdenum alloys		300	1010	S10											
H	Hardened steel	Hardened and tempered	50 HRC	-	H1										
		Hardened and tempered	55 HRC	-	H2										
		Hardened and tempered	60 HRC	-	H3										
	Hardened cast iron	Hardened and tempered	55 HRC	-	H4										
O	Thermoplastics	Without abrasive fillers			O1	20	12	EO	18	12	EO				
	Thermosetting plastics	Without abrasive fillers			O2	16	8		L	14	8				
	Plastic, glass-fibre reinforced	GFRP			O3										
		CFRP			O4										
	Plastic, carbon-fibre reinforced	CFRP			O5										
	Plastic, aramid-fibre reinforced	AFRP			O6										
Graphite (technical)		80 Shore			O6										

~22 × D <sub>c</sub>				~30 × D <sub>c</sub>				~60 × D <sub>c</sub>				~85 × D <sub>c</sub>				~16 × D <sub>c</sub>			
A1722 A4722 UFL®				A1822 UFL®				A1922S UFL®				A1922L UFL®				A4611			
DIN 1869 II / DIN 1870 II				DIN 1869 III				Walter				Walter				DIN 1870 I			
Uncoated				Uncoated				Uncoated				Uncoated				Uncoated			
3-40				3,5-12				6-14				8-12				8-50			
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
20	9	EO		16	9	EO		16	9	EO		16	9	EO		18	8	EO	
18	10	EO		16	10	EO		16	10	EO		16	10	EO		18	9	EO	
18	10	EO		14	9	EO													
16	9	EO		12	9	EO		12	9	EO		12	9	EO		11	7	EO	
8	8	EO		7,1	8	EO		7,1	8	EO		7,1	8	EO		6,3	8	EO	
20	10	EO		16	10	EO		16	10	EO		16	10	EO		18	9	EO	
20	10	EO		16	10	EO		16	10	EO		16	10	EO		18	9	EO	
7,1	8	EO		6,3	8	EO		6,3	8	EO		6,3	8	EO		5,6	8	EO	
5	3	OE		4	3	OE		4	3	OE		4	3	OE		2,2	6	OE	
																1,4	5	OE	
7,1	5	EO		5,6	4	EO													
8	8	EO		7,1	8	EO		7,1	8	EO		7,1	8	EO		6,3	8	EO	
1,8	3	OE		1,2	3	OE		1,2	3	OE		1,2	3	OE		3,2	6	OE	
16	10	EO		14	10	EO		14	10	EO		14	10	EO		16	9	EO	
8	8	EO		6,3	8	EO													
2,5	4	OE		1,8	4	OE		1,8	4	OE		1,8	4	OE		2,2	3	OE	
2,8	5	EO		2	5	EO		2	5	EO		2	5	EO		2,8	5	EO	
1,6	3	OE		1,2	3	OE		1,2	3	OE		1,2	3	OE		2	3	OE	
11	16	EO		9	16	EO		9	16	EO		9	16	EO		12	12	EO	
8	12	EO		7,1	12	EO		7,1	12	EO		7,1	12	EO		9	10	EO	
14	16	EO		12	16	EO		12	16	EO		12	16	EO		14	12	EO	
11	16	EO		9	16	EO		9	16	EO		9	16	EO		12	12	EO	
12	16	EO		10	16	EO		10	16	EO		10	16	EO		14	12	EO	
8	12	EO		7,1	12	EO		7,1	12	EO		7,1	12	EO		9	10	EO	
9	12	EO		8	12	EO		8	12	EO		8	12	EO		10	10	EO	
40	12	EO	M	32	12	EO	M	32	12	EO	M	32	12	EO	M	36	12	EO	M
40	12	EO	M	32	12	EO	M	32	12	EO	M	32	12	EO	M	36	12	EO	M
25	12	EO	M	20	12	EO	M	20	12	EO	M	20	12	EO	M	22	12	EO	M
18	10	EO	M	14	10	EO	M	14	10	EO	M	14	10	EO	M	16	10	EO	M
32	12		ML	25	12		ML	25	12		ML	25	12		ML				
25	5	EO		22	5	EO		22	5	EO		22	5	EO		28	5	EO	
22	10	EO		18	10	EO		18	10	EO		18	10	EO		22	10	EO	
32	12	EO		28	12	EO		28	12	EO		28	12	EO		32	12	EO	
																5	5	EO	
2	3	OE		1,4	3	OE		1,4	3	OE		1,4	3	OE		1,8	2	OE	
3,2	2	OE		2,8	2	OE		2,8	2	OE		2,8	2	OE		3,6	2	OE	
1,6	3	EO		1,1	3	EO		1,1	3	EO		1,1	3	EO		1,8	3	EO	
																2,8	4	EO	
																1,4	3	EO	
																1,2	3	OE	
16	12	EO		14	12	EO		14	12	EO		14	12	EO		16	12	EO	
14	8		L	11	8		L	11	8		L	11	8		L	14	8		L

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

### VCRR: Speed diagram HSS micro drills



## VRR: Feed rate charts for HSS drilling and reaming tools

VRR	Feed f [mm] for diameter [mm]													
	0,05	0,06	0,08	0,1	0,12	0,15	0,2	0,25	0,4	0,5	0,6	0,8	1	1,2
1	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,003	0,004
2	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,003	0,003	0,004	0,005	0,007	0,008
3	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,010	0,012
4	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,003	0,005	0,007	0,008	0,011	0,013	0,016
5	0,001	0,001	0,001	0,002	0,002	0,003	0,003	0,004	0,007	0,008	0,010	0,013	0,017	0,020
6	0,001	0,001	0,002	0,002	0,002	0,003	0,004	0,005	0,008	0,010	0,012	0,016	0,020	0,024
7	0,001	0,001	0,002	0,002	0,003	0,004	0,005	0,006	0,009	0,012	0,014	0,019	0,023	0,028
8	0,001	0,002	0,002	0,003	0,003	0,004	0,005	0,007	0,011	0,013	0,016	0,021	0,027	0,032
9	0,002	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,012	0,015	0,018	0,024	0,030	0,036
10	0,002	0,002	0,003	0,003	0,004	0,005	0,007	0,008	0,013	0,017	0,020	0,027	0,033	0,040
12	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,010	0,016	0,020	0,024	0,032	0,040	0,048
16	0,003	0,003	0,004	0,005	0,006	0,008	0,011	0,013	0,021	0,027	0,032	0,043	0,053	0,064
20	0,003	0,004	0,005	0,007	0,008	0,010	0,013	0,017	0,027	0,033	0,040	0,053	0,067	0,080
25	0,004	0,005	0,007	0,008	0,010	0,013	0,017	0,021	0,033	0,042	0,050	0,067	0,083	0,100
30	0,005	0,006	0,008	0,010	0,012	0,015	0,020	0,025	0,040	0,050	0,060	0,080	0,100	0,120

VRR	Feed f [mm] for diameter [mm]													
	1,5	2	2,5	4	5	6	8	10	12	15	20	25	40	50
1	0,005	0,007	0,008	0,013	0,017	0,018	0,021	0,024	0,026	0,029	0,033	0,037	0,047	0,053
2	0,010	0,013	0,017	0,027	0,033	0,037	0,042	0,047	0,052	0,058	0,067	0,075	0,094	0,11
3	0,015	0,020	0,025	0,040	0,050	0,055	0,063	0,071	0,077	0,087	0,10	0,11	0,14	0,16
4	0,020	0,027	0,033	0,053	0,067	0,073	0,084	0,094	0,10	0,12	0,13	0,15	0,19	0,21
5	0,025	0,033	0,042	0,067	0,083	0,091	0,11	0,12	0,13	0,14	0,17	0,19	0,24	0,26
6	0,030	0,040	0,050	0,080	0,10	0,11	0,13	0,14	0,15	0,17	0,20	0,22	0,28	0,32
7	0,035	0,047	0,058	0,093	0,12	0,13	0,15	0,16	0,18	0,20	0,23	0,26	0,33	0,37
8	0,040	0,053	0,067	0,11	0,13	0,15	0,17	0,19	0,21	0,23	0,27	0,30	0,38	0,42
9	0,045	0,060	0,075	0,12	0,15	0,16	0,19	0,21	0,23	0,26	0,30	0,34	0,42	0,47
10	0,050	0,067	0,083	0,13	0,17	0,18	0,21	0,24	0,26	0,29	0,33	0,37	0,47	0,53
12	0,060	0,080	0,10	0,16	0,20	0,22	0,25	0,28	0,31	0,35	0,40	0,45	0,57	0,63
16	0,080	0,11	0,13	0,21	0,27	0,29	0,34	0,38	0,41	0,46	0,53	0,60	0,75	0,84
20	0,10	0,13	0,17	0,27	0,33	0,37	0,42	0,47	0,52	0,58	0,67	0,75	0,94	1,05
25	0,125	0,167	0,21	0,33	0,42	0,46	0,53	0,59	0,65	0,72	0,83	0,93	1,18	1,32
30	0,150	0,200	0,25	0,40	0,50	0,55	0,63	0,71	0,77	0,87	1,00	1,12	1,41	1,58

## Cutting tool materials, surface treatment and coatings for HSS drilling and reaming tools

### Cutting tool materials for HSS drilling and reaming tools

	Material no.	Short name	Old standard designation	AISI ASTM	AFNOR	B.S.	UNI	Alloy table					
								C	Cr	W	Mo	V	Co
HSS	1.3343	S 6-5-2	DMo5	M2	–	BM2	HS 6-5-2	0,82	4,0	6,5	5,0	2,0	–
HSS-E	1.3243	S 6-5-2-5	EMo5 Co5	M35	6.5.2.5	–	HS 6-5-2-5	0,82	4,5	6,0	5,0	2,0	5,0
HSS-E-PM	Trade name ASP												

### Surface treatment and hard material coatings for improved performance

	Steam treatment of HSS tools	Nitriding of HSS tools
<b>Implementation</b>	Dry steam atmosphere, 520 °C to 580 °C	Treatment in media emitting nitrogen, 520 °C to 570 °C
<b>Effect</b>	Adherent oxide layer consisting of Fe <sub>3</sub> O <sub>4</sub> , approx. 0.003 to 0.010 mm deep	Enrichment of surface with nitrogen and partially with carbon
<b>Properties</b>	<ul style="list-style-type: none"> <li>– Reduced tendency to cause galling</li> <li>– Increased surface hardness and therefore improved wear resistance</li> <li>– Increased corrosion resistance</li> <li>– Improved sliding properties thanks to better lubricant adhesion as a result of FeO crystals</li> <li>– Reduction in grinding stress</li> </ul>	<ul style="list-style-type: none"> <li>– Reduced tendency to cause galling and built-up edges</li> <li>– Increased hardness and therefore greater wear resistance</li> </ul>

Surface coating has developed into a proven technological process for improving the performance of machining tools. In contrast to surface treatments, the tool surface remains chemically unaltered and a thin layer is applied.

For Walter Titex high-speed steel and carbide tools, the coating is applied using PVD processes, which work at process temperatures of below 600 °C and therefore do not result in any change to the base material. Hard material layers have a greater hardness and wear resistance than the cutting tool material itself.

In addition

- they separate the cutting tool material and the material to be cut from each other
- they act as a thermal insulation layer

#### Advantages:

This also means that coated tools not only have a longer tool life, but they can also be used with higher cutting speeds and feeds.

Surface treatment/ coating and grades	Process/coating	Properties	Tool example
Uncoated	No treatment	–	
Steam-treated	Steam treatment	Universal treatment for HSS	
Fibre-steamed	Steam treatment	Universal treatment of lands for HSS	
TiN	TiN coating	Universal coating	
TFT	Tinal TOP coating	High-performance coating with particularly low friction	
TFP	TiNAl tip coating	High-performance coating for optimum chip evacuation	
XPL	AlCrN coating	High-performance coating for maximum wear resistance	
WZ30AJ	TiN tip coating	Universal coating	

## Dimensions

### Twist drills with Morse taper

Walter designation  D <sub>c</sub> [mm] above – to	A42..			A44..			A46..			A47..		
	DIN 345		MK**	DIN 341		MK**	DIN 1870 series 1		MK**	DIN 1870 series 2		MK**
	l <sub>1</sub>	L <sub>c</sub>		l <sub>1</sub>	L <sub>c</sub>		l <sub>1</sub>	L <sub>c</sub>		l <sub>1</sub>	L <sub>c</sub>	
2,65–3,00	114	33	1									
3,00–3,35	117	36	1									
3,35–3,75	120	39	1									
3,75–4,25	124	43	1									
4,25–4,75	128	47	1									
4,75–5,30	133	52	1	155	74	1						
5,30–6,00	138	57	1	161	80	1						
6,00–6,70	144	63	1	167	86	1						
6,70–7,50	150	69	1	174	93	1						
7,50–8,50	156	75	1	181	100	1	265	165	1	330	210	1
8,50–9,50	162	81	1	188	107	1	275	175	1	345	220	1
9,50–10,60	168	87	1	197	116	1	285	185	1	360	235	1
10,60–11,80	175	94	1	206	125	1	300	195	1	375	250	1
11,80–13,20	182	101	1	215	134	1	310	205	1	395	260	1
13,20–14,00	189	108	1	223	142	1	325	220	1	410	275	1
14,00–15,00	212	114	2	245	147	2	340	220	2	425	275	2
15,00–16,00	218	120	2	251	153	2	355	230	2	445	295	2
16,00–17,00	223	125	2	257	159	2	355	230	2	445	295	2
17,00–18,00	228	130	2	263	165	2	370	245	2	465	310	2
18,00–19,00	233	135	2	269	171	2	370	245	2	465	310	2
19,00–20,00	238	140	2	275	177	2	385	260	2	490	325	2
20,00–21,20	243	145	2	282	184	2	385	260	2	490	325	2
21,20–22,40	248	150	2	289	191	2	405	270	2	515	345	2
22,40–23,02	253	155	2	296	198	2	405	270	2	515	345	2
23,02–23,60	276	155	3	319	198	3	425	270	3	535	345	3
23,60–25,00	281	160	3	327	206	3	440	290	3	555	365	3
25,00–26,50	286	165	3	335	214	3	440	290	3	555	365	3
26,50–28,00	291	170	3	343	222	3	460	305	3	580	385	3
28,00–30,00	296	175	3	351	230	3	460	305	3	580	385	3
30,00–31,50	301	180	3	360	239	3	480	320	3	610	410	3
31,50–31,75	306	185	3	369	248	3	480	320	3	610	410	3
31,75–33,50	334	185	4	397	248	4	505	320	4	635	410	4
33,50–35,50	339	190	4	406	257	4	530	340	4	665	430	4
35,50–37,50	344	195	4	416	267	4	530	340	4	665	430	4
37,50–40,00	349	200	4	426	277	4	555	360	4	695	460	4
40,00–42,50	354	205	4	436	287	4	555	360	4	695	460	4
42,50–45,00	359	210	4	447	298	4	585	385	4	735	490	4
45,00–47,50	364	215	4	459	310	4	585	385	4	735	490	4
47,50–50,00	369	220	4	470	321	4	605	405	4	765	510	4
50,00–50,80	374	225	4	485*	336*	4						
50,80–53,00	412	225	5	523*	336*	5						
53,00–56,00	417	230	5	534*	347*	5						
56,00–60,00	422	235	5	550*	363*	5						
60,00–63,00	427	240	5	566*	379*	5						
63,00–67,00	432	245	5	581*	394*	5						
67,00–71,00	437	250	5	599*	412*	5						
71,00–75,00	442	255	5	617*	430*	5						
75,00–76,20	447	260	5	637*	450*	5						
76,20–80,00	514	260	6	704*	450*	6						
80,00–85,00	519	265	6	727*	473*	6						
85,00–90,00	524	270	6	750*	496*	6						
90,00–95,00	529	275	6									
95,00–100,00	534	280	6									

\* Walter standard \*\* MT = Morse taper

## Cutting data for solid carbide and HSS NC centre drills

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining possible (M = MQL, L = dry) Cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart  * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.			Designation			A1174 A1174C			A1115/A1114 A1115S/A1114S A1115L/A1114L				
				Countersink angle			90° and 120°			90° and 120°				
				Dia. range (mm)			3,00–20,00			2,00–25,40				
				Cutting tool material			K30F			HSS				
Coating			Uncoated			Uncoated								
Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group *									
						v <sub>c</sub>	VRR							
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1					32	8	EO	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2					32	9	EO	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3					30	9	EO	
		C > 0,55 %	Annealed	190	640	P4					32	9	EO	
		C > 0,55 %	Heat-treated	300	1010	P5					21	8	EO	
		Free-machining steel (short-chipping)	Annealed	220	750	P6					32	9	EO	
	Low-alloy steel	Annealed		175	590	P7					32	9	EO	
		Heat-treated		285	960	P8					21	8	EO	
		Heat-treated		380	1280	P9					11	7	OE	
		Heat-treated		430	1480	P10					8	6	OE	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11					21	8	EO	
		Hardened and tempered		300	1010	P12					15	7	EO	
		Hardened and tempered		380	1280	P13					8	6	OE	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14					9	4	EO	
		Martensitic, heat-treated		330	1110	P15					8	4	EO	
M	Stainless steel	Austenitic, quench hardened		200	680	M1					6	3	OE	
		Austenitic, precipitation hardened (PH)		300	1010	M2					8	5	OE	
		Austenitic/ferritic, duplex		230	780	M3					5	3	OE	
K	Malleable cast iron	Ferritic		200	400	K1	45	8	EO		24	12	EO	
		Pearlitic		260	700	K2	34	6	EO		18	12	EO	
	Grey cast iron	Low strength		180	200	K3	56	8	EO		30	12	EO	
		High strength/austenitic		245	350	K4	45	8	EO		24	12	EO	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	45	8	EO		24	12	EO	
Pearlitic			265	700	K6	34	6	EO		18	12	EO		
CGI			230	400	K7	40	7	EO		21	12	EO		
N	Wrought aluminium alloys	Not hardenable		30	–	N1	220	10	EO M		63	16	EO	
		Hardenable, hardened		100	340	N2	220	10	EO M		63	16	EO	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	170	10	EO M		42	12	EO	
		≤ 12% Si, hardenable, hardened		90	310	N4	150	10	EO M		30	12	EO	
		> 12% Si, not hardenable		130	450	N5	100	9	EO					
	Magnesium-based alloys		70	250	N6	210	10		M L		30	12	M L	
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	140	7	EO		48	6	EO	
Brass, bronze, red brass			90	310	N8	100	9	EO		38	12	EO		
Copper alloys, short-chipping			110	380	N9	110	12	EO M L		67	12	EO M L		
High tensile, Ampco			300	1010	N10	50	6	EO M L		15	7	EO		
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1				6	3	OE	
			Hardened		280	940	S2	7	3	OE				
		Ni- or Co-based	Annealed		250	840	S3					6	3	OE
			Hardened		350	1180	S4	7	3	OE				
			Cast		320	1080	S5	7	3	OE				
	Titanium alloys	Pure titanium		200	680	S6	25	3	OE		10	4	EO	
		α and β alloys, hardened		375	1260	S7	17	2	OE		6	4	OE	
		β alloys		410	1400	S8								
Tungsten alloys		300	1010	S9					15	7	EO			
Molybdenum alloys		300	1010	S10					15	7	EO			
H	Hardened steel	Hardened and tempered		50 HRC	–	H1								
		Hardened and tempered		55 HRC	–	H2								
		Hardened and tempered		60 HRC	–	H3								
	Hardened cast iron		55 HRC	–	H4									
O	Thermoplastics	Without abrasive fillers				O1	40	12	EO		40	12	EO	
	Thermosetting plastics	Without abrasive fillers				O2	67	5		L	24	8	L	
	Plastic, glass-fibre reinforced	GFRP				O3	30	5		L				
	Plastic, carbon-fibre reinforced	CFRP				O4	20	5		L				
	Plastic, aramid-fibre reinforced	AFRP				O5	67	5		L	24	8	L	
	Graphite (technical)		80 Shore				O6	20	5		L			

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

## VRR: Feed rate charts for solid carbide and HSS NC centre drills

VRR	Feed f [mm] for diameter [mm]												
	0,05	0,06	0,08	0,1	0,12	0,15	0,2	0,25	0,4	0,5	0,6	0,8	1
1	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,003
2	0,001	0,001	0,001	0,001	0,001	0,001	0,001	0,002	0,003	0,003	0,004	0,005	0,007
3	0,001	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,010
4	0,001	0,001	0,001	0,001	0,002	0,002	0,003	0,003	0,005	0,007	0,008	0,011	0,013
5	0,001	0,001	0,001	0,002	0,002	0,003	0,003	0,004	0,007	0,008	0,010	0,013	0,017
6	0,001	0,001	0,002	0,002	0,002	0,003	0,004	0,005	0,008	0,010	0,012	0,016	0,020
7	0,001	0,001	0,002	0,002	0,003	0,004	0,005	0,006	0,009	0,012	0,014	0,019	0,023
8	0,001	0,002	0,002	0,003	0,003	0,004	0,005	0,007	0,011	0,013	0,016	0,021	0,027
9	0,002	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,012	0,015	0,018	0,024	0,030
10	0,002	0,002	0,003	0,003	0,004	0,005	0,007	0,008	0,013	0,017	0,020	0,027	0,033
12	0,002	0,002	0,003	0,004	0,005	0,006	0,008	0,010	0,016	0,020	0,024	0,032	0,040
16	0,003	0,003	0,004	0,005	0,006	0,008	0,011	0,013	0,021	0,027	0,032	0,043	0,053
20	0,003	0,004	0,005	0,007	0,008	0,010	0,013	0,017	0,027	0,033	0,040	0,053	0,067
25	0,004	0,005	0,007	0,008	0,010	0,013	0,017	0,021	0,033	0,042	0,050	0,067	0,083
30	0,005	0,006	0,008	0,010	0,012	0,015	0,020	0,025	0,040	0,050	0,060	0,080	0,100

VRR	Feed f [mm] for diameter [mm]												
	1,2	1,5	2	2,5	4	5	6	8	10	12	15	20	25
1	0,004	0,005	0,007	0,008	0,013	0,017	0,018	0,021	0,024	0,026	0,029	0,033	0,037
2	0,008	0,010	0,013	0,017	0,027	0,033	0,037	0,042	0,047	0,052	0,058	0,067	0,075
3	0,012	0,015	0,020	0,025	0,040	0,050	0,055	0,063	0,071	0,077	0,087	0,10	0,11
4	0,016	0,020	0,027	0,033	0,053	0,067	0,073	0,084	0,094	0,10	0,12	0,13	0,15
5	0,020	0,025	0,033	0,042	0,067	0,083	0,091	0,11	0,12	0,13	0,14	0,17	0,19
6	0,024	0,030	0,040	0,050	0,080	0,10	0,11	0,13	0,14	0,15	0,17	0,20	0,22
7	0,028	0,035	0,047	0,058	0,093	0,12	0,13	0,15	0,16	0,18	0,20	0,23	0,26
8	0,032	0,040	0,053	0,067	0,11	0,13	0,15	0,17	0,19	0,21	0,23	0,27	0,30
9	0,036	0,045	0,060	0,075	0,12	0,15	0,16	0,19	0,21	0,23	0,26	0,30	0,34
10	0,040	0,050	0,067	0,083	0,13	0,17	0,18	0,21	0,24	0,26	0,29	0,33	0,37
12	0,048	0,060	0,080	0,10	0,16	0,20	0,22	0,25	0,28	0,31	0,35	0,40	0,45
16	0,064	0,080	0,11	0,13	0,21	0,27	0,29	0,34	0,38	0,41	0,46	0,53	0,60
20	0,080	0,10	0,13	0,17	0,27	0,33	0,37	0,42	0,47	0,52	0,58	0,67	0,75
25	0,100	0,125	0,167	0,21	0,33	0,42	0,46	0,53	0,59	0,65	0,72	0,83	0,93
30	0,120	0,150	0,200	0,25	0,40	0,50	0,55	0,63	0,71	0,77	0,87	1,00	1,12

## Cutting data for solid carbide and HSS centre drills

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining possible (M = MQL, L = dry) Cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart  * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.		Standard		DIN 333									
			Designation		K1161XPL		K1161							
			Form		A		A							
			Dia. range [mm]		0,50-6,30		0,50-6,30							
Cutting tool material		K10/20		K10/20										
Coating		XPL		Uncoated										
				v <sub>c</sub>		VRR		v <sub>c</sub>		VRR				
				EO		ML		EO		ML				
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	72	6	EO	ML	48	6	EO	ML
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	68	6	EO	ML	45	6	EO	ML
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	63	6	EO	ML	42	6	EO	ML
		C > 0,55 %	Annealed	190	640	P4	68	6	EO	ML	45	6	EO	ML
		C > 0,55 %	Heat-treated	300	1010	P5	48	5	EO	ML	32	5	EO	ML
		Free-machining steel (short-chipping)	Annealed	220	750	P6	72	6	EO	ML	48	6	EO	ML
	Low-alloy steel	Annealed	175	590	P7	68	6	EO	ML	45	6	EO	ML	
		Heat-treated	285	960	P8	48	5	EO	ML	32	5	EO	ML	
		Heat-treated	380	1280	P9	32	3	OE		21	3	OE		
		Heat-treated	430	1480	P10	24	2	OE		16	2	OE		
	High-alloy steel and high-alloy tool steel	Annealed	200	680	P11	42	4	EO		28	4	EO		
		Hardened and tempered	300	1010	P12	38	4	EO		25	4	EO		
		Hardened and tempered	380	1280	P13	24	2	OE		16	2	OE		
	Stainless steel	Ferritic/martensitic, annealed	200	680	P14	42	4	EO		28	4	EO		
		Martensitic, heat-treated	330	1110	P15	32	3	EO		21	3	EO		
M	Stainless steel	Austenitic, quench hardened	200	680	M1									
		Austenitic, precipitation hardened (PH)	300	1010	M2	21	3	EO		21	3	EO		
		Austenitic/ferritic, duplex	230	780	M3									
K	Malleable cast iron	Ferritic	200	400	K1	72	8	EO	ML	40	8	EO	ML	
		Pearlitic	260	700	K2	58	7	EO	ML	32	7	EO	ML	
	Grey cast iron	Low strength	180	200	K3	86	8	EO	ML	48	8	EO	ML	
		High strength/austenitic	245	350	K4	72	8	EO	ML	40	8	EO	ML	
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	72	8	EO	ML	40	8	EO	ML	
		Pearlitic	265	700	K6	58	7	EO	ML	32	7	EO	ML	
CGI		230	400	K7	65	8	EO	ML	36	8	EO	ML		
N	Wrought aluminium alloys	Not hardenable	30	-	N1	130	5	EO		130	5	EO		
		Hardenable, hardened	100	340	N2	130	5	EO		130	5	EO		
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	105	7	EO		105	7	EO		
		≤ 12% Si, hardenable, hardened	90	310	N4	90	7	EO		90	7	EO		
		> 12% Si, not hardenable	130	450	N5	71	7	EO		71	7	EO		
	Magnesium-based alloys		70	250	N6	90	7		ML	90	7		ML	
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7	90	3	EO	M	90	3	EO	M	
		Brass, bronze, red brass	90	310	N8	75	6	EO		75	6	EO		
		Copper alloys, short-chipping	110	380	N9	80	8	EO	ML	80	8	EO	ML	
		High tensile, Ampco	300	1010	N10	48	5	EO		32	5	EO		
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	33	2	OE		22	2	OE	
			Hardened	280	940	S2	15	2	OE		15	2	OE	
		Ni- or Co-based	Annealed	250	840	S3	27	2	OE		18	2	OE	
			Hardened	350	1180	S4	10	1	OE		10	1	OE	
	Titanium alloys	Cast	320	1080	S5	12	1	OE		12	1	OE		
		Pure titanium	200	680	S6									
	Tungsten alloys	α and β alloys, hardened	375	1260	S7									
		β alloys	410	1400	S8									
Molybdenum alloys		300	1010	S9	48	5	EO		32	5	EO			
H	Hardened steel		300	1010	S10	48	5	EO		32	5	EO		
		Hardened and tempered	50 HRC	-	H1	19	2	OE		12,5	2	OE		
		Hardened and tempered	55 HRC	-	H2									
	Hardened and tempered	60 HRC	-	H3										
Hardened cast iron	Hardened and tempered	55 HRC	-	H4										
O	Thermoplastics	Without abrasive fillers			O1	45	7	EO		45	7	EO		
	Thermosetting plastics	Without abrasive fillers			O2	45	7	EO		45	7	EO		
	Plastic, glass-fibre reinforced	GFRP			O3	35	6		L	35	6		L	
	Plastic, carbon-fibre reinforced	CFRP			O4	25	5		L	25	5		L	
	Plastic, aramid-fibre reinforced	AFRP			O5	45	7		L	45	7		L	
	Graphite (technical)		80 Shore			O6	25	5		L	25	5		L

DIN 333																															
K1111TiN				K1111				K1112				K1131				K1113TiN				K1113				K1114				K1215			
A				A				A				A				R				R				R				B			
1,00-5,00				0,50-12,50				1,60-5,00				0,50-6,30				1,00-5,00				0,50-12,50				1,60-5,00				1,00-10,00			
HSS				HSS				HSS				HSS left				HSS				HSS				HSS							
TiN				Uncoated				Uncoated				Uncoated				TiN				Uncoated				Uncoated							
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR						
38	8	EO		30	7	EO		30	7	EO		30	7	EO		38	8	EO		30	7	EO		30	7	EO					
38	9	EO		30	8	EO		30	8	EO		30	8	EO		38	9	EO		30	8	EO		30	8	EO					
36	9	EO		28	8	EO		28	8	EO		28	8	EO		36	9	EO		28	8	EO		28	8	EO					
38	9	EO		30	8	EO		30	8	EO		30	8	EO		38	9	EO		30	8	EO		30	8	EO					
28	8	EO		20	7	EO		20	7	EO		20	7	EO		28	8	EO		20	7	EO		20	7	EO					
38	9	EO		30	8	EO		30	8	EO		30	8	EO		38	9	EO		30	8	EO		30	8	EO					
38	9	EO		30	8	EO		30	8	EO		30	8	EO		38	9	EO		30	8	EO		30	8	EO					
28	8	EO		20	7	EO		20	7	EO		20	7	EO		28	8	EO		20	7	EO		20	7	EO					
13	6	EO		11	6	OE		11	6	OE		11	6	OE		13	6	EO		11	6	OE		11	6	OE					
				7	5	OE		7	5	OE		7	5	OE						7	5	OE		7	5	OE					
9	4	EO		8	4	EO		8	4	EO		8	4	EO		9	4	EO		8	4	EO		8	4	EO					
21	6	EO		14	6	EO		14	6	EO		14	6	EO		21	6	EO		14	6	EO		14	6	EO					
				7	5	OE		7	5	OE		7	5	OE						7	5	OE		7	5	OE					
9	4	EO		8	4	EO		8	4	EO		8	4	EO		9	4	EO		8	4	EO		8	4	EO					
				7	4	EO		7	4	EO		7	4	EO						7	4	EO		7	4	EO					
7	4	OE		6	3	OE		6	3	OE		6	3	OE		7	4	OE		6	3	OE		6	3	OE					
13	5	OE		8	5	OE		8	5	OE		8	5	OE		13	5	OE		8	5	OE		8	5	OE					
6	4	OE		5	3	OE		5	3	OE		5	3	OE		6	4	OE		5	3	OE		5	3	OE					
34	12	EO		22	12	EO		22	12	EO		22	12	EO		34	12	EO		22	12	EO		22	12	EO					
26	10	EO		17	10	EO		17	10	EO		17	10	EO		26	10	EO		17	10	EO		17	10	EO					
42	12	EO		28	12	EO		28	12	EO		28	12	EO		42	12	EO		28	12	EO		28	12	EO					
34	12	EO		22	12	EO		22	12	EO		22	12	EO		34	12	EO		22	12	EO		22	12	EO					
34	12	EO		22	12	EO		22	12	EO		22	12	EO		34	12	EO		22	12	EO		22	12	EO					
26	10	EO		17	10	EO		17	10	EO		17	10	EO		26	10	EO		17	10	EO		17	10	EO					
30	12	EO		20	12	EO		20	12	EO		20	12	EO		30	12	EO		20	12	EO		20	12	EO					
79	12	EO		63	12	EO		63	12	EO		63	12	EO		79	12	EO		63	12	EO		63	12	EO					
79	12	EO		63	12	EO		63	12	EO		63	12	EO		79	12	EO		63	12	EO		63	12	EO					
50	12	EO		40	12	EO		40	12	EO		40	12	EO		50	12	EO		40	12	EO		40	12	EO					
35	10	EO		28	10	EO		28	10	EO		28	10	EO		35	10	EO		28	10	EO		28	10	EO					
35	10		ML	28	10		ML	28	10		ML	28	10		ML	35	10		ML	28	10		ML	28	10		ML				
56	5	EO		45	5	EO		45	5	EO		45	5	EO		56	5	EO		45	5	EO		45	5	EO					
				36	10	EO		36	10	EO		36	10	EO						36	10	EO		36	10	EO					
71	12	EO	ML	63	12	EO	ML	63	12	EO	ML	63	12	EO	ML	71	12	EO	ML	63	12	EO	ML	63	12	EO	ML				
21	6	EO		14	6	EO		14	6	EO		14	6	EO		21	6	EO		14	6	EO		14	6	EO					
7	4	OE		6	3	OE		6	3	OE		6	3	OE		7	4	OE		6	3	OE		6	3	OE					
4	3	OE		4	3	OE		6	3	OE		4	3	OE		4	3	OE		6	3	OE		4	3	OE					
				6	3	OE		6	3	OE		6	3	OE						6	3	OE		6	3	OE					
8	4	EO		8	4	EO		8	4	EO		8	4	EO		8	4	EO		8	4	EO		8	4	EO					
6	4	OE		6	4	OE		6	4	OE		6	4	OE		6	4	OE		6	4	OE		6	4	OE					
21	6	EO		14	6	EO		14	6	EO		14	6	EO		21	6	EO		14	6	EO		14	6	EO					
21	6	EO		14	6	EO		14	6	EO		14	6	EO		21	6	EO		14	6	EO		14	6	EO					
				38	12	EO		38	12	EO		38	12	EO						38	12	EO		38	12	EO					
34	8		L	22	7		L	22	7		L	22	7		L	34	8		L	22	7		L	22	7		L				
34	8		L	22	7		L	22	7		L	22	7		L	34	8		L	22	7		L	22	7		L				

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for solid carbide and HSS centre drills

(continued)

Material group	<p>  = Wet machining (E = emulsion, O = oil)   = Dry machining possible (M = MQL, L = dry)                      Cutting data must be selected from Walter GPS                       v<sub>c</sub> = Cutting speed                      VRR = Feed rate chart                       * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.                 </p>			Standard			Walter								
				Designation			K1313			K1311					
				Form			R			A					
				Dia. range [mm]			1,00-4,00			0,63-6,00					
Cutting tool material			HSS			HSS									
Coating			Uncoated			Uncoated									
<p>Overview of the main material groups and code letters</p>			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group *										
						v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	30	7	EO		30	7	EO		
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	30	8	EO		30	8	EO		
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	28	8	EO		28	8	EO		
		C > 0,55 %	Annealed	190	640	P4	30	8	EO		30	8	EO		
		C > 0,55 %	Heat-treated	300	1010	P5	20	7	EO		20	7	EO		
		Free-machining steel (short-chipping)	Annealed	220	750	P6	30	8	EO		30	8	EO		
P	Low-alloy steel	Annealed		175	590	P7	30	8	EO		30	8	EO		
		Heat-treated		285	960	P8	20	7	EO		20	7	EO		
		Heat-treated		380	1280	P9	11	6	OE		11	6	OE		
		Heat-treated		430	1480	P10	7	5	OE		7	5	OE		
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	8	4	EO		8	4	EO		
		Hardened and tempered		300	1010	P12	14	6	EO		14	6	EO		
		Hardened and tempered		380	1280	P13	7	5	OE		7	5	OE		
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	8	4	EO		8	4	EO		
		Martensitic, heat-treated		330	1110	P15	7	4	EO		7	4	EO		
M	Stainless steel	Austenitic, quench hardened		200	680	M1	6	3	OE		6	3	OE		
		Austenitic, precipitation hardened (PH)		300	1010	M2	8	5	OE		8	5	OE		
		Austenitic/ferritic, duplex		230	780	M3	4,8	3	OE		4,8	3	OE		
K	Malleable cast iron	Ferritic		200	400	K1	22	12	EO		22	12	EO		
		Pearlitic		260	700	K2	17	10	EO		17	10	EO		
	Grey cast iron	Low strength		180	200	K3	28	12	EO		28	12	EO		
		High strength/austenitic		245	350	K4	22	12	EO		22	12	EO		
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	22	12	EO		22	12	EO		
Pearlitic			265	700	K6	17	10	EO		17	10	EO			
	CGI			230	400	K7	20	12	EO		20	12	EO		
N	Wrought aluminium alloys	Not hardenable		30	-	N1	63	12	EO		63	12	EO		
		Hardenable, hardened		100	340	N2	63	12	EO		63	12	EO		
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	40	12	EO		40	12	EO		
		≤ 12% Si, hardenable, hardened		90	310	N4	28	10	EO		28	10	EO		
		> 12% Si, not hardenable		130	450	N5									
	Magnesium-based alloys			70	250	N6	28	10		ML	28	10		ML	
				100	340	N7	45	5	EO		45	5	EO		
Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	45	5	EO		45	5	EO			
	Brass, bronze, red brass		90	310	N8	36	10	EO		36	10	EO			
	Copper alloys, short-chipping		110	380	N9	63	12	EO	ML	63	12	EO	ML		
	High tensile, Ampco		300	1010	N10	14	6	EO		14	6	EO			
S	Heat-resistant alloys	Fe-based	Annealed		200	680	S1	6	3	OE		6	3	OE	
			Hardened		280	940	S2	4	3	OE		4	3	OE	
		Ni- or Co-based	Annealed		250	840	S3	6	3	OE		6	3	OE	
			Hardened		350	1180	S4								
		Cast		320	1080	S5									
	Titanium alloys	Pure titanium		200	680	S6	8	4	EO		8	4	EO		
α and β alloys, hardened			375	1260	S7	6	4	OE		6	4	OE			
β alloys			410	1400	S8										
Tungsten alloys		300	1010	S9	14	6	EO		14	6	EO				
Molybdenum alloys		300	1010	S10	14	6	EO		14	6	EO				
H	Hardened steel	Hardened and tempered		50 HRC	-	H1									
		Hardened and tempered		55 HRC	-	H2									
		Hardened and tempered		60 HRC	-	H3									
Hardened cast iron	Hardened and tempered		55 HRC	-	H4										
O	Thermoplastics	Without abrasive fillers				O1	38	12	EO		38	12	EO		
	Thermosetting plastics	Without abrasive fillers				O2	22	7		L	22	7	L		
	Plastic, glass-fibre reinforced	GFRP				O3									
	Plastic, carbon-fibre reinforced	CFRP				O4									
	Plastic, aramid-fibre reinforced	AFRP				O5	22	7		L	22	7	L		
	Graphite (technical)		80 Shore				O6								

		Walter						ANSI B 94.11 M-1979						B.S. 328					
		K1411S			K1411M			K1411L			K1811			K1911					
		A			A			A			A			A					
		0,75-5,00			0,75-4,00			2,00-4,00			0,64-7,97			1,19-7,94					
		HSS			HSS			HSS			HSS			HSS					
		Uncoated			Uncoated			Uncoated			Uncoated			Uncoated					
		$v_c$	VRR		$v_c$	VRR		$v_c$	VRR		$v_c$	VRR		$v_c$	VRR				
		30	7	EO				30	7	EO				30	7	EO			
		30	8	EO				30	8	EO				30	8	EO			
		28	8	EO				28	8	EO				28	8	EO			
		30	8	EO				30	8	EO				30	8	EO			
		20	7	EO				20	7	EO				20	7	EO			
		30	8	EO				30	8	EO				30	8	EO			
		30	8	EO				30	8	EO				30	8	EO			
		20	7	EO				20	7	EO				20	7	EO			
		11	6	OE				11	6	OE				11	6	OE			
		7	5	OE				7	5	OE				7	5	OE			
		8	4	EO				8	4	EO				8	4	EO			
		14	6	EO				14	6	EO				14	6	EO			
		7	5	OE				7	5	OE				7	5	OE			
		8	4	EO				8	4	EO				8	4	EO			
		7	4	EO				7	4	EO				7	4	EO			
		6	3	OE				6	3	OE				6	3	OE			
		8	5	OE				8	5	OE				8	5	OE			
		4,8	3	OE				4,8	3	OE				5	3	OE			
		22	12	EO				22	12	EO				22	12	EO			
		17	10	EO				17	10	EO				17	10	EO			
		28	12	EO				28	12	EO				28	12	EO			
		22	12	EO				22	12	EO				22	12	EO			
		22	12	EO				22	12	EO				22	12	EO			
		17	10	EO				17	10	EO				17	10	EO			
		20	12	EO				20	12	EO				20	12	EO			
		63	12	EO				63	12	EO				63	12	EO			
		63	12	EO				63	12	EO				63	12	EO			
		40	12	EO				40	12	EO				40	12	EO			
		28	10	EO				28	10	EO				28	10	EO			
		28	10		ML			28	10		ML			28	10		ML		
		45	5	EO				45	5	EO				45	5	EO			
		36	10	EO				36	10	EO				36	10	EO			
		63	12	EO	ML			63	12	EO	ML			63	12	EO	ML		
		14	6	EO				14	6	EO				14	6	EO			
		6	3	OE				6	3	OE				6	3	OE			
		4	3	OE				4	3	OE				4	3	OE			
		6	3	OE				6	3	OE				6	3	OE			
		8	4	EO				8	4	EO				8	4	EO			
		6	4	OE				6	4	OE				6	4	OE			
		14	6	EO				14	6	EO				14	6	EO			
		14	6	EO				14	6	EO				14	6	EO			
		38	12	EO				38	12	EO				38	12	EO			
		22	7		L			22	7		L			22	7		L		
		22	7		L			22	7		L			22	7		L		

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

## VRR: Feed rate charts for solid carbide and HSS centre drills

VRR	Feed f [mm] for diameter [mm]													
	0,5	0,6	0,8	1	1,2	1,5	2	2,5	4	5	6	8	10	12
1	0,002	0,002	0,003	0,003	0,004	0,005	0,007	0,008	0,013	0,017	0,018	0,021	0,024	0,026
2	0,003	0,004	0,005	0,007	0,008	0,010	0,013	0,017	0,027	0,033	0,037	0,042	0,047	0,052
3	0,005	0,006	0,008	0,010	0,012	0,015	0,020	0,025	0,040	0,050	0,055	0,063	0,071	0,077
4	0,007	0,008	0,011	0,013	0,016	0,020	0,027	0,033	0,053	0,067	0,073	0,084	0,094	0,10
5	0,008	0,010	0,013	0,017	0,020	0,025	0,033	0,042	0,067	0,083	0,091	0,11	0,12	0,13
6	0,010	0,012	0,016	0,020	0,024	0,030	0,040	0,050	0,080	0,10	0,11	0,13	0,14	0,15
7	0,012	0,014	0,019	0,023	0,028	0,035	0,047	0,058	0,093	0,12	0,13	0,15	0,16	0,18
8	0,013	0,016	0,021	0,027	0,032	0,040	0,053	0,067	0,11	0,13	0,15	0,17	0,19	0,21
9	0,015	0,018	0,024	0,030	0,036	0,045	0,060	0,075	0,12	0,15	0,16	0,19	0,21	0,23
10	0,017	0,020	0,027	0,033	0,040	0,050	0,067	0,083	0,13	0,17	0,18	0,21	0,24	0,26
12	0,020	0,024	0,032	0,040	0,048	0,060	0,080	0,10	0,16	0,20	0,22	0,25	0,28	0,31
16	0,027	0,032	0,043	0,053	0,064	0,080	0,11	0,13	0,21	0,27	0,29	0,34	0,38	0,41
20	0,033	0,040	0,053	0,067	0,080	0,10	0,13	0,17	0,27	0,33	0,37	0,42	0,47	0,52
25	0,042	0,050	0,067	0,083	0,100	0,125	0,167	0,21	0,33	0,42	0,46	0,53	0,59	0,65
30	0,050	0,060	0,080	0,100	0,120	0,150	0,200	0,25	0,40	0,50	0,55	0,63	0,71	0,77

### Centre drill forms in accordance with DIN 333

Form A	Form B	Form R

## Designation key for Walter Titex solid drills

Example:

<b>D</b>	<b>C</b>	<b>1</b>	<b>80</b>	<b>-</b>	<b>05</b>	<b>-</b>	<b>03.000</b>	<b>A</b>	<b>1</b>	<b>-</b>	<b>W</b>	<b>J</b>	<b>30</b>	<b>EZ</b>
1	2	3	4	5	6		7	8	9		Grade			

1	2	3	4	5
<b>Tool group</b>	<b>Generation</b>	<b>Tool type</b>	<b>Tool type</b>	<b>1. Delimiters</b>
<b>D</b> Drilling		<b>1</b> Cylindrical drill <b>2</b> Chamfer drill	<b>10</b> Perform type N <b>50</b> Perform Universal <b>30</b> Advance micro drill <b>60</b> Advance Universal <b>65</b> Advance ISO K, ISO N <b>18</b> Supreme 180° point angle <b>31</b> Supreme micro pilot drill <b>33</b> Supreme micro drill <b>66</b> Supreme ISO N <b>70</b> Supreme ISO P, ISO K <b>75</b> Supreme ISO M, ISO S <b>80</b> Supreme Universal <b>83</b> Supreme three-edge tool	- Metric . Inches

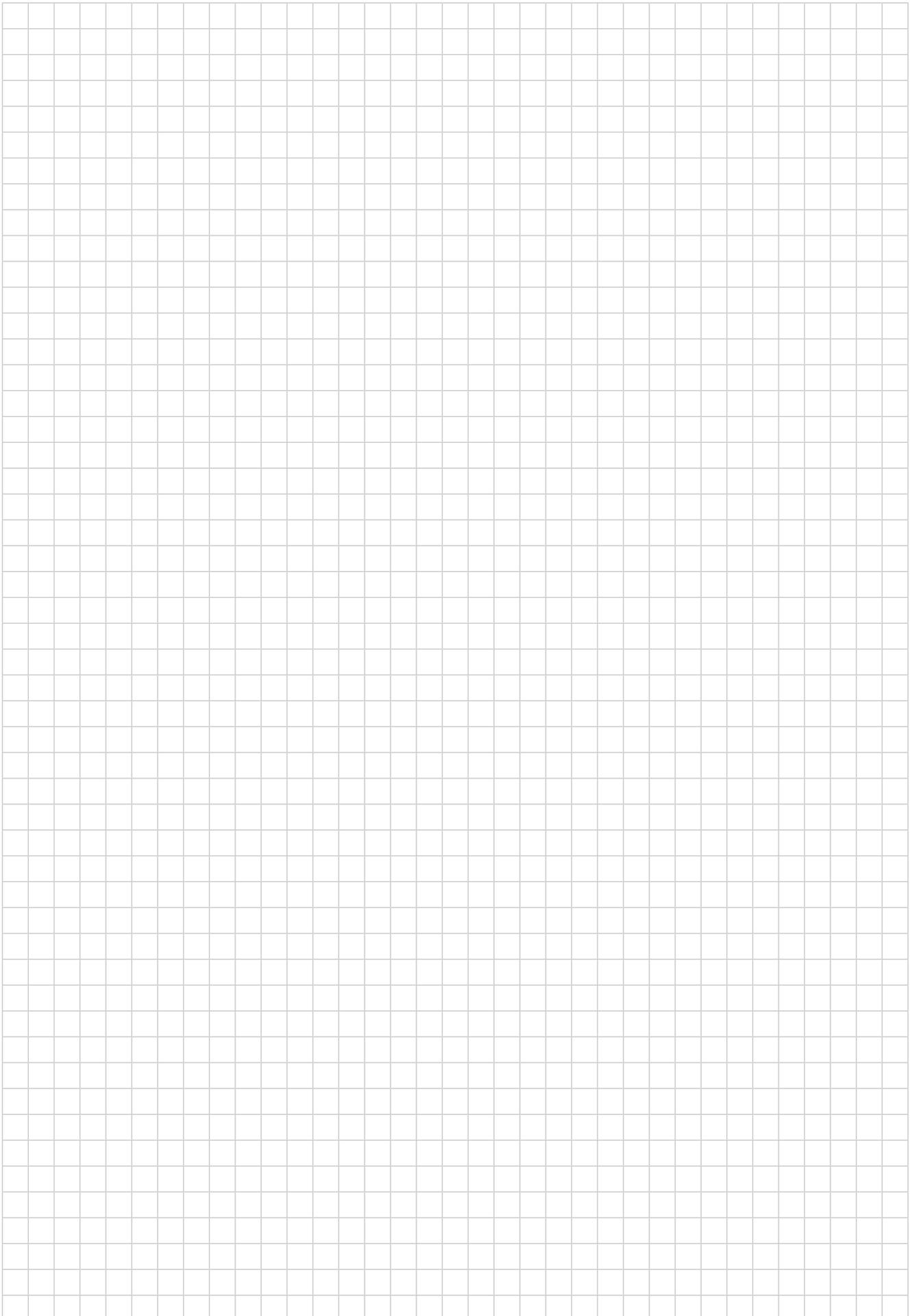
6	7	8	9
<b>Drilling depth</b>	<b>Cutting diameter</b>	<b>Shank type</b>	<b>Cooling</b>
<b>02</b> $\approx 2 \times D_c$ In accordance with Walter standard <b>03</b> $\approx 3 \times D_c$ In accordance with DIN 6537 short <b>05</b> $\approx 5 \times D_c$ In accordance with DIN 6537 long or in accordance with Walter standard <b>08</b> $\approx 8 \times D_c$ In accordance with Walter standard In accordance with DIN 338 <b>12</b> $\approx 12 \times D_c$ In accordance with Walter standard <b>16</b> $\approx 16 \times D_c$ In accordance with Walter standard <b>20</b> $\approx 20 \times D_c$ In accordance with Walter standard <b>25</b> $\approx 25 \times D_c$ In accordance with Walter standard <b>30</b> $\approx 30 \times D_c$ In accordance with Walter standard		<b>A</b> Cylindrical shank DIN 6535 HA <b>F</b> Cylindrical shank DIN 6535 HE <b>U</b> Cylindrical shank <b>D</b> Cylindrical shank DIN 6535 HB/ DIN 6535 HE	<b>0</b> External coolant <b>1</b> Axial internal coolant

## Grade designation key for solid carbide and HSS cutting tool materials

Example:

W	J	30	EY
Walter	1	2	3

1		2		3																											
Substrate		Application range		Coating																											
Solid carbide	J	Wear resistance		<table border="0"> <tr> <td style="padding-right: 10px;"><b>EJ</b></td> <td>TiAlN (AlCrN)</td> </tr> <tr> <td><b>RE</b></td> <td>TiAlN</td> </tr> <tr> <td><b>TA</b></td> <td>TiAlN</td> </tr> <tr> <td><b>EL</b></td> <td>AlCrN</td> </tr> <tr> <td><b>ER</b></td> <td>AlCrN tip coating</td> </tr> <tr> <td><b>UU</b></td> <td>Uncoated</td> </tr> <tr> <td><b>ET</b></td> <td>TiSiAlCrN/AlTiN</td> </tr> <tr> <td><b>EU</b></td> <td>TiSiAlCrN/AlTiN tip coating</td> </tr> <tr> <td><b>AJ</b></td> <td>TiN tip coating</td> </tr> <tr> <td><b>RZ</b></td> <td>TiAlSiN (HiPIMS)</td> </tr> <tr> <td><b>RY</b></td> <td>TiAlSiN (HiPIMS) tip coating</td> </tr> <tr> <td><b>EZ</b></td> <td><b>Krato-tec™</b> AlTiN</td> </tr> <tr> <td><b>EY</b></td> <td><b>Krato-tec™</b> AlTiN tip coating</td> </tr> </table>		<b>EJ</b>	TiAlN (AlCrN)	<b>RE</b>	TiAlN	<b>TA</b>	TiAlN	<b>EL</b>	AlCrN	<b>ER</b>	AlCrN tip coating	<b>UU</b>	Uncoated	<b>ET</b>	TiSiAlCrN/AlTiN	<b>EU</b>	TiSiAlCrN/AlTiN tip coating	<b>AJ</b>	TiN tip coating	<b>RZ</b>	TiAlSiN (HiPIMS)	<b>RY</b>	TiAlSiN (HiPIMS) tip coating	<b>EZ</b>	<b>Krato-tec™</b> AlTiN	<b>EY</b>	<b>Krato-tec™</b> AlTiN tip coating
	<b>EJ</b>					TiAlN (AlCrN)																									
<b>RE</b>	TiAlN																														
<b>TA</b>	TiAlN																														
<b>EL</b>	AlCrN																														
<b>ER</b>	AlCrN tip coating																														
<b>UU</b>	Uncoated																														
<b>ET</b>	TiSiAlCrN/AlTiN																														
<b>EU</b>	TiSiAlCrN/AlTiN tip coating																														
<b>AJ</b>	TiN tip coating																														
<b>RZ</b>	TiAlSiN (HiPIMS)																														
<b>RY</b>	TiAlSiN (HiPIMS) tip coating																														
<b>EZ</b>	<b>Krato-tec™</b> AlTiN																														
<b>EY</b>	<b>Krato-tec™</b> AlTiN tip coating																														
HSS	Z	Toughness																													



## Designation key for Walter drilling tools with indexable or exchangeable tips

Example:

<b>D</b>	<b>3</b>	<b>1</b>	<b>20</b>	<b>—</b>	<b>03</b>	<b>—</b>	<b>58.00</b>	<b>F40</b>	<b>—</b>	<b>P27</b>
1	2	3	4	5	6	7	8	9		

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
<b>Tool group</b>	<b>Generation</b>	<b>Tool type</b>	<b>Tool type</b>	<b>1st separator</b>
<b>D</b> Drilling (holemaking)		<b>1</b> Cylindrical holemaking tool <b>2</b> Chamfer drill <b>5</b> Chamfering tool	<b>20</b> Indexable insert drills with square indexable inserts  <b>40</b> Exchangeable-tip drill with P600x  <b>42</b> Double-sided Exchangeable-tip drill with DS42  <b>70</b> Indexable insert-Drill with Cartridges  <b>80</b> Compact chamfering tool	<b>—</b> Metric <b>.</b> Inch

<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>Drilling depth / Chamfer angle</b>	<b>Cutting diameter / clamping diameter Chamfering tool</b>	<b>Shank type and size, cylindrical</b>	<b>Insert size / interface size</b>
<b>01</b> $1,3 \times D_c$ <b>02</b> $2 \times D_c / 2,5 \times D_c$ <b>03</b> $3 \times D_c$ <b>04</b> $4 \times D_c$ <b>05</b> $5 \times D_c$ <b>07</b> $7 \times D_c$ <b>10</b> $10 \times D_c$ <b>45</b> 45° Chamfer angle		<b>F16</b> 16 mm <b>F20</b> 20 mm <b>F25</b> 25 mm <b>F32</b> 32 mm <b>F40</b> 40 mm <b>A12</b> 12 mm <b>A16</b> 16 mm <b>A20</b> 20 mm <b>A25</b> 25 mm <b>A13</b> 0,500 inch <b>A15</b> 0,625 inch <b>A19</b> 0,750 inch <b>A26</b> 1,000 inch	 <b>A</b> . .  <b>W</b>  <b>P41</b> P484 Size 1 . .  <b>P48</b> P484 Size 8  <b>P21</b> P284 Size 1 . .  <b>P27</b> P284 Size 7

## Designation key for exchangeable tips for drilling from solid

Example:

<b>P600</b>	<b>6</b>	—	<b>D 37,99</b>	<b>R</b>	<b>WPP25</b>
1	2		3	4	5

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Walter exchangeable tips Designation</b>	<b>Walter geometry</b>	<b>Insert diameter</b>	<b>Cutting direction</b>
<b>P600x</b> for D4140 / D4240 / B401 . .	<b>1</b> for ISO P <b>3</b> for ISO M, ISO S <b>4</b> for ISO N <b>5</b> for ISO K <b>6</b> for ISO P	<b>D</b> in mm	<b>R</b> right cutting
			<b>5</b>
			<b>Cutting tool materials</b>

## Designation key for double-sided exchangeable tips for solid drilling

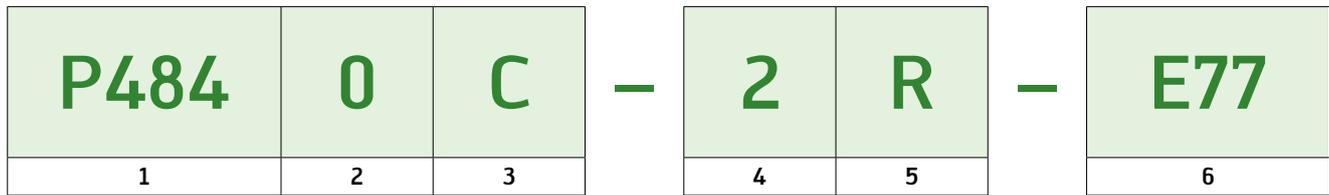
Example:

<b>DS42</b>	—	<b>25,70</b>	<b>A</b>	—	<b>F58 WPP25</b>
1		2	3		4 5

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Walter designation for double-sided exchangeable tips</b>	<b>Insert diameter</b>	<b>Insert size / Interface size</b>	<b>Walter geometry</b>
<b>DS42</b> for D5142	in mm	 <b>A</b> . . . <b>W</b>	<b>F58</b> for ISO P, ISO K
			<b>5</b>
			<b>Cutting tool materials</b>

## Designation key for square Indexable inserts for drilling from solid

Example:



1
<b>Walter Indexable insert designation</b>
<b>P284</b> for D3120
<b>P484</b> for D4120, D4170 and B421 .

2
<b>Design</b>
<b>0</b> Fully ground circumference
<b>1</b> Fully sintered circumference

3
<b>Position</b>
<b>C</b> Centre insert
<b>P</b> Outer insert
<b>S</b> Centre and outer insert identical

4
<b>Insert size</b>
<b>P284</b>
<b>1</b> D <sub>c</sub> = 16,00–20,00
<b>2</b> D <sub>c</sub> = 21,00–25,00
<b>3</b> D <sub>c</sub> = 26,00–30,00
<b>4</b> D <sub>c</sub> = 31,00–36,00
<b>5</b> D <sub>c</sub> = 37,00–42,00
<b>6</b> D <sub>c</sub> = 43,00–50,00
<b>7</b> D <sub>c</sub> = 50,50–58,00
<b>P484</b>
<b>1</b> D <sub>c</sub> = 13,50–16,00
<b>2</b> D <sub>c</sub> = 16,50–20,00
<b>3</b> D <sub>c</sub> = 20,50–24,00
<b>4</b> D <sub>c</sub> = 24,50–29,00
<b>5</b> D <sub>c</sub> = 29,50–35,00
<b>6</b> D <sub>c</sub> = 36,00–42,00
<b>7</b> D <sub>c</sub> = 43,00–50,00
<b>8</b> D <sub>c</sub> = 51,00–59,00

5
<b>Cutting direction</b>
<b>R</b> right cutting
<b>N</b> neutral

6
<b>Walter geometry</b>
<b>A57</b> the stable one
<b>E57</b> the universal one
<b>E67</b> the positive one
<b>E77</b> the sharp one

## Designation key according to ISO 1832 for Indexable inserts for Drilling from solid

Example:

<b>L</b>	<b>C</b>	<b>G</b>	<b>X</b>	<b>06</b>	<b>T2</b>	<b>04</b>	<b>—</b>	<b>E77</b>
1	2	3	4	5	6	7		8

1	
Insert shape	
L	W
T	

2	
Clearance angle	
C	O

3			
Tolerances			
	Permissible deviation in mm for		
	d	m	s
	<b>E</b>	$\pm 0,025$	$\pm 0,025$
<b>M</b>	$\pm 0,05-0,152$	$\pm 0,08-0,202$	$\pm 0,130$
<sup>1</sup> Inserts with Ground face cutting edges <sup>2</sup> depending on Insert size (see ISO standard 1832)			

4	
Machining and fastening features	
A	X
B	

Drawing or exact description of der Indexable insert required

5	
Cutting edge length	

6	
Insert thickness	
<b>02</b>	s = 2,38
<b>T2</b>	s = 2,78
<b>03</b>	s = 3,18
<b>T3</b>	s = 3,97
<b>04</b>	s = 4,76
<b>05</b>	s = 5,56
<b>06</b>	s = 6,35

7	
Corner radius	
<b>02</b>	r = 0,2 mm
<b>04</b>	r = 0,4 mm
<b>08</b>	r = 0,8 mm

8	
Walter geometry	
<b>A57</b>	the stable one
<b>E57</b>	the universal one
<b>E67</b>	the positive one
<b>E77</b>	the sharp one

## Designation key for Cutting material grades for Indexable inserts for Solid drilling

Example:

W	N	N	15	
Walter	1	2	3	4

1	2	3	4
1st Primary application or type of coating	2nd Primary application	ISO application range	Generation
<b>P</b> Steel <b>M</b> Stainless steel <b>K</b> Cast iron <b>N</b> NF metals <b>S</b> Materials that are difficult to machine <b>H</b> Hardness materials  <b>A</b> CVD aluminium coating <b>X</b> PVD coating	<b>P</b> Steel <b>M</b> Stainless steel <b>K</b> Cast iron <b>N</b> NF metals <b>S</b> Materials that are difficult to machine <b>H</b> Hardness materials	Wear resistance 01 10 15 20 25 30 35 45 Toughness	<b>C</b> Color Select <b>G</b> Tiger-tec® Gold <b>S</b> Tiger-tec® Silver

## Geometry designation key for Indexable inserts for Drilling from solid

Example:

E	7	7
1	2	3

1	2	3
Chip breaker groove	Cutting edge	Flank face design
smaller larger A = 0° B = 6° D = 10° E = 15° F = 16° G = 20° K = 25°	thick honed sharp 2 5 8	5 6 7 8

## Calculation formulae for boring and precision boring

### Speed

$$n = \frac{v_c \times 1000}{D_c \times \pi} \quad [\text{min}^{-1}]$$

### Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{1000} \quad [\text{m/min}]$$

### Feed per revolution

$$f = f_z \times z \quad [\text{mm}]$$

### Feed rate

$$v_f = f \times n \quad [\text{mm/min}]$$

### Metal removal rate (drilling from solid)

$$Q = \frac{v_f \times \pi \times (D_c^2 - D_p^2)}{4 \times 1000} \quad [\text{cm}^3/\text{min}]$$

### Power requirement

$$P_c = \frac{Q \times k_c}{6000} \quad [\text{kW}]$$

$$P_{\text{mot}} = \frac{P_c}{\eta} \quad [\text{kW}]$$

### Torque

$$M_c = \frac{P_c \times 9500}{\eta} \quad [\text{Nm}]$$

### Feed force

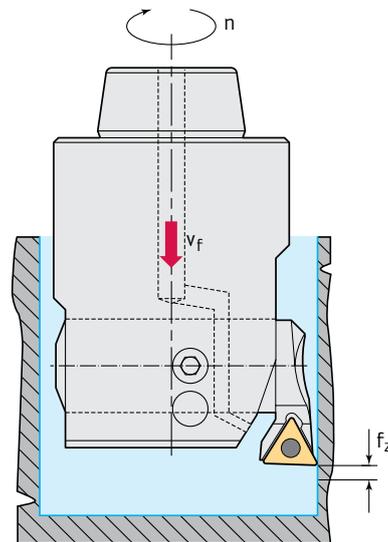
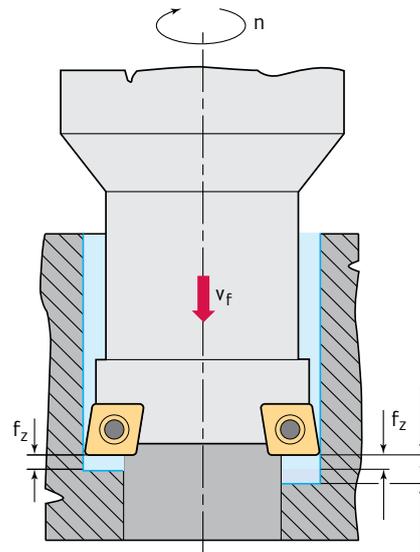
$$F_f = 0,63 \times \frac{f \times (D_c - D_p) \times k_c}{2} \quad [\text{N}]$$

### Specific cutting force

$$k_c = \frac{k_{c1.1}}{h^{m_c}}$$

### Chip thickness

$$h = f_z \times \sin \kappa \quad [\text{mm}]$$



n	Speed	rpm
D <sub>c</sub>	Cutting diameter	mm
D <sub>p</sub>	Start hole	mm
z	Number of teeth	
v <sub>c</sub>	Cutting speed	m/min
v <sub>f</sub>	Feed rate	mm/min
f <sub>z</sub>	Feed per tooth	mm
f	Feed per revolution	mm
A	Chip cross section	mm <sup>2</sup>
Q	Metal removal rate	cm <sup>3</sup> /min
P <sub>mot</sub>	Drive power	kW
P <sub>c</sub>	Effective power	kW
M <sub>c</sub>	Torque	Nm
F <sub>f</sub>	Feed force	N
h	Chip thickness	mm
k <sub>c</sub>	Specific cutting force	N/mm <sup>2</sup>
η	Machine efficiency (0.7–0.95)	
κ	Lead angle	°
k <sub>c1.1</sub> *	Specific cutting force for 1 mm <sup>2</sup> chip cross section with h = 1 mm	N/mm <sup>2</sup>
m <sub>c</sub> *	Increase in the k <sub>c</sub> curve	

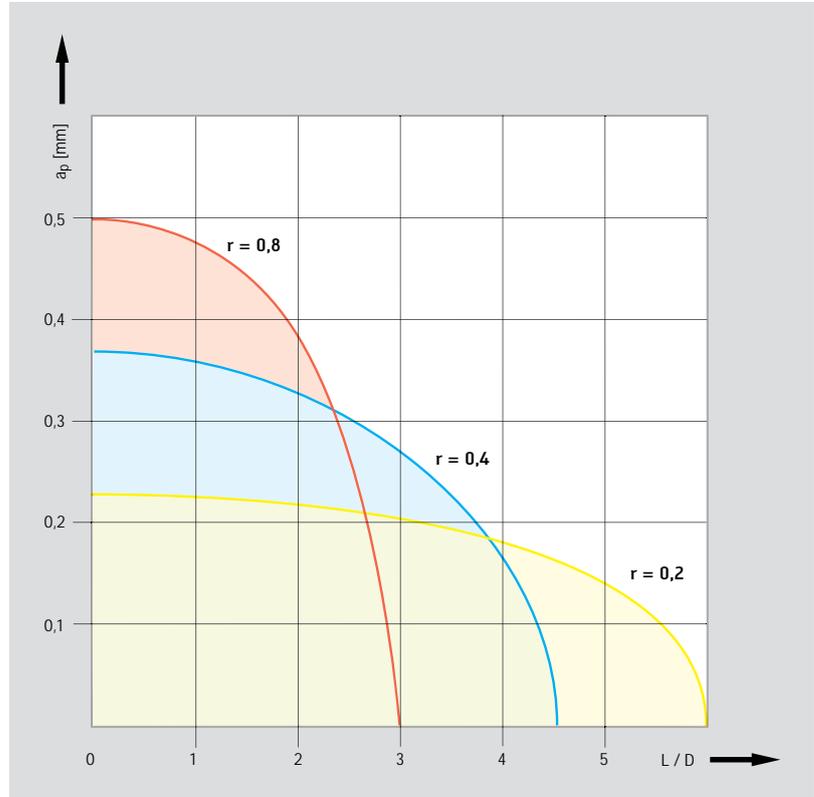
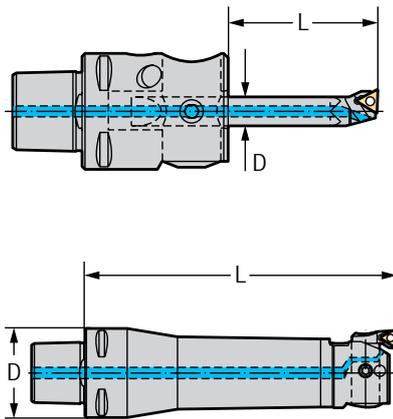
\* For m<sub>c</sub> and k<sub>c1.1</sub>: see the "General" section of the Technical Compendium, page F7.

## Determining the feed – Precision boring

### Selecting the corner radius

Select the **corner radius  $r$**  and the **depth of cut  $a_p$**  on the basis of the adjacent diagram.

Select the maximum possible corner radius with reference to the relevant length-to-diameter ratio ( $L/D$ ).



### Determining the feed

Select the maximum feed depending on the specified surface quality of the workpiece and the selected corner radius of the indexable insert.

Indexable insert corner radius	Depth of surface roughness [ $\mu\text{m}$ ]									
	Max. feed $f$ [mm/rev]									
	0,03		0,06		0,09		0,12		0,15	
$r$ [mm]	$R_{\text{max}}$	$R_a$	$R_{\text{max}}$	$R_a$	$R_{\text{max}}$	$R_a$	$R_{\text{max}}$	$R_a$	$R_{\text{max}}$	$R_a$
0,2	0,56	0,14	2,26	0,58	5,13	1,32	9,21	3,38	14,60	3,79
0,4	0,28	0,07	1,13	0,29	2,54	0,65	4,53	1,16	7,09	1,83

### Cutting data for precision boring (boring bars)

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	 	Cutting material grade				
								Starting values for cutting speed v <sub>c</sub> [m/min]				
								3 × D <sub>c</sub>	4 × D <sub>c</sub>	5 × D <sub>c</sub>		
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●		355	230	100	
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●		335	210	80	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●		300	190	80	
		C > 0,55 %	Annealed	190	639	P4	●●		290	180	70	
		C > 0,55 %	Heat-treated	300	1013	P5	●●		255	160	60	
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●●	●	300	190	80	
	Low-alloy steel			Annealed	175	591	P7	●●		330	210	80
				Heat-treated	300	1013	P8	●●		275	170	70
				Heat-treated	380	1282	P9	●●		245	150	60
				Heat-treated	430	1477	P10	●●		200	120	40
	High-alloy steel and high-alloy tool steel			Annealed	200	675	P11	●●		275	170	70
				Hardened and tempered	300	1013	P12	●●		230	140	60
	Stainless steel			Hardened and tempered	400	1361	P13	●●		210	130	50
				Ferritic/martensitic, annealed	200	675	P14	●●		275	170	70
				Martensitic, heat-treated	330	1114	P15	●●		210	130	50
M	Stainless steel			Austenitic, quench hardened	200	675	M1	●●				
				Austenitic, precipitation hardened (PH)	300	1013	M2	●●				
				Austenitic/ferritic, duplex	230	778	M3	●●				
K	Malleable cast iron			Ferritic	200	675	K1	●●	●	280	170	70
				Pearlitic	260	867	K2	●●	●	220	140	60
	Grey cast iron			Low strength	180	602	K3	●●	●	300	190	80
				High strength/austenitic	245	825	K4	●●	●	220	140	60
	Cast iron with spheroidal graphite			Ferritic	155	518	K5	●●		275	170	70
				Pearlitic	265	885	K6	●●		255	160	60
CGI				200	675	K7	●●		235	140	50	
N	Wrought aluminium alloys			Not hardenable	30	-	N1	●●				
				Hardenable, hardened	100	343	N2	●●				
	Cast aluminium alloys			≤ 12% Si, not hardenable	75	260	N3	●●				
				≤ 12% Si, hardenable, hardened	90	314	N4	●●				
				> 12% Si, not hardenable	130	447	N5	●●				
	Magnesium-based alloys					70	250	N6	●●			
	Copper and copper alloys (bronze/brass)			Non-alloyed, electrolytic copper	100	343	N7	●●		285	160	
				Brass, bronze, red brass	90	314	N8	●●		345	190	
		Copper alloys, short-chipping	110	382	N9	●●						
		High tensile, Ampco	300	1013	N10							
S	Heat-resistant alloys	Fe-based	Annealed	200	675	S1	●●					
			Hardened	280	943	S2	●●					
		Ni- or Co-based	Annealed	250	839	S3	●●					
			Hardened	350	1177	S4	●●					
			Cast	320	1076	S5	●●					
	Titanium alloys			Pure titanium	200	675	S6					
				α and β alloys, hardened	375	1262	S7	●●				
		β alloys	410	1396	S8	●●						
Tungsten alloys				300	1013	S9						
Molybdenum alloys				300	1013	S10						
H	Hardened steel			50 HRC	-	H1	●●	●				
				55 HRC	-	H2	●●	●				
				60 HRC	-	H3	●●	●				
	Hardened cast iron			55 HRC	-	H4	●●					
O	Thermoplastics	Without abrasive fillers				O1						
	Thermosetting plastics	Without abrasive fillers				O2						
	Plastic, glass-fibre reinforced	GFRP				O3						
	Plastic, carbon-fibre reinforced	CFRP				O4						
	Plastic, aramid-fibre reinforced	AFRP				O5						
	Graphite (technical)			80 Shore		O6						

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Cutting material grade																							
Starting values for cutting speed v <sub>c</sub> [m/min]																							
HC																							
WTP35			WSM10S			WSM20S / WSM30S			WAK15			WNN10			WPP10G			WPP20G / WPP30G			WMP20S		
L/D			L/D			L/D			L/D			L/D			L/D			L/D			L/D		
3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>
260	160	65							310	200	85	260	160	65	355	230	100	320	190	50	260	150	30
220	140	55							290	180	70	220	140	55	335	210	80	300	170	40	220	130	30
200	130	50							260	160	65	200	130	50	300	190	75	270	150	38	200	120	30
190	120	45							250	160	60	190	120	45	290	180	70	260	150	35	190	110	20
140	90	35							220	140	55	140	90	35	255	160	63	230	130	33	140	80	20
200	130	50							260	160	65	200	130	50	300	190	75	270	150	38	200	120	30
220	140	55							290	180	70	220	140	55	330	210	80	300	170	40	220	130	30
180	110	45							240	150	60	180	110	45	275	170	70	250	140	35	180	100	20
130	80	30							210	130	50	130	80	30	245	140	29	220	130	30	130	80	20
100	60	25							180	110	35	100	60	25	200	120	40	190	110	25	100	60	10
180	110	45							240	150	60	180	110	45	275	170	70	250	140	35	180	100	20
160	100	40							200	130	50	160	100	40	230	130	29	210	120	30	160	90	20
110	70	30							190	120	40	110	70	30	210	130	45	200	110	25	110	70	20
160	100	40							240	150	60	160	100	40	275	170	70	250	140	35	160	90	20
150	90	35							180	110	40	150	90	35	210	130	50	190	110	30	150	90	20
200	130	50	220	140	55	200	130	50	240	120		200	130	50				230	130	35	200	120	30
150	100	40	160	110	50	150	100	45	190	100		150	90	30				170	100	30	150	90	20
180	120	50	180	110	45	170	110	40	220	110		180	110	40				190	110	25	170	100	20
180	110	40							240	150	55	180	110	40	280	170	65	250	140	35			
160	100	40							190	120	50	160	100	40	220	140	58	200	120	30			
220	140	50							260	160	65	200	130	50	300	190	75	270	160	40			
160	100	40							190	120	50	160	100	40	220	140	58	200	120	30			
180	110	45							240	150	60	180	110	45	275	170	70	250	140	35			
160	100	40							220	140	55	160	100	40	255	160	63	230	130	35			
									200	130	50				235	140	53						
600	380	165										600	380	165									
500	320	140										500	320	140									
500	320	140										500	320	140									
400	260	110										400	260	110									
300	200	100										300	200	100									
450	290	125										450	290	125									
350	220	90										350	220	90	285	140							
						250	130		250	130					345	170		260	130		250	130	
						300	150		300	150								310	160		300	150	
			90	60	25	80	50	20	80	50	20							90	50	15	80	50	20
			80	50	25	70	50	20	70	50	20							80	50	15	70	50	20
			80	50	25	70	50	20	70	50	20							80	50	15	70	50	20
			60	40	20	50	30	15	50	30	15							60	40	10	50	30	10
			60	40	20	50	30	15	50	30	15							60	40	10	50	30	10
			60	40	20	50	30	15													50	40	20

HC = Coated carbide

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for precision boring (boring bars)

(continued)

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength $R_m$ [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>		Cutting material grade		
								Starting values for cutting speed $v_c$ [m/min]		
								HW	WN10	L/D
				$3 \times D_c$	$4 \times D_c$	$6 \times D_c$				
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●			
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●			
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●			
		C > 0,55 %	Annealed	190	639	P4	●●			
		C > 0,55 %	Heat-treated	300	1013	P5	●●			
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●● ●			
	Low-alloy steel	Annealed		175	591	P7	●●			
		Heat-treated		300	1013	P8	●●			
		Heat-treated		380	1282	P9	●●			
		Heat-treated		430	1477	P10	●●			
High-alloy steel and high-alloy tool steel	Annealed		200	675	P11	●●				
	Hardened and tempered		300	1013	P12	●●				
	Hardened and tempered		400	1361	P13	●●				
Stainless steel	Ferritic/martensitic, annealed		200	675	P14	●●				
	Martensitic, heat-treated		330	1114	P15	●●				
M	Stainless steel	Austenitic, quench hardened		200	675	M1	●●			
		Austenitic, precipitation hardened (PH)		300	1013	M2	●●			
		Austenitic/ferritic, duplex		230	778	M3	●●			
K	Malleable cast iron	Ferritic		200	675	K1	●● ●	160	120	90
		Pearlitic		260	867	K2	●● ●	150	120	90
	Grey cast iron	Low strength		180	602	K3	●● ●	210	170	120
		High strength/austenitic		245	825	K4	●● ●	150	120	90
	Cast iron with spheroidal graphite	Ferritic		155	518	K5	●●	170	140	100
		Pearlitic		265	885	K6	●●	140	110	70
CGI			200	675	K7	●●				
N	Wrought aluminium alloys	Not hardenable		30	-	N1	●●	750	600	400
		Hardenable, hardened		100	343	N2	●●	600	480	330
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●●	600	480	330
		≤ 12% Si, hardenable, hardened		90	314	N4	●●	450	360	250
		> 12% Si, not hardenable		130	447	N5	●●	350	350	200
	Magnesium-based alloys		70	250	N6	●●	550	450	300	
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	343	N7	●●	300	240	170
Brass, bronze, red brass			90	314	N8	●●	250	180	130	
Copper alloys, short-chipping			110	382	N9	●●	300	240	170	
	High tensile, Ampco		300	1013	N10					
S	Heat-resistant alloys	Fe-based	Annealed	200	675	S1	●●			
			Hardened	280	943	S2	●●			
		Ni- or Co-based	Annealed	250	839	S3	●●			
			Hardened	350	1177	S4	●●			
			Cast	320	1076	S5	●●			
	Titanium alloys	Pure titanium		200	675	S6				
	α and β alloys, hardened		375	1262	S7	●●				
	β alloys		410	1396	S8	●●				
	Tungsten alloys		300	1013	S9					
	Molybdenum alloys		300	1013	S10					
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	●● ●			
		Hardened and tempered		55 HRC	-	H2	●● ●			
		Hardened and tempered		60 HRC	-	H3	●● ●			
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4	●●			
O	Thermoplastics	Without abrasive fillers				O1				
	Thermosetting plastics	Without abrasive fillers				O2				
	Plastic, glass-fibre reinforced	GFRP				O3				
	Plastic, carbon-fibre reinforced	CFRP				O4				
	Plastic, aramid-fibre reinforced	AFRP				O5				
	Graphite (technical)			80 Shore			O6			

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

\* Comply with limit speeds.  
The ideal cutting speed for PCD machining is determined via the factors of the maximum possible and/or permitted speed, the tool length and the chip control.  
The specified cutting speeds are approximate standard values.  
These must be clarified via testing.



### Cutting data for precision boring (cartridges)

Material group	Overview of the main material groups and code letters				Brinell hardness HB	Tensile strength $R_m$ [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>		Cutting material grade					
									Starting values for cutting speed $v_c$ [m/min]					
									HC WKP01G L/D					
				3 × D <sub>C</sub>	4 × D <sub>C</sub>	6 × D <sub>C</sub>								
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●		355	320	195			
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●		335	265	160			
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●		300	240	150			
		C > 0,55 %	Annealed	190	639	P4	●●		290	230	140			
		C > 0,55 %	Heat-treated	300	1013	P5	●●		255	205	125			
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●●	●	300	240	150			
	Low-alloy steel			Annealed	175	591	P7	●●		330	265	160		
				Heat-treated	300	1013	P8	●●		275	220	140		
				Heat-treated	380	1282	P9	●●		245	195	115		
				Heat-treated	430	1477	P10	●●		200	160	80		
	High-alloy steel and high-alloy tool steel			Annealed	200	675	P11	●●		275	220	140		
				Hardened and tempered	300	1013	P12	●●		230	195	115		
	Stainless steel			Hardened and tempered	400	1361	P13	●●		210	170	90		
				Ferritic/martensitic, annealed	200	675	P14	●●		275	205	140		
				Martensitic, heat-treated	330	1114	P15	●●		210	180	100		
M	Stainless steel			Austenitic, quench hardened	200	675	M1	●●						
				Austenitic, precipitation hardened (PH)	300	1013	M2	●●						
				Austenitic/ferritic, duplex	230	778	M3	●●						
K	Malleable cast iron			Ferritic	200	675	K1	●●	●	280	235	130		
				Pearlitic	260	867	K2	●●	●	220	185	115		
	Grey cast iron			Low strength	180	602	K3	●●	●	300	255	150		
				High strength/austenitic	245	825	K4	●●	●	220	185	115		
	Cast iron with spheroidal graphite			Ferritic	155	518	K5	●●		275	220	140		
				Pearlitic	265	885	K6	●●		255	195	125		
CGI				200	675	K7	●●		235	175	105			
N	Wrought aluminium alloys			Not hardenable	30	-	N1	●●						
				Hardenable, hardened	100	343	N2	●●						
	Cast aluminium alloys			≤ 12% Si, not hardenable	75	260	N3	●●						
				≤ 12% Si, hardenable, hardened	90	314	N4	●●						
				> 12% Si, not hardenable	130	447	N5	●●						
	Magnesium-based alloys				70	250	N6	●●						
	Copper and copper alloys (bronze/brass)			Non-alloyed, electrolytic copper	100	343	N7	●●		285	230			
				Brass, bronze, red brass	90	314	N8	●●		345	275			
				Copper alloys, short-chipping	110	382	N9	●●						
				High tensile, Ampco	300	1013	N10							
S	Heat-resistant alloys			Fe-based	200	675	S1	●●						
				Hardened	280	943	S2	●●						
				Annealed	250	839	S3	●●						
				Ni- or Co-based	350	1177	S4	●●						
				Cast	320	1076	S5	●●						
	Titanium alloys			Pure titanium	200	675	S6							
				α and β alloys, hardened	375	1262	S7	●●						
				β alloys	410	1396	S8	●●						
Tungsten alloys				300	1013	S9								
Molybdenum alloys				300	1013	S10								
H	Hardened steel			Hardened and tempered	50 HRC	-	H1	●●	●					
				Hardened and tempered	55 HRC	-	H2	●●	●					
				Hardened and tempered	60 HRC	-	H3	●●	●					
	Hardened cast iron			Hardened and tempered	55 HRC	-	H4	●●						
O	Thermoplastics			Without abrasive fillers			O1							
	Thermosetting plastics			Without abrasive fillers			O2							
	Plastic, glass-fibre reinforced			GFRP			O3							
	Plastic, carbon-fibre reinforced			CFRP			O4							
	Plastic, aramid-fibre reinforced			AFRP			O5							
	Graphite (technical)				80 Shore		O6							

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

\* Comply with limit speeds.  
 The ideal cutting speed for PCD machining is determined via the factors of the maximum possible and/or permitted speed, the tool length and the chip control.  
 The specified cutting speeds are approximate standard values.  
 These must be clarified via testing.

Cutting material grade																										
Starting values for cutting speed v <sub>c</sub> [m/min]																										
HC																										
WTP35			WSM10S			WSM20S / WSM30S			WAK15			WNN10			WXM15			WPP10G			WPP20G / WPP30G			WMP20S		
L/D			L/D			L/D			L/D			L/D			L/D			L/D			L/D					
3×D <sub>c</sub>	4×D <sub>c</sub>	5×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>	3×D <sub>c</sub>	4×D <sub>c</sub>	6×D <sub>c</sub>			
260	210	130							310	280	170				260	210	130	355	320	195	320	290	180	260	210	130
220	180	110							290	230	140				220	180	110	335	265	160	300	240	150	220	180	110
200	160	100							260	210	130				200	160	100	300	240	150	270	220	140	200	160	100
190	150	90							250	200	120				190	150	90	290	230	140	260	210	130	190	150	90
140	110	70							220	180	110				140	110	70	255	205	125	230	190	120	140	110	70
200	160	100							260	210	130				200	160	100	300	240	150	270	220	140	200	160	100
220	170	110							290	230	140				220	170	110	330	265	160	300	240	150	220	170	110
180	150	90							240	190	120				180	150	90	275	220	140	250	200	130	180	150	90
130	100	60							210	170	100				130	100	60	245	195	115	220	180	110	130	100	60
100	75	50							180	140	70				100	75	50	200	160	80	190	150	80	100	75	50
180	150	90							240	180	120				180	150	90	275	220	140	250	190	130	180	150	90
160	130	80							200	170	100				160	130	80	230	195	115	210	180	110	160	130	80
110	85	60							190	150	80				110	85	60	210	170	90	200	160	90	110	85	60
160	130	80							240	190	120				160	130	80	275	205	140	250	200	130	160	130	80
150	120	70							180	160	80				150	120	70	210	180	100	190	170	100	150	120	70
200	160	100	220	170	110	200	160	100	240	190				200	160	100				230	180	120	200	160	100	
150	110	80	160	120	100	150	110	90	190	140				150	110	80				170	130	110	150	110	90	
180	140	100	180	140	90	170	130	80	220	170				180	140	100				190	150	90	170	130	80	
180	140	80							240	200	110				180	140	80	280	235	130	250	210	120			
160	130	80							190	160	100				160	130	80	220	185	115	200	170	110			
220	160	100							260	220	130				200	160	100	300	255	150	270	230	140			
160	130	80							190	160	100				160	130	80	220	185	115	200	170	110			
180	140	90							240	190	120				180	140	90	275	220	140	250	200	130			
160	130	80							220	170	110				160	130	80	255	195	125	230	180	120			
									200	150	100							235	175	105						
600	480	330										940	750	500	600	480	330									
500	400	280										750	600	410	500	400	280									
500	400	280										750	600	410	500	400	280									
400	320	220										560	450	310	400	320	220									
300	250	200										440	440	250	300	250	200									
450	350	250										700	550	350	450	350	250									
350	280	180										380	300	210	350	280	180	285	230							
						250	200		250	200		310	230	160				345	275		260	210		250	200	
						300	240		300	240		380	280	210							310	250		300	240	
			90	70	50	80	60	40	80	60	40										90	70	50	80	60	40
			80	60	45	70	50	35	70	50	35										80	60	45	70	50	35
			80	60	45	70	50	35	70	50	35										80	60	45	70	50	35
			60	50	35	50	40	25	50	40	25										60	50	35	50	40	25
			60	50	35	50	40	25	50	40	25										60	50	35	50	40	25
			60	50	40	50	40	30																50	40	30

HC = Coated carbide

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for precision boring (cartridges)

(continued)

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength $R_m$ [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>		Cutting material grade			
								Starting values for cutting speed $v_c$ [m/min]			
								HW	WN10	L/D	
				$3 \times D_c$	$4 \times D_c$	$6 \times D_c$					
P	Non-alloyed steel	$C \leq 0,25\%$	Annealed	125	428	P1	●●				
		$C > 0,25\% \leq 0,55\%$	Annealed	190	639	P2	●●				
		$C > 0,25\% \leq 0,55\%$	Heat-treated	210	708	P3	●●				
		$C > 0,55\%$	Annealed	190	639	P4	●●				
		$C > 0,55\%$	Heat-treated	300	1013	P5	●●				
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●●	●			
P	Low-alloy steel	Annealed		175	591	P7	●●				
		Heat-treated		300	1013	P8	●●				
		Heat-treated		380	1282	P9	●●				
		Heat-treated		430	1477	P10	●●				
P	High-alloy steel and high-alloy tool steel	Annealed		200	675	P11	●●				
		Hardened and tempered		300	1013	P12	●●				
		Hardened and tempered		400	1361	P13	●●				
				200	675	P14	●●				
P	Stainless steel	Ferritic/martensitic, annealed		200	675	P14	●●				
		Martensitic, heat-treated		330	1114	P15	●●				
M	Stainless steel	Austenitic, quench hardened		200	675	M1	●●				
		Austenitic, precipitation hardened (PH)		300	1013	M2	●●				
		Austenitic/ferritic, duplex		230	778	M3	●●				
K	Malleable cast iron	Ferritic		200	675	K1	●●	●	160	120	90
		Pearlitic		260	867	K2	●●	●	150	120	90
	Grey cast iron	Low strength		180	602	K3	●●	●	210	170	120
		High strength/austenitic		245	825	K4	●●	●	150	120	90
	Cast iron with spheroidal graphite	Ferritic		155	518	K5	●●		170	140	100
		Pearlitic		265	885	K6	●●		140	110	70
CGI			200	675	K7	●●					
N	Wrought aluminium alloys	Not hardenable		30	-	N1	●●		750	600	400
		Hardenable, hardened		100	343	N2	●●		600	480	330
	Cast aluminium alloys	$\leq 12\%$ Si, not hardenable		75	260	N3	●●		600	480	330
		$\leq 12\%$ Si, hardenable, hardened		90	314	N4	●●		450	360	250
	Magnesium-based alloys	$> 12\%$ Si, not hardenable		130	447	N5	●●		350	350	200
				70	250	N6	●●		550	450	300
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	343	N7	●●		300	240	170
		Brass, bronze, red brass		90	314	N8	●●		250	180	130
		Copper alloys, short-chipping		110	382	N9	●●		300	240	170
		High tensile, Ampco		300	1013	N10	●●				
S	Heat-resistant alloys	Fe-based	Annealed		200	675	S1	●●			
			Hardened		280	943	S2	●●			
		Ni- or Co-based	Annealed		250	839	S3	●●			
			Hardened		350	1177	S4	●●			
			Cast		320	1076	S5	●●			
S	Titanium alloys	Pure titanium		200	675	S6					
		$\alpha$ and $\beta$ alloys, hardened		375	1262	S7	●●				
		$\beta$ alloys		410	1396	S8	●●				
Tungsten alloys		300	1013	S9							
Molybdenum alloys		300	1013	S10							
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	●●	●			
		Hardened and tempered		55 HRC	-	H2	●●	●			
		Hardened and tempered		60 HRC	-	H3	●●	●			
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4	●●				
O	Thermoplastics	Without abrasive fillers				O1					
	Thermosetting plastics	Without abrasive fillers				O2					
	Plastic, glass-fibre reinforced	GFRP				O3					
	Plastic, carbon-fibre reinforced	CFRP				O4					
	Plastic, aramid-fibre reinforced	AFRP				O5					
	Graphite (technical)			80 Shore			O6				

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

\* Comply with limit speeds.  
The ideal cutting speed for PCD machining is determined via the factors of the maximum possible and/or permitted speed, the tool length and the chip control. The specified cutting speeds are approximate standard values. These must be clarified via testing.



### Cutting data for boring

Material group	= Cutting data for wet machining = Dry machining is possible		Overview of the main material groups and code letters		Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>		Indexable insert geometry								
									Starting values for feed f [mm/rev]								
									-E47 / -MP4 / -MK4 / -MM4			-RP4 / -RK4 / -RM4					
									D <sub>c</sub> [mm]			D <sub>c</sub> [mm]					
		< 44	> 44-73	> 73	< 44	> 44-73	> 73										
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●	0,20	0,30	0,40	0,22	0,30	0,40				
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●	0,16	0,24	0,40	0,16	0,24	0,40				
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●	0,15	0,22	0,35	0,15	0,22	0,35				
		C > 0,55 %	Annealed	190	639	P4	●●	0,14	0,20	0,30	0,14	0,20	0,30				
		C > 0,55 %	Heat-treated	300	1013	P5	●●	0,12	0,18	0,25	0,12	0,18	0,25				
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●● ●	0,15	0,22	0,35	0,15	0,22	0,35				
	Low-alloy steel	Annealed			175	591	P7	●●	0,20	0,30	0,40	0,20	0,30	0,40			
		Heat-treated			300	1013	P8	●●	0,14	0,20	0,30	0,14	0,20	0,30			
		Heat-treated			380	1282	P9	●●	0,12	0,18	0,25	0,12	0,18	0,25			
		Heat-treated			430	1477	P10	●●	0,10	0,15	0,20	0,10	0,15	0,20			
		High-alloy steel and high-alloy tool steel	Annealed			200	675	P11	●●	0,14	0,20	0,30	0,14	0,20	0,30		
			Hardened and tempered			300	1013	P12	●●	0,13	0,18	0,27	0,13	0,18	0,27		
			Hardened and tempered			400	1361	P13	●●	0,10	0,15	0,20	0,10	0,15	0,20		
	Stainless steel	Ferritic/martensitic, annealed			200	675	P14	●●	0,12	0,16	0,24	0,12	0,16	0,24			
		Martensitic, heat-treated			330	1114	P15	●●	0,12	0,16	0,24	0,12	0,16	0,24			
M	Stainless steel	Austenitic, quench hardened		200	675	M1	●●	0,12	0,16	0,24	0,12	0,16	0,24				
		Austenitic, precipitation hardened (PH)		300	1013	M2	●●	0,12	0,16	0,24	0,12	0,16	0,24				
		Austenitic/ferritic, duplex		230	778	M3	●●	0,12	0,16	0,24	0,12	0,16	0,24				
K	Malleable cast iron	Ferritic		200	675	K1	●● ●	0,18	0,26	0,34	0,18	0,26	0,34				
		Pearlitic		260	867	K2	●● ●	0,16	0,24	0,30	0,16	0,24	0,30				
	Grey cast iron	Low strength		180	602	K3	●● ●	0,20	0,30	0,40	0,20	0,30	0,40				
		High strength/austenitic		245	825	K4	●● ●	0,16	0,24	0,30	0,16	0,24	0,30				
	Cast iron with spheroidal graphite	Ferritic		155	518	K5	●● ●	0,20	0,30	0,40	0,20	0,30	0,40				
		Pearlitic		265	885	K6	●●	0,16	0,24	0,30	0,16	0,24	0,30				
	CGI			200	675	K7	●● ●	0,18	0,26	0,34	0,18	0,26	0,34				
N	Wrought aluminium alloys	Not hardenable		30	-	N1	●●										
		Hardenable, hardened		100	343	N2	●●										
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●● ●										
		≤ 12% Si, hardenable, hardened		90	314	N4	●● ●										
		> 12% Si, not hardenable		130	447	N5	●● ●										
	Magnesium-based alloys			70	250	N6	●● ●										
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper			100	343	N7	●●	0,16	0,24	0,40	0,16	0,24	0,40			
		Brass, bronze, red brass			90	314	N8	●● ●	0,16	0,24	0,40	0,16	0,24	0,40			
		Copper alloys, short-chipping			110	382	N9	●● ●	0,16	0,24	0,40	0,16	0,24	0,40			
		High tensile, Ampco			300	1013	N10	●●									
S	Heat-resistant alloys	Fe-based	Annealed		200	675	S1	●●	0,10	0,15	0,20	0,10	0,15	0,20			
			Hardened		280	943	S2	●●	0,10	0,15	0,20	0,10	0,15	0,20			
		Ni- or Co-based	Annealed		250	839	S3	●●	0,10	0,15	0,20	0,10	0,15	0,20			
			Hardened		350	1177	S4	●●	0,10	0,15	0,20	0,10	0,15	0,20			
			Cast		320	1076	S5	●●	0,10	0,15	0,20	0,10	0,15	0,20			
	Titanium alloys	Pure titanium			200	675	S6	●●									
		α and β alloys, hardened			375	1262	S7	●●	0,14	0,16	0,24	0,14	0,16	0,24			
		β alloys			410	1396	S8	●●	0,12	0,14	0,22	0,12	0,14	0,22			
	Tungsten alloys			300	1013	S9	●●										
	Molybdenum alloys			300	1013	S10	●●										
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	●●										
		Hardened and tempered		55 HRC	-	H2	●●										
		Hardened and tempered		60 HRC	-	H3	●●										
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4	●●										
O	Thermoplastics	Without abrasive fillers				O1	●●										
	Thermosetting plastics	Without abrasive fillers				O2	●●										
	Plastic, glass-fibre reinforced	GFRP				O3	●●										
	Plastic, carbon-fibre reinforced	CFRP				O4	●●										
	Plastic, aramid-fibre reinforced	AFRP				O5	●●										
	Graphite (technical)			80 Shore		O6	●●										

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Indexable insert geometry				Cutting material grade																									
				Starting values for feed f [mm/rev]				Starting values for cutting speed v <sub>c</sub> [m/min]																					
-MN2 D <sub>c</sub> [mm] < 44 > 44-73 > 73			-PF4 / -PS5 / -FP4 / -FP6 / -FK6 D <sub>c</sub> [mm] < 44 > 44-73 > 73			HC																							
						WKP01G			WPP20G			WPP30G			WSM10S			WSM20S			WSM30S								
						f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]								
						0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4						
				0.16	0.24	0.32	300	280		280	260	240	260	240	220				240	220		220	20						
				0.13	0.19	0.32	280	260		260	240	220	220	200	180				180	160		160	140						
				0.12	0.18	0.28	260	240		240	220	200	200	180	160				140	120		120	100						
				0.11	0.16	0.24	250	220		220	200	180	180	160	140				160	140		140	120						
				0.10	0.14	0.20	220	200		200	180	160	140	130	120														
				0.12	0.18	0.28	260	240		240	220	200	200	180	160				160	140			140	120					
				0.16	0.24	0.32	280	260		260	240	220	220	200	180														
				0.11	0.16	0.24	240	220		220	200	180	180	160	150														
				0.10	0.14	0.20	210	190		190	170	150	130	120	110														
				0.08	0.12	0.16	180	160		160	120	100	120	100	80														
				0.11	0.16	0.24	220	200		220	200		180	160	150														
				0.11	0.16	0.24	180	160		180	160		160	150	140														
				0.08	0.12	0.16	180	160		160	120	100	120	100	80														
				0.10	0.13	0.19				220	200		160	130															
				0.10	0.13	0.19				170	150		130	110															
				0.10	0.13	0.19							220	200		220	170		200	180		140	100	70					
				0.10	0.13	0.19							180	160		160	120		150	120		110	100	50					
				0.10	0.13	0.19							200	180		180	140		170	140		130	120	60					
				0.14	0.22	0.30	220	200	160	200	180	140	180	160	120														
				0.13	0.19	0.24	170	150	140	160	150	130	160	140	120														
				0.16	0.24	0.32	240	220	180	220	200	160	200	180	140														
				0.13	0.19	0.24	170	150	140	160	150	130	160	140	120														
				0.16	0.24	0.32	200	180	160	180	160	140	150	140	120														
				0.13	0.19	0.24	180	160	140	160	140	130	160	130	110														
				0.14	0.22	0.30	165	150	130																				
	0.24	0.30	0.40																										
	0.24	0.30	0.40																										
	0.24	0.30	0.40																										
	0.24	0.30	0.40																										
	0.24	0.30	0.40																										
	0.24	0.30	0.40																										
	0.24	0.30	0.40	0.13	0.19	0.32	300	250	220	300	250	200																	
	0.24	0.30	0.40	0.13	0.19	0.32	350	300	250	330	300	250																	
	0.24	0.30	0.40	0.13	0.19	0.32	400	360	300	350	330	300																	
				0.08	0.12	0.16										90	90		80	80		60	35						
				0.08	0.12	0.16										70	70		60	60		40	30						
				0.08	0.12	0.16										60	60		50	50		40	20						
				0.08	0.12	0.16										50	50		40	40		35	20						
				0.08	0.12	0.16										50	50		40	40		30	10						
				0.11	0.13	0.19										60	60		50	50									
				0.09	0.11	0.16										50	50		40	40									

HC = Coated carbide

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

# Cutting data for boring

(continued)

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength $R_m$ [N/mm <sup>2</sup> ]	Machining group <sup>1</sup>	= Cutting data for wet machining = Dry machining is possible	Cutting material grade												
								Starting values for cutting speed $v_c$ [m/min]												
								HC												
								WPP10G			WPP20G									
f [mm/rev]			f [mm/rev]						0.1	0.2	0.4									
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●													
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●													
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●													
		C > 0,55 %	Annealed	190	639	P4	●●													
		C > 0,55 %	Heat-treated	300	1013	P5	●●													
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●● ●													
	Low-alloy steel	Annealed			175	591	P7	●●												
		Heat-treated			300	1013	P8	●●												
		Heat-treated			380	1282	P9	●●												
		Heat-treated			430	1477	P10	●●												
High-alloy steel and high-alloy tool steel	Annealed			200	675	P11	●●													
	Hardened and tempered			300	1013	P12	●●													
	Hardened and tempered			400	1361	P13	●●													
Stainless steel	Ferritic/martensitic, annealed			200	675	P14	●●													
	Martensitic, heat-treated			330	1114	P15	●●													
M	Stainless steel	Austenitic, quench hardened		200	675	M1	●●													
		Austenitic, precipitation hardened (PH)		300	1013	M2	●●													
		Austenitic/ferritic, duplex		230	778	M3	●●													
K	Malleable cast iron	Ferritic		200	675	K1	●● ●													
		Pearlitic		260	867	K2	●● ●													
	Grey cast iron	Low strength		180	602	K3	●● ●													
		High strength/austenitic		245	825	K4	●● ●													
Cast iron with spheroidal graphite	Ferritic			155	518	K5	●● ●													
	Pearlitic			265	885	K6	●●													
CGI			200	675	K7	●● ●														
N	Wrought aluminium alloys	Not hardenable		30	-	N1	●●													
		Hardenable, hardened		100	343	N2	●●													
	Cast aluminium alloys	≤ 12% Si, not hardenable			75	260	N3	●● ●												
		≤ 12% Si, hardenable, hardened			90	314	N4	●● ●												
		> 12% Si, not hardenable			130	447	N5	●● ●												
	Magnesium-based alloys			70	250	N6	●● ●													
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper			100	343	N7	●●												
Brass, bronze, red brass				90	314	N8	●● ●													
Copper alloys, short-chipping				110	382	N9	●● ●													
High tensile, Ampco				300	1013	N10	●●													
S	Heat-resistant alloys	Fe-based	Annealed		200	675	S1	●●												
			Hardened		280	943	S2	●●												
		Ni- or Co-based	Annealed		250	839	S3	●●												
			Hardened		350	1177	S4	●●												
			Cast		320	1076	S5	●●												
	Titanium alloys	Pure titanium		200	675	S6	●●													
	α and β alloys, hardened		375	1262	S7	●●														
	β alloys		410	1396	S8	●●														
	Tungsten alloys			300	1013	S9														
	Molybdenum alloys			300	1013	S10														
H	Hardened steel	Hardened and tempered		50 HRC	-	H1														
		Hardened and tempered		55 HRC	-	H2														
		Hardened and tempered		60 HRC	-	H3														
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4														
O	Thermoplastics	Without abrasive fillers				O1														
	Thermosetting plastics	Without abrasive fillers				O2														
	Plastic, glass-fibre reinforced	GFRP				O3														
	Plastic, carbon-fibre reinforced	CFRP				O4														
	Plastic, aramid-fibre reinforced	AFRP				O5														
	Graphite (technical)			80 Shore		O6														

- Recommended application (the specified cutting data is regarded as starting values for the recommended application)
- Possible application. MQL (minimum quantity lubrication) or compressed air is recommended.

<sup>1</sup> The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

\* Comply with limit speeds.  
 The ideal cutting speed for PCD machining is determined via the factors of the maximum possible and/or permitted speed, the tool length and the chip control.  
 The specified cutting speeds are approximate standard values.  
 These must be clarified via testing.

Cutting material grade																							
Starting values for cutting speed v <sub>c</sub> [m/min]																							
HC																		HW					
WPP30G			WMP20S			WKP30S			WNN10			WKK10S			WKK20S			WN10					
f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]					
0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4	0.1	0.2	0.4
270	250	230	195	180	170																		
230	210	190	180	170	155																		
210	190	170	170	155	140																		
190	170	150	155	140	125																		
150	140	130	140	125	110																		
210	190	170	170	155	140																		
230	210	190	180	170	155																		
190	170	160	155	140	125																		
140	130	120	130	120	105																		
130	110	90	110	85	70																		
190	170	160	155	140	140																		
170	160	150	125	110	130																		
130	110	90	110	85	70																		
170	140		155	140																			
140	120		120	105																			
230	210		150	110	80																		
190	170		120	110																			
210	190		140	130	70																		
190	170	130				280	250	210				280	250	210	210	190	180						
170	150	130				220	200	150				220	200	150	170	150	110						
210	190	150				390	350	260				390	350	260	350	320	200						
170	150	130				250	220	170				250	220	170	190	170	130						
160	150	130				260	230	190				260	230	190	200	180	150						
170	140	120				190	170	150				190	170	150	150	130	110						
						190	160	120				190	160	120	160	140	120						
									1000*	1000*	1000*							1000*	1000*				
									900	900	900							800	800				
									500	500	500							500	500	500			
									400	400	400							400	400	400			
									300	300	300							300	300	300			
									500	500	500							500	500	500			
									450	400	350							450	400	350			
									400	350	300							400	350	300			
									350	300	250							350	300	250			
			70	70																			
			50	50																			
			40	40																			
			30	30																			
			30	30																			
			40	40														45	45				
			30	30														40	40				

HC = Coated carbide  
HW = Uncoated carbide

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.

### Cutting tool material application charts – Boring and precision boring

Carbide																					
Walter grade designation	Standard designation	Material groups						Application range							Coating process	Coating composition	Example of indexable insert				
		P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	01	05	10	15	20	25				30	35	40	45
WPP10S	HC – P 10	●●							[Application range chart for WPP10S]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)				
	HC – K 20	●																			
WPP20G	HC – P 20	●●							[Application range chart for WPP20G]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)				
	HC – K 30	●																			
WPP30G	HC – P 30	●●							[Application range chart for WPP30G]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)				
WMP20S	HC – M 20	●●	●●						[Application range chart for WMP20S]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)				
	HC – P 25	●●																			
	HC – S 20	●				●															
WSM01	HC – M 01	●●	●●						[Application range chart for WSM01]							PVD	TiAlN (HiPIMS)				
	HC – S 01	●●				●●															
	HC – P 10	●																			
	HC – N 10				●																
WSM10S	HC – M 10	●●	●●						[Application range chart for WSM10S]							PVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ Al)				
	HC – S 10	●●				●●															
	HC – P 10	●																			
WSM20S	HC – M 20	●●	●●						[Application range chart for WSM20S]							PVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ Al)				
	HC – S 20	●●				●●															
	HC – P 20	●																			
WSM30S	HC – M 30	●●	●●						[Application range chart for WSM30S]							PVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ Al)				
	HC – S 30	●●				●●															
	HC – P 30	●																			
WKP01G	HC – P 01	●●							[Application range chart for WKP01G]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiN)				
	HC – K 10	●																			
WPP10	HC – P 10	●●							[Application range chart for WPP10]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiN)				
	HC – K 20	●																			
WPP20	HC – P 20	●●							[Application range chart for WPP20]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiN)				
	HC – K 30	●																			
WPP30	HC – P 30	●●							[Application range chart for WPP30]							CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiN)				
WXM15	HC – P 15	●●							[Application range chart for WXM15]							PVD	TiAlN/TiN multi-layer				
	HC – M 15	●	●																		
	HC – K 15	●																			
WTP35	HC – P 35	●●							[Application range chart for WTP35]							CVD	TiCN + TiN				
	HC – M 35	●	●																		
	HC – S 35	●				●															

HC = Coated carbide

- Primary application
- Additional application

## Cutting tool material application charts – Boring and precision boring

(continued)

Carbide																			
Walter grade designation	Standard designation	Material groups						Application range								Coating process	Coating composition	Example of indexable insert	
		P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	01	05	10	15	20	25	30				35
WSM10	HC – M 10		●●						[Application range diagram]								PVD	TiAlN + Al <sub>2</sub> O <sub>3</sub> (ZrCN)	
	HC – S 10					●●		[Application range diagram]											
	HC – P 10	●						[Application range diagram]											
WSM20	HC – M 20		●●						[Application range diagram]								PVD	TiAlN + Al <sub>2</sub> O <sub>3</sub> (ZrCN)	
	HC – S 20					●●		[Application range diagram]											
	HC – P 20	●						[Application range diagram]											
WSM30	HC – M 30		●●						[Application range diagram]								PVD	TiAlN + Al <sub>2</sub> O <sub>3</sub> (ZrCN)	
	HC – S 30					●●		[Application range diagram]											
	HC – P 30	●						[Application range diagram]											
WSM21	HC – M 20		●●						[Application range diagram]								PVD	TiAlN	
	HC – S 20					●●		[Application range diagram]											
	HC – P 20	●●						[Application range diagram]											
WKK10S	HC – K 10			●●					[Application range diagram]								CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)	
	HC – H 30						●	[Application range diagram]											
WKK20S	HC – K 20			●●					[Application range diagram]								CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)	
	HC – P 10	●						[Application range diagram]											
WKP30S	HC – K 30			●●					[Application range diagram]								CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiCN)	
	HC – P 35	●●						[Application range diagram]											
	HC – M 30		●					[Application range diagram]											
WAK15	HC – K 10			●●					[Application range diagram]								CVD	TiCN + Al <sub>2</sub> O <sub>3</sub> (+ TiN)	
	HC – H 30						●	[Application range diagram]											
	HC – K 15			●●				[Application range diagram]											
WNN10	HC – N 10				●●				[Application range diagram]								—	TiCN <sup>plus</sup>	
	HC – P 01	●						[Application range diagram]											
	HC – M 01		●					[Application range diagram]											
WN10	HW – N 10				●●				[Application range diagram]								—	—	
	HW – S 10					●	[Application range diagram]												

HC = Coated carbide  
HW = Uncoated carbide

●● Primary application  
● Additional application

## Cutting tool material application charts – Boring and precision boring

(continued)

Cermets/PCD																					
Walter grade designation	Standard designation	Material groups						Application range							Coating process	Coating composition	Example of indexable insert				
		P	M	K	N	S	H	O	01	05	10	15	20	25				30	35	40	45
		Steel	Stainless steel	Cast iron	NF metals	Materials with difficult cutting properties	Hard materials	Other													
WEP10S	HE – P 10	●●								[Application range diagram: Peak at 10, range from 05 to 15]							PVD	TiCN + TiAlN			
	HE – M 10		●						[Application range diagram: Peak at 10, range from 05 to 15]												
	HE – K 10			●					[Application range diagram: Peak at 10, range from 05 to 15]												
WCB50	BH – H 10						●●		[Application range diagram: Peak at 10, range from 05 to 15]							—	CBN				
	BH – K 10			●				[Application range diagram: Peak at 10, range from 05 to 15]													
WCB80	BH – K 05			●●					[Application range diagram: Peak at 10, range from 05 to 15]							—	CBN				
	BH – H 15						●	[Application range diagram: Peak at 10, range from 05 to 15]													
WCD10	DP – N 10				●●				[Application range diagram: Peak at 10, range from 05 to 15]							—	PCD				
WDN10	DP – N 20				●●				[Application range diagram: Peak at 10, range from 05 to 15]							—	PCD				
	DP – O 20						●●	[Application range diagram: Peak at 10, range from 05 to 15]													

HE = Coated cermet  
 BH = CBN with high CBN content  
 DP = Polycrystalline diamond

●● Primary application  
 ● Additional application

## Geometry overview of indexable inserts for boring and precision boring – Positive basic shape

Precision boring		Material groups							Main cutting edge section	Corner radius section	a <sub>p</sub> [mm]	f [mm]
Geometry	Remarks/application area	P	M	K	N	S	H	O				
	<b>X5 – The stable one</b> – 5° rake angle – For cast iron and steel materials – For unfavourable machining conditions	••		••							0,1–0,3	0,03–0,15
	<b>X15 – The universal one</b> – 15° rake angle – For steel, stainless materials and materials with difficult cutting properties – Long projection lengths	••	••	•	•	•					0,1–0,3	0,03–0,15
	<b>X25 – The soft one</b> – 25° rake angle – Aluminium, soft steels, long-chipping materials	••	•		••	•					0,1–0,3	0,03–0,15
	<b>FW4</b> – Finishing with wiper technology – Double the feed rate – the same high surface quality – Reduced cutting pressure thanks to short radiused wiper cutting edge	••	••	••		•					0,1–2,5	0,03–0,50
	<b>FN2</b> – Finishing insert with fully ground circumference – Low cutting forces – Machining long, small diameter shafts with a tendency to vibrate	••	••		••	••					0,12–4,5	0,02–0,45
	<b>FM2</b> – Finishing insert with fully ground circumference – Low cutting forces – Machining long, small diameter shafts with a tendency to vibrate	••	••	•	•	••					0,12–4,5	0,02–0,45
	<b>FP2</b> – Finishing insert with fully ground circumference – Long, small-diameter shafts with a tendency to vibrate – Low cutting forces	••	••	•	••	••					0,12–4,5	0,02–0,45
	<b>FM4</b> – Finishing insert – Excellent chip control – Can also be used for precision boring	•	••			••					0,1–2,5	0,04–0,20
	<b>FP4</b> – Finishing insert – Excellent chip control – Can also be used for precision boring	••	•	•		•					0,1–2,5	0,04–0,20
	<b>FM6</b> – Universal insert for finishing and medium machining operations – Can also be used for boring	•	••			•		•			0,3–2,5	0,08–0,32

•• Primary application  
• Additional application

Remark: Sectional views show CCMT09T308... or CCGT09T308...

## Geometry overview of indexable inserts for boring and precision boring – Positive basic shape (continued)

### Precision boring

Geometry	Remarks/application area	Material groups							Main cutting edge section	Corner radius section	a <sub>p</sub> [mm]	f [mm]
		P	M	K	N	S	H	O				
	<b>FP6</b> – Universal insert for finishing and medium machining operations – Can also be used for boring	●●	●	●		●					0,3–2,5	0,08–0,32
	<b>FK6</b> – Universal insert for finishing and medium machining operations – Can also be used for boring	●	●	●●		●				0,3–2,5	0,08–0,32	

### Boring

Geometry	Remarks/application area	Material groups							Main cutting edge section	Corner radius section	a <sub>p</sub> [mm]	f [mm]
		P	M	K	N	S	H	O				
	<b>E47 – The universal one</b> – 15° rake angle – Flexible universal geometry for almost all depths of cut – For materials of the ISO machining groups P, M, K and S	●●	●●	●●	●	●●					0,4–7,6 0,4–10,0 P4130	0,15–0,45
	<b>G88</b> – Especially for machining aluminium – Boring (with and without interrupted cuts) – ISO N materials				●●						0,1–7,6	0,1–0,45
	<b>MW4</b> – Medium machining with wiper technology – Double the feed rate – the same high surface quality – Maximum feeds thanks to long radiused wiper cutting edge	●●	●	●●		●				0,5–4,0	0,12–0,60	
	<b>MN2</b> – Universal indexable insert for non-ferrous metallic materials – Sharp cutting edge with fully ground circumference – Polished rake face – Precision finishing on steel and stainless materials	●	●		●●	●				0,5–6,0	0,02–0,80	

- Primary application
- Additional application

Remark: Sectional views show CCMT09T308... CCGT09T308... CCMW09T308... or RCMX2006...

## Geometry overview of indexable inserts for boring and precision boring – Positive basic shape (continued)

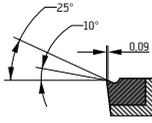
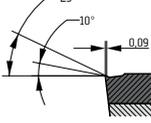
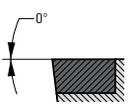
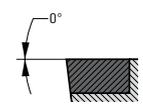
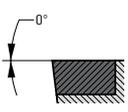
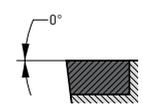
Boring		Material groups						Main cutting edge section	Corner radius section	a <sub>p</sub> [mm]	f [mm]
Geometry	Remarks/application area	P	M	K	N	S	H				
	<b>MM4</b> – Machining of long-chipping materials – Can be used universally in a wide application range – Circumference precision-ground – Circumference precision-sintered – Straight cutting edge for C, S and T basic shapes, for use as a chamfer insert in boring tools	•	••	•	••				 	0,4–3,0	0,08–0,32
	<b>MP4</b> – Machining of long-chipping materials – Can be used universally in a wide application range – Circumference precision-ground – Circumference precision-sintered – Straight cutting edge for C, S and T basic shapes, for use as a chamfer insert in boring tools	••	•	•	•				 	0,4–3,5	0,08–0,32
	<b>MK4</b> – Machining of fragile components, internal machining – Additional version with fully ground circumference available for maximum precision – Straight cutting edge for C, S and T basic shapes, for use as a chamfer insert in boring tools	•	•	••	•				 	0,4–3,5	0,08–0,32
	<b>MP6</b> – Medium machining of steel – Positive geometry with good chip control with very stable cutting edge	••	•	•	•				 	0,4–4,0	0,10–0,35
	<b>RM4</b> – Universal geometry for roughing and medium machining operations – Extremely large chip breaking range – Maximum metal removal rate and tool life	•	••	•	••				 	0,6–5,0	0,12–0,50
	<b>RP4</b> – Universal geometry for roughing and medium machining operations – Extremely large chip breaking range – Maximum metal removal rate and tool life	••	•	•	•				 	0,6–5,0	0,12–0,50
	<b>RK4</b> – First choice for grey cast iron and ductile cast iron – Universal geometry for roughing and medium machining operations – Extremely large chip breaking range	•	•	••	•				 	0,6–5,0	0,12–0,50
	<b>RK6</b> – Cast iron machining with hard scale – Interrupted cuts – Stable cutting edge design			••				•	 	0,2–0,6	0,12–0,50

•• Primary application  
 • Additional application

Remark: Sectional views show CCMT09T308... CCGT09T308... CCMW09T308... or RCMX2006...

## Geometry overview of indexable inserts for boring and precision boring – Positive basic shape – PCD/ceramic

### PCD/ceramic cutting tool materials

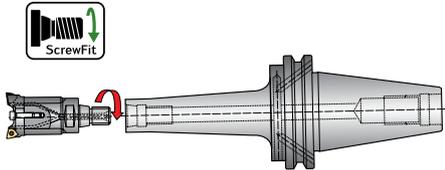
Geometry	Remarks/application area	Material groups							Main cutting edge section	Corner radius section	a <sub>p</sub> [mm]	f [mm]
		P	M	K	N	S	H	O				
	<p><b>.CGT...FS-1</b></p> <ul style="list-style-type: none"> <li>– PCD finishing insert with fully ground circumference in G tolerance</li> <li>– Extremely low cutting forces due to 7°–10° rake angle</li> <li>– Extremely high surface quality</li> </ul>				●●	●					0,05–1,5	0,03–0,38
	<p><b>.CGT...FS-M1</b></p> <ul style="list-style-type: none"> <li>– PCD indexable insert with fully ground circumference in G tolerance</li> <li>– Excellent chip control due to laser-generated chip-breaker geometry</li> <li>– Finishing to medium machining</li> </ul>				●●	●		●●			0,1–3,0	0,08–0,2
	<p><b>.CGW...FS-1</b></p> <ul style="list-style-type: none"> <li>– PCD indexable insert with fully ground circumference in G tolerance</li> <li>– Universal PCD indexable insert with 0° rake angle</li> <li>– Maximum repeat accuracy</li> </ul>				●●	●		●●			0,05–3,5	0,03–0,38
	<p><b>.CGW...FSL/R-9</b></p> <ul style="list-style-type: none"> <li>– PCD indexable insert with fully ground circumference in G tolerance</li> <li>– Cutting edge with guide pad</li> <li>– Maximum depth of cut and shoulder machining</li> </ul>				●●	●		●●			0,05–9,0	0,03–0,38

- Primary application
- Additional application

Remark: Sectional views show CCG09T304...  
CCGW09T304.. or RCGX090700...

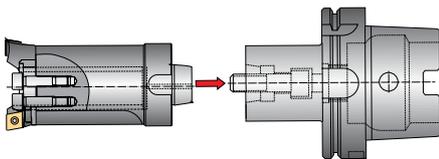
## Tightening torques

### Modular front pieces



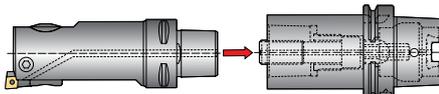
Cut-off area	Thread	Tightening torque	Wrench size [mm]	Taper diameter corresponds to
T 9	M 5	6 Nm	SW 8	—
T 14	M 8	25 Nm	SW 12	—
T 18	M 10	50 Nm	SW 14	—
T 22	M 12	80 Nm	SW 17	NCT 25/32
T 28	M 16	150 Nm	SW 21	—
T 36	M 20	200 Nm	SW 30	NCT 40/50
T 45	M 20	200 Nm	SW 36	NCT 40/50

### NCT tools



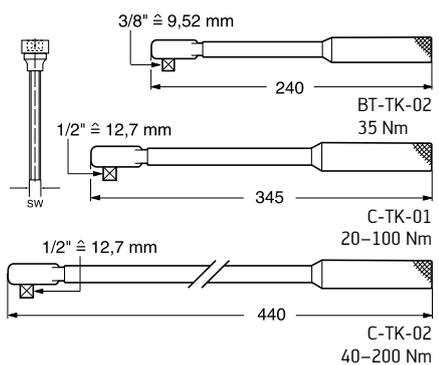
NCT	Thread	Wrench size	Torque wrench	Socket wrench	Tightening torque	Limit speed
25	M 8	5	FS 1385	FS 402	18 Nm	20,000 rpm
32	M 8	5	FS 1385	FS 402	18 Nm	30,000 rpm
40	M 12	8	FS 1386	FS 403	80 Nm	30,000 rpm
50	M 12	8	FS 1386	FS 403	80 Nm	30,000 rpm
63	M 16	12	FS 1386	FS 404	150 Nm	30,000 rpm
80	M 20	14	FS 1386	FS 405	200 Nm	30,000 rpm

### Walter Capto™ tools (axial)



Walter Capto™	Wrench size	Torque	Torque wrench
C3	8	45	C-TK-01
C4	8	55	C-TK-01
C5	14	95	C-TK-01
C6	14	170	C-TK-02
C8	14	170	C-TK-02

### Torque wrench for centre screw clamping



Torque wrench Order no.	Size	Tightening torque Nm	Spare parts	
			Wrench adaptor	WAF [mm]
C-TK-01	C3	45	5680 015-05	8
C-TK-01	C4	55	5680 015-05	8
C-TK-01	C5	95	5680 015-01	14
C-TK-02	C6	170	5680 015-02	14
C-TK-02	C8	170	5680 015-02	14

## Assembly and operating instructions for Walter Precision XT B5110 $\varnothing$ 1–20 mm (0.039–0.787")

### Fitting the boring bar

1. Push the boring bar into the locating bore on the precision boring head.
2. Align the cutting edge with the line marking on the precision boring head.
3. Tighten the clamping screw ① to the recommended torque.

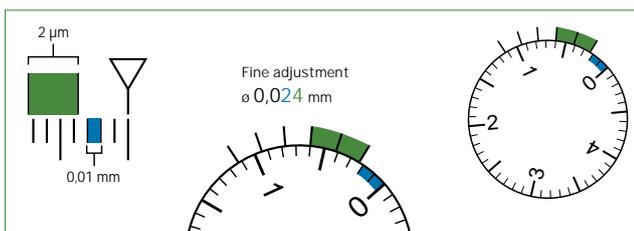


### Setting the tool diameter

1. Fit the solid carbide boring bar or boring bar with indexable insert.
2. Set the tool presetting device to the required diameter and insert the tool in the tool presetting device.
3. Rotate the precision boring tool body until it reaches the largest diameter shown. Then undo the clamping screw ① on the adjustment mechanism.
4. Set the diameter by turning the setting scale ② clockwise.
5. Always make the adjustment from small to large diameter.
6. When the required diameter is set, the clamping screw ③ must be tightened to the recommended torque.
7. Check the tool diameter and length in the tool presetting device. If possible, transfer the tool data to the machine control system.



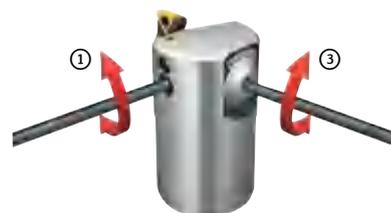
### Fine adjustment



1. Undo the adjusting screw before adjusting the diameter.
2. Always perform the settings from the minimum to the maximum value in order to avoid any backlash. Do not exceed the maximum values!
3. Turn the scale disc clockwise to adjust by 0.01 mm increments (blue). Use the vernier scale (green) for 0.002 mm adjustments. Setting example for 0.024 mm
4. Tighten the adjusting screw to the correct torque.
5. Use an acid-free, light machine oil to lubricate the tool.

A full rotation of the scale disc results in a radial adjustment of the indexable insert by 0.25 mm (0.010"), which equates to a diameter of 0.5 mm (0.01969").

Every interval has 50 divisions for 0.010 mm (0.0004")/diameter. The vernier scale has five line divisions, which enables the diameter to be adjusted by 0.002 mm (0.00008").



**Warning – to avoid damaging the tool, always undo the locking screw ① before adjusting the diameter.**

## Assembly and operating instructions for Walter Precision XT B5110 $\varnothing$ 1–20 mm (0.039–0.787")

(continued)

### Torques

#### Torques for B5110

Designation	$\varnothing$ [mm] (inch)	Nm	ft/lbs
Clamping screw	D <sub>c</sub> 1–10 mm (0.039–0.391 inch)	1,2	0,9
	D <sub>c</sub> 10–20 mm (0.391–0.787 inch)	3,0	2,2
Boring bar clamping screw	D <sub>c</sub> 1–10 mm (0.039–0.391 inch)	1,2	0,9
	D <sub>c</sub> 10–20 mm (0.391–0.787 inch)	3,0	2,2
Indexable insert screw	TC06	0,6	0,4
	TC1.2(1.2)		

## Assembly and operating instructions for Walter Precision XT B5115 Ø 19–167 mm (0.748–6.57") B5125 Lightweight (LWS) Ø 69–167 mm (2.716–6.57")

### Fitting the cartridge

1. Attach the cartridge to the elliptical interface on the slider on the precision boring head.
2. Tighten the clamping screw on the cartridge to the recommended torque.

By using an extension, the diameter range can be extended with the same basic body and the same cartridge. This is possible for machining in the axial direction and for reverse machining.

When using extension A (available as an accessory), the diameter changes as follows:

Precision boring tool $D_c$ [mm]	Extension A	Thickness b [mm]	Diameter range [mm]
19–36	EB735	3	+6
35–56	EB736	3.6	+7.2
55–635	EB737	4.8	+9.6

Precision boring tool $D_c$ (inch)	Extension A	Thickness b (inch)	Diameter range (inch)
0.748–1.417	EB735	0.118	+0.236
1.377–2.204	EB736	0.141	+0.282
2.165–25	EB737	0.188	+0.376

$D_c$  is extended by double the function width **b** of the extension.

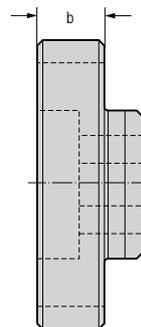
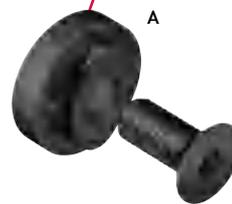
I.e.:

- $2 \times 3.0 = 6.0$  mm for EB735
- $2 \times 3.6 = 7.2$  mm for EB736
- $2 \times 4.8 = 9.6$  mm for EB737
- $2 \times 0.118 = 0.236$ " for EB735
- $2 \times 0.141 = 0.282$ " for EB736
- $2 \times 0.188 = 0.376$ " for EB737

When using an extension, the diameter range changes from dia. 19–635 mm (0.748–25") to dia. 25–644.6 mm (0.984–25.37").

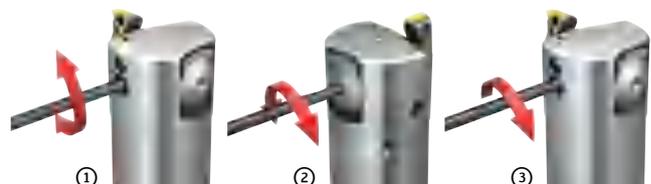
#### Note:

If an extension A is used for the cartridges, the longer screw supplied with the extension A must be used.  
Tighten the clamping screw to the recommended torque.



### Setting the tool diameter

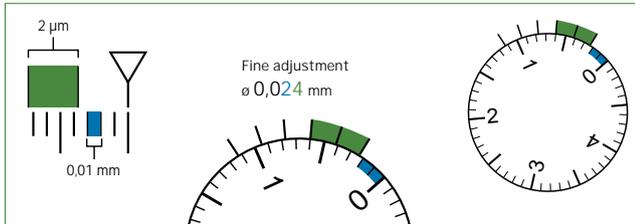
1. Fit the indexable insert.
2. Set the tool presetting device to the required diameter and insert the tool in the tool presetting device.
3. Rotate the precision boring tool body until it reaches the largest diameter shown. Then undo the clamping screw ① on the adjustment mechanism.
4. Set the diameter by turning the setting scale ② clockwise.
5. Always make the adjustment from small to large diameter.
6. When the required diameter is set, the clamping screw ③ must be tightened to the recommended torque.
7. Check the tool diameter and length in the tool presetting device.  
If possible, transfer the tool data to the machine control system.



## Assembly and operating instructions for Walter Precision XT B5115 Ø 19–167 mm (0.748–6.57") B5125 Lightweight (LWS) Ø 69–167 mm (2.716–6.57")

(continued)

### Fine adjustment



1. Undo the adjusting screw before adjusting the diameter.
2. Always perform the settings from the minimum to the maximum value in order to avoid any backlash. Do not exceed the maximum values!
3. Turn the scale disc clockwise to adjust by 0.01 mm increments (blue).  
Use the vernier scale (green) for 0.002 mm adjustments.  
Setting example for 0.024 mm
4. Tighten the adjusting screw to the correct torque.
5. Use an acid-free, light machine oil to lubricate the tool.

A full rotation of the scale disc results in a radial adjustment of the indexable insert by 0.25 mm (0.010"), which equates to a diameter of 0.5 mm (0.01969").

Every interval has 50 divisions for 0.010 mm (0.0004")/diameter.  
The vernier scale has five line divisions, which enables the diameter to be adjusted by 0.002 mm (0.00008").



**Warning** – to avoid damaging the tool, always undo the locking screw ① before adjusting the diameter.

### Fitting the cartridge for reverse boring



1. Remove the threaded plug from the lower outlet for the cooling lubricant ① and fit it to the upper outlet for the cooling lubricant ②.
2. If necessary, fit extension A (see "Fitting the cartridge").
3. Turn the cartridge 180° towards the boring bar and fit the cartridge to the slider or the extension A.
4. Tighten the clamping screw C on the cartridge to the recommended torque.

#### Important:

Change the direction of rotation → to the left-hand cutting version.

## Assembly and operating instructions for Walter Precision XT

**B5115** Ø 19–167 mm (0.748–6.57")

**B5125 Lightweight (LWS)** Ø 69–167 mm (2.716–6.57")

(continued)

### Reverse boring

With reverse boring,  $l_4$  is reduced by double the length  $f$  of the cartridge.

i.e.:

- $f = 11$  mm for cartridge EB713.TC06 →  $l_4 = -22$  mm
- $f = 17$  mm for cartridges EB714.TC09 and EB716.CC06 →  $l_4 = -34$  mm
- $f = 23$  mm for cartridge EB715.TC11 →  $l_4 = -46$  mm
- $f = 27$  mm for cartridge EB717.CC09 →  $l_4 = -54$  mm

**Important:**

Change the direction of rotation → to the left-hand cutting version.

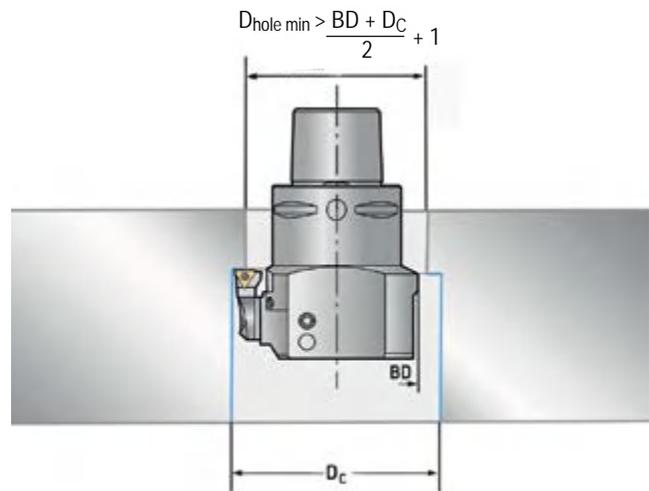
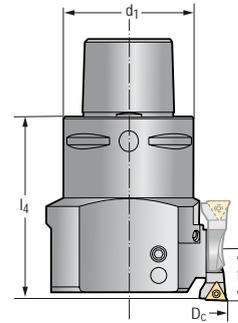
(b) When using an extension (see Fitting upper cartridges)

**Note:**

- Check the tool and boring bar length to avoid collisions.
- Make sure that the boring tool advances through the hole with the shoulder and does not collide with the component.

Calculation of the smallest possible hole diameter with reverse boring:

$$D_{\text{hole min}} = \frac{BD + D_c}{2} + 1$$



### Torques

#### Torques for B5115 and B5125

Designation	Ø [mm] (inch)	Nm	ft/lbs	
Screw for cartridge	19–36 (0.748–1.417)	1,2	0.9	
	35–56 (1.378–2.205)	3,0	2.3	
	55–167 (2.165–6.575)	6,0	4.3	
Clamping screw	19–29 (0.748–1.142)	0,9	0.7	
	28–36 (1.102–1.417)	1,2	0.9	
	35–56 (1.378–2.205)	3,0	2.3	
	55–167 (2.165–6.575)	6,0	4.3	
Indexable insert screw	TC06	TC1.2(1.2)	0,6	0.4
	TC09	TC1.8(1.5)	0,8	0.6
	TC11	TP22	0,9	0.7
	CC06	CC2(1.5)	0,8	0.6
	CC09	CC3(2.5)	3,0	2.2

## Assembly and operating instructions for Walter Precision XT B5120 Ø 148–635 mm (5.826–25.000")

### Fitting the cartridge and precision boring head

1. Attach the cartridge ① to the interface on the slider on the precision boring head ②.
2. Tighten the clamping screw on the cartridge to the recommended torque.  
For recommendations on the correct tightening torque for the clamping screw, see the assembly instructions below.
3. Attach the O-ring to the precision boring head.
4. Attach the precision boring head to the slider ③.
5. Tighten both screws on the precision boring head to the correct torque.

By using an extension, the diameter range can be extended with the same basic body and the same cartridge. This is possible for machining in the axial direction and for reverse machining.

When using extension **A** (available as an accessory), the diameter changes as follows:

Precision boring tool $D_c$ [mm]	Extension A	Thickness $b$ [mm]	Diameter range [mm]
19–36	EB735	3	+6
35–56	EB736	3,6	+7,2
55–635	EB737	4,8	+9,6

Precision boring tool $D_c$ (inch)	Extension A	Thickness $b$ (inch)	Diameter range (inch)
0.748–1.417	EB735	0.118	+0.236
1.377–2.204	EB736	0.141	+0.282
2.165–25	EB737	0.188	+0.376

$D_c$  is extended by double the function width  $b$  of the extension.

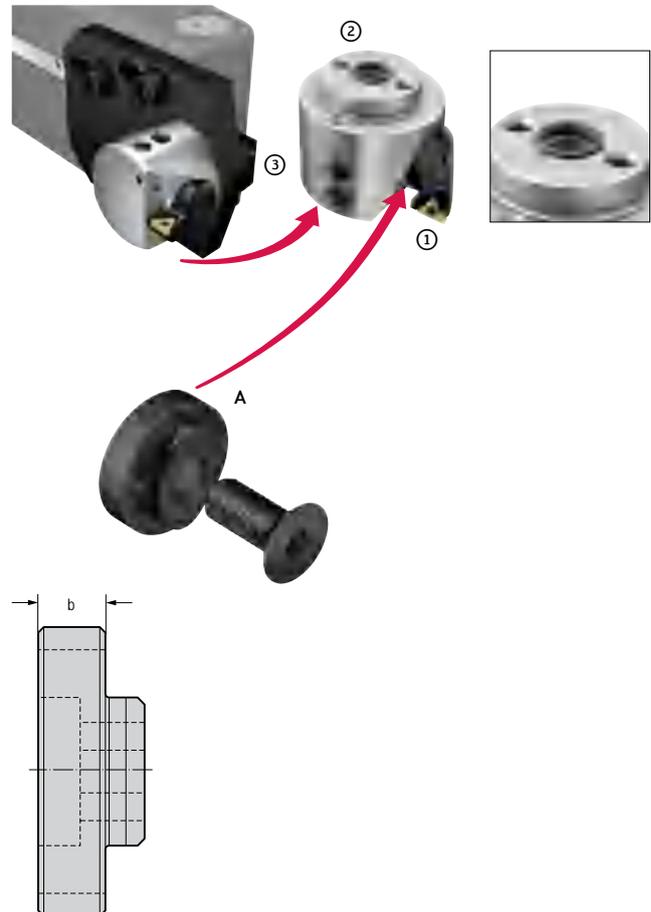
I.e.:

- $2 \times 3.0 = 6.0$  mm for EB735                      –  $2 \times 0.118 = 0.236$ " for EB735
- $2 \times 3.6 = 7.2$  mm for EB736                      –  $2 \times 0.141 = 0.282$ " for EB736
- $2 \times 4.8 = 9.6$  mm for EB737                      –  $2 \times 0.188 = 0.376$ " for EB737

When using an extension, the diameter range changes from dia. 19–635 mm (0.748–25") to dia. 25–644.6 mm (0.984–25.37").

#### Note:

If an extension **A** is used for the cartridges, the longer screw supplied with the extension **A** must be used.  
Tighten the clamping screw to the recommended torque.



## Assembly and operating instructions for Walter Precision XT B5120 Ø 148–635 mm (5.826–25.000")

(continued)

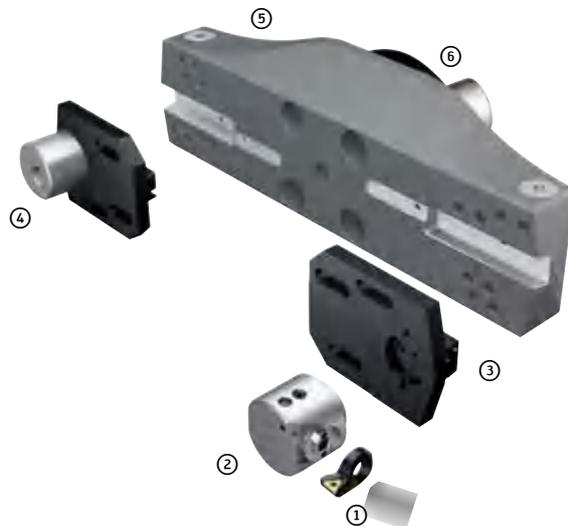
### Fitting the bridges and sliders, dia. 148–315 mm (5.826–12.401")

1. Attach the sliders ③ and ④ along with the precision boring head and counterweight to the adaptor and place the washers on the clamping screws.
2. Tighten the clamping screws on the sliders by hand so that the sliders can move easily.



### Fitting the bridges and sliders, dia. 298–635 mm (11.732–25.0")

1. Attach the sliders ③ and ④ along with the precision boring head and counterweight to the bridge ⑤ in the correct position depending on the diameter range.
2. Place the cup springs on the clamping screws.
3. Tighten the clamping screws on the sliders by hand so that the slides, along with the counterweight and precision boring head, can move easily.
4. Secure the basic body ⑥ to the bridge ⑤.



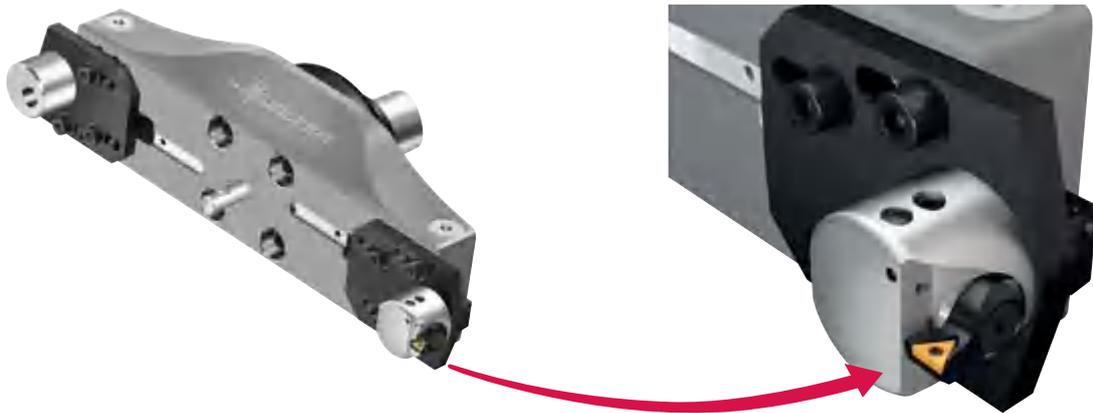
## Assembly and operating instructions for Walter Precision XT B5120 $\varnothing$ 148–635 mm (5.826–25.000")

(continued)

### Fitting the cartridge for reverse boring

1. Remove the threaded plug from the lower outlet for the cooling lubricant ① and fit it to the upper outlet for the cooling lubricant ②.
2. If necessary, fit extension A (see "Fitting the cartridge").
3. Turn the cartridge 180° towards the boring bar and fit the cartridge to the slider or the extension A.
4. Tighten the clamping screw C on the cartridge to the recommended torque.

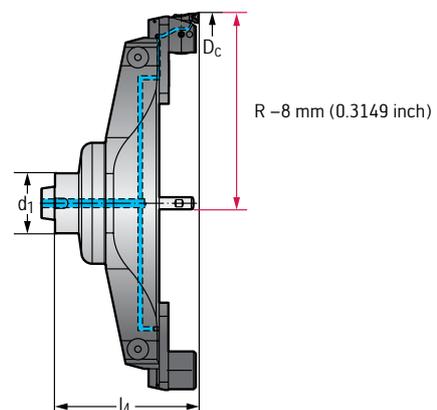
When using an extension, see "Fitting the cartridge and precision boring head"



### Tool setting

1. Fit the indexable inserts.
2. Insert the tool in the presetting device.
3. Set the required diameter on the tool presetting device.  
Approximate setting of the diameter (radial):
  - 3.1 Pre-tension the clamping screws on the slider for easy adjustment.
  - 3.2 Use the adjusting screw on the slider to set the precision boring head until the corner radius of the indexable insert reaches the required diameter. Always set the diameter from the smaller to the larger value.
  - 3.3 Tighten the clamping screws on the slider to the correct torque on the bridge. (Torque: See table – if necessary, can be done outside of the tool presetting device.)
  - 3.4 Fine adjustment of the diameter:  
For setting the precision boring tool, see the table.
4. Set the counterweight according to the scale value that is shown on the slider with the precision boring head.
5. Tighten the clamping screws on the slider with the counterweight to the recommended torque. (Torque: See table – if necessary, can be done outside of the tool presetting device.)
6. Check the tool diameter and length in the tool presetting device. If possible, transfer the tool data to the machine control system.

The adjustment pin can also be used as an adjustment aid. This is helpful if there is no presetting device. To do this, the measurement to be set from the centre pin to the cutting edge is determined and set. In addition, the adjustment range must be reduced by the radius (8 mm (0.3149")) of the adjustment pin.



## Assembly and operating instructions for Walter Precision XT B5120 Ø 148–635 mm (5.826–25.000")

(continued)

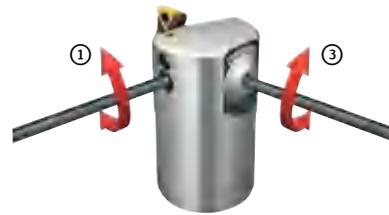
### Fine adjustment



1. Undo the clamping screw before adjusting the diameter.
2. Always perform the settings from the minimum to the maximum value in order to avoid any backlash. Do not exceed the maximum values!
3. Turn the scale disc clockwise to adjust by 0.01 mm increments (blue).  
Use the vernier scale (green) for 0.002 mm adjustments.  
Setting example for 0.024 mm
4. Tighten the clamping screw to the correct torque.
5. Use an acid-free, light machine oil to lubricate the tool.

A full rotation of the scale disc results in a radial adjustment of the indexable insert by 0.25 mm (0.010"), which equates to a diameter of 0.5 mm (0.01969").

Every interval has 50 divisions for 0.010 mm (0.0004")/diameter.  
The vernier scale has five line divisions, which enables the diameter to be adjusted by 0.002 mm (0.00008").



**Warning – to avoid damaging the tool, always undo the locking screw ① before adjusting the diameter.**

### Reverse boring

With reverse boring,  $l_4$  is reduced by double the mounting holder length  $f$ .  
I.e.:

- $f = 23 \text{ mm (0.905")}$  for cartridge EB715.TC11  $\rightarrow l_4 = -46 \text{ mm (1.811")}$
- $f = 27 \text{ mm (1.062")}$  for cartridge EB717.CC09  $\rightarrow l_4 = -54 \text{ mm (2.125")}$

**Important:**  
Change the direction of rotation  $\rightarrow$  to the left-hand cutting version.

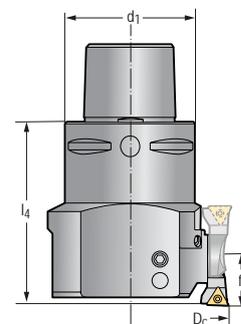
(b) When using an extension (see Fitting upper cartridges)

**Note:**

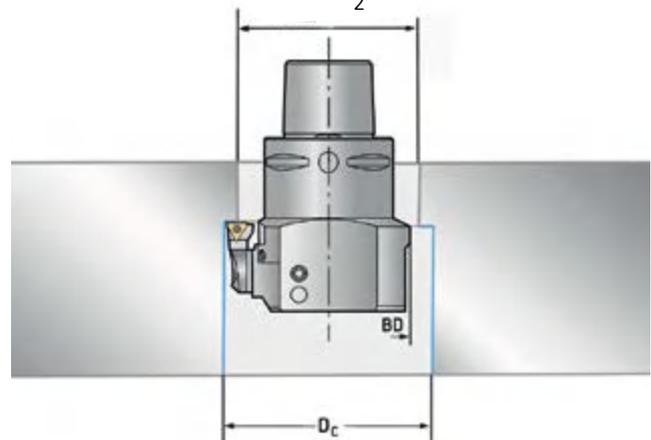
- Check the tool and boring bar length to avoid collisions.
- Make sure that the boring tool advances through the hole with the shoulder and does not collide with the component.

Calculation of the smallest possible hole diameter with reverse boring:

$$D_{\text{hole min}} = \frac{BD + D_c}{2} + 1$$



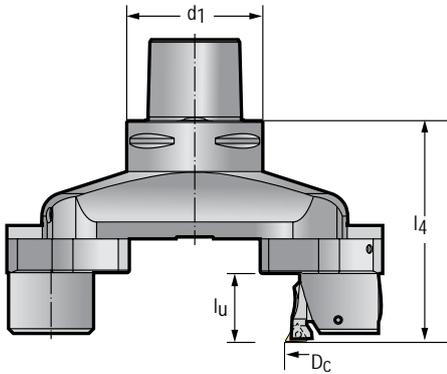
$$D_{\text{hole min}} > \frac{BD + D_c}{2} + 1$$



## Assembly and operating instructions for Walter Precision XT B5120 Ø 148–635 mm (5.826–25.000")

(continued)

### Tool setting for pin machining



1. Reverse the direction of rotation.
2. Turn the cutting head 180°.
3. Note the maximum possible machining length  $l_u$  and outer diameter of the tool in order to avoid collisions.

Tools for the diameter range (**internal machining**) 148 mm to 315 mm can be used by converting to pin machining of diameters 23 mm to 190 mm. The usable length  $l_u$  is maximum 34 mm.

Tools for the diameter range (**internal machining**) 298 mm to 635 mm can be used by converting to pin machining of diameters 173 mm to 510 mm. The usable length  $l_u$  is maximum 28 mm.

With **external machining**, the masses of the cartridge and the precision boring head rotate around the workpiece and thus generate high centrifugal forces. The maximum cutting speed for external machining must therefore be calculated in relation to the maximum cutting speed for the diameter with a head turned by 180°. This means that the tool is configured for precision boring.

#### Example calculation:

- Outer diameter to be machined (pin): 80 mm (3.15").
- In this case, the inner diameter (hole) (with this position of the cartridge and precision boring head) that can be machined is: 210 mm (8.27").
- **Note:** To determine the diameter for calculating the maximum speed, **always add 130 mm (5.12") to the diameter to be machined (pin)**.
- The maximum cutting speed depends on the internal machining (in the example for B5120: 1200 m/min (3937 ft/min).
- 1200 m/min (3937 ft/min) with a diameter of 210 mm (8.27") corresponds to 1820 rpm.
- This means that 1820 rpm is the maximum that can be achieved for this position of cartridge and precision boring head.
- For external machining (pin), 1820 rpm corresponds to a cutting speed of 460 m/min (1509 ft/min) with a diameter of 80 mm (3.15").

### Torques

#### Torques for B5120 Ø 148–315 mm (5.826–12.401 inch)

Designation	Ø [mm] (inch)		Nm	ft/lbs
Slider			60	44
Balance compensation			60	44
Precision boring head			16	12
Clamping screw for cartridge			6	4.4
Clamping screw for indexable inserts	TC1102	TC2(1.5)	0,9	0,7
	CC09T3	CC3(2.5)	3,0	2.2

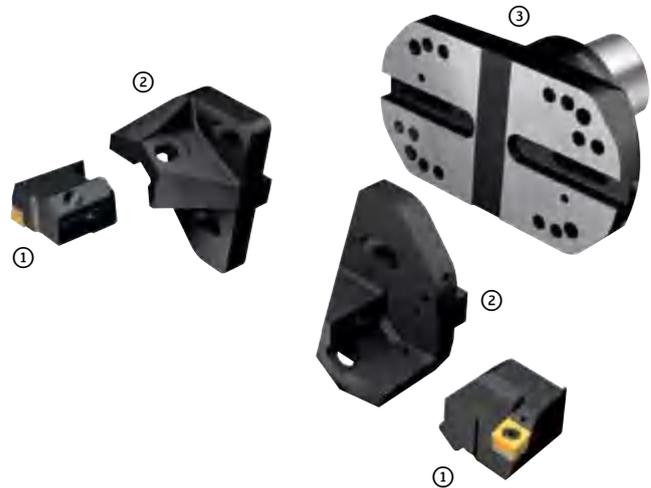
#### Torques for B5120 Ø 298–635 mm (11.732–25 inch)

Designation	Ø [mm] (inch)		Nm	ft/lbs
Bridge			200	140
Slider			60	74
Balance compensation			60	44
Precision boring head			60	44
Clamping screw (precision boring head)			16	12
Clamping screw for cartridge			6	4.4
Clamping screw for indexable inserts	TC1102	TC2(1.5)	0,9	0,7
	CC09T3	CC3(2.5)	3,0	2.2

## Assembly and operating instructions for Walter Boring XT B5460/B5560 Ø 148–620 mm (5.826–24.409")

### Tool assembly, dia. 148–300 mm (5.826–11.800")

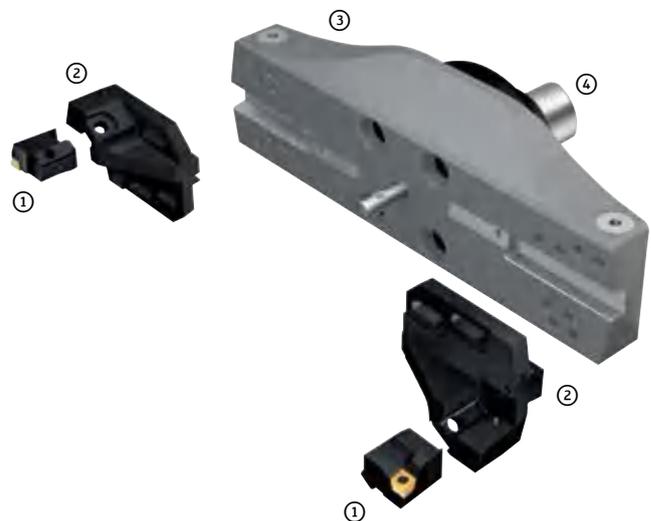
1. Secure the sliders ② to the bridge ③ and place the washers on the clamping screws.
2. Place the cartridges ① on the sliders and secure with the clamping screws.
3. Tighten the clamping screws on the sliders by hand so that they can be moved easily to make adjustments.



### Tool assembly, dia. 298–620 mm (11.732–24.409")

1. Fit the sliders ② in the correct position on the bridge ③ depending on the diameter range.
2. Place the cartridges ① on the sliders and secure with the clamping screw.
3. Attach the cup springs to the clamping screws.
4. Tighten the clamping screws on the sliders and cartridges by hand so that they can be moved easily to make adjustments.
5. Secure the basic body ④ to the bridge ③.

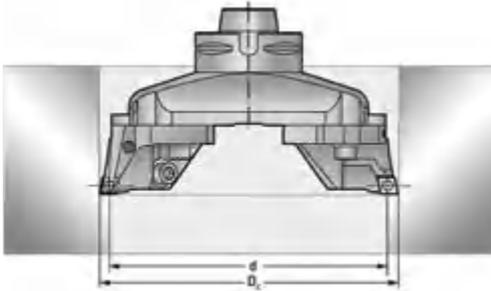
The pressure of the cup springs prevents the sliders from moving during adjustment when the screws are tightened or gravity.



## Assembly and operating instructions for Walter Boring XT B5460/B5560 $\varnothing$ 148–620 mm (5.826–24.409")

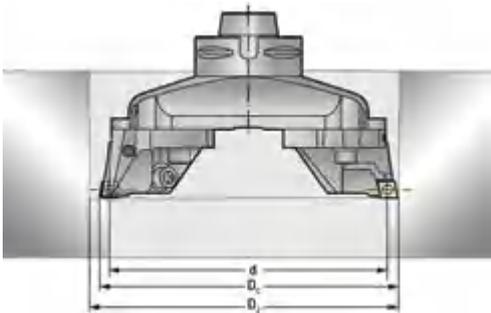
(continued)

### Tool setting



#### Boring symmetrically

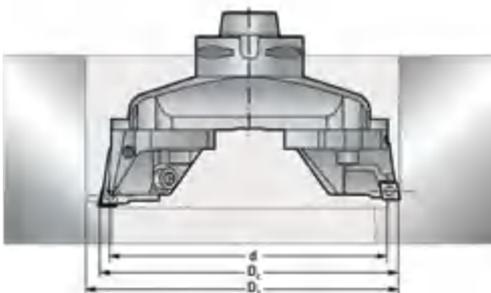
1. Fit the indexable inserts.
2. Insert the tool in the presetting device.
3. Turn the tool until the largest diameter has been found on the selected slider. Lock this position on the presetting device.
4. Set the required diameter on the presetting device:
  - a. **Adjusting the cartridge axially:**
    - 4.1 Manually move the cartridge into position. Pre-tension the clamping screws on the cartridge and the slider for easy adjustment.
    - 4.2 Adjust using the adjusting screw until the corner radius reaches the set length.
    - 4.3 Always set the length from the smaller to the larger value.
    - 4.4 Tighten the clamping screws on the cartridge and the slider.
  - b. **Adjusting the cartridge radially:**
    - 4.1 Manually move the cartridge into position. Pre-tension the clamping screws on the cartridge and the slider for easy adjustment.
    - 4.2 Adjust using the adjusting screw until the corner radius reaches the set diameter.
    - 4.3 Always set the diameter from the smaller to the larger value.
    - 4.4 Tighten the clamping screws on the cartridge and the slider.
5. Repeat this procedure for the cartridge and slider 2.
6. Tighten the clamping screws on the sliders and cartridges – if necessary, this can be done outside of the tool presetting device. Recommendations on the correct tightening torque: See assembly instructions below.
7. Check the diameter and tool length in the tool presetting device. If possible, transfer the tool data to the machine control system.



#### Boring asymmetrically

Setting procedure as for symmetrical boring (refer to point **b** above). However, cutting edge 1 is set to diameter  $D_2$  and cutting edge 2 to the smaller diameter  $D_1$ . The recommended difference should be **maximum** 2/3 of the cutting edge length.

The feed rate per tooth corresponds to the feed rate per rotation number of teeth, in this case, 1.



#### Boring with axial and radial offset

Set the two cartridges to different diameters and heights. The cartridge with the smaller diameter must be placed in the longer axial position; the cartridge with the end diameter represents a smaller tool length.

The axial difference between the two cutting edges must be at least half of the feed rate. The feed rate per tooth corresponds to the feed rate per rotation.

1. Fit the indexable inserts.
2. Insert the tool in the presetting device.
3. Turn the tool until the largest diameter has been found on the selected slider. Lock this position on the presetting device.
 

**Note:** Divide the total cutting depth into two equal parts so that the tool can be kept balanced as well as possible.
4. To set the required diameter on the presetting device:

## Assembly and operating instructions for Walter Boring XT B5460/B5560 $\varnothing$ 148–620 mm (5.826–24.409")

(continued)

### Tool setting



#### a. Adjusting the cartridge axially:

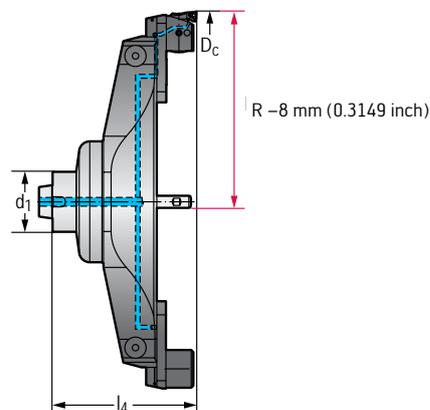
- 4.1 Manually move the cartridge into position. Pre-tension the clamping screws on the cartridge and the slider for easy adjustment.
- 4.2 Adjust using the adjusting screw until the corner radius reaches the set length.
- 4.3 Always set the length from the smaller to the larger value.
- 4.4 Tighten the clamping screws on the cartridge and the slider.



#### b. Adjusting the cartridge radially:

- 4.1 Pre-tension the clamping screws on the cartridge and the slider for easy adjustment.
- 4.2 Adjust using the adjusting screw until the corner radius reaches the set diameter.
- 4.3 Always set the diameter from the smaller to the larger value.
- 4.4 Tighten the clamping screws on the cartridge and the slider.
5. Repeat this procedure for the cartridge and slider 2.
6. Tighten the clamping screws on the sliders and cartridges – if necessary, this can be done outside of the tool presetting device. Recommendations on the correct tightening torque: See assembly instructions below.
7. Check the diameter and tool length in the tool presetting device. If possible, transfer the tool data to the machine control system.

The adjustment pin can also be used as an adjustment aid. This is helpful if there is no presetting device. To do this, the measurement to be set from the centre pin to the cutting edge is determined and set. In addition, the adjustment range must be reduced by the radius (8 mm (0.3149")) of the adjustment pin.



## Assembly and operating instructions for Walter Boring XT B5460/B5560 Ø 148–620 mm (5.826–24.409")

(continued)

### Torques

#### Torques for B5460/B5560 Ø 148–300 mm (5.826–11.800 inch)

Designation	Ø [mm] (inch)		Nm	ft/lbs
Slider			60	44
Cartridges			60	44
Clamping screw for indexable inserts	CC1204	CC43	3,0	2.2
	CN1906	CN64	6,4	4.7
	SC1204	SC43	3,0	2.2
	P4xxx	—	2,0	1.5

#### Torques for B5460/B5560 Ø 298–620 mm (11.732–24.409 inch)

Designation	Ø [mm] (inch)		Nm	ft/lbs
Bridge			200	140
Slider			60	44
Cartridges			60	44
Clamping screw for indexable inserts	CC1204	CC43	3,0	2.2
	CN1906	CN64	6,4	4.7
	SC1204	SC43	3,0	2.2
	P4xxx	—	2,0	1.5

## Setting instructions for Walter Precision B3230/B4030 precision boring tools

These tools have a highly precise adjustment mechanism.

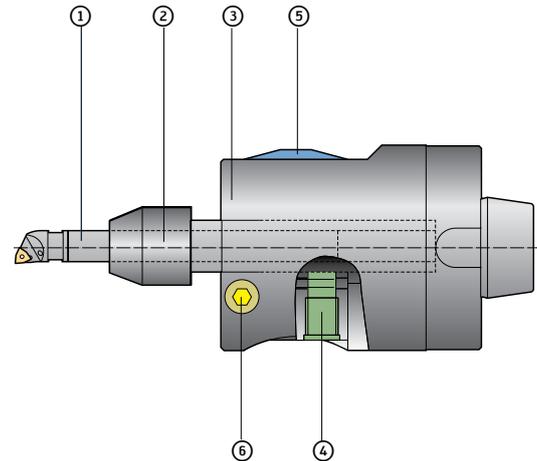
The scale graduation permits effortless adjustment of the cutting edge in the  $\mu$  range.

### Walter Precision<sup>MINI</sup>

1. Insert the solid boring bar or indexable insert holder ①, using a reducing sleeve ② if necessary, into the locating bore of the base body ③ until both clamping screws ④ are engaged.
2. Align the cutting edge with the marking provided on the face of the boring head and tighten the two clamping screws ④.
3. Move the base body ③ to the required diameter by turning the feed screw ⑤ with the clamping screw ⑥ undone.

The scale disc with vernier scale allows for a precise reading of the diameter change (1 DIV = 0.01 mm in diameter, with vernier scale 1 DIV = 0.002 mm in diameter).

4. Tighten the clamping screw ⑥.

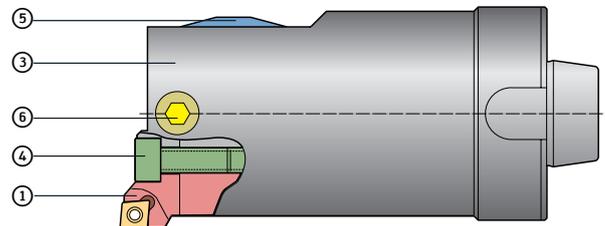


### Walter Precision<sup>MEDIUM</sup>

1. Position the cartridge ① in the cartridge guide of the base body ③ and secure with clamping screws ⑥.
2. Undo the clamping screw ⑥.
3. Move the cartridge holder into the required diameter by turning the feed screw ⑤ with the clamping screw ⑥ undone.

The scale disc with vernier scale allows for a precise reading of the diameter change (1 DIV = 0.01 mm in diameter, with vernier scale 1 DIV = 0.002 mm in diameter).

4. Tighten the clamping screw ⑥.



**One full rotation of the scale ① = 1 mm.**

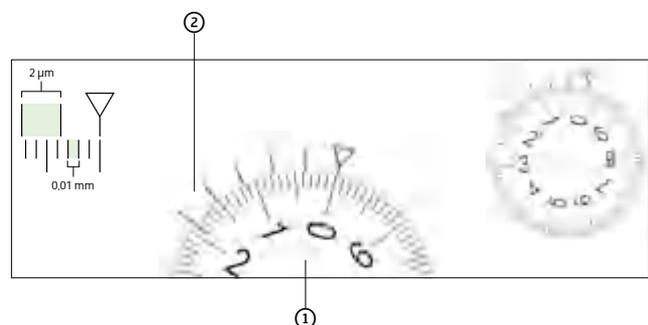
The disc is divided into ten equal sections.

This means that turning the disc from **0 to 1** = 0.1 mm.

∇ is the "zero position".

The vernier scale ② is divided into five equal sections.

The distance between **one scale line on the vernier scale corresponds to 0.002 mm** in terms of the diameter.



#### General information:

Note the path restriction of the base body. Never use force when performing adjustments. Periodical lubrication (approx. every 20 operating hours) via the lubricating nipple (face of base body) guarantees extremely high precision coupled with a long service life.

We recommend using a light machine oil such as Mobil Vactra Oil No. 2, BP Energol HLP-32, Klueber Isoflex PDP 94.

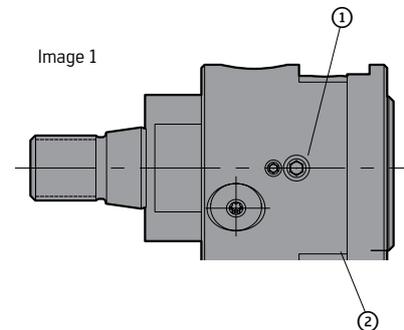
## Setting instructions for Walter Precision<sup>DIGITAL</sup> B4035

### Clamping/diameter adjustment

1. Switch on the digital display by pressing the "ON/Reset" button.
2. Undo the clamping screw ①.
3. Adjust the boring range via the adjusting screw ② using an Allen key (WAF 4), and read off the display at the same time.

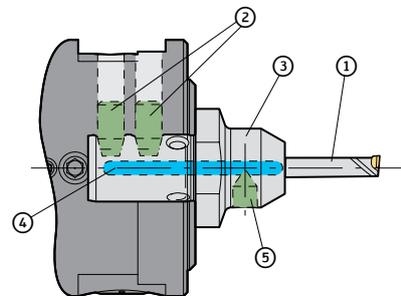
Display = actual adjusting distance  
 + = diameter increase  
 - = diameter reduction

4. Tighten the clamping screw ①.



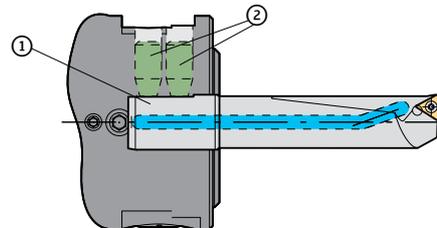
### Mini boring tools, dia. 3–10 mm

1. Insert the adaptor ③ into the bore in the slider and secure with the two tapered threaded pins ②.
2. Insert a mini insert holder ① with a diameter of up to 14.7 mm into the adaptor.
3. Align the cutting position via the surface ④ at the end of the shank.
4. Clamp the mini insert holder using the tapered threaded pin ⑤ (4 Nm).
5. Diameter adjustment in accordance with image 1.



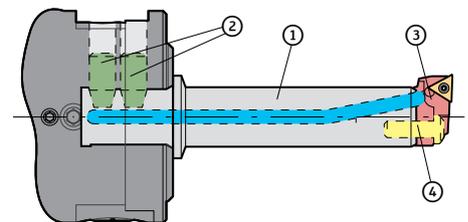
### Boring bar, dia. 20–32 mm

1. Clamp the boring bar ① in the slider with the two fastening screws ②.
2. Diameter adjustment in accordance with image 1.



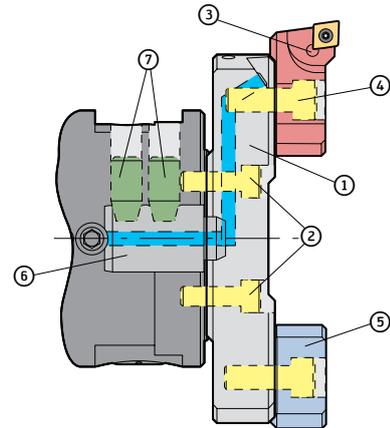
### Extension and cartridges, dia. 32–68 mm

1. Secure extensions ① in the slider with the two tapered threaded pins ②.
2. Place the cartridge ③ in the serration of the extension and clamp with the screw ④ (8 Nm).
3. Preset the cartridge ③ to diameter on the scale.
4. Diameter adjustment in accordance with image 1.



### Bridges with cooling lubricant transfer piece Cartridges for boring and counterweight, dia. 68–124 mm

1. Insert the coolant transfer piece ⑥ into the locating bore in the slider and secure with the two tapered threaded pins ⑦.
2. Secure the bridge ① to the slider (4 Nm) with four fastening screws ② (8 Nm).
3. Place the cartridge ③ on the bridge (near the coolant outlet).
4. Approximately preset the cartridge to the required diameter using the scale. Tighten with the clamping screw ④ (8 Nm).
5. Fit the counterweight ⑤ on the opposite side, align to diameter using the scale, and secure.
6. Diameter adjustment in accordance with image 1.



Detailed operating instructions including notes on balancing compensation are included with the tool set.

## Setting instructions for balance compensation for Walter Precision<sup>MINI</sup> B4030 precision boring tools

- ① Angle scale
- ② Adjusting ring A
- ③ Adjusting ring B
- ④ Clamping screw

1. Set the required diameter (see page B 134).
2. Turn the adjusting rings ② + ③ to the neutral position and secure in place ④ (image 1).
3. Take imbalance values from the settings table (included with the tool).  
Take the corner radius R into account.
4. Example:  
Drilling diameter 28.5 mm  
Imbalance U
5. Set imbalance value 350 gmm for adjusting ring A ② to 160° on the angle scale ① and secure the ring (image 2).
6. Set imbalance value 350 gmm for adjusting ring B ③ to the zero value of adjusting ring A ② and secure the ring (image 3).

Image 1

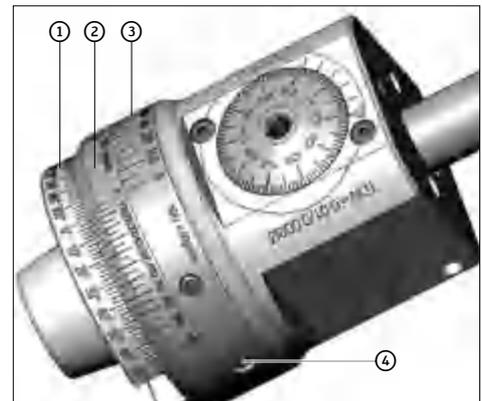


Image 2

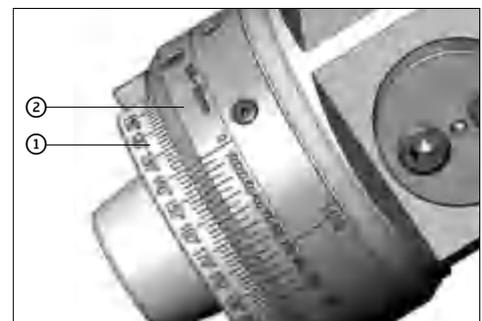


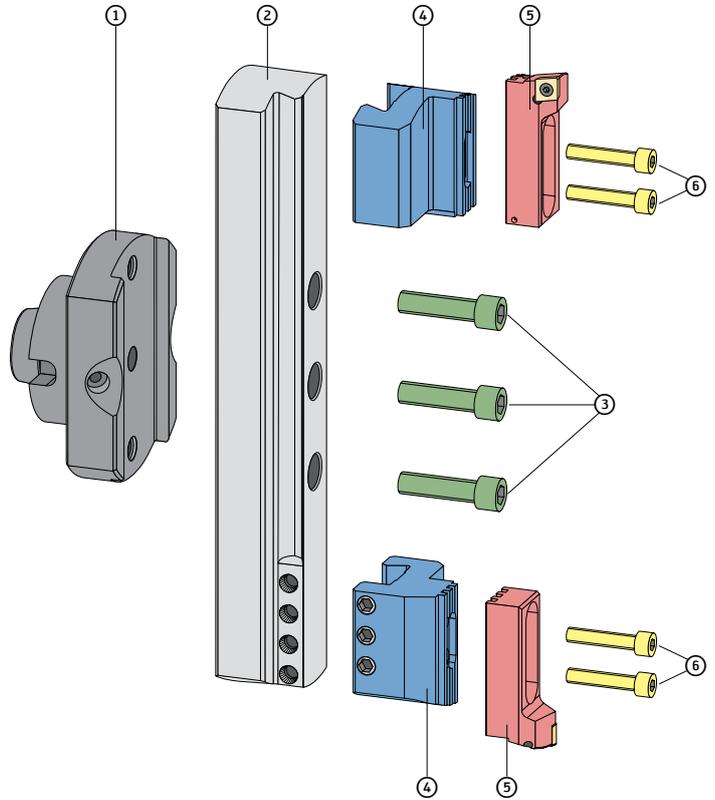
Image 3



## Assembly instructions for Walter bridge-type tools

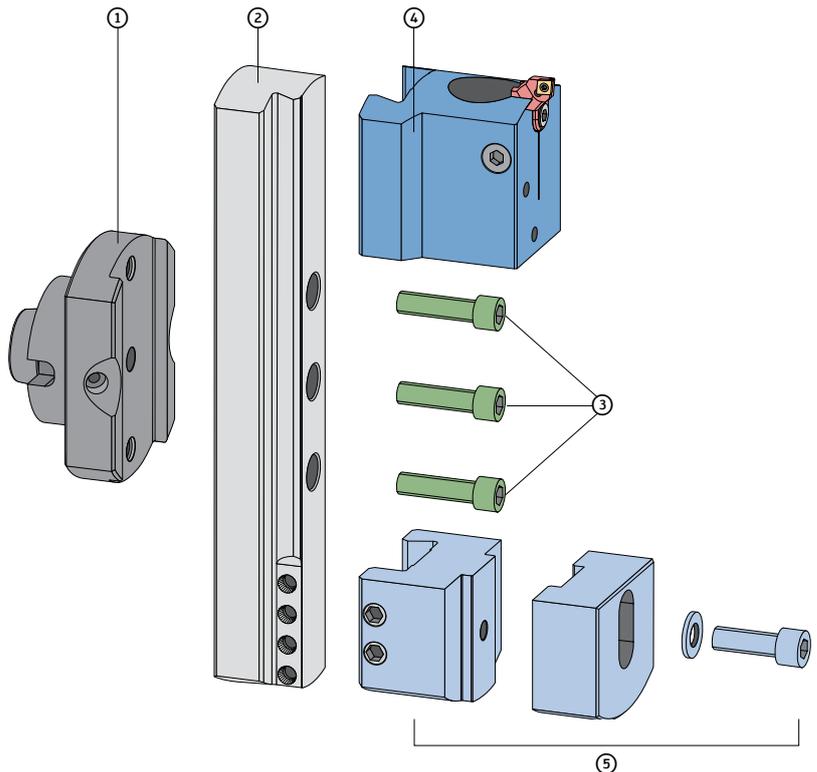
### Walter Boring<sup>MAXI</sup> B3220/B3224 boring tool

- ① Basic body
- ② Bridge
- ③ Clamping screws for the bridge
- ④ Cartridge holder
- ⑤ Cartridge
- ⑥ Clamping screws for the cartridge



### Walter Precision<sup>MAXI</sup> B3230/B3234 precision boring tool

- ① Basic body
- ② Bridge
- ③ Clamping screws for the bridge
- ④ Cartridge holder with cartridge
- ⑤ Balance compensation



## Precision boring cartridges

### 0.01 mm and 0.002 mm adjustment accuracy

#### Mode of operation and adjustment range

- ① Axial adjustment (1 mm) via eccentric
- ② Fastening screw (5–6 Nm)
- ③ Fine adjustment  
0.01 mm or 0.002 mm in diameter per scale line

Radial adjusting distance 0.3 mm

- ④ Lubricating nipple  
Lubricant recommendation  
lithium soap-based grease NLGI grade 1 KP1N10  
e.g. Fuchs Renolit GL 1

The maintenance interval depends on the application conditions.  
Re-greasing should be performed approximately every four weeks in the event of continuous use.

Speed max. 10,000 rpm



## Information on high-speed applications

1. Maximum permissible speeds:  
The limit values specified in the tables should not be exceeded. Otherwise correct operation and/or reliability are no longer guaranteed.
2. Only use genuine Walter indexable inserts and assembly parts (screws, etc.). Recommendation: New screws should be used after having replaced the indexable inserts five times at the most.
3. Observe the torque specified in the catalogues.
4. Balancing:  
Balancing must be performed in two steps when working at high speeds (> 6000 rpm):
  - a. Basic balancing of the tool body including indexable inserts (carried out by Walter on request). The tool adaptor also has to be balanced.
  - b. Fine balancing of the tool when fully mounted on the adaptor. The fine balancing operation is strongly recommended, as even the smallest concentricity fault can seriously affect the balance status.
5. Short projection lengths reduce concentricity faults and imbalance, and increase spindle service life. The specified speeds only apply to the use of tools without additional extensions.
6. Safety guards:  
Appropriate safety guards or machine enclosures must be used to securely collect particles that spin off such as chips or parts of cutting edges that are broken as a result of collisions.
7. Damaged tools:  
The operating speed must be specified for the repair of an HSC tool.  
Repairs on Walter tools for HSC machining operations must only be carried out by Walter.
8. Technical progress:  
As research and standardisation in the field of HSC machining are ongoing, we reserve the right to make changes. The discussion on balancing specifications in particular is still in progress. The results of the "Balancing" working group of the Technical University of Darmstadt show that the quality category G16 is usually sufficient.

### 1. Walter Boring B3220/B3221 boring tools

Diameter range D <sub>c</sub> [mm]	n <sub>max</sub> [rpm]
20–24	16.000
26–33	12.000
33–41	10.000
41–55	7.800
55–70	5.800
70–90	4.600
90–110	3.700
110–153	2.900
150–220	2.100
220–290	1.450
290–360	1.100
360–430	900
430–500	750
500–570	650
570–640	550

The specified limiting speeds refer to symmetrically set tools (Z = 2). The values are reduced by 50% for asymmetrically set tools (Z = 1).

### 2. Walter Precision B3230 precision boring tools

Diameter range D <sub>c</sub> [mm]	n <sub>max</sub> [rpm]
2–45,5*	6.000
20–26	12.000
26–33	10.000
33–41	8.100
41–55	6.450
55–70	4.850
70–90	3.835
90–110	3.090
110–153	2.390
150–220	1.440
220–290	1.090
290–360	880
360–430	740
430–500	630
500–570	550
570–640	490

\* The boring bar should be positioned as close to the centre as possible. Always use the largest boring bar possible.

### 3. Walter Precision B4030 precision boring tools

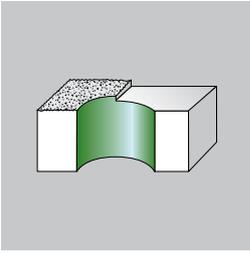
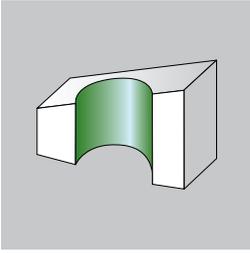
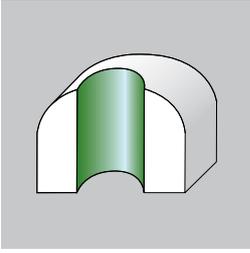
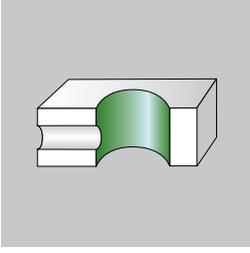
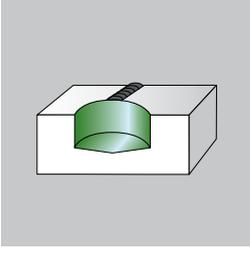
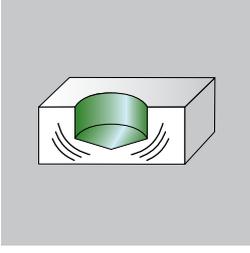
Diameter range D <sub>c</sub> [mm]	n <sub>max</sub> [rpm]
2–10*	14.000
10–20*	12.000
20–45*	8.000
33–41	15.000
41–55	11.500
55–70	9.000
70–90	7.000
90–110	5.500
110–153	4.000

\* The boring bar should be positioned as close to the centre as possible. Always use the largest boring bar possible.

### 4. Walter Precision<sup>DIGITAL</sup> B4035 precision boring tools

Diameter range D <sub>c</sub> [mm]	n <sub>max</sub> [rpm]
3–20	16.000
20–32	12.000
32–80	10.000
50–68	8.000
68–96	6.000
96–124	5.000

## Application recommendation

Application	Characteristics
<p><b>Boring on uneven surfaces (cast surfaces)</b></p> 	<ul style="list-style-type: none"> <li>- Depending on the drill entry angle, the spot drilling feed must be reduced.</li> <li>Use tools with max. <math>2 \times D_c</math>.</li> <li>Rule of thumb: <math>3^\circ \rightarrow 30\%</math>; <math>10^\circ \rightarrow 40\%</math>; <math>25^\circ \rightarrow 60\%</math></li> <li>- Use a tough indexable insert grade</li> <li>- Use a strong corner radius</li> </ul>
<p><b>Inclined hole entry and hole exit</b></p> 	<ul style="list-style-type: none"> <li>- Starting from an interrupted cut, reduce the feed by up to 50%</li> <li>- Use a tough indexable insert grade</li> <li>- Use a strong corner radius</li> </ul>
<p><b>Boring on convex surfaces</b></p> 	<ul style="list-style-type: none"> <li>- Possible without problems</li> <li>- Reduce the feed if necessary</li> </ul>
<p><b>Boring with cross hole</b></p> 	<ul style="list-style-type: none"> <li>- If necessary, reduce the feed by up to 50%</li> <li>- Watch out for chip jamming in the area of the cross hole</li> <li>- Use a tough indexable insert grade</li> <li>- Use a strong corner radius</li> </ul>
<p><b>Boring on a forged/welded/cast seam</b></p> 	<ul style="list-style-type: none"> <li>- Reduce the feed</li> <li>- Use tools with max. <math>3 \times D_c</math></li> </ul>
<p><b>Vibration</b></p> 	<ul style="list-style-type: none"> <li>- The feed is too high</li> <li>- The cutting speed is too high</li> <li>- The geometry is too blunt</li> <li>- Check the axial/radial settings</li> <li>- Check the tool design</li> <li>- If necessary, use an HMD damping element</li> </ul>

## Application information

### Reverse machining for precision boring

For reverse machining, the preset tool must be fed into the hole with axial offset. Therefore, the boring diameter "D", the diameter of the entry hole "d" and the diameter of the tool body "d<sub>1</sub>" have a specific ratio to each other.

In order to evaluate the feasibility of reverse machining and select the appropriate tools, these values can be calculated as follows:

Min. diameter of the entry hole "d"

$$d = \frac{D + d_1}{2}$$

Max. boring diameter "d<sub>1</sub>"

$$d_1 = 2d - d_1$$

Max. diameter of the tool body "d<sub>1</sub>"

$$A = 2d - D$$

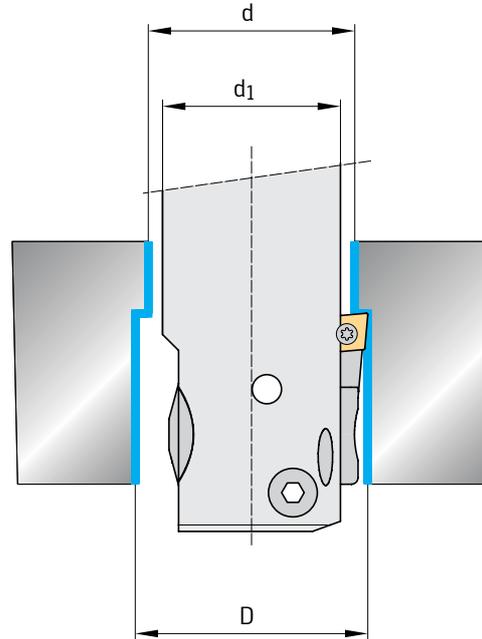
**Example:**

Calculating the minimum diameter of the entry hole "d"

**Given:**

- Boring diameter D = 93 mm
- Tool combination: B3230.C5.55-100.Z1
- Indexable insert holder no. 3, d<sub>1</sub> = 50 mm

$$d = \frac{D + d_1}{2} = \frac{93 + 50}{2} = 71,5 \text{ mm}$$



**Important:**

- The anticlockwise spindle must be used for reverse machining.
- The cutting edge is set back relative to the boring head.
- Note the overall length of the tool.
- Note the space restrictions on the back of the workpiece.

### Reading the vernier scale on the B3230/B4030

**One full rotation of the disc = 1 mm.**

The disc is divided into ten equal sections. This means that turning the disc from 0 to 1 = 0.1 mm.

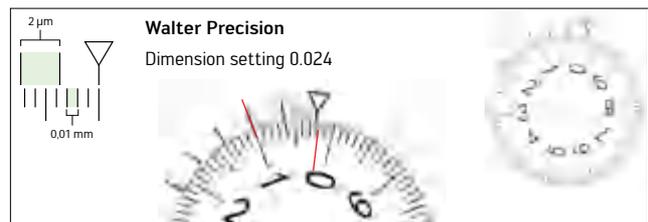
▽ is the "zero position".

The vernier scale is divided into five equal sections. The distance between one scale line on the vernier scale corresponds to 0.002 mm in terms of the diameter.

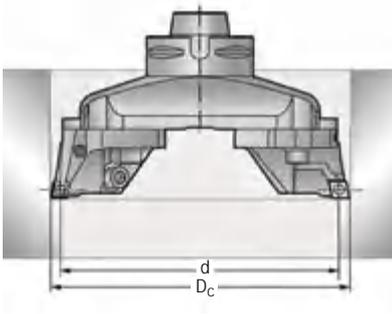


**Example:**

Adjusting the disc by 0.024 mm clockwise (± adjustment)

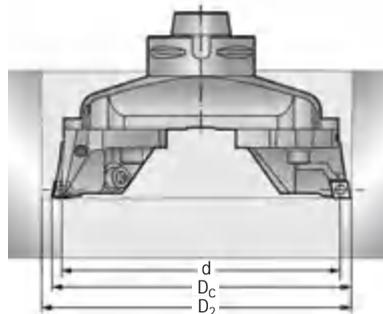


**Boring methods**



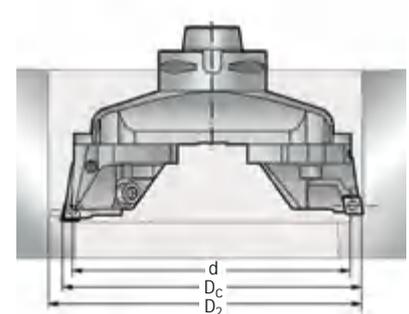
**Boring symmetrically**

- The most frequently used method for:
- Low to moderate material removal
  - High  $v_c$  values
  - High  $f_z$  values
  - $Z = 2$



**Boring asymmetrically**

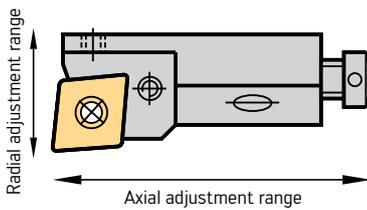
- Positioning of the cutting edges offset in the diameter for:
- Maximum material removal
  - Low power requirement
  - Large shoulder dimensions
  - $Z = 1$



**Asymmetrical boring and boring with radial offset (ARS)**

- Positioning of the cutting edges offset in the diameter and axially for:
- Maximum material removal
  - Excellent chip control
  - Large shoulder dimensions possible
  - $Z = 1$

**Adjustment range of standard assembly parts for Walter special drills**

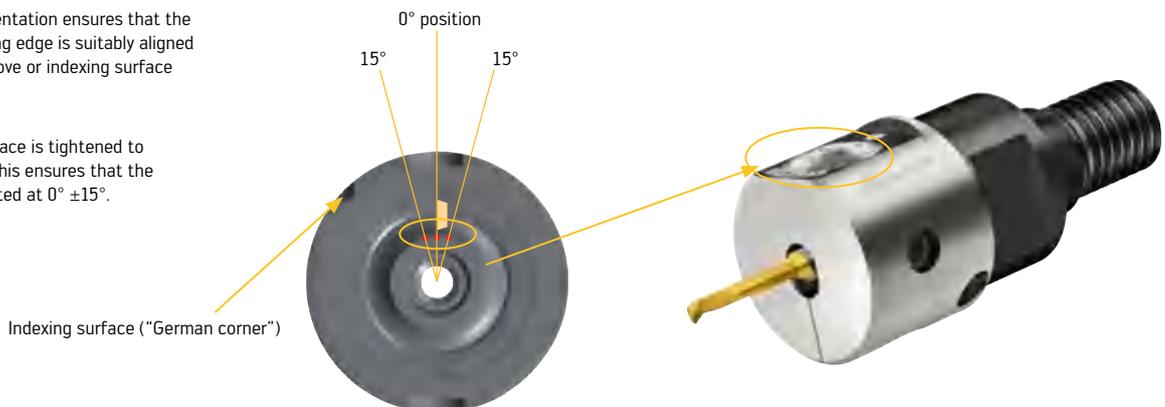


Group	Axial	Radial
ISO cartridges	2,0 mm	0,5 mm
Walter mini cartridges	1,0 mm	0,5 mm
Walter precision boring cartridges	1,0 mm	0,3 mm

**Cutting edge orientation for ScrewFit precision boring tools**

The cutting edge orientation ensures that the position of the cutting edge is suitably aligned with the adaptor groove or indexing surface ("German corner").

If the ScrewFit interface is tightened to the defined torque, this ensures that the cutting edge is situated at  $0^\circ \pm 15^\circ$ .



## Problem-solving expertise for boring with Walter Boring XT

Application	Cause	Solution
<b>Chip breaking</b> <b>The chips are too short and hard</b>	<ul style="list-style-type: none"> <li>– The feed is too high</li> <li>– The cutting speed is too low</li> <li>– The geometry is unsuitable</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce the feed</li> <li>– Increase the cutting speed</li> <li>– Choose a geometry with a more open chip breaker</li> </ul>
<b>Chip breaking</b> <b>The chips are too long</b>	<ul style="list-style-type: none"> <li>– The feed is too low</li> <li>– The cutting speed is too high</li> <li>– The geometry is unsuitable</li> </ul>	<ul style="list-style-type: none"> <li>– Increase the feed</li> <li>– Reduce the cutting speed</li> <li>– Choose a geometry with a narrower chip breaker</li> </ul>
<b>Tool vibration</b>	<ul style="list-style-type: none"> <li>– The ratio between the length and coupling system size is too large</li> </ul>	<ul style="list-style-type: none"> <li>– Use the largest possible size of coupling system</li> <li>– Use/shorten the vibration-damped boring tool</li> </ul>
	<ul style="list-style-type: none"> <li>– Unstable conditions</li> </ul>	<ul style="list-style-type: none"> <li>– Ensure stable clamping with contact between the flange and spindle</li> <li>– Use a rough boring tool with two cutting edges</li> <li>– Check that all units have been installed properly in the tool assembly and have been tightened to the correct torque</li> <li>– Check the machine spindle, stress, wear, etc.</li> </ul>
	<ul style="list-style-type: none"> <li>– The feed is too low</li> </ul>	<ul style="list-style-type: none"> <li>– Increase the feed</li> </ul>
	<ul style="list-style-type: none"> <li>– The feed is too high</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce the feed</li> </ul>
	<ul style="list-style-type: none"> <li>– The speed is too high</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce the cutting speed</li> </ul>
	<ul style="list-style-type: none"> <li>– The depth of cut is too great</li> </ul>	<ul style="list-style-type: none"> <li>– Use multi-edge boring</li> </ul>
	<ul style="list-style-type: none"> <li>– The cutting force is too high</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce the depth of cut</li> <li>– Use positive indexable inserts</li> <li>– Choose a smaller corner radius</li> <li>– The wiper indexable insert is not recommended for long overhangs or unstable conditions</li> </ul>
	<ul style="list-style-type: none"> <li>– The cutting force is too low</li> </ul>	<ul style="list-style-type: none"> <li>– Increase the depth of cut</li> </ul>
<b>Machine power</b>	<ul style="list-style-type: none"> <li>– Limited machine power</li> </ul>	<ul style="list-style-type: none"> <li>– Ensure that the machine can provide the necessary torque and the power for the specific boring application, especially for rough boring</li> <li>– Reduce cutting data</li> <li>– Use multi-edge boring</li> </ul>

## Problem-solving expertise for precision boring

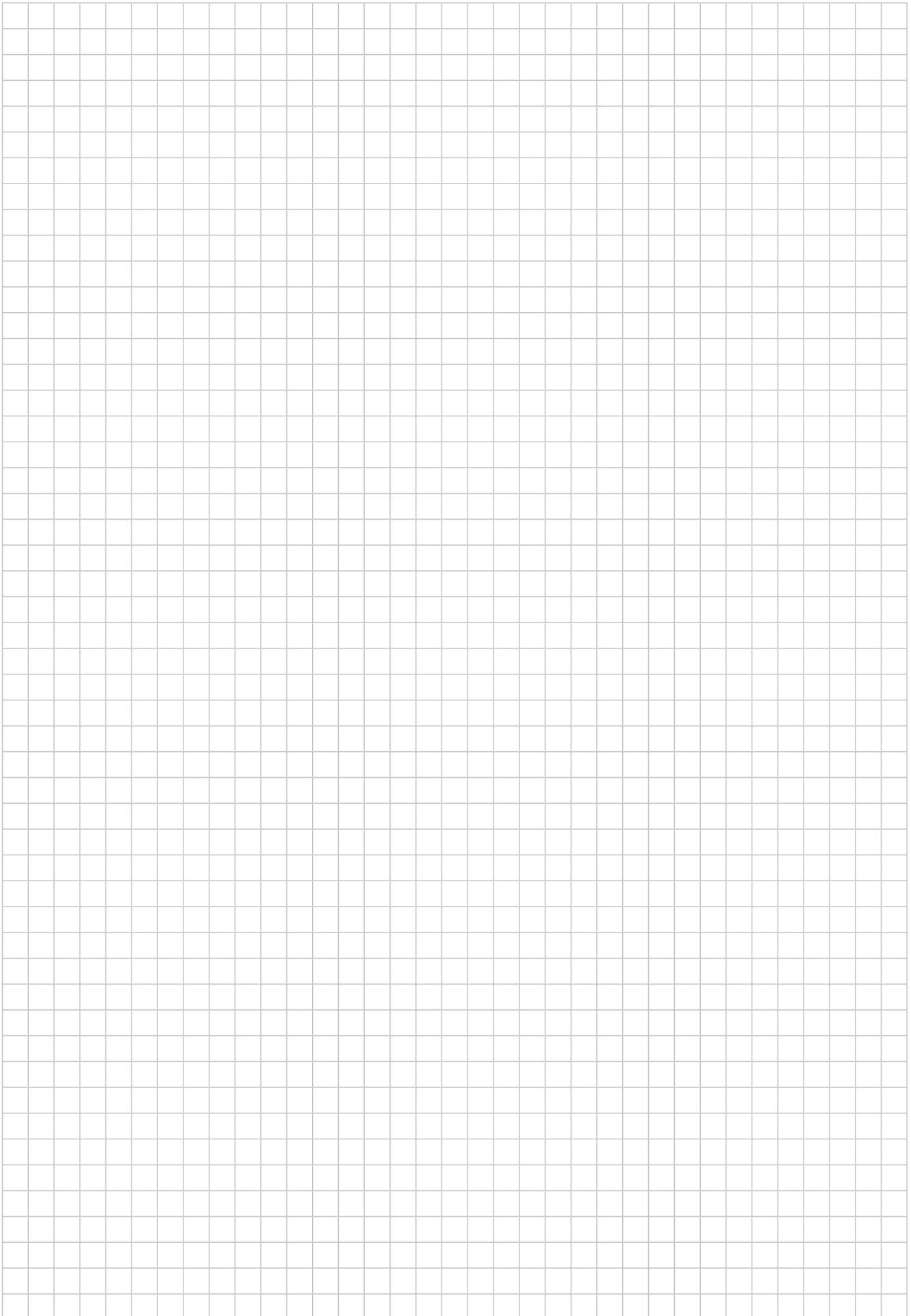
Application	Cause	Solution
<b>Chip breaking</b> The chips are too short and hard	<ul style="list-style-type: none"> <li>– The feed is too high</li> <li>– The cutting speed is too low</li> <li>– The geometry is unsuitable</li> </ul>	<ul style="list-style-type: none"> <li>– Reduce the feed</li> <li>– Increase the cutting speed</li> <li>– Choose a geometry with a more open chip breaker</li> </ul>
<b>Chip breaking</b> The chips are too long	<ul style="list-style-type: none"> <li>– The feed is too low</li> <li>– The cutting speed is too high</li> <li>– The geometry is unsuitable</li> </ul>	<ul style="list-style-type: none"> <li>– Increase the feed</li> <li>– Reduce the cutting speed</li> <li>– Choose a geometry with a narrower chip breaker</li> </ul>
<b>Tool vibration</b>	– The cutting force is too high	<ul style="list-style-type: none"> <li>– Use the largest possible size of coupling system</li> <li>– Use an easy-cutting indexable insert geometry</li> <li>– Choose a smaller corner radius</li> <li>– Choose sharp cutting edges with a thin coating or no coating</li> <li>– Wiper indexable inserts are not recommended for unstable conditions or long overhangs</li> <li>– Choose a smaller corner radius</li> <li>– Reduce the depth of cut</li> </ul>
	– The ratio between the length and coupling system size is too large	<ul style="list-style-type: none"> <li>– Ensure stable clamping with contact between the flange and spindle</li> <li>– Use the largest possible size of coupling system</li> <li>– Shorten the complete tool if possible</li> <li>– Use vibration-damped boring tools</li> </ul>
	– Unstable conditions	<ul style="list-style-type: none"> <li>– Ensure stable clamping with contact between the flange and spindle</li> <li>– Check that all units have been installed properly in the complete tool and have been tightened to the correct torque</li> <li>– Check the machine spindle, stress, wear, etc.</li> </ul>
	– The feed is too high	– Reduce the feed
	– The speed is too high	– Reduce the cutting speed
	– Friction instead of a clean cut	– Increase the depth of cut
<b>Machine power</b>	– Limited machine power	– Ensure that the machine can provide the necessary torque and the power for the specific boring application, especially for rough boring
	– Vibration	– Reduce the cutting speed
	– Marks due to feed	<ul style="list-style-type: none"> <li>– Use an easy-cutting indexable insert geometry</li> <li>– Choose a larger corner radius</li> <li>– Reduce the feed</li> </ul>
	– Indexable insert worn	<ul style="list-style-type: none"> <li>– Replace the cutting edge</li> <li>– Prevent specific wear patterns</li> </ul>
	– Surface scratches due to chips	– Improve chip breaking

### Cutting data for HSS countersinks

Material group	<p>  = Wet machining (E = emulsion, O = oil)   = Dry machining possible (M = MQL, L = dry)                      Cutting data must be selected from Walter GPS   <math>v_c</math> = Cutting speed                      VRR = Feed rate chart                       * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.                 </p>			Standard			DIN 335			
				Designation			E6819TIN			
				Form			C			
				Type			90°			
Dia. range [mm]			6,00–31,00							
Cutting tool material			HSS							
Coating			TiN							
Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength $R_m$ [N/mm <sup>2</sup> ]	Machining group *	$v_c$	VRR			
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	26	8	E O	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	26	9	E O	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	24	9	E O	
		C > 0,55 %	Annealed	190	640	P4	26	9	E O	
		C > 0,55 %	Heat-treated	300	1010	P5	18	8	E O	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	26	9	E O	
	Low-alloy steel	Annealed	175	590	P7	26	9	E O		
		Heat-treated	285	960	P8	18	8	E O		
		Heat-treated	380	1280	P9	12	5	E O		
		Heat-treated	430	1480	P10	5,6	4	E O		
High-alloy steel and high-alloy tool steel	Annealed	200	680	P11	6	4	E O			
	Hardened and tempered	300	1010	P12	14	6	E O			
	Hardened and tempered	380	1280	P13	6	4	E O			
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	6	4	E O			
	Martensitic, heat-treated	330	1110	P15	6	4	E O			
M	Stainless steel	Austenitic, quench hardened	200	680	M1	5	4	O E		
		Austenitic, precipitation hardened (PH)	300	1010	M2	9	5	O E		
		Austenitic/ferritic, duplex	230	780	M3	4	4	O E		
K	Malleable cast iron	Ferritic	200	400	K1	24	12	E O		
		Pearlitic	260	700	K2	18	10	E O		
K	Grey cast iron	Low strength	180	200	K3	30	12	E O		
		High strength/austenitic	245	350	K4	24	12	E O		
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	24	12	E O		
		Pearlitic	265	700	K6	18	10	E O		
	CGI	230	400	K7	21	12	E O			
N	Wrought aluminium alloys	Not hardenable	30	–	N1	60	12	E O		
		Hardenable, hardened	100	340	N2	60	12	E O		
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	35	12	E O		
		≤ 12% Si, hardenable, hardened	90	310	N4	25	12	E O		
		> 12% Si, not hardenable	130	450	N5	10	12	E O		
		Magnesium-based alloys	70	250	N6	25	12		M L	
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7	38	5	E O		
Brass, bronze, red brass		90	310	N8	30	10	E O			
Copper alloys, short-chipping		110	380	N9	48	12	E O	M L		
High tensile, Ampco		300	1010	N10	14	6	E O			
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	5	4	O E	
			Hardened	280	940	S2	3	3	O E	
		Ni- or Co-based	Annealed	250	840	S3	5	4	O E	
			Hardened	350	1180	S4				
			Cast	320	1080	S5	2	3	O E	
	Titanium alloys	Pure titanium	200	680	S6	8	4	O E		
		α and β alloys, hardened	375	1260	S7	5	4	O E		
β alloys		410	1400	S8						
	Tungsten alloys	300	1010	S9	10	4	O E			
	Molybdenum alloys	300	1010	S10	10	4	O E			
H	Hardened steel	Hardened and tempered	50 HRC	–	H1					
		Hardened and tempered	55 HRC	–	H2					
		Hardened and tempered	60 HRC	–	H3					
		Hardened cast iron	Hardened and tempered	55 HRC	–	H4				
O	Thermoplastics	Without abrasive fillers			O1	26	12	E O		
	Thermosetting plastics	Without abrasive fillers			O2	24	8		L	
	Plastic, glass-fibre reinforced	GFRP			O3					
	Plastic, carbon-fibre reinforced	CFRP			O4					
	Plastic, aramid-fibre reinforced	AFRP			O5	24	8		L	
		Graphite (technical)		80 Shore		O6				

DIN 335				DIN 334				DIN 335				DIN 334			
E6819				E6818				E7819				E7818			
C 90°				C 60°				D 90°				D 60°			
4,30-31,00				6,30-25,00				15,00-80,00				16,00-80,00			
HSS				HSS				HSS				HSS			
Uncoated				Uncoated				Uncoated				Uncoated			
v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR			v <sub>c</sub>	VRR		
21	7	EO		21	7	EO		21	7	EO		21	7	EO	
21	8	EO		21	8	EO		21	8	EO		21	8	EO	
20	8	EO		20	8	EO		20	8	EO		20	8	EO	
21	8	EO		21	8	EO		21	8	EO		21	8	EO	
14	7	EO		14	7	EO		14	7	EO		14	7	EO	
21	8	EO		21	8	EO		21	8	EO		21	8	EO	
21	8	EO		21	8	EO		21	8	EO		21	8	EO	
14	7	EO		14	7	EO		14	7	EO		14	7	EO	
8	6	OE		8	6	OE		8	6	OE		8	6	OE	
6	4	EO		6	4	EO		6	4	EO		6	4	EO	
10	6	EO		10	6	EO		10	6	EO		10	6	EO	
5	5	OE		5	5	OE		5	5	OE		5	5	OE	
6	4	EO		6	4	EO		6	4	EO		6	4	EO	
5	4	EO		5	4	EO		5	4	EO		5	4	EO	
4	3	OE		4	3	OE		4	3	OE		4	3	OE	
5	5	OE		5	5	OE		5	5	OE		5	5	OE	
4	3	OE		4	3	OE		4	3	OE		4	3	OE	
15	12	EO		15	12	EO		15	12	EO		15	12	EO	
12	10	EO		12	10	EO		12	10	EO		12	10	EO	
19	12	EO		19	12	EO		19	12	EO		19	12	EO	
15	12	EO		15	12	EO		15	12	EO		15	12	EO	
15	12	EO		15	12	EO		15	12	EO		15	12	EO	
12	10	EO		12	10	EO		12	10	EO		12	10	EO	
14	12	EO		14	12	EO		14	12	EO		14	12	EO	
42	12	EO		42	12	EO		42	12	EO		42	12	EO	
42	12	EO		42	12	EO		42	12	EO		42	12	EO	
26	12	EO		26	12	EO		26	12	EO		26	12	EO	
19	10	EO		19	10	EO		19	10	EO		19	10	EO	
8	12	EO		8	12	EO		8	12	EO		8	12	EO	
25	12		ML												
30	5	EO		30	5	EO		30	5	EO		30	5	EO	
25	10	EO		25	10	EO		25	10	EO		25	10	EO	
42	12	EO	ML												
9	4	EO		9	4	EO		9	4	EO		9	4	EO	
4	3	OE		4	3	OE		4	3	OE		4	3	OE	
3	3	OE		3	3	OE		3	3	OE		3	3	OE	
4	3	OE		4	3	OE		4	3	OE		4	3	OE	
2	3	OE		2	3	OE		2	3	OE		2	3	OE	
7	4	EO		7	4	EO		7	4	EO		7	4	EO	
4	4	OE		4	4	OE		4	4	OE		4	4	OE	
9	4	EO		9	4	EO		9	4	EO		9	4	EO	
9	4	EO		9	4	EO		9	4	EO		9	4	EO	
26	12	EO		26	12	EO		26	12	EO		26	12	EO	
15	7		L												
15	7		L												

The specified cutting data represents average standard values.  
For specific applications, adjustment is recommended.



## VRR: Feed rate charts for HSS countersinks

VRR	Feed f [mm] for diameter [mm]														
	2,5	4	5	6	8	10	12	15	20	25	40	50	60	80	100
1	0,008	0,013	0,017	0,018	0,021	0,024	0,026	0,029	0,033	0,037	0,047	0,053	0,058	0,067	0,075
2	0,017	0,027	0,033	0,037	0,042	0,047	0,052	0,058	0,067	0,075	0,094	0,11	0,12	0,13	0,15
3	0,025	0,040	0,050	0,055	0,063	0,071	0,077	0,087	0,10	0,11	0,14	0,16	0,17	0,20	0,22
4	0,033	0,053	0,067	0,073	0,084	0,094	0,10	0,12	0,13	0,15	0,19	0,21	0,23	0,27	0,30
5	0,042	0,067	0,083	0,091	0,11	0,12	0,13	0,14	0,17	0,19	0,24	0,26	0,29	0,33	0,37
6	0,050	0,080	0,10	0,11	0,13	0,14	0,15	0,17	0,20	0,22	0,28	0,32	0,35	0,40	0,45
7	0,058	0,093	0,12	0,13	0,15	0,16	0,18	0,20	0,23	0,26	0,33	0,37	0,40	0,47	0,52
8	0,067	0,11	0,13	0,15	0,17	0,19	0,21	0,23	0,27	0,30	0,38	0,42	0,46	0,53	0,60
9	0,075	0,12	0,15	0,16	0,19	0,21	0,23	0,26	0,30	0,34	0,42	0,47	0,52	0,60	0,67
10	0,083	0,13	0,17	0,18	0,21	0,24	0,26	0,29	0,33	0,37	0,47	0,53	0,58	0,67	0,75
12	0,10	0,16	0,20	0,22	0,25	0,28	0,31	0,35	0,40	0,45	0,57	0,63	0,69	0,80	0,89
16	0,13	0,21	0,27	0,29	0,34	0,38	0,41	0,46	0,53	0,60	0,75	0,84	0,92	1,07	1,19
20	0,17	0,27	0,33	0,37	0,42	0,47	0,52	0,58	0,67	0,75	0,94	1,05	1,15	1,33	1,49
25	0,21	0,33	0,42	0,46	0,53	0,59	0,65	0,72	0,83	0,93	1,18	1,32	1,44	1,67	1,86
30	0,25	0,40	0,50	0,55	0,63	0,71	0,77	0,87	1,00	1,12	1,41	1,58	1,73	2,00	2,24

## Designation key for indexable inserts for boring and precision boring

Example:

<b>C</b>	<b>C</b>	<b>M</b>	<b>T</b>	<b>06</b>	<b>02</b>	<b>04</b>	—	<b>E47</b>
1	2	3	4	5	6	7		8

1	
Insert shape	
<b>A</b>	<b>M</b>
<b>B</b>	<b>O</b>
<b>C</b>	<b>P</b>
<b>D</b>	<b>R</b>
<b>E</b>	<b>S</b>
<b>H</b>	<b>T</b>
<b>K</b>	<b>L</b>
<b>L</b>	<b>L</b>

2	
Clearance angle	
<b>A</b>	<b>F</b>
<b>B</b>	<b>G</b>
<b>C</b>	<b>N</b>
<b>D</b>	<b>P</b>
<b>E</b>	

3			
Tolerances			
Permissible deviation in mm for			
	d	m	s
	<b>A</b> ± 0,025	± 0,005	± 0,025
	<b>C</b> ± 0,025	± 0,013	± 0,025
	<b>E</b> ± 0,025	± 0,025	± 0,025
	<b>F</b> ± 0,013	± 0,005	± 0,025
	<b>G</b> ± 0,025	± 0,025	± 0,130
	<b>H</b> ± 0,013	± 0,013	± 0,025
	<b>J</b> <sup>1</sup> ± 0,05–0,15 <sup>2</sup>	± 0,005	± 0,025
	<b>K</b> <sup>1</sup> ± 0,05–0,15 <sup>2</sup>	± 0,013	± 0,025
	<b>L</b> <sup>1</sup> ± 0,05–0,15 <sup>2</sup>	± 0,025	± 0,025
	<b>M</b> ± 0,05–0,15 <sup>2</sup>	± 0,08–0,20 <sup>2</sup>	± 0,130
	<b>N</b> ± 0,05–0,15 <sup>2</sup>	± 0,08–0,20 <sup>2</sup>	± 0,025
	<b>U</b> ± 0,08–0,25 <sup>2</sup>	± 0,13–0,38 <sup>2</sup>	± 0,130

<sup>1</sup> Inserts with ground planar cutting edges  
<sup>2</sup> Depending on the insert size (see ISO standard 1832)

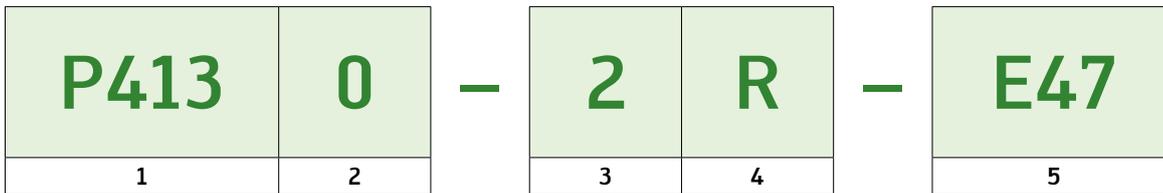
7	
Corner radius	
	<b>01</b> r = 0,1
	<b>02</b> r = 0,2
	<b>04</b> r = 0,4
	<b>08</b> r = 0,8
	<b>12</b> r = 1,2
	<b>16</b> r = 1,6
	<b>24</b> r = 2,4
	<b>00</b> For diameters converted from imperial units to mm
	<b>M0</b> For diameters in metric units

8	
Geometry	
<b>X5</b>	Tough
<b>X15</b>	Universal
<b>X25</b>	Easy-cutting
<b>E47</b>	Boring

4			5		6	
Machining and fastening features			Cutting edge length		Insert thickness	
<b>A</b>		<b>J</b>				<b>01</b> s = 1,59
<b>B</b>	 $\alpha = 70-90^\circ$	<b>M</b>				<b>T1</b> s = 1,98
<b>C</b>	 $\alpha = 70-90^\circ$	<b>N</b>				<b>T2</b> s = 2,78
<b>F</b>		<b>Q</b>	 $\beta = 40-60^\circ$			<b>03</b> s = 3,18
<b>G</b>		<b>R</b>				<b>T3</b> s = 3,97
<b>H</b>	 $\alpha = 70-90^\circ$	<b>T</b>	 $\beta = 40-60^\circ$			<b>04</b> s = 4,76
		<b>U</b>				<b>05</b> s = 5,56
		<b>W</b>	 $\beta = 40-60^\circ$			<b>06</b> s = 6,35
		<b>X</b>	Drawing or precise description of the indexable insert is required			<b>07</b> s = 7,94
						<b>09</b> s = 9,52

## Designation key for negative indexable inserts for boring

Example:



1
<b>Walter indexable insert designation</b>
<b>P413</b>
<b>P416</b> Negative boring
<b>P446</b>

2
<b>Version</b>
<b>0</b> Ground
<b>1</b> Sintered

3
<b>Insert size</b>
<b>0</b> 08...
<b>2</b> 10...
<b>3</b> 12...
<b>4</b> 14...

4
<b>Cutting direction</b>
<b>R</b> RH-cutting
<b>L</b> LH-cutting

5
<b>Walter geometry</b>
<b>E47</b> The universal one
<b>G88</b> The sharp one

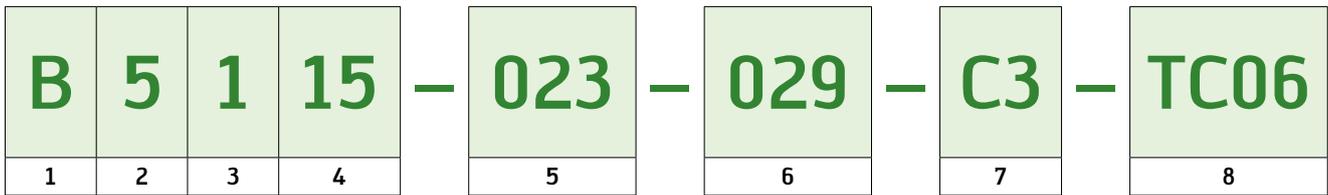
## Designation key for cutting material grades – Drilling

<b>W</b>	<b>K</b>	<b>P</b>	<b>25</b>	<b>S</b>
Walter	1	2	3	4

1	2	3	4
1. Primary application or coating type	2. Primary application	ISO application range	Generation
<p><b>P</b> Steel</p> <p><b>M</b> Stainless steel</p> <p><b>K</b> Cast iron</p> <p><b>N</b> NF metals</p> <p><b>S</b> Materials with difficult cutting properties</p> <p><b>H</b> Hard materials</p> <hr/> <p><b>A</b> CVD aluminium coating</p> <p><b>X</b> PVD coating</p>	<p><b>P</b> Steel</p> <p><b>M</b> Stainless steel</p> <p><b>K</b> Cast iron</p> <p><b>N</b> NF metals</p> <p><b>S</b> Materials with difficult cutting properties</p> <p><b>H</b> Hard materials</p>	<p style="text-align: center;">Wear resistance</p> <div style="display: flex; align-items: center; justify-content: center;"> <div style="text-align: right; margin-right: 10px;"> <p><b>01</b></p> <p><b>10</b></p> <p><b>15</b></p> <p><b>20</b></p> <p><b>25</b></p> <p><b>30</b></p> <p><b>35</b></p> <p><b>45</b></p> </div> <div style="text-align: left; margin-left: 10px;"> <p style="text-align: center;">Toughness</p> </div> </div>	<p><b>C</b> Color Select</p> <p><b>S</b> Tiger-tec® Silver</p>

## Designation key for boring and precision boring with Walter Precision XT/Walter Boring XT

Example:



1
<b>Tool group</b>
<b>B</b> Boring Precision boring

2
<b>Generation</b>
<b>5</b> Walter Precision XT Walter Boring XT

3
<b>Tool type</b>
<b>1</b> Precision boring tool, analogue radial <b>4</b> Boring tool, radial <b>5</b> Boring tool with tangential/lateral indexable insert

4
<b>Tool type</b>
<b>10</b> With boring bar <b>15</b> With cartridge <b>20</b> With bridge design <b>25</b> Lightweight design with cartridge <b>60</b> Boring Z = two-bridge design

5
<b>Min. diameter</b>

6
<b>Max. diameter</b>

7
<b>Shank</b>
<b>C</b> Walter Capto™ <b>N</b> Walter NCT <b>T</b> Walter ScrewFit

8
<b>Indexable insert/designation suffix</b>
<b>B</b> Basic body <b>CS</b> Solid carbide <b>TC..</b> Indexable insert type and size

## Designation key for boring and precision boring tools

Example:

<b>B</b>	<b>4030</b>	<b>T</b>	<b>45</b>	<b>55-70</b>	<b>Z1</b>	<b>CC06</b>
1	2	3	4	5	6	7

1
Tool range
<b>B</b> Drilling and reaming tools

2
Tool type
<b>3220</b> Walter Boring <b>3221</b> Walter Boring <b>3224</b> Walter Boring <b>3230</b> Walter Precision <b>3234</b> Walter Precision <b>4030</b> Walter Precision, balanceable, self-balancing <b>4035</b> Walter Precision <sup>DIGITAL</sup>

3
Interface
<b>N</b> Walter NCT <b>T</b> Walter ScrewFit

4
Interface size

5
Diameter range

6
Number of teeth

7
Insert type and size

# ISO designation key for ISO cartridges

Example: Walter Turn

P	W	L	N	R	25	25	M	08	...
1	2	3	4	5	6	7	8	9	10

1	2	3
Insert mounting type	Indexable insert basic shape	Approach angle
<p><b>C</b> Top clamping </p> <p><b>D</b> Top and hole clamping </p> <p><b>M</b> Top and hole clamping </p> <p><b>P</b> Hole clamping </p> <p><b>S</b> Screw clamping </p>	<p><b>C</b> </p> <p><b>D</b> </p> <p><b>R</b> </p> <p><b>S</b> </p> <p><b>T</b> </p> <p><b>V</b> </p> <p><b>W</b> </p>	<p><b>A</b> </p> <p><b>B</b> </p> <p><b>C</b> </p> <p><b>D</b> </p> <p><b>E</b> </p> <p><b>F</b> </p> <p><b>G</b> </p> <p><b>H</b> </p> <p><b>J</b> </p> <p><b>K</b> </p> <p><b>L</b> </p> <p><b>M</b> </p> <p><b>N</b> </p> <p><b>R</b> </p> <p><b>S</b> </p> <p><b>T</b> </p> <p><b>U</b> </p> <p><b>V</b> </p> <p><b>W</b> </p> <p><b>Y</b> </p> <p><b>X</b> Approach angles not specified in the standard. Specific information required.</p>

7	8	9
Toolholder width b or f dimension [mm]	Turning toolholder length l <sub>1</sub> /l <sub>4</sub> [mm]	Length of cutting edge l [mm]
<p>Shank width b in mm. Figures after the decimal point are ignored. Single-digit numbers are preceded by a "0", e.g. b = 8 mm = 08. For CA cartridges.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> </div>	<p>32 = A 40 = B 50 = C 60 = D 70 = E 80 = F 100 = H 110 = J 125 = K 140 = L 150 = M 160 = N 170 = P 180 = Q 200 = R 250 = S 300 = T 350 = U 400 = V 450 = W</p> <div style="display: flex; justify-content: center; align-items: center;"> </div> <p style="text-align: center;">Special = X 500 = Y</p>	<p><b>C/D/V</b> </p> <p><b>R</b> </p> <p><b>S</b> </p> <p><b>T</b> </p> <p><b>W</b> </p>



Example: Walter Capto™

<b>C5</b>	<b>-</b>	<b>P</b>	<b>W</b>	<b>L</b>	<b>N</b>	<b>R</b>	<b>-</b>	<b>22</b>	<b>110</b>	<b>-</b>	<b>08</b>	<b>...</b>
0		1	2	3	4	5		7	8		9	10

4	
Indexable insert clearance angle	
B	
C	
E	
F	
N	
P	

5	
Turning toolholder design	
R	
L	
N	

6	
Turning toolholder height $h_1$ [mm]	
<p>Height of the peripheral cutting edge <math>h_1</math> in mm. Figures after the decimal point are ignored. Single-digit numbers are preceded by a "0", e.g. <math>h_1 = 8 \text{ mm} = 08</math>.</p>	

10	
Manufacturer option	
<p>If necessary, an additional symbol comprising a maximum of three letters or figures can be added to the standard code.</p> <p>This symbol must be separated from the standard designation with a hyphen.</p>	
<p>-W Wedge-type clamping -P Precision cooling</p>	

## Cutting data for solid carbide and HSS reaming tools

Material group	= Wet machining (E = emulsion, O = oil) = Dry machining possible (M = MQL, L = dry) Cutting data must be selected from Walter GPS  v <sub>c</sub> = Cutting speed VRR = Feed rate chart  * The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.			Standard			Walter					
				Designation			F2482			F2482TMS		
				Form			—			—		
				Type			Straight-fluted			Straight-fluted		
Dia. range (mm)			3,97–20,00			3,97–20,00						
Cutting tool material			K10F			K10F						
Coating			Uncoated			TMS						
Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R <sub>m</sub> [N/mm <sup>2</sup> ]	Machining group*							
						v <sub>c</sub>	VRR	v <sub>c</sub>	VRR			
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	45	8	OE	190	20	OE
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	40	8	OE	175	20	OE
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	40	8	OE	170	20	OE
		C > 0,55 %	Annealed	190	640	P4	40	8	OE	175	20	OE
		C > 0,55 %	Heat-treated	300	1010	P5	30	8	OE	130	20	OE
	Free-machining steel (short-chipping)	Annealed	220	750	P6	45	8	OE	190	20	OE	
	Low-alloy steel	Annealed	175	590	P7	40	8	OE	175	20	OE	
		Heat-treated	285	960	P8	30	8	OE	130	20	OE	
		Heat-treated	380	1280	P9	20	8	OE	80	20	OE	
		Heat-treated	430	1480	P10	10	8	OE	50	20	OE	
	High-alloy steel and high-alloy tool steel	Annealed	200	680	P11	25	8	OE	110	20	OE	
		Hardened and tempered	300	1010	P12	20	8	OE	95	20	OE	
Hardened and tempered		380	1280	P13	15	8	OE	65	20	OE		
Stainless steel	Ferritic/martensitic, annealed	200	680	P14	25	8	OE	110	20	OE		
	Martensitic, heat-treated	330	1110	P15	20	8	OE	80	20	OE		
M	Stainless steel	Austenitic, quench hardened	200	680	M1							
		Austenitic, precipitation hardened (PH)	300	1010	M2							
		Austenitic/ferritic, duplex	230	780	M3							
K	Malleable cast iron	Ferritic	200	400	K1	35	8	OE	120	20	OE	
		Pearlitic	260	700	K2	30	8	OE	95	20	OE	
K	Grey cast iron	Low strength	180	200	K3	45	8	OE	145	20	OE	
		High strength/austenitic	245	350	K4	35	8	OE	120	20	OE	
	Cast iron with spheroidal graphite	Ferritic	155	400	K5	35	8	OE	120	20	OE	
		Pearlitic	265	700	K6	30	8	OE	95	20	OE	
CGI		230	400	K7	35	8	OE	110	20	OE		
N	Wrought aluminium alloys	Not hardenable	30	–	N1	115	8	OE				
		Hardenable, hardened	100	340	N2	115	8	OE				
	Cast aluminium alloys	≤ 12% Si, not hardenable	75	260	N3	90	8	OE				
		≤ 12% Si, hardenable, hardened	90	310	N4	80	8	OE				
		> 12% Si, not hardenable	130	450	N5	65	8	OE				
	Magnesium-based alloys		70	250	N6	80	8	O				
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper	100	340	N7	80	8	OE				
Brass, bronze, red brass		90	310	N8	65	8	OE					
Copper alloys, short-chipping		110	380	N9	70	8	OE					
High tensile, Ampco		300	1010	N10	20	8	OE					
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1						
			Hardened	280	940	S2						
		Ni- or Co-based	Annealed	250	840	S3						
			Hardened	350	1180	S4						
			Cast	320	1080	S5						
	Titanium alloys	Pure titanium	200	680	S6							
		α and β alloys, hardened	375	1260	S7							
		β alloys	410	1400	S8							
	Tungsten alloys		300	1010	S9							
	Molybdenum alloys		300	1010	S10							
H	Hardened steel	Hardened and tempered	50 HRC	–	H1							
		Hardened and tempered	55 HRC	–	H2							
		Hardened and tempered	60 HRC	–	H3							
	Hardened cast iron	Hardened and tempered	55 HRC	–	H4							
O	Thermoplastics	Without abrasive fillers			O1	40	8	E				
	Thermosetting plastics	Without abrasive fillers			O2	40	8	E				
	Plastic, glass-fibre reinforced	GFRP			O3	30	8	E				
	Plastic, carbon-fibre reinforced	CFRP			O4							
	Plastic, aramid-fibre reinforced	AFRP			O5							
	Graphite (technical)		80 Shore			O6						

	Walter												DIN 212						DIN 2179		
	F2481			F2481TMS			F2162			F2171			F1342			F1352 F1352HUN			F3234		
	—			—			A / C			B / D			A / C			B / D			—		
	Left-hand helix			Left-hand helix			Straight-fluted			Left-hand helix			Straight-fluted			Left-hand helix			Taper 1:50		
	3,97–20,00			3,97–20,00			4,00–20,00			2,00–20,00			1,00–20,00			0,90–20,00			1,00–12,00		
	K10F			K10F			K10			K10			HSS-E			HSS-E			HSS-E		
	Uncoated			TMS			Uncoated			Uncoated			Uncoated			Uncoated			Uncoated		
	v <sub>c</sub>	VRR		v <sub>c</sub>	VRR		v <sub>c</sub>	VRR		v <sub>c</sub>	VRR		v <sub>c</sub>	VRR		v <sub>c</sub>	VRR		v <sub>c</sub>	VRR	
45	8	OE		190	20	OE	24	8	EO	24	8	EO	14	8	EO	14	8	EO	8	8	EO
40	8	OE		175	20	OE	22	8	EO	22	8	EO	14	8	EO	14	8	EO	8	8	EO
40	8	OE		170	20	OE	21	8	EO	21	8	EO	13	8	EO	13	8	EO	8	8	EO
40	8	OE		175	20	OE	22	8	EO	22	8	EO	14	8	EO	14	8	EO	8	8	EO
30	8	OE		130	20	OE	16	8	EO	16	8	EO									
45	8	OE		190	20	OE	24	8	EO	24	8	EO	14	8	EO	14	8	EO	8	8	EO
40	8	OE		175	20	OE	22	8	EO	22	8	EO	14	8	EO	14	8	EO	8	8	EO
30	8	OE		130	20	OE	16	8	EO	16	8	EO	10	8	EO	10	8	EO	5	8	EO
20	8	OE		80	20	OE	10	8	EO	10	8	EO									
10	8	OE		50	20	OE	6	8	EO	6	8	EO									
25	8	OE		110	20	OE	14	8	EO	14	8	EO	4	8	EO	4	8	EO	2	8	EO
20	8	OE		95	20	OE	12	8	EO	12	8	EO									
15	8	OE		65	20	OE	8	8	EO	8	8	EO									
25	8	OE		110	20	OE	14	8	EO	14	8	EO	4	8	EO	4	8	EO	2	8	EO
20	8	OE		80	20	OE	10	8	EO	10	8	EO									
							8	8		8	8										
							12	8		12	8										
							6	8		6	8										
35	8	OE		120	20	OE	20	8	EO	20	8	EO	11	8	EO	11	8	EO	6	8	EO
30	8	OE		95	20	OE	16	8	EO	16	8	EO	8	8	EO	8	8	EO	5	8	EO
45	8	OE		145	20	OE	24	8	EO	24	8	EO	13	8	EO	13	8	EO	8	8	EO
35	8	OE		120	20	OE	20	8	EO	20	8	EO	11	8	EO	11	8	EO	6	8	EO
35	8	OE		120	20	OE	20	8	EO	20	8	EO	11	8	EO	11	8	EO	6	8	EO
30	8	OE		95	20	OE	16	8	EO	16	8	EO	8	8	EO	8	8	EO	5	8	EO
35	8	OE		110	20	OE	18	8	EO	18	8	EO	10	8	EO	10	8	EO	5	8	EO
115	8	OE					63	10	EO	63	10	EO	28	10	EO	28	10	EO	16	10	EO
115	8	OE					63	10	EO	63	10	EO	28	10	EO	28	10	EO	16	10	EO
90	8	OE					50	10	EO	50	10	EO	18	10	EO	18	10	EO	11	10	EO
80	8	OE					45	10	EO	45	10	EO	13	10	EO	13	10	EO	8	10	EO
65	8	OE					36	10	EO	36	10	EO									
80	8	O					45	10	O	45	10	O	13	10	O	13	10	O	8	10	O
80	8	OE					45	10	EO	45	10	EO	21	10	EO	21	10	EO	12	10	EO
65	8	OE					36	10	EO	36	10	EO	17	10	EO	17	10	EO	10	10	EO
70	8	OE					40	10	EO	40	10	EO	30	10	EO	30	10	EO	17	10	EO
20	8	OE					12	10	EO	12	10	EO									
							12	8	EO	12	8	EO									
							10	8	EO	10	8	EO									
							10	8	EO	10	8	EO									
							6	8	EO	6	8	EO									
							6	8	EO	6	8	EO									
							10	8	EO	10	8	EO									
							8	8	EO	8	8	EO									
							6	8	EO	6	8	EO									
							12	8	EO	12	8	EO									
							12	8	EO	12	8	EO									
40	8	E					22	8	E	22	8	E	18	8	E	18	8	E	10	8	E
40	8	E					22	8	L	22	8	L	11	8	L	11	8	L	6	8	L
30	8	E					16	8	L	16	8	L									

The specified cutting data represents average standard values. For specific applications, adjustment is recommended.

## VRR: Feed rate charts for solid carbide and HSS reaming tools

		Feed f [mm] for diameter [mm]														
VRR	1	1,2	1,5	2	2,5	4	5	6	8	10	12	15	20	25	40	50
6	0,04	0,04	0,04	0,05	0,06	0,08	0,09	0,10	0,12	0,14	0,15	0,17	0,21	0,23	0,31	0,35
8	0,05	0,05	0,06	0,07	0,08	0,11	0,12	0,14	0,16	0,18	0,20	0,23	0,27	0,31	0,41	0,47
10	0,06	0,07	0,07	0,09	0,10	0,13	0,15	0,17	0,20	0,23	0,25	0,29	0,34	0,39	0,51	0,59
12	0,07	0,08	0,09	0,11	0,12	0,16	0,18	0,20	0,24	0,27	0,30	0,35	0,41	0,47	0,62	0,70
20						0,18	0,30	0,45	0,70	0,80	0,90	1,00	1,20	1,30		

Material removal from diameter [mm]			
≤ 5	5-12	12-16	16-20
0,1	0,1-0,2	0,2	0,2-0,3

## Reaming tool tolerances in accordance with DIN 1420

### Basic information for determining the manufacturing tolerances

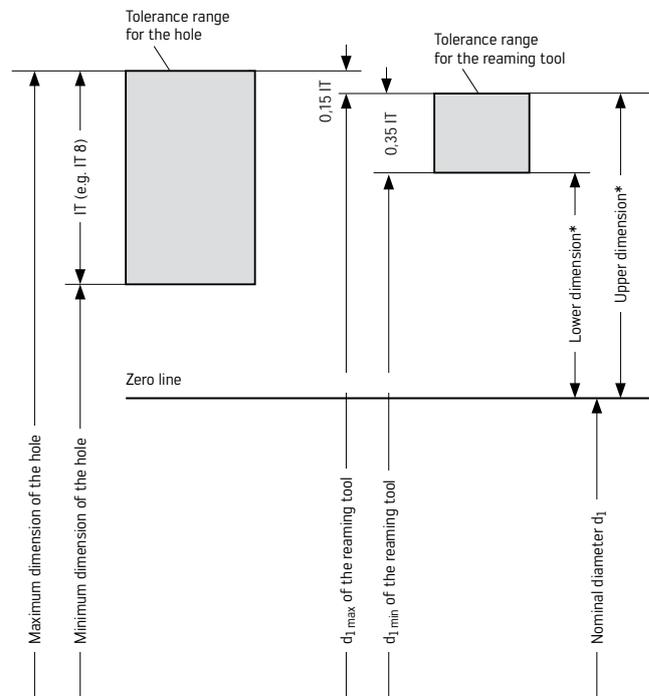
The manufacturing tolerances specified in the DIN 1420 standard are assigned to specific tolerance ranges for the holes to be reamed. In general, they ensure that the reamed hole is within the associated tolerance range and also ensure that the reaming tool can be used cost-effectively.

However, it is important to bear in mind that the size of the reamed hole depends not only on the manufacturing tolerance of the reaming tool, but also on other factors, e.g.:

- On the angles on the cutting edge
- On the chamfer of the reaming tool
- On the clamping of the workpiece
- On the tool adaptor
- On the condition of the machine tool
- On the lubrication and the material being reamed

There are therefore special cases in which other manufacturing tolerances are better suited. However, considering the importance of cost-effective manufacturing and inventory as well as of the interchangeability between reaming tools from different manufacturers, other manufacturing tolerances should only be used in well-founded special cases.

### Determining the manufacturing tolerances for reaming tools



\* in relation to the nominal diameter  $d_1$  of the reaming tool

### Determining the permitted maximum and minimum dimensions of reaming tools

The permitted maximum diameter  $D_{C \max}$  of the reaming tool is 15% below the corresponding hole tolerance (0.15 IT), the permitted maximum dimension for the hole. For calculating this, the value 0.15 IT is rounded to the nearest whole or half  $\mu\text{m}$  value, in order to ensure round  $\mu\text{m}$  values for  $D_{C \max}$ .

The permitted minimum diameter  $D_{C \min}$  of the reaming tool is 35% below the corresponding hole tolerance (0.35 IT), the permitted maximum reaming tool diameter  $D_{C \max}$ .

#### Example: 20 H8 reaming tool

Nominal diameter $D_C$	= 20.000 mm
Upper dimension	= 20.033 mm
Tolerance of the hole (IT 8)	= 0.033 mm
15% of the hole tolerance (0.15 IT 8)	= 0.0049 mm
	≈ 0.005 mm

Maximum dimension of the reaming tool:

$$D_{C \max} = 20.033 - 0.005 = 20.028 \text{ mm}$$

Manufacturing tolerance of the reaming tool:

$$33\% \text{ of the hole tolerance (0.35 IT 8)} = 0.0115 \text{ mm}$$

$$\approx 0.012 \text{ mm}$$

Minimum dimension of the reaming tool:

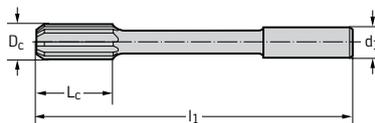
$$D_{C \min} = D_{C \max} - 0.35 \text{ IT 8}$$

$$= 20.028 - 0.012 = 20.016 \text{ mm}$$

## Dimensions for HSS reaming tools

### Reaming tools with cylindrical shank

Walter designation $D_c$ mm above – to	F11..			F13..			F12..		
	DIN 206			DIN 212			DIN 859		
	$l_1$	$L_c$	$d_1 e_9$	$l_1$	$L_c$	$d_1 h_9$	$l_1$	$L_c$	$d_1 e_9$
0,75–1,06	34	13	$D_c = d_1$	34	5,5				$D_c = d_1$
1,06–1,18	36	15	$D_c = d_1$	36	6,5				$D_c = d_1$
1,18–1,32	38	17	$D_c = d_1$	38	7,5				$D_c = d_1$
1,32–1,50	41	20	$D_c = d_1$	40	8				$D_c = d_1$
1,50–1,70	44	21	$D_c = d_1$	43	9				$D_c = d_1$
1,70–1,90	47	23	$D_c = d_1$	46	10				$D_c = d_1$
1,90–2,12	50	25	$D_c = d_1$	49	11				$D_c = d_1$
2,12–2,36	54	27	$D_c = d_1$	53	12				$D_c = d_1$
2,36–2,65	58	29	$D_c = d_1$	57	14				$D_c = d_1$
2,65–3,00	62	31	$D_c = d_1$	61	15				$D_c = d_1$
3,00–3,35	66	33	$D_c = d_1$	65	16				$D_c = d_1$
3,35–3,75	71	35	$D_c = d_1$	70	18				$D_c = d_1$
3,75–4,25	76	38	$D_c = d_1$	75	19	4	76	38	$D_c = d_1$
4,25–4,75	81	41	$D_c = d_1$	80	21	4,5	81	41	$D_c = d_1$
4,75–5,30	87	44	$D_c = d_1$	86	23	5	87	44	$D_c = d_1$
5,30–6,00	93	47	$D_c = d_1$	93	26	5,6	93	47	$D_c = d_1$
6,00–6,70	100	50	$D_c = d_1$	101	28	6,3	100	50	$D_c = d_1$
6,70–7,50	107	54	$D_c = d_1$	109	31	7,1	107	54	$D_c = d_1$
7,50–8,50	115	58	$D_c = d_1$	117	33	8	115	58	$D_c = d_1$
8,50–9,50	124	62	$D_c = d_1$	125	36	9	124	62	$D_c = d_1$
9,50–10,60	133	66	$D_c = d_1$	133	38	10	133	66	$D_c = d_1$
10,60–11,80	142	71	$D_c = d_1$	142	41	10	142	71	$D_c = d_1$
11,80–13,20	152	76	$D_c = d_1$	151	44	10	152	76	$D_c = d_1$
13,20–14,00	163	81	$D_c = d_1$	160	47	12,5	163	81	$D_c = d_1$
14,00–15,00	163	81	$D_c = d_1$	162	50	12,5	163	81	$D_c = d_1$
15,00–16,00	175	87	$D_c = d_1$	170	52	12,5	175	87	$D_c = d_1$
16,00–17,00	175	87	$D_c = d_1$	175	54	14	175	87	$D_c = d_1$
17,00–18,00	188	93	$D_c = d_1$	182	56	14	188	93	$D_c = d_1$
18,00–19,00	188	93	$D_c = d_1$	189	58	16	188	93	$D_c = d_1$
19,00–21,20	201	100	$D_c = d_1$	195	60	16	201	100	$D_c = d_1$
21,20–23,60	215	107	$D_c = d_1$				215	107	$D_c = d_1$
23,60–26,50	231	115	$D_c = d_1$				231	115	$D_c = d_1$
26,50–30,00	247	124	$D_c = d_1$				247	124	$D_c = d_1$
30,00–33,50	265	133	$D_c = d_1$				265	133	$D_c = d_1$
33,50–37,50	284	142	$D_c = d_1$				284	142	$D_c = d_1$
37,50–42,50	305	152	$D_c = d_1$				305	152	$D_c = d_1$
42,50–47,50	326	163	$D_c = d_1$				326	163	$D_c = d_1$
47,50–53,00	347	174	$D_c = d_1$				347	174	$D_c = d_1$
53,00–60,00	367	184	$D_c = d_1$				367	181	$D_c = d_1$
60,00–67,00	387	194	$D_c = d_1$				387	194	$D_c = d_1$
67,00–75,00	406	203	$D_c = d_1$				406	203	$D_c = d_1$



# Sustainable action in all Business divisions

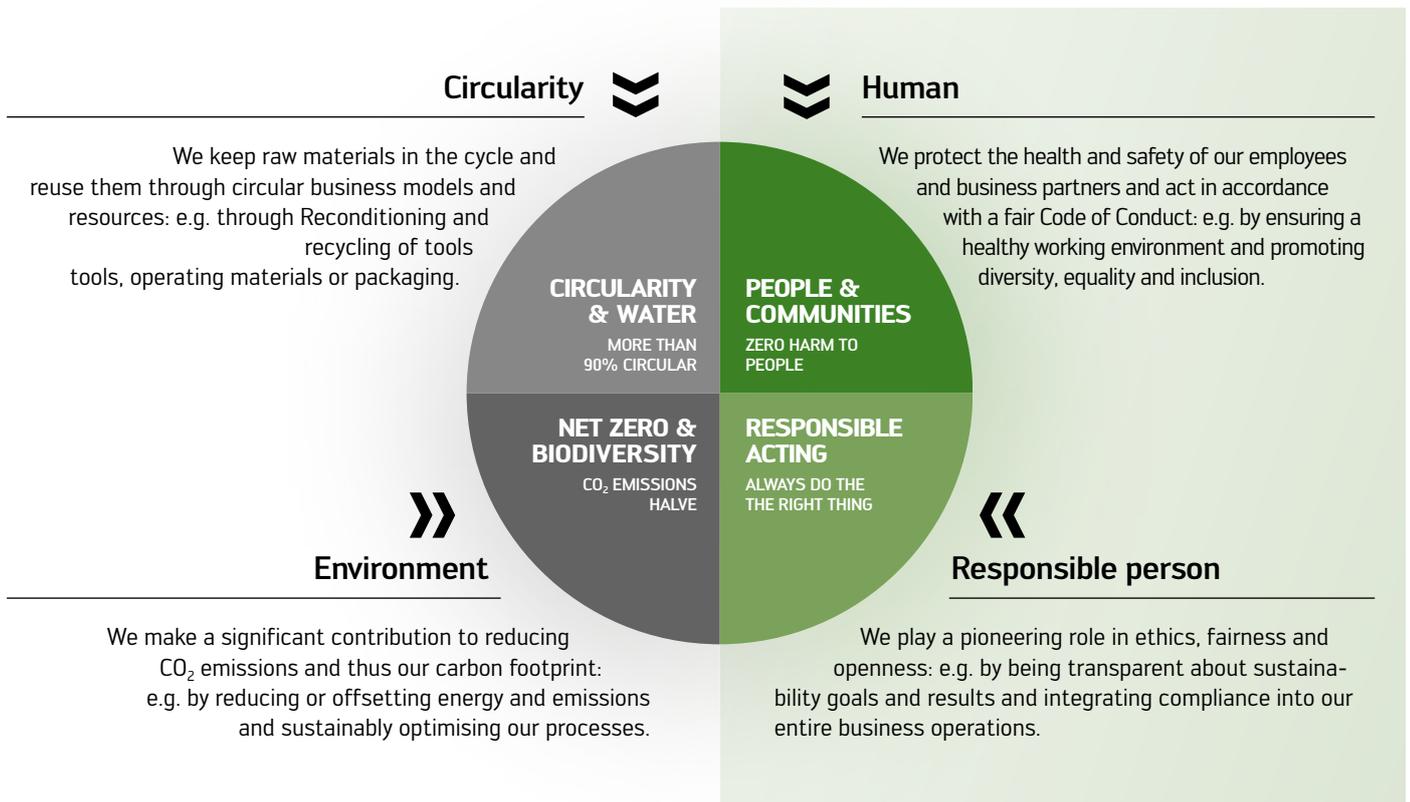
Create  
the  
Change

Sustainability is an essential Requirement for Walter to be successful as a company on the market in the long term. It is therefore a key component of our corporate strategy. Our responsible person for sustainability encompasses all areas: from product recycling, sustainable packaging, energy efficiency and the reduction of CO<sub>2</sub> emissions to our commitment to health and safety and responsible behaviour towards our business partners.



Visit our website:  
[www.walter-tools.com/en-gb/company/sustainable-company](http://www.walter-tools.com/en-gb/company/sustainable-company)

## THE WALTER SUSTAINABILITY GOALS BY 2030



## PROVEN TO BE MANUFACTURED TO HIGH STANDARDS

All processes, procedures, methods and resources that we use are audited and evaluated by an independent body according to Hardness criteria: Occupational health and safety, Quality assurance and environmentally friendly behaviour are examples of this. Our social commitment shows that Walter takes his responsibility much further.

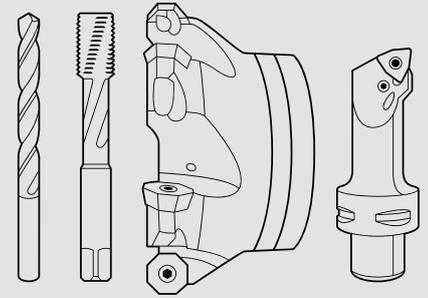


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