Engineering Kompetenz

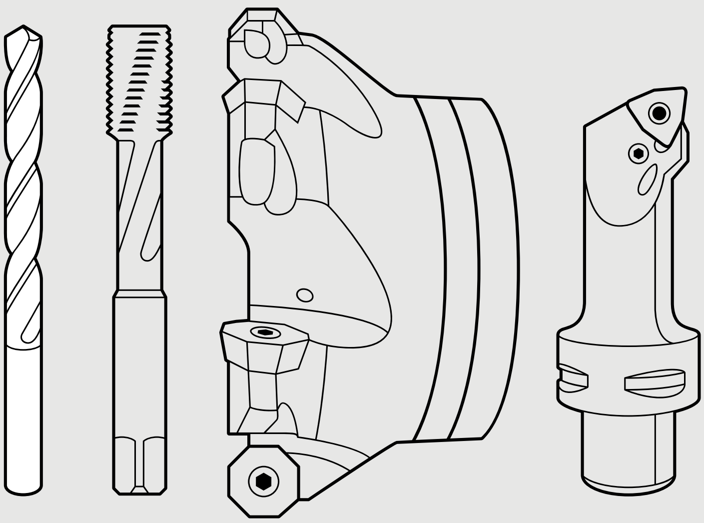
Drilling from solid, boring,
precision boring, reaming

Technical Compendium – Holemaking
Edition 2024

_ METAL IS OUR WHOLE WORLD

Technical Compendium

Holemaking




Krato·tec™

Technical Compendium – Holemaking

Drilling from solid

Technical Compendium – Holemaking (continued)

Boring and precision boring

General information

Setting and assembly instructions

Application information

General information – Countersinks

Designation key

Reaming

General information

Technologies at Walter

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.

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.

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.

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.

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 Green

Walter Green: Sustainability and responsible use of resources are central components of our company principles. We use our "Walter Green" seal to show how we implement these principles – such as by offsetting our CO_2 emissions with environmental conservation projects.

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.

Technologies at Walter (continued)

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 Technologie

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 $70 \times D_c$ 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_2 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.

"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.

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 × D_c as a standard tool and up to 70 × 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 × D_c
- Patented clamping provides maximum process reliability

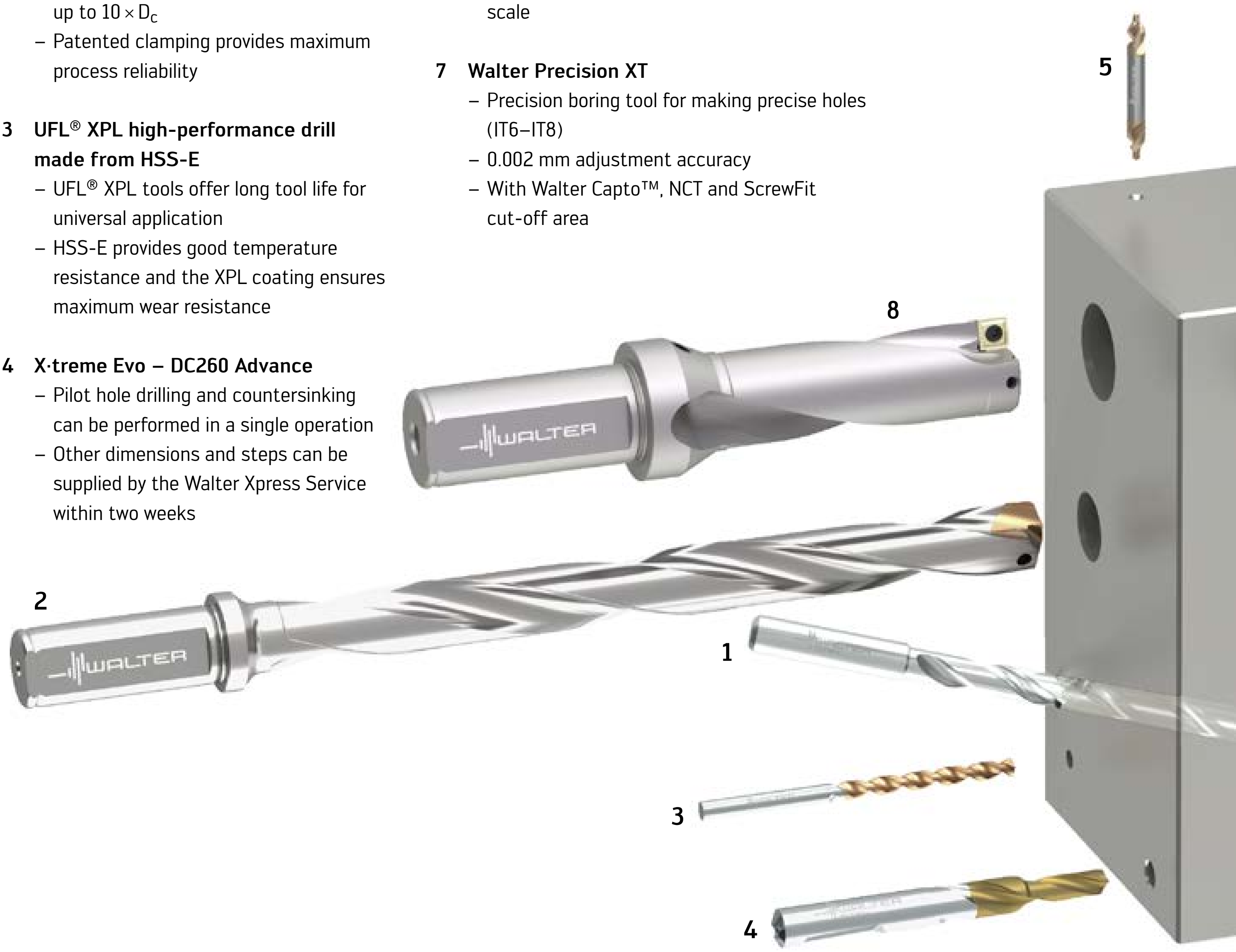
3 **UFL® XPL high-performance drill made from HSS-E**
- UFL® XPL tools offer long tool life for universal application
- HSS-E provides good temperature resistance and the XPL coating ensures maximum wear resistance

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° 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



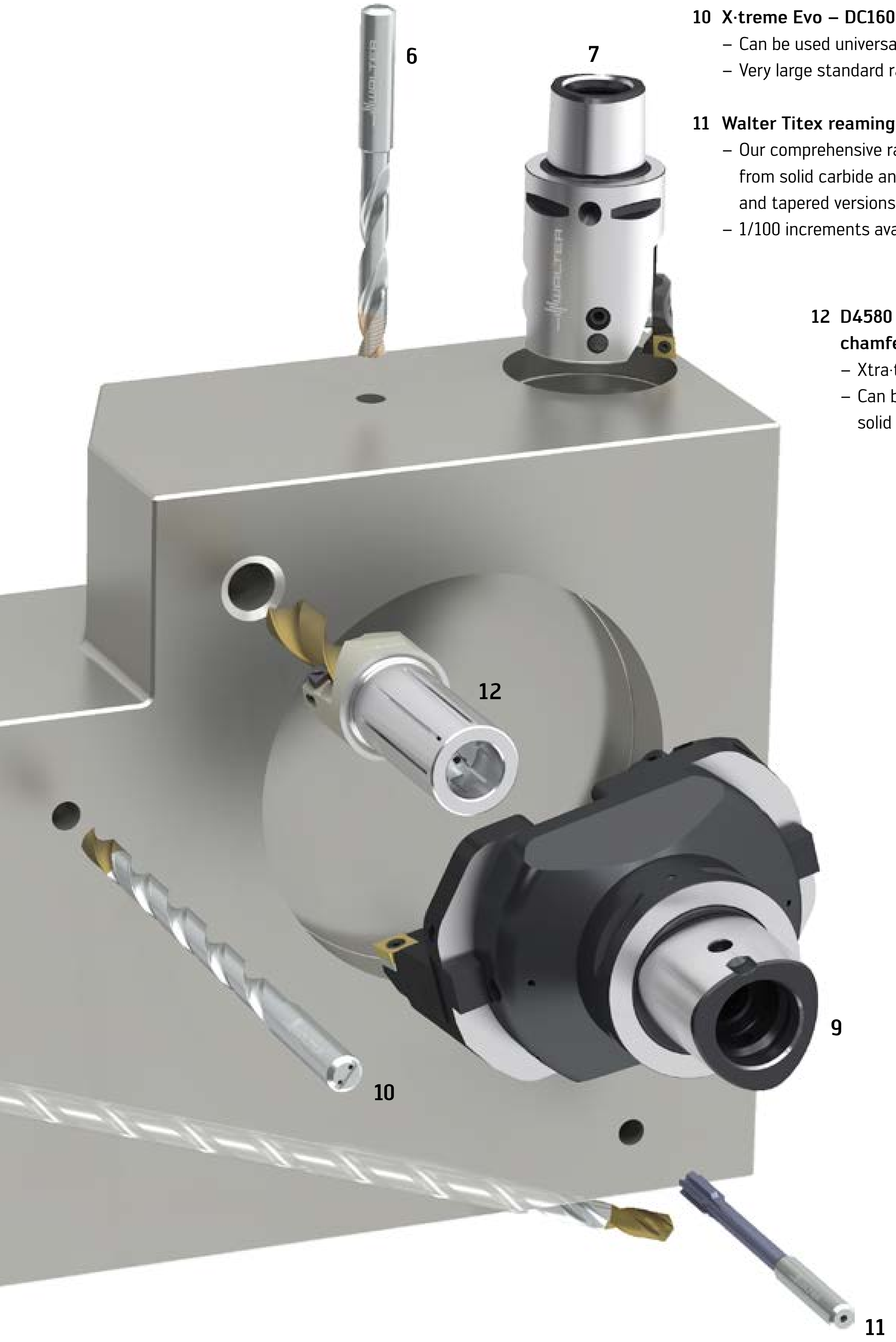
8 **D4120 indexable insert drill**
- Indexable insert drill which can be used universally for high productivity with excellent hole quality

9 **Walter Boring XT**
- Boring tool for efficient boring of existing holes (IT9)

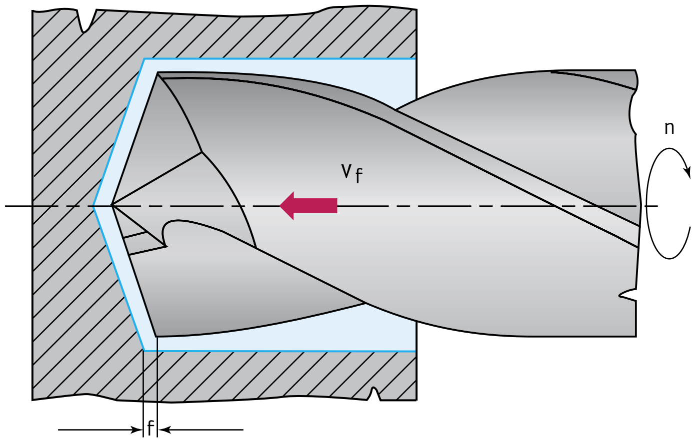
10 **X·treme Evo – DC160 Advance**
- Can be used universally with a range of materials
- Very large standard range from 3 to 30 × D_c

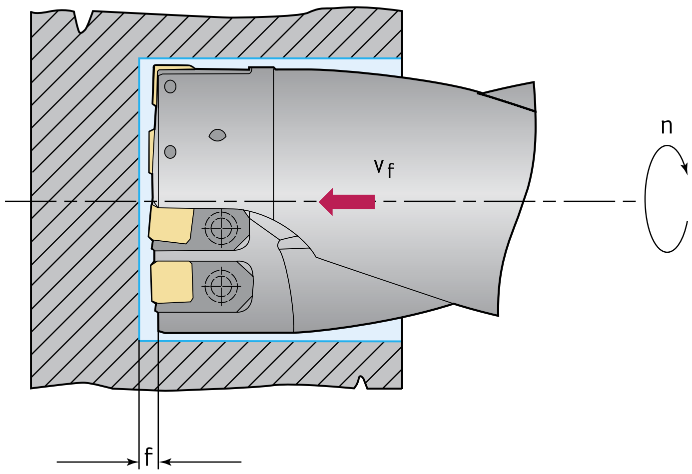
11 **Walter Titex reaming**
- Our comprehensive range of reaming tools made from solid carbide and HSS includes cylindrical and tapered versions
- 1/100 increments available from stock

12 **D4580 + DC160 Advance chamfering tools**
- Xtra·tec®
- Can be used with various solid carbide drills



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

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

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_c	Cutting diameter	mm
v_c	Cutting speed	m/min
v_f	Feed rate	mm/min
f_z	Feed per tooth	mm
f	Feed per revolution	mm
A	Chip cross section	mm^2
Q	Metal removal rate	cm^3/min
P_{mot}	Drive power	kW
M_c	Torque	Nm
F_f	Feed force	N
h	Chip thickness	mm
k_c	Specific cutting force	N/mm^2
η	Machine efficiency (0.7–0.95)	
κ	Lead angle	°
$k_{c1.1}$*	Specific cutting force for 1 mm^2 chip cross section with h = 1 mm	N/mm^2
m_c*	Increase in the k_c curve	

* For m_c and $k_{c1.1}$: see the "General" section of the Technical Compendium, page F7.

WALTER TITEX

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

= Wet machining (E = emulsion, O = oil)

= Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	v_c	VRR			v_c	VRR		
				Drilling depth			3 × D_c							
				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			
														
P	Non-alloyed 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	
	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	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	100	9	E O		126	9	E O	
		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	
		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[2]			70	250	N6								
	Copper and copper alloys (bronze/brass)	Non-alloyed, 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								
	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

	$3 \times D_c$																				$5 \times D_c$							
	DC175 Supreme				DC170 Supreme				DC160 Advance X·treme Evo				DC150 Perform				A3289DPL X·treme Plus				DB133 Supreme				DC183 Supreme X·treme Evo 3			
	DIN 6537 K				DIN 6537 K				DIN 6537 K				DIN 6537 K				DIN 6537 K				Walter				DIN 6537 L			
	WJ30RZ				WJ30EJ				WJ30ET				WJ30RE				DPL				WJ30EL				WJ30RZ			
	3–20				3–20				3–20				3–20				3–20				0,7–2,95				3–16			
	v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			VCRR	VRR			v_c	VRR		
	140	10	E O		200	16	E O	M	140	12	E O		120	12	E O		200	16	E O		C100	12	E O		200	17	E O	
					180	12	E O	M	140	12	E O		100	10	E O		180	12	E O		C80	12	E O		160	13	E O	
					160	12	E O	M	120	12	E O		80	9	E O		160	12	E O		C80	12	E O		160	13	E O	
					180	12	E O	M	140	9	E O		90	9	E O		160	12	E O		C80	12	E O		160	13	E O	
					140	12	E O	M	110	10	E O		71	8	E O		140	12	E O		C63	10	E O		120	13	E O	
	140	12	E O		200	16	E O	M	160	12	E O		120	12	E O		200	16	E O						200	17	E O	
	120	10	E O		180	12	E O	M	140	10	E O		100	12	E O		180	12	E O		C80	12	E O		180	13	E O	
					120	16	E O	M	100	10	E O		71	9	E O		110	12	E O		C50	10	E O		110	13	E O	
					100	12	E O	M	63	8	E O		45	6	E O		90	8	E O		C40	7	E O		90	9	E O	
					80	8	E O	M	50	5	E O		40	4	E O		71	6	E O		C40	6	E O		70	7	E O	
					140	9	E O	M	90	9	E O		80	9	E O		120	9	E O		C80	10	E O		120	10	E O	
					140	12	E O	M	110	10	E O		63	10	E O		140	12	E O		C63	10	E O		120	13	E O	
					56	8	E O	M	50	7	E O		50	6	E O		56	8	E O		C40	7	E O		55	9	E O	
	120	10	E O		160	12	E O	M	120	12	E O		80	10	E O		140	12	E O		C80	12	E O		140	13	E O	
					71	12	E O	M	56	10	E O		50	9	E O		63	12	E O		C63	10	E O		63	13	E O	
	63	6	E O						50	6	E O		40	5	E O		45	6	E O		C40	8	E O		45	7	E O	
	63	6	E O						45	6	E O		56	6	E O		63	6	E O		C50	6	E O		63	7	E O	
	45	5	E O						36	5	E O		32	4	E O		45	6	E O		C25	6	E O		45	7	E O	
					140	16	E O	M	110	16	E O		100	16	E O		120	16	E O		C80	16	E O		120	17	E O	
					140	16	E O	M	100	16	E O		71	16	E O		120	16	E O		C63	12	E O		110	17	E O	
					160	16	E O	M	120	16	E O		110	16	E O		160	16	E O		C100	16	E O		140	17	E O	
					140	16	E O	M	110	16	E O		90	16	E O		120	16	E O		C80	12	E O		120	17	E O	
					180	20	E O	M	140	20	E O		110	16	E O		140	20	E		C100	16	E O		140	21	E	
					140	16	E O	M	100	16	E O		71	16	E O		120	16	E O		C63	12	E O		110	17	E O	
					140	16	E O	M	110	16	E O		80	16	E O		120	16	E O		C80	12	E O		110	17	E O	
	450	16	E O	M					400	16	E O	M	400	16	E O		450	16	E O	M	C125	20	E O	M	450	17	E O	M
	450	16	E O	M					400	16	E O	M	400	16	E O		450	16	E O	M	C125	20	E O	M	450	17	E O	M
	250	16	E O	M					250	16	E O	M	250	16	E O	M	320	16	E O	M	C125	20	E O	M	320	17	E O	M
	220	16	E O	M					250	16	E O	M	220	16	E O	M	320	16	E O	M	C125	20	E O	M	320	17	E O	M
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									180	10	E O		160	10	E O		220	16	E O		C100	9	E O		200	17	E O	
	200	16	E O						200	12	E O		180	16	E O		250	20	E O		C100	16	E O		250	21	E O	
	45	5	E O						50	5	E O		45	5	E O		63	7	E O		C40	5	E O		63	8	E O	
	50	5	E O						40	4	E O		32	4	E O		36	5	E O		C32	6	E O		35	6	E O	
	36	4	E O						28	4	E O		22	3	E O		25	3	E O		C20	4	E O		25	4	E O	
	40	5	E O						32	5	E O		32	4	E O		40	5	E O		C25	6	E O		40	6	E O	
	22	4	E O						14	4	E O		11	3	E O		18	4	E O		C16	5	E O		17	5	E O	
	32	4	E O						25	4	E O		18	3	E O		28	4	E O		C16	6	E O		28	5	E O	
	50	6	E O						56	6	E O		45	6	E O		63	6	E O		C50	6	E O		55	7	E O	
	36	4	E O						40	4	E O		32	4	E O		40	4	E O		C25	4	E O		40	5	E O	
	32	4	E O						36	4	E O		28	4	E O		36	4	E O		C32	4	E O		35	5	E O	
	32	4	E O						50	5	E O		18	3	E O		28	4	E O		C16	6	E O		28	5	E O	
	32	4	E O						50	5	E O		18	3	E O		28	4	E O		C16	6	E O		28	5	E O	
					40	3	O E	M	45	3	O E		28	3	O E		50	4	O E		C32	3	E O		50	5	O E	
																	40	4	O E						35	5	O E	
																	28	4	O E						25	5	O E	
																	40	4	O E						35	5	O E	
	100	16	E O						110	16	E O		90	16	E O		140	16	E O		C100	20	E O		140	17	E O	

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

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

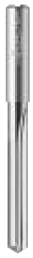
= Wet machining (E = emulsion, O = oil)

= Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

				Drilling depth			5 × D_c							
				Designation			DC180 Supreme X·treme Evo Plus				DC175 Supreme			
				Standard			DIN 6537 L				Walter			
				Coating/grade			WJ30RZ				WJ30RZ			
				Dia. range [mm]			3–20				3–20			
														
Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	v_c	VRR			v_c	VRR		
P	Non-alloyed steel	C ≤ 0.25%	Annealed	125	430	P1	210	16	**E** O		120	10	**E** O	
		C > 0.25 ... ≤ 0.55%	Annealed	190	640	P2	168	12	**E** O					
		C > 0.25 ... ≤ 0.55%	Heat-treated	210	710	P3	168	12	**E** O					
		C > 0.55%	Annealed	190	640	P4	168	12	**E** O					
		C > 0.55%	Heat-treated	300	1010	P5	126	12	**E** O					
		Free-machining steel (short-chipping)	Annealed	220	750	P6	210	16	**E** O		140	12	**E** O	
	Low-alloy steel	Annealed		175	590	P7	189	12	**E** O		120	10	**E** O	
		Heat-treated		285	960	P8	115	12	**E** O					
		Heat-treated		380	1280	P9	94	8	**E** O					
		Heat-treated		430	1480	P10	74	6	**E** O					
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	126	9	**E** O					
		Hardened and tempered		300	1010	P12	126	12	**E** O					
		Hardened and tempered		380	1280	P13	58	8	**E** O					
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	147	12	**E** O		120	10	**E** O	
		Martensitic, heat-treated		330	1110	P15	66	12	**E** O					
M	Stainless steel	Austenitic, quench hardened		200	680	M1	47	6	**E** O		63	6	**E** O	
		Austenitic, precipitation hardened (PH)		300	1010	M2	66	6	**E** O		63	6	**E** O	
		Austenitic/ferritic, duplex		230	780	M3	47	6	**E** O		45	5	**E** O	
K	Malleable cast iron	Ferritic		200	400	K1	126	16	**E** O					
		Pearlitic		260	700	K2	115	16	**E** O					
	Grey cast iron	Low strength		180	200	K3	147	16	**E** O					
		High strength/austenitic		245	350	K4	126	16	**E** O					
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	147	20	**E**					
		Pearlitic		265	700	K6	115	16	**E** O					
	CGI			230	400	K7	115	16	**E** O					
N	Wrought aluminium alloys	Not hardenable		30	-	N1	472	16	**E** O	M	450	16	**E** O	M
		Hardenable, hardened		100	340	N2	472	16	**E** O	M	450	16	**E** O	M
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	336	16	**E** O	M	250	16	E O	**M**
		≤ 12% Si, hardenable, hardened		90	310	N4	336	16	**E** O	M	220	16	**E** O	M
		> 12% Si, not hardenable		130	450	N5	262	16	**E** O	M	180	16	**E** O	M
	Magnesium-based alloys[2]			70	250	N6								
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	231	12	**E** O		180	10	**E** O	
		Brass, bronze, red brass		90	310	N8	210	16	**E** O					
		Copper alloys, short-chipping		110	380	N9	262	20	**E** O		200	16	**E** O	
		High tensile, Ampco		300	1010	N10	66	7	**E** O		45	5	**E** O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	37	5	**E** O		50	5	**E** O	
			Hardened	280	940	S2	26	3	**E** O		32	4	**E** O	
		Ni- or Co-based	Annealed	250	840	S3	42	5	**E** O		40	5	**E** O	
			Hardened	350	1180	S4	18	4	**E** O		22	4	**E** O	
			Cast	320	1080	S5	29	4	**E** O		28	4	**E** O	
	Titanium alloys	Pure titanium		200	680	S6	58	6	**E** O		50	6	**E** O	
		α and β alloys, hardened		375	1260	S7	42	4	**E** O		32	4	**E** O	
		β alloys		410	1400	S8	37	4	**E** O		28	4	**E** O	
	Tungsten alloys			300	1010	S9	29	4	**E** O		28	4	**E** O	
	Molybdenum alloys			300	1010	S10	29	4	**E** O		28	4	**E** O	
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	52	4	**O** E					
		Hardened and tempered		55 HRC	-	H2	37	4	**O** E					
		Hardened and tempered		60 HRC	-	H3	26	4	**O** E					
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4	37	4	**O** E					
O	Thermoplastics	Without abrasive fillers				O1	147	16	**E** O		100	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								
	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

	5 × D_c																							
	DC170 Supreme				DC166 Supreme				DC165 Advance				DC160 Advance X·treme Evo				DC150 Perform				A3389DPL X·treme Plus			
	DIN 6537 L				DIN 6537 L				Walter				DIN 6537 L				DIN 6537 L				DIN 6537 L			
	WJ30EJ				WJ30UU				WJ30UU				WJ30ET				WJ30RE				DPL			
	3–20				3–12				4–16				3–25				3–20				3–20			
																								
	v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
	200	16	**E** O	M									140	12	**E** O		110	12	**E** O		200	16	**E** O	
	180	12	**E** O	M									140	12	**E** O		100	10	**E** O		160	12	**E** O	
	160	12	**E** O	M									110	12	**E** O		80	9	**E** O		160	12	**E** O	
	180	12	**E** O	M									140	9	**E** O		90	9	**E** O		160	12	**E** O	
	140	12	**E** O	M									110	10	**E** O		71	8	**E** O		120	12	**E** O	
	200	16	**E** O	M									160	12	**E** O		110	12	**E** O		200	16	**E** O	
	180	12	**E** O	M									140	10	**E** O		100	12	**E** O		180	12	**E** O	
	120	16	**E** O	M									100	10	**E** O		71	9	**E** O		110	12	**E** O	
	100	12	**E** O	M									63	8	**E** O		45	6	**E** O		90	8	**E** O	
	80	8	**E** O	M									50	5	**E** O		36	4	**E** O		71	6	**E** O	
	140	9	**E** O	M									90	9	**E** O		80	9	**E** O		120	9	**E** O	
	140	12	**E** O	M									110	10	**E** O		63	10	**E** O		120	12	**E** O	
	56	8	**E** O	M									50	7	**E** O		50	6	**E** O		56	8	**E** O	
	160	12	**E** O	M									120	12	**E** O		80	10	**E** O		140	12	**E** O	
	71	12	**E** O	M									56	10	**E** O		50	9	**E** O		63	12	**E** O	
													50	6	**E** O		40	5	**E** O		45	6	**E** O	
													45	6	**E** O		56	6	**E** O		63	6	**E** O	
													36	5	**E** O		32	4	**E** O		45	6	**E** O	
	140	16	**E** O	M					100	12	**E** O		110	16	**E** O		100	16	**E** O		120	16	**E** O	
	140	16	**E** O	M									100	16	**E** O		71	16	**E** O		110	16	**E** O	
	160	16	**E** O	M					120	12	**E** O		120	16	**E** O		110	16	**E** O		140	16	**E** O	
	140	16	**E** O	M					100	12	**E** O		110	16	**E** O		90	16	**E** O		120	16	**E** O	
	180	20	**E** O	M					110	8	**E** O		140	20	**E** O		100	16	**E** O		140	20	**E**	
	140	16	**E** O	M									100	16	**E** O		71	16	**E** O		110	16	**E** O	
	140	16	**E** O	M					45	3	**E** O		110	16	**E** O		80	16	**E** O		110	16	**E** O	
					472	17	**E** O	M	450	9	**E** O		400	16	**E** O	M	400	16	**E** O		450	16	**E** O	M
					472	17	**E** O	M	450	9	**E** O		400	16	**E** O	M	400	16	**E** O		450	16	**E** O	M
					336	17	**E** O	M	250	9	**E** O		250	16	**E** O	M	250	16	**E** O	M	320	16	**E** O	M
					336	17	**E** O	M	400	9	**E** O		250	16	**E** O	M	220	16	**E** O	M	320	16	**E** O	M
					262	17	**E** O	M	200	9	**E** O		200	16	**E** O	M	200	16	**E** O	M	250	16	**E** O	M
					231	13	**E** O						200	9	**E** O		180	8	**E** O		220	12	**E** O	
					210	17	**E** O						180	10	**E** O		160	10	**E** O		200	16	**E** O	
					262	21	**E** O		220	16	**E** O		200	12	**E** O		180	16	**E** O		250	20	**E** O	
					66	8	**E** O						50	5	**E** O		45	5	**E** O		63	7	**E** O	
													40	4	**E** O		32	4	**E** O		36	5	**E** O	
													28	4	**E** O		22	3	**E** O		25	3	**E** O	
													32	5	**E** O		32	4	**E** O		40	5	**E** O	
													12	4	**E** O		11	3	**E** O		18	4	**E** O	
													25	4	**E** O		18	3	**E** O		28	4	**E** O	
													50	6	**E** O		45	6	**E** O		56	6	**E** O	
													40	4	**E** O		32	4	**E** O		40	4	**E** O	
													36	4	**E** O		25	4	**E** O		36	4	**E** O	
													50	5	**E** O		18	3	**E** O		28	4	**E** O	
													50	5	**E** O		18	3	**E** O		28	4	**E** O	
	40	3	**O** E	M									40	3	**O** E		28	3	**O** E		50	4	**O** E	
																					36	4	**O** E	
																					25	4	**O** E	
																					36	4	**O** E	
													110	16	**E** O		90	16	**E** O		140	16	**E** O	

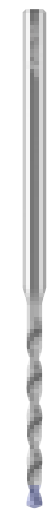
The specified cutting data are average standard values.
For specific applications, adjustment is recommended.

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

= Wet machining (E = emulsion, O = oil)

= Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

Drilling depth	8 × D_c	
Designation	DB133 Supreme	DC183 Supreme X·treme Evo 3
Standard	Walter	Walter
Coating/grade	WJ30ER	WJ30RY
Dia. range [mm]	0,7–2,95	3–16
		

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	VCRR	VRR	Wet	Dry	v_c	VRR	Wet	Dry
P	Non-alloyed steel	C ≤ 0.25%	Annealed	125	430	P1	C100	12	**E** O		180	17	**E** O	
		C > 0.25 ... ≤ 0.55%	Annealed	190	640	P2	C80	12	**E** O		160	13	**E** O	
		C > 0.25 ... ≤ 0.55%	Heat-treated	210	710	P3	C80	12	**E** O		160	13	**E** O	
		C > 0.55%	Annealed	190	640	P4	C80	12	**E** O		160	13	**E** O	
		C > 0.55%	Heat-treated	300	1010	P5	C63	10	**E** O		120	13	**E** O	
		Free-machining steel (short-chipping)	Annealed	220	750	P6					180	17	**E** O	
	Low-alloy steel	Annealed		175	590	P7	C80	12	**E** O		160	13	**E** O	
		Heat-treated		285	960	P8	C50	10	**E** O		110	13	**E** O	
		Heat-treated		380	1280	P9	C40	7	**E** O		80	9	**E** O	
		Heat-treated		430	1480	P10	C32	6	**E** O		63	7	**E** O	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	C63	10	**E** O		120	10	**E** O	
		Hardened and tempered		300	1010	P12	C63	10	**E** O		120	13	**E** O	
		Hardened and tempered		380	1280	P13	C40	7	**E** O		50	9	**E** O	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	C63	12	**E** O		140	13	**E** O	
		Martensitic, heat-treated		330	1110	P15	C63	10	**E** O		63	13	**E** O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1	C32	8	**E** O		45	7	**E** O	
		Austenitic, precipitation hardened (PH)		300	1010	M2	C40	6	**E** O		56	7	**E** O	
		Austenitic/ferritic, duplex		230	780	M3	C25	6	**E** O		40	7	**E** O	
K	Malleable cast iron	Ferritic		200	400	K1	C80	16	**E** O		120	17	**E** O	
		Pearlitic		260	700	K2	C63	12	**E** O		110	17	**E** O	
	Grey cast iron	Low strength		180	200	K3	C100	16	**E** O		140	17	**E** O	
		High strength/austenitic		245	350	K4	C80	12	**E** O		120	17	**E** O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	C100	16	**E** O		160	21	**E**	
		Pearlitic		265	700	K6	C63	12	**E** O		110	17	**E** O	
	CGI			230	400	K7	C63	12	**E** O		120	17	**E** O	
N	Wrought aluminium alloys	Not hardenable		30	-	N1	C125	20	E O	**M**	450	17	**E** O	M
		Hardenable, hardened		100	340	N2	C125	20	E O	**M**	450	17	**E** O	M
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	C125	20	**E** O	M	320	17	**E** O	M
		≤ 12% Si, hardenable, hardened		90	310	N4	C125	20	**E** O	M	320	17	**E** O	M
		> 12% Si, not hardenable		130	450	N5	C125	16	E O	**M**	250	17	**E** O	M
	Magnesium-based alloys[2]			70	250	N6								
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	C80	6	**E** O		200	13	**E** O	
		Brass, bronze, red brass		90	310	N8	C80	9	**E** O		180	17	**E** O	
		Copper alloys, short-chipping		110	380	N9	C80	16	**E** O		250	21	**E** O	
		High tensile, Ampco		300	1010	N10	C40	5	**E** O		63	8	**E** O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	C25	6	**E** O		36	6	**E** O	
			Hardened	280	940	S2	C20	4	**E** O		25	4	**E** O	
		Ni- or Co-based	Annealed	250	840	S3	C25	6	**E** O		36	6	**E** O	
			Hardened	350	1180	S4	C16	5	**E** O		16	5	**E** O	
			Cast	320	1080	S5	C16	6	**E** O		25	5	**E** O	
	Titanium alloys	Pure titanium		200	680	S6	C40	6	**E** O		50	7	**E** O	
		α and β alloys, hardened		375	1260	S7	C25	4	**E** O		36	5	**E** O	
		β alloys		410	1400	S8	C25	4	**E** O		32	5	**E** O	
	Tungsten alloys			300	1010	S9	C16	6	**E** O		25	5	**E** O	
	Molybdenum alloys			300	1010	S10	C16	6	**E** O		25	5	**E** O	
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	C32	3	**E** O		40	5	**O** E	
		Hardened and tempered		55 HRC	-	H2					32	5	**O** E	
		Hardened and tempered		60 HRC	-	H3					22	5	**O** E	
	Hardened cast iron	Hardened and tempered		55 HRC	-	H4					32	5	**O** E	
O	Thermoplastics	Without abrasive fillers				O1	C100	20	**E** O		140	17	**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								
	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

DC180 Supreme X·treme Evo Plus				DC175 Supreme				DC170 Supreme				DC160 Advance X·treme Evo				DC150 Perform				A6489DPP X·treme D8				A3486TIP Alpha® 44			
Walter				Walter				Walter				Walter				Walter				Walter				Walter			
WJ30ET				WJ30RY				WJ30EJ				WJ30ET				WJ30TA				DPP				TIP			
3–20				3–16				3–20				3–20				3–20				3–20				5–9			
v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
189	16	E O		120	10	E O		200	16	E O	M	140	12	E O		110	12	E O		180	16	E O		90	10	E O	
168	12	E O						180	12	E O	M	120	12	E O		90	10	E O		160	12	E O		71	10	E O	
168	12	E O						160	12	E O	M	110	12	E O		71	9	E O		160	12	E O		63	8	E O	
168	12	E O						180	12	E O	M	140	9	E O		80	9	E O		160	12	E O		80	8	E O	
126	12	E O						140	12	E O	M	110	10	E O		71	9	E O		120	12	E O		50	7	E O	
189	16	E O		140	12	E O		200	16	E O	M	140	12	E O		110	12	E O		180	16	E O		90	12	E O	
168	12	E O		120	10	E O		180	12	E O	M	140	10	E O		90	12	E O		160	12	E O		90	10	E O	
116	12	E O						120	16	E O	M	90	10	E O		63	9	E O		110	12	E O		50	8	E O	
84	8	E O						100	12	E O	M	56	8	E O		36	7	E O		80	8	E O		28	3	E O	
66	6	E O						80	8	E O	M	45	5	E O		28	6	E O		63	6	E O					
126	9	E O						140	9	E O	M	90	9	E O		80	9	E O		120	9	E O		56	8	E O	
126	12	E O						140	12	E O	M	110	10	E O		50	10	E O		120	12	E O		71	10	E O	
53	8	E O						56	8	E O	M	45	7	E O		45	7	E O		50	8	E O		20	3	E O	
147	12	E O		120	10	E O		160	12	E O	M	110	12	E O		90	10	E O		140	12	E O		63	9	E O	
66	12	E O						71	12	E O	M	56	10	E O		45	9	E O		63	12	E O		56	9	E O	
47	6	E O		56	6	E O						50	6	E O		40	5	E O		45	6	E O		28	5	E O	
59	6	E O		63	6	E O						45	6	E O		50	6	E O		56	6	E O		36	5	E O	
42	6	E O		40	5	E O						36	5	E O		32	4	E O		40	6	E O		18	4	E O	
122	16	E O						140	16	E O	M	110	16	E O		90	16	E O		120	16	E O		63	16	E O	
112	16	E O						140	16	E O	M	90	16	E O		71	16	E O		110	16	E O		50	12	E O	
143	16	E O						160	16	E O	M	120	16	E O		110	16	E O		140	16	E O		80	16	E O	
123	16	E O						140	16	E O	M	100	16	E O		90	16	E O		120	16	E O		63	16	E O	
145	20	E O						180	20	E O	M	140	20	E O		90	16	E O		160	20	E O		71	16	E O	
112	16	E O						140	16	E O	M	90	16	E O		63	16	E O		110	16	E O		50	12	E O	
112	16	E O						140	16	E O	M	100	16	E O		71	16	E O		120	16	E O		56	12	E O	
465	16	E O	M	400	16	E O	M					400	16	E O	M	400	16	E O	M	450	16	E O	M	280	12	E O	M
465	16	E O	M	400	16	E O	M					400	16	E O	M	400	16	E O	M	450	16	E O	M	280	12	E O	M
330	16	E O	M	220	16	E O	M					250	16	E O	M	250	16	E O	M	320	16	E O	M	220	12	E O	M
330	16	E O	M	220	16	E O	M					250	16	E O	M	220	16	E O	M	320	16	E O	M	200	12	E O	M
258	16	E O	M	180	16	E O	M					180	16	E O	M	200	16	E O	M	250	16	E O	M	160	12	E O	M
210	12	E O		160	10	E O						180	9	E O		160	8	E O		200	12	E O		140	6	E O	
189	16	E O										160	10	E O		140	10	E O		180	16	E O		110	9	E O	
258	20	E O		200	16	E O						180	12	E O		180	12	E O		250	20	E O		120	16	E O	
65	7	E O		45	5	E O						45	5	E O		45	5	E O		63	7	E O					
37	5	E O		45	5	E O						40	4	E O		36	4	E O		36	5	E O		22	4	E O	
26	3	E O		32	4	E O						28	4	E O		22	3	E O		25	3	E O					
38	5	E O		40	5	E O						32	5	E O		32	4	E O		36	5	E O		16	4	E O	
17	4	E O		20	4	E O						12	4	E O						16	4	E O					
26	4	E O		28	4	E O						25	4	E O		18	3	E O		25	4	E O					
53	6	E O		40	6	E O						45	6	E O		45	6	E O		50	6	E O		32	5	E O	
38	4	E O		28	4	E O						40	4	E O		28	4	E O		36	4	E O		22	3	E O	
34	4	E O		25	4	E O						32	4	E O		22	4	E O		32	4	E O		18	3	E O	
26	4	E O		28	4	E O						45	5	E O		18	3	E O		25	4	E O					
26	4	E O		28	4	E O						45	5	E O		18	3	E O		25	4	E O					
45	4	O E						40	3	O E	M					25	3	O E		40	4	O E					
34	4	O E																		32	4	O E					
23	4	O E																		22	4	O E					
34	4	O E																		32	4	O E					
145	16	E O		100	16	E O						110	16	E O		90	16	E O		140	16	E O		100	16	E O	

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

WALTER TITEX

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

= Wet machining (E = emulsion, O = oil)

= Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

				Drilling depth			12 × D_c							
				Designation			DB133 Supreme				DC170 Supreme			
				Standard			Walter				Walter			
				Coating/grade			WJ30ER				WJ30EJ			
				Dia. range [mm]			0,7–2,9				3–20			
														
Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	VCRR	VRR			v_c	VRR		
P	Non-alloyed steel	C ≤ 0.25%	Annealed	125	430	P1	C80	12	**E** O		180	16	**E** O	M
		C > 0.25 ... ≤ 0.55%	Annealed	190	640	P2	C80	12	**E** O		160	12	**E** O	M
		C > 0.25 ... ≤ 0.55%	Heat-treated	210	710	P3	C63	12	**E** O		140	12	**E** O	M
		C > 0.55%	Annealed	190	640	P4	C63	12	**E** O		160	12	**E** O	M
		C > 0.55%	Heat-treated	300	1010	P5	C50	10	**E** O		120	12	**E** O	M
		Free-machining steel (short-chipping)	Annealed	220	750	P6	C80	12	**E** O		180	16	**E** O	M
	Low-alloy steel	Annealed		175	590	P7	C80	12	**E** O		160	12	**E** O	M
		Heat-treated		285	960	P8	C50	10	**E** O		110	16	**E** O	M
		Heat-treated		380	1280	P9	C40	7	**E** O		90	12	**E** O	M
		Heat-treated		430	1480	P10	C32	6	**E** O		71	8	**E** O	M
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	C63	10	**E** O		120	9	**E** O	M
		Hardened and tempered		300	1010	P12	C50	10	**E** O		120	12	**E** O	M
		Hardened and tempered		380	1280	P13	C40	7	**E** O		50	8	**E** O	M
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	C63	12	**E** O		140	12	**E** O	M
		Martensitic, heat-treated		330	1110	P15	C50	10	**E** O		63	12	**E** O	M
M	Stainless steel	Austenitic, quench hardened		200	680	M1	C32	8	**E** O					
		Austenitic, precipitation hardened (PH)		300	1010	M2	C40	6	**E** O					
		Austenitic/ferritic, duplex		230	780	M3	C25	6	**E** O					
K	Malleable cast iron	Ferritic		200	400	K1	C80	16	**E** O		120	16	**E** O	M
		Pearlitic		260	700	K2	C63	12	**E** O		120	16	**E** O	M
	Grey cast iron	Low strength		180	200	K3	C80	16	**E** O		140	16	**E** O	M
		High strength/austenitic		245	350	K4	C80	12	**E** O		120	16	**E** O	M
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	C80	16	**E** O		160	20	**E** O	M
		Pearlitic		265	700	K6	C63	12	**E** O		120	16	**E** O	M
	CGI			230	400	K7	C63	12	**E** O		120	16	**E** O	M
N	Wrought aluminium alloys	Not hardenable		30	-	N1	C125	20	E O	**M**				
		Hardenable, hardened		100	340	N2	C125	20	E O	**M**				
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	C125	20	**E** O	M				
		≤ 12% Si, hardenable, hardened		90	310	N4	C125	20	**E** O	M				
		> 12% Si, not hardenable		130	450	N5	C100	16	E O	**M**				
	Magnesium-based alloys[2]			70	250	N6								
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	C63	6	**E** O					
		Brass, bronze, red brass		90	310	N8	C80	9	**E** O					
		Copper alloys, short-chipping		110	380	N9	C80	16	**E** O					
		High tensile, Ampco		300	1010	N10	C40	5	**E** O					
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	C25	6	**E** O					
			Hardened	280	940	S2	C20	4	**E** O					
		Ni- or Co-based	Annealed	250	840	S3	C20	6	**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	C40	6	**E** O					
		α and β alloys, hardened		375	1260	S7	C20	4	**E** O					
		β alloys		410	1400	S8	C25	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	C32	3	**E** O		36	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	C100	20	**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								
	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the “General” section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

12 × D_c												16 × D_c											
DC160 Advance X·treme Evo				DC150 Perform				A6589DPP X·treme D12				DB133 Supreme				DC170 Supreme				DC160 Advance X·treme Evo			
Walter				Walter				Walter				Walter				Walter				Walter			
WJ30EU				WJ30TA				DPP				WJ30ER				WJ30EJ				WJ30EU			
3–20				3–20				3–20				2–2,9				3–16				3–16			
																							
v_c	VRR			v_c	VRR			v_c	VRR			VCRR	VRR			v_c	VRR			v_c	VRR		
120	10	**E** O		100	12	**E** O		160	16	**E** O		C125	12	**E** O		140	12	**E** O	M	120	12	**E** O	
120	12	**E** O		80	10	**E** O		140	12	**E** O		C125	12	**E** O		120	12	**E** O	M	110	12	**E** O	
110	12	**E** O		63	9	**E** O		140	12	**E** O		C100	12	**E** O		100	10	**E** O	M	80	10	**E** O	
120	9	**E** O		71	9	**E** O		140	12	**E** O		C125	12	**E** O		110	10	**E** O	M	90	10	**E** O	
90	10	**E** O		63	9	**E** O		110	12	**E** O		C100	12	**E** O		80	10	**E** O	M	71	10	**E** O	
140	12	**E** O		100	12	**E** O		160	16	**E** O		C125	12	**E** O		140	12	**E** O	M	120	12	**E** O	
120	10	**E** O		80	12	**E** O		140	12	**E** O		C125	12	**E** O		120	12	**E** O	M	110	12	**E** O	
80	10	**E** O		50	9	**E** O		100	12	**E** O		C100	12	**E** O		71	10	**E** O	M	63	10	**E** O	
50	8	**E** O		25	7	**E** O		63	8	**E** O		C80	12	**E** O		56	8	**E** O	M	56	8	**E** O	
36	5	**E** O		22	6	**E** O		50	6	**E** O		C63	6	**E** O		40	7	**E** O	M	36	7	**E** O	
80	9	**E** O		71	9	**E** O		100	9	**E** O		C125	10	**E** O		100	9	**E** O	M	90	9	**E** O	
90	10	**E** O		36	10	**E** O		110	12	**E** O		C100	12	**E** O		80	10	**E** O	M	80	10	**E** O	
36	7	**E** O		40	7	**E** O		45	8	**E** O		C80	12	**E** O		56	8	**E** O	M	56	8	**E** O	
100	12	**E** O		80	10	**E** O		120	12	**E** O		C100	12	**E** O		100	10	**E** O	M	90	10	**E** O	
50	10	**E** O		36	9	**E** O		56	12	**E** O		C80	10	**E** O		63	9	**E** O	M	63	9	**E** O	
45	6	**E** O		36	5	**E** O		40	6	**E** O		C32	8	**E** O						45	6	**E** O	
40	6	**E** O		45	6	**E** O		50	6	**E** O		C40	12	**E** O						56	6	**E** O	
32	5	**E** O		28	4	**E** O		36	6	**E** O		C25	6	**E** O						40	4	**E** O	
100	16	**E** O		80	16	**E** O		110	16	**E** O		C63	25	**E** O		120	16	**E** O	M	110	16	**E** O	
80	16	**E** O		63	16	**E** O		100	16	**E** O		C63	20	**E** O		100	16	**E** O	M	80	16	**E** O	
110	16	**E** O		90	16	**E** O		120	16	**E** O		C80	25	**E** O		140	16	**E** O	M	140	16	**E** O	
90	16	**E** O		80	16	**E** O		110	16	**E** O		C63	25	**E** O		120	16	**E** O	M	110	16	**E** O	
120	20	**E** O		71	16	**E** O		140	20	**E** O		C63	30	**E** O		140	16	**E** O	M	120	16	**E** O	
80	16	**E** O		50	16	**E** O		100	16	**E** O		C63	20	**E** O		100	16	**E** O	M	80	16	**E** O	
90	16	**E** O		50	16	**E** O		100	16	**E** O		C50	20	**E** O		100	16	**E** O	M	90	16	**E** O	
360	16	**E** O	M	360	16	**E** O	M	400	16	**E** O	M	C125	25	E O	**M**					220	20	**E** O	M
360	16	**E** O	M	360	16	**E** O	M	400	16	**E** O	M	C125	25	E O	**M**					220	20	**E** O	M
220	16	**E** O	M	220	16	**E** O	M	280	16	**E** O	M	C125	25	E O	**M**					220	20	**E** O	M
220	16	**E** O	M	200	16	**E** O	M	280	16	**E** O	M	C125	25	E O	**M**					220	20	**E** O	M
160	16	**E** O	M	180	16	**E** O	M	220	16	**E** O	M	C100	20	E O	**M**					220	16	**E** O	M
160	9	**E** O		120	8	**E** O		160	12	**E** O		C63	6	**E** O						180	8	**E** O	
140	10	**E** O		110	10	**E** O		140	16	**E** O		C80	10	**E** O						160	10	**E** O	
160	12	**E** O		160	12	**E** O		250	20	**E** O		C80	20	**E** O						180	12	**E** O	
40	5	**E** O		40	5	**E** O		63	7	**E** O		C40	6	**E** O						56	5	**E** O	
36	4	**E** O		32	4	**E** O		32	5	**E** O		C25	6	**E** O						36	4	**E** O	
25	4	**E** O		22	3	**E** O		25	3	**E** O		C20	6	**E** O						22	2	**E** O	
28	5	**E** O		28	4	**E** O		32	5	**E** O		C25	5	**E** O						32	4	**E** O	
11	4	**E** O						12	4	**E** O		C12	5	**E** O						12	3	**E** O	
22	4	**E** O		16	3	**E** O		20	4	**E** O		C12	6	**E** O						22	3	**E** O	
40	6	**E** O		36	6	**E** O		36	6	**E** O		C40	6	**E** O						56	6	**E** O	
32	4	**E** O		20	4	**E** O		25	4	**E** O		C20	4	**E** O						40	4	**E** O	
28	4	**E** O		16	4	**E** O		22	4	**E** O		C20	4	**E** O						36	4	**E** O	
40	5	**E** O		16	3	**E** O		20	4	**E** O		C12	6	**E** O						22	3	**E** O	
40	5	**E** O		16	3	**E** O		20	4	**E** O		C12	6	**E** O						22	3	**E** O	
				18	3	**O** E		32	4	**O** E		C32	3	**E** O		40	3	**O** E	M	36	3	**O** E	
								22	4	**O** E													
								16	4	**O** E													
								22	4	**O** E													
100	16	**E** O		80	16	**E** O		120	16	**E** O		C80	25	**E** O						110	16	**E** O	

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

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

(wet machining symbol) = Wet machining (E = emulsion, O = oil)

(dry machining symbol) = Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	DB133 Supreme				DC170 Supreme			
						Drilling depth	20 × D_c							
						Standard	Walter				Walter			
						Coating/grade	WJ30ER				WJ30EJ			
						Dia. range [mm]	2–2,9				3–16			
														
							VCRR	VRR	Wet	Dry	v_c	VRR	Wet	Dry
P	Non-alloyed steel	C ≤ 0.25%	Annealed	125	430	P1	C125	12	E O		140	12	E O	M
P	Non-alloyed steel	C > 0.25 ... ≤ 0.55%	Annealed	190	640	P2	C125	12	E O		120	12	E O	M
P	Non-alloyed steel	C > 0.25 ... ≤ 0.55%	Heat-treated	210	710	P3	C100	12	E O		100	10	E O	M
P	Non-alloyed steel	C > 0.55%	Annealed	190	640	P4	C125	12	E O		110	10	E O	M
P	Non-alloyed steel	C > 0.55%	Heat-treated	300	1010	P5	C100	12	E O		80	10	E O	M
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	C125	12	E O		140	12	E O	M
P	Low-alloy steel	Annealed		175	590	P7	C125	12	E O		120	12	E O	M
P	Low-alloy steel	Heat-treated		285	960	P8	C100	12	E O		71	10	E O	M
P	Low-alloy steel	Heat-treated		380	1280	P9	C80	12	E O		56	8	E O	M
P	Low-alloy steel	Heat-treated		430	1480	P10	C63	6	E O		40	7	E O	M
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	C125	10	E O		100	9	E O	M
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	C100	12	E O		80	10	E O	M
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	C80	12	E O		56	8	E O	M
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	C100	12	E O		100	10	E O	M
P	Stainless steel	Martensitic, heat-treated		330	1110	P15	C80	10	E O		63	9	E O	M
M	Stainless steel	Austenitic, quench hardened		200	680	M1	C32	8	E O					
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	C32	12	E O					
M	Stainless steel	Austenitic/ferritic, duplex		230	780	M3	C25	6	E O					
K	Malleable cast iron	Ferritic		200	400	K1	C50	25	E O		120	16	E O	M
K	Malleable cast iron	Pearlitic		260	700	K2	C50	20	E O		100	16	E O	M
K	Grey cast iron	Low strength		180	200	K3	C63	25	E O		140	16	E O	M
K	Grey cast iron	High strength/austenitic		245	350	K4	C50	25	E O		120	16	E O	M
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	C63	30	E O		140	16	E O	M
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	C50	20	E O		100	16	E O	M
K	CGI			230	400	K7	C50	20	E O		100	16	E O	M
N	Wrought aluminium alloys	Not hardenable		30	-	N1	C125	25	E O	M				
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2	C125	25	E O	M				
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	C125	25	E O	M				
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	C125	25	E O	M				
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5	C100	20	E O	M				
N	Magnesium-based alloys[2]			70	250	N6								
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	C50	6	E O					
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	C63	10	E O					
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	C63	20	E O					
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10	C40	6	E O					
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	C25	6	E O					
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	C16	6	E O					
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	C20	5	E O					
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4	C12	5	E O					
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5	C12	6	E O					
S	Titanium alloys	Pure titanium		200	680	S6	C32	6	E O					
S	Titanium alloys	α and β alloys, hardened		375	1260	S7	C20	4	E O					
S	Titanium alloys	β alloys		410	1400	S8	C16	4	E O					
S	Tungsten alloys			300	1010	S9	C12	6	E O					
S	Molybdenum alloys			300	1010	S10	C12	6	E O					
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	C32	3	E O		40	3	O E	M
H	Hardened steel	Hardened and tempered		55 HRC	-	H2								
H	Hardened steel	Hardened and tempered		60 HRC	-	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	-	H4								
O	Thermoplastics	Without abrasive fillers				O1	C80	25	E O					
O	Thermosetting plastics	Without abrasive fillers				O2								
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the “General” section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

WALTER TITEX

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

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

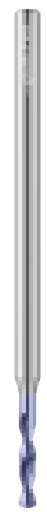
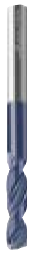
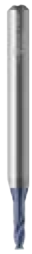
Cutting data for solid carbide drilling and reaming tools
Solid carbide drill – with internal coolant

(wet machining symbol) = Wet machining (E = emulsion, O = oil)
(dry machining symbol) = Dry machining is possible (M = MQL, L = dry)
The cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	DC170 Supreme – v_c	VRR	Wet	Dry	DC160 Advance X·treme Evo – v_c	VRR	Wet	Dry
				Drilling depth			30 × D_c							
				Designation			DC170 Supreme				DC160 Advance X·treme Evo			
				Standard			Walter				Walter			
				Coating/grade			WJ30EJ				WJ30EU			
				Dia. range [mm]			3–12				3–12			
P	Non-alloyed steel	C ≤ 0.25%	Annealed	125	430	P1	140	12	E O	M	120	12	E O	
P	Non-alloyed steel	C > 0.25 … ≤ 0.55%	Annealed	190	640	P2	120	12	E O	M	110	12	E O	
P	Non-alloyed steel	C > 0.25 … ≤ 0.55%	Heat-treated	210	710	P3	100	10	E O	M	80	10	E O	
P	Non-alloyed steel	C > 0.55%	Annealed	190	640	P4	110	10	E O	M	90	10	E O	
P	Non-alloyed steel	C > 0.55%	Heat-treated	300	1010	P5	80	10	E O	M	71	10	E O	
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	140	12	E O	M	120	12	E O	
P	Low-alloy steel	Annealed		175	590	P7	120	12	E O	M	110	12	E O	
P	Low-alloy steel	Heat-treated		285	960	P8	71	10	E O	M	63	10	E O	
P	Low-alloy steel	Heat-treated		380	1280	P9	56	8	E O	M	56	8	E O	
P	Low-alloy steel	Heat-treated		430	1480	P10	40	7	E O	M	36	7	E O	
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	100	9	E O	M	90	9	E O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	80	10	E O	M	80	10	E O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	56	8	E O	M	56	8	E O	
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	100	10	E O	M	90	10	E O	
P	Stainless steel	Martensitic, heat-treated		330	1110	P15	63	9	E O	M	63	9	E O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1					45	6	E O	
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2					56	6	E O	
M	Stainless steel	Austenitic/ferritic, duplex		230	780	M3					40	4	E O	
K	Malleable cast iron	Ferritic		200	400	K1	120	16	E O	M	110	16	E O	
K	Malleable cast iron	Pearlitic		260	700	K2	100	16	E O	M	80	16	E O	
K	Grey cast iron	Low strength		180	200	K3	140	16	E O	M	140	16	E O	
K	Grey cast iron	High strength/austenitic		245	350	K4	120	16	E O	M	110	16	E O	
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	140	16	E O	M	120	16	E O	
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	100	16	E O	M	80	16	E O	
K	CGI			230	400	K7	100	16	E O	M	90	16	E O	
N	Wrought aluminium alloys	Not hardenable		30	-	N1					120	20	E O	M
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2					120	20	E O	M
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3					120	20	E O	M
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4					120	20	E O	M
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5					120	16	E O	M
N	Magnesium-based alloys[2]			70	250	N6								
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7					120	8	E O	
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8					110	10	E O	
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9					120	12	E O	
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10					56	5	E O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1					36	4	E O	
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2					22	2	E O	
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3					32	4	E O	
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4					12	3	E O	
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5					22	3	E O	
S	Titanium alloys	Pure titanium		200	680	S6					56	6	E O	
S	Titanium alloys	α and β alloys, hardened		375	1260	S7					40	4	E O	
S	Titanium alloys	β alloys		410	1400	S8					36	4	E O	
S	Tungsten alloys			300	1010	S9					22	3	E O	
S	Molybdenum alloys			300	1010	S10					22	3	E O	
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	40	3	O E	M	36	3	O E	
H	Hardened steel	Hardened and tempered		55 HRC	-	H2								
H	Hardened steel	Hardened and tempered		60 HRC	-	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	-	H4								
O	Thermoplastics	Without abrasive fillers				O1					110	16	E O	
O	Thermosetting plastics	Without abrasive fillers				O2								
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the “General” section of the Technical Compendium, page F7.
[2] Water-miscible cooling lubricants must not be used when machining magnesium-based alloys.

30 × D_c				40 × D_c				50 × D_c				2 × D_c															
A6994TFP X·treme DH30				**A7495TTP X·treme D40**				**A7595TTP X·treme D50**				**DB131 Supreme**				**A6181TFT XD Pilot**				**DC118 Supreme**				**K5191TFT X·treme Pilot 180 C**			
Walter				Walter				Walter				Walter				Walter				Walter				Walter			
TFP				TTP				TTP				WJ30EL				TFT				WJ30ET				TFT			
3–10				3–11				3–9				2–2,95				3–16				3–20				4–7			
																											
v_c	VRR			v_c	VRR			v_c	VRR			VCRR	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
				90	10	**E** 0		90	10	**E** 0		C100	12	**E** 0		120	12	**E** 0		120	9	**E** 0		120	9	**E** 0	
				90	10	**E** 0		90	10	**E** 0		C100	12	**E** 0		100	10	**E** 0		100	8	**E** 0		100	8	**E** 0	
				90	10	**E** 0		90	10	**E** 0		C80	12	**E** 0		80	9	**E** 0		80	7	**E** 0		80	7	**E** 0	
				90	10	**E** 0		90	10	**E** 0		C100	12	**E** 0		90	9	**E** 0		90	7	**E** 0		90	7	**E** 0	
71	10	**E** 0		71	10	**E** 0		71	10	**E** 0		C80	16	**E** 0		71	8	**E** 0		71	6	**E** 0		71	6	**E** 0	
				90	10	**E** 0		90	10	**E** 0		C100	12	**E** 0		120	12	**E** 0		120	9	**E** 0		120	9	**E** 0	
				90	10	**E** 0		90	10	**E** 0		C100	12	**E** 0		100	12	**E** 0		100	8	**E** 0		100	8	**E** 0	
63	10	**E** 0		63	8	**E** 0		63	8	**E** 0		C63	16	**E** 0		71	9	**E** 0		63	6	**E** 0		63	6	**E** 0	
50	8	**E** 0										C63	12	**E** 0		45	6	**E** 0		50	4	**E** 0		50	4	**E** 0	
40	7	**E** 0										C50	6	**E** 0		40	4	**E** 0		40	2	**E** 0		40	2	**E** 0	
90	9	**E** 0		90	10	**E** 0		90	10	**E** 0		C100	10	**E** 0		80	9	**E** 0		90	6	**E** 0		90	6	**E** 0	
71	10	**E** 0		71	10	**E** 0		71	10	**E** 0		C80	16	**E** 0		63	10	**E** 0		71	6	**E** 0		71	6	**E** 0	
50	8	**E** 0										C63	12	**E** 0		50	6	**E** 0		50	4	**E** 0		50	4	**E** 0	
90	10	**E** 0		90	9	**E** 0		90	9	**E** 0		C63	12	**E** 0		80	10	**E** 0		90	7	**E** 0		90	7	**E** 0	
71	10	**E** 0		56	8	**E** 0		56	8	**E** 0		C80	16	**E** 0		50	9	**E** 0		71	6	**E** 0		71	6	**E** 0	
				63	6	**E** 0		63	6	**E** 0		C50	8	**E** 0		40	5	**E** 0		45	4	**E** 0		45	4	**E** 0	
56	6	**E** 0										C63	1	**E** 0		56	6	**E** 0		56	4	**E** 0		56	4	**E** 0	
												C32	6	**E** 0		32	4	**E** 0		36	3	**E** 0		36	3	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C200	25	**E** 0		100	16	**E** 0		100	12	**E** 0		100	12	**E** 0	
80	16	**E** 0		80	9	**E** 0		80	9	**E** 0		C160	20	**E** 0		71	16	**E** 0		80	10	**E** 0		80	10	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C200	25	**E** 0		120	16	**E** 0		120	12	**E** 0		120	12	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C200	25	**E** 0		100	16	**E** 0		100	12	**E** 0		100	12	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C200	30	**E** 0		90	25	**E**		110	12	**E** 0		110	12	**E** 0	
80	16	**E** 0		80	9	**E** 0		80	9	**E** 0		C160	20	**E** 0		71	16	**E** 0		80	10	**E** 0		80	10	**E** 0	
36	7	**E** 0		80	9	**E** 0		80	9	**E** 0		C160	20	**E** 0		71	16	**E** 0		80	10	**E** 0		80	10	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C160	25	**E** 0	M	400	16	**E** 0	M	400	12	**E** 0	M	400	12	**E** 0	M
				90	12	**E** 0		90	12	**E** 0		C160	25	**E** 0	M	400	16	**E** 0	M	400	12	**E** 0	M	400	12	**E** 0	M
				90	12	**E** 0		90	12	**E** 0		C160	25	**E** 0	M	250	16	**E** 0	M	250	12	**E** 0	M	250	12	**E** 0	M
				90	12	**E** 0		90	12	**E** 0		C160	25	**E** 0	M	220	16	**E** 0	M	220	12	**E** 0	M	220	12	**E** 0	M
				90	12	**E** 0		90	12	**E** 0		C125	20	**E** 0	M	200	16	**E** 0	M	200	10	**E** 0	M	200	10	**E** 0	M
				90	12	**E** 0		90	12	**E** 0		C100	6	**E** 0		180	8	**E** 0		220	6	**E** 0		220	6	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C100	10	**E** 0		160	10	**E** 0		200	7	**E** 0		200	7	**E** 0	
				90	12	**E** 0		90	12	**E** 0		C100	20	**E** 0		200	16	**E** 0		200	12	**E** 0		200	12	**E** 0	
50	5	**E** 0		50	5	**E** 0		50	5	**E** 0		C50	6	**E** 0		50	5	**E** 0		50	4	**E** 0		50	4	**E** 0	
												C40	6	**E** 0		32	4	**E** 0		36	3	**E** 0		36	3	**E** 0	
20	2	**E** 0										C25	6	**E** 0						11	3	**E** 0		11	3	**E** 0	
												C32	5	**E** 0		32	4	**E** 0		32	3	**E** 0		32	3	**E** 0	
12	3	**E** 0										C20	5	**E** 0		11	3	**E** 0		12	2	**E** 0		12	2	**E** 0	
20	3	**E** 0										C20	6	**E** 0		18	3	**E** 0		20	2	**E** 0		20	2	**E** 0	
												C50	6	**E** 0		45	6	**E** 0		56	5	**E** 0		56	5	**E** 0	
												C32	4	**E** 0		32	4	**E** 0		40	3	**E** 0		40	3	**E** 0	
												C25	4	**E** 0		28	4	**E** 0		32	3	**E** 0		32	3	**E** 0	
20	3	**E** 0										C20	6	**E** 0		18	3	**E** 0		20	2	**E** 0		20	2	**E** 0	
20	3	**E** 0										C20	6	**E** 0		18	3	**E** 0		20	2	**E** 0		20	2	**E** 0	
36	3	**O** E										C40	3	**O** E		32	3	**O** E		36	2	**O** E		36	2	**O** E	
												C125	25	**E** 0		100	16	**E** 0		100	12	**E** 0		100	12	**E** 0	

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

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

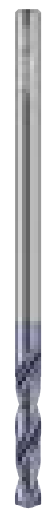
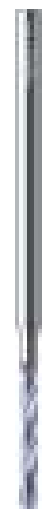
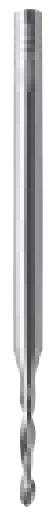
= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

Material group	Overview of the main material groups and code letters						Drilling depth	3 × D_c						
							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		
														
				Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]		v_c	VRR			v_c	VRR		
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1		120	12	**E** O		100	12	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Annealed	190	640	P2		120	12	**E** O		110	12	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3		120	12	**E** O		110	12	**E** O	
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4		120	10	**E** O		110	10	**E** O	
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5		100	10	**E** O		80	10	**E** O	
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6		120	16	**E** O		110	16	**E** O	
P	Low-alloy steel	Annealed		175	590	P7		120	12	**E** O		110	12	**E** O	
P	Low-alloy steel	Heat-treated		285	960	P8		90	10	**E** O		71	10	**E** O	
P	Low-alloy steel	Heat-treated		380	1280	P9		71	7	**E** O		56	7	**E** O	
P	Low-alloy steel	Heat-treated		430	1480	P10		50	5	**E** O		40	5	**E** O	
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11		90	9	**E** O		71	9	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12		100	10	**E** O		80	10	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13		45	7	**E** O		45	7	**E** O	
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14		110	12	**E** O		100	12	**E** O	
P	Stainless steel	Martensitic, heat-treated		330	1110	P15		71	10	**E** O		56	10	**E** O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1									
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2									
M	Stainless steel	Austenitic/ferritic, duplex		230	780	M3									
K	Malleable cast iron	Ferritic		200	400	K1		90	16	**E** O		80	16	**E** O	
K	Malleable cast iron	Pearlitic		260	700	K2		90	12	**E** O		80	12	**E** O	
K	Grey cast iron	Low strength		180	200	K3		110	16	**E** O		100	16	**E** O	
K	Grey cast iron	High strength/austenitic		245	350	K4		90	16	**E** O		90	16	**E** O	
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5		120	16	**E** O		110	16	**E** O	
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6		90	12	**E** O		80	12	**E** O	
K	CGI			230	400	K7		110	2	**E** O		100	2	**E** O	
N	Wrought aluminium alloys	Not hardenable		30	-	N1									
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2									
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3		250	16	**E** O	M	250	16	**E** O	M
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4		220	16	**E** O	M	220	16	**E** O	M
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5		180	12	**E** O	M	180	12	**E** O	M
N	Magnesium-based alloys			70	250	N6									
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7		200	6	**E** O		180	6	**E** O	
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8		180	10	**E** O		160	10	**E** O	
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9		200	16	**E** O		200	16	**E** O	
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10		45	5	**E** O		45	5	**E** O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1									
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2									
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3									
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4									
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5									
S	Titanium alloys	Pure titanium		200	680	S6		45	5	**E** O		36	5	**E** O	
S	Titanium alloys	α and β alloys, hardened		375	1260	S7		32	3	**E** O		25	3	**E** O	
S	Titanium alloys	β alloys		410	1400	S8		28	3	**E** O		22	3	**E** O	
S	Tungsten alloys			300	1010	S9									
S	Molybdenum alloys			300	1010	S10									
H	Hardened steel	Hardened and tempered		50 HRC	-	H1		36	3	**O** E		28	3	**O** E	
H	Hardened steel	Hardened and tempered		55 HRC	-	H2									
H	Hardened steel	Hardened and tempered		60 HRC	-	H3									
H	Hardened cast iron	Hardened and tempered		55 HRC	-	H4									
O	Thermoplastics	Without abrasive fillers				O1		100	16	**E** O		100	16	**E** O	
O	Thermosetting plastics	Without abrasive fillers				O2									
O	Plastic, glass-fibre reinforced	GFRP				O3									
O	Plastic, carbon-fibre reinforced	CFRP				O4									
O	Plastic, aramid-fibre reinforced	AFRP				O5									
O	Graphite (technical)			80 Shore		O6									

[1] The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

3 × D_c																				5 × D_c							
DC150 Perform				DC150 Perform				A1163				A1166TIN				A1166				DB133 Supreme				DB130 Advance			
DIN 6539				DIN 6537 K				DIN 6539				Walter				Walter				Walter				DIN 1899			
WJ30RE				WJ30RE				Uncoated				TiN				Uncoated				WJ30EL				WJ30UU			
1,5–2,9				3–20				1–12				3–14				3–18				0,5–2,95				0,1–0,99			
																											
VCRR	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			VCRR	VRR			VCRR	VRR		
C80	12	**E** 0		90	12	**E** 0														C100	12	**E** 0		C63	5	**E** 0	
C80	10	**E** 0		80	10	**E** 0						56	6	**E** 0						C100	12	**E** 0		C63	6	**E** 0	
C80	10	**E** 0		80	10	**E** 0						56	6	**E** 0						C63	8	**E** 0		C63	6	**E** 0	
C63	9	**E** 0		71	9	**E** 0						71	6	**E** 0						C80	8	**E** 0		C50	5	**E** 0	
C50	8	**E** 0		56	8	**E** 0						63	7	**E** 0		50	5	**E** 0		C63	8	**E** 0		C40	5	**E** 0	
C80	12	**E** 0		90	12	**E** 0														C100	12	**E** 0		C63	6	**E** 0	
C80	12	**E** 0		80	12	**E** 0														C100	12	**E** 0		C63	6	**E** 0	
C50	8	**E** 0		50	8	**E** 0						50	7	**E** 0		45	5	**E** 0		C63	8	**E** 0		C40	5	**E** 0	
C32	6	**E** 0		36	6	**E** 0						40	4	**E** 0		36	4	**E** 0		C40	5	**E** 0		C25	4	**E** 0	
C25	4	**E** 0		28	4	**E** 0						36	4	**E** 0		32	4	**E** 0		C40	4	**E** 0		C20	3	**E** 0	
C63	9	**E** 0		63	9	**E** 0						71	8	**E** 0						C80	7	**E** 0		C32	4	**E** 0	
C50	8	**E** 0		56	8	**E** 0						63	7	**E** 0		50	5	**E** 0		C63	8	**E** 0		C40	5	**E** 0	
C40	6	**E** 0		40	6	**E** 0						45	4	**E** 0		36	4	**E** 0		C40	5	**E** 0		C25	4	**E** 0	
C63	10	**E** 0		71	10	**E** 0						1,1	9	**E** 0						C80	10	**E** 0		C50	5	**E** 0	
C50	8	**E** 0		56	8	**E** 0						45	7	**E** 0		45	5	**E** 0		C50	7	**E** 0		C40	5	**E** 0	
																								C12	3	**E** 0	
C40	5	**E** 0		40	5	**E** 0																		C20	3	**E** 0	
																								C12	2	**E** 0	
C63	16	**E** 0		71	16	**E** 0		40	7	**E** 0										C80	20	**E** 0		C50	6	**E** 0	
C50	12	**E** 0		56	12	**E** 0		28	5	**E** 0										C63	20	**E** 0		C40	4	**E** 0	
C80	16	**E** 0		90	16	**E** 0		50	7	**E** 0										C100	20	**E** 0		C63	7	**E** 0	
C63	16	**E** 0		71	16	**E** 0		40	7	**E** 0										C80	20	**E** 0		C50	6	**E** 0	
C80	16	**E** 0		80	16	**E** 0		40	8	**E** 0										C100	25	**E** 0		C63	7	**E** 0	
C50	12	**E** 0		56	12	**E** 0		28	5	**E** 0										C63	20	**E** 0		C40	4	**E** 0	
C63	12	**E** 0		63	12	**E** 0		32	6	**E** 0										C80	20	**E** 0		C50	5	**E** 0	
C250	10	**E** 0	M	250	10	**E** 0	M	200	9	**E** 0	M									C125	16	**E** 0	M	C160	9	**E** 0	M
C250	10	**E** 0	M	250	10	**E** 0	M	200	9	**E** 0	M									C125	16	**E** 0	M	C160	9	**E** 0	M
C200	16	**E** 0	M	220	16	**E** 0	M	160	9	**E** 0	M									C125	20	**E** 0	M	C125	9	**E** 0	M
C200	16	**E** 0	M	200	16	**E** 0	M	140	9	**E** 0	M									C125	20	**E** 0	M	C100	9	**E** 0	M
C160	12	**E** 0	M	160	12	**E** 0	M	90	8	**E** 0	M									C125	20	**E** 0	M	C63	8	**E** 0	M
								180	9		**M** L													C125	9		**M** L
C160	6	**E** 0		160	6	**E** 0		120	6	**E** 0										C125	10	**E** 0		C100	6	**E** 0	
C125	10	**E** 0		140	10	**E** 0		100	8	**E** 0										C100	12	**E** 0		C80	8	**E** 0	
C160	16	**E** 0		180	16	**E** 0		100	10	**E** 0										C125	20	**E** 0		C80	8	**E** 0	
C40	5	**E** 0		45	5	**E** 0		25	3	**E** 0						28	3	**E** 0		C40	9	**E** 0		C20	3	**E** 0	
																				C25	4	**E** 0		C12	2	**E** 0	
																				C20	4	**E** 0					
																18	4	**E** 0		C20	3	**E** 0		C12	2	**E** 0	
																8	3	**E** 0									
								5,6	3	**E** 0																	
C32	5	**E** 0		32	5	**E** 0		22	3	**E** 0						25	3	**E** 0		C50	9	**E** 0		C20	3	**E** 0	
C20	3	**E** 0		22	3	**E** 0		12	2	**E** 0						16	2	**E** 0		C32	6	**E** 0		C12	2	**E** 0	
C16	3	**E** 0		20	3	**E** 0		10	1	**E** 0						14	1	**E** 0		C32	6	**E** 0		C12	1	**E** 0	
								5,6	3	**E** 0																	
								5,6	3	**E** 0																	
C20	3	**O** E		22	3	**O** E						28	3	**O** E		25	3	**O** E		C32	3	**O** E					
C100	16	**E** 0		90	16	**E** 0		36	12	**E** 0										C63	20	**E** 0		C25	12	**E** 0	
								63	8		**L**									C63	20	**E** 0		C40	8		**L**
								63	8		**L**													C40	8		**L**
								63	8		**L**													C40	8		**L**
								63	8		**L**									C100	20		**L**	C40	8		**L**

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

WALTER TITEX

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

Wet machining symbol = Wet machining (E = emulsion, O = oil)

Dry machining symbol = Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

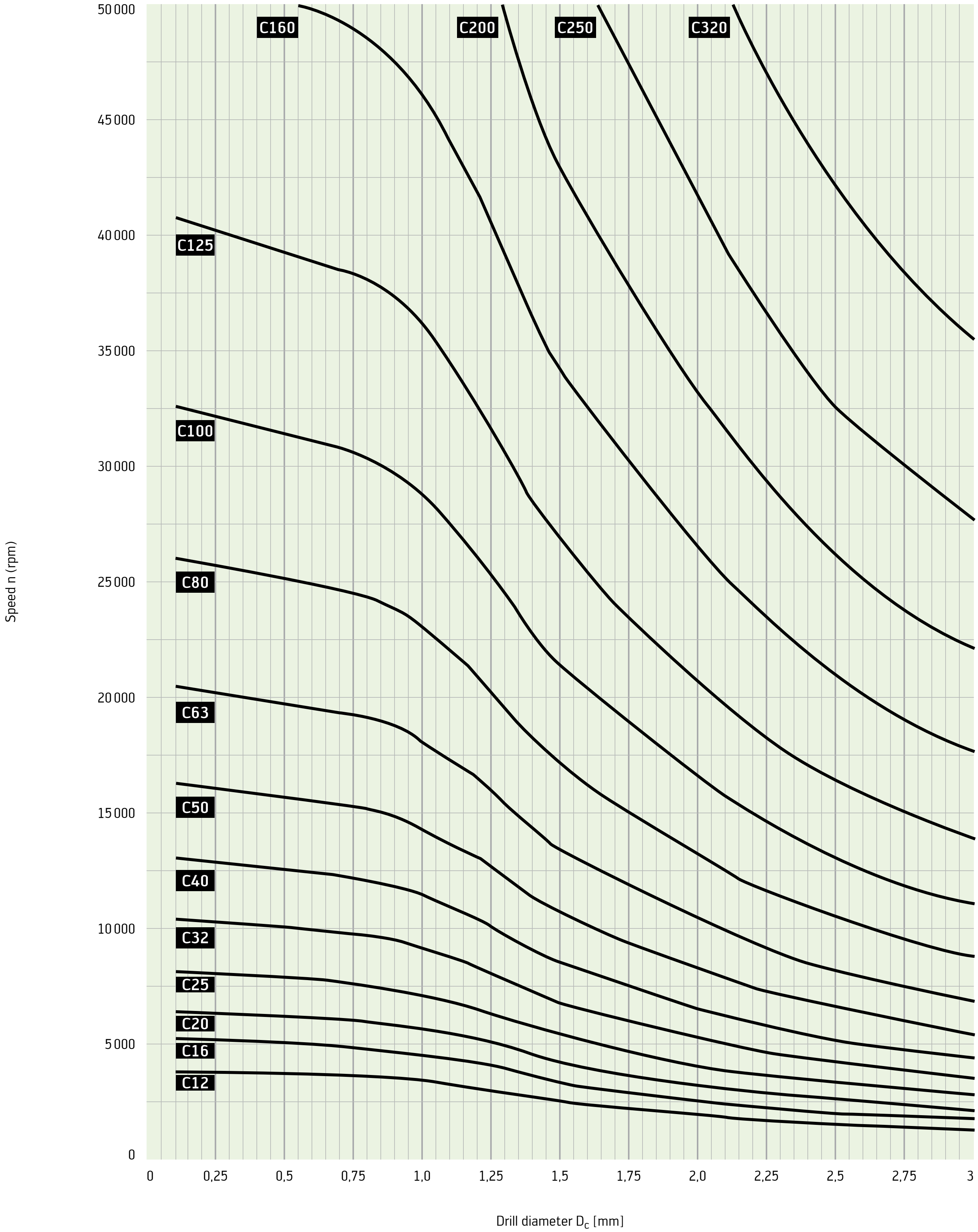
Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	v_c	VRR	Wet	Dry	v_c	VRR	Wet	Dry
				Drilling depth			5 × D_c							
				Designation			DC160 Advance X·treme Evo				DC150 Perform			
				Standard			DIN 6537 L				DIN 6537 L			
				Coating/grade			WJ30ET				WJ30TA			
				Dia. range [mm]			3–25				3–20			
														
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	100	12	**E** O		80	12	**E** O	
		C > 0,25… ≤ 0,55 %	Annealed	190	640	P2	110	12	**E** O		80	10	**E** O	
		C > 0,25… ≤ 0,55 %	Heat-treated	210	710	P3	100	12	**E** O		71	10	**E** O	
		C > 0,55 %	Annealed	190	640	P4	110	10	**E** O		71	9	**E** O	
		C > 0,55 %	Heat-treated	300	1010	P5	71	10	**E** O		56	8	**E** O	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	100	16	**E** O		80	12	**E** O	
	Low-alloy steel	Annealed		175	590	P7	110	12	**E** O		80	12	**E** O	
		Heat-treated		285	960	P8	63	10	**E** O		45	8	**E** O	
		Heat-treated		380	1280	P9	50	7	**E** O		32	6	**E** O	
		Heat-treated		430	1480	P10	36	5	**E** O		25	4	**E** O	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	71	9	**E** O		63	9	**E** O	
		Hardened and tempered		300	1010	P12	71	10	**E** O		56	8	**E** O	
		Hardened and tempered		380	1280	P13	45	7	**E** O		40	6	**E** O	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	90	12	**E** O		71	10	**E** O	
		Martensitic, heat-treated		330	1110	P15	50	10	**E** O		50	8	**E** O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1								
		Austenitic, precipitation hardened (PH)		300	1010	M2					40	5	**E** O	
		Austenitic/ferritic, duplex		230	780	M3								
K	Malleable cast iron	Ferritic		200	400	K1	80	16	**E** O		71	16	**E** O	
		Pearlitic		260	700	K2	80	12	**E** O		56	12	**E** O	
	Grey cast iron	Low strength		180	200	K3	100	16	**E** O		80	16	**E** O	
		High strength/austenitic		245	350	K4	80	16	**E** O		71	16	**E** O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	100	16	**E** O		71	16	**E** O	
		Pearlitic		265	700	K6	80	12	**E** O		56	12	**E** O	
	CGI			230	400	K7	90	2	**E** O		56	12	**E** O	
N	Wrought aluminium alloys	Not hardenable		30	-	N1					250	10	**E** O	M
		Hardenable, hardened		100	340	N2					250	10	**E** O	M
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	250	16	**E** O	M	220	16	**E** O	M
		≤ 12% Si, hardenable, hardened		90	310	N4	220	16	**E** O	M	200	16	**E** O	M
		> 12% Si, not hardenable		130	450	N5	180	12	**E** O	M	160	12	**E** O	M
	Magnesium-based alloys			70	250	N6								
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	180	6	**E** O		160	6	**E** O	
		Brass, bronze, red brass		90	310	N8	160	10	**E** O		140	10	**E** O	
		Copper alloys, short-chipping		110	380	N9	200	16	**E** O		180	16	**E** O	
		High tensile, Ampco		300	1010	N10	45	5	**E** O		45	5	**E** O	
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	**E** O		28	5	**E** O	
		α and β alloys, hardened		375	1260	S7	22	3	**E** O		20	3	**E** O	
		β alloys		410	1400	S8	20	3	**E** O		18	3	**E** O	
	Tungsten alloys			300	1010	S9								
	Molybdenum alloys			300	1010	S10								
H	Hardened steel	Hardened and tempered		50 HRC	-	H1	28	3	**O** E		20	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	100	16	**E** O		90	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								
	Graphite (technical)			80 Shore		O6								

[1] The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

5 × D_c				8 × D_c												2 × D_c			
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_c	VRR			VCRR	VRR			v_c	VRR			v_c	VRR			VCRR	VRR		
				C100	12	**E** O		71	10	**E** O						C100	12	**E** O	
				C100	12	**E** O		63	10	**E** O						C80	12	**E** O	
				C63	8	**E** O		50	8	**E** O						C80	12	**E** O	
				C80	8	**E** O		63	8	**E** O						C80	12	**E** O	
				C63	8	**E** O		63	8	**E** O						C63	16	**E** O	
				C100	12	**E** O		71	12	**E** O						C100	12	**E** O	
				C100	12	**E** O		63	10	**E** O						C80	12	**E** O	
				C50	8	**E** O		56	8	**E** O						C63	16	**E** O	
				C40	5	**E** O										C50	12	**E** O	
				C32	4	**E** O										C40	6	**E** O	
				C63	7	**E** O		63	9	**E** O						C80	10	**E** O	
				C63	8	**E** O		63	8	**E** O						C63	16	**E** O	
				C40	5	**E** O										C50	12	**E** O	
				C80	10	**E** O		56	10	**E** O						C63	12	**E** O	
				C50	7	**E** O		56	8	**E** O						C63	16	**E** O	
																C40	8	**E** O	
																C63	1	**E** O	
																C32	6	**E** O	
71	16	**E** O		C80	20	**E** O		63	16	**E** O		32	7	**E** O		C160	25	**E** O	
56	16	**E** O		C63	20	**E** O		50	12	**E** O		25	5	**E** O		C125	20	**E** O	
90	16	**E** O		C100	20	**E** O		71	16	**E** O		40	7	**E** O		C160	25	**E** O	
71	16	**E** O		C80	20	**E** O		63	16	**E** O		32	7	**E** O		C160	25	**E** O	
80	16	**E** O		C100	25	**E** O		63	16	**E** O		36	8	**E** O		C160	30	**E** O	
56	16	**E** O		C63	20	**E** O		50	12	**E** O		25	5	**E** O		C125	20	**E** O	
63	16	**E** O		C63	20	**E** O		50	12	**E** O		25	6	**E** O		C125	20	**E** O	
320	10	**E** O	M	C125	16	**E** O	M					180	9	**E** O	M	C160	25	**E** O	M
320	10	**E** O	M	C125	16	**E** O	M					180	9	**E** O	M	C160	25	**E** O	M
200	16	**E** O	M	C125	20	**E** O	M	220	16	**E** O	M	140	9	**E** O	M	C160	25	**E** O	M
180	16	**E** O	M	C125	20	**E** O	M	160	16	**E** O	M	120	9	**E** O	M	C160	25	**E** O	M
140	16	**E** O	M	C125	20	**E** O	M	120	12	**E** O	M	80	8	**E** O	M	C125	20	**E** O	M
180	16		**M** L									140	9		**M** L				
180	8	**E** O		C125	10	**E** O		120	6	**E** O		100	6	**E** O		C100	6	**E** O	
140	12	**E** O		C100	12	**E** O		110	10	**E** O		80	8	**E** O		C100	10	**E** O	
140	16	**E** O		C100	20	**E** O		120	16	**E** O		80	10	**E** O		C100	20	**E** O	
				C40	9	**E** O		32	5	**E** O		22	3	**E** O		C50	6	**E** O	
				C25	4	**E** O										C32	6	**E** O	
				C20	4	**E** O										C25	6	**E** O	
				C20	3	**E** O										C32	5	**E** O	
																C16	5	**E** O	
												4	3	**E** O		C16	6	**E** O	
28	4	**E** O		C50	9	**E** O		32	5	**E** O		18	3	**E** O		C50	6	**E** O	
18	2	**E** O		C32	6	**E** O		20	3	**E** O		10	2	**E** O		C25	4	**E** O	
16	2	**E** O		C25	6	**E** O		25	3	**E** O		8	1	**E** O		C25	4	**E** O	
												4	3	**E** O		C16	6	**E** O	
												4	3	**E** O		C16	6	**E** O	
				C32	3	**O** E										C32	3	**O** E	
40	16	**E** O		C63	20	**E** O						32	12	**E** O		C100	25	**E** O	
50	8		**L**	C63	20	**E** O						56	8		**L**				
71	10		**L**									56	8		**L**				
71	10		**L**									56	8		**L**				
71	10		**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

	Feed f [mm] for diameter [mm]															
VRR	**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**	**1,5**	**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	0,005	0,007
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	0,010	0,013
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	0,015	0,020
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	0,020	0,027
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	0,025	0,033
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	0,030	0,040
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	0,035	0,047
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	0,040	0,053
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	0,045	0,060
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	0,050	0,067
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	0,060	0,080
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	0,080	0,11
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	0,10	0,13
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	0,125	0,167
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	0,150	0,200

	Feed f [mm] for diameter [mm]														
VRR	**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


WALTER
TITEX

Grade description

Coated carbide

Walter grade description	Standard designation	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Application range (01 05 10 15 20 25 30 35 40 45)	Coating process	Coating composition	Tool example
WJ30EJ	HC – P 30	●●								PVD	TiNAl/AlCrN multi-layer coating	
	HC – K 30			●●								
WJ30RE	HC – 30	●●	●●	●●	●●	●●	●	●●		PVD	TiNAl multi-layer coating	
WJ30TA	HC – 30	●●	●●	●●	●●	●●	●	●●		PVD	TiNAl multi-layer coating with post-treatment	
WJ30EL	HC – 30	●●		●●	●●	●	●	●		PVD	AlCrN single-layer coating	
WJ30ER	HC – 30	●●		●●	●●	●	●	●		PVD	AlCrN single-layer tip coating	
WJ30ET	HC – 30	●●	●	●●	●●	●●	●	●		PVD	TiSiAlCrN/AlTiN multi-layer coating	
WJ30EU	HC – 30	●●	●	●●	●●	●●	●	●		PVD	TiSiAlCrN/AlTiN multi-layer coating, tip coating	
WJ30UU	HW – 30	●●	●●	●●	●●	●●		●●			Uncoated	
WJ30RZ	HC – 30	●	●●		●	●●		●		PVD	TiAlSiN – (HiPIMS) multi-layer coating	
WJ30RY	HC – 30	●	●●		●	●●		●		PVD	TiAlSiN – (HiPIMS) multi-layer coating, tip coating	
WJ30EZ	HC – 30	●●	●●	●●	●●	●●	●●	●		PVD	AlTiN multi-layer coating	**Krato·tec™** 
WJ30EY	HC – 30	●●	●	●●	●●	●				PVD	AlTiN multi-layer coating, tip coating	**Krato·tec™** 

HC = Coated carbide
HW = Uncoated carbide

●● Primary application
● Additional application

Type description

					Material groups						
					P	M	K	N	S	H	O
Product line		Product family		Coolant supply	Steel	Stainless steel	Cast iron	NF metals	Materials with difficult cutting properties	Hard materials	Other
Supreme	Micro drill	DB133		Internal	●●	●●	●●	●●	●	●	●
				External	●●		●●	●●	●	●	●
		DB131		Internal	●●	●●	●●	●●	●	●	●
				External	●●	●●	●●	●●	●	●	●
Advance		DB130		External	●●	●●	●●	●●	●●		●●
Supreme		DC183 X·treme Evo 3 **Krato·tec™**		Internal	●●		●●	●●			
		DC180 X·treme Evo Plus **Krato·tec™**		Internal	●●	●●	●●	●●	●●	●●	●
		DC175 Supreme		Internal	●	●●		●	●●		●
		DC170 Supreme		Internal	●●		●●			●	
		DC166		Internal				●●			
		DC118 Supreme		Internal	●●	●●	●●	●●	●●	●	●
Advance		DC165		Internal			●●	●●			
		DC160 Advance DC260 Advance	 	Internal	●●	●	●●	●●	●●	●	●
			 	External	●●		●●	●	●	●	●
Perform		DC150 Perform		Internal	●●	●	●●	●●	●●	●	●
				External	●●	●	●●	●	●	●	●
X·treme		X·treme Plus; D8; D12		Internal	●●	●●	●●	●●	●●	●●	●
		XD Pilot X·treme Pilot 180C		Internal	●●	●●	●●	●●	●●	●	●
											
		X·treme D40 … D50		Internal	●●	●	●●	●●			
		X·treme DH20 – DH30		Internal	●●	●	●	●	●	●	

●● Primary application
● Additional application

	$2 \times D_c$	$3 \times D_c$	$5 \times D_c$	$8 \times D_c$	$12 \times D_c$	$16 \times D_c$	$20 \times D_c$	$25 \times D_c$	$30 \times D_c$	$40 \times D_c$	$50 \times D_c$
			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							
		DC175-03-A1	DC175-05-A1	DC175-08-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								
		A3289DPL	A3389DPL	A6489DPP	A6589DPP						
	A6181TFT K5191TFT										
										A7495TTP	A7595TTP
							A6794TFP		A6994TFP		

Drilling strategies

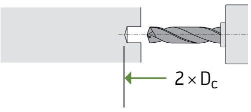
XD Technology ≤ 30 × D_c

P	M	K	N	S	H	O
✓	✓	✓		✓	✓	✓

Pilot drilling

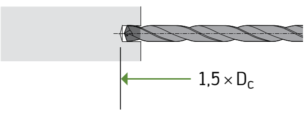
10–50 bar
145–725 psi
On

2 × D_c
A6181TFT
DC118
K5191TFT



Running in

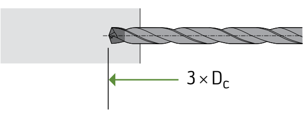
Off



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

Spot drilling

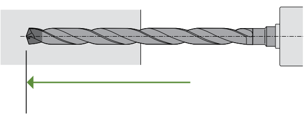
10–50 bar
145–725 psi
On



v_c = 100%
v_f = 25–50%

Deep-hole drilling

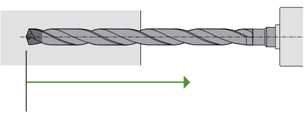
10–50 bar
145–725 psi
On



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.

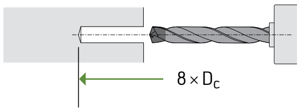
XD Technology ≤ 30 × D_c

P	M	K	N	S	H	O
			✓			

Pilot drilling

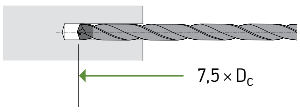
10–50 bar
145–725 psi
On

8 × D_c
DC160-08-A1



Running in

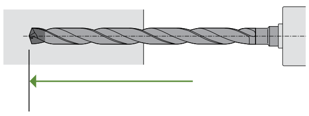
Off



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

Deep-hole drilling

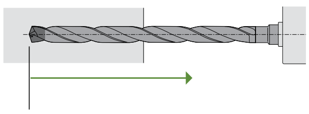
10–50 bar
145–725 psi
On



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)

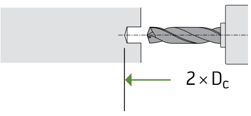
XD Technology $\leq 50 \times D_c$

P	M	K	N	S	H	O
✓		✓	✓			

Pilot drilling no. 1

10–50 bar
145–725 psi
On

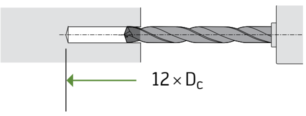
$2 \times D_c$
A6181TFT
DC118-02-A1



Pilot drilling no. 2

10–50 bar
145–725 psi
On

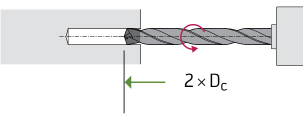
$12 \times D_c$
DC160-12-A1



Running in

Off

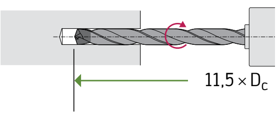
With anticlockwise rotation:
n_{max} = 100 rpm
v_f = 1000 mm/min



Running in

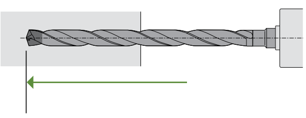
Off

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



Deep-hole drilling

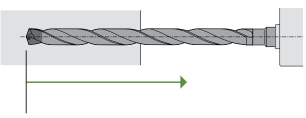
10–50 bar
145–725 psi
On



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.

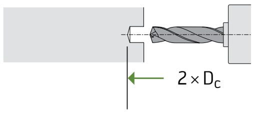
XD Technology $\geq 50 \times D_c$

P	M	K	N	S	H	O
✓		✓	✓			

Pilot drilling no. 1

10–50 bar
145–725 psi
On

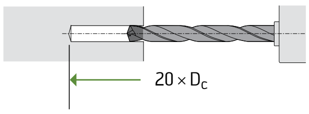
$2 \times D_c$
A6181TFT
DC118-02-A1



Pilot drilling no. 2

10–50 bar
145–725 psi
On

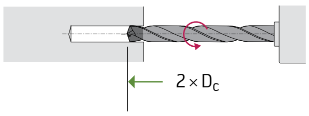
$20 \times D_c$
DC160-20-A1



Running in

Off

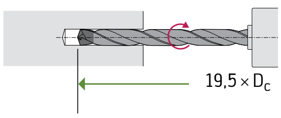
With anticlockwise rotation:
n_{max} = 100 rpm
v_f = 1000 mm/min



Running in

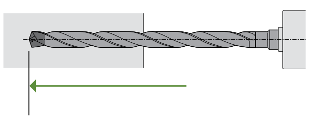
Off

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



Deep-hole drilling

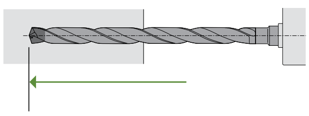
10–50 bar
145–725 psi
On



v_c = 100%
v_f = 100%

Retracting

Off



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

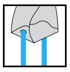
Recommended cutting data can be found in Walter GPS.

Drilling strategies (continued)

XD Technology micro ≤ 30 × D_c

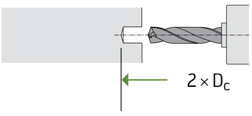
P	M	K	N	S	H	O
✓	✓	✓	✓	✓	✓	✓

Pilot drilling

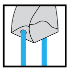


10–50 bar
145–725 psi
On

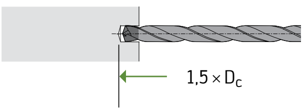
2 × D_c
DB131-02-A0 / A1



Running in

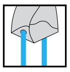


Off

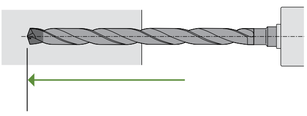


n_{max} = 100 rpm
v_f = 1000 mm/min

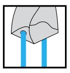
Deep-hole drilling



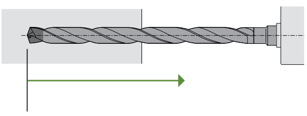
30–70 bar
435–1015 psi
On



Retracting



Off



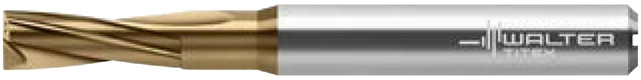
n_{max} = 100 rpm
v_f = 1000 mm/min

Recommended cutting data can be found in Walter GPS.

Application information
DC118 Supreme

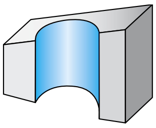
ISO material groups:

P	M	K	N	S	H	O
●●	●●	●●	●●	●●	●	●



Cooling: Emulsion 5–12%
Oil
Coolant pressure: 10–40 bar/ 145–580 psi

Areas of use

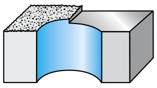


For inclined entrance,
e.g. for pilot drilling on crankshafts

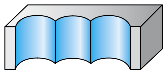
≤ 15°: Reduce the feed by **15**–50%
until the full diameter is engaged

≤ 30°: Reduce the feed by **30**–50%
until the full diameter is engaged

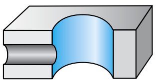
≤ 50°: Reduce the feed by **50**%
until the full diameter is engaged



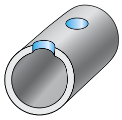
For rough and uneven surfaces,
such as forged skin



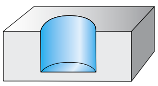
For chain drilling:
First make the complete holes and then drill the root faces



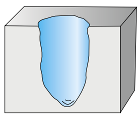
For interrupted cuts,
such as cross holes



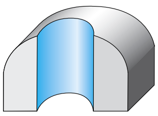
For pipes and thin-walled components:
Reduced burr formation



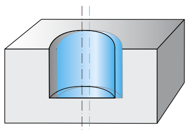
For a flat hole face



For pre-cast conical holes



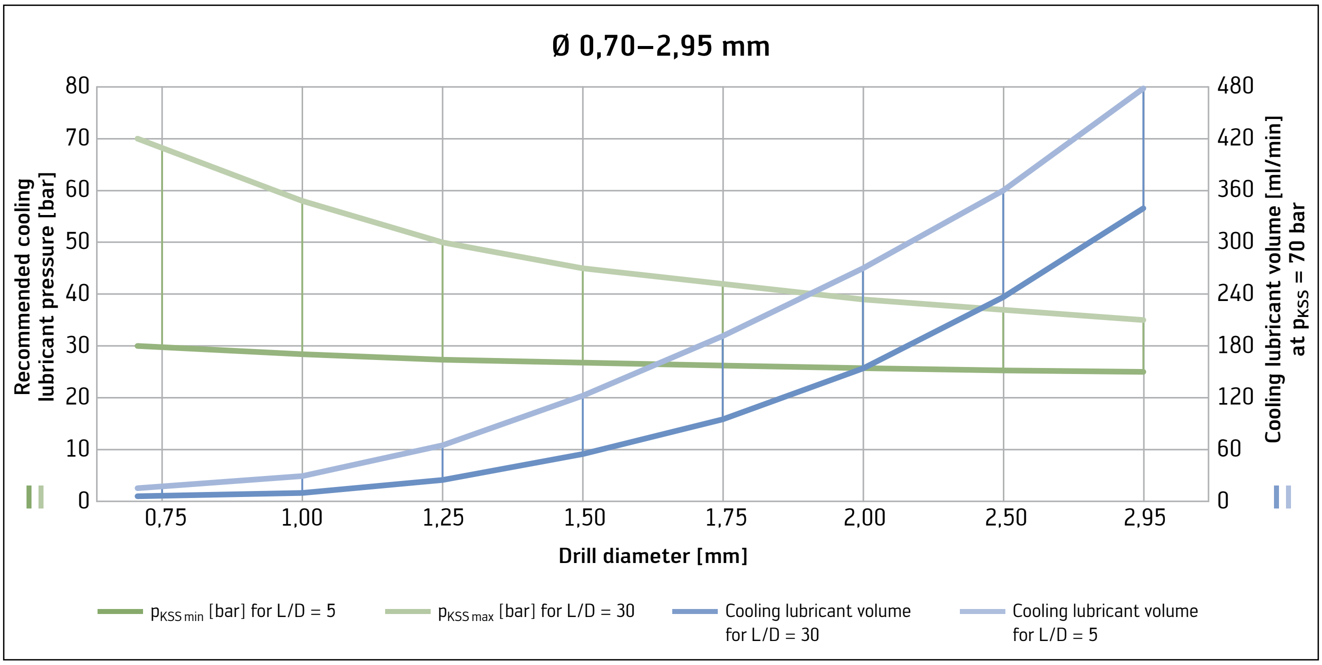
For convex surfaces

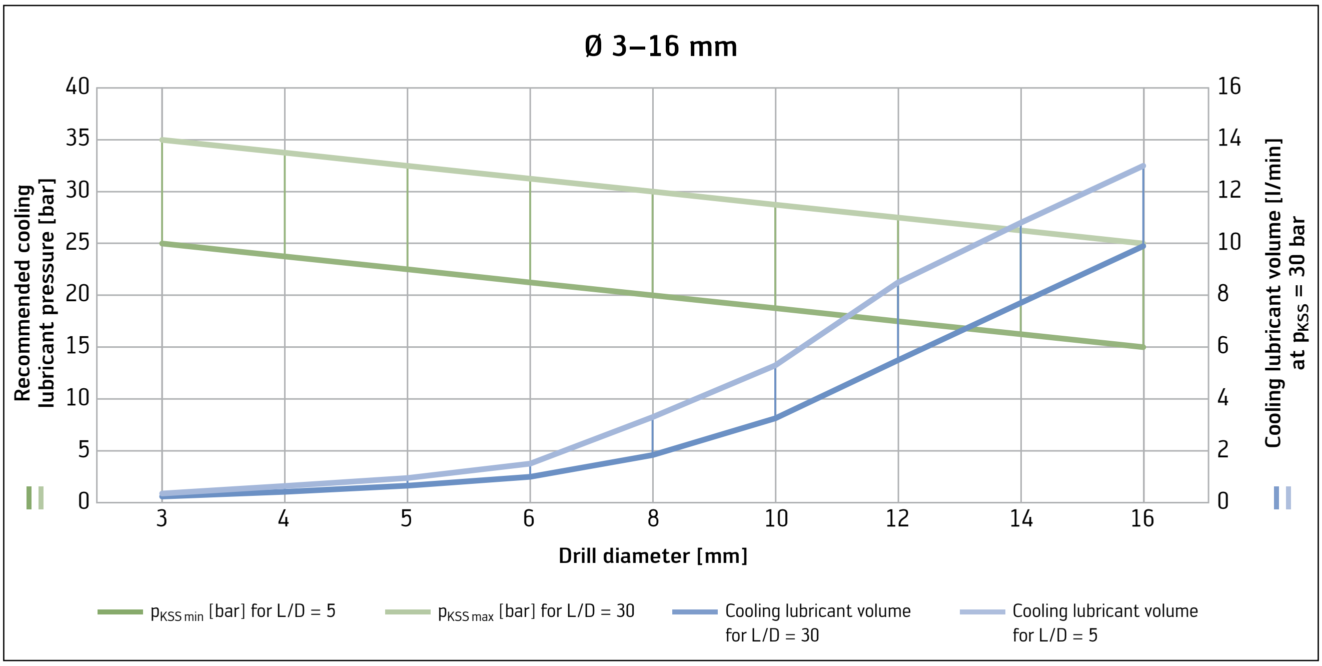


For correcting holes with axial offset

Standard value diagrams for coolant pressure/flow rate information

Solid carbide drilling





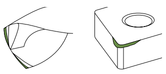
Note
The standard values shown were determined under laboratory conditions. During use, deviations may occur due to factors including the machine type being used, the coolant, the coolant preparation or the coolant pump.

Abbreviations

L/D	Length/Diameter
p_{KSS}	Coolant pressure
$p_{KSS\,max}$	Maximum coolant pressure
$p_{KSS\,min}$	Minimum coolant pressure

Problem-solving expertise: Wear patterns from drilling

Wear patterns | **Description** | **Measures**



Flank face wear
Abrasion on the flank face

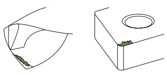
Abrasion between the workpiece and the flank face leads to flank face wear.

Solid carbide drilling

1.1 Reduce the cutting speed
1.2 Increase the feed
1.3 Increase the coolant volume (e.g. by increasing the coolant pressure)

Indexable insert drilling

2.1 Reduce the cutting speed
2.2 Increase the feed
2.3 Use a more wear-resistant cutting tool material



Build-up on the cutting edge
Adhesion of material along the cutting edge on the rake face

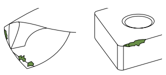
Micro galling of the workpiece material on the cutting edge leads to build-up on the cutting edge.

Solid carbide drilling

1.1 Increase the cutting speed
1.2 Increase the coolant volume (e.g. by increasing the coolant pressure)

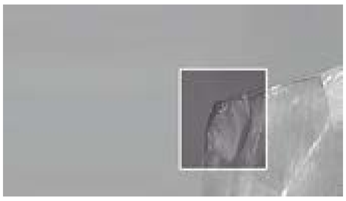
Indexable insert drilling

2.1 Increase the cutting speed
2.2 Increase the coolant pressure
2.3 Increase the amount of oil in the coolant
2.4 Use a more positive geometry



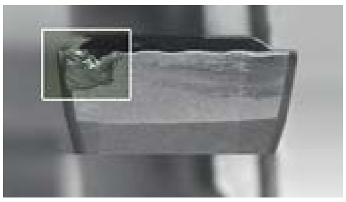
Fractures
Fractures along the cutting edge

Hairline cracks, chip impacts, vibration and the cutting tool material having excessively high wear resistance lead to fractures.



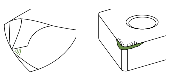
Solid carbide drilling

1.1 Replace and recondition the tool sooner
1.2 Improve stability (of the workpiece/tool)



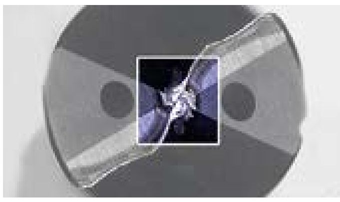
Indexable insert drilling

2.1 Reduce the feed
2.2 Increase the coolant volume (e.g. by increasing the coolant pressure)
2.3 Improve stability (of the workpiece/tool)
2.4 Use a tougher cutting tool material
2.5 Use a more stable geometry



Plastic deformation
Deformation on the cutting edge (particularly on the chisel edge and corner radius)

High build-up of heat and mechanical stress cause plastic deformation.



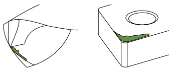
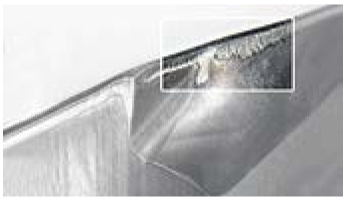
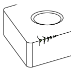
Solid carbide drilling

1.1 Reduce the feed
1.2 Increase the coolant volume (e.g. by increasing the coolant pressure)

Indexable insert drilling

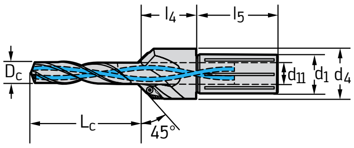
2.1 Reduce the cutting speed
2.2 Reduce the feed
2.3 Increase the coolant pressure
2.4 Use a more wear-resistant cutting tool material

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

Wear patterns	Description		Measures
 **Crater wear** Erosion or hollowing on the rake face	Crater wear is caused by diffusion and abrasion on the rake face.		**Solid carbide drilling** 1.1 Increase the cutting speed 1.2 Increase the feed 1.3 Increase the coolant pressure
			**Indexable insert drilling** 2.1 Reduce the cutting speed 2.2 Reduce the feed 2.3 Increase the coolant volume (e.g. by increasing the coolant pressure) 2.4 Use a more wear-resistant cutting tool material 2.5 Use a more positive geometry
 **Thermal cracks** Small cracks perpendicular to the cutting edge	Fluctuations in temperature (thermal shock) cause hairline cracks.		**Indexable insert drilling** 1. Reduce the cutting speed 2. Dry machining (switch off coolant) 3. Use a tougher cutting tool material

Application information for D4580 **Xtra·tec**®

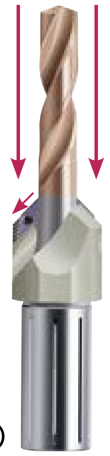
Dimensions



D_c mm	DIN 6537 K $3 \times D_c$ mm	DIN 6537 L $5 \times D_c$ mm	$8 \times D_c$ mm
	L_c [min–max] metric		
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

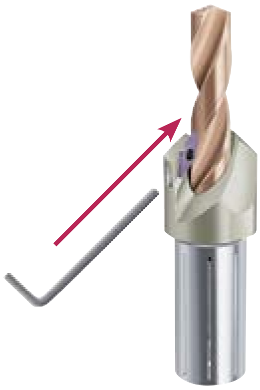
Maximum chamfer depth l_t: 2.8 mm/0.110"

Assembly instructions

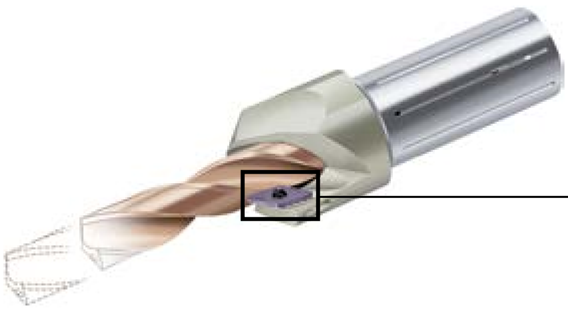


① Release the indexable insert, insert the drill

② Position the drill

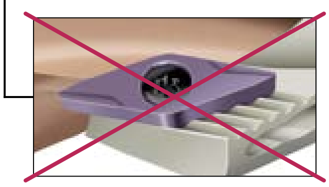


④ Slightly tighten the fastening screw, slide the indexable insert up to the drill and tighten it



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

correct



incorrect

Cutting data for D4120

Wet machining icon = Wet machining (E = emulsion, O = oil)

Dry machining icon = Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

* The assignment of the machining groups can be found in the “General” section of the Technical Compendium, page F7.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	Wet	Dry	Indexable insert geometry – Starting values for feed f [mm/rev] – A 57 – Size 1 – D_c [mm] 13,5–16,4	Size 2 – 16,5–20,4	Size 3 – 20,5–24,4	Size 4 – 24,5–29,4	Size 5 Size 6 – 29,5–42,4	Size 7 Size 8 – 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
P	Non-alloyed steel	C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●		0,07	0,09	0,10	0,13	0,18	0,19
P	Non-alloyed steel	C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●		0,07	0,09	0,10	0,13	0,18	0,19
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4	●●		0,07	0,09	0,10	0,13	0,18	0,19,
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5	●●		0,07	0,09	0,10	0,13	0,18	0,19
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	●●	●	0,07	0,09	0,10	0,13	0,18	0,19,
P	Low-alloy steel	Annealed		175	590	P7	●●		0,08	0,10	0,12	0,15	0,20	0,21
P	Low-alloy steel	Heat-treated		285	960	P8	●●		0,07	0,09	0,10	0,13	0,15	0,16
P	Low-alloy steel	Heat-treated		380	1280	P9	●●		0,07	0,09	0,10	0,13	0,15	0,16
P	Low-alloy steel	Heat-treated		430	1480	P10	●●		0,05	0,06	0,06	0,09	0,12	0,13
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	●●		0,08	0,10	0,12	0,15	0,18	0,19
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	●●		0,07	0,09	0,10	0,13	0,15	0,16
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	●●		0,06	0,08	0,09	0,12	0,14	0,15
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	●●		0,07	0,09	0,10	0,13	0,15	0,16
P	Stainless steel	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
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	●●		0,06	0,07	0,08	0,10	0,13	0,14
M	Stainless steel	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
K	Malleable cast iron	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
K	Grey cast iron	High strength/austenitic		245	350	K4	●●	●	0,08	0,10	0,12	0,15	0,20	0,21
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●●	●	0,10	0,13	0,15	0,18	0,23	0,24
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	●●		0,08	0,10	0,12	0,18	0,23	0,24
K	CGI			230	400	K7	●●	●	0,09	0,12	0,14	0,17	0,22	0,23
N	Wrought aluminium alloys	Not hardenable		30	–	N1								
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2	●●							
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●●							
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	●●							
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5	●●	●						
N	Magnesium-based alloys			70	250	N6	●●							
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7								
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	●●							
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	●●	●						
N	Copper and copper alloys (bronze/brass)	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	●●							
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	●●							
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	●●							
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4	●●							
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5	●●							
S	Titanium alloys	Pure titanium		200	680	S6								
S	Titanium alloys	α and β alloys, hardened		375	1260	S7	●●							
S	Titanium alloys	β alloys		410	1400	S8	●●							
S	Tungsten alloys			300	1010	S9	●●		0,05	0,06	0,06	0,09	0,11	0,12
S	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
H	Hardened steel	Hardened and tempered		55 HRC	–	H2	●●		0,05	0,06	0,06	0,09	0,10	0,10
H	Hardened steel	Hardened and tempered		60 HRC	–	H3								
H	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	●●	●						
O	Thermosetting plastics	Without abrasive fillers				O2	●●	●						
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	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_c drilling depth. MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D_c, the following reductions are recommended:
> 3 × D_c: Cutting speed v_c −20%, feed f −30% when spot drilling, feed f −50% when spot drilling on inclined surfaces.
> 4 × D_c: Cutting speed v_c −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_c [mm]						D_c [mm]						D_c [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	0,07	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	0,07	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.

WALTER

Cutting data for D4120

(continued)

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	Wet	Dry	Cutting material grade Outer insert [P484.P..] – Starting values for cutting speed v_c [m/min] – HC – WKP25S – 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
		Hardened and tempered		380	1280	P13	●●		190	160	140
	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	●●	●	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_c drilling depth. MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D_c, the following reductions are recommended:
> 3 × D_c: Cutting speed v_c −20%, feed f −30% when spot drilling, feed f −50% when spot drilling on inclined surfaces.
> 4 × D_c: Cutting speed v_c −30%, feed f −40% when spot drilling.

Cutting material grade
Outer insert [P484.P..]

Starting values for cutting speed
v_c [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.

WALTER

Cutting data for D3120

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*			Indexable insert geometry / Starting values for feed f [mm/rev] / A 57 / Size 1 / D_c [mm] 16–20	Size 2 / 21–25	Size 3 / 26–30	Size 4 / 31–36	Size 5 / 37–42
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●		0,05	0,06	0,06	0,09	0,12
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●		0,07	0,09	0,10	0,13	0,18
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●		0,07	0,09	0,10	0,13	0,18
		C > 0,55 %	Annealed	190	640	P4	●●		0,07	0,09	0,10	0,13	0,18
		C > 0,55 %	Heat-treated	300	1010	P5	●●		0,07	0,09	0,10	0,13	0,18
		Free-machining steel (short-chipping)	Annealed	220	750	P6	●●	●	0,07	0,09	0,10	0,13	0,18
	Low-alloy steel	Annealed		175	590	P7	●●		0,08	0,10	0,12	0,15	0,20
		Heat-treated		285	960	P8	●●		0,07	0,09	0,10	0,13	0,15
		Heat-treated		380	1280	P9	●●		0,07	0,09	0,10	0,13	0,15
		Heat-treated		430	1480	P10	●●		0,05	0,06	0,06	0,09	0,12
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	●●		0,08	0,10	0,12	0,15	0,18
		Hardened and tempered		300	1010	P12	●●		0,07	0,09	0,10	0,13	0,15
		Hardened and tempered		380	1280	P13	●●		0,06	0,08	0,09	0,12	0,14
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	●●		0,07	0,09	0,10	0,13	0,15
		Martensitic, heat-treated		330	1110	P15	●●		0,06	0,08	0,09	0,12	0,14
M	Stainless steel	Austenitic, quench hardened		200	680	M1	●●		0,06	0,07	0,08	0,10	0,13
		Austenitic, precipitation hardened (PH)		300	1010	M2	●●		0,06	0,07	0,08	0,10	0,13
		Austenitic/ferritic, duplex		230	780	M3	●●		0,06	0,07	0,08	0,10	0,13
K	Malleable cast iron	Ferritic		200	400	K1	●●	●	0,09	0,12	0,14	0,17	0,22
		Pearlitic		260	700	K2	●●	●	0,07	0,09	0,11	0,14	0,19
	Grey cast iron	Low strength		180	200	K3	●●	●	0,10	0,13	0,15	0,18	0,23
		High strength/austenitic		245	350	K4	●●	●	0,08	0,10	0,12	0,15	0,20
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●●	●	0,10	0,13	0,15	0,18	0,23
		Pearlitic		265	700	K6	●●		0,08	0,10	0,12	0,18	0,23
	CGI			230	400	K7	●●	●	0,09	0,12	0,14	0,17	0,22
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
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
	Molybdenum alloys			300	1010	S10	●●		0,05	0,06	0,06	0,09	0,11
H	Hardened steel	Hardened and tempered		50 HRC	–	H1	●●		0,05	0,06	0,06	0,09	0,10
		Hardened and tempered		55 HRC	–	H2	●●		0,05	0,06	0,06	0,09	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
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

●● Recommended application (the specified cutting data is regarded as starting values for the recommended application)
● Possible application, limited to 2 × D_c drilling depth, MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D_c, the following reductions are recommended:
> 3 × D_c: Cutting speed v_c –20%, feed f –30% when spot drilling, feed f –50% when spot drilling on inclined surfaces.
> 4 × D_c: Cutting speed v_c –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 1	Size 2	Size 3	Size 4	Size 5	Size 1	Size 2	Size 3	Size 4	Size 5
D_c [mm]					D_c [mm]					D_c [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	0,07	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										

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

WALTER

Cutting data for D3120

(continued)

(Wet machining symbol) = Wet machining (E = emulsion, O = oil)

(Dry machining symbol) = Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	Wet	Dry	Cutting material grade – Starting values for cutting speed v_c [m/min] – HC – WKP25S f [mm/rev] 0,06	WKP25S 0,10	WKP25S 0,16	WKP35S f [mm/rev] 0,06	WKP35S 0,10	WKP35S 0,16
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●		350	320		300	270	
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●		260	240	220	220	200	180
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●		240	220	200	200	180	150
		C > 0,55 %	Annealed	190	640	P4	●●		220	200	180	180	150	140
		C > 0,55 %	Heat-treated	300	1010	P5	●●		190	170	150	150	130	120
		Free-machining steel (short-chipping)	Annealed	220	750	P6	●●	●	220	200	180	180	150	140
	Low-alloy steel	Annealed		175	590	P7	●●		260	240	220	220	200	180
		Heat-treated		285	960	P8	●●		230	210	190	190	170	140
		Heat-treated		380	1280	P9	●●		210	190	170	180	160	130
		Heat-treated		430	1480	P10	●●		190	170	160	170	140	130
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	●●		220	200	180	200	170	150
		Hardened and tempered		300	1010	P12	●●		200	170	150	180	140	130
		Hardened and tempered		380	1280	P13	●●		190	160	140	170	130	120
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	●●					190	170	150
		Martensitic, heat-treated		330	1110	P15	●●					150	130	120
M	Stainless steel	Austenitic, quench hardened		200	680	M1	●●					220	200	180
		Austenitic, precipitation hardened (PH)		300	1010	M2	●●					150	130	110
		Austenitic/ferritic, duplex		230	780	M3	●●					120	100	80
K	Malleable cast iron	Ferritic		200	400	K1	●●	●	210	190	170	190	180	160
		Pearlitic		260	700	K2	●●	●	190	140	120	130	120	110
	Grey cast iron	Low strength		180	200	K3	●●	●	220	200	180	200	190	170
		High strength/austenitic		245	350	K4	●●	●	180	150	130	150	130	110
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●●	●	150	140	130	140	120	110
		Pearlitic		265	700	K6	●●		140	130	120	120	110	100
	CGI			230	400	K7	●●	●	180	150	130	150	130	110
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	●●	●				150	130	110
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	●●		100	100		100	100	
			Hardened	280	940	S2	●●		80	80		80	80	
		Ni- or Co-based	Annealed	250	840	S3	●●		60	60		60	60	
			Hardened	350	1180	S4	●●		50	50		50	50	
			Cast	320	1080	S5	●●		50	50		50	50	
	Titanium alloys	Pure titanium		200	680	S6								
		α and β alloys, hardened		375	1260	S7	●●					50	50	
		β alloys		410	1400	S8	●●					50	50	
	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	●●	●				400	400	400
	Thermosetting plastics	Without abrasive fillers				O2	●●	●	300	300	300	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	250	200	150

●● Recommended application (the specified cutting data is regarded as starting values for the recommended application)
● Possible application, limited to 2 × D_c drilling depth, MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D_c, the following reductions are recommended:
> 3 × D_c: Cutting speed v_c −20%, feed f −30% when spot drilling, feed f −50% when spot drilling on inclined surfaces.
> 4 × D_c: Cutting speed v_c −30%, feed f −40% when spot drilling.

Cutting material grade														
Starting values for cutting speed v_c [m/min]														
HC												HW		
WNN15 f [mm/rev]			WN15 f [mm/rev]			WSP45G f [mm/rev]			WXP40 f [mm/rev]			WK40 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
						250	220		200	180	160			
						170	160	150	150	140	130			
						150	140	130	150	140	120			
						140	130	120	150	140	130			
						130	120	110	120	110	100			
						140	130	120	120	110	130			
						170	160	160	150	140	130			
						140	130	120	140	120	110			
						140	120	110	140	120	90			
						140	120	110	120	110	80			
						140	130	120	130	120	110			
						130	120	110	120	110	100			
						120	110	100	110	100	80			
						140	130	120	130	120	110			
						120	110	100	110	100	90			
						180	170	150	160	150	120			
						130	110	100	110	100	75			
						100	80	70	80	70	60			
						170	140	120	160	140	140			
						130	120	110	130	120	120			
						180	160	130	160	140	120			
						150	130	110	130	120	100			
						150	130	120	130	120	110			
						120	110	110	110	100	100			
						150	130	110	130	120	100			
													500	500
450	450	450	450	450	450	450	450	450					450	400
300	300	300	300	300	300	300	300	300					400	400
250	250	250	250	250	250	250	250	250					300	300
200	200	200	200	200	200	200	200	200					200	200
300	300	300	300	300	300	300	300	300						
													300	260
300	250	200	300	250	200	300	250	200					300	260
350	300	250	350	300	250	350	300	250					400	350
130	110	100	130	110	100	130	110	100						
						90	90		80	80	70	70	70	
						70	70		60	60	50	50	50	
						50	50		50	50	40	40	40	
						40	40		40	40	35	30	30	
						40	40		40	40	35	30	30	
						50	45							
						40	40							
						400	400	400	400	400	400			
						300	300	300	300	300	300			
						250	200	150	250	200	150			

HC = Coated carbide
HW = Uncoated carbide

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

Cutting data for B321.

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

* The assignment of the machining groups can be found in the “General” section of the Technical Compendium, page F7.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	Wet	Dry	Indexable insert geometry – Starting values for feed f [mm/rev] – LCMX..-B57 – D_c [mm] 10,0–12,0	LCMX..-B57 – D_c [mm] 12,1–18,0	LCMX..-D57 – D_c [mm] 10,0–12,0	LCMX..-D57 – D_c [mm] 12,1–18,0
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	●●		0,05	0,06	0,06	0,07
		C > 0,25 ... ≤ 0,55 %	Annealed	190	640	P2	●●		0,06	0,08	0,06	0,08
		C > 0,25 ... ≤ 0,55 %	Heat-treated	210	710	P3	●●				0,06	0,08
		C > 0,55 %	Annealed	190	640	P4	●●				0,06	0,08
		C > 0,55 %	Heat-treated	300	1010	P5	●●				0,05	0,06
		Free-machining steel (short-chipping)	Annealed	220	750	P6	●●	●			0,05	0,06
	Low-alloy steel	Annealed		175	590	P7	●●		0,06	0,07	0,07	0,08
		Heat-treated		285	960	P8	●●				0,07	0,08
		Heat-treated		380	1280	P9	●●				0,07	0,08
		Heat-treated		430	1480	P10	●●				0,05	0,06
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	●●				0,06	0,08
		Hardened and tempered		300	1010	P12	●●				0,05	0,07
		Hardened and tempered		380	1280	P13	●●				0,06	0,07
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	●●				0,06	0,08
		Martensitic, heat-treated		330	1110	P15	●●				0,06	0,07
M	Stainless steel	Austenitic, quench hardened		200	680	M1	●●		0,05	0,06	0,06	0,07
		Austenitic, precipitation hardened (PH)		300	1010	M2	●●		0,05	0,06	0,06	0,07
		Austenitic/ferritic, duplex		230	780	M3	●●		0,05	0,06	0,06	0,07
K	Malleable cast iron	Ferritic		200	400	K1	●●	●	0,09	0,10	0,10	0,12
		Pearlitic		260	700	K2	●●	●	0,07	0,08	0,08	0,10
	Grey cast iron	Low strength		180	200	K3	●●	●	0,09	0,10	0,10	0,12
		High strength/austenitic		245	350	K4	●●	●	0,07	0,08	0,08	0,10
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	●●	●	0,07	0,09	0,08	0,10
		Pearlitic		265	700	K6	●●		0,06	0,08	0,07	0,08
	CGI			230	400	K7	●●	●	0,09	0,10	0,10	0,12
N	Wrought aluminium alloys	Not hardenable		30	–	N1						
		Hardenable, hardened		100	340	N2	●●				0,08	0,10
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	●●				0,08	0,10
		≤ 12% Si, hardenable, hardened		90	310	N4	●●				0,08	0,10
		> 12% Si, not hardenable		130	450	N5	●●	●			0,08	0,10
	Magnesium-based alloys			70	250	N6	●●				0,08	0,10
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7						
		Brass, bronze, red brass		90	310	N8	●●				0,08	0,10
		Copper alloys, short-chipping		110	380	N9	●●	●			0,07	0,09
		High tensile, Ampco		300	1010	N10	●●	●			0,06	0,08
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	●●		0,05	0,06	0,05	0,06
			Hardened	280	940	S2	●●				0,04	0,05
		Ni- or Co-based	Annealed	250	840	S3	●●				0,04	0,05
			Hardened	350	1180	S4	●●				0,04	0,05
			Cast	320	1080	S5	●●				0,04	0,05
	Titanium alloys	Pure titanium		200	680	S6						
		α and β alloys, hardened		375	1260	S7	●●		0,05	0,06	0,05	0,06
		β alloys		410	1400	S8	●●		0,05	0,06	0,05	0,06
	Tungsten alloys			300	1010	S9	●●				0,05	0,06
	Molybdenum alloys			300	1010	S10	●●				0,05	0,06
H	Hardened steel	Hardened and tempered		50 HRC	–	H1	●●				0,04	0,05
		Hardened and tempered		55 HRC	–	H2	●●				0,04	0,05
		Hardened and tempered		60 HRC	–	H3						
	Hardened cast iron	Hardened and tempered		55 HRC	–	H4	●●				0,04	0,05
O	Thermoplastics	Without abrasive fillers				O1	●●	●			0,12	0,14
	Thermosetting plastics	Without abrasive fillers				O2	●●	●			0,10	0,12
	Plastic, glass-fibre reinforced	GFRP				O3						
	Plastic, carbon-fibre reinforced	CFRP				O4						
	Plastic, aramid-fibre reinforced	AFRP				O5						
	Graphite (technical)			80 Shore		O6	●●	●	0,07	0,09	0,06	0,08

●● Recommended application (the specified cutting data is regarded as starting values for the recommended application)
● Possible application. Limited to 2 × D_c drilling depth. MQL (minimum quantity lubrication) or compressed air is recommended.

When using drills > 3 × D_c, the following reductions are recommended:
> 3 × D_c: Cutting speed v_c –20%, feed f –30% when spot drilling, feed f –50% when spot drilling on inclined surfaces.

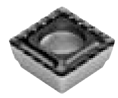
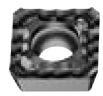
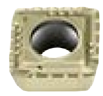
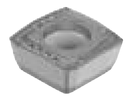
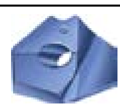
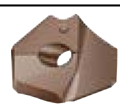
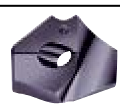
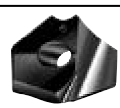
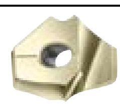
Indexable insert geometry				Cutting material grades											
Starting values for feed f [mm/rev]				Starting values for cutting speed v_c [m/min]											
LCMX..-E57		LCGX..-E77		HC											
D_c [mm]		D_c [mm]		WKP25S f [mm/rev]		WKP35S f [mm/rev]		WNN15 f [mm/rev]		WN15 f [mm/rev]		WSP45G f [mm/rev]		WXP40 f [mm/rev]	
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	300	300
0,06	0,08			300	250	250	200					250	200	250	200

HC = Coated carbide

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

Cutting tool material application charts – Drilling

Grades for drilling from solid

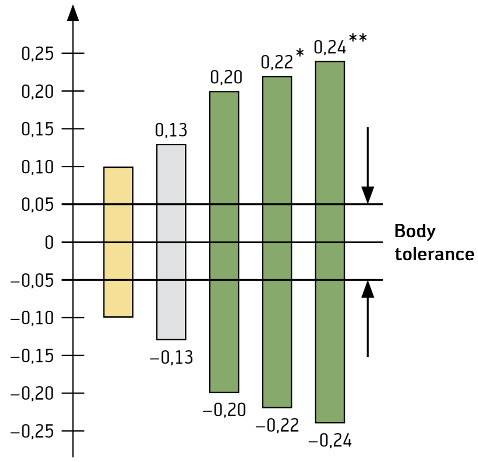
Walter grade designation	Standard designation	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Application range (01 05 10 15 20 25 30 35 40 45)	Coating process	Coating composition	Example of indexable insert
WKP25S	HC – P 25	●●								CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – K 25			●●								
WKP35S	HC – P 35	●●								CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – K 35			●●								
WN15	HW – N 15				●●					–	–	
	HW – S 15					●						
WNN15	HC – N 15				●●					PVD	AlTiN	
WSP45G	HC – P 45	●●								PVD	TiAlN + Al_2O_3 (+ ZrN)	
	HC – M45		●●									
	HC – S 45					●●						
	HC – N 30				●							
WXP40	HC – P 40	●●								PVD	TiCN	
	HC – M30		●●									
	HC – K 40			●●								
	HC – S 30					●						
WXP30	HC – P 30	●●								PVD	TiAlN / TiSiN	
	HC – M30		●									
	HC – K 30			●●								
	HC – N 30				●							
	HC – S 30					●						
WPP45C	HC – P 45	●●								PVD	TiAlN / TiAl	
	HC – K 45			●								
WKK45C	HC – P 45	●								PVD	TiAlN / TiSiAlCrN / TiSiN	
	HC – K 45			●●								
WMP35	HC – P 35	●●								PVD	TiAlN	
	HC – M35		●●									
	HC – S 35					●●						
WNN25	HC – N 25				●●					PVD	ta-C (DLC)	
	HC – O 25							●				
WPP25	HC – P 25	●●								PVD	AlTiN	
	HC – N 25				●							

HC = Coated carbide
HW = Uncoated carbide

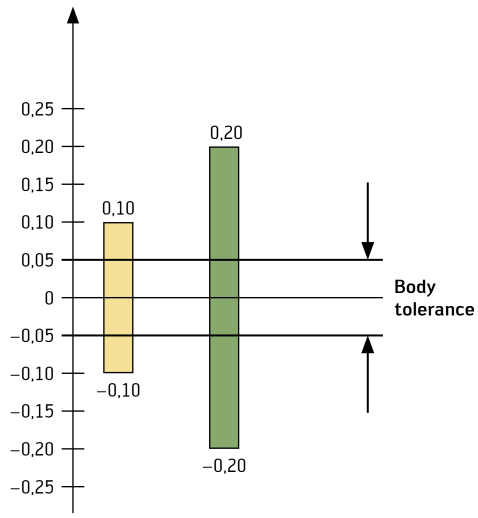
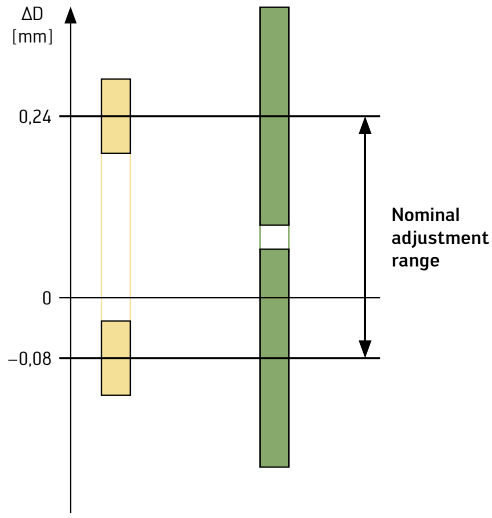
●● Primary application
● Additional application

Tool diameter tolerance ranges

1. For the D4120 indexable insert drill

Designation	Tolerance range without eccentric sleeve
P484.. **Ø 13.5–59 mm** Master insert P4840 ground insert P4841 sintered insert	 * for indexable insert grade 7 ** for indexable insert grade 8

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

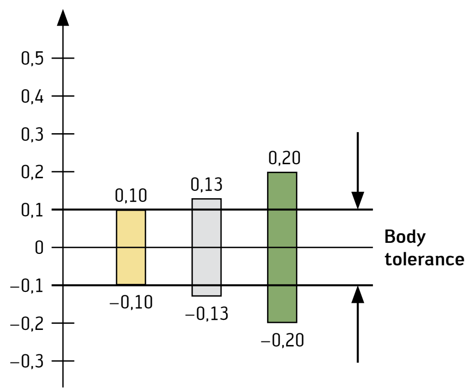
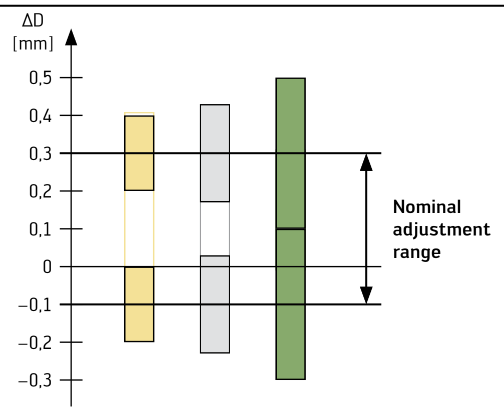
Designation	Tolerance range without eccentric sleeve	Tolerance range with FS 1207 eccentric sleeve
LCMX **Ø 10–18 mm** Master insert LCMX sintered insert		

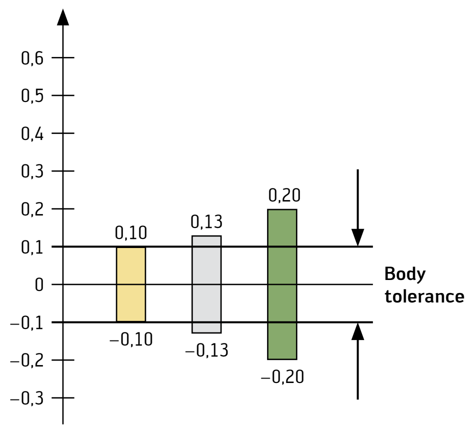
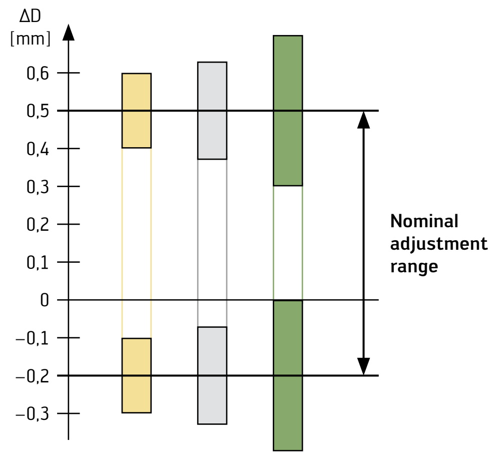
The resulting workpiece diameter may differ due to the drilling depth, workpiece material, feed and chip removal conditions, etc.

Tool diameter tolerance ranges

(continued)

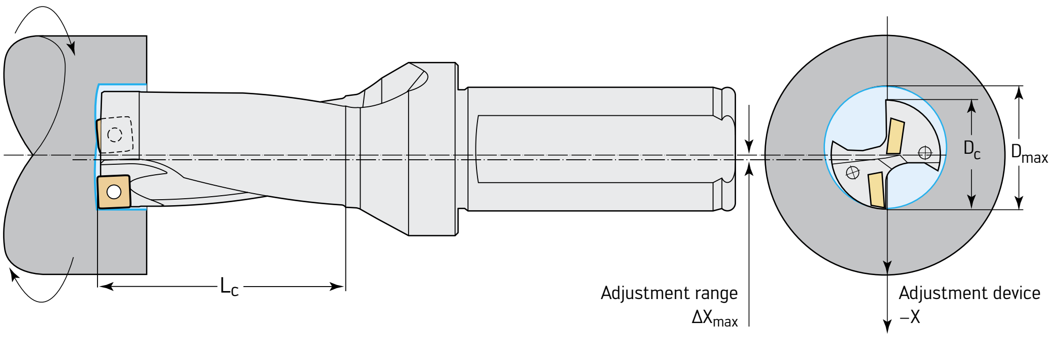
3. For the D3120 indexable insert drill

Designation	Tolerance range without eccentric sleeve	Tolerance range with FS 1208 eccentric sleeve
P284.. **Ø 16–25 mm** Master insert, P2840 ground insert, P2841 sintered insert		

Designation	Tolerance range without eccentric sleeve	Tolerance range with FS 722/FS 723/FS 724 eccentric sleeve
P284.. **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

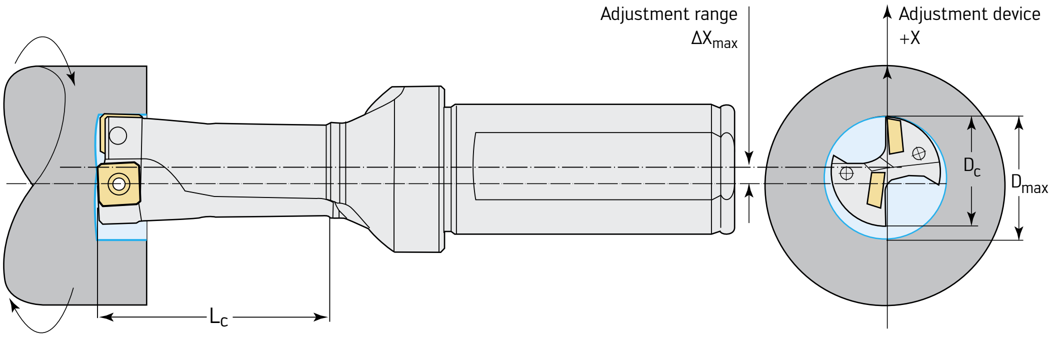


Indexable insert size		$(L_c / D_c) \geq 4$		$(L_c / D_c) < 4$	
	D_c [mm]	ΔX [mm]	D_{max} [mm]	ΔX_{max} [mm]	D_{max} [mm]
1	13,5	0,5	14,5	0,7	14,9
	14	0,35	14,7	0,6	15,2
	14,5	0,3	15,1	0,5	15,5
	15	0,2	15,4	0,45	15,9
	15,5	0,15	15,8	0,35	16,2
	16	0,05	16,1	0,3	16,6
	16,4	0	–	0,2	16,8
2	16,5	0,6	17,7	0,9	18,3
	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
3	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
	24,4*	0	–	0	–
4	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]	ΔX [mm]	D_{max} [mm]	ΔX_{max} [mm]	D_{max} [mm]
5	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
6	35,5	0,8	37,1	1,4	38,3
	36	0,7	37,4	1,25	38,5
	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
7	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
	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
8	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
	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

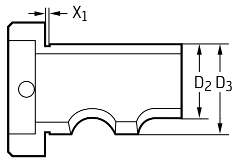


Indexable insert size	D_c [mm]	$(L_c/D_c) \geq 4$ ΔX [mm]	$(L_c/D_c) \geq 4$ D_{max} [mm]	$(L_c/D_c) < 4$ ΔX_{max} [mm]	$(L_c/D_c) < 4$ D_{max} [mm]
1	16	1,0	18,0	1,8	19,6
	17	0,8	18,6	1,5	20,0
	17,5	0,7	18,9	1,3	20,1
	18	0,7	19,4	1,3	20,6
	19	0,5	20,0	1,0	21,0
	19,5	0,3	20,1	0,8	21,1
	20	0,3	20,6	0,8	21,6
2	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
3	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
	30	0,3	30,6	0,7	31,4
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
5	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

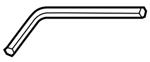
Indexable insert size	D_c [mm]	$(L_c/D_c) \geq 4$ ΔX [mm]	$(L_c/D_c) \geq 4$ D_{max} [mm]	$(L_c/D_c) < 4$ ΔX_{max} [mm]	$(L_c/D_c) < 4$ D_{max} [mm]
6	43	0,7	44,4	1,5	46,0
	44	0,5	45,0	1,2	46,4
	45	0,5	46,0	1,2	47,4
	46	0,4	46,8	0,9	47,8
	47	0,2	47,4	0,6	48,2
	48	0,0	48,0	0,0	48,0
	49	0,0	49,0	0,0	49,0
	50	0,0	50,0	0,0	50,0
7	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
	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

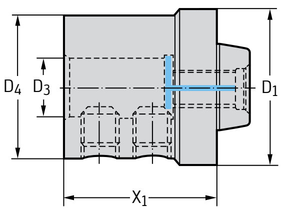


	Eccentric sleeve designation	D_c D3120 [mm]	D_2 [mm]	D_3 [mm]	X_1 [mm]
Adjustment range: −0.1 mm to +0.3 mm compared to nominal diameter	FS 1208	16–25	25	32	4
Adjustment range: −0.2 mm to +0.55 mm compared to nominal diameter	FS 722	16–25	25	32	4
	FS 723	26–36	32	40	4
	FS 724	37–42	40	50	4



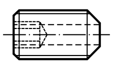
DIN 911 hex key	For D_3 = 32–40 mm = WAF 10	For D_3 = 50 mm = WAF 12

Adaptor



Designation	D_1 [mm]	D_3 [mm]	D_4 [mm]	X_1 [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_3 = 32–40 mm	D_3 = 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

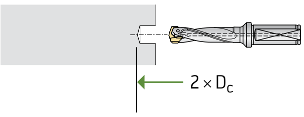
P6001–P6005 — 7–10 × D_c

P	M	K	N	S	H	O
✓	✓	✓	✓	✓		✓

Pilot drilling

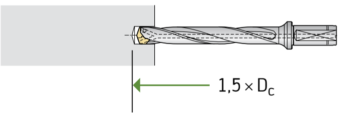
10–50 bar
145–725 psi
On

D4140-03
D4140.03



Running in

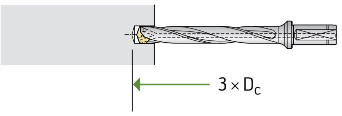
Off



n_{max} = 100 rpm
v_f = 100%

Spot drilling

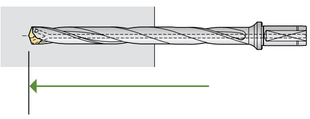
10–50 bar
145–725 psi
On



v_c = 75%
v_f = 50%

Deep-hole drilling

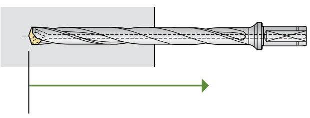
10–50 bar
145–725 psi
On



v_c = 100%
v_f = 100%

Retracting

Off



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

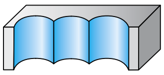
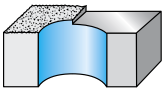
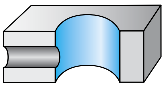
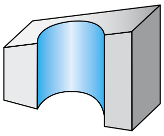
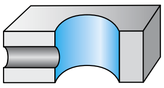
Recommended cutting data can be found in Walter GPS.

P6006 — 7–10 × D_c

P	M	K	N	S	H	O
✓			✓			

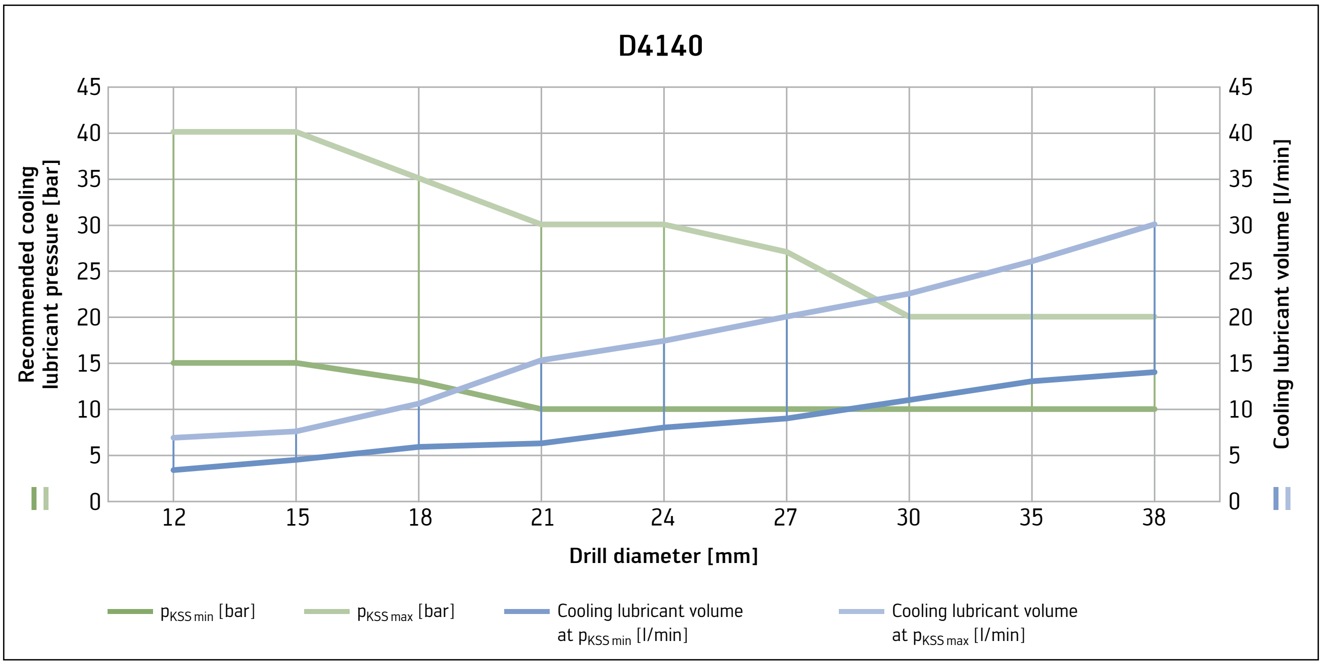
No pilot drilling strategy necessary

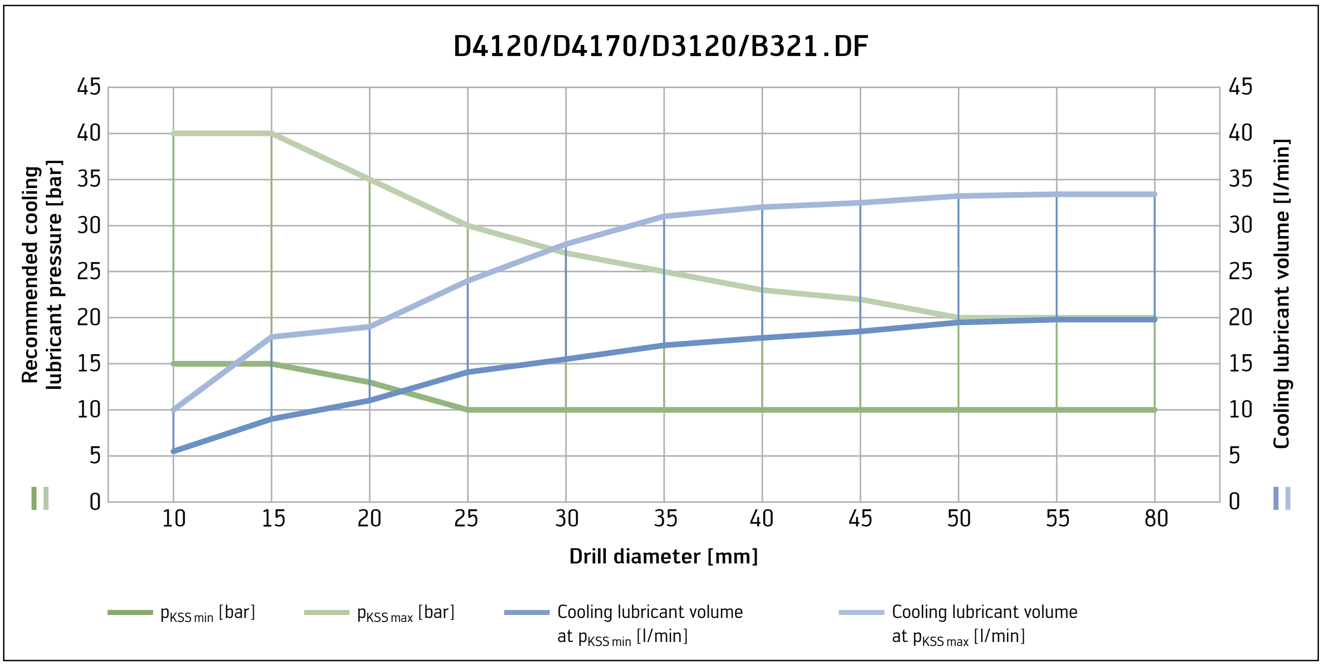
Possible uses for D4170, D4120 and D3120 indexable insert drills

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

Standard value diagrams for coolant pressure/flow rate information

Indexable insert 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.

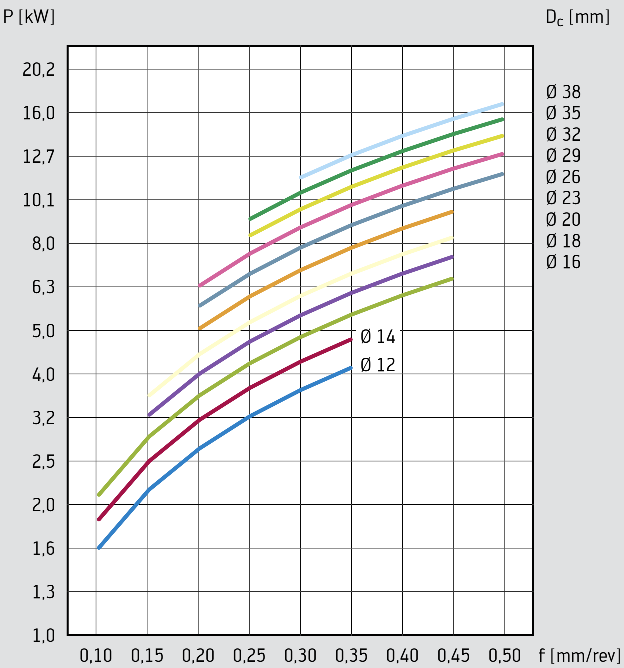
Abbreviations

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

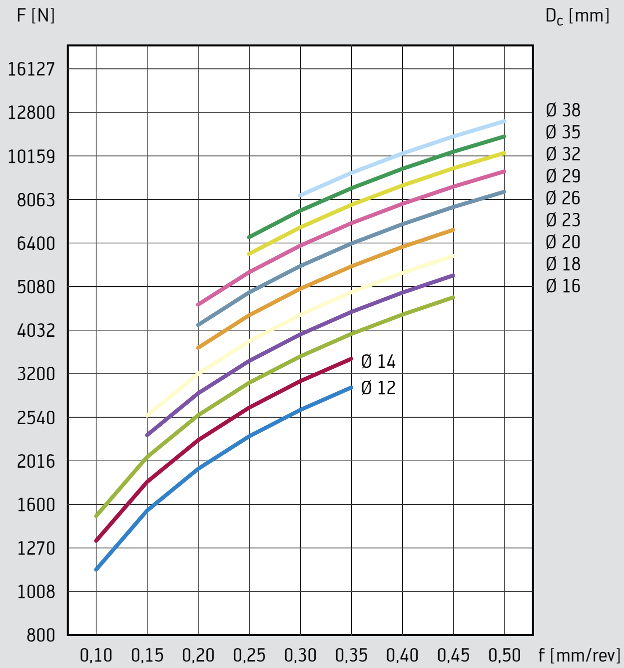
Standard values for drilling from solid with D4140 and D4240 exchangeable insert drills

Material: C45 – (1.0503) steel, steel casting [R_m = 650 N/mm²]

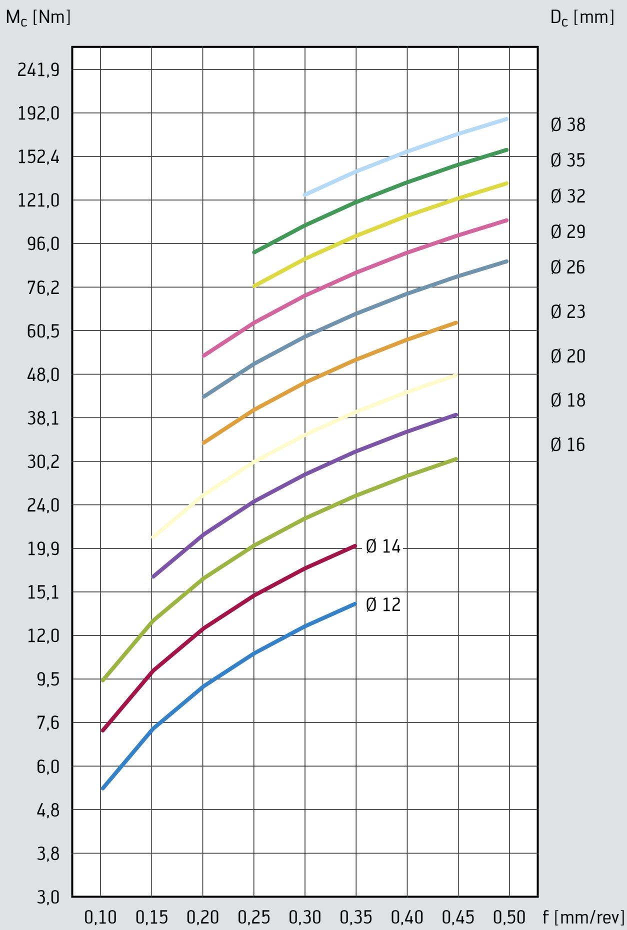
Power requirement *



Feed force



Torque



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

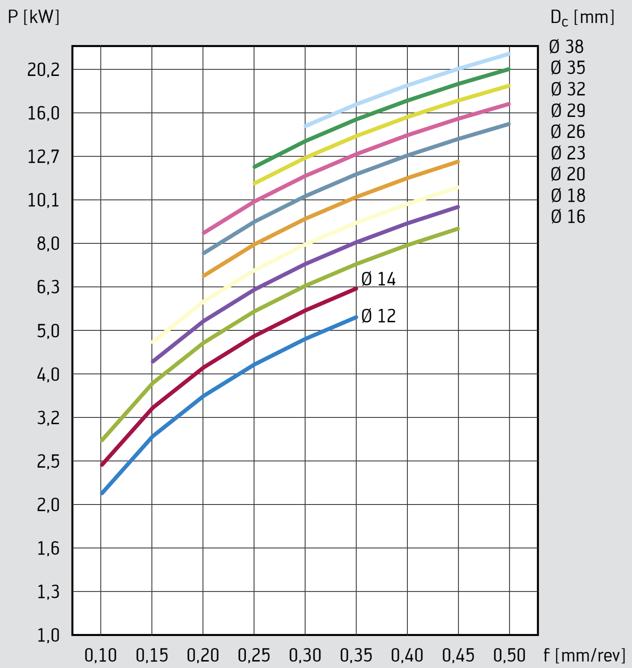
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

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

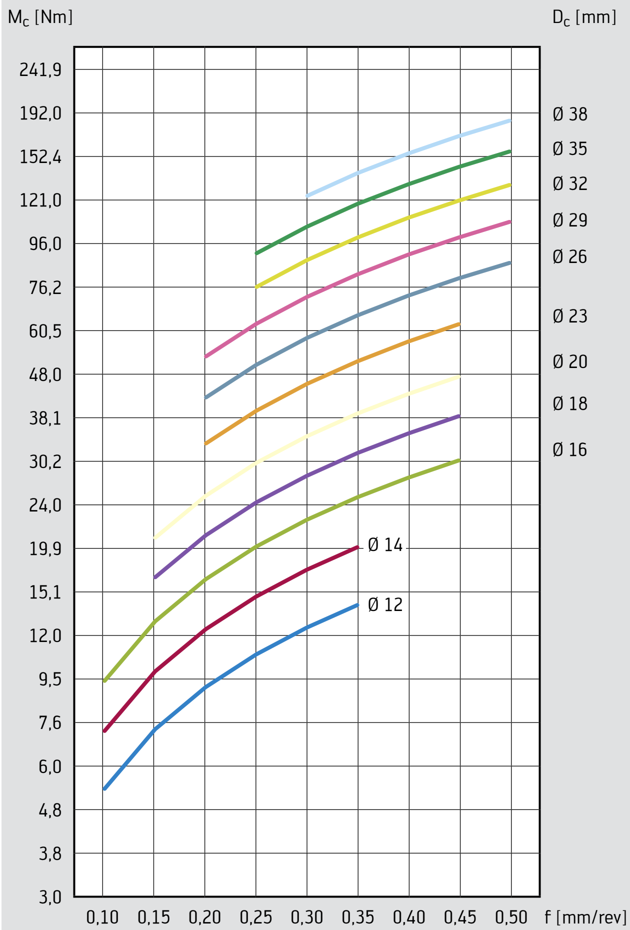
Standard values for drilling from solid with D4140 and D4240 exchangeable insert drills (continued)

Material: 42CrMo$_4$ – chromium-molybdenum alloy heat treatable steel [R_m = 750–900 N/mm^2]

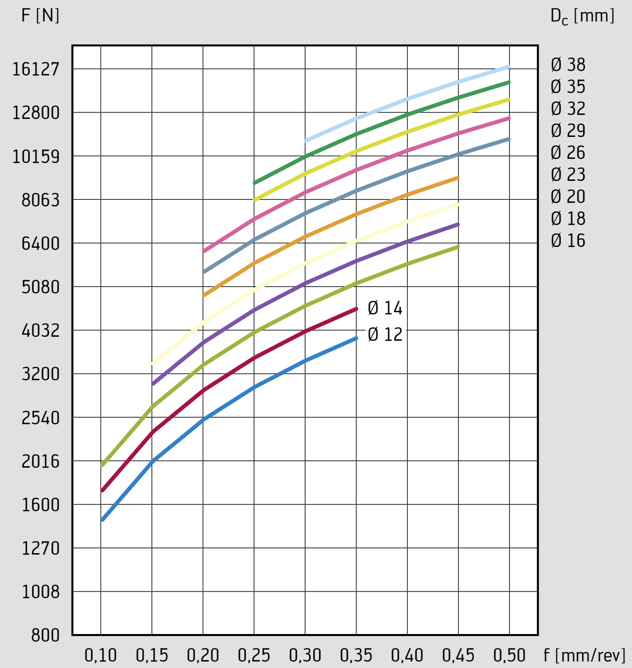
Power requirement *



Torque



Feed force



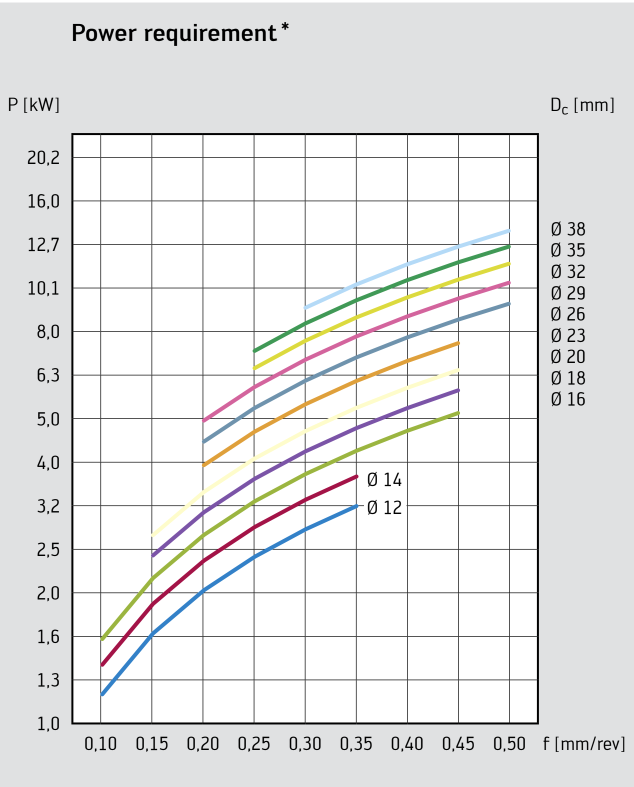
The power requirement * data is based on a cutting speed of 100 m/min.

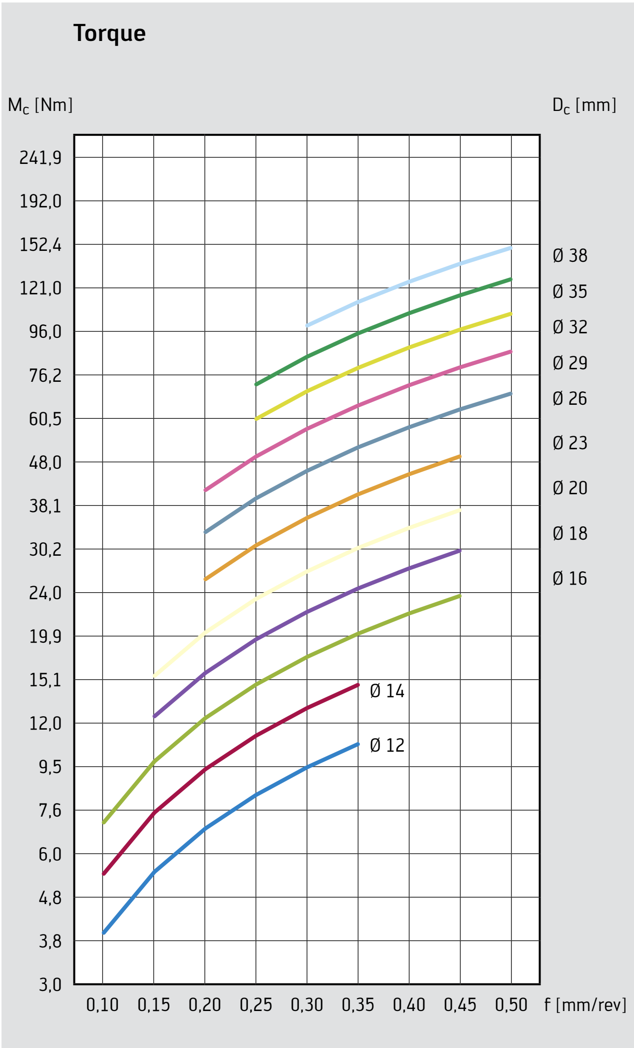
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

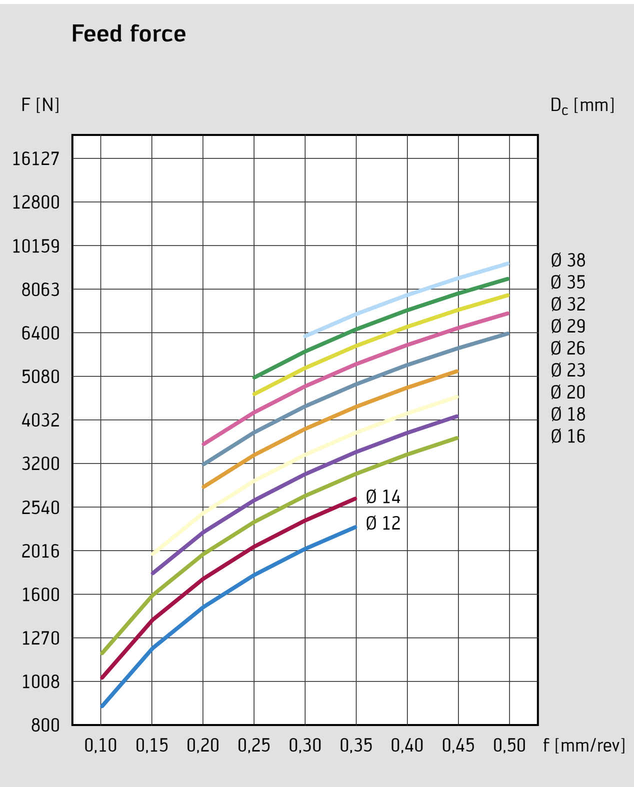
For steels with a higher tensile strength, the power and torque required are correspondingly higher.

Standard values for drilling from solid with D4140 and D4240 exchangeable insert drills (continued)

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







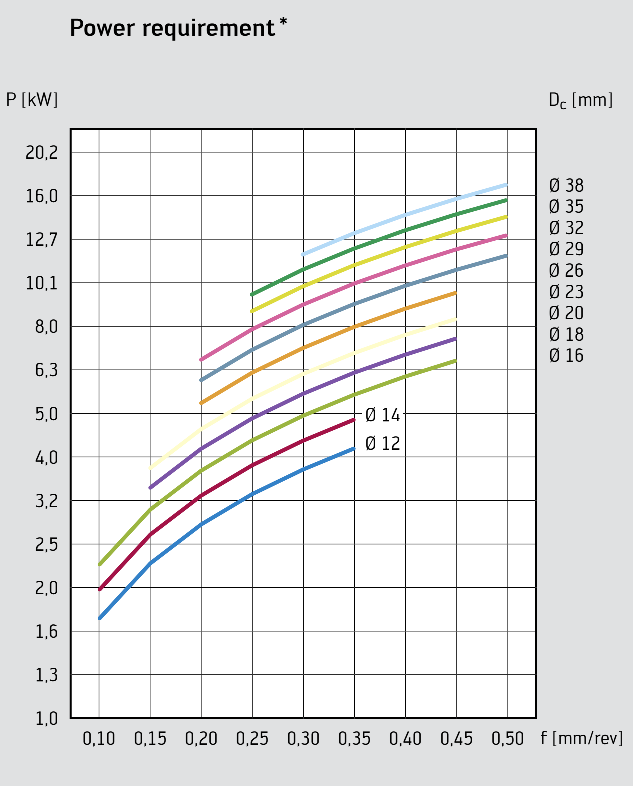
The power requirement * data is based on a cutting speed of 100 m/min.

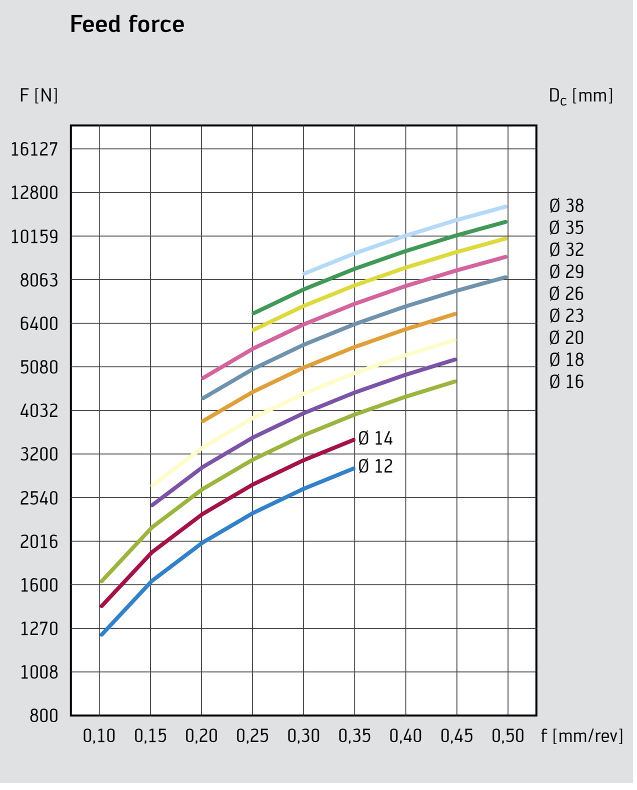
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

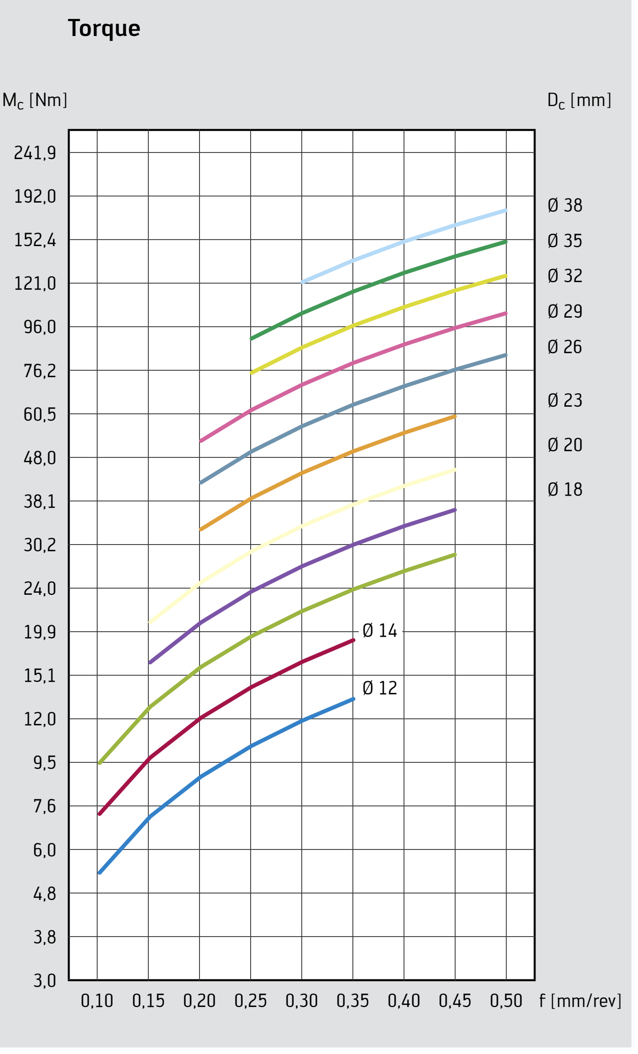
For harder cast iron, the power and torque required are correspondingly higher.

Standard values for drilling from solid with D4140 and D4240 exchangeable insert drills (continued)

Material: GGG70 – (0.7070) cast iron with spheroidal graphite [R_m = 690 N/mm²]







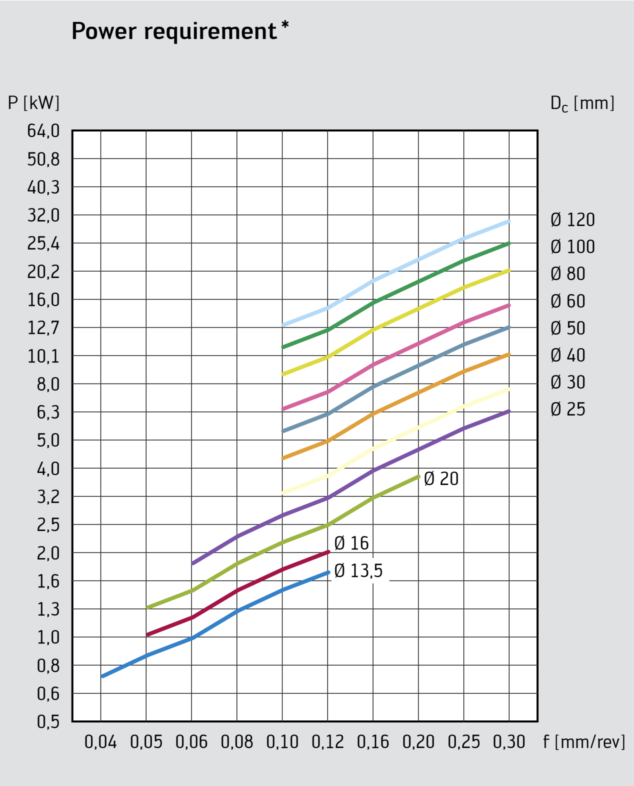
The power requirement * data is based on a cutting speed of 100 m/min.

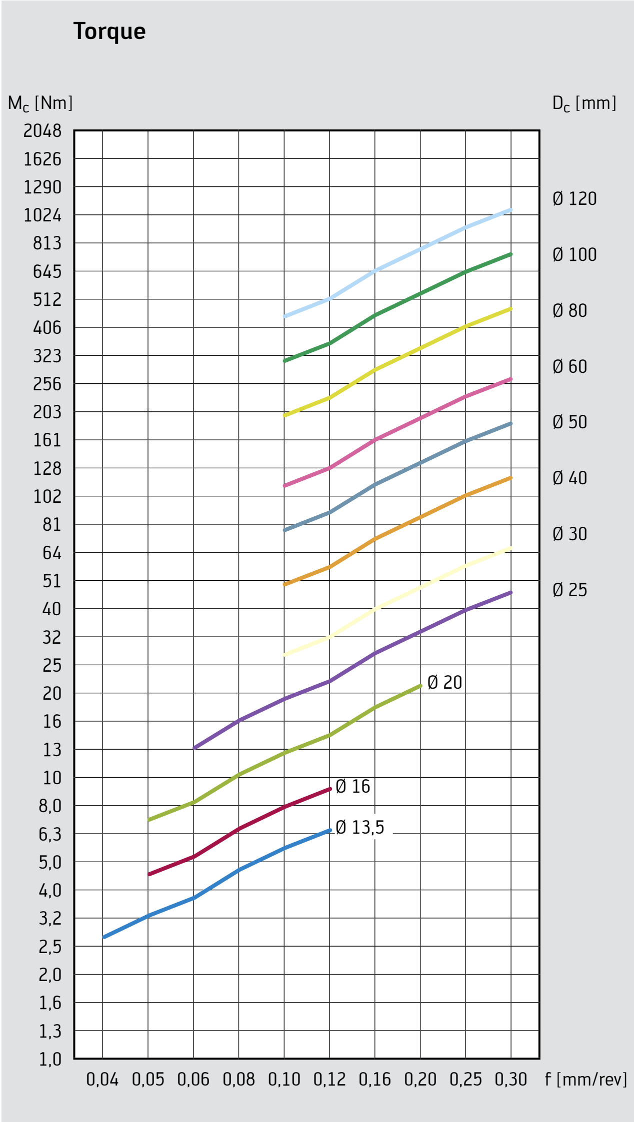
If the cutting speed is doubled, the power requirement also doubles,
i.e. the power requirement is directly proportional to the cutting speed.

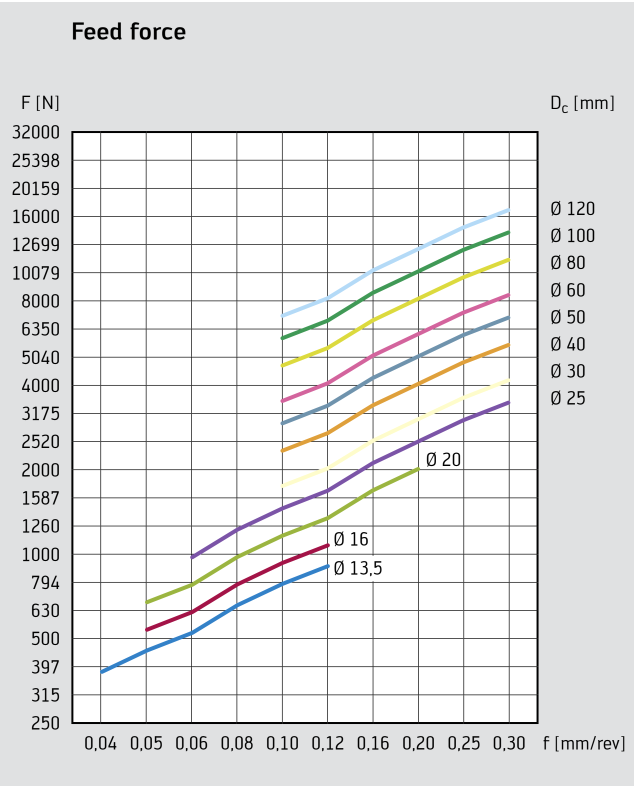
For harder cast iron, the power and torque required are correspondingly higher.

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

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







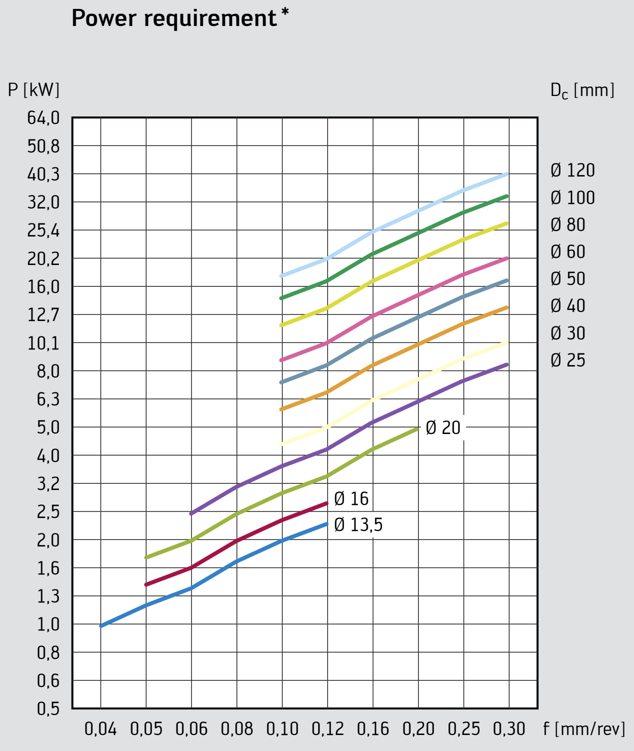
The power requirement * data is based on a cutting speed of 100 m/min.

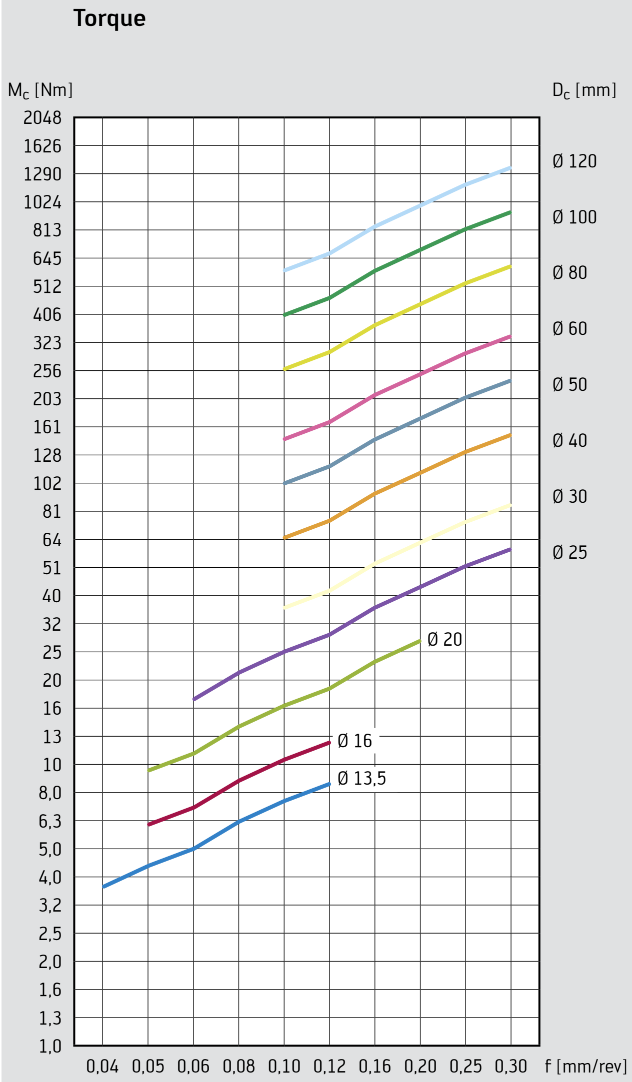
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

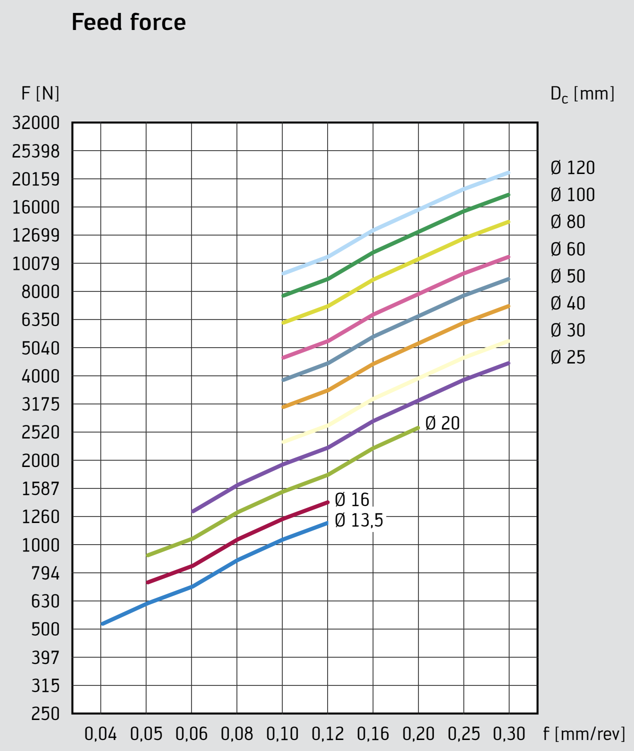
For steels with a higher tensile strength, the power and torque required are correspondingly higher.

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

Material: 42CrMo$_4$ – chromium-molybdenum alloy heat treatable steel [R_m = 750–900 N/mm^2]







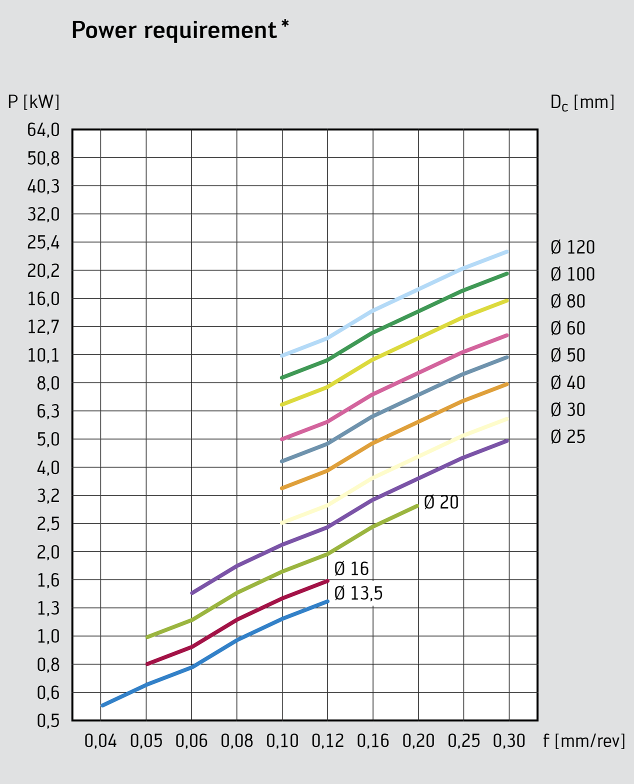
The power requirement* data is based on a cutting speed of 100 m/min.

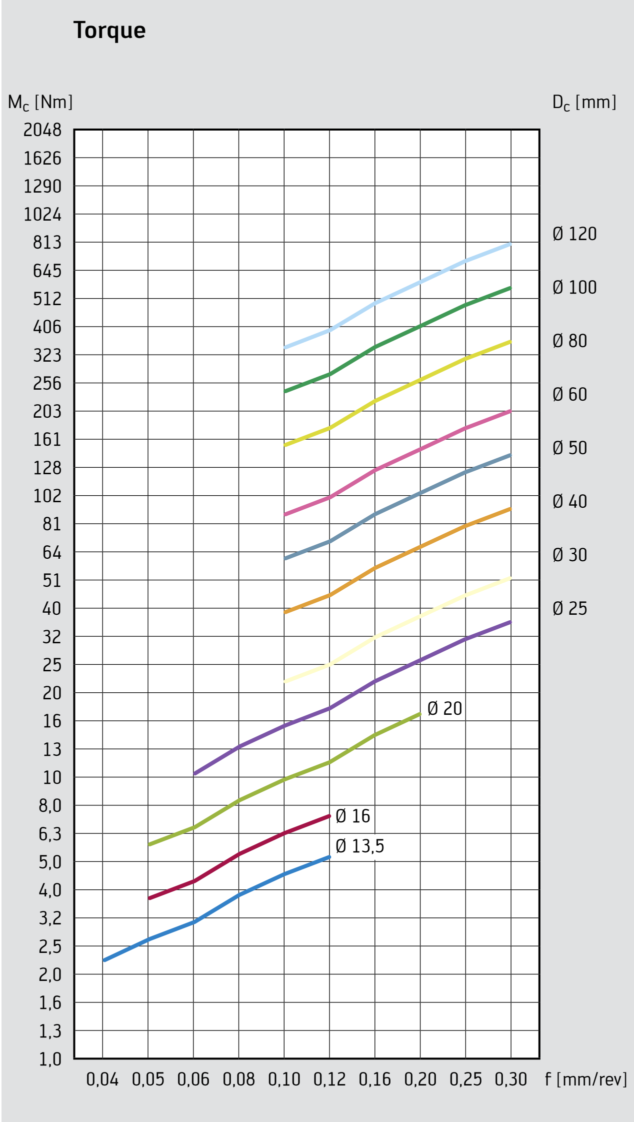
If the cutting speed is doubled, the power requirement also doubles,
i.e. the power requirement is directly proportional to the cutting speed.

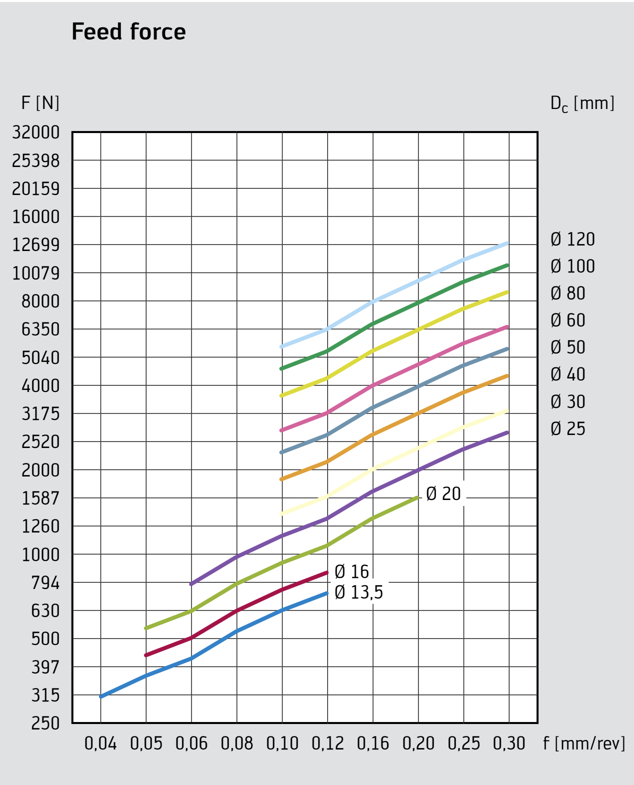
For steels with a higher tensile strength, the power and torque required are correspondingly higher.

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

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







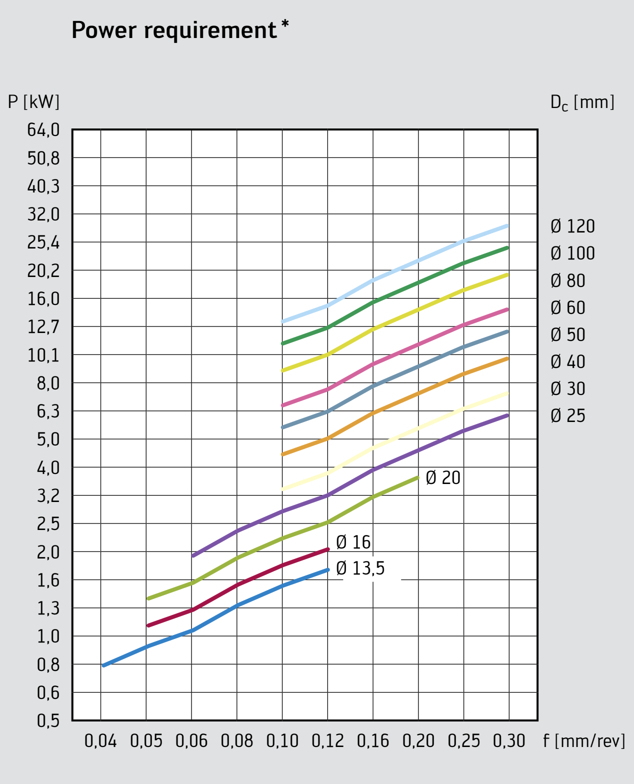
The power requirement * data is based on a cutting speed of 100 m/min.

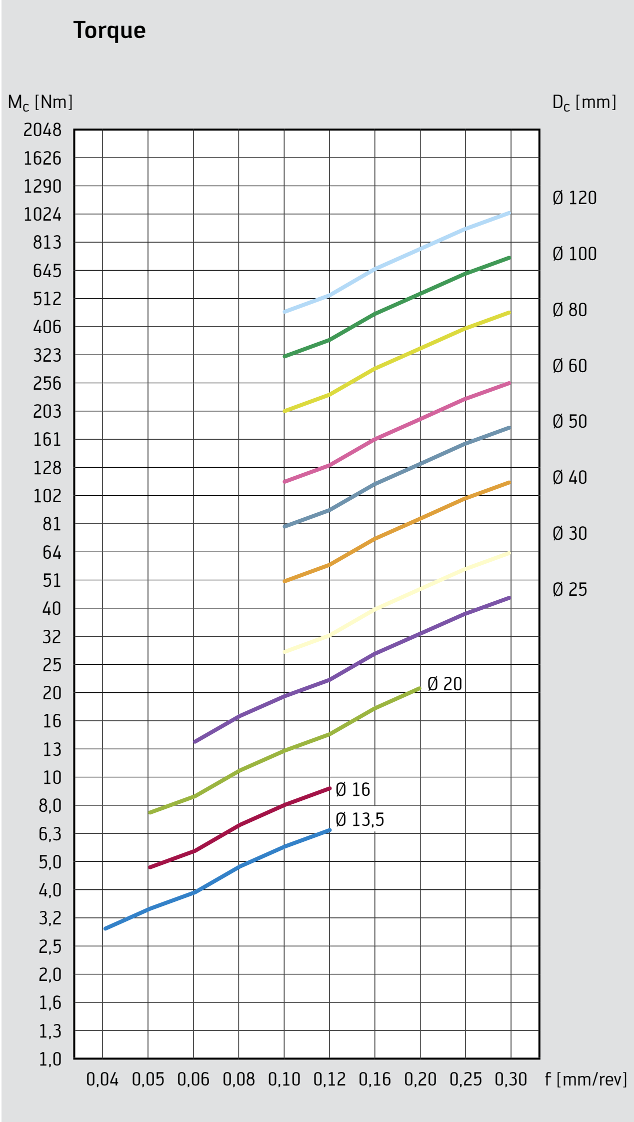
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

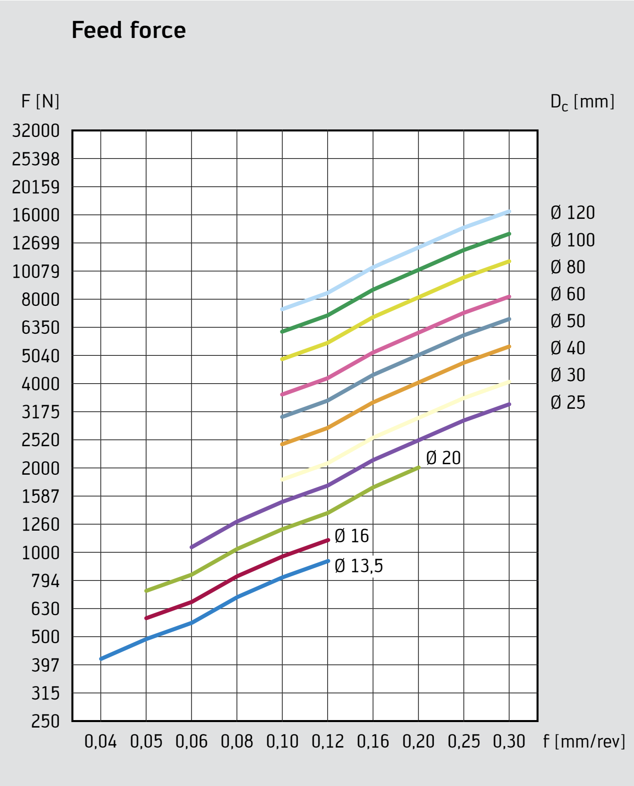
For harder cast iron, the power and torque required are correspondingly higher.

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 N/mm^2]





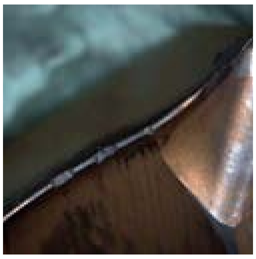


The power requirement * data is based on a cutting speed of 100 m/min.

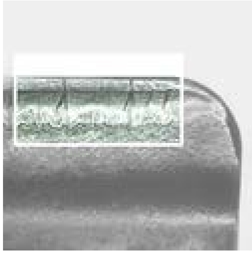
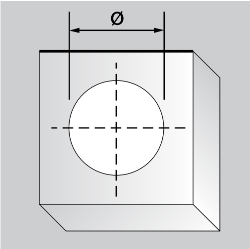
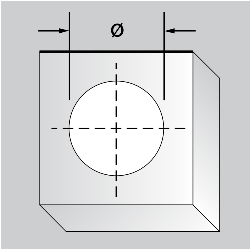
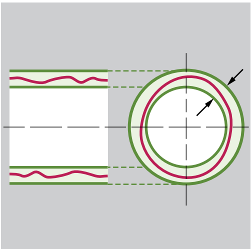
If the cutting speed is doubled, the power requirement also doubles, i.e. the power requirement is directly proportional to the cutting speed.

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

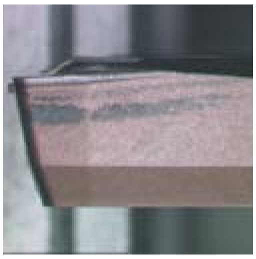
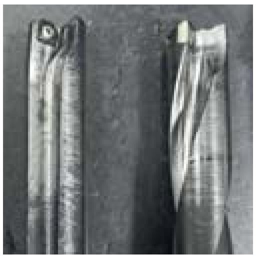
Problem-solving expertise for D4140 and D4240 exchangeable insert drills

Wear patterns		Characteristics	Measures
Wear at the corners		1. Incorrect drill 2. Poor cutting conditions 3. Insufficient coolant 4. Workpiece moving	1. Check the drill type, drilling depth, cooling system and workpiece material 2a. Reduce the cutting speed and increase the feed 2b. Check the cutting parameters on entry and exit. Reduce the feed by 15–20% before finishing 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 4. Stabilise the workpiece clamping and check the stability of the machine tool
Breakage at the corners		1. Fault in the chuck 2. Workpiece moving 3. Incorrect drill 4. Insufficient coolant 5. Poor cutting conditions	1. Check the torque transmission. Use a hydraulic chuck or a high-precision clamping system 2. Stabilise the workpiece clamping and check the stability of the machine tool 3. Check the drill type, drilling depth, cooling system and workpiece material; if necessary, use a longer drill 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 5. Check the cutting parameters and reduce the feed if necessary
Breakage on the chisel edge		1. Fault in the chuck 2. Cutting conditions	1. Check the accuracy of the clamping. Use a hydraulic chuck or a high-precision clamping system 2. Increase the feed
Breakage on the cutting edges		1. Fault in the chuck 2. Poor application conditions due to a built-up edge	1. Check the accuracy of the clamping and the transmission torque. Use a hydraulic chuck or a high-precision clamping system 2a. Check the cutting parameters and increase the cutting speed if required 2b. Regularly check for built-up edges
Build-up on the cutting edge		1. Insufficient coolant 2. Poor cutting conditions	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 2. Increase the cutting speed by 20–30%

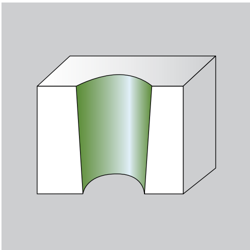
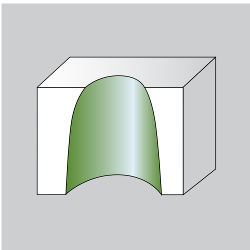
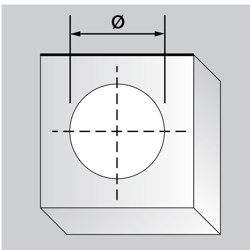
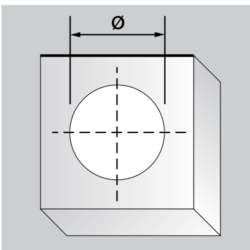
Problem-solving expertise for D4140 and D4240 exchangeable insert drills (continued)

Wear patterns		Characteristics	Measures
Formation of hairline cracks		1. Poor cutting conditions	1. Inconsistent/insufficient coolant supply
Hole too large		1. Poor cutting conditions 2. Fault in the chuck 3. Incorrect drill	1. Check the cutting data, increase the cutting speed or reduce the feed 2. Check the accuracy of the clamping and the torque transmission. Use a hydraulic chuck or a high-precision clamping system 3a. Check the drill diameter 3b. Check the drill tolerance 3c. Check whether the drill is running concentrically
Hole too small		1. Insufficient coolant 2. Poor cutting conditions 3. Incorrect drill	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 2. Reduce the cutting speed and increase the feed 3. Check the drill diameter
Hole is not cylindrical		1. Fault in the chuck 2. Workpiece moving 3. Incorrect drill 4. Poor cutting conditions	1. Check the accuracy of the clamping and the torque transmission. Use a hydraulic chuck or a high-precision clamping system 2. Stabilise the workpiece clamping and check the stability of the machine tool 3. Check the drill type and drilling depth and use a longer drill 4. Reduce the feed during entry

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

Wear patterns	Characteristics	Measures
Low tool edge life, high wear on indexable inserts	1. Incorrect cutting parameters 2. The cutting tool material has insufficient wear resistance 3. Insufficient coolant 4. Damaged insert seat 5. The drill body is longer than necessary 6. Unstable clamping 7. Setting error (on lathes)	1. Correct the cutting parameters 2. Select a more wear-resistant grade 3. Check the coolant pressure. If it is too low, increase the volume flow rate 4. Check the drill body and replace it if necessary 5. If possible, use a shorter tool 6. Increase the stability of the clamping fixture 7. Check the machine alignment
Fracture on the inner indexable insert 	1. The centre height of the tool is too high/too low (on lathes) 2. The feed is too high 3. The cutting edge grade is too hard 4. The indexable insert geometry encourages high forces 5. Unstable clamping	1. Check and adjust the centre height 2. Reduce the feed 3. Use a tougher cutting tool material 4. Use a geometry with a sharper cutting edge 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
Fracture on the outer indexable inserts 	1. The feed is too high 2. Interrupted cuts 3. The indexable insert geometry encourages high forces	1. Reduce the feed 2. Use a tougher cutting edge grade and a stronger geometry 3. Use an indexable insert with sharper geometry
Build-up on the cutting edge 	1. Insufficient coolant 2. Incorrect cutting parameters	1. Check the coolant pressure. If it is too low, increase the volume flow rate 2. Increase the cutting speed and reduce the feed
Chip removal and/or chip breaking is not ideal 	1. Insufficient coolant 2. Incorrect cutting parameters	1. Increase the coolant pressure and volume (for better chip removal and cooling of the cutting edges) 2. Improve the cutting parameters and chip control to suit the specified application. Increase the cutting speed and reduce the feed
Friction marks on the drill body 	1. The drilling diameter is too small 2. Poor chip removal 3. High bending forces due to rounded cutting edge	1. Check the setting 2. Improve the cutting parameters and check the indexable insert geometry 3. Select a sharper geometry

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

Wear patterns	Characteristics	Measures
Poor hole quality 	1. Insufficient coolant 2. Incorrect cutting parameters 3. Unstable clamping 4. Setting error (on lathes)	1. Increase the coolant pressure and volume 2a. Increase the cutting speed and reduce the feed 2b. Check the clamping accuracy (of the tool and the workpiece) and improve it if necessary 3. Improve the clamping stability 4. Check the machine alignment
The hole tapers off 	1. Chips accumulating in the external indexable insert groove 2. The material is very soft	1. Select an alternative chip breaking geometry and increase the feed if necessary 2a. Increase the cutting speed and reduce the feed 2b. Use a different cutting geometry
The hole is bell-shaped 	1. Chips accumulating in the central indexable insert groove	1. Select a different geometry and increase the feed if necessary
The hole is too small/too large 	1. The machine is not running at the zero position (on lathes) 2. The machine axis has shifted (on lathes) 3. Incorrect setting on the eccentric sleeve	1. Check and correct the setting 2. Check and correct the setting 3. Check and correct the setting
The hole is too small/too large for cartridge-type drills 	1. Setting error (on the outer cartridge)	1. Check and correct the setting

Cutting data for HSS drilling and reaming tools

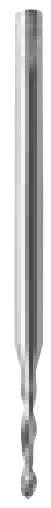
= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart
VCRR = v_c rate chart

* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.


Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	v_c	VRR			v_c	VRR		
						Drilling depth	~3 × D_c							
						Designation	A1149XPL UFL®				A1154TFT VA Inox			
						Standard	DIN 1897				DIN 1897			
						Coating	XPL				TFT			
						Dia. range [mm]	1–20				2–16			
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	56	12	**E** O		56	12	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	63	12	**E** O		56	12	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	63	12	**E** O					
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4	63	10	**E** O					
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5	50	10	**E** O					
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	56	12	**E** O		56	12	**E** O	
P	Low-alloy steel	Annealed		175	590	P7	56	12	**E** O		56	12	**E** O	
P	Low-alloy steel	Heat-treated		285	960	P8	45	10	**E** O					
P	Low-alloy steel	Heat-treated		380	1280	P9	28	7	**E** O					
P	Low-alloy steel	Heat-treated		430	1480	P10	18	5	**E** O					
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	32	5	**E** O					
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	50	10	**E** O					
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	25	7	**E** O					
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	50	12	**E** O					
P	Stainless steel	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	
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	22	6	**E** O					
M	Stainless steel	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					
K	Malleable cast iron	Pearlitic		260	700	K2	40	12	**E** O					
K	Grey cast iron	Low strength		180	200	K3	56	16	**E** O					
K	Grey cast iron	High strength/austenitic		245	350	K4	45	16	**E** O					
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	50	16	**E** O					
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	40	12	**E** O					
K	CGI			230	400	K7	40	12	**E** O					
N	Wrought aluminium alloys	Not hardenable		30	-	N1					110	12	**E** O	M
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2					110	12	**E** O	M
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	71	12	**E** O	M	63	12	**E** O	M
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	71	12	**E** O	M				
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5								
N	Magnesium-based alloys			70	250	N6								
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	80	5	**E** O		71	5	**E** O	
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	80	12	**E** O		71	12	**E** O	
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	120	12	**E** O					
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10								
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	11	4	**O** E		14	7	**O** E	
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	6,3	3	**E** O					
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	16	4	**E** O					
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4								
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5								
S	Titanium alloys	Pure titanium		200	680	S6					16	4	**O** E	
S	Titanium alloys	α and β alloys, hardened		375	1260	S7								
S	Titanium alloys	β alloys		410	1400	S8								
S	Tungsten alloys			300	1010	S9								
S	Molybdenum alloys			300	1010	S10								
H	Hardened steel	Hardened and tempered		50 HRC	–	H1								
H	Hardened steel	Hardened and tempered		55 HRC	–	H2								
H	Hardened steel	Hardened and tempered		60 HRC	–	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	–	H4								
O	Thermoplastics	Without abrasive fillers				O1	45	12	**E** O		40	12	**E** O	
O	Thermosetting plastics	Without abrasive fillers				O2	45	8		**L**	40	8		**L**
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	Graphite (technical)			80 Shore		O6								

~3 × D_c				~5 × D_c				~8 × D_c															
A1148 UFL®				A3143 A3153				A1249XPL UFL®				A1254TFT VA Inox				A1247 A4247 Alpha® XE				A1244 A4244 VA			
DIN 1897 / Walter				DIN 1899				DIN 338				DIN 338				DIN 338 / DIN 345				DIN 338 / DIN 345			
Uncoated				Uncoated				XPL				TFT				Uncoated				Uncoated			
1–20				0,05–1,45				1–20				3–16				1–40				0,3–32			
																							
v_c	VRR			VCRR	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
36	9	**E** O		H22	8	**E** O		45	12	**E** O		40	12	**E** O		28	9	**E** O					
36	10	**E** O		H22	9	**E** O		45	12	**E** O		40	12	**E** O		28	10	**E** O		25	7	**E** O	
36	10	**E** O		H22	9	**E** O		40	12	**E** O						25	10	**E** O		25	7	**E** O	
36	9	**E** O		H18	6	**E** O		40	10	**E** O						22	9	**E** O		22	7	**E** O	
28	8	**E** O		H14	8	**E** O		32	10	**E** O						14	8	**E** O		14	8	**E** O	
36	10	**E** O		H22	9	**E** O		45	12	**E** O		40	12	**E** O		28	10	**E** O					
36	10	**E** O		H22	9	**E** O		45	12	**E** O		40	12	**E** O		28	10	**E** O					
25	8	**E** O		H14	8	**E** O		28	10	**E** O						12	8	**E** O		12	8	**E** O	
16	6	**O** E						12	7	**E** O						7,1	6	**O** E		6,3	5	**O** E	
12	5	**O** E						7,1	5	**E** O						5	5	**O** E		5	5	**O** E	
16	5	**E** O		H12	4	**E** O		20	5	**E** O						12	5	**E** O		12	4	**E** O	
28	8	**E** O		H14	8	**E** O		32	10	**E** O						14	8	**E** O		14	8	**E** O	
14	6	**O** E		H8	6	**O** E		16	7	**E** O						9	6	**E** O		8	5	**O** E	
32	10	**E** O		H20	9	**E** O		40	12	**E** O						25	10	**E** O					
25	8	**E** O		H14	8	**E** O		28	10	**E** O						14	8	**E** O		14	8	**E** O	
11	4	**O** E		H6	4	**O** E		9	5	**O** E		10	9	**O** E		6,3	4	**O** E		6,3	4	**O** E	
11	5	**E** O		H8	5	**E** O		14	6	**E** O						7,1	5	**E** O		7,1	5	**E** O	
11	4	**O** E						10	4	**O** E		8	7	**O** E		5,6	4	**O** E		5,6	4	**O** E	
25	16	**E** O		H16	12	**E** O		32	16	**E** O						18	16	**E** O					
18	12	**E** O		H12	10	**E** O		28	12	**E** O						14	12	**E** O					
32	16	**E** O		H20	12	**E** O		40	16	**E** O						22	16	**E** O					
25	16	**E** O		H16	12	**E** O		32	16	**E** O						18	16	**E** O					
28	16	**E** O		H18	12	**E** O		36	16	**E** O						20	16	**E** O					
18	12	**E** O		H12	10	**E** O		28	12	**E** O						14	12	**E** O					
22	12	**E** O		H14	10	**E** O		28	12	**E** O						16	12	**E** O					
71	12	**E** O	M	H50	12	**E** O	M					80	12	**E** O	M								
71	12	**E** O	M	H50	12	**E** O	M					80	12	**E** O	M								
50	12	**E** O	M	H36	12	**E** O	M	50	12	**E** O	M	50	12	**E** O	M	40	12	**E** O	M				
36	10	**E** O	M	H25	10	**E** O	M	50	12	**E** O	M					28	10	**E** O	M				
90	12		**M** L													56	12		**M** L				
56	5	**E** O		H36	5	**E** O		56	5	**E** O		50	5	**E** O		40	5	**E** O					
40	10	**E** O		H28	10	**E** O		56	12	**E** O		50	12	**E** O		32	10	**E** O					
71	12	**E** O		H45	12	**E** O		80	12	**E** O						50	12	**E** O					
																11	5	**E** O		11	5	**E** O	
8	3	**O** E		H6	3	**O** E		7,1	4	**O** E		8	7	**O** E		5	3	**O** E		5	3	**O** E	
7,1	3	**O** E		H4	2	**O** E		6,3	3	**E** O						5	2	**O** E		5	2	**O** E	
10	4	**E** O						9	4	**E** O						5,6	4	**E** O		5,6	4	**E** O	
																1,6	3	**E** O		1,6	3	**E** O	
5	3	**E** O		H4	3	**E** O										2	3	**E** O		2	3	**E** O	
12	4	**O** E		H6	4	**E** O						8	4	**O** E		6,3	4	**O** E		6,3	4	**O** E	
8	3	**E** O														4,5	3	**E** O		4,5	3	**E** O	
7,1	3	**O** E														3,6	3	**O** E		3,6	3	**O** E	
5	3	**E** O		H4	3	**E** O										2	3	**E** O		2	3	**E** O	
5	3	**E** O		H4	3	**E** O										2	3	**E** O		2	3	**E** O	
40	12	**E** O		H28	12	**E** O		28	12	**E** O		25	12	**E** O		25	10	**E** O					
25	8		**L**	H18	8		**L**	36	8		**L**	32	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)

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = 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.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	A1222 UFL® v_c	A1222 UFL® VRR	A1222 UFL® Wet machining	A1222 UFL® Dry machining	DA110 Perform v_c	DA110 Perform VRR	DA110 Perform Wet machining	DA110 Perform Dry machining
						Drilling depth	~8 × D_c							
						Standard	DIN 338				DIN 338			
						Coating	Uncoated				WZ90AJ			
						Dia. range [mm]	1–16				1–16			
														
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	28	9	**E** O		29	9	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	28	10	**E** O		29	10	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	25	10	**E** O		23	10	**E** O	
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4	20	9	**E** O		22	8	**E** O	
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5	14	8	**E** O		15	8	**E** O	
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	28	10	**E** O		29	10	**E** O	
P	Low-alloy steel	Annealed		175	590	P7	28	10	**E** O		29	10	**E** O	
P	Low-alloy steel	Heat-treated		285	960	P8	12	8	**E** O		13	8	**E** O	
P	Low-alloy steel	Heat-treated		380	1280	P9	6,3	3	**O** E		9	3	**E** O	
P	Low-alloy steel	Heat-treated		430	1480	P10								
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	10	5	**E** O		9	4	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	14	8	**E** O		15	8	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	4	3	**O** E		7	3	**E** O	
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	22	10	**E** O		24	10	**E** O	
P	Stainless steel	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	
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	5,6	5	**E** O		8	5	**E** O	
M	Stainless steel	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	
K	Malleable cast iron	Pearlitic		260	700	K2	12	12	**E** O		17	10	**E** O	
K	Grey cast iron	Low strength		180	200	K3	20	16	**E** O		28	12	**E** O	
K	Grey cast iron	High strength/austenitic		245	350	K4	16	16	**E** O		22	12	**E** O	
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	18	16	**E** O		25	12	**E** O	
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	12	12	**E** O		17	10	**E** O	
K	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				
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2	56	12	**E** O	M				
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	36	12	**E** O	M				
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	25	10	**E** O	M				
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5								
N	Magnesium-based alloys			70	250	N6	50	12		**M** L				
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	36	5	**E** O		41	5	**E** O	
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	28	10	**E** O					
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	45	12	**E** O		51	12	**E** O	
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10								
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	4	3	**O** E		4	3	**O** E	
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	4	2	**O** E					
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	3,2	3	**E** O					
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4								
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5								
S	Titanium alloys	Pure titanium		200	680	S6								
S	Titanium alloys	α and β alloys, hardened		375	1260	S7								
S	Titanium alloys	β alloys		410	1400	S8								
S	Tungsten alloys			300	1010	S9								
S	Molybdenum alloys			300	1010	S10								
H	Hardened steel	Hardened and tempered		50 HRC	–	H1								
H	Hardened steel	Hardened and tempered		55 HRC	–	H2								
H	Hardened steel	Hardened and tempered		60 HRC	–	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	–	H4								
O	Thermoplastics	Without abrasive fillers				O1	25	12	**E** O		25	12	**E** O	
O	Thermosetting plastics	Without abrasive fillers				O2	18	8		**L**	28	8		**L**
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	Graphite (technical)			80 Shore		O6								

WALTER TITEX

~8 × D_c								~12 × D_c															
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_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
32	9	**E** O		25	8	**E** O		32	12	**E** O		25	9	**E** O						22	9	**E** O	
32	10	**E** O		25	9	**E** O		32	12	**E** O		25	10	**E** O		18	7	**E** O		22	10	**E** O	
25	10	**E** O		20	9	**E** O		25	12	**E** O		18	10	**E** O		18	7	**E** O		22	10	**E** O	
25	8	**E** O		18	7	**E** O		25	9	**E** O		18	9	**E** O		16	7	**E** O		18	9	**E** O	
18	8	**E** O		12	8	**E** O		20	10	**E** O		10	8	**E** O		10	8	**E** O		10	8	**E** O	
32	10	**E** O		25	9	**E** O		32	12	**E** O		25	10	**E** O						22	10	**E** O	
32	10	**E** O		25	9	**E** O		32	12	**E** O		25	10	**E** O						22	10	**E** O	
16	8	**E** O		10	8	**E** O		18	10	**E** O		9	8	**E** O		9	8	**E** O		9	8	**E** O	
12	3	**E** O		4,5	6	**O** E		6,3	7	**E** O		4,5	6	**O** E		4	5	**O** E		6,3	3	**O** E	
				3,2	5	**O** E		4	5	**E** O		3,2	5	**O** E		3,2	5	**O** E					
9	4	**E** O		8	4	**E** O		12	5	**E** O		10	5	**E** O		10	4	**E** O		8	5	**E** O	
18	8	**E** O		12	8	**E** O		20	10	**E** O		10	8	**E** O		10	8	**E** O		10	8	**E** O	
7,1	3	**E** O		5,6	6	**O** E		9	7	**E** O		6,3	6	**E** O		5,6	5	**O** E		2,8	3	**O** E	
25	10	**E** O		22	9	**E** O		32	12	**E** O		22	10	**E** O						20	10	**E** O	
18	8	**E** O		11	8	**E** O		20	10	**E** O		10	8	**E** O		9	8	**E** O		10	8	**E** O	
5,6	4	**O** E		4	3	**O** E		5,6	5	**O** E		4,5	4	**O** E		4,5	4	**O** E		3,6	4	**O** E	
10	5	**E** O		5	5	**E** O		7,1	5	**E** O		5	5	**E** O		5	5	**E** O		4,5	5	**E** O	
				3,6	3	**O** E		6,3	4	**O** E		4	4	**O** E		4	4	**O** E		2,5	3	**O** E	
28	12	**E** O		16	12	**E** O		25	16	**E** O		16	16	**E** O						14	16	**E** O	
22	10	**E** O		12	10	**E** O		20	12	**E** O		11	12	**E** O						11	12	**E** O	
36	12	**E** O		20	12	**E** O		32	16	**E** O		20	16	**E** O						18	16	**E** O	
28	12	**E** O		16	12	**E** O		25	16	**E** O		16	16	**E** O						14	16	**E** O	
32	12	**E** O		18	12	**E** O		28	16	**E** O		18	16	**E** O						16	16	**E** O	
22	10	**E** O		12	10	**E** O		20	12	**E** O		11	12	**E** O						11	12	**E** O	
25	10	**E** O		14	10	**E** O		22	12	**E** O		12	12	**E** O						12	12	**E** O	
				50	12	**E** O	M	63	12	**E** O	M									45	12	**E** O	M
				50	12	**E** O	M	63	12	**E** O	M									45	12	**E** O	M
				32	12	**E** O	M	36	12	**E** O	M	32	12	**E** O	M					32	12	**E** O	M
				22	10	**E** O	M	28	12	**E** O	M	25	10	**E** O	M					22	10	**E** O	M
												45	12		**M** L					40	12		**M** L
45	5	**E** O		36	5	**E** O		40	5	**E** O		36	5	**E** O						32	5	**E** O	
				28	10	**E** O		45	12	**E** O		28	10	**E** O						25	10	**E** O	
56	12	**E** O		45	12	**E** O		56	12	**E** O		45	12	**E** O						40	12	**E** O	
				9	5	**E** O						8	5	**E** O		8	5	**E** O					
4,5	3	**O** E		3,2	2	**O** E		4,5	4	**O** E		3,6	3	**O** E		3,6	3	**O** E		3,2	3	**O** E	
				5	2	**O** E		4	2	**E** O		5	2	**O** E		5	2	**O** E		4	2	**O** E	
				3,2	3	**E** O		5,6	4	**E** O		3,6	4	**E** O		3,6	4	**E** O		2,5	3	**E** O	
												1	3	**E** O		1	3	**E** O					
												1,4	3	**E** O		1,4	3	**E** O					
				5,6	4	**E** O						4,5	4	**O** E		4,5	4	**O** E					
				2,8	3	**E** O						3,2	3	**E** O		3,2	3	**E** O					
				2,2	3	**O** E						2,5	3	**O** E		2,5	3	**O** E					
												1,4	3	**E** O		1,4	3	**E** O					
												1,4	3	**E** O		1,4	3	**E** O					
25	12	**E** O		25	12	**E** O		20	12	**E** O		20	10	**E** O						20	12	**E** O	
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)

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = 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.

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	A1511				A1622 A4622 UFL®			
						Drilling depth	~12 × D_c				~16 × D_c			
						Standard	DIN 340 / DIN 341				DIN 1869 I / DIN 1870 I			
						Coating	Uncoated				Uncoated			
						Dia. range [mm]	0,5–50				2–30			
														
							v_c	VRR	Wet	Dry	v_c	VRR	Wet	Dry
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	22	8	**E** O		20	9	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	22	9	**E** O		20	10	**E** O	
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	16	9	**E** O		20	10	**E** O	
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4	14	7	**E** O		16	9	**E** O	
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5	8	8	**E** O		9	8	**E** O	
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	22	9	**E** O		20	10	**E** O	
P	Low-alloy steel	Annealed		175	590	P7	22	9	**E** O		20	10	**E** O	
P	Low-alloy steel	Heat-treated		285	960	P8	7,1	8	**E** O		8	8	**E** O	
P	Low-alloy steel	Heat-treated		380	1280	P9	2,8	6	**O** E		5,6	3	**O** E	
P	Low-alloy steel	Heat-treated		430	1480	P10	2	5	**O** E					
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	6,3	4	**E** O		7,1	5	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	8	8	**E** O		9	8	**E** O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	4,5	6	**O** E		2,2	3	**O** E	
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	18	9	**E** O		18	10	**E** O	
P	Stainless steel	Martensitic, heat-treated		330	1110	P15	8	8	**E** O		9	8	**E** O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1	2,8	3	**O** E		2,8	4	**O** E	
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	3,6	5	**E** O		3,2	5	**E** O	
M	Stainless steel	Austenitic/ferritic, duplex		230	780	M3	2,5	3	**O** E		2	3	**O** E	
K	Malleable cast iron	Ferritic		200	400	K1	14	12	**E** O		12	16	**E** O	
K	Malleable cast iron	Pearlitic		260	700	K2	11	10	**E** O		9	12	**E** O	
K	Grey cast iron	Low strength		180	200	K3	18	12	**E** O		16	16	**E** O	
K	Grey cast iron	High strength/austenitic		245	350	K4	14	12	**E** O		12	16	**E** O	
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	16	12	**E** O		14	16	**E** O	
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	11	10	**E** O		9	12	**E** O	
K	CGI			230	400	K7	12	10	**E** O		10	12	**E** O	
N	Wrought aluminium alloys	Not hardenable		30	-	N1	45	12	**E** O	M	40	12	**E** O	M
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2	45	12	**E** O	M	40	12	**E** O	M
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	28	12	**E** O	M	28	12	**E** O	M
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	20	10	**E** O	M	20	10	**E** O	M
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5								
N	Magnesium-based alloys			70	250	N6					36	12		**M** L
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	32	5	**E** O		28	5	**E** O	
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	25	10	**E** O		22	10	**E** O	
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	40	12	**E** O		36	12	**E** O	
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10	6,3	5	**E** O					
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	2,2	2	**O** E		2,5	3	**O** E	
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	4,5	2	**O** E		3,6	2	**O** E	
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	2,5	3	**E** O		1,8	3	**E** O	
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4								
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5								
S	Titanium alloys	Pure titanium		200	680	S6	3,6	4	**E** O					
S	Titanium alloys	α and β alloys, hardened		375	1260	S7	1,8	3	**E** O					
S	Titanium alloys	β alloys		410	1400	S8	1,6	3	**O** E					
S	Tungsten alloys			300	1010	S9								
S	Molybdenum alloys			300	1010	S10								
H	Hardened steel	Hardened and tempered		50 HRC	-	H1								
H	Hardened steel	Hardened and tempered		55 HRC	-	H2								
H	Hardened steel	Hardened and tempered		60 HRC	-	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	-	H4								
O	Thermoplastics	Without abrasive fillers				O1	20	12	**E** O		18	12	**E** O	
O	Thermosetting plastics	Without abrasive fillers				O2	16	8		**L**	14	8		**L**
O	Plastic, glass-fibre reinforced	GFRP				O3								
O	Plastic, carbon-fibre reinforced	CFRP				O4								
O	Plastic, aramid-fibre reinforced	AFRP				O5								
O	Graphite (technical)			80 Shore		O6								

WALTER TITEX

	~22 × D_c				~30 × D_c				~60 × D_c				~85 × D_c				~16 × D_c			
	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_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
	20	9	**E** O		16	9	**E** O		16	9	**E** O		16	9	**E** O		18	8	**E** O	
	18	10	**E** O		16	10	**E** O		16	10	**E** O		16	10	**E** O		18	9	**E** O	
	18	10	**E** O		14	10	**E** O		14	10	**E** O		14	10	**E** O		14	9	**E** O	
	16	9	**E** O		12	9	**E** O		12	9	**E** O		12	9	**E** O		11	7	**E** O	
	8	8	**E** O		7,1	8	**E** O		7,1	8	**E** O		7,1	8	**E** O		6,3	8	**E** O	
	20	10	**E** O		16	10	**E** O		16	10	**E** O		16	10	**E** O		18	9	**E** O	
	20	10	**E** O		16	10	**E** O		16	10	**E** O		16	10	**E** O		18	9	**E** O	
	7,1	8	**E** O		6,3	8	**E** O		6,3	8	**E** O		6,3	8	**E** O		5,6	8	**E** O	
	5	3	**O** E		4	3	**O** E		4	3	**O** E		4	3	**O** E		2,2	6	**O** E	
																	1,4	5	**O** E	
	7,1	5	**E** O		5,6	5	**E** O		5,6	5	**E** O		5,6	5	**E** O		5,6	4	**E** O	
	8	8	**E** O		7,1	8	**E** O		7,1	8	**E** O		7,1	8	**E** O		6,3	8	**E** O	
	1,8	3	**O** E		1,2	3	**O** E		1,2	3	**O** E		1,2	3	**O** E		3,2	6	**O** E	
	16	10	**E** O		14	10	**E** O		14	10	**E** O		14	10	**E** O		16	9	**E** O	
	8	8	**E** O		6,3	8	**E** O		6,3	8	**E** O		6,3	8	**E** O		6,3	8	**E** O	
	2,5	4	**O** E		1,8	4	**O** E		1,8	4	**O** E		1,8	4	**O** E		2,2	3	**O** E	
	2,8	5	**E** O		2	5	**E** O		2	5	**E** O		2	5	**E** O		2,8	5	**E** O	
	1,6	3	**O** E		1,2	3	**O** E		1,2	3	**O** E		1,2	3	**O** E		2	3	**O** E	
	11	16	**E** O		9	16	**E** O		9	16	**E** O		9	16	**E** O		12	12	**E** O	
	8	12	**E** O		7,1	12	**E** O		7,1	12	**E** O		7,1	12	**E** O		9	10	**E** O	
	14	16	**E** O		12	16	**E** O		12	16	**E** O		12	16	**E** O		14	12	**E** O	
	11	16	**E** O		9	16	**E** O		9	16	**E** O		9	16	**E** O		12	12	**E** O	
	12	16	**E** O		10	16	**E** O		10	16	**E** O		10	16	**E** O		14	12	**E** O	
	8	12	**E** O		7,1	12	**E** O		7,1	12	**E** O		7,1	12	**E** O		9	10	**E** O	
	9	12	**E** O		8	12	**E** O		8	12	**E** O		8	12	**E** O		10	10	**E** O	
	40	12	**E** O	M	32	12	**E** O	M	32	12	**E** O	M	32	12	**E** O	M	36	12	**E** O	M
	40	12	**E** O	M	32	12	**E** O	M	32	12	**E** O	M	32	12	**E** O	M	36	12	**E** O	M
	25	12	**E** O	M	20	12	**E** O	M	20	12	**E** O	M	20	12	**E** O	M	22	12	**E** O	M
	18	10	**E** O	M	14	10	**E** O	M	14	10	**E** O	M	14	10	**E** O	M	16	10	**E** O	M
	32	12		**M** L	25	12		**M** L	25	12		**M** L	25	12		**M** L				
	25	5	**E** O		22	5	**E** O		22	5	**E** O		22	5	**E** O		28	5	**E** O	
	22	10	**E** O		18	10	**E** O		18	10	**E** O		18	10	**E** O		22	10	**E** O	
	32	12	**E** O		28	12	**E** O		28	12	**E** O		28	12	**E** O		32	12	**E** O	
																	5	5	**E** O	
	2	3	**O** E		1,4	3	**O** E		1,4	3	**O** E		1,4	3	**O** E		1,8	2	**O** E	
	3,2	2	**O** E		2,8	2	**O** E		2,8	2	**O** E		2,8	2	**O** E		3,6	2	**O** E	
	1,6	3	**E** O		1,1	3	**E** O		1,1	3	**E** O		1,1	3	**E** O		1,8	3	**E** O	
																	2,8	4	**E** O	
																	1,4	3	**E** O	
																	1,2	3	**O** E	
	16	12	**E** O		14	12	**E** O		14	12	**E** O		14	12	**E** O		16	12	**E** O	
	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.

VRR: Feed rate charts for HSS drilling and reaming tools

	Feed f [mm] for diameter [mm]													
VRR	**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

	Feed f [mm] for diameter [mm]													
VRR	**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

WALTER TITEX

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

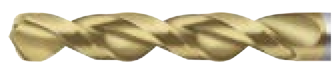
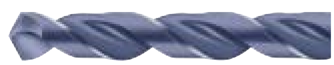
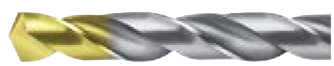
	Steam treatment of HSS tools	Nitriding of HSS tools
Implementation	Dry steam atmosphere, 520 °C to 580 °C	Treatment in media emitting nitrogen, 520 °C to 570 °C
Effect	Adherent oxide layer consisting of Fe_3O_4 approx. 0.003 to 0.010 mm deep	Enrichment of surface with nitrogen and partially with carbon
Properties	– Reduced tendency to cause galling – Increased surface hardness and therefore improved wear resistance – Increased corrosion resistance – Improved sliding properties thanks to better lubricant adhesion as a result of FeO crystals – Reduction in grinding stress	– Reduced tendency to cause galling and built-up edges – Increased hardness and therefore greater wear resistance

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	A42..			A44..			A46..			A47..		
D_c [mm] above – to	DIN 345		MK**	DIN 341		MK**	DIN 1870 series 1		MK**	DIN 1870 series 2		MK**
	l_1	L_c		l_1	L_c		l_1	L_c		l_1	L_c	
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

WALTER TITEX

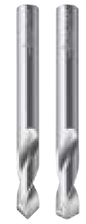
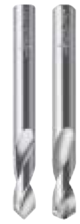
Cutting data for solid carbide and HSS NC centre drills

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = 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
		

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	v_c	VRR			v_c	VRR		
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1					32	8	**E O**	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2					32	9	**E O**	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3					30	9	**E O**	
		C > 0,55 %	Annealed	190	640	P4					32	9	**E O**	
		C > 0,55 %	Heat-treated	300	1010	P5					21	8	**E O**	
		Free-machining steel (short-chipping)	Annealed	220	750	P6					32	9	**E O**	
	Low-alloy steel	Annealed		175	590	P7					32	9	**E O**	
		Heat-treated		285	960	P8					21	8	**E O**	
		Heat-treated		380	1280	P9					11	7	**O E**	
		Heat-treated		430	1480	P10					8	6	**O E**	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11					21	8	**E O**	
		Hardened and tempered		300	1010	P12					15	7	**E O**	
		Hardened and tempered		380	1280	P13					8	6	**O E**	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14					9	4	**E O**	
		Martensitic, heat-treated		330	1110	P15					8	4	**E O**	
M	Stainless steel	Austenitic, quench hardened		200	680	M1					6	3	**O E**	
		Austenitic, precipitation hardened (PH)		300	1010	M2					8	5	**O E**	
		Austenitic/ferritic, duplex		230	780	M3					5	3	**O E**	
K	Malleable cast iron	Ferritic		200	400	K1	45	8	**E O**		24	12	**E O**	
		Pearlitic		260	700	K2	34	6	**E O**		18	12	**E O**	
	Grey cast iron	Low strength		180	200	K3	56	8	**E O**		30	12	**E O**	
		High strength/austenitic		245	350	K4	45	8	**E O**		24	12	**E O**	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	45	8	**E O**		24	12	**E O**	
		Pearlitic		265	700	K6	34	6	**E O**		18	12	**E O**	
	CGI			230	400	K7	40	7	**E O**		21	12	**E O**	
N	Wrought aluminium alloys	Not hardenable		30	–	N1	220	10	**E O**	**M**	63	16	**E O**	
		Hardenable, hardened		100	340	N2	220	10	**E O**	**M**	63	16	**E O**	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	170	10	**E O**	**M**	42	12	**E O**	
		≤ 12% Si, hardenable, hardened		90	310	N4	150	10	**E O**	**M**	30	12	**E O**	
		> 12% Si, not hardenable		130	450	N5	100	9	**E O**					
	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	**E O**		48	6	**E O**	
		Brass, bronze, red brass		90	310	N8	100	9	**E O**		38	12	**E O**	
		Copper alloys, short-chipping		110	380	N9	110	12	**E O**	**M L**	67	12	**E O**	**M L**
		High tensile, Ampco		300	1010	N10	50	6	**E O**	**M L**	15	7	**E O**	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1					6	3	**O E**	
			Hardened	280	940	S2	7	3	**O E**					
		Ni- or Co-based	Annealed	250	840	S3					6	3	**O E**	
			Hardened	350	1180	S4	7	3	**O E**					
			Cast	320	1080	S5	7	3	**O E**					
	Titanium alloys	Pure titanium		200	680	S6	25	3	**O E**		10	4	**E O**	
		α and β alloys, hardened		375	1260	S7	17	2	**O E**		6	4	**O E**	
		β alloys		410	1400	S8								
	Tungsten alloys			300	1010	S9					15	7	**E O**	
	Molybdenum alloys			300	1010	S10					15	7	**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	Hardened and tempered		55 HRC	–	H4								
O	Thermoplastics	Without abrasive fillers				O1	40	12	**E O**		40	12	**E O**	
	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

	Feed f [mm] for diameter [mm]												
VRR	**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

	Feed f [mm] for diameter [mm]												
VRR	**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

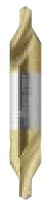
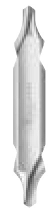
= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = 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.


Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	K1161XPL v_c	K1161XPL VRR	K1161XPL wet	K1161XPL dry	K1161 v_c	K1161 VRR	K1161 wet	K1161 dry
						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			
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	72	6	E O	M L	48	6	E O	M L
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	68	6	E O	M L	45	6	E O	M L
P	Non-alloyed steel	C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	63	6	E O	M L	42	6	E O	M L
P	Non-alloyed steel	C > 0,55 %	Annealed	190	640	P4	68	6	E O	M L	45	6	E O	M L
P	Non-alloyed steel	C > 0,55 %	Heat-treated	300	1010	P5	48	5	E O	M L	32	5	E O	M L
P	Non-alloyed steel	Free-machining steel (short-chipping)	Annealed	220	750	P6	72	6	E O	M L	48	6	E O	M L
P	Low-alloy steel	Annealed		175	590	P7	68	6	E O	M L	45	6	E O	M L
P	Low-alloy steel	Heat-treated		285	960	P8	48	5	E O	M L	32	5	E O	M L
P	Low-alloy steel	Heat-treated		380	1280	P9	32	3	O E		21	3	O E	
P	Low-alloy steel	Heat-treated		430	1480	P10	24	2	O E		16	2	O E	
P	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	42	4	E O		28	4	E O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		300	1010	P12	38	4	E O		25	4	E O	
P	High-alloy steel and high-alloy tool steel	Hardened and tempered		380	1280	P13	24	2	O E		16	2	O E	
P	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	42	4	E O		28	4	E O	
P	Stainless steel	Martensitic, heat-treated		330	1110	P15	32	3	E O		21	3	E O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1								
M	Stainless steel	Austenitic, precipitation hardened (PH)		300	1010	M2	21	3	E O		21	3	E O	
M	Stainless steel	Austenitic/ferritic, duplex		230	780	M3								
K	Malleable cast iron	Ferritic		200	400	K1	72	8	E O	M L	40	8	E O	M L
K	Malleable cast iron	Pearlitic		260	700	K2	58	7	E O	M L	32	7	E O	M L
K	Grey cast iron	Low strength		180	200	K3	86	8	E O	M L	48	8	E O	M L
K	Grey cast iron	High strength/austenitic		245	350	K4	72	8	E O	M L	40	8	E O	M L
K	Cast iron with spheroidal graphite	Ferritic		155	400	K5	72	8	E O	M L	40	8	E O	M L
K	Cast iron with spheroidal graphite	Pearlitic		265	700	K6	58	7	E O	M L	32	7	E O	M L
K	CGI			230	400	K7	65	8	E O	M L	36	8	E O	M L
N	Wrought aluminium alloys	Not hardenable		30	–	N1	130	5	E O		130	5	E O	
N	Wrought aluminium alloys	Hardenable, hardened		100	340	N2	130	5	E O		130	5	E O	
N	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	105	7	E O		105	7	E O	
N	Cast aluminium alloys	≤ 12% Si, hardenable, hardened		90	310	N4	90	7	E O		90	7	E O	
N	Cast aluminium alloys	> 12% Si, not hardenable		130	450	N5	71	7	E O		71	7	E O	
N	Magnesium-based alloys			70	250	N6	90	7		M L	90	7		M L
N	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	90	3	E O	M	90	3	E O	M
N	Copper and copper alloys (bronze/brass)	Brass, bronze, red brass		90	310	N8	75	6	E O		75	6	E O	
N	Copper and copper alloys (bronze/brass)	Copper alloys, short-chipping		110	380	N9	80	8	E O	M L	80	8	E O	M L
N	Copper and copper alloys (bronze/brass)	High tensile, Ampco		300	1010	N10	48	5	E O		32	5	E O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	33	2	O E		22	2	O E	
S	Heat-resistant alloys	Fe-based	Hardened	280	940	S2	15	2	O E		15	2	O E	
S	Heat-resistant alloys	Ni- or Co-based	Annealed	250	840	S3	27	2	O E		18	2	O E	
S	Heat-resistant alloys	Ni- or Co-based	Hardened	350	1180	S4	10	1	O E		10	1	O E	
S	Heat-resistant alloys	Ni- or Co-based	Cast	320	1080	S5	12	1	O E		12	1	O E	
S	Titanium alloys	Pure titanium		200	680	S6								
S	Titanium alloys	α and β alloys, hardened		375	1260	S7								
S	Titanium alloys	β alloys		410	1400	S8								
S	Tungsten alloys			300	1010	S9	48	5	E O		32	5	E O	
S	Molybdenum alloys			300	1010	S10	48	5	E O		32	5	E O	
H	Hardened steel	Hardened and tempered		50 HRC	–	H1	19	2	O E		12,5	2	O E	
H	Hardened steel	Hardened and tempered		55 HRC	–	H2								
H	Hardened steel	Hardened and tempered		60 HRC	–	H3								
H	Hardened cast iron	Hardened and tempered		55 HRC	–	H4								
O	Thermoplastics	Without abrasive fillers				O1	45	7	E O		45	7	E O	
O	Thermosetting plastics	Without abrasive fillers				O2	45	7	E O		45	7	E O	
O	Plastic, glass-fibre reinforced	GFRP				O3	35	6		L	35	6		L
O	Plastic, carbon-fibre reinforced	CFRP				O4	25	5		L	25	5		L
O	Plastic, aramid-fibre reinforced	AFRP				O5	45	7		L	45	7		L
O	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				HSS			
TiN				Uncoated				Uncoated				Uncoated				TiN				Uncoated				Uncoated				Uncoated			
																															
v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
38	8	E O		30	7	E O		30	7	E O		30	7	E O		38	8	E O		30	7	E O		30	7	E O		30	7	E O	
38	9	E O		30	8	E O		30	8	E O		30	8	E O		38	9	E O		30	8	E O		30	8	E O		30	8	E O	
36	9	E O		28	8	E O		28	8	E O		28	8	E O		36	9	E O		28	8	E O		28	8	E O		28	8	E O	
38	9	E O		30	8	E O		30	8	E O		30	8	E O		38	9	E O		30	8	E O		30	8	E O		30	8	E O	
28	8	E O		20	7	E O		20	7	E O		20	7	E O		28	8	E O		20	7	E O		20	7	E O		20	7	E O	
38	9	E O		30	8	E O		30	8	E O		30	8	E O		38	9	E O		30	8	E O		30	8	E O		30	8	E O	
38	9	E O		30	8	E O		30	8	E O		30	8	E O		38	9	E O		30	8	E O		30	8	E O		30	8	E O	
28	8	E O		20	7	E O		20	7	E O		20	7	E O		28	8	E O		20	7	E O		20	7	E O		20	7	E O	
13	6	E O		11	6	O E		11	6	O E		11	6	O E		13	6	E O		11	6	O E		11	6	O E		11	6	O E	
				7	5	O E		7	5	O E		7	5	O E						7	5	O E		7	5	O E		7	5	O E	
9	4	E O		8	4	E O		8	4	E O		8	4	E O		9	4	E O		8	4	E O		8	4	E O		8	4	E O	
21	6	E O		14	6	E O		14	6	E O		14	6	E O		21	6	E O		14	6	E O		14	6	E O		14	6	E O	
				7	5	O E		7	5	O E		7	5	O E						7	5	O E		7	5	O E		7	5	O E	
9	4	E O		8	4	E O		8	4	E O		8	4	E O		9	4	E O		8	4	E O		8	4	E O		8	4	E O	
				7	4	E O		7	4	E O		7	4	E O						7	4	E O		7	4	E O		7	4	E O	
7	4	O E		6	3	O E		6	3	O E		6	3	O E		7	4	O E		6	3	O E		6	3	O E		6	3	O E	
13	5	O E		8	5	O E		8	5	O E		8	5	O E		13	5	O E		8	5	O E		8	5	O E		8	5	O E	
6	4	O E		5	3	O E		5	3	O E		5	3	O E		6	4	O E		5	3	O E		5	3	O E		5	3	O E	
34	12	E O		22	12	E O		22	12	E O		22	12	E O		34	12	E O		22	12	E O		22	12	E O		22	12	E O	
26	10	E O		17	10	E O		17	10	E O		17	10	E O		26	10	E O		17	10	E O		17	10	E O		17	10	E O	
42	12	E O		28	12	E O		28	12	E O		28	12	E O		42	12	E O		28	12	E O		28	12	E O		28	12	E O	
34	12	E O		22	12	E O		22	12	E O		22	12	E O		34	12	E O		22	12	E O		22	12	E O		22	12	E O	
34	12	E O		22	12	E O		22	12	E O		22	12	E O		34	12	E O		22	12	E O		22	12	E O		22	12	E O	
26	10	E O		17	10	E O		17	10	E O		17	10	E O		26	10	E O		17	10	E O		17	10	E O		17	10	E O	
30	12	E O		20	12	E O		20	12	E O		20	12	E O		30	12	E O		20	12	E O		20	12	E O		20	12	E O	
79	12	E O		63	12	E O		63	12	E O		63	12	E O		79	12	E O		63	12	E O		63	12	E O		63	12	E O	
79	12	E O		63	12	E O		63	12	E O		63	12	E O		79	12	E O		63	12	E O		63	12	E O		63	12	E O	
50	12	E O		40	12	E O		40	12	E O		40	12	E O		50	12	E O		40	12	E O		40	12	E O		40	12	E O	
35	10	E O		28	10	E O		28	10	E O		28	10	E O		35	10	E O		28	10	E O		28	10	E O		28	10	E O	
35	10		M L	28	10		M L	28	10		M L	28	10		M L	35	10		M L	28	10		M L	28	10		M L	28	10		M L
56	5	E O		45	5	E O		45	5	E O		45	5	E O		56	5	E O		45	5	E O		45	5	E O		45	5	E O	
				36	10	E O		36	10	E O		36	10	E O						36	10	E O		36	10	E O		36	10	E O	
71	12	E O	M L	63	12	E O	M L	63	12	E O	M L	63	12	E O	M L	71	12	E O	M L	63	12	E O	M L	63	12	E O	M L	63	12	E O	M L
21	6	E O		14	6	E O		14	6	E O		14	6	E O		21	6	E O		14	6	E O		14	6	E O		14	6	E O	
7	4	O E		6	3	O E		6	3	O E		6	3	O E		7	4	O E		6	3	O E		6	3	O E		6	3	O E	
4	3	O E		4	3	O E		[6	[3	O E		4	3	O E		4	3	O E		4	3	O E		4	3	O E		4	3	O E	
				6	3	O E		6	3	O E		6	3	O E						6	3	O E		6	3	O E		6	3	O E	
8	4	E O		8	4	E O		8	4	E O		8	4	E O		8	4	E O		8	4	E O		8	4	E O		8	4	E O	
6	4	O E		6	4	O E		6	4	O E		6	4	O E		6	4	O E		6	4	O E		6	4	O E		6	4	O E	
21	6	E O		14	6	E O		14	6	E O		14	6	E O		21	6	E O		14	6	E O		14	6	E O		14	6	E O	
21	6	E O		14	6	E O		14	6	E O		14	6	E O		21	6	E O		14	6	E O		14	6	E O		14	6	E O	
				38	12	E O		38	12	E O		38	12	E O						38	12	E O		38	12	E O		38	12	E O	
34	8		L	22	7		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	22	7		L	34	8		L	22	7		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

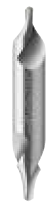
(continued)

= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = 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			K1313				K1311			
				Form			R				A			
				Dia. range [mm]			1,00–4,00				0,63–6,00			
				Cutting tool material			HSS				HSS			
				Coating			Uncoated				Uncoated			
														
Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	v_c	VRR	Wet	Dry	v_c	VRR	Wet	Dry
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	30	7	E O		30	7	E O	
		C > 0,25… ≤ 0,55 %	Annealed	190	640	P2	30	8	E O		30	8	E O	
		C > 0,25… ≤ 0,55 %	Heat-treated	210	710	P3	28	8	E O		28	8	E O	
		C > 0,55 %	Annealed	190	640	P4	30	8	E O		30	8	E O	
		C > 0,55 %	Heat-treated	300	1010	P5	20	7	E O		20	7	E O	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	30	8	E O		30	8	E O	
	Low-alloy steel	Annealed		175	590	P7	30	8	E O		30	8	E O	
		Heat-treated		285	960	P8	20	7	E O		20	7	E O	
		Heat-treated		380	1280	P9	11	6	O E		11	6	O E	
		Heat-treated		430	1480	P10	7	5	O E		7	5	O E	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	8	4	E O		8	4	E O	
		Hardened and tempered		300	1010	P12	14	6	E O		14	6	E O	
		Hardened and tempered		380	1280	P13	7	5	O E		7	5	O E	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	8	4	E O		8	4	E O	
		Martensitic, heat-treated		330	1110	P15	7	4	E O		7	4	E O	
M	Stainless steel	Austenitic, quench hardened		200	680	M1	6	3	O E		6	3	O E	
		Austenitic, precipitation hardened (PH)		300	1010	M2	8	5	O E		8	5	O E	
		Austenitic/ferritic, duplex		230	780	M3	4,8	3	O E		4,8	3	O E	
K	Malleable cast iron	Ferritic		200	400	K1	22	12	E O		22	12	E O	
		Pearlitic		260	700	K2	17	10	E O		17	10	E O	
	Grey cast iron	Low strength		180	200	K3	28	12	E O		28	12	E O	
		High strength/austenitic		245	350	K4	22	12	E O		22	12	E O	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	22	12	E O		22	12	E O	
		Pearlitic		265	700	K6	17	10	E O		17	10	E O	
	CGI			230	400	K7	20	12	E O		20	12	E O	
N	Wrought aluminium alloys	Not hardenable		30	–	N1	63	12	E O		63	12	E O	
		Hardenable, hardened		100	340	N2	63	12	E O		63	12	E O	
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	40	12	E O		40	12	E O	
		≤ 12% Si, hardenable, hardened		90	310	N4	28	10	E O		28	10	E O	
		> 12% Si, not hardenable		130	450	N5								
	Magnesium-based alloys			70	250	N6	28	10		M L	28	10		M L
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	45	5	E O		45	5	E O	
		Brass, bronze, red brass		90	310	N8	36	10	E O		36	10	E O	
		Copper alloys, short-chipping		110	380	N9	63	12	E O	M L	63	12	E O	M L
		High tensile, Ampco		300	1010	N10	14	6	E O		14	6	E O	
S	Heat-resistant alloys	Fe-based	Annealed	200	680	S1	6	3	O E		6	3	O E	
			Hardened	280	940	S2	4	3	O E		4	3	O E	
		Ni- or Co-based	Annealed	250	840	S3	6	3	O E		6	3	O E	
			Hardened	350	1180	S4								
			Cast	320	1080	S5								
	Titanium alloys	Pure titanium		200	680	S6	8	4	E O		8	4	E O	
		α and β alloys, hardened		375	1260	S7	6	4	O E		6	4	O E	
		β alloys		410	1400	S8								
	Tungsten alloys			300	1010	S9	14	6	E O		14	6	E O	
	Molybdenum alloys			300	1010	S10	14	6	E O		14	6	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	Hardened and tempered		55 HRC	–	H4								
O	Thermoplastics	Without abrasive fillers				O1	38	12	E O		38	12	E O	
	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								

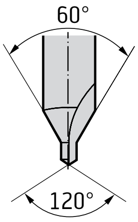
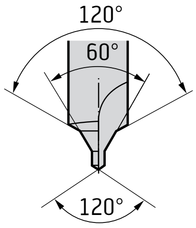
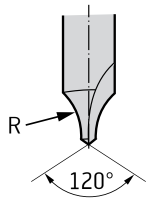
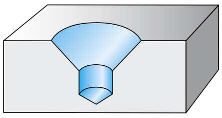
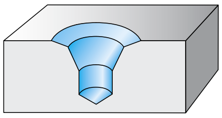
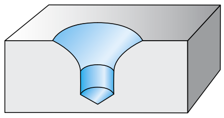
Walter												ANSI B 94.11 M-1979				B.S. 328			
K1411S				K1411M				K1411L				K1811				K1911			
A				A				A				A				A			
0,75–5,00				0,75–4,00				2,00–4,00				0,64–7,97				1,19–7,94			
HSS				HSS				HSS				HSS				HSS			
Uncoated				Uncoated				Uncoated				Uncoated				Uncoated			
														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

	Feed f [mm] for diameter [mm]													
VRR	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:

D	C	1	80	–	05	–	03.000	A	1	–	W	J	30	EZ
1	2	3	4	5	6		7	8	9		Grade			

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

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

Grade designation key for solid carbide and HSS cutting tool materials

Example:

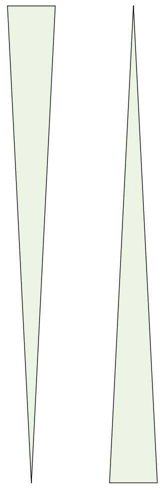
W	J	30	EY
Walter	1	2	3

1	
Substrate	
Solid carbide	J
HSS	Z

2
Application range

Wear resistance

5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95



Toughness

3	
Coating	
EJ	TiAlN (AlCrN)
RE	TiAlN
TA	TiAlN
EL	AlCrN
ER	AlCrN tip coating
UU	Uncoated
ET	TiSiAlCrN/AlTiN
EU	TiSiAlCrN/AlTiN tip coating
AJ	TiN tip coating
RZ	TiAlSiN (HiPIMS)
RY	TiAlSiN (HiPIMS) tip coating
EZ	**Krato·tec™** AlTiN
EY	**Krato·tec™** AlTiN tip coating

Designation key
for square indexable inserts for drilling from solid

Example:

P484	0	C	–	2	R	–	E77
1	2	3		4	5		6

1	
Walter indexable insert designation	
P284	For D3120
P484	For D4120, D4170 and B421 .

2	
Version	
0	Fully ground circumference
1	Fully sintered circumference

3	
Position	
C	Centre insert
P	Outer insert
S	Centre insert and outer insert identical

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

5	
Cutting direction	
R	RH-cutting
N	Neutral

6	
Walter geometry	
A57	The stable one
E57	The universal one
E67	The positive one
E77	The sharp one

Designation key
for exchangeable inserts for drilling from solid

Example:

P600	6	–	D 37.99	R	WPP25
1	2		3	4	5

1		
Walter exchangeable insert designation		
P600x	for	D4140 / D4240 / B401 . .

2	
Walter geometry	
1	For ISO P
3	For ISO M, ISO S
4	For ISO N
5	For ISO K
6	For ISO P

3	
Insert diameter	
D	In mm

4	
Cutting direction	
R	RH-cutting

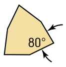
5
Coating

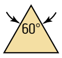
Designation key in accordance with ISO 1832 for indexable inserts for drilling from solid

Example:

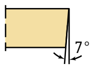
L	C	G	X	06	T2	04	–	E77
1	2	3	4	5	6	7		8

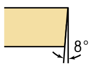
1 Insert shape

L 
W 

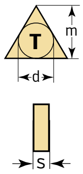
T 

2 Clearance angle

C 

O 

3 Tolerances

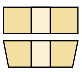
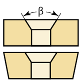


Permissible deviation in mm for

	d	m	s
E	± 0,025	± 0,025	± 0,025
M	± 0,05–0,152	± 0,08–0,202	± 0,130

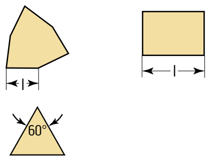
[1] Inserts with ground planar cutting edges
[2] Depending on the insert size (see ISO standard 1832)

4 Machining and fastening features

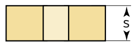
A 
B 

X Drawing or precise description of the indexable insert is required

5 Cutting edge length

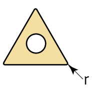


6 Insert thickness



02	s = 2,38
T2	s = 2,78
03	s = 3,18
T3	s = 3,97
04	s = 4,76
05	s = 5,56
06	s = 6,35

7 Corner radius



02	r = 0,2 mm
04	r = 0,4 mm
08	r = 0,8 mm

8 Walter geometry

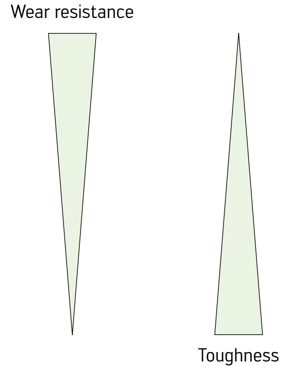
A57	The stable one
E57	The universal one
E67	The positive one
E77	The sharp one

Designation key
for cutting material grades for indexable inserts for drilling from solid

Example:

W	N	N	15	
Walter	1	2	3	4

1	2	3	4
1. Primary application or coating type	**2. Primary application**	**ISO application range**	**Generation**
P Steel	**P** Steel	01	**C** Color Select
M Stainless steel	**M** Stainless steel	10	**G** Tiger·tec® Gold
K Cast iron	**K** Cast iron	15	**S** Tiger·tec® Silver
N NF metals	**N** NF metals	20	
S Materials with difficult cutting properties	**S** Materials with difficult cutting properties	25	
H Hard materials	**H** Hard materials	30	
A CVD aluminium coating		35	
X PVD coating		45	

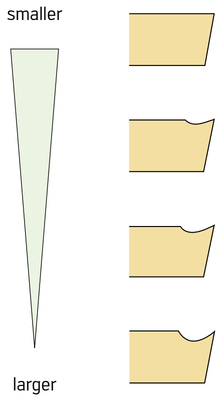


Geometry designation key
for indexable inserts for drilling from solid

Example:

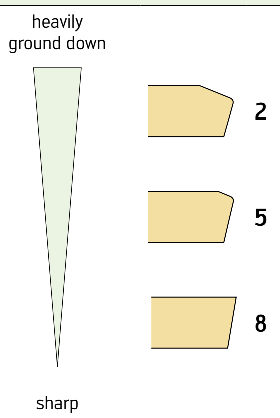
E	7	7
1	2	3

1 – Chip breaker groove

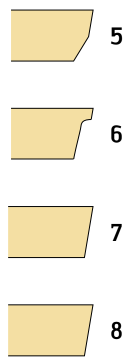


A = 0°
B = 6°
D = 10°
E = 15°
F = 16°
G = 20°
K = 25°

2 – Cutting edge



3 – Flank face design



Designation key
for Walter drilling tools with indexable inserts

Example:

D	3	1	20	–	03	–	58.00	F40	–	P27
1	2	3	4	5	6		7	8		9

1	
Tool group	
D	Drilling

2
Generation

3	
Tool type	
1	Cylindrical drill
2	Chamfer drill
5	Chamfering tool

4	
Tool type	
20	Indexable insert drill with square indexable insert
40	Exchangeable insert drill with P600x indexable insert
70	Indexable insert drill with cartridges
80	Compact chamfering tool

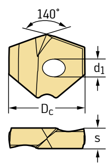
5	
1. Delimiters	
–	Metric
.	Inches

6	
Drilling depth/ chamfer angle	
01	$1{,}3 \times D_c$
02	$2 \times D_c$ / $2{,}5 \times D_c$
03	$3 \times D_c$
04	$4 \times D_c$
05	$5 \times D_c$
07	$7 \times D_c$
10	$10 \times D_c$
45	45° chamfer angle

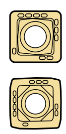
7
Cutting diameter/ clamping diameter Chamfering tool

8	
Shank type and size, parallel	
F16	16 mm
F20	20 mm
F25	25 mm
F32	32 mm
F40	40 mm
A12	12 mm
A16	16 mm
A20	20 mm
A25	25 mm
A13	0.500 inches
A15	0.625 inches
A19	0.750 inches
A26	1.000 inch

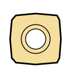
9 – Insert size/interface size



Seat size	d_1 [mm]	s [mm]
A	3,0	3,6
B	3,0	4,0
C	4,0	4,5
D	4,0	5,0
E	5,0	5,5
F	5,0	6,0
G	5,0	6,5
H	6,0	7,1
J	6,0	7,7
K	6,0	8,0
M	6,0	8,3
N	6,0	8,6
P	6,0	8,9



P41	P484	Size 1
.	.	.
.	.	.
.	.	.
P48	P484	Size 8



P21	P284	Size 1
.	.	.
.	.	.
.	.	.
P27	P284	Size 7

Calculation formulae for boring and precision boring

Speed

$$n = \frac{v_c \times 1\,000}{D_c \times \pi} \qquad [\text{min}^{-1}]$$

Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{1\,000} \qquad [\text{m/min}]$$

Feed per revolution

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

Feed rate

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

Metal removal rate (drilling from solid)

$$Q = \frac{v_f \times \pi \times \left(D_c^2 - D_p^2\right)}{4 \times 1\,000} \qquad [\text{cm}^3/\text{min}]$$

Power requirement

$$P_c = \frac{Q \times k_c}{6\,000} \qquad [\text{kW}]$$

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

Torque

$$M_c = \frac{P_c \times 9\,500}{\eta} \qquad [\text{Nm}]$$

Feed force

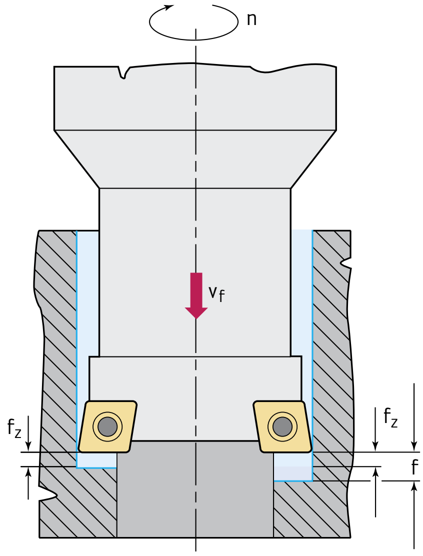
$$F_f = 0{,}63 \times \frac{f \times (D_c - D_p) \times k_c}{2} \qquad [\text{N}]$$

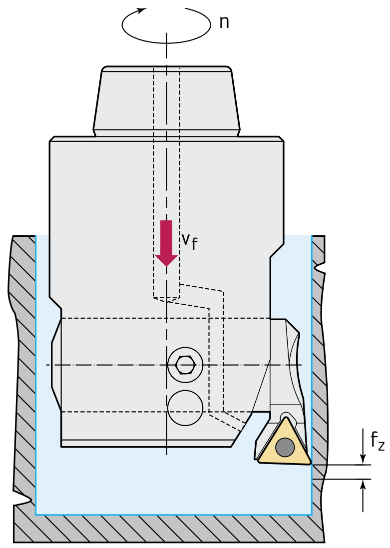
Specific cutting force

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

Chip thickness

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





n	Speed	rpm
D_c	Cutting diameter	mm
D_p	Start hole	mm
z	Number of teeth	
v_c	Cutting speed	m/min
v_f	Feed rate	mm/min
f_z	Feed per tooth	mm
f	Feed per revolution	mm
A	Chip cross section	mm^2
Q	Metal removal rate	cm^3/min
P_{mot}	Drive power	kW
P_c	Effective power	kW
M_c	Torque	Nm
F_f	Feed force	N
h	Chip thickness	mm
k_c	Specific cutting force	N/mm^2
η	Machine efficiency (0.7–0.95)	
κ	Lead angle	°
$k_{c1.1}$*	Specific cutting force for 1 mm^2 chip cross section with h = 1 mm	N/mm^2
m_c*	Increase in the k_c curve	

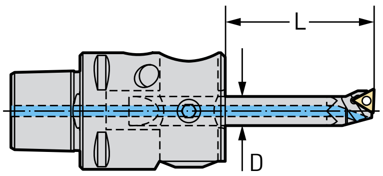
* For m_c and $k_{c1.1}$: see the "General" section of the Technical Compendium, page F7.

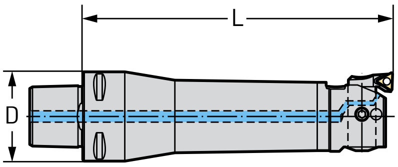
Determining the feed – Precision boring

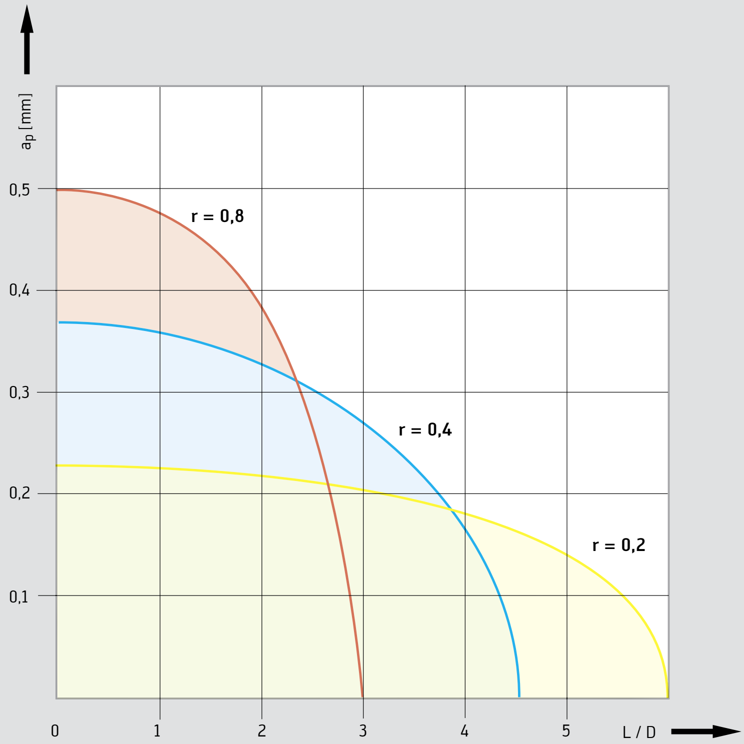
Selecting the corner radius

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).







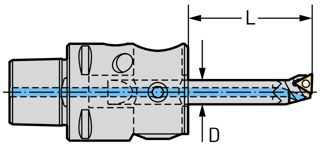
Determining the feed

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 [µm] Max. feed f [mm/rev]									
	0,03		0,06		0,09		0,12		0,15	
r [mm]	R_{max}	R_a	R_{max}	R_a	R_{max}	R_a	R_{max}	R_a	R_{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)

(wet machining symbol) = Cutting data for wet machining
(dry machining symbol) = Dry machining is possible



Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	Wet	Dry	Cutting material grade: HC WKP01G – Starting values for cutting speed v_c [m/min], L/D $3 \times D_c$	$4 \times D_c$	$5 \times D_c$
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
		Hardened and tempered		400	1361	P13	●●		210	130	50
	Stainless steel	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	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.

[1] 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_c [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		
$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$
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

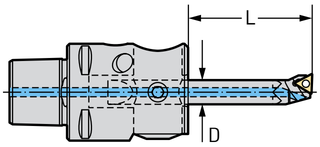
The specified cutting data represents average standard values.
For specific applications, adjustment is recommended.

Cutting data for precision boring (boring bars)

(continued)

= Cutting data for wet machining

= Dry machining is possible



Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	Wet	Dry	Cutting material grade / Starting values for cutting speed v_c [m/min] / HW / WN10 / L/D: 3 × D_c	4 × D_c	6 × 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.

[1] 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_c [m/min]														
HC						HE			BH			DP	
WKK10S			WKK20S			WEP10			WCB50 / WCB80			WCD10	WDN10
L/D			L/D			f [mm/rev]			L/D				
$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$5 \times D_c$		
320	290	180	300	270	160	288	261	162					
300	240	150	280	220	130	270	216	135					
270	220	140	250	200	120	243	198	126					
260	210	130	240	190	110	234	189	117					
230	190	120	210	170	100	207	171	108					
270	220	140	250	200	120	243	198	126					
300	240	150	280	220	130	270	216	135					
250	200	130	230	180	110	225	180	117					
220	180	110	200	160	90	198	162	99					
190	150	80	170	130	60	171	135	72					
250	190	130	230	170	110	225	171	117					
210	180	110	190	160	90	189	162	99					
200	160	90	180	140	70	180	144	81					
250	200	130	230	180	110	225	180	117					
190	170	90	170	150	70	171	153	90					
240	190		220	170		207	162	108					
190	140		160	120		153	117	99					
220	170		180	140		171	135	81					
300	250	140	280	230	120	225	189	108	600*	420			
240	200	120	220	180	100	180	153	99	700*	360			
320	270	160	300	250	140	243	207	126	2000*	1080			
240	200	120	220	180	100	180	153	99	900*	480			
290	240	150	270	220	130	225	180	117	800*	420			
270	210	130	250	190	110	207	162	108	700*	360			
250	190	110	230	170	90								
												1800*	1800*
												1800*	1800*
												900*	900*
												700*	700*
												600*	600*
												700*	700*
250	200											600*	600*
300	240											700*	700*
90	70	50	80	60	40								
80	60	45	70	50	35								
80	60	45	70	50	35								
60	50	35	50	40	25								
60	50	35	50	40	25								
									300	250			
									200	150			
									100	60			
									250	200			

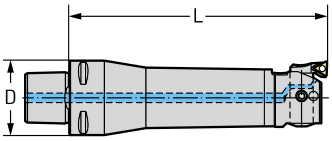
HC = Coated carbide
HE = Coated cermet
HW = Uncoated carbide
BH = CBN with high CBN content
DP = Polycrystalline diamond

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

Cutting data for precision boring (cartridges)

[wet machining symbol] = Cutting data for wet machining

[dry machining symbol] = Dry machining is possible



Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	Wet	Dry	Cutting material grade / Starting values for cutting speed v_c [m/min] / HC / WKP01G / 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	●●		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
		Hardened and tempered		400	1361	P13	●●		210	170	90
	Stainless steel	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	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.

[1] 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_c [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			L/D		
$3 \times D_c$	$4 \times D_c$	$5 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$	$3 \times D_c$	$4 \times D_c$	$6 \times D_c$
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	60				170	130	110	150	110	90
180	140	100	180	140	90	170	130	80	220	170					180	140	80				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

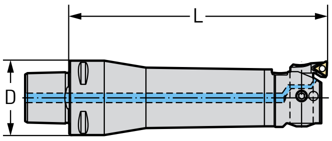
The specified cutting data represents average standard values.
For specific applications, adjustment is recommended.

Cutting data for precision boring (cartridges)

(continued)

= Cutting data for wet machining

= Dry machining is possible



Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]			Cutting material grade Starting values for cutting speed v_c [m/min] HW WN10 L/D 3 × D_c	4 × D_c	6 × 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.

[1] 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_c [m/min]															
HC						HE			BH			DP			
WKK10S			WKK20S			WEP10			WCB50 / WCB80			WCD10			WDN10
L/D			L/D			f [mm/rev]			L/D			L/D			
3 × D_c	4 × D_c	6 × D_c	3 × D_c	4 × D_c	6 × D_c	3 × D_c	4 × D_c	6 × D_c	3 × D_c	4 × D_c	6 × D_c	3 × D_c	4 × D_c	6 × D_c	
320	290	180	300	270	160	288	261	162							
300	240	150	280	220	130	270	216	135							
270	220	140	250	200	120	243	198	126							
260	210	130	240	190	110	234	189	117							
230	190	120	210	170	100	207	171	108							
270	220	140	250	200	120	243	198	126							
300	240	150	280	220	130	270	216	135							
250	200	130	230	180	110	225	180	117							
220	180	110	200	160	90	198	162	99							
190	150	80	170	130	60	171	135	72							
250	190	130	230	170	110	225	171	117							
210	180	110	190	160	90	189	162	99							
200	160	90	180	140	70	180	144	81							
250	200	130	230	180	110	225	180	117							
190	170	90	170	150	70	171	153	90							
240	190		220	170		207	162	108							
190	140		160	120		153	117	99							
220	170		180	140		171	135	81							
300	250	140	280	230	120	225	189	108	600*	700*					
240	200	120	220	180	100	180	153	99	700*	600*					
320	270	160	300	250	140	243	207	126	2000*	1800*					
240	200	120	220	180	100	180	153	99	900*	800*					
290	240	150	270	220	130	225	180	117	800*	700*					
270	210	130	250	190	110	207	162	108	700*	600*					
250	190	110	230	170	90										
												2000*	1800*	1600*	1800*
												2000*	1800*	1600*	1800*
												1000*	900*	800*	900*
												800*	700*	600*	700*
												700*	600*	500*	600*
												800*	700*	600*	700*
250	200											700*	600*	500*	600*
300	240											800*	700*	600*	700*
90	70	50	80	60	40										
80	60	45	70	50	35										
80	60	45	70	50	35										
60	50	35	50	40	25										
60	50	35	50	40	25										
									300	250					
									200	150					
									100	60					
									250	200					

HC = Coated carbide
HE = Coated cermet
HW = Uncoated carbide
BH = CBN with high CBN content
DP = Polycrystalline diamond

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

Cutting data for boring

= Cutting data for wet machining
= Dry machining is possible

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	Wet	Dry	–E47 / –MP4 / –MK4 / –MM4, D_c [mm] < 44	> 44–73	> 73	–RP4 / –RK4 / –RM4, D_c [mm] < 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.

[1] 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_c [m/min]																	
							HC																	
	−MN2			−PF4 / −PS5 / −FP4 / −FP6 / −FK6			WKP01G			WPP20G			WPP30G			WSM10S			WSM20S			WSM30S		
	D_c [mm]			D_c [mm]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]			f [mm/rev]		
	< 44	> 44–73	> 73	< 44	> 44–73	> 73	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)

= Cutting data for wet machining

= Dry machining is possible

Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group[1]	Wet	Dry	HC WPP10G f [mm/rev] 0,1	0,2	0,4	HC WPP20G f [mm/rev] 0,1	0,2	0,4
									Cutting material grade – Starting values for cutting speed v_c [m/min]					
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	428	P1	●●		310	290		290	270	250
		C > 0,25... ≤ 0,55 %	Annealed	190	639	P2	●●		290	270		270	250	230
		C > 0,25... ≤ 0,55 %	Heat-treated	210	708	P3	●●		270	250		250	230	210
		C > 0,55 %	Annealed	190	639	P4	●●		260	230		230	210	190
		C > 0,55 %	Heat-treated	300	1013	P5	●●		230	210		210	190	170
		Free-machining steel (short-chipping)	Annealed	220	745	P6	●●	●	270	250		250	230	210
	Low-alloy steel	Annealed		175	591	P7	●●		290	270		270	250	230
		Heat-treated		300	1013	P8	●●		250	230		230	210	190
		Heat-treated		380	1282	P9	●●		220	200		200	180	160
		Heat-treated		430	1477	P10	●●		190	170		170	130	110
	High-alloy steel and high-alloy tool steel	Annealed		200	675	P11	●●		230	210		230	210	
		Hardened and tempered		300	1013	P12	●●		190	170		190	170	
		Hardened and tempered		400	1361	P13	●●		190	170		170	130	110
	Stainless steel	Ferritic/martensitic, annealed		200	675	P14	●●					230	210	
		Martensitic, heat-treated		330	1114	P15	●●					180	160	
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	●●	●	230	210	170	210	190	150
		Pearlitic		260	867	K2	●●	●	180	160	150	170	160	140
	Grey cast iron	Low strength		180	602	K3	●●	●	250	230	190	230	210	170
		High strength/austenitic		245	825	K4	●●	●	180	160	150	170	160	140
	Cast iron with spheroidal graphite	Ferritic		155	518	K5	●●	●	210	190	170	190	170	150
		Pearlitic		265	885	K6	●●		190	170	150	170	150	140
	CGI			200	675	K7	●●	●	175	160	140			
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	●●		310	260	230	310	260	210
		Brass, bronze, red brass		90	314	N8	●●	●	360	310	260	340	310	260
		Copper alloys, short-chipping		110	382	N9	●●	●	410	370	310	360	340	310
		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.

[1] 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_c [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
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	

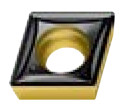
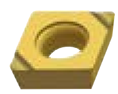
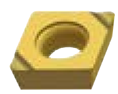
HC = Coated carbide
HW = Uncoated carbide

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

WALTER

Cutting tool material application charts – Boring and precision boring

Carbide

Walter grade designation	Standard designation	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Application range (01 05 10 15 20 25 30 35 40 45)	Coating process	Coating composition	Example of indexable insert
WPP10S	HC – P 10	●●								CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – K 20			●								
WPP20G	HC – P 20	●●								CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – K 30			●								
WPP30G	HC – P 30	●●								CVD	TiCN + Al_2O_3 (+ TiCN)	
WMP20S	HC – M 20		●●							CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – P 25	●●										
	HC – S 20					●						
WSM01	HC – M 01		●●							PVD	TiAlN (HiPIMS)	
	HC – S 01					●●						
	HC – P 10	●										
	HC – N 10				●							
	HC – H 20						●					
WSM10S	HC – M 10		●●							PVD	TiCN + Al_2O_3 (+ Al)	
	HC – S 10					●●						
	HC – P 10	●										
WSM20S	HC – M 20		●●							PVD	TiCN + Al_2O_3 (+ Al)	
	HC – S 20					●●						
	HC – P 20	●										
WSM30S	HC – M 30		●●							PVD	TiCN + Al_2O_3 (+ Al)	
	HC – S 30					●●						
	HC – P 30	●										
WKP01G	HC – P 01	●●								CVD	TiCN + Al_2O_3 (+ TiN)	
	HC – K 10			●								
WPP10	HC – P 10	●●								CVD	TiCN + Al_2O_3 (+ TiN)	
	HC – K 20			●								
WPP20	HC – P 20	●●								CVD	TiCN + Al_2O_3 (+ TiN)	
	HC – K 30			●								
WPP30	HC – P 30	●●								CVD	TiCN + Al_2O_3 (+ TiN)	
WXM15	HC – P 15	●●								PVD	TiAlN/TiN multi-layer	
	HC – M 15		●									
	HC – K 15			●								
WTP35	HC – P 35	●●								CVD	TiCN + TiN	
	HC – M 35		●									
	HC – S 35					●						

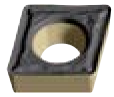
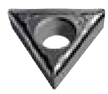
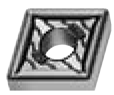
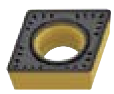
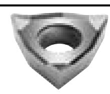
HC = Coated carbide

●● Primary application
● Additional application

Cutting tool material application charts – Boring and precision boring

(continued)

Carbide

Walter grade designation	Standard designation	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Application range 01 05 10 15 20 25 30 35 40 45	Coating process	Coating composition	Example of indexable insert
WSM10	HC – M 10		●●							PVD	TiAlN + Al_2O_3 (ZrCN)	
	HC – S 10					●●						
	HC – P 10	●										
WSM20	HC – M 20		●●							PVD	TiAlN + Al_2O_3 (ZrCN)	
	HC – S 20					●●						
	HC – P 20	●										
WSM30	HC – M 30		●●							PVD	TiAlN + Al_2O_3 (ZrCN)	
	HC – S 30					●●						
	HC – P 30	●										
WSM21	HC – M 20		●●							PVD	TiAlN	
	HC – S 20					●●						
	HC – P 20	●●										
WKK10S	HC – K 10			●●						CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – H 30						●					
WKK20S	HC – K 20			●●						CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – P 10	●										
WKP30S	HC – K 30			●●						CVD	TiCN + Al_2O_3 (+ TiCN)	
	HC – P 35	●●										
	HC – M 30		●									
WAK15	HC – K 10			●●						CVD	TiCN + Al_2O_3 (+ TiN)	
	HC – H 30						●					
	HC – K 15			●●						CVD	TiCN + Al_2O_3 (+ TiN)	
WNN10	HC – N 10				●●					—	TiCN[plus]	
	HC – P 01	●										
	HC – M 01		●									
WN10	HW – N 10				●●					—	—	
	HW – S 10					●						

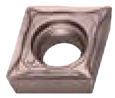
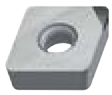
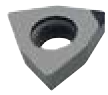
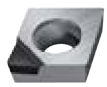
HC = Coated carbide
HW = Uncoated carbide

●● Primary application
● Additional application

Cutting tool material application charts – Boring and precision boring

(continued)

Cermet/PCD

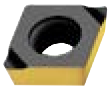
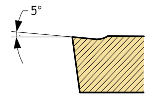
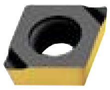
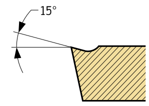
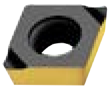
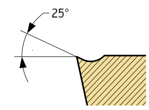
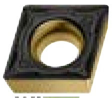
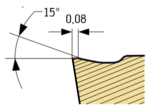
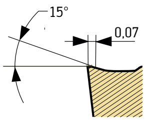
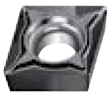
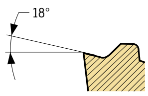
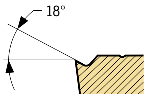
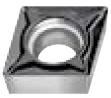
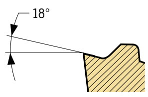
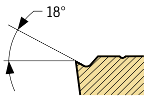
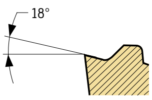
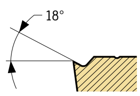
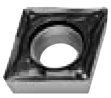
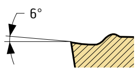
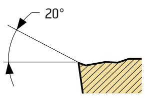
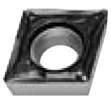
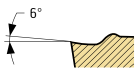
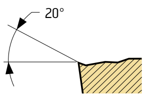
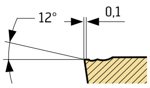
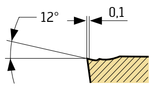
Walter grade designation	Standard designation	Material groups P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Application range 01 05 10 15 20 25 30 35 40 45	Coating process	Coating composition	Example of indexable insert
WEP10S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

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

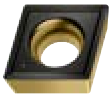
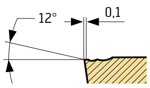
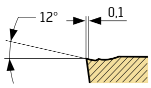
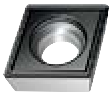
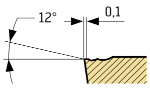
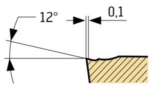
Geometry	Remarks/application area	Material groups P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Main cutting edge section	Corner radius section	a_p [mm]	f [mm]
	**X5 – The stable one** – 5° rake angle – For cast iron and steel materials – For unfavourable machining conditions	●●		●●							0,1–0,3	0,03–0,15
	**X15 – The universal one** – 15° rake angle – For steel, stainless materials and materials with difficult cutting properties – Long projection lengths	●●	●●	●	●	●					0,1–0,3	0,03–0,15
	**X25 – The soft one** – 25° rake angle – Aluminium, soft steels, long-chipping materials	●●	●		●●	●					0,1–0,3	0,03–0,15
 Wiper	**FW4** – 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
	**FN2** – 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
	**FM2** – 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
	**FP2** – 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
	**FM4** – Finishing insert – Excellent chip control – Can also be used for precision boring	●	●●			●●					0,1–2,5	0,04–0,20
	**FP4** – Finishing insert – Excellent chip control – Can also be used for precision boring	●●	●	●		●					0,1–2,5	0,04–0,20
	**FM6** – 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

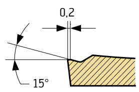
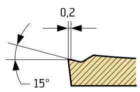
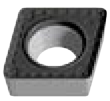
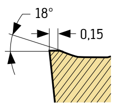
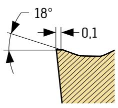
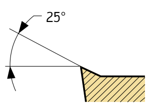
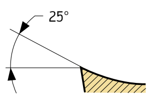
Remark: Sectional views show CCMT09T308.. or CCGT09T308..

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

Precision boring

Geometry	Remarks/application area	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Main cutting edge section	Corner radius section	a_p [mm]	f [mm]
	**FP6** – Universal insert for finishing and medium machining operations – Can also be used for boring	●●	●	●		●					0,3–2,5	0,08–0,32
	**FK6** – Universal insert for finishing and medium machining operations – Can also be used for boring	●	●	●●		●					0,3–2,5	0,08–0,32

Boring

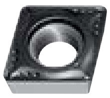
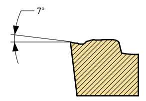
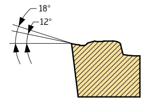
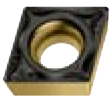
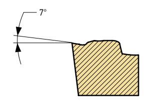
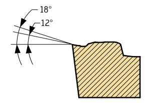
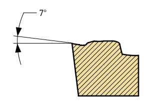
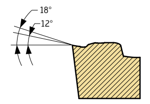
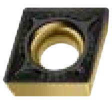
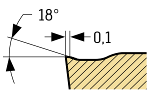
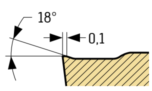
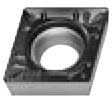
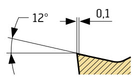
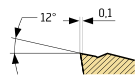
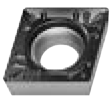
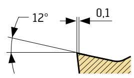
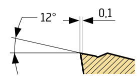
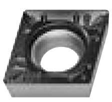
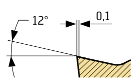
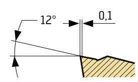
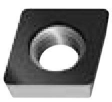
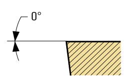
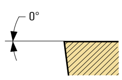
Geometry	Remarks/application area	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Main cutting edge section	Corner radius section	a_p [mm]	f [mm]
	**E47 – The universal one** – 15° rake angle – Flexible universal geometry for almost 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
	**G88** – Especially for machining aluminium – Boring (with and without interrupted cuts) – ISO N materials				●●						0,1–7,6	0,1–0,45
 Wiper	**MW4** – 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
	**MN2** – 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

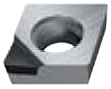
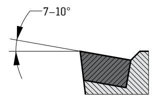
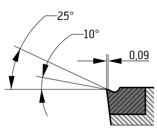
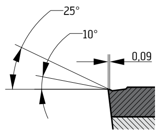
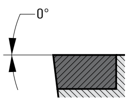
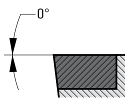
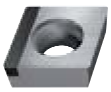
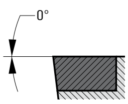
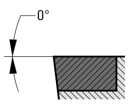
Geometry	Remarks/application area	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Main cutting edge section	Corner radius section	a_p [mm]	f [mm]
	**MM4** – Machining of long-chipping materials – Can be used universally in a wide 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
	**MP4** – 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
	**MK4** – 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
	**MP6** – Medium machining of steel – Positive geometry with good chip control with very stable cutting edge	●●	●	●		●					0,4–4,0	0,10–0,35
	**RM4** – 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
	**RP4** – 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
	**RK4** – 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
	**RK6** – 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

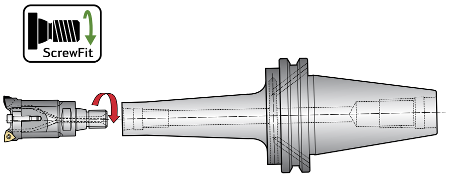
Geometry	Remarks/application area	P Steel	M Stainless steel	K Cast iron	N NF metals	S Materials with difficult cutting properties	H Hard materials	O Other	Main cutting edge section	Corner radius section	a_p [mm]	f [mm]
	**.CGT...FS-1** – PCD finishing insert with fully ground circumference in G tolerance – Extremely low cutting forces due to 7°–10° rake angle – Extremely high surface quality				●●	●		●●	–		0,05–1,5	0,03–0,38
	**.CGT...FS-M1** – PCD indexable insert with fully ground circumference in G tolerance – Excellent chip control due to laser-generated chip-breaker geometry – Finishing to medium machining				●●	●		●●			0,1–3,0	0,08–0,2
	**.CGW...FS-1** – PCD indexable insert with fully ground circumference in G tolerance – Universal PCD indexable insert with 0° rake angle – Maximum repeat accuracy				●●	●		●●			0,05–3,5	0,03–0,38
	**.CGW...FSL/R-9** – PCD indexable insert with fully ground circumference in G tolerance – Cutting edge with guide pad – Maximum depth of cut and shoulder machining				●●	●		●●			0,05–9,0	0,03–0,38

●● Primary application
● Additional application

Remark: Sectional views show CCGT09T304.., CCGW09T304.. or RCGX090700...

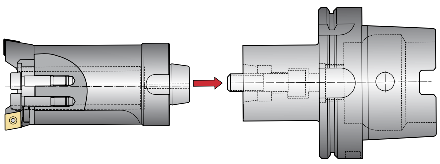
Tightening torques

Modular front pieces



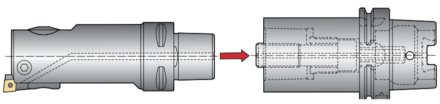
Cut-off area	Thread	Tightening torque	Wrench size [mm]	Taper diameter corresponds to
T 9	M 5	6 Nm	SW 8	–
T 14	M 8	25 Nm	SW 12	–
T 18	M 10	50 Nm	SW 14	–
T 22	M 12	80 Nm	SW 17	NCT 25/32
T 28	M 16	150 Nm	SW 21	–
T 36	M 20	200 Nm	SW 30	NCT 40/50
T 45	M 20	200 Nm	SW 36	NCT 40/50

NCT tools



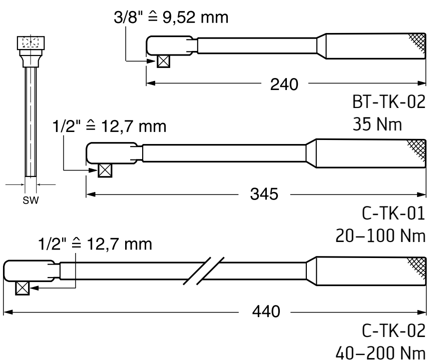
NCT	Thread	Wrench size	Torque wrench	Socket wrench	Tightening torque	Limit speed
25	M 8	5	FS 1385	FS 402	18 Nm	20,000 rpm
32	M 8	5	FS 1385	FS 402	18 Nm	30,000 rpm
40	M 12	8	FS 1386	FS 403	80 Nm	30,000 rpm
50	M 12	8	FS 1386	FS 403	80 Nm	30,000 rpm
63	M 16	12	FS 1386	FS 404	150 Nm	30,000 rpm
80	M 20	14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

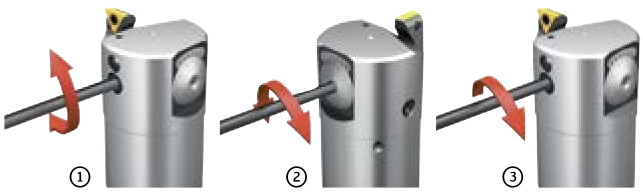
B5110 Ø 1–20 mm (0.039–0.787")

Fitting the boring bar

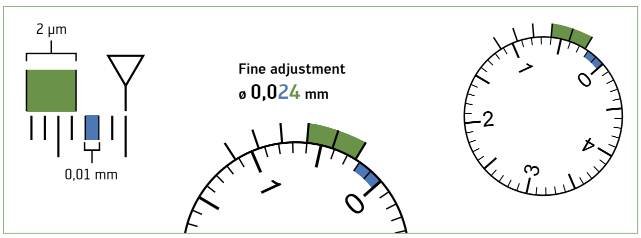
1. Push the boring bar into the locating bore on the precision boring head.
2. Align the cutting edge with the line marking on the precision boring head.
3. Tighten the clamping screw ① to the recommended torque.

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.



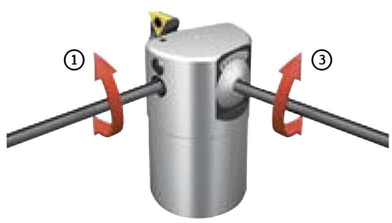
Fine adjustment



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").

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.



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 Ø 1–20 mm (0.039–0.787")

(continued)

Torques

Torques for B5110

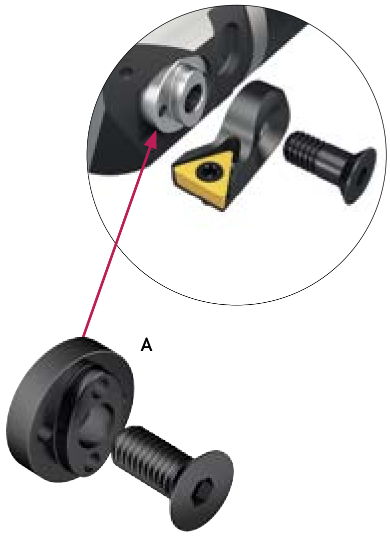
Designation	Ø [mm] (inch)		Nm	ft/lbs
Clamping screw	D_c 1–10 mm (0.039–0.391 inch)		1,2	0.9
	D_c 10–20 mm (0.391–0.787 inch)		3,0	2.2
Boring bar clamping screw	D_c 1–10 mm (0.039–0.391 inch)		1,2	0.9
	D_c 10–20 mm (0.391–0.787 inch)		3,0	2.2
Indexable insert screw	TC06	TC1.2(1.2)	0,6	0.4

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

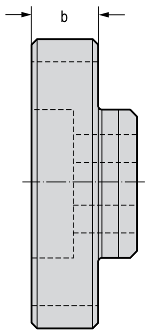
1. Attach the cartridge to the elliptical interface on the slider on the precision boring head.
2. Tighten the clamping screw on the cartridge to the recommended torque.

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 × 3.0 = 6.0 mm for EB735
– 2 × 3.6 = 7.2 mm for EB736
– 2 × 4.8 = 9.6 mm for EB737

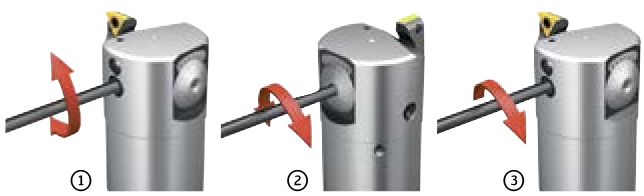
– 2 × 0.118 = 0.236" for EB735
– 2 × 0.141 = 0.282" for EB736
– 2 × 0.188 = 0.376" for EB737

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.



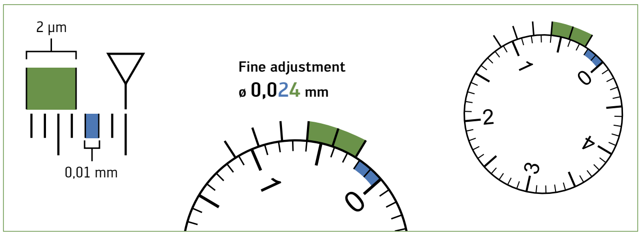
Assembly and operating instructions for Walter Precision XT

B5115 Ø 19–167 mm (0.748–6.57")

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

(continued)

Fine adjustment



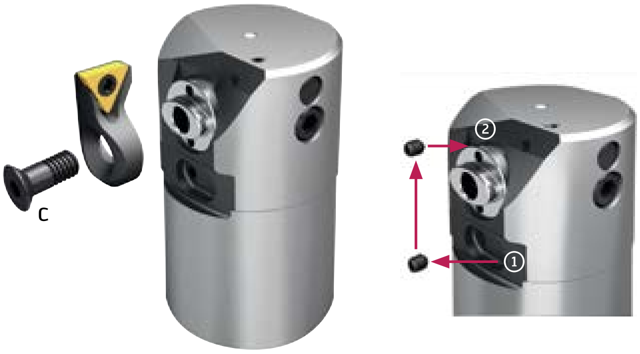
A full rotation of the scale disc results in a radial adjustment of the indexable insert by 0.25 mm (0.010"), which equates to a diameter of 0.5 mm (0.01969").

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").

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.

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

Fitting the cartridge for reverse boring



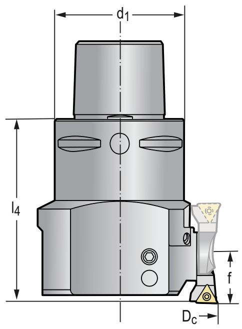
1. Remove the threaded plug from the lower outlet for the cooling lubricant ① and fit it to the upper outlet for the cooling lubricant ②.
2. If necessary, fit extension **A** (see "Fitting the cartridge").
3. Turn the cartridge 180° towards the boring bar and fit the cartridge to the slider or the extension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



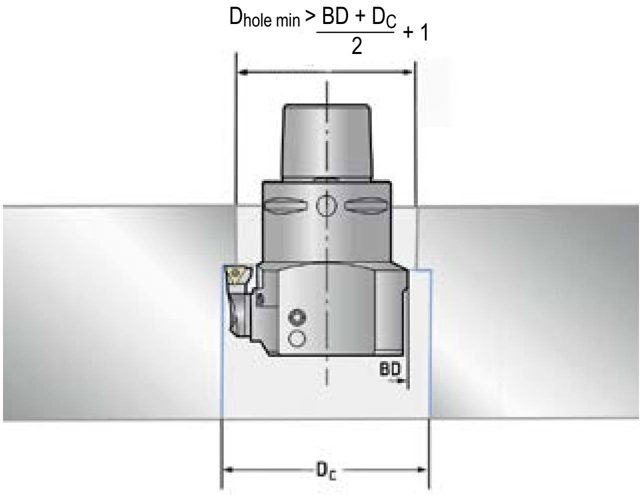
Important:
Change the direction of rotation → to the left-hand cutting version.

(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:

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



Torques

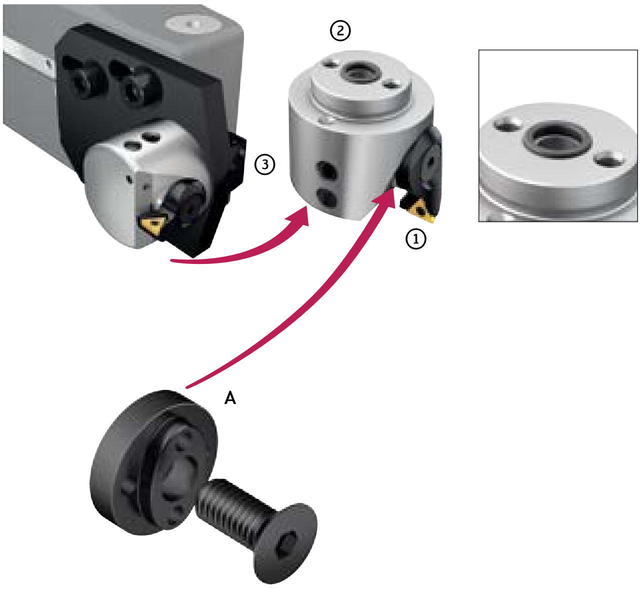
Torques for B5115 and B5125				
Designation	**Ø [mm] (inch)**		**Nm**	**ft/lbs**
Screw for cartridge	19–36 (0.748–1.417)		1,2	0.9
	35–56 (1.378–2.205)		3,0	2.3
	55–167 (2.165–6.575)		6,0	4.3
Clamping screw	19–29 (0.748–1.142)		0,9	0.7
	28–36 (1.102–1.417)		1,2	0.9
	35–56 (1.378–2.205)		3,0	2.3
	55–167 (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")

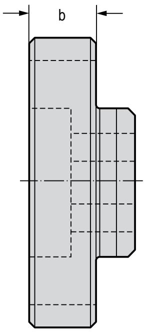
Fitting the cartridge and precision boring head

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 × 3.0 = 6.0 mm for EB735
– 2 × 3.6 = 7.2 mm for EB736
– 2 × 4.8 = 9.6 mm for EB737

– 2 × 0.118 = 0.236" for EB735
– 2 × 0.141 = 0.282" for EB736
– 2 × 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")

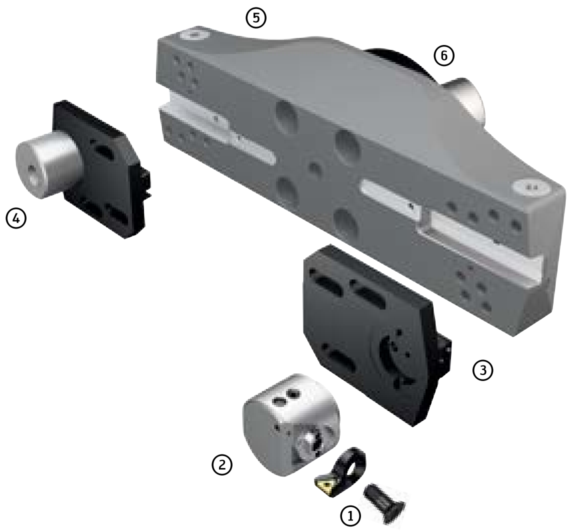
(continued)

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

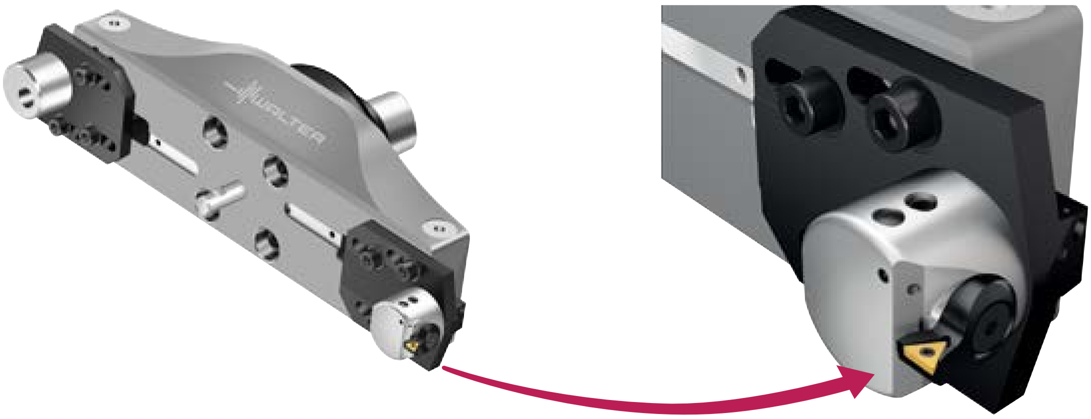
B5120 Ø 148–635 mm (5.826–25.000")

(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.

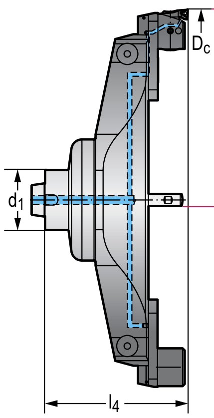
When using an extension, see "Fitting the cartridge and precision boring head"



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.



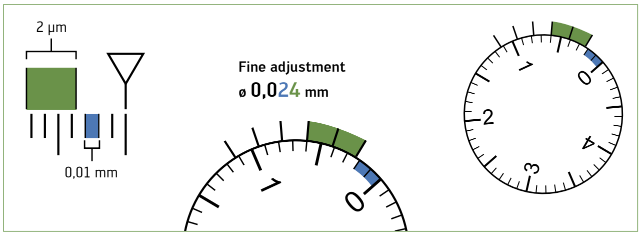
R –8 mm (0.3149 inch)

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 mm (0.905") for cartridge EB715.TC11 → l_4 = –46 mm (1.811")
– f = 27 mm (1.062") for cartridge EB717.CC09 → l_4 = –54 mm (2.125")

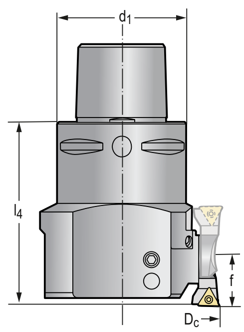
Important:
Change the direction of rotation → to the left-hand cutting version.

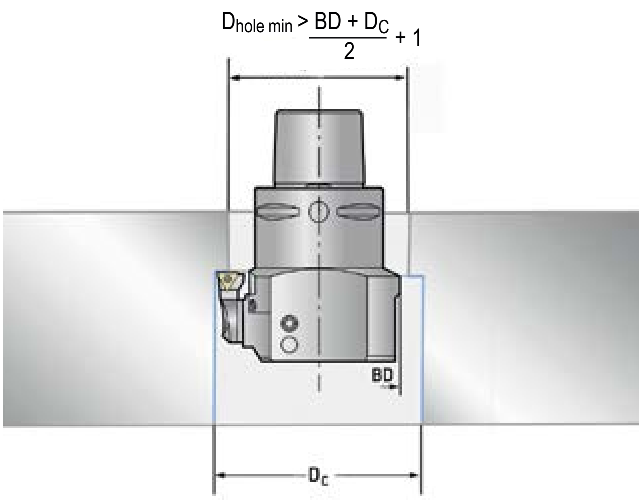
(b) When using an extension (see Fitting upper cartridges)

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:

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



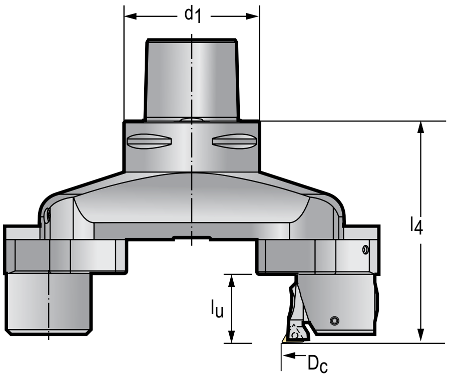


Assembly and operating instructions for Walter Precision XT

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

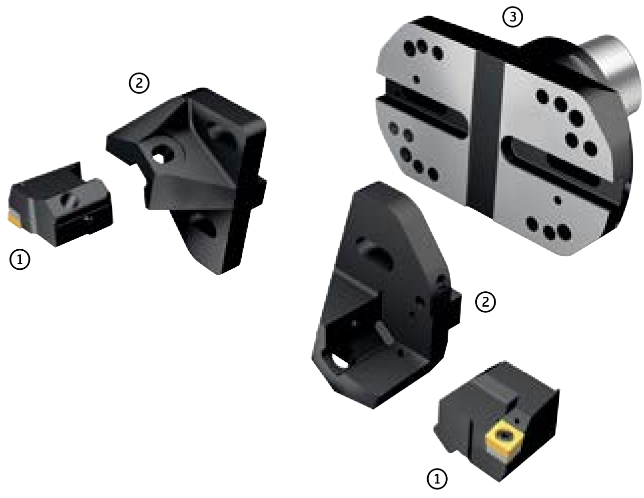
Torques for B5120
Ø 298–635 mm (11.732–25 inch)

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")

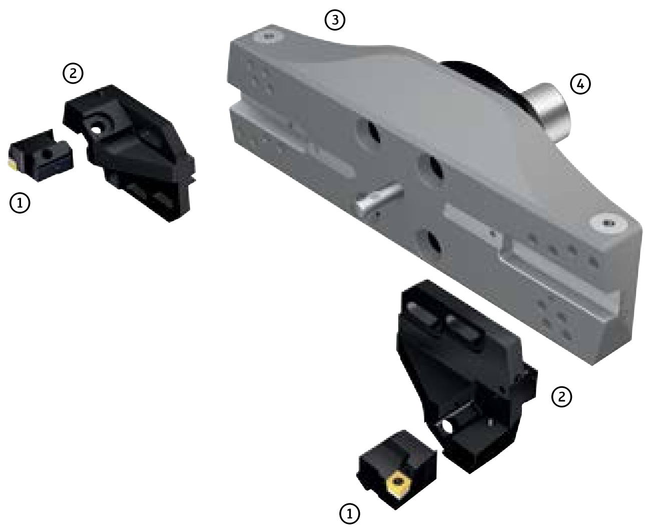
1. Secure the sliders ② to the bridge ③ and place the washers on the clamping screws.
2. Place the cartridges ① on the sliders and secure with the clamping screws.
3. Tighten the clamping screws on the sliders by hand so that they can be moved easily to make adjustments.



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.

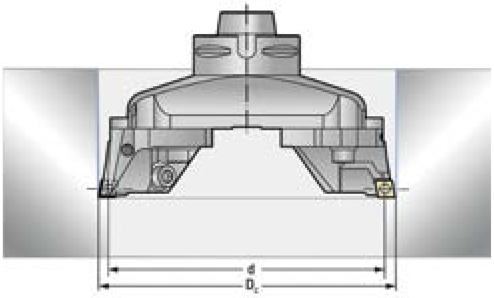


Assembly and operating instructions for Walter Boring XT

B5460/B5560 Ø 148–620 mm (5.826–24.409")

(continued)

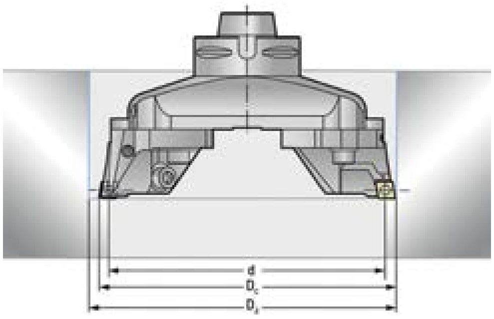
Tool setting



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.

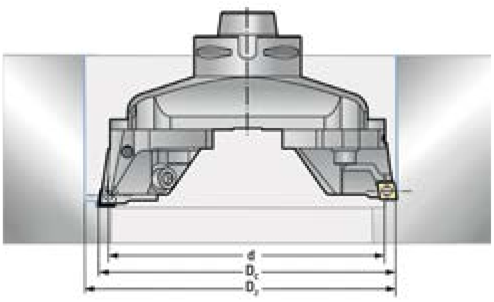
   b. Adjusting the cartridge radially:
   - 4.1 Manually move the cartridge into position. Pre-tension the clamping screws on the cartridge and the slider for easy adjustment.
   - 4.2 Adjust using the adjusting screw until the corner radius reaches the set diameter.
   - 4.3 Always set the diameter from 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.

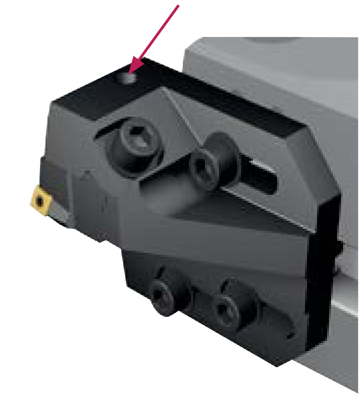
The axial difference between the two cutting edges must be at least half of the feed rate. The feed rate per tooth corresponds to the feed rate per rotation.

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 Ø 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.

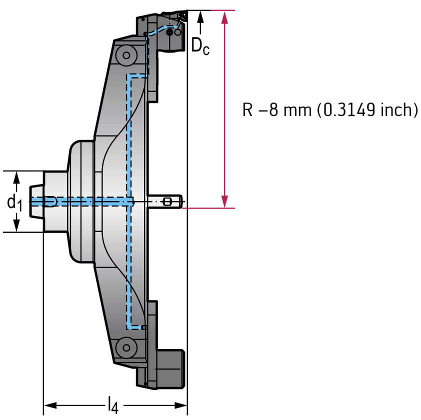
4.2 Adjust using the adjusting screw until the corner radius reaches the set diameter.

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)

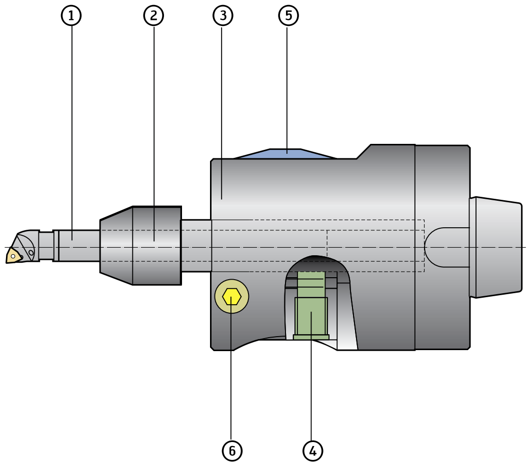
Designation	Ø [mm] (inch)		Nm	ft/lbs
Bridge			200	140
Slider			60	44
Cartridges			60	44
Clamping screw for indexable inserts	CC1204	CC43	3,0	2.2
	CN1906	CN64	6,4	4.7
	SC1204	SC43	3,0	2.2
	P4xxx	—	2,0	1.5

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 µ range.

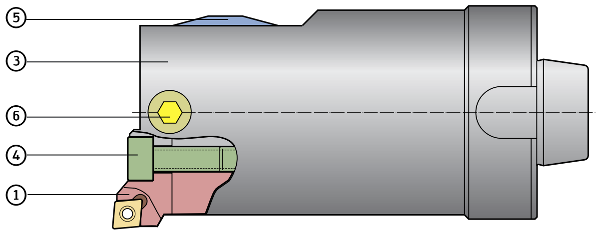
Walter Precision^MINI

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.

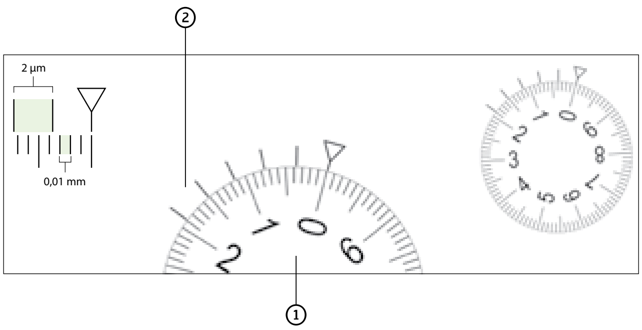


Walter Precision^MEDIUM

1. Position the cartridge ① in the cartridge guide of the base body ③ and secure with clamping screws ④.
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^{DIGITAL} B4035

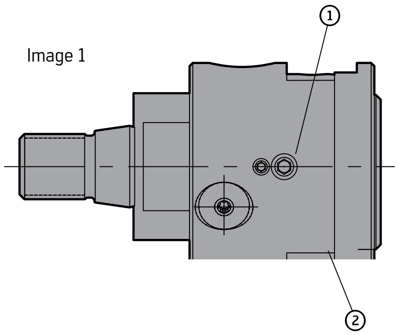
Clamping/diameter adjustment

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

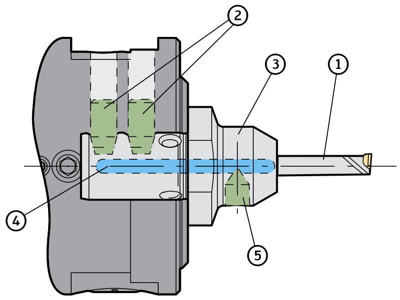
4. Tighten the clamping screw ①.

Image 1



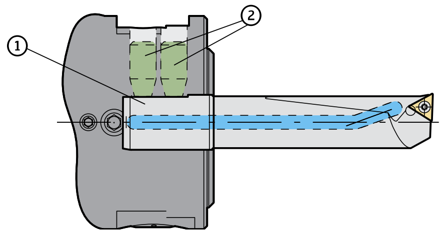
Mini boring tools, dia. 3–10 mm

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.



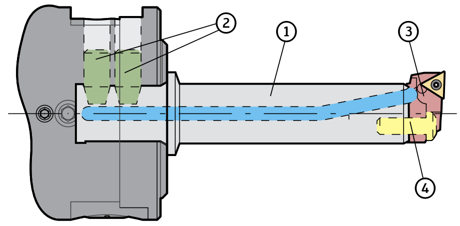
Boring bar, dia. 20–32 mm

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



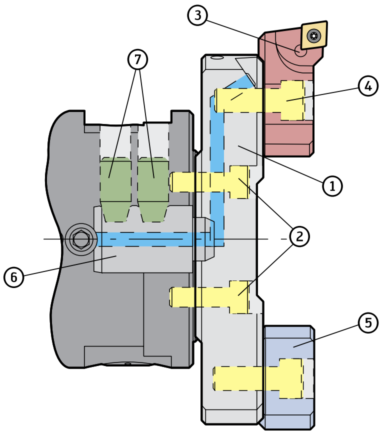
Extension and cartridges, dia. 32–68 mm

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^{MINI} 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 ① (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

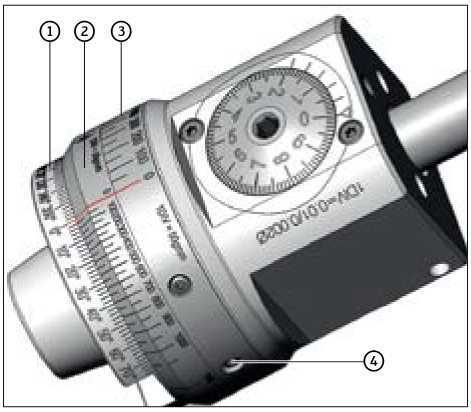


Image 2

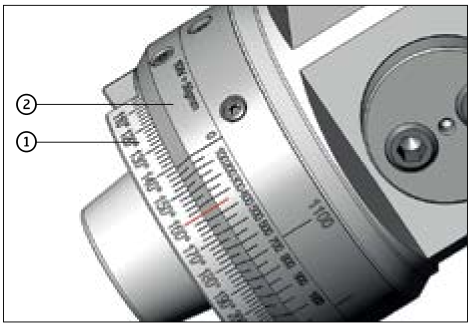
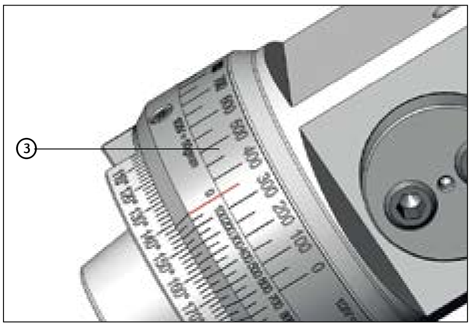


Image 3



Assembly instructions for Walter bridge-type tools

Walter Boring^MAXI B3220/B3224 boring tool

① Basic body

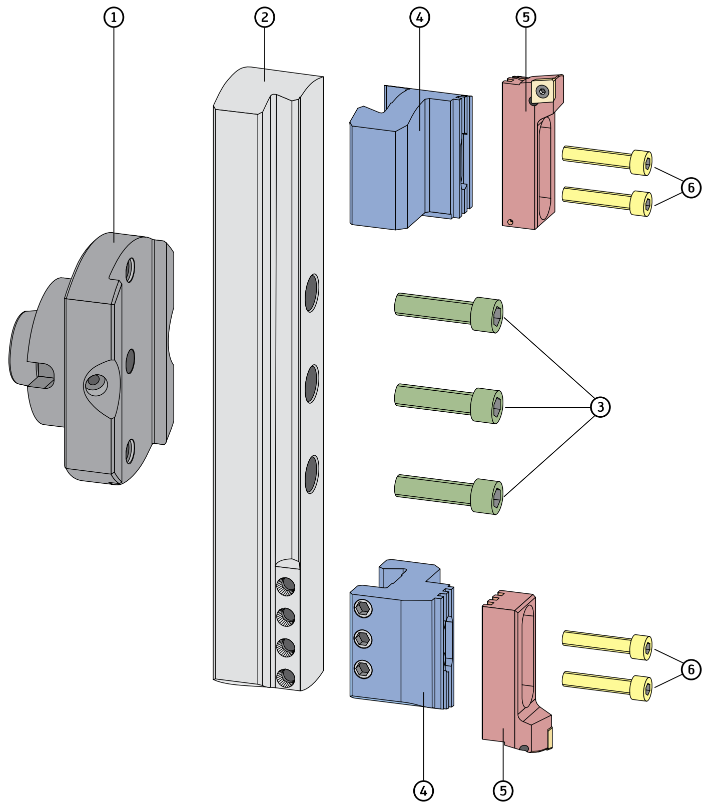
② Bridge

③ Clamping screws for the bridge

④ Cartridge holder

⑤ Cartridge

⑥ Clamping screws for the cartridge



Walter Precision^MAXI B3230/B3234 precision boring tool

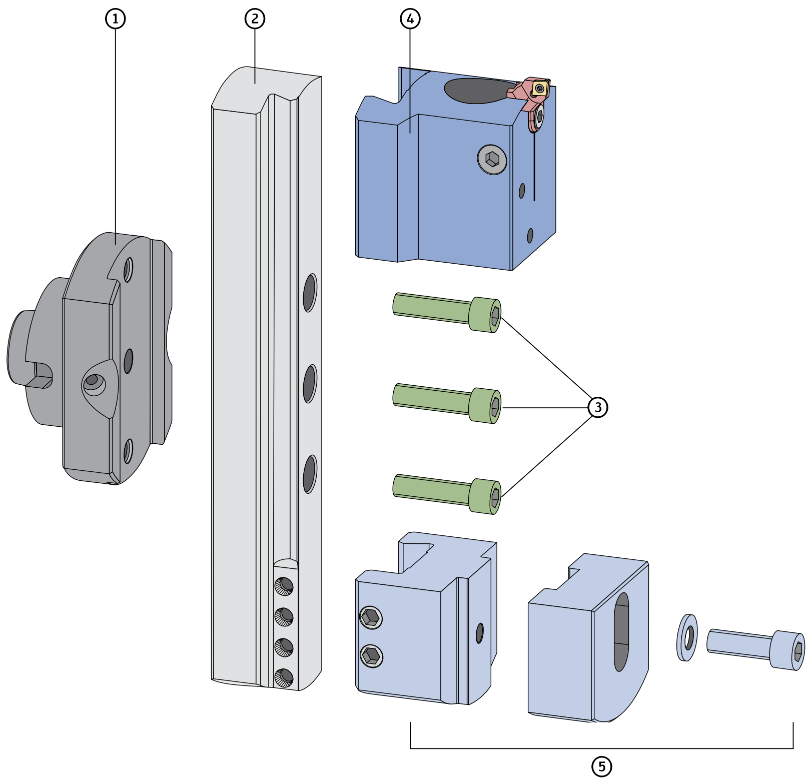
① Basic body

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_c [mm]	n_{max} [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_c [mm]	n_{max} [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

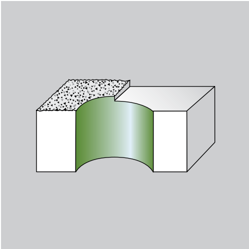
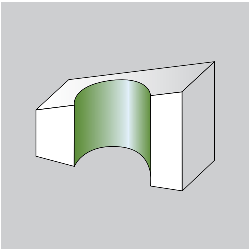
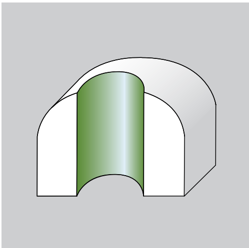
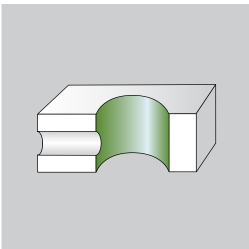
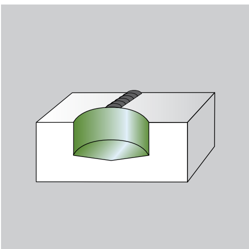
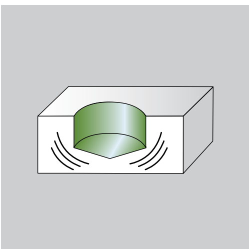
Diameter range D_c [mm]	n_{max} [rpm]
2–10*	14.000
10–20*	12.000
20–45*	8.000
33–41	15.000
41–55	11.500
55–70	9.000
70–90	7.000
90–110	5.500
110–153	4.000

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

4. Walter Precision^DIGITAL B4035 precision boring tools

Diameter range D_c [mm]	n_{max} [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
Boring on uneven surfaces (cast surfaces)		– Depending on the drill entry angle, the spot drilling feed must be reduced. Use tools with max. 2 × D_c. Rule of thumb: 3° → 30%; 10° → 40%; 25° → 60% – Use a tough indexable insert grade – Use a strong corner radius
Inclined hole entry and hole exit		– Starting from an interrupted cut, reduce the feed by up to 50% – Use a tough indexable insert grade – Use a strong corner radius
Boring on convex surfaces		– Possible without problems – Reduce the feed if necessary
Boring with cross hole		– If necessary, reduce the feed by up to 50% – Watch out for chip jamming in the area of the cross hole – Use a tough indexable insert grade – Use a strong corner radius
Boring on a forged/welded/cast seam		– Reduce the feed – Use tools with max. 3 × D_c
Vibration		– The feed is too high – The cutting speed is too high – The geometry is too blunt – Check the axial/radial settings – Check the tool design – If necessary, use an HMD damping element

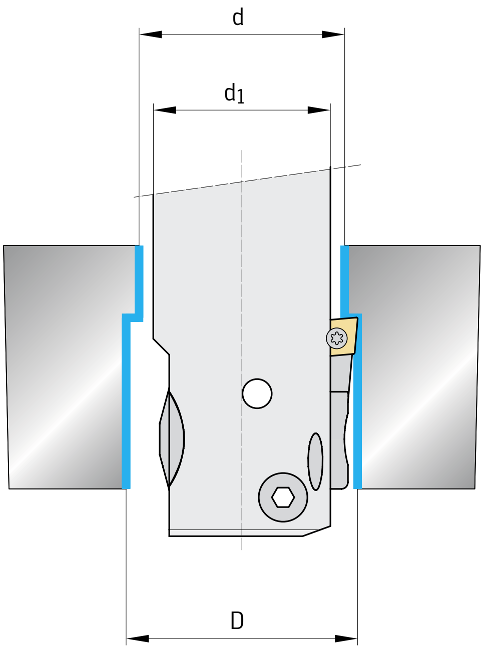
Application information

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_1" 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_1"	$d_1 = 2d - d_1$
Max. diameter of the tool body "d_1"	$A = 2d - D$



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_1 = 50 mm

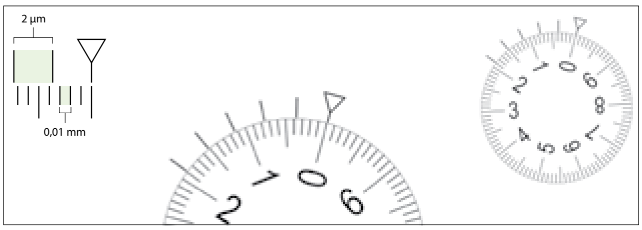
$$d = \frac{D + d_1}{2} = \frac{93 + 50}{2} = 71{,}5 \text{ mm}$$

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.**

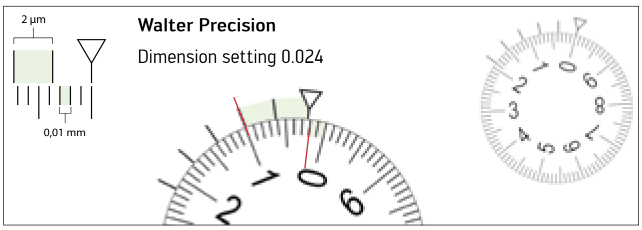
Reading the vernier scale on the B3230/B4030

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.

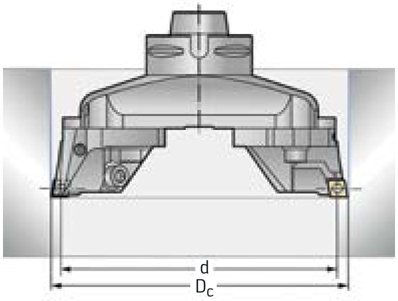


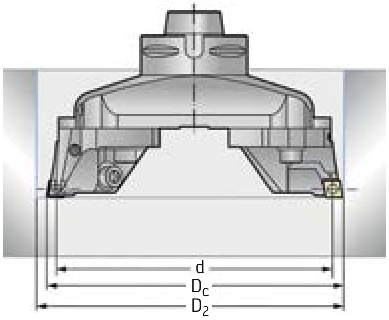
Example:

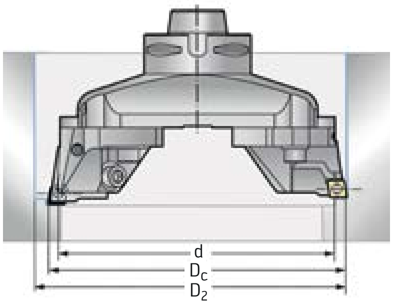
Adjusting the disc by 0.024 mm
clockwise (± adjustment)



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

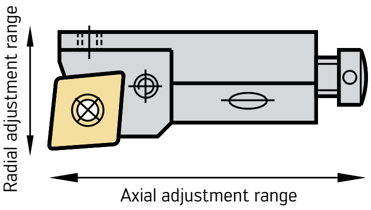
Boring asymmetrically

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

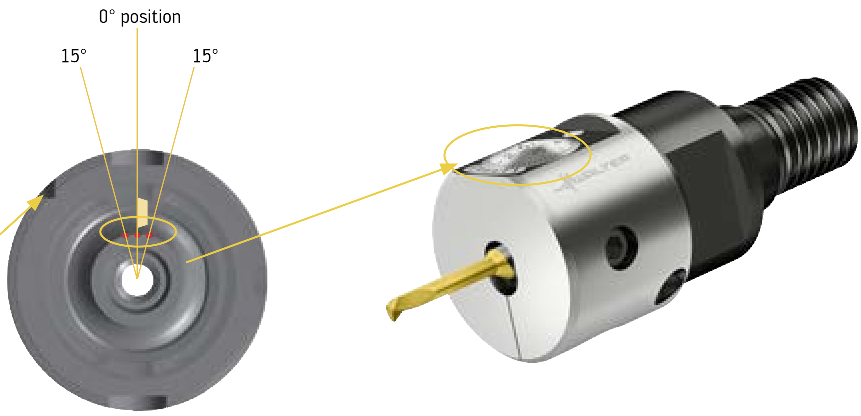


Group	Axial	Radial
ISO cartridges	2,0 mm	0,5 mm
Walter mini cartridges	1,0 mm	0,5 mm
Walter precision boring cartridges	1,0 mm	0,3 mm

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° ±15°.



Problem-solving expertise for boring with Walter Boring XT

Application	Cause	Solution
Chip breaking **The chips are too short and hard**	– The feed is too high – The cutting speed is too low – The geometry is unsuitable	– Reduce the feed – Increase the cutting speed – Choose a geometry with a more open chip breaker
Chip breaking **The chips are too long**	– The feed is too low – The cutting speed is too high – The geometry is unsuitable	– Increase the feed – Reduce the cutting speed – Choose a geometry with a narrower chip breaker
Tool vibration	– The ratio between the length and coupling system size is too large	– Use the largest possible size of coupling system – Use/shorten the vibration-damped boring tool
	– Unstable conditions	– Ensure stable clamping with contact between the flange and spindle – Use a rough boring tool with two cutting edges – Check that all units have been installed properly in the tool assembly and have been tightened to the correct torque – Check the machine spindle, stress, wear, etc.
	– The feed is too low	– Increase the feed
	– The feed is too high	– Reduce the feed
	– The speed is too high	– Reduce the cutting speed
	– The depth of cut is too great	– Use multi-edge boring
	– The cutting force is too high	– Reduce the depth of cut – Use positive indexable inserts – Choose a smaller corner radius – The wiper indexable insert is not recommended for long overhangs or unstable conditions
	– The cutting force is too low	– Increase the depth of cut
Machine power	– Limited machine power	– Ensure that the machine can provide the necessary torque and the power for the specific boring application, especially for rough boring – Reduce cutting data – Use multi-edge boring

Problem-solving expertise for precision boring

Application	Cause	Solution
Chip breaking **The chips are too short and hard**	– The feed is too high – The cutting speed is too low – The geometry is unsuitable	– Reduce the feed – Increase the cutting speed – Choose a geometry with a more open chip breaker
Chip breaking **The chips are too long**	– The feed is too low – The cutting speed is too high – The geometry is unsuitable	– Increase the feed – Reduce the cutting speed – Choose a geometry with a narrower chip breaker
Tool vibration	– The cutting force is too high	– Use the largest possible size of coupling system – Use an easy-cutting indexable insert geometry – Choose a smaller corner radius – Choose sharp cutting edges with a thin coating or no coating – Wiper indexable inserts are not recommended for unstable conditions or long overhangs – Choose a smaller corner radius – Reduce the depth of cut
	– The ratio between the length and coupling system size is too large	– Ensure stable clamping with contact between the flange and spindle – Use the largest possible size of coupling system – Shorten the complete tool if possible – Use vibration-damped boring tools
	– Unstable conditions	– Ensure stable clamping with contact between the flange and spindle – Check that all units have been installed properly in the complete tool and have been tightened to the correct torque – Check the machine spindle, stress, wear, etc.
	– 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
Machine power	– 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	– Use an easy-cutting indexable insert geometry – Choose a larger corner radius – Reduce the feed
	– Indexable insert worn	– Replace the cutting edge Prevent specific wear patterns
	– Surface scratches due to chips	– Improve chip breaking

Cutting data for HSS countersinks

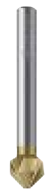
= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

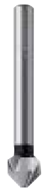
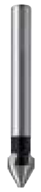
v_c = Cutting speed
VRR = Feed rate chart

* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

Standard	DIN 335
Designation	E6819TIN
Form	C
Type	90°
Dia. range [mm]	6,00–31,00
Cutting tool material	HSS
Coating	TiN



Material group	Overview of the main material groups and code letters			Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group *	v_c	VRR	Wet machining	Dry machining
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	
	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				C				D				D			
90°				60°				90°				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_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
21	7	**E O**		21	7	**E O**		21	7	**E O**		21	7	**E O**	
21	8	**E O**		21	8	**E O**		21	8	**E O**		21	8	**E O**	
20	8	**E O**		20	8	**E O**		20	8	**E O**		20	8	**E O**	
21	8	**E O**		21	8	**E O**		21	8	**E O**		21	8	**E O**	
14	7	**E O**		14	7	**E O**		14	7	**E O**		14	7	**E O**	
21	8	**E O**		21	8	**E O**		21	8	**E O**		21	8	**E O**	
21	8	**E O**		21	8	**E O**		21	8	**E O**		21	8	**E O**	
14	7	**E O**		14	7	**E O**		14	7	**E O**		14	7	**E O**	
8	6	**O E**		8	6	**O E**		8	6	**O E**		8	6	**O E**	
6	4	**E O**		6	4	**E O**		6	4	**E O**		6	4	**E O**	
10	6	**E O**		10	6	**E O**		10	6	**E O**		10	6	**E O**	
5	5	**O E**		5	5	**O E**		5	5	**O E**		5	5	**O E**	
6	4	**E O**		6	4	**E O**		6	4	**E O**		6	4	**E O**	
5	4	**E O**		5	4	**E O**		5	4	**E O**		5	4	**E O**	
4	3	**O E**		4	3	**O E**		4	3	**O E**		4	3	**O E**	
5	5	**O E**		5	5	**O E**		5	5	**O E**		5	5	**O E**	
4	3	**O E**		4	3	**O E**		4	3	**O E**		4	3	**O E**	
15	12	**E O**		15	12	**E O**		15	12	**E O**		15	12	**E O**	
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19	10	**E O**		19	10	**E O**		19	10	**E O**		19	10	**E O**	
8	12	**E O**		8	12	**E O**		8	12	**E O**		8	12	**E O**	
25	12		**M L**	25	12		**M L**	25	12		**M L**	25	12		**M L**
30	5	**E O**		30	5	**E O**		30	5	**E O**		30	5	**E O**	
25	10	**E O**		25	10	**E O**		25	10	**E O**		25	10	**E O**	
42	12	**E O**	**M L**	42	12	**E O**	**M L**	42	12	**E O**	**M L**	42	12	**E O**	**M L**
9	4	**E O**		9	4	**E O**		9	4	**E O**		9	4	**E O**	
4	3	**O E**		4	3	**O E**		4	3	**O E**		4	3	**O E**	
3	3	**O E**		3	3	**O E**		3	3	**O E**		3	3	**O E**	
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2	3	**O E**		2	3	**O E**		2	3	**O E**		2	3	**O E**	
7	4	**E O**		7	4	**E O**		7	4	**E O**		7	4	**E O**	
4	4	**O E**		4	4	**O E**		4	4	**O E**		4	4	**O E**	
9	4	**E O**		9	4	**E O**		9	4	**E O**		9	4	**E O**	
9	4	**E O**		9	4	**E O**		9	4	**E O**		9	4	**E O**	
26	12	**E O**		26	12	**E O**		26	12	**E O**		26	12	**E O**	
15	7		**L**	15	7		**L**	15	7		**L**	15	7		**L**
15	7		**L**	15	7		**L**	15	7		**L**	15	7		**L**

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

WALTER TITEX

VRR: Feed rate charts for HSS countersinks

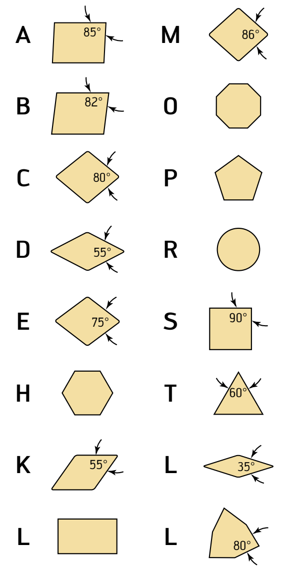
	Feed f [mm] for diameter [mm]													
VRR	**2,5**	**4**	**5**	**6**	**8**	**10**	**12**	**15**	**20**	**25**	**40**	**50**	**60**	**80**	**100**
1	0,008	0,013	0,017	0,018	0,021	0,024	0,026	0,029	0,033	0,037	0,047	0,053	0,058	0,067	0,075
2	0,017	0,027	0,033	0,037	0,042	0,047	0,052	0,058	0,067	0,075	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

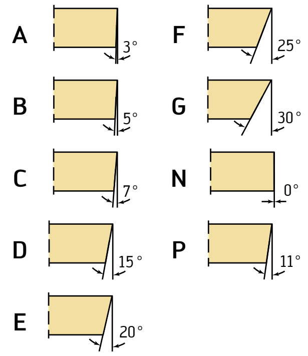
Example:

C	C	M	T	06	02	04	–	E47
1	2	3	4	5	6	7		8

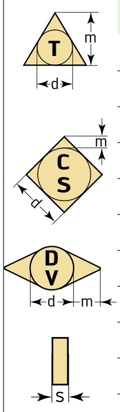
1 Insert shape



2 Clearance angle



3 Tolerances

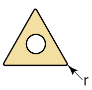


Permissible deviation in mm for

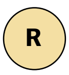
	d	m	s
A	± 0,025	± 0,005	± 0,025
C	± 0,025	± 0,013	± 0,025
E	± 0,025	± 0,025	± 0,025
F	± 0,013	± 0,005	± 0,025
G	± 0,025	± 0,025	± 0,130
H	± 0,013	± 0,013	± 0,025
J[1]	± 0,05–0,15[2]	± 0,005	± 0,025
K[1]	± 0,05–0,15[2]	± 0,013	± 0,025
L[1]	± 0,05–0,15[2]	± 0,025	± 0,025
M	± 0,05–0,15[2]	± 0,08–0,20[2]	± 0,130
N	± 0,05–0,15[2]	± 0,08–0,20[2]	± 0,025
U	± 0,08–0,25[2]	± 0,13–0,38[2]	± 0,130

[1] Inserts with ground planar cutting edges
[2] Depending on the insert size (see ISO standard 1832)

7 Corner radius



01	r = 0,1
02	r = 0,2
04	r = 0,4
08	r = 0,8
12	r = 1,2
16	r = 1,6
24	r = 2,4
00	For diameters converted from imperial units to mm



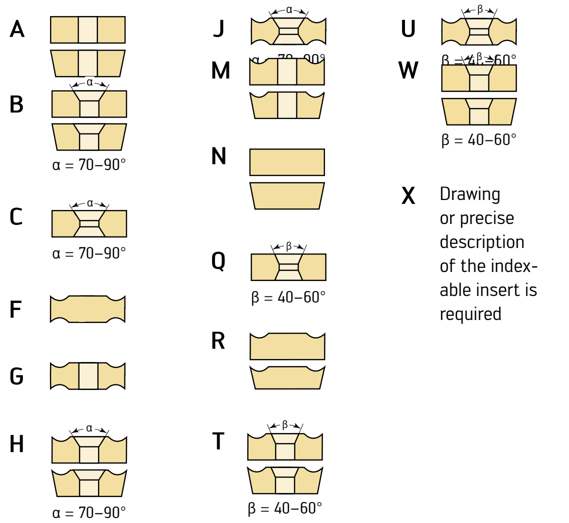
M0	For diameters in metric units

8 Geometry

X5	Tough
X15	Universal
X25	Easy-cutting
E47	Boring

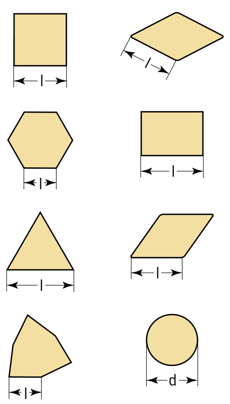
4

Machining and fastening features



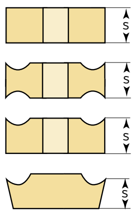
5

Cutting edge length



6

Insert thickness



01	s = 1,59
T1	s = 1,98
T2	s = 2,78
03	s = 3,18
T3	s = 3,97
04	s = 4,76
05	s = 5,56
06	s = 6,35
07	s = 7,94
09	s = 9,52

Designation key
for negative indexable inserts for boring

Example:

P413	0	–	2	R	–	E47
1	2		3	4		5

1	
Walter indexable insert designation	
P413	
P416	Negative boring
P446	

2	
Version	
0	Ground
1	Sintered

3	
Insert size	
0	08…
2	10…
3	12…
4	14…

4	
Cutting direction	
R	RH-cutting
L	LH-cutting

5	
Walter geometry	
E47	The universal one
G88	The sharp one

Designation key for cutting material grades – Drilling

W	K	P	25	S
Walter	1	2	3	4

1

1. Primary application or coating type

P	Steel
M	Stainless steel
K	Cast iron
N	NF metals
S	Materials with difficult cutting properties
H	Hard materials
A	CVD aluminium coating
X	PVD coating

2

2. Primary application

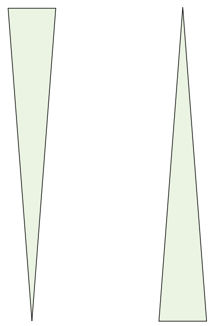
P	Steel
M	Stainless steel
K	Cast iron
N	NF metals
S	Materials with difficult cutting properties
H	Hard materials

3

ISO application range

Wear resistance

01
10
15
20
25
30
35
45



Toughness

4

Generation

C	Color Select
S	Tiger·tec® Silver

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

Example:

B	5	1	15	–	023	–	029	–	C3	–	TC06
1	2	3	4		5		6		7		8

1	2	3	4
Tool group	**Generation**	**Tool type**	**Tool type**
B Boring Precision boring	**5** Walter Precision XT Walter Boring XT	**1** Precision boring tool, analogue radial **4** Boring tool, radial **5** Boring tool with tangential/lateral indexable insert	**10** With boring bar **15** With cartridge **20** With bridge design **25** Lightweight design with cartridge **60** Boring Z = two-bridge design

5	6	7	8
Min. diameter	**Max. diameter**	**Shank**	**Indexable insert/designation suffix**
		C Walter Capto™ **N** Walter NCT **T** Walter ScrewFit	**B** Basic body **CS** Solid carbide **TC..** Indexable insert type and size

Designation key for boring and precision boring tools

Example:

B	4030	.	T	45	.	55–70	.	Z1	.	CC06
1	2		3	4		5		6		7

1 – Tool range

B	Drilling and reaming tools

2 – Tool type

3220	Walter Boring
3221	Walter Boring
3224	Walter Boring
3230	Walter Precision
3234	Walter Precision
4030	Walter Precision, balanceable, self-balancing
4035	Walter Precision[DIGITAL]

3 – Interface

N	Walter NCT
T	Walter ScrewFit

4 – Interface size

5 – Diameter range

6 – Number of teeth

7 – Insert type and size

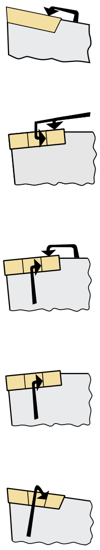
ISO designation key for ISO cartridges

Example: Walter Turn

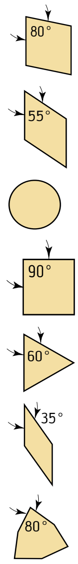
P	W	L	N	R	25	25	M	08	...
1	2	3	4	5	6	7	8	9	10

1 – Insert mounting type

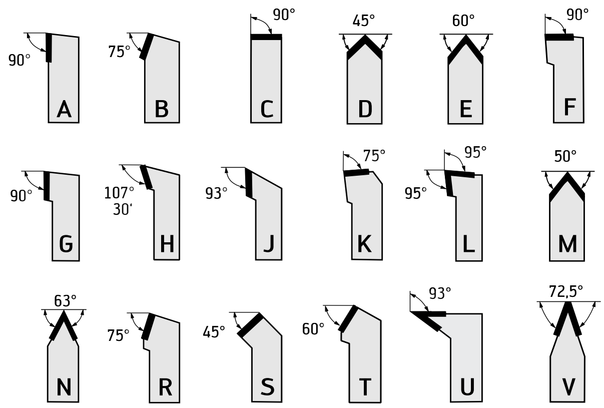
- **C** Top clamping
- **D** Top and hole clamping
- **M** Top and hole clamping
- **P** Hole clamping
- **S** Screw clamping

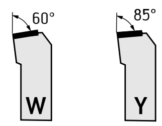


2 – Indexable insert basic shape



3 – Approach angle

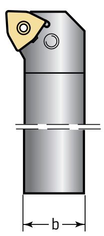


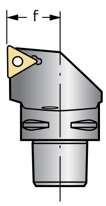


X
Approach angles not specified in the standard.
Specific information required.

7 – Toolholder width b or f dimension [mm]

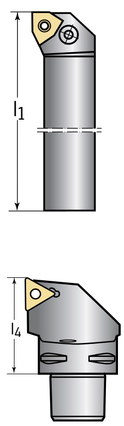
Shank width b in mm.
Figures after the decimal point are ignored.
Single-digit numbers are preceded by a "0",
e.g. b = 8 mm = 08.
For CA cartridges.



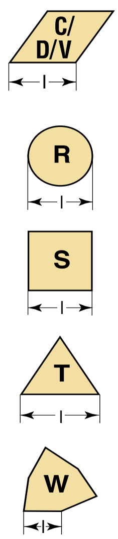


8 – Turning toolholder length l_1/l_4 [mm]

32 = A	160 = N
40 = B	170 = P
50 = C	180 = Q
60 = D	200 = R
70 = E	250 = S
80 = F	300 = T
100 = H	350 = U
110 = J	400 = V
125 = K	450 = W
140 = L	Special = X
150 = M	500 = Y



9 – Length of cutting edge l [mm]



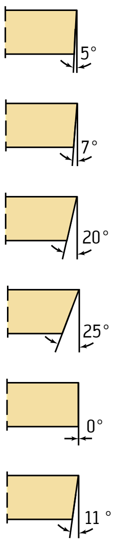
Example: Walter Capto™

C5	–	P	W	L	N	R	–	22	110	–	08	...
0		1	2	3	4	5		7	8		9	10

4

Indexable insert clearance angle

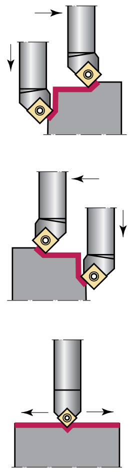
B
C
E
F
N
P



5

Turning toolholder design

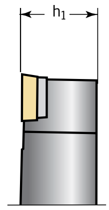
R
L
N



6

Turning toolholder height h_1 [mm]

Height of the peripheral cutting edge h_1 in mm. Figures after the decimal point are ignored. Single-digit numbers are preceded by a "0", e.g. h_1 = 8 mm = 08.



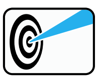
10

Manufacturer option

If necessary, an additional symbol comprising a maximum of three letters or figures can be added to the standard code.

This symbol must be separated from the standard designation with a hyphen.

–W Wedge-type clamping
–P Precision cooling



Cutting data for solid carbide and HSS reaming tools

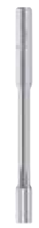
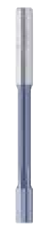
= Wet machining (E = emulsion, O = oil)

= Dry machining possible (M = MQL, L = dry)
Cutting data must be selected from Walter GPS

v_c = Cutting speed
VRR = Feed rate chart

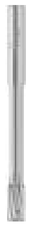
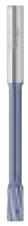
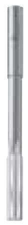
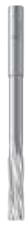
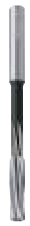
* The assignment of the machining groups can be found in the "General" section of the Technical Compendium, page F7.

	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

Material group				Brinell hardness HB	Tensile strength R_m [N/mm²]	Machining group*	F2482 v_c	F2482 VRR	F2482 wet	F2482 dry	F2482TMS v_c	F2482TMS VRR	F2482TMS wet	F2482TMS dry
P	Non-alloyed steel	C ≤ 0,25 %	Annealed	125	430	P1	45	8	**O E**		190	20	**O E**	
		C > 0,25... ≤ 0,55 %	Annealed	190	640	P2	40	8	**O E**		175	20	**O E**	
		C > 0,25... ≤ 0,55 %	Heat-treated	210	710	P3	40	8	**O E**		170	20	**O E**	
		C > 0,55 %	Annealed	190	640	P4	40	8	**O E**		175	20	**O E**	
		C > 0,55 %	Heat-treated	300	1010	P5	30	8	**O E**		130	20	**O E**	
		Free-machining steel (short-chipping)	Annealed	220	750	P6	45	8	**O E**		190	20	**O E**	
	Low-alloy steel	Annealed		175	590	P7	40	8	**O E**		175	20	**O E**	
		Heat-treated		285	960	P8	30	8	**O E**		130	20	**O E**	
		Heat-treated		380	1280	P9	20	8	**O E**		80	20	**O E**	
		Heat-treated		430	1480	P10	10	8	**O E**		50	20	**O E**	
	High-alloy steel and high-alloy tool steel	Annealed		200	680	P11	25	8	**O E**		110	20	**O E**	
		Hardened and tempered		300	1010	P12	20	8	**O E**		95	20	**O E**	
		Hardened and tempered		380	1280	P13	15	8	**O E**		65	20	**O E**	
	Stainless steel	Ferritic/martensitic, annealed		200	680	P14	25	8	**O E**		110	20	**O E**	
		Martensitic, heat-treated		330	1110	P15	20	8	**O E**		80	20	**O E**	
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	**O E**		120	20	**O E**	
		Pearlitic		260	700	K2	30	8	**O E**		95	20	**O E**	
	Grey cast iron	Low strength		180	200	K3	45	8	**O E**		145	20	**O E**	
		High strength/austenitic		245	350	K4	35	8	**O E**		120	20	**O E**	
	Cast iron with spheroidal graphite	Ferritic		155	400	K5	35	8	**O E**		120	20	**O E**	
		Pearlitic		265	700	K6	30	8	**O E**		95	20	**O E**	
	CGI			230	400	K7	35	8	**O E**		110	20	**O E**	
N	Wrought aluminium alloys	Not hardenable		30	–	N1	115	8	**O E**					
		Hardenable, hardened		100	340	N2	115	8	**O E**					
	Cast aluminium alloys	≤ 12% Si, not hardenable		75	260	N3	90	8	**O E**					
		≤ 12% Si, hardenable, hardened		90	310	N4	80	8	**O E**					
		> 12% Si, not hardenable		130	450	N5	65	8	**O E**					
	Magnesium-based alloys			70	250	N6	80	8	**O**					
	Copper and copper alloys (bronze/brass)	Non-alloyed, electrolytic copper		100	340	N7	80	8	**O E**					
		Brass, bronze, red brass		90	310	N8	65	8	**O E**					
		Copper alloys, short-chipping		110	380	N9	70	8	**O E**					
		High tensile, Ampco		300	1010	N10	20	8	**O E**					
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_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
45	8	**O E**		190	20	**O E**		24	8	**E O**		24	8	**E O**		14	8	**E O**		14	8	**E O**		8	8	**E O**	
40	8	**O E**		175	20	**O E**		22	8	**E O**		22	8	**E O**		14	8	**E O**		14	8	**E O**		8	8	**E O**	
40	8	**O E**		170	20	**O E**		21	8	**E O**		21	8	**E O**		13	8	**E O**		13	8	**E O**		8	8	**E O**	
40	8	**O E**		175	20	**O E**		22	8	**E O**		22	8	**E O**		14	8	**E O**		14	8	**E O**		8	8	**E O**	
30	8	**O E**		130	20	**O E**		16	8	**E O**		16	8	**E O**													
45	8	**O E**		190	20	**O E**		24	8	**E O**		24	8	**E O**		14	8	**E O**		14	8	**E O**		8	8	**E O**	
40	8	**O E**		175	20	**O E**		22	8	**E O**		22	8	**E O**		14	8	**E O**		14	8	**E O**		8	8	**E O**	
30	8	**O E**		130	20	**O E**		16	8	**E O**		16	8	**E O**		10	8	**E O**		10	8	**E O**		5	8	**E O**	
20	8	**O E**		80	20	**O E**		10	8	**O E**		10	8	**O E**													
10	8	**O E**		50	20	**O E**		6	8	**O E**		6	8	**O E**													
25	8	**O E**		110	20	**O E**		14	8	**E O**		14	8	**E O**		4	8	**E O**		4	8	**E O**		2	8	**E O**	
20	8	**O E**		95	20	**O E**		12	8	**E O**		12	8	**E O**													
15	8	**O E**		65	20	**O E**		8	8	**O E**		8	8	**O E**													
25	8	**O E**		110	20	**O E**		14	8	**E O**		14	8	**E O**		4	8	**E O**		4	8	**E O**		2	8	**E O**	
20	8	**O E**		80	20	**O E**		10	8	**E O**		10	8	**E O**													
								8	8			8	8														
								12	8			12	8														
								6	8			6	8														
35	8	**O E**		120	20	**O E**		20	8	**E O**		20	8	**E O**		11	8	**E O**		11	8	**E O**		6	8	**E O**	
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30	8	**O E**		95	20	**O E**		16	8	**E O**		16	8	**E O**		8	8	**E O**		8	8	**E O**		5	8	**E O**	
35	8	**O E**		110	20	**O E**		18	8	**E O**		18	8	**E O**		10	8	**E O**		10	8	**E O**		5	8	**E O**	
115	8	**O E**						63	10	**E O**		63	10	**E O**		28	10	**E O**		28	10	**E O**		16	10	**E O**	
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65	8	**O E**						36	10	**E O**		36	10	**E O**		17	10	**E O**		17	10	**E O**		10	10	**E O**	
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20	8	**O E**						12	10	**E O**		12	10	**E O**													
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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

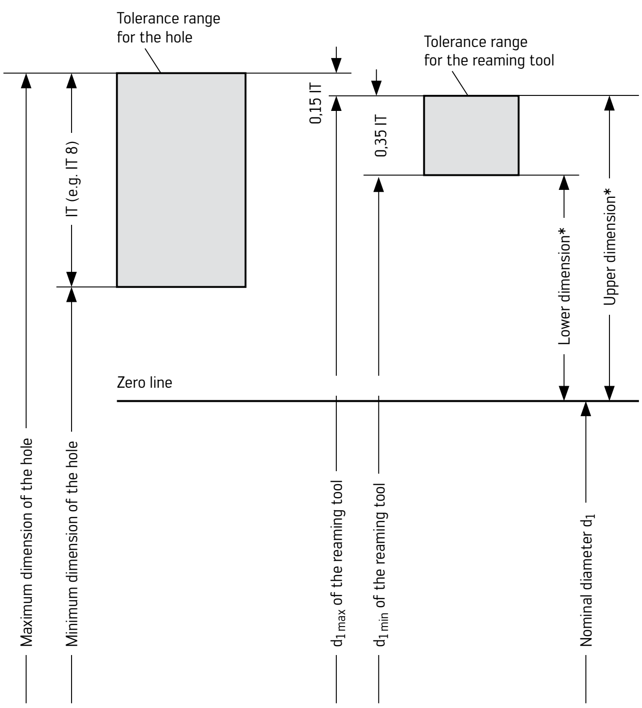
The manufacturing tolerances specified in the DIN 1420 standard are assigned to specific tolerance ranges for the holes to be reamed. In general, they ensure that the reamed hole is within the associated tolerance range and also ensure that the reaming tool can be used cost-effectively.

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 µm value, in order to ensure round µm 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

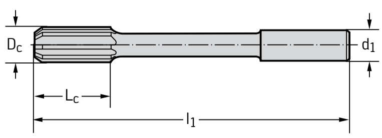
Maximum dimension of the reaming tool:
$D_{c\,max}$ = 20.033 - 0.005 = **20.028 mm**
Manufacturing tolerance of the reaming tool:
33% of the hole tolerance (0.35 IT 8) = 0.0115 mm
≈ 0.012 mm

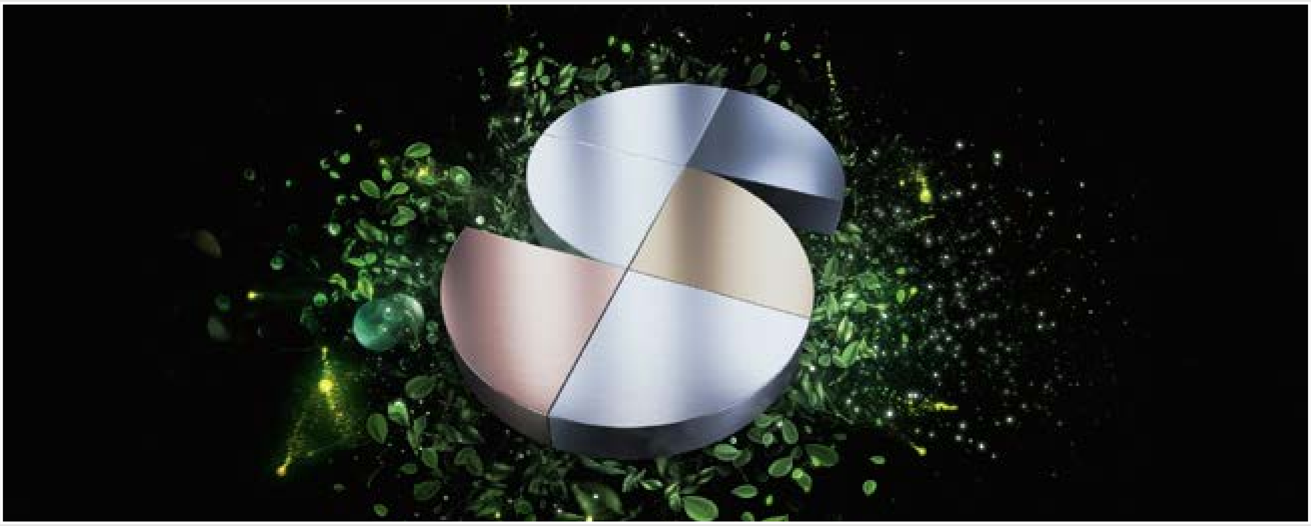
Minimum dimension of the reaming tool:
$D_{c\,min}$ = $D_{c\,max}$ - 0.35 IT 8
= 20.028 - 0.012 = **20.016 mm**

Dimensions for HSS reaming tools

Reaming tools with cylindrical shank

Walter designation	F11..			F13..			F12..		
D_c mm	DIN 206			DIN 212			DIN 859		
above – to	l_1	L_c	d_1 e9	l_1	L_c	d_1 h9	l_1	L_c	d_1 e9
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 products and services – certified and transparent

Walter is a company that takes responsibility for people and the environment. Sustainability is a central component of our corporate strategy. It pervades our products and business divisions and is reviewed and certified by independent third parties on a regular basis.

Proven to be produced to high standards

All processes, procedures, methods and instruments that we use are checked and certified by an independent body according to strict criteria. Occupational health and safety, quality assurance and environmentally friendly actions (for example through resource-saving, energy-efficient and CO_2-offset production) are examples of this. Our social commitment shows that Walter has a broader definition of responsibility.

Transparency throughout the entire process chain – for your peace of mind

The integrated management system at Walter includes the sustainable use of resources and production equipment as well as of people – our customers, partners and employees. So that you can count on all of our products meeting these requirements throughout the entire process chain, we apply our own benchmarks to our suppliers too.

Certification

The integrated management system at Walter includes certification in accordance with:

- ISO 9001 (Quality management)
- VDA 6.4 (Production equipment for the automotive industry)
- ISO 14001 (Environmental management)
- ISO 45001 (Occupational health and safety management)
- ISO 50001 (Energy management)

You can find more information on Walter certification here:

Occupational health and safety
Walter protects its employees against health hazards. To prevent accidents, we continuously review our processes and take proactive measures as a precaution.

Environmental and energy management
Environmental protection is an important company objective for Walter. We use energy efficiently and deploy practical methods to sustainably reduce the consumption of energy, water and resources.

Quality management
Walter is continuously improving its products and processes. We ensure our product quality using effective measures and procedures – and check it on a regular basis with our comprehensive quality management system.

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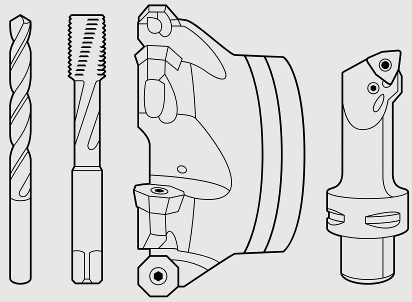

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