Product handbook

Drilling

_ THE TECHNOLOGY OF GAINING BENEFIT

Competence in solid carbide drilling

CONTENTS

Drilling

Competence in solid carbide drilling

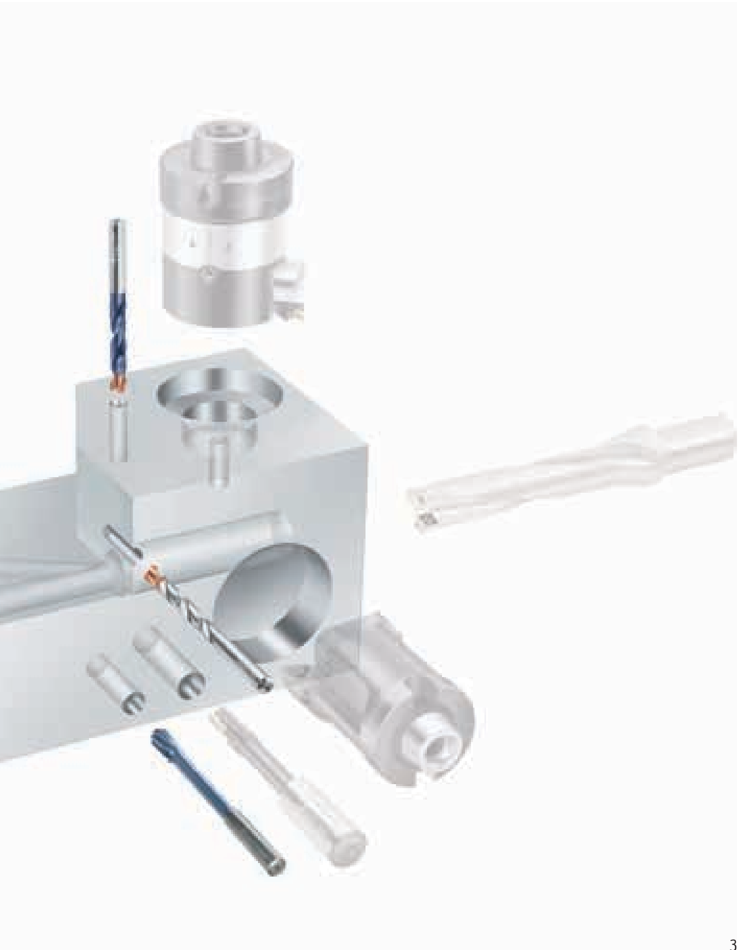
This is the strength of **Walter Titex**. Founded in 1890 in Frankfurt am Main by Ludwig Günther, the brand draws on over 120 years' experience in drilling metals.

Numerous innovations mark **Walter Titex**'s successful journey. At the start of the twentieth century, the brand succeeded in using carbide tools to reach drilling depths that had been thought impossible. Thanks to its experiences in HSS, **Walter Titex** was a global pioneer among manufacturers in this sector.

The tools made by the competence brand are highly economical in that the cost of drilling each hole is low without compromising on hole quality.

Some things do not change with time: Our promise to deliver a standard of service that matches our outstanding tools, so that our customers can draw even greater benefit from them, has not changed since 1890.

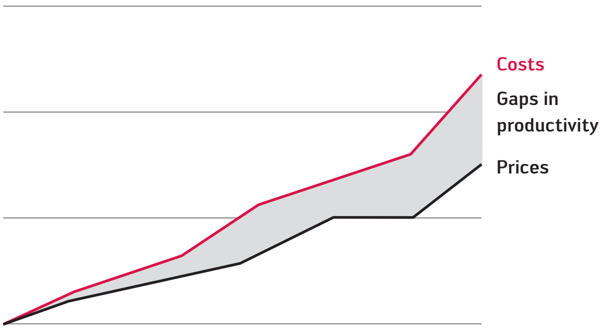
Should you require more detailed information about our products, we have provided page references to sections within **this handbook** (HB), to the **Walter General Catalog 2012** (GC) and to the **Walter Supplementary Catalog 2014** (SC).



Productivity – Gaps in productivity – Costs pie chart

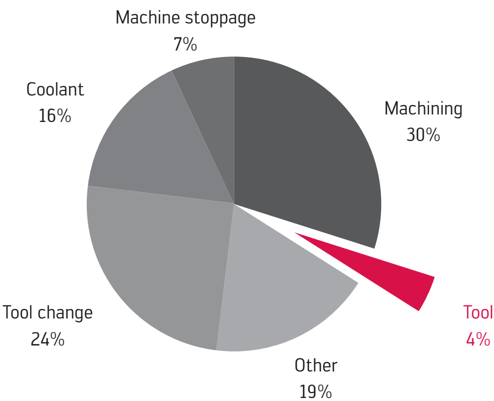
Gaps in productivity

In most sectors, the general increase in costs is higher than the increase in price of products on the market. We can help you to close these "gaps in productivity".



Costs pie chart

Tool costs account for approx. 4% of machining costs.



Productivity

Productivity is understood as the relationship between the unit of input and the rate of output. The aim is always to achieve the greatest possible output from the least possible input.

→ $\frac{\text{output}}{\text{input}}$

The basic premise of “tool economics”: The price of a tool accounts for only 4% of the total manufacturing costs. However its efficiency affects the remaining 96%.

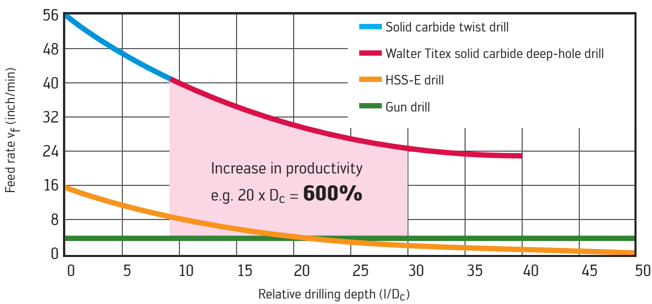
Example 1:

A 25% decrease in the price of a tool only results in a 1% saving in the total manufacturing costs. By contrast, a 30% increase in the cutting data reduces the total manufacturing costs by 10%.

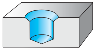
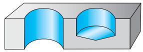
→ 1 : 10

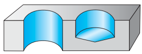
Example 2:

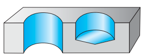
Potential increase in productivity gained by using Walter Titex solid carbide deep-hole drills.



Solid carbide drills with internal cooling

Operation				
Drilling depth	**3 x D_c**		**3 x D_c**	
Designation	**K3299XPL**	**K3899XPL**	**A3289DPL**	**A3293TTP**
Type	X·treme Step 90	X·treme Step 90	X·treme Plus	X·treme Inox
Ø range (mm)	3.30 – 14.00	3.30 – 14.00	3.00 – 20.00	3.00 – 20.00
Shank	DIN 6535 HA	DIN 6535 HE	DIN 6535 HA	DIN 6535 HA
Page	SC **B-21**	SC **B-23**	GC **B 66**	SC **B-8**
				

Operation				
Drilling depth	**5 x D_c**			
Designation	**A3382XPL**	**A3399XPL**	**A3999XPL**	**A3387**
Type	X·treme CI	X·treme	X·treme	Alpha® Jet
Ø range (mm)	3.00 – 20.00	3.00 – 25.00	3.00 – 25.00	4.00 – 20.00
Shank	DIN 6535 HA	DIN 6535 HA	DIN 6535 HE	DIN 6535 HA
Page	GC **B 81**	GC **B 82**	GC **B 115**	GC **B 85**
				

Operation				
Drilling depth	**8 x D_c**		**12 x D_c**	
Designation	**A3486TIP**	**A3586TIP**	**A6589AMP**	**A6588TML**
Type	Alpha® 44	Alpha® 44	X·treme DM12	Alpha® 4 Plus Micro
Ø range (mm)	5.00 – 12.00	5.00 – 12.00	2.00 – 2.90	1.00 – 1.90
Shank	DIN 6535 HA	DIN 6535 HE	DIN 6535 HA	DIN 6535 HA
Page	GC **B 97**	GC **B 99**	GC **B 131**	GC **B 130**
				

Page information refers to:
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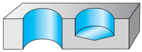
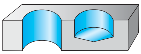
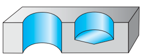
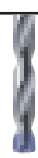


3 x D_c		5 x D_c		
A3299XPL	**A3899XPL**	**A3389AML**	**A3389DPL**	**A3393TTP**
X·treme	X·treme	X·treme M	X·treme Plus	X·treme Inox
3.00 – 20.00	3.00 – 20.00	2.00 – 2.95	3.00 – 20.00	3.00 – 20.00
DIN 6535 HA	DIN 6535 HE	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
GC **B 69**	GC **B 105**	GC **B 86**	GC **B 87**	SC **B-11**
				

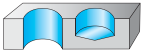
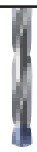


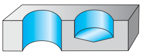
5 x D_c	8 x D_c			
A3384	**A6489AMP**	**A6488TML**	**A6489DPP**	**A3487**
Alpha® Ni	X·treme DM8	Alpha® 4 Plus Micro	X·treme D8	Alpha® Jet
3.00 – 12.00	2.00 – 2.95	0.75 – 1.95	3.00 – 20.00	5.00 – 20.00
DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
GC **B 84**	GC **B 126**	GC **B 124**	GC **B 127**	GC **B 98**
				



12 x D_c		16 x D_c	
A6589DPP	**A3687**	**A6689AMP**	**A6685TFP**
X·treme D12	Alpha® Jet	X·treme DM16	Alpha® 4 XD16
3.00 – 20.00	5.00 – 20.00	2.00 – 2.90	3.00 – 16.00
DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
GC **B 132**	GC **B 100**	SC **B-15**	GC **B 135**
			

Solid carbide drills with internal cooling

Operation				
Drilling depth	**20 x D_c**			**25 x D_c**
Designation	**A6789AMP**	**A6794TFP**	**A6785TFP**	**A6889AMP**
Type	X·treme DM20	X·treme DH20	Alpha® 4 XD20	X·treme DM25
Ø range (mm)	2.00 – 2.90	3.00 – 10.00	3.00 – 16.00	2.00 – 2.90
Shank	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
Page	SC **B-16**	GC **B 138**	GC **B 136**	SC **B-17**
				

Operation		
Drilling depth	**40 x D_c**	**50 x D_c**
Designation	**A7495TTP**	**A7595TTP**
Type	X·treme D40	X·treme D50
Ø range (mm)	4.50 – 11.00	4.50 – 9.00
Shank	DIN 6535 HA	DIN 6535 HA
Page	SC **B-19**	HB **49**, HB **68**
		

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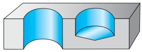
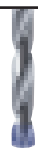
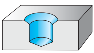
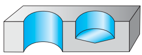
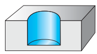
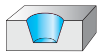
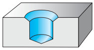
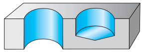
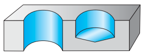
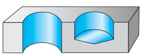
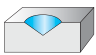
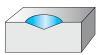
			
25 x D_c	30 x D_c		
A6885TFP	**A6989AMP**	**A6994TFP**	**A6985TFP**
Alpha® 4 XD25	X·treme DM30	X·treme DH30	Alpha® 4 XD30
3.00 – 12.00	2.00 – 2.90	3.00 – 10.00	3.00 – 12.00
DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
GC **B 139**	SC **B-18**	GC **B 142**	GC **B 141**
			

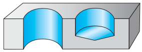
				
Pilot				
K3281TFT	**A6181AML**	**A6181TFT**	**A7191TFT**	**K5191TFT**
X·treme Pilot Step 90	X·treme Pilot 150	XD Pilot	X·treme Pilot 180	X·treme Pilot 180C
3.00 – 16.00	2.00 – 2.95	3.00 – 16.00	3.00 – 20.00	4.00 – 7.00
DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA	DIN 6535 HA
SC **B-20**	SC **B-14**	GC **B 121**	GC **B 143**	GC **B 145**
				

Solid carbide drills without internal cooling

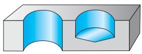
Operation				
Drilling depth	**3 x D_c**	**3 x D_c**		
Designation	**K3879XPL**	**A3279XPL**	**A3879XPL**	**A3269TFL**
Type	X·treme Step 90	X·treme	X·treme	Alpha® Rc
Ø range (mm)	3.30 – 14.50	3.00 – 20.00	3.00 – 20.00	3.40 – 10.40
Shank	DIN 6535 HE	DIN 6535 HA	DIN 6535 HE	DIN 6535 HA
Page	SC **B-27**	GC **B 62**	GC **B 101**	GC **B 61**
				

Operation				
Drilling depth	**5 x D_c**			
Designation	**A3378TML**	**A3162**	**A3379XPL**	**A3979XPL**
Type	Alpha® 2 Plus Micro	ESU	X·treme	X·treme
Ø range (mm)	0.50 – 2.95	0.10 – 1.45	3.00 – 25.00	3.00 – 25.00
Shank	DIN 6535 HA	Parallel shank	DIN 6535 HA	DIN 6535 HE
Page	GC **B 75**	GC **B 59**	GC **B 77**	GC **B 111**
				

Operation				
Drilling depth	**3 x D_c – Carbide-tipped**		**NC spot drill**	
Designation	**A2971**	**A5971**	**A1174**	**A1174C**
Type	Carbide	Carbide	90°	120°
Ø range (mm)	3.00 – 16.00	8.00 – 32.00	3.00 – 20.00	3.00 – 20.00
Shank	Parallel shank	Morse taper	Parallel shank	Parallel shank
Page	GC **B 58**	GC **B 119**	GC **B 53**	GC **B 54**
				



3 x D_c					
A1164TIN	**A1163**	**A1166TIN**	**A1166**	**A1167A**	**A1167B**
Alpha® 2	N	Maximiza	Maximiza	Maximiza	Maximiza
1.50 – 20.00	1.00 – 12.00	3.00 – 20.00	3.00 – 20.00	3.00 – 20.00	3.00 – 20.00
Parallel shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank
GC **B 38**	GC **B 36**	GC **B 46**	GC **B 42**	GC **B 47**	GC **B 50**
					



5 x D_c		8 x D_c		
A3367	**A3967**	**A6478TML**	**A1276TFL**	**A1263**
BSX	BSX	Alpha® 2 Plus Micro	Alpha® 22	N
3.00 – 16.00	3.00 – 16.00	0.50 – 2.95	3.00 – 12.00	0.60 – 12.00
DIN 6535 HA	DIN 6535 HE	DIN 6535 HA	Parallel shank	Parallel shank
GC **B 73**	GC **B 109**	GC **B 122**	GC **B 57**	GC **B 55**
				

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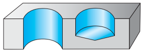
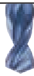
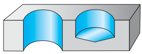
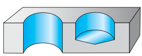
HSS drills

Operation				
Drilling depth	**~ 3 x D_c**			
Designation	**A1149XPL**	**A1149TFL**	**A1154TFT**	**A1148**
Dimensions	DIN 1897	DIN 1897	DIN 1897	DIN 1897
Type	UFL®	UFL®	VA Inox	UFL®
Ø range (mm)	1.00 – 20.00	1.00 – 20.00	2.00 – 16.00	1.00 – 20.00
Shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank
Page	GC **B 169**	GC **B 164**	GC **B 174**	GC **B 159**
				

Operation					
Drilling depth	**~ 8 x D_c**				
Designation	**A1249XPL**	**A1249TFL**	**A1254TFT**	**A1247**	**A1244**
Dimensions	DIN 338	DIN 338	DIN 338	DIN 338	DIN 338
Type	UFL®	UFL®	VA Inox	Alpha® XE	VA
Ø range (mm)	1.00 – 16.00	1.00 – 20.00	3.00 – 16.00	1.00 – 16.00	0.30 – 15.00
Shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank
Page	GC **B 218**	GC **B 214**	GC **B 222**	GC **B 210**	GC **B 205**
					

Operation				
Drilling depth	**~ 12 x D_c**			
Designation	**A1549TFP**	**A1547**	**A1544**	**A1522**
Dimensions	DIN 340	DIN 340	DIN 340	DIN 340
Type	UFL®	Alpha® XE	VA	UFL®
Ø range (mm)	1.00 – 12.00	1.00 – 12.70	1.00 – 12.00	1.00 – 22.225
Shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank
Page	GC **B 236**	GC **B 233**	GC **B 231**	GC **B 227**
				

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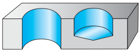
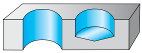
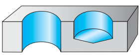


~ 3 x D_c		~ 5 x D_c		
A1111	**A2258**	**A3143**	**A3153**	**A6292TIN**
DIN 1897	Walter standard	DIN 1899	DIN 1899	Walter standard
N	UFL® left	ESU	ESU left	MegaJet
0.50 – 32.00	1.00 – 20.00	0.05 – 1.45	0.15 – 1.4	5.00 – 24.00
Parallel shank	Parallel shank	Parallel shank	Parallel shank	DIN 1835 E
GC **B 147**	GC **B 245**	GC **B 249**	GC **B 251**	GC **B 275**
				

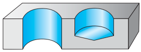


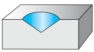
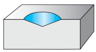
~ 8 x D_c					
A1222	**A1211TIN**	**A1211**	**A1212**	**A1234**	**A1231**
DIN 338	DIN 338	DIN 338	DIN 338	DIN 338	DIN 338
UFL®	N	N	H	UFL® left	N left
1.00 – 16.00	0.50 – 16.00	0.20 – 22.00	0.40 – 16.00	1.016 – 12.70	0.20 – 20.00
Parallel shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank	Parallel shank
GC **B 191**	GC **B 186**	GC **B 177**	GC **B 188**	GC **B 201**	GC **B 196**
					

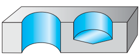


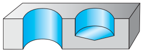
~ 12 x D_c	~ 16 x D_c	~ 22 x D_c	~ 30 x D_c
A1511	**A1622**	**A1722**	**A1822**
DIN 340	DIN 1869-I	DIN 1869-II	DIN 1869-III
N	UFL®	UFL®	UFL®
0.50 – 22.00	2.00 – 12.70	3.00 – 12.00	3.50 – 12.00
Parallel shank	Parallel shank	Parallel shank	Parallel shank
GC **B 224**	GC **B 238**	GC **B 241**	GC **B 242**
			

HSS drills

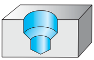
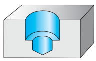
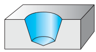
Operation					
Drilling depth	**~ 60 x D_c**	**~ 85 x D_c**	**~ 8 x D_c**		
Designation	**A1922S**	**A1922L**	**A4211TIN**	**A4211**	**A4244**
Dimensions	Walter standard	Walter standard	DIN 345	DIN 345	DIN 345
Type	UFL®	UFL®	N	N	VA
Ø range (mm)	6.00 – 14.00	8.00 – 12.00	5.00 – 30.00	3.00 – 100.00	10.00 – 32.00
Shank	Parallel shank	Parallel shank	Morse taper	Morse taper	Morse taper
Page	GC **B 244**	GC **B 243**	GC **B 261**	GC **B 253**	GC **B 262**
					

Operation		
	NC spot drill	
Designation	**A1115 · A1115S · A1115L**	**A1114 · A1114S · A1114L**
Dimensions	Walter standard	Walter standard
Type	90°	120°
Ø range (mm)	2.00 – 25.40	2.00 – 25.40
Shank	Parallel shank	Parallel shank
Page	GC **B 155**	GC **B 152**
		

Operation	
	Twist drill set
Dimensions	**DIN 338**
Type	N; VA; UFL®
Shank	Parallel shank
Page	GC **B 352**

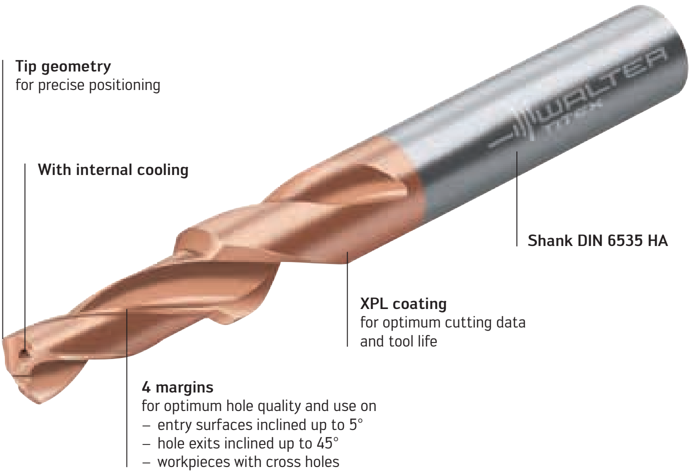


~ 8 x D_c	~ 12 x D_c		~ 16 x D_c		~ 22 x D_c
A4247	**A4422**	**A4411**	**A4622**	**A4611**	**A4722**
DIN 345	DIN 341	DIN 341	DIN 1870-I	DIN 1870-I	DIN 1870-II
Alpha® XE	UFL®	N	UFL®	N	UFL®
10.00 – 40.00	10.00 – 31.00	5.00 – 50.00	12.00 – 30.00	8.00 – 50.00	8.00 – 40.00
Morse taper	Morse taper	Morse taper	Morse taper	Morse taper	Morse taper
GC **B 264**	GC **B 269**	GC **B 266**	GC **B 273**	GC **B 271**	GC **B 274**
					

				
Multi-diameter step drill			**Taper pin drill**	
K6221	**K6222**	**K6223**	**K2929**	**K4929**
DIN 8374	DIN 8378	DIN 8376	DIN 1898 A	DIN 1898 B
90°	90°	180°		
3.20 – 8.40	2.50 – 10.20	4.50 – 11.00	1.00 – 12.00	5.00 – 25.00
Parallel shank	Parallel shank	Parallel shank	Parallel shank	Morse taper
GC **B 279**	GC **B 288**	GC **B 281**	GC **B 277**	GC **B 278**
				

Page information refers to:
HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

Walter Titex X·treme Step 90



Walter Titex X·treme Step 90 **Type:** K3299XPL, HA shank, 3 x D_C

The tool

- Solid carbide high-performance chamfer drill with and without internal cooling
- XPL coating
- Diameter range 3.3 to 14.5 mm
  - Core hole diameter: M4–M16 x 1.5 mm
- Step length in accordance with DIN 8378
- Shank in accordance with DIN 6535 HA and HE

The application

- For thread/core hole diameters
- For ISO material groups P, M, K, N, S, H
- Can be used with emulsion and oil
- Can be used for inclined exits and cross holes
- Can be used for inclined and convex surfaces
- For use in general mechanical engineering, mold and die making, and the automotive and energy industries

Watch product video:
Scan this QR code
or go directly to
http://goo.gl/MvBTg

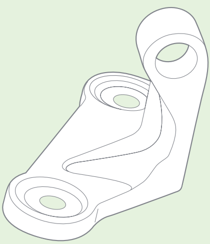
Benefits for you

- 50% higher productivity
- Can be universally used for all material groups as well as for cross holes and inclined exits
- Improved hole quality thanks to the 4 margins

Walter Titex X·treme Step 90

Types: K3899XPL, HE shank, 3 x D_C
K3299XPL, HA shank, 3 x D_C
K3879XPL, HE shank, 3 x D_C

Module hinge



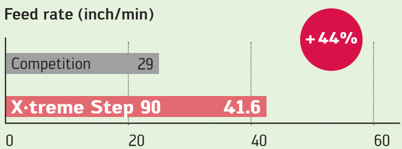
Workpiece material: St52

Tool: **X·treme Step 90**
K3299XPL-M8
Diameter 6.8 mm

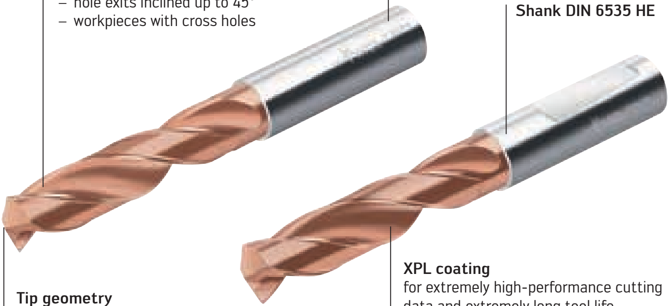
Cutting data

	Competition	X·treme Step 90
Cutting speed v_c	321 SFM	321 SFM
N	4600 rpm	4600 rpm
Feed f	0.006 inch/rev	0.009 inch/rev
Feed rate v_f	29 inch/min	41.6 inch/min

Feed rate (inch/min)



Walter Titex X·treme – without internal cooling



Walter Titex X·treme

Types: A3279XPL, HA shank, 3 x D_C
A3879XPL, HE shank, 3 x D_C

The tool

- Solid carbide high-performance drill with internal cooling
- XPL coating
- 140° point angle
- Dimensions to
  - DIN 6537 K → 3 x D_C
  - DIN 6537 L → 5 x D_C
- Diameter range 3 to 25 mm
- Shank in accordance with DIN 6535 HA and HE

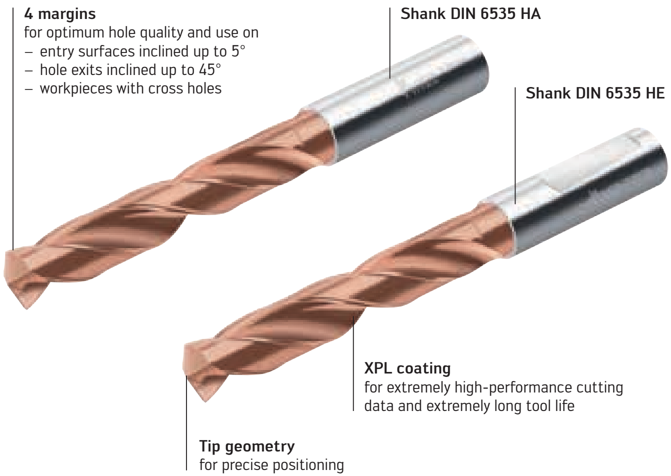
The application

- For all ISO material groups P, M, K, N, S, H
- Can be used with emulsion and oil
- Can be used for inclined exits and cross holes
- Can be used for inclined and convex surfaces
- For use in general mechanical engineering, mold and die making, and the automotive and energy industries

Watch product video:
Scan this QR code
or go directly to
http://goo.gl/dzSSy

Benefits for you

- 50% higher productivity
- Can be universally used for all material groups as well as for cross holes and inclined exits
- Improved hole quality thanks to the 4 margins



Walter Titex X·treme

Types: A3379XPL, HA shank, 5 x D_c
A3979XPL, HE shank, 5 x D_c

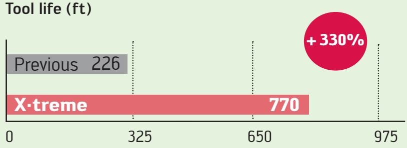
Magnetic core for controllers

Workpiece material:	C15
Tool:	**X·treme** A3279XPL-12.5 Diameter 12.5 mm

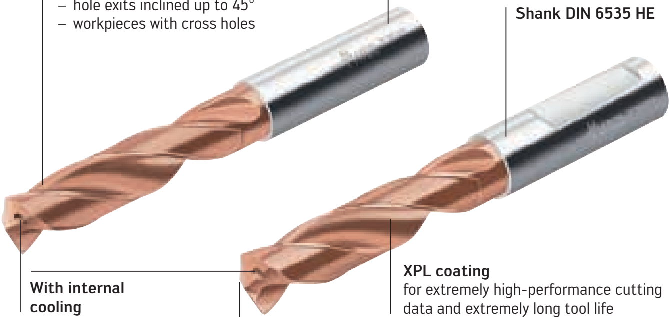
Cutting data

	Previous	X·treme
Cutting speed v_c	400 SFM	400 SFM
N	3107 rpm	3107 rpm
Feed f	0.009 inch/rev	0.009 inch/rev
Feed rate v_f	28.1 inch/min	28.1 inch/min

Tool life (ft)



Walter Titex X·treme – with internal cooling



Walter Titex X·treme

Types: A3299XPL, HA shank, 3 x D_C
A3899XPL, HE shank, 3 x D_C

The tool

- Solid carbide high-performance drill with internal cooling
- XPL coating
- 140° point angle
- Dimensions to
  - DIN 6537 K → 3 x D_C
  - DIN 6537 L → 5 x D_C
- Diameter range 3 to 25 mm
- Shank in accordance with DIN 6535 HA and HE

The application

- For all ISO material groups P, M, K, N, S, H
- Can be used with emulsion and oil
- Can be used for inclined exits and cross holes
- Can be used for inclined and convex surfaces
- For use in general mechanical engineering, mold and die making, and the automotive and energy industries

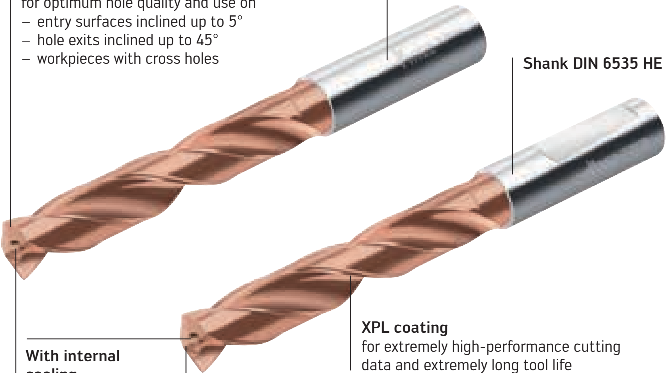
Benefits for you

- 50% higher productivity
- Can be universally used for all material groups as well as for cross holes and inclined exits
- Improved hole quality thanks to the 4 margins

4 margins
for optimum hole quality and use on
– entry surfaces inclined up to 5°
– hole exits inclined up to 45°
– workpieces with cross holes

Shank DIN 6535 HA

Shank DIN 6535 HE



With internal cooling

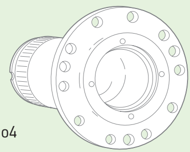
XPL coating
for extremely high-performance cutting data and extremely long tool life

Tip geometry
for precise positioning

Walter Titex X·treme

Types: A3399XPL, HA shank, 5 x D_c
A3999XPL, HE shank, 5 x D_c

Transmission shaft:
Flange drilling



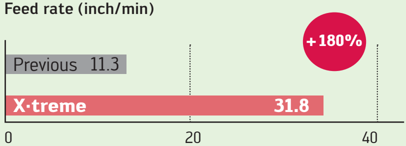
Workpiece material: 42CrMo4

Tool: **X·treme**
A3399XPL-6.8
Diameter 6.8 mm

Cutting data

	Previous	X·treme
Cutting speed v_c	183 SFM	299 SFM
N	2621 rpm	4260 rpm
Feed f	0.004 inch/rev	0.007 inch/rev
Feed rate v_f	11.3 inch/min	31.8 inch/min

Feed rate (inch/min)



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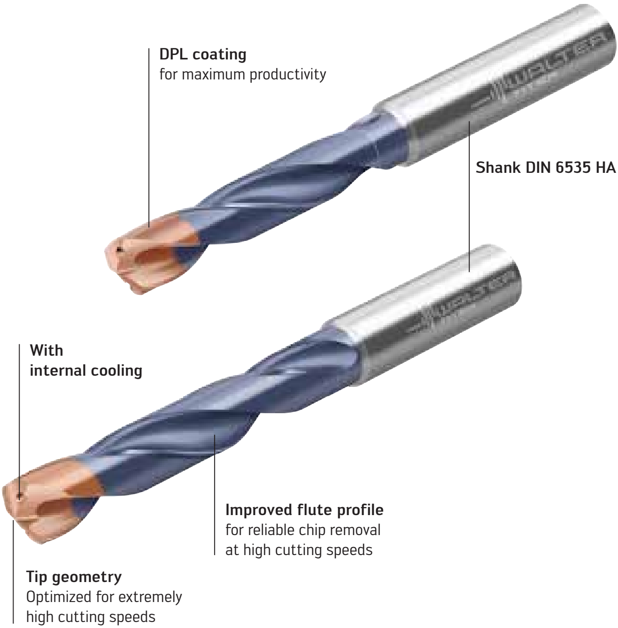
Walter Titex X·treme Plus



Walter Titex X·treme Plus

Types: A3289DPL, HA shank, 3 x D_C
A3389DPL, HA shank, 5 x D_C

The tool

– Solid carbide high performance drill with internal coolant supply
– New type of multifunctional double coating (DPL: “Double Performance Line”)
– 140° point angle
– Dimensions in accordance with
  • DIN 6537 K → 3 x D_C
  • DIN 6537 L → 5 x D_C
– Diameter range 3 to 20 mm
– Shank according to DIN 6535 HA

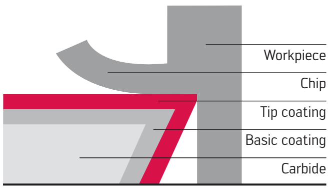
The application

– For all ISO material groups P, M, K, S, H (N)
– Can be used with emulsion, oil and minimum quantity lubrication
– For use in general mechanical engineering, in mold and die making, and the automotive and energy industries

With this tool, Walter Titex is setting new standards in drilling with solid carbide tools. The drill incorporates a wealth of innovations – including the new multifunctional double coating (DPL) that has outstanding properties. With Walter Titex X·treme Plus you can increase productivity in the series production of steel components.

Benefits for you

- Maximum productivity: At least double that achievable using conventional tools (greater productivity, lower production costs)
- Alternatively: Double the tool life with conventional cutting data (e.g. fewer tool changes)
- Excellent surface finish
- High process reliability
- Varied application possibilities with regard to materials and application (e.g. MQL)
- Ensures spare machine capacity



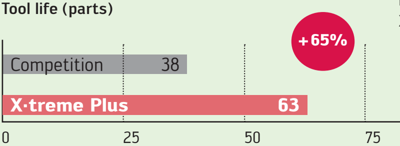
Example

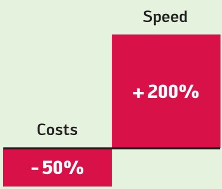
Workpiece material: 42CrMo4

Tool: **X·treme Plus**
A3389DPL-8.5
Diameter 8.5 mm

	Competition	**X·treme Plus**
Feed rate v_f	15.4 inch/min	57.5 inch/min
Tool life	38 parts	63 parts

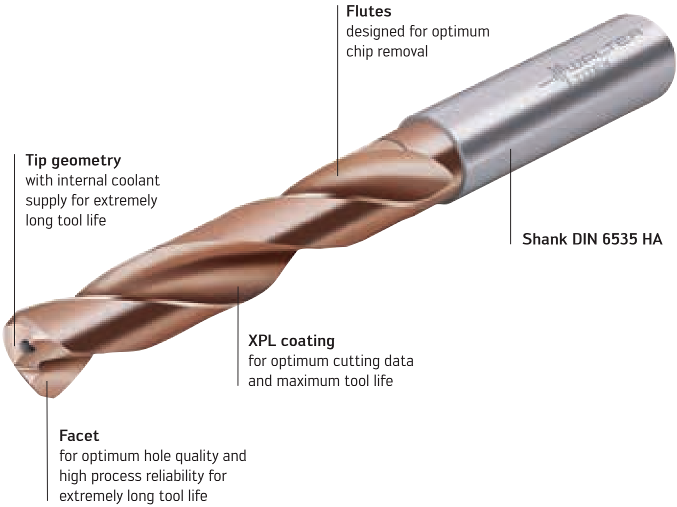
Tool life (parts)





Cost savings and increases in productivity with the X·treme Plus

Walter Titex X·treme CI



Walter Titex X·treme CI — **Type:** A3382XPL, HA shank, 5 x D_C

The tool

– Solid carbide high-performance drill with internal cooling
– XPL coating
– 140° point angle
– Dimensions according to
  - DIN 6537 L → 5 x D_C
– Diameter range 3 to 20 mm
– Shank according to DIN 6535 HA

The application

– For ISO material group K
– Can be used with emulsion, oil, minimum quantity lubrication and dry machining
– For use in general mechanical engineering, in mold and die making, and in the automotive and energy industries

Benefits for you

- Increase in productivity thanks to 50% higher workpiece values in comparison with conventional solid carbide drills
- Optimum hole quality for blind holes and through holes thanks to special facet → no chipping at the hole exit
- High process reliability thanks to very even wear behavior when machining cast iron materials

Bearing cap:
Drilling of flange holes

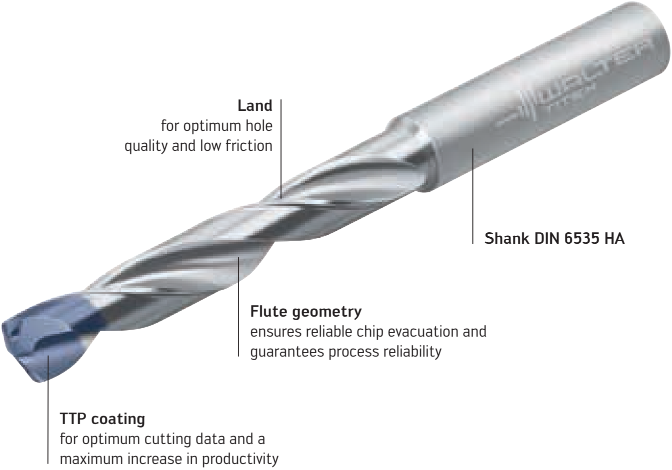
Workpiece material:	GJS–400
Tool:	**X·treme CI** A3382XPL-18.5 Diameter 18.5 mm
Drilling depth:	60 mm

Cutting data

	X·treme CI
Cutting speed v_c	394 SFM
N	2065 rpm
Feed f	0.020 inch
Feed rate v_f	40.6 inch/min

Flank face wear
after 1020 ft drill travel

Walter Titex X·treme Inox



Walter Titex X·treme Inox — **Type:** A3393TTP, HA shank, 5 x D_C

The tool

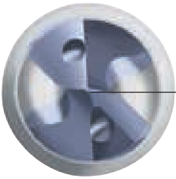
- Solid carbide high-performance drill
- TTP coating
- Dimensions to
  - DIN 6537 K → 3 x D_C
  - DIN 6537 L → 5 x D_C
- Diameter range 3 to 20 mm
- Shank according to DIN 6535 HA

The application

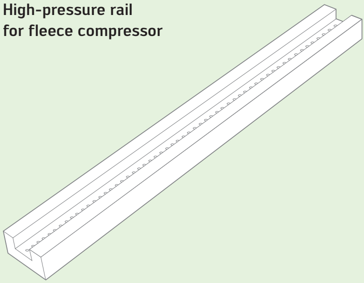
- For ISO material group M
- Can be used with emulsion and oil
- For use in general mechanical engineering and in the automotive, aerospace, medical, food and valve industries

Benefits for you

- Reduced cutting forces due to new type of geometry
- Significant increase in productivity over universal drilling tools
- Low burr formation on entry and exit
- Excellent surface quality on component
- Stable main cutting edges guarantee maximum process reliability



High-pressure rail for fleece compressor

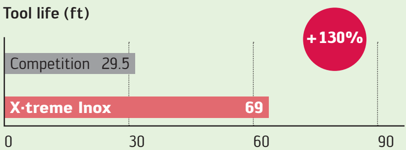


Workpiece material: 1.4542
Tool: **X·treme Inox**
A3393TTP-14.2
Diameter 14.2 mm

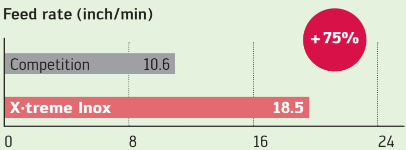
Cutting data

	Competition	**X·treme Inox**
Cutting speed v_c	200 SFM	230 SFM
N	1345 rpm	1570 rpm
Feed f	0.008 inch/rev	0.012 inch/rev
Feed rate v_f	10.6 inch/min	18.5 inch/min

Tool life (ft)



Feed rate (inch/min)



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http://goo.gl/96NSH

Walter Titex X·treme M, DM8..30

Watch product video:
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or go directly to
http://goo.gl/FmrPC

The tool

- Solid carbide high-performance drill with internal cooling
- AML coating (AlTiN)
- AMP coating (AlTiN tip coating)
- Available in the following sizes:
  - 2 x D_C X·treme Pilot 150
  - 5 x D_C X·treme M
  - 8 x D_C X·treme DM8
  - 12 x D_C X·treme DM12
  - 16 x D_C X·treme DM16
  - 20 x D_C X·treme DM20
  - 25 x D_C X·treme DM25
  - 30 x D_C X·treme DM30
- Diameter range 2 to 2.95 mm
- Shank according to DIN 6535 HA

The application

- ISO material groups P, M, K, N, S, H, O
- Drilling with emulsion and oil
- For use in general mechanical engineering, mold and die making, and the automotive and energy industries

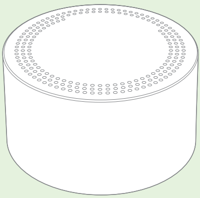
Benefits for you

- Measurable increases in productivity due to machining values which are up to 50% higher than conventional solid carbide micro-drills
- New types of point and flute geometry ensure high process reliability
- Polished flutes ensure reliable chip evacuation

Demo component

Workpiece material:
1.4571

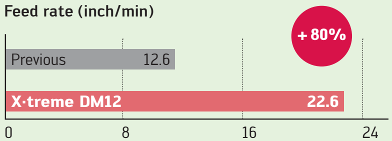
Tool:
X·treme DM12
A6589AMP-2
Diameter 2 mm



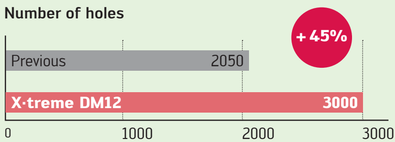
Cutting data

	Previous	X·treme DM12
Cutting speed v_c	165 SFM	200 SFM
N	7960 rpm	9550 rpm
Feed f	0.0015 inch/rev	0.002 inch/rev
Feed rate v_f	12.6 inch/min	22.6 inch/min

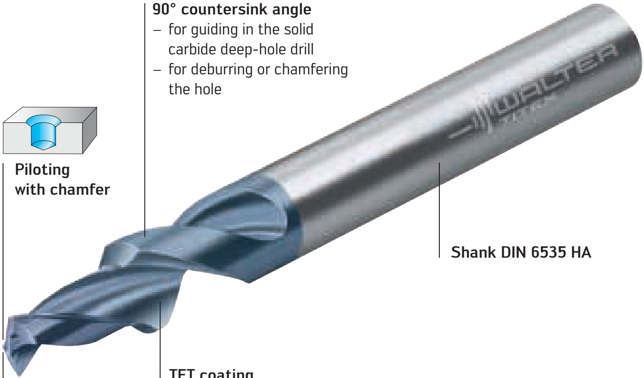
Feed rate (inch/min)



Number of holes



Walter Titex X·treme Pilot Step 90



Walter Titex X·treme Pilot Step 90 **Type:** K3281TFT, HA shank, 2 x D_C

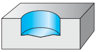
The tool

- Solid carbide high-performance chamfering pilot drill with internal cooling
- TFT coating
- 150° point angle
- 90° countersink angle
- Dimensions according to Walter standard
- Drilling depth
  - 2 x D_C
- Diameter range 3 to 16 mm
- Shank according to DIN 6535 HA

The application

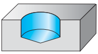
- For the ISO material groups P, M, K, N, S, H
- Step pilot drill for solid carbide deep-hole drills from the Alpha® and X·treme drill families for drilling depths of approx. 12 x D_C
- Can be used with emulsion and oil
- For use in general mechanical engineering, in the hydraulic industry, in mold and die making, and in the automotive and energy industries

Other Walter Titex pilot drills



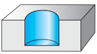
Cylindrical piloting

Type: A6181TFT



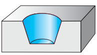
Cylindrical piloting

Type: A6181AML

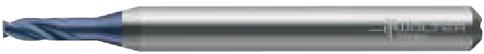


Cylindrical piloting

Type: A7191TFT



Conical piloting

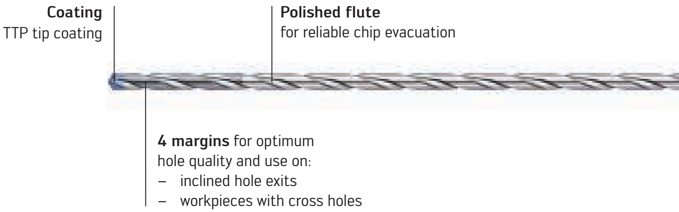


Type: K5191TFT

Benefits for you

- Higher process reliability and tool life in deep-hole drilling
- Significantly reduced hole run-off
- No tolerance overlaps with solid carbide deep-hole drills
- High positioning accuracy as a result of a short chisel edge width

Walter Titex XD70 Technology



The tool

- Solid carbide high-performance drill with internal cooling
- TTP tip coating
- Dimensions:
  - Up to 50 x D_c as a standard tool
  - 60-70 x D_c as a special tool
- Diameter range 4.5 to 12 mm
- Shank according to DIN 6535 HA

The application

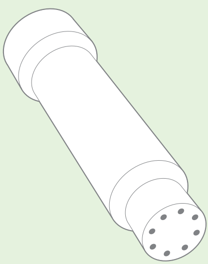
- For the ISO material groups P, K, N (M, S)
- Can be used with emulsion and oil
- For use in general mechanical engineering, mold and die making, and the automotive and energy industries

Piston rod

Workpiece material:
St 52-3

Tool:
Diameter 7 mm

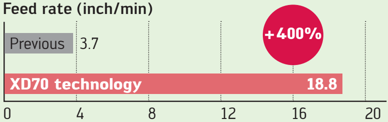
Drilling depth:
450 mm–65 x D_c



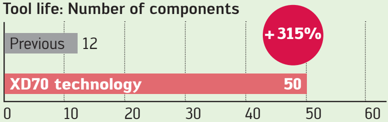
Cutting data

	Previous Gun drill	XD70 technology
Cutting speed v_c	230 SFM	230 SFM
N	3185 rpm	3185 rpm
Feed f	0.0012 inch/rev	0.006 inch/rev
Feed rate v_f	3.7 inch/min	18.8 inch/min
Tool life	12 components	50 components

Feed rate (inch/min)



Tool life: Number of components



70 x D_C as special tool

Standard range

X·treme D50 – 50 x D_C

X·treme D40 – 40 x D_C

Alpha®4 XD30 – 30 x D_C

Alpha®4 XD25 – 25 x D_C

Alpha®4 XD20 – 20 x D_C

Alpha®4 XD16 – 16 x D_C

Benefits for you

- Up to 10-times higher productivity than gun drills
- Drilling without pecking
- Maximum process reliability at deep drilling depths
- Suitable for use with low coolant pressures from 290 PSI
- Can be used with various material groups such as ISO P, K, N (M, S)
- Can be used for cross holes and inclined exits

Watch product video:
Scan this QR code or go directly to http://goo.gl/yQB64

Watch product animation:
Scan this QR code or go directly to http://goo.gl/ZBIMm

Walter Select for carbide and HSS drilling tools

Step by step to the right tool

STEP 1

Define the **material** to be machined, see GC page **H 8** onwards.

Note the **machining group** that corresponds to your material e.g.: K5.

Identi-fication letters	Machining group	Groups of the materials to be machined	
P	**P1–P15**	**Steel**	All types of steel and cast steel, with the exception of steel with an austenitic structure
M	**M1–M3**	**Stainless steel**	Stainless austenitic steel, austenitic-ferritic steel and cast steel
K	**K1–K7**	**Cast iron**	Grey cast iron, cast iron with spheroidal graphite, malleable cast iron, cast iron with vermicular graphite
N	**N1–N10**	**NF metals**	Aluminum and other non-ferrous metals, non-ferrous materials
S	**S1–S10**	**Super alloys and titanium alloys**	Heat-resistant special alloys based on iron, nickel and cobalt, titanium and titanium alloys
H	**H1–H4**	**Hard materials**	Hardened steel, hardened cast iron materials, chilled cast iron
O	**O1–O6**	**Other**	Plastics, glass- and carbon-fiber reinforced plastics, graphite

STEP 2

Select the **machining conditions**:

Machine stability, clamping system and workpiece		
very good	**good**	**moderate**

STEP 3

Select the **cutting material** (HSS, carbide) and the type of cooling:

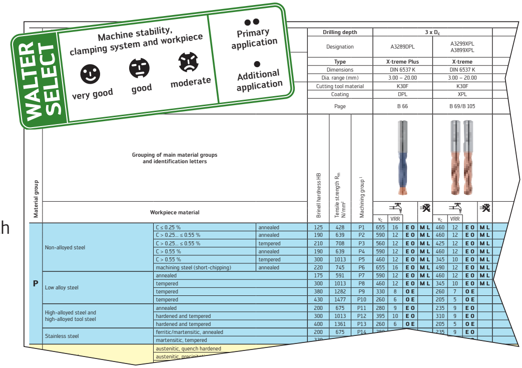
Tools made from **carbide with internal cooling**: from page GC **B 16**
Tools made from **carbide without internal cooling**: from page GC **B 22**
Tools made from **HSS**: from page GC **B 26**

Page information refers to:
HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

STEP 4

Choose your tool:

- In accordance with the drilling depth or **DIN** (e.g. 3 x D_C or DIN 338)
- In accordance with **machining conditions** (see step 2: very good, good, moderate)
- For the relevant machining group (see step 1: P1–15; M1–M3; . . . O1–O6)



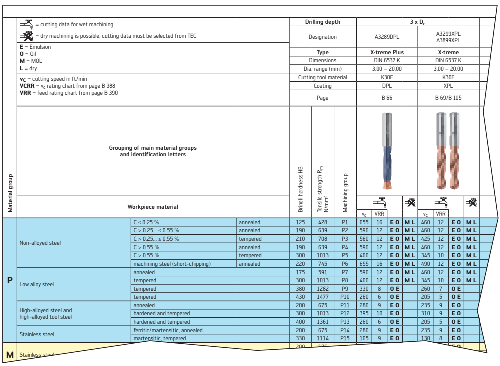
Drilling depth	3 x D_c	
Designation	A3289DPL	A3299XPL A3899XPL
Type	X·treme Plus	X·treme
Dimensions	DIN 6537 K	DIN 6537 K
Dia. range (mm)	3.00 – 20.00	3.00 – 20.00
Cutting tool material	K30F	K30F
Coating	DPL	XPL
Page	B 66	B 69/B 105

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group [1]	v_c	VRR	wet	dry	v_c	VRR	wet	dry
P	Non-alloyed steel	C ≤ 0.25 %	annealed	125	428	P1	655	16	E O	M L	460	12	E O	M L
		C > 0.25... ≤ 0.55 %	annealed	190	639	P2	590	12	E O	M L	460	12	E O	M L
		C > 0.25... ≤ 0.55 %	tempered	210	708	P3	560	12	E O	M L	425	12	E O	M L
		C > 0.55 %	annealed	190	639	P4	590	12	E O	M L	460	12	E O	M L
		C > 0.55 %	tempered	300	1013	P5	460	12	E O	M L	345	10	E O	M L
		machining steel (short-chipping)	annealed	220	745	P6	655	16	E O	M L	490	12	E O	M L
	Low alloy steel	annealed		175	591	P7	590	12	E O	M L	460	12	E O	M L
		tempered		300	1013	P8	460	12	E O	M L	345	10	E O	M L
		tempered		380	1282	P9	330	8	O E		260	7	O E	
		tempered		430	1477	P10	260	6	O E		205	5	O E	
	High-alloyed steel and high-alloyed tool steel	annealed		200	675	P11	280	9	E O		235	9	E O	
		hardened and tempered		300	1013	P12	395	10	E O		310	9	E O	
		hardened and tempered		400	1361	P13	260	6	O E		205	5	O E	
	Stainless steel	ferritic/martensitic, annealed		200	675	P14					235	9	E O	
		martensitic, tempered												
		austenitic, quench hardened												
		austenitic, precipit...												

STEP 5

Choose your **cutting data** from the table. See GC page **B 358** or HB page **36** onwards:

- **Cutting speed:** v_C; VCRR (v_C rate chart for micro)
- **Feed:** VRR (feed rate chart)



Drilling depth	3 x D_c	
Designation	A3289DPL	A3299XPL A3899XPL
Type	X·treme Plus	X·treme
Dimensions	DIN 6537 K	DIN 6537 K
Dia. range (mm)	3.00 – 20.00	3.00 – 20.00
Cutting tool material	K30F	K30F
Coating	DPL	XPL
Page	B 66	B 69/B 105

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group [1]	v_c	VRR	wet	dry	v_c	VRR	wet	dry
P	Non-alloyed steel	C ≤ 0.25 %	annealed	125	428	P1	655	16	E O	M L	460	12	E O	M L
		C > 0.25... ≤ 0.55 %	annealed	190	639	P2	590	12	E O	M L	460	12	E O	M L
		C > 0.25... ≤ 0.55 %	tempered	210	708	P3	560	12	E O	M L	425	12	E O	M L
		C > 0.55 %	annealed	190	639	P4	590	12	E O	M L	460	12	E O	M L
		C > 0.55 %	tempered	300	1013	P5	460	12	E O	M L	345	10	E O	M L
		machining steel (short-chipping)	annealed	220	745	P6	655	16	E O	M L	490	12	E O	M L
	Low alloy steel	annealed		175	591	P7	590	12	E O	M L	460	12	E O	M L
		tempered		300	1013	P8	460	12	E O	M L	345	10	E O	M L
		tempered		380	1282	P9	330	8	O E		260	7	O E	
		tempered		430	1477	P10	260	6	O E		205	5	O E	
	High-alloyed steel and high-alloyed tool steel	annealed		200	675	P11	280	9	E O		235	9	E O	
		hardened and tempered		300	1013	P12	395	10	E O		310	9	E O	
		hardened and tempered		400	1361	P13	260	6	O E		205	5	O E	
	Stainless steel	ferritic/martensitic, annealed		200	675	P14	280	9	E O		235	9	E O	
		martensitic, tempered		330	1114	P15	165	9	E O		130	8	E O	
M	Stainless steel													

Go to the row of your machining group (e.g. K5) and the column of your selected drilling tool. You will find the cutting speed v_C or the VCRR and VRR there.

The v_C rate chart (**VCRR**) and the feed rate chart (**VRR**) can be found in the GC from page **B 388** or in the SC from page **B-48** onwards.

Solid carbide cutting data with internal cooling (part 1/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

$\mathbf{v_c}$ = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Material group	Structure of main material groups and code letters – Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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

3 x D_c															
K3299XPL · K3899XPL				A3289DPL				A3293TTP				A3299XPL · A3899XPL			
X·treme Step 90				**X·treme Plus**				**X·treme Inox**				**X·treme**			
Walter standard				DIN 6537 K				DIN 6537 K				DIN 6537 K			
3.30 – 14.00				3.00 – 20.00				3.00 – 20.00				3.00 – 20.00			
K30F				K30F				K30F				K30F			
XPL				DPL				TTP				XPL			
SC **B-21 / B-23**				GC **B 66**				SC **B-8**				GC **B 69 / B 108**			
															
v_c	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
460	12	**E O**	**M L**	655	16	**E O**	**M L**	525	10	**E O**	**M L**	460	12	**E O**	**M L**
460	12	**E O**	**M L**	590	12	**E O**	**M L**	395	10	**E O**	**M L**	460	12	**E O**	**M L**
425	12	**E O**	**M L**	560	12	**E O**	**M L**	360	10	**E O**	**M L**	425	12	**E O**	**M L**
460	12	**E O**	**M L**	590	12	**E O**	**M L**	395	10	**E O**	**M L**	460	12	**E O**	**M L**
345	10	**E O**	**M L**	460	12	**E O**	**M L**					345	10	**E O**	**M L**
490	12	**E O**	**M L**	655	16	**E O**	**M L**	475	12	**E O**	**M L**	490	12	**E O**	**M L**
460	12	**E O**	**M L**	590	12	**E O**	**M L**	395	10	**E O**	**M L**	460	12	**E O**	**M L**
345	10	**E O**	**M L**	460	12	**E O**	**M L**					345	10	**E O**	**M L**
260	7	**O E**		330	8	**O E**						260	7	**O E**	
205	5	**O E**		260	6	**O E**						205	5	**O E**	
235	9	**E O**		280	9	**E O**						235	9	**E O**	
310	9	**E O**		395	10	**E O**						310	9	**E O**	
205	5	**O E**		260	6	**O E**						205	5	**O E**	
235	9	**E O**		280	9	**E O**		310	9	**E O**		235	9	**E O**	
130	8	**E O**		165	9	**E O**		180	8	**E O**		130	8	**E O**	
130	6	**E O**		165	6	**E O**		175	6	**E O**		130	6	**E O**	
150	6	**E O**		205	6	**E O**		225	6	**E O**		150	6	**E O**	
110	5	**E O**		130	6	**E O**		175	6	**E O**		110	5	**E O**	
330	16	**E O**	**M L**	425	20	**E O**	**M L**					330	16	**E O**	**M L**
205	10	**E O**	**M L**	395	16	**E O**	**M L**					205	10	**E O**	**M L**
410	16	**E O**	**M L**	525	20	**E O**	**M L**					410	16	**E O**	**M L**
345	16	**E O**	**M L**	425	20	**E O**	**M L**					345	16	**E O**	**M L**
425	16	**E O**	**M L**	490	16	**E**	**M L**					425	16	**E O**	**M L**
310	16	**E O**	**M L**	395	16	**E O**	**M L**					310	16	**E O**	**M L**
360	16	**E O**	**M L**	460	16	**O E**	**M L**					360	16	**E O**	**M L**
1310	16	**E O**	**M**	1475	16	**E O**	**M**	1475	16	**E O**	**M**	1310	16	**E O**	**M**
1310	16	**E O**	**M**	1475	16	**E O**	**M**	1475	16	**E O**	**M**	1310	16	**E O**	**M**
820	16	**E O**	**M**	1050	16	**E O**	**M**	820	16	**E O**	**M**	820	16	**E O**	**M**
785	16	**E O**	**M**	985	16	**E O**	**M**	785	16	**E O**	**M**	785	16	**E O**	**M**
625	16	**E O**	**M**	820	16	**E O**	**M**	625	16	**E O**	**M**	625	16	**E O**	**M**
785	16		**M L**	985	16		**M L**	785	16		**M L**	785	16		**M L**
625	8	**E O**	**M**	920	12	**E O**	**M**	690	9	**E O**	**M**	625	8	**E O**	**M**
525	10	**E O**		785	16	**E O**		590	12	**E O**		525	10	**E O**	
625	16	**E O**	**M**	855	20	**E O**	**M**	625	16	**E O**	**M**	625	16	**E O**	**M**
195	5	**E O**		395	10	**E O**		195	7	**E O**		195	5	**E O**	
165	6	**E O**		165	6	**E O**		165	6	**E O**		165	6	**E O**	
100	5	**O E**		125	5	**O E**		125	5	**O E**		100	5	**O E**	
110	5	**E O**		140	5	**E O**		140	5	**E O**		110	5	**E O**	
60	4	**O E**		85	4	**O E**		85	4	**O E**		60	4	**O E**	
85	4	**O E**		105	4	**O E**		105	4	**O E**		85	4	**O E**	
185	6	**O E**		235	6	**O E**		235	6	**O E**		185	6	**O E**	
165	5	**O E**		205	5	**O E**		205	5	**O E**		165	5	**O E**	
40	4	**O E**		65	4	**O E**		65	4	**O E**		40	4	**O E**	
195	5	**E O**		395	10	**E O**		395	9	**E O**		195	5	**E O**	
195	5	**E O**		395	10	**E O**		395	9	**E O**		195	5	**E O**	
155	4	**O E**		175	4	**O E**						155	4	**O E**	
105	3	**O E**		150	4	**O E**						105	3	**O E**	
105	3	**O E**		150	4	**O E**						105	3	**O E**	
330	16	**E O**		425	16	**E O**		425	16	**E O**		330	16	**E O**	

HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

Solid carbide cutting data with internal cooling (part 2/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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

	5 x D_c															
	A3389AML				A3389DPL				A3393TTP				A3382XPL			
	X·treme M				**X·treme Plus**				**X·treme Inox**				**X·treme CI**			
	Walter standard				DIN 6537 L				DIN 6537 L				DIN 6537 L			
	2.00 – 2.95				3.00 – 20.00				3.00 – 20.00				3.00 – 20.00			
	K30F				K30F				K30F				K30F			
	AML				DPL				TTP				XPL			
	GC **B 86**				GC **B 87**				SC **B-11**				GC **B 81**			
																
	VCRR	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
	C100	12	**E**		625	12	**E O**	**M L**	490	10	**E O**	**M L**				
	C80	12	**E**		560	12	**E O**	**M L**	360	10	**E O**	**M L**				
	C80	12	**E**		525	12	**E O**	**M L**	330	10	**E O**	**M L**				
	C100	12	**E**		560	12	**E O**	**M L**	360	10	**E O**	**M L**				
	C71	12	**E**		425	12	**E O**	**M L**								
	C100	12	**E**		625	16	**E O**	**M L**	445	12	**E O**	**M L**				
	C80	12	**E**		560	12	**E O**	**M L**	360	10	**E O**	**M L**				
	C71	12	**E**		425	12	**E O**	**M L**								
	C56	9	**E**		310	8	**O E**									
	C40	6	**E**		235	6	**O E**									
	C63	10	**E**		280	9	**E O**									
	C63	12	**E**		395	10	**E O**									
	C40	6	**E**		235	6	**O E**									
	C63	10	**E**		280	9	**E O**		295	9	**E O**					
	C50	8	**E**		155	9	**E O**		165	8	**E O**					
	C40	8	**E**		155	6	**E O**		165	6	**E O**					
	C63	10	**E**		195	6	**E O**		215	6	**E O**					
	C32	5	**E**		125	6	**E O**		165	6	**E O**					
	C160	21	**E**		410	16	**E O**	**M L**					425	20	**E O**	**M L**
	C160	21	**E**		395	16	**E O**	**M L**					395	16	**E O**	**M L**
	C160	21	**E**		490	16	**E O**	**M L**					525	20	**E O**	**M L**
	C160	21	**E**		410	16	**E O**	**M L**					425	20	**E O**	**M L**
	C160	21	**E**		460	16	**E**	**M L**					525	20	**E O**	**M L**
	C125	16	**E**		395	16	**E O**	**M L**					395	16	**E O**	**M L**
	C140	19	**E**		425	16	**O E**	**M L**					460	20	**E O**	**M L**
	C160	26	**E**		1475	16	**E O**	**M**	1475	16	**E O**	**M**				
	C160	26	**E**		1475	16	**E O**	**M**	1475	16	**E O**	**M**				
	C160	24	**E**		1050	16	**E O**	**M**	820	16	**E O**	**M**				
	C160	24	**E**		985	16	**E O**	**M**	785	16	**E O**	**M**				
	C125	20	**E**		820	16	**E O**	**M**	625	16	**E O**	**M**				
					985	16		**M L**	785	16		**M L**				
	C100	6	**E**		785	10	**E O**	**M**	690	9	**E O**	**M**				
	C80	12	**E**		655	12	**E O**		590	12	**E O**					
	C100	20	**E**		855	20	**E O**	**M**	625	16	**E O**	**M**				
	C56	8	**E**		395	10	**E O**		195	7	**E O**					
	C50	8	**E**		155	6	**E O**		155	6	**E O**					
	C26	6	**E**		120	5	**O E**		120	5	**O E**					
	C32	5	**E**		130	5	**E O**		130	5	**E O**					
	C16	6	**E**		80	4	**O E**		80	4	**O E**					
	C16	6	**E**		100	4	**O E**		100	4	**O E**					
	C50	6	**E**		195	6	**O E**		195	6	**O E**					
	C32	5	**E**		175	5	**O E**		175	5	**O E**					
	C16	5	**E**		60	4	**O E**		60	4	**O E**					
	C56	8	**E**		395	10	**E O**		395	9	**E O**					
	C56	8	**E**		395	10	**E O**		395	9	**E O**					
	C32	3	**E**		175	4	**O E**									
	C32	3	**E**		150	4	**O E**									
	C32	3	**E**		150	4	**O E**									
	C100	22	**E**		425	16	**E O**		425	16	**E O**					

HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

Solid carbide cutting data with internal cooling (part 3/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

The specified cutting data are average recommended values.
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	5 x D_c				8 x D_c								12 x D_c			
	A3399XPL · A3999XPL				A6489AMP				A6489DPP				A6589AMP			
	X·treme				**X·treme DM8**				**X·treme D8**				**X·treme DM12**			
	DIN 6537 L				Walter standard				Walter standard				Walter standard			
	3.00 – 25.00				2.00 – 2.95				3.00 – 20.00				2.00 – 2.90			
	K30F				K30F				K30F				K30F			
	XPL				AMP				DPP				AMP			
	GC **B 82 / B 115**				GC **B 126**				GC **B 127**				GC **B 131**			
																
	v_c	VRR			VCRR	VRR			v_c	VRR			VCRR	VRR		
	395	10	**E O**	**M L**	C100	12	**E**		590	12	**E O**	**M L**	C80	12	**E**	
	330	10	**E O**	**M L**	C80	12	**E**		525	12	**E O**	**M L**	C80	12	**E**	
	310	10	**E O**	**M L**	C80	12	**E**		490	12	**E O**	**M L**	C80	12	**E**	
	330	10	**E O**	**M L**	C80	12	**E**		525	12	**E O**	**M L**	C80	12	**E**	
	235	8	**E O**	**M L**	C71	12	**E**		410	10	**E O**	**M L**	C59	10	**E**	
	395	12	**E O**	**M L**	C100	12	**E**		590	12	**E O**	**M L**	C80	12	**E**	
	330	10	**E O**	**M L**	C80	12	**E**		525	12	**E O**	**M L**	C80	12	**E**	
	235	8	**E O**	**M L**	C71	12	**E**		410	10	**E O**	**M L**	C59	10	**E**	
	155	6	**O E**		C53	8	**E**		280	7	**O E**		C45	7	**E**	
	125	4	**O E**		C40	6	**E**		205	5	**O E**		C40	6	**E**	
	205	8	**E O**		C63	10	**E**		260	8	**E O**		C63	10	**E**	
	185	7	**E O**		C63	10	**E**		360	9	**E O**		C50	8	**E**	
	125	4	**O E**		C40	6	**E**		205	5	**O E**		C40	6	**E**	
	205	8	**E O**		C63	10	**E**		260	8	**E O**		C63	10	**E**	
	140	7	**E O**		C50	8	**E**		150	8	**E O**		C50	8	**E**	
	125	5	**E O**		C40	8	**E**		150	6	**E O**		C40	7	**E**	
	140	6	**E O**		C50	8	**E**		185	6	**E O**		C50	7	**E**	
	100	5	**E O**		C32	5	**E**		120	6	**E O**		C25	5	**E**	
	310	16	**E O**	**M L**	C125	17	**E**		395	12	**E O**	**M L**	C100	13	**E**	
	235	12	**E O**	**M L**	C125	17	**E**		360	12	**E O**	**M L**	C100	13	**E**	
	395	16	**E O**	**M L**	C125	17	**E**		460	12	**E O**	**M L**	C100	13	**E**	
	310	16	**E O**	**M L**	C125	17	**E**		395	12	**E O**	**M L**	C100	13	**E**	
	310	16	**E O**	**M L**	C125	17	**E**		460	12	**E O**	**M L**	C100	13	**E**	
	235	12	**E O**	**M L**	C100	14	**E**		360	12	**E O**	**M L**	C80	11	**E**	
	280	16	**E O**	**M L**	C110	16	**E**		410	12	**E O**	**M L**	C100	12	**E**	
	1310	16	**E O**	**M**	C160	26	**E**		1475	16	**E O**	**M**	C160	25	**E**	
	1310	16	**E O**	**M**	C160	26	**E**		1475	16	**E O**	**M**	C160	25	**E**	
	820	16	**E O**	**M**	C160	24	**E**		1050	16	**E O**	**M**	C160	23	**E**	
	785	16	**E O**	**M**	C160	24	**E**		985	16	**E O**	**M**	C160	23	**E**	
	625	16	**E O**	**M**	C125	20	**E**		820	16	**E O**	**M**	C125	19	**E**	
	785	16		**M L**					985	16		**M L**				
	590	8	**E O**	**M**	C80	6	**E**		655	9	**E O**	**M**	C80	6	**E**	
	490	10	**E O**		C80	12	**E**		560	12	**E O**		C80	11	**E**	
	625	16	**E O**	**M**	C100	20	**E**		855	20	**E O**	**M**	C80	19	**E**	
	185	7	**E O**		C52	8	**E**		360	9	**E O**		C50	7	**E**	
	140	5	**E O**		C40	8	**E**		150	6	**E O**		C40	7	**E**	
	80	4	**O E**		C24	6	**E**		105	5	**O E**		C21	6	**E**	
	100	4	**E O**		C32	5	**E**		125	5	**E O**		C25	5	**E**	
	50	3	**O E**		C16	6	**E**		70	4	**O E**		C16	5	**E**	
	60	3	**O E**		C16	6	**E**		85	4	**O E**		C16	5	**E**	
	155	6	**O E**		C50	6	**E**		165	5	**O E**		C40	6	**E**	
	130	5	**O E**		C32	5	**E**		150	5	**O E**		C32	5	**E**	
	35	3	**O E**		C16	5	**E**		50	4	**O E**		C16	5	**E**	
	185	7	**E O**		C52	8	**E**		360	9	**E O**		C56	8	**E**	
	185	7	**E O**		C52	8	**E**		360	9	**E O**		C56	8	**E**	
	100	3	**O E**		C32	3	**E**		150	3	**O E**		C32	3	**E**	
	85	3	**O E**		C32	3	**E**		125	3	**O E**		C32	3	**E**	
	85	3	**O E**		C32	3	**E**		125	3	**O E**		C32	3	**E**	
					C100	22	**E**		425	16	**E O**		C100	20	**E**	

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Solid carbide cutting data with internal cooling (part 4/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth / Designation / Type / Dimensions / Ø range (mm) / Cutting material / Coating / Page

Material group	Structure of main material groups and code letters – Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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	12 x D_c				16 x D_c								20 x D_c			
	A6589DPP				A6689AMP				A6685TFP				A6789AMP			
	X·treme D12				**X·treme DM16**				**Alpha® 4 XD16**				**X·treme DM20**			
	Walter standard				Walter standard				Walter standard				Walter standard			
	3.00 – 20.00				2.00 – 2.90				3.00 – 16.00				2.00 – 2.90			
	K30F				K30F				K30F				K30F			
	DPP				AMP				TFP				AMP			
	GC **B 132**				SC **B-15**				GC **B 135**				SC **B-16**			
																
	v_c	VRR			VCRR	VRR			v_c	VRR			VCRR	VRR		
	560	12	**E O**	**M L**	C80	10	**E**		360	10	**E O**	**M L**	C80	10	**E**	
	490	12	**E O**	**M L**	C71	10	**E**		310	10	**E O**	**M L**	C63	10	**E**	
	460	12	**E O**	**M L**	C63	10	**E**		295	10	**E O**	**M L**	C71	10	**E**	
	490	12	**E O**	**M L**	C71	10	**E**		310	10	**E O**	**M L**	C63	10	**E**	
	395	10	**E O**	**M L**	C45	6	**E**		220	9	**E O**	**M L**	C50	8	**E**	
	560	12	**E O**	**M L**	C80	10	**E**		360	12	**E O**	**M L**	C80	10	**E**	
	490	12	**E O**	**M L**	C71	10	**E**		310	10	**E O**	**M L**	C63	10	**E**	
	395	10	**E O**	**M L**	C45	6	**E**		220	9	**E O**	**M L**	C50	8	**E**	
	260	7	**O E**		C45	10	**E**		140	7	**O E**		C36	5	**E**	
	185	5	**O E**		C36	5	**E**		90	6	**O E**		C32	5	**E**	
	245	8	**E O**		C63	9	**E**		195	8	**E O**		C50	9	**E**	
	345	9	**E O**		C45	6	**E**		185	8	**E O**		C40	5	**E**	
	185	5	**O E**		C45	10	**E**		90	6	**O E**		C32	5	**E**	
	245	8	**E O**		C50	10	**E**		195	8	**E O**		C50	9	**E**	
	140	8	**E O**		C45	4	**E**		130	7	**E O**		C40	8	**E**	
	140	6	**E O**		C36	7	**E**		130	5	**O E**		C32	6	**E**	
	185	6	**E O**		C45	4	**E**		165	5	**E O**		C32	4	**E**	
	110	6	**E O**		C28	5	**E**		105	5	**O E**		C25	4	**E**	
	360	12	**E O**	**M L**	C71	10	**E**		295	16	**E O**	**M L**	C63	8	**E**	
	270	12	**E O**	**M L**	C63	10	**E**		220	12	**E O**	**M L**	C63	8	**E**	
	425	12	**E O**	**M L**	C90	10	**E**		360	16	**E O**	**M L**	C80	8	**E**	
	360	12	**E O**	**M L**	C71	11	**E**		295	16	**E O**	**M L**	C63	8	**E**	
	425	12	**E O**	**M L**	C80	12	**E**		295	16	**E O**	**M L**	C63	8	**E**	
	345	12	**E O**	**M L**	C63	10	**E**		220	12	**E O**	**M L**	C50	8	**E**	
	395	12	**E O**	**M L**	C63	9	**E**		260	16	**E O**	**M L**	C63	9	**E**	
	1380	16	**E O**	**M**	C125	24	**E**		425	16	**E O**	**M**	C125	22	**E**	
	1380	16	**E O**	**M**	C125	24	**E**		425	16	**E O**	**M**	C125	22	**E**	
	1050	16	**E O**	**M**	C125	22	**E**		425	16	**E O**	**M**	C125	20	**E**	
	920	16	**E O**	**M**	C125	22	**E**		425	16	**E O**	**M**	C125	20	**E**	
	785	16	**E O**	**M**	C100	18	**E**		425	16	**E O**	**M**	C100	17	**E**	
	920	16		**M L**					425	16		**M L**				
	625	8	**E O**	**M**	C63	5	**E**		360	7	**E O**	**M**	C63	5	**E**	
	525	10	**E O**		C80	9	**E**		295	9	**E O**		C63	10	**E**	
	820	20	**E O**	**M**	C80	18	**E**		360	10	**E O**	**M**	C80	17	**E**	
	345	9	**E O**		C40	5	**E**		185	8	**E O**		C45	6	**E**	
	140	6	**E O**		C20	5	**E**		130	5	**O E**		C32	6	**E**	
	100	4	**O E**		C28	5	**E**		80	4	**O E**		C21	5	**E**	
	120	5	**E O**		C14	5	**E**		100	4	**E O**		C25	4	**E**	
	60	3	**O E**		C14	5	**E**		45	3	**O E**		C14	5	**E**	
	70	3	**O E**		C25	5	**E**		50	3	**O E**		C14	5	**E**	
	150	5	**O E**		C40	5	**E**		120	5	**O E**		C40	5	**E**	
	130	4	**O E**		C22	4	**E**		80	5	**O E**		C25	4	**E**	
	45	3	**O E**		C18	3	**E**		30	3	**O E**		C14	4	**E**	
	345	9	**E O**		C14	5	**E**		185	8	**E O**		C45	7	**E**	
	345	9	**E O**		C14	5	**E**		185	8	**E O**		C45	7	**E**	
	125	3	**O E**		C28	3	**E**		70	2	**O E**		C25	3	**E**	
	105	3	**O E**										C25	3	**E**	
	105	3	**O E**										C25	3	**E**	
	410	16	**E O**		C90	20	**E**		295	16	**E O**		C100	20	**E**	

HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

Solid carbide cutting data with internal cooling (part 5/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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

20 x D_c								25 x D_c							
A6794TFP				A6785TFP				A6889AMP				A6885TFP			
X·treme DH20				**Alpha® 4 XD20**				**X·treme DM25**				**Alpha® 4 XD25**			
Walter standard				Walter standard				Walter standard				Walter standard			
3.00 – 10.00				3.00 – 16.00				2.00 – 2.90				3.00 – 12.00			
K30F				K30F				K30F				K30F			
TFP				TFP				AMP				TFP			
GC **B 138**				GC **B 136**				SC **B-17**				GC **B 139**			
															
v_c	VRR			v_c	VRR			VCRR	VRR			v_c	VRR		
				345	10	**E O**	**M L**	C80	10	**E**		310	9	**E O**	**M L**
				295	10	**E O**	**M L**	C63	10	**E**		280	9	**E O**	**M L**
				280	10	**E O**	**M L**	C63	10	**E**		260	9	**E O**	**M L**
				295	10	**E O**	**M L**	C63	10	**E**		280	9	**E O**	**M L**
205	8	**E O**	**M L**	205	8	**E O**	**M L**	C50	8	**E**		195	8	**E O**	**M L**
				345	10	**E O**	**M L**	C80	10	**E**		310	10	**E O**	**M L**
				295	10	**E O**	**M L**	C63	10	**E**		280	9	**E O**	**M L**
205	8	**E O**	**M L**	205	8	**E O**	**M L**	C50	8	**E**		195	8	**E O**	**M L**
130	7	**O E**	**M L**	130	7	**O E**		C36	5	**E**		120	6	**O E**	
80	6	**O E**		80	6	**O E**		C32	5	**E**		80	5	**O E**	
185	7	**E O**		185	8	**E O**		C50	9	**E**		175	7	**E O**	
175	7	**E O**	**M L**	175	7	**E O**		C40	5	**E**		155	7	**E O**	
80	6	**O E**		80	6	**O E**		C32	5	**E**		80	5	**O E**	
185	7	**E O**		185	8	**E O**		C50	9	**E**		175	7	**E O**	
120	6	**E O**		120	6	**E O**		C40	8	**E**		110	6	**E O**	
				120	5	**O E**		C32	6	**E**		110	4	**O E**	
155	5	**E O**		155	5	**E O**		C32	4	**E**		150	5	**E O**	
				95	5	**O E**		C25	4	**E**		90	4	**O E**	
				280	12	**E O**	**M L**	C63	8	**E**		260	12	**E O**	**M L**
				205	12	**E O**	**M L**	C63	8	**E**		195	12	**E O**	**M L**
				345	12	**E O**	**M L**	C80	8	**E**		310	12	**E O**	**M L**
				280	12	**E O**	**M L**	C63	8	**E**		260	12	**E O**	**M L**
				280	12	**E O**	**M L**	C63	8	**E**		260	12	**E O**	**M L**
205	12	**E O**	**M L**	205	12	**E O**	**M L**	C50	8	**E**		195	12	**E O**	**M L**
235	12	**O E**	**M L**	245	12	**E O**	**M L**	C63	9	**E**		235	12	**E O**	**M L**
				345	16	**E O**	**M**	C125	22	**E**		260	16	**E O**	**M**
				345	16	**E O**	**M**	C125	22	**E**		260	16	**E O**	**M**
				345	16	**E O**	**M**	C125	20	**E**		260	16	**E O**	**M**
				345	16	**E O**	**M**	C125	20	**E**		260	16	**E O**	**M**
				345	16	**E O**	**M**	C100	17	**E**		260	12	**E O**	**M**
				345	16		**M L**					260	16		**M L**
				345	7	**E O**	**M**	C63	5	**E**		310	6	**E O**	**M**
				280	9	**E O**		C63	10	**E**		260	8	**E O**	
				345	10	**E O**	**M**	C80	17	**E**		310	10	**E O**	**M**
175	7	**E O**	**M**	175	7	**E O**		C45	6	**E**		155	7	**E O**	
				120	5	**O E**		C32	6	**E**		110	4	**O E**	
50	3	**O E**		70	3	**O E**		C19	5	**E**		65	3	**O E**	
				90	3	**E O**		C25	4	**E**		85	3	**E O**	
40	3	**O E**		40	3	**O E**		C14	5	**E**		35	2	**O E**	
50	3	**O E**		50	3	**O E**		C14	5	**E**		45	2	**O E**	
				110	5	**O E**		C40	5	**E**		105	5	**O E**	
				70	4	**O E**		C25	4	**E**		60	4	**O E**	
30	3	**O E**		30	3	**O E**		C14	4	**E**		30	2	**O E**	
175	7	**E O**	**M**	175	7	**E O**		C45	7	**E**		155	7	**E O**	
175	7	**E O**	**M**	175	7	**E O**		C45	7	**E**		155	7	**E O**	
70	2	**O E**		70	2	**O E**		C25	3	**E**		65	2	**O E**	
								C25	3	**E**					
								C25	3	**E**					
				280	12	**E O**		C100	20	**E**		260	12	**E O**	

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Solid carbide cutting data with internal cooling (part 6/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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

	30 x D_c												40 x D_c			
	A6989AMP				A6994TFP				A6985TFP				A7495TTP			
	X·treme DM30				**X·treme DH30**				**Alpha® 4 XD30**				**X·treme D40**			
	Walter standard				Walter standard				Walter standard				Walter standard			
	2.00 – 2.90				3.00 – 10.00				3.00 – 12.00				4.50 –11.00			
	K30F				K30F				K30F				K30F			
	AMP				TFP				TFP				TTP			
	SC **B-18**				GC **B 142**				GC **B 141**				SC **B-19**			
																
	VCRR	VRR			v_c	VRR			v_c	VRR			v_c	VRR		
	C56	10	**E**						310	9	**E O**	**M L**	295	10	**E O**	
	C50	10	**E**						280	9	**E O**	**M L**	295	10	**E O**	
	C45	10	**E**						260	9	**E O**	**M L**	260	10	**E O**	
	C50	10	**E**						280	9	**E O**	**M L**	295	10	**E O**	
	C23	4	**E**		195	8	**E O**	**M L**	195	8	**E O**	**M L**	205	10	**E O**	
	C56	10	**E**						310	10	**E O**	**M L**	260	10	**E O**	
	C50	10	**E**						280	9	**E O**	**M L**	295	10	**E O**	
	C23	4	**E**		195	8	**E O**	**M L**	195	8	**E O**	**M L**	235	8	**E O**	
	C32	7	**E**		120	6	**O E**	**M L**	120	6	**O E**					
	C25	4	**E**		80	5	**O E**		80	5	**O E**					
	C45	6	**E**		175	7	**E O**		175	7	**E O**		260	10	**E O**	
	C22	4	**E**		155	7	**E O**	**M L**	155	7	**E O**		205	10	**E O**	
	C32	7	**E**		80	5	**O E**		80	5	**O E**					
	C36	10	**E**		175	7	**E O**		175	7	**E O**		235	9	**E O**	
	C22	4	**E**		110	6	**E O**		110	6	**E O**		185	8	**E O**	
	C25	5	**E**						110	4	**O E**		185	6	**O E**	
	C22	3	**E**		150	5	**E O**		150	5	**E O**					
	C18	3	**E**						90	4	**O E**		165	6	**O E**	
	C45	8	**E**						260	12	**E O**	**M L**	295	12	**E O**	
	C40	5	**E**						195	12	**E O**	**M L**	235	9	**E O**	
	C45	8	**E**						310	12	**E O**	**M L**	295	11	**E O**	
	C45	7	**E**						260	12	**E O**	**M L**	295	12	**E O**	
	C50	7	**E**						260	12	**E O**	**M L**	295	11	**E O**	
	C40	5	**E**		195	12	**E O**	**M L**	195	12	**E O**	**M L**	235	9	**E O**	
	C40	5	**E**		235	12	**O E**	**M L**	235	12	**E O**	**M L**	235	9	**E O**	
	C90	22	**E**						260	16	**E O**	**M**	295	13	**E O**	
	C90	22	**E**						260	16	**E O**	**M**	295	13	**E O**	
	C90	15	**E**						260	16	**E O**	**M**	295	13	**E O**	
	C90	15	**E**						260	16	**E O**	**M**	295	13	**E O**	
	C71	13	**E**						260	12	**E O**	**M**	295	13	**E O**	
									260	16		**M L**				
	C32	4	**E**						310	6	**E O**	**M**	295	13	**E O**	
	C56	6	**E**						260	8	**E O**		295	13	**E O**	
	C56	13	**E**						310	10	**E O**	**M**				
	C28	4	**E**		155	7	**E O**	**M**	155	7	**E O**					
	C14	3	**E**						110	4	**O E**					
	C20	4	**E**		50	2	**O E**		65	3	**O E**					
	C10	4	**E**		0				85	3	**E O**					
	C10	3	**E**		35	2	**O E**		35	2	**O E**					
	C16	3	**E**		45	2	**O E**		45	2	**O E**					
	C28	4	**E**						105	5	**O E**					
	C14	3	**E**						60	4	**O E**		105	4	**O E**	
	C12	2	**E**		30	2	**O E**		30	2	**O E**					
	C10	4	**E**		155	7	**E O**	**M**	155	7	**E O**					
	C10	4	**E**		155	7	**E O**	**M**	155	7	**E O**					
	C20	2	**E**		65	2	**O E**		65	2	**O E**					
	C63	14	**E**						260	12	**E O**					

HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

Solid carbide cutting data with internal cooling (part 7/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

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

50 x D_c				Pilot drill											
A7595TTP				K3281TFT				A6181AML				A6181TFT			
X·treme D50				**X·treme Pilot Step 90**				**X·treme Pilot 150**				**XD Pilot**			
Walter standard				Walter standard				Walter standard				Walter standard			
4.50 – 9.00				3.00 – 16.00				2.00 – 2.95				3.00 – 16.00			
K30F				K30F				K30F				K30F			
TTP				TFT				AML				TFT			
HB **68**				SC **B-20**				SC **B-14**				GC **B 121**			
															
v_c	VRR			v_c	VRR			VCRR	VRR			v_c	VRR		
295	10	**E O**		395	12	**E O**	**M L**	C100	12	**E**		395	12	**E O**	**M L**
295	10	**E O**		345	12	**E O**	**M L**	C80	12	**E**		345	12	**E O**	**M L**
260	10	**E O**		330	12	**E O**	**M L**	C80	12	**E**		330	12	**E O**	**M L**
295	10	**E O**		345	12	**E O**	**M L**	C80	12	**E**		345	12	**E O**	**M L**
205	10	**E O**		245	9	**E O**	**M L**	C67	9	**E**		245	9	**E O**	**M L**
260	10	**E O**		395	12	**E O**	**M L**	C100	12	**E**		395	12	**E O**	**M L**
295	10	**E O**		345	12	**E O**	**M L**	C80	12	**E**		345	12	**E O**	**M L**
235	8	**E O**		245	9	**E O**	**M L**	C67	9	**E**		245	9	**E O**	**M L**
				165	6	**O E**	**M L**	C45	6	**E**		165	6	**O E**	**M L**
				140	4	**O E**		C40	6	**E**		140	4	**O E**	
260	10	**E O**		220	9	**E O**		C63	10	**E**		220	9	**E O**	
205	10	**E O**		195	7	**E O**	**M L**	C50	6	**E**		195	7	**E O**	**M L**
				140	4	**O E**		C40	6	**E**		140	4	**O E**	
235	9	**E O**		220	9	**E O**		C63	10	**E**		220	9	**E O**	
185	8	**E O**		140	7	**E O**		C50	8	**E**		140	7	**E O**	
185	6	**O E**		140	5	**E O**		C40	8	**E**		140	5	**E O**	
				185	6	**E O**		C50	6	**E**		185	6	**E O**	
165	6	**O E**		110	5	**E O**		C25	5	**E**		110	5	**E O**	
295	12	**E O**		330	16	**E O**	**M L**	C80	10	**E**		330	16	**E O**	**M L**
235	9	**E O**		245	16	**E O**	**M L**	C80	10	**E**		245	16	**E O**	**M L**
295	11	**E O**		395	16	**E O**	**M L**	C100	10	**E**		395	16	**E O**	**M L**
295	12	**E O**		330	16	**E O**	**M L**	C80	10	**E**		330	16	**E O**	**M L**
295	11	**E O**		310	20	**E**	**M L**	C80	10	**E**		310	20	**E**	**M L**
235	9	**E O**		245	16	**E O**	**M L**	C63	10	**E**		245	16	**E O**	**M L**
235	9	**E O**		280	20	**O E**	**M L**	C71	10	**E**		280	20	**O E**	**M L**
295	13	**E O**		1310	16	**E O**	**M**	C160	20	**E**		1310	16	**E O**	**M**
295	13	**E O**		1310	16	**E O**	**M**	C160	20	**E**		1310	16	**E O**	**M**
295	13	**E O**		820	16	**E O**	**M**	C160	20	**E**		820	16	**E O**	**M**
295	13	**E O**		785	16	**E O**	**M**	C160	20	**E**		785	16	**E O**	**M**
295	13	**E O**		625	16	**E O**	**M**	C125	20	**E**		625	16	**E O**	**M**
				785	16		**M L**					785	16		**M L**
295	13	**E O**		690	9	**E O**	**M**	C80	6	**E**		690	9	**E O**	**M**
295	13	**E O**		590	12	**E O**		C80	12	**E**		590	12	**E O**	
				625	16	**E O**	**M**	C100	20	**E**		625	16	**E O**	**M**
				195	7	**E O**	**M**	C56	8	**E**		195	7	**E O**	**M**
				140	5	**E O**		C40	8	**E**		140	5	**E O**	
				85	4	**O E**		C22	6	**E**		85	4	**O E**	
				105	4	**E O**		C25	5	**E**		105	4	**E O**	
				50	3	**O E**		C20	6	**E**		50	3	**O E**	
				65	3	**O E**		C20	6	**E**		65	3	**O E**	
				185	6	**O E**		C50	6	**E**		185	6	**O E**	
105	4	**O E**		155	5	**O E**		C32	5	**E**		155	5	**O E**	
				40	3	**O E**		C20	5	**E**		40	3	**O E**	
				195	7	**E O**	**M**	C56	8	**E**		195	7	**E O**	**M**
				195	7	**E O**	**M**	C56	8	**E**		195	7	**E O**	**M**
				120	3	**O E**		C40	3	**E**		120	3	**O E**	
				100	3	**O E**		C40	3	**E**		100	3	**O E**	
				100	3	**O E**		C40	3	**E**		100	3	**O E**	
				330	16	**E O**		C100	20	**E**		330	16	**E O**	

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Solid carbide cutting data with internal cooling (part 8/8)

= Cutting data for wet machining

= Dry machining is possible, cutting data must be selected from Walter GPS

E = Emulsion
O = Oil
M = MQL
L = Dry

$\mathbf{v_c}$ = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth
Designation
Type
Dimensions
Ø range (mm)
Cutting material
Coating
Page

Structure of main material groups and code letters

Material group	Workpiece material			Brinell hardness HB	Tensile strength R_m N/mm²	Machining group[1]
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 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		330	1114	P15
M	Stainless steel	austenitic, quench hardened		200	675	M1
		austenitic, precipitation hardened (PH)		300	1013	M2
		austenitic/ferritic, duplex		230	778	M3
K	Malleable cast iron	ferritic		200	675	K1
		pearlitic		260	867	K2
	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
		pearlitic		265	885	K6
	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

Page information refers to:

	Pilot drill							
	A7191TFT				K5191TFT			
	X·treme Pilot 180				**X·treme Pilot 180C**			
	Walter standard				Walter standard			
	3.00 – 10.00				4.00 – 7.00			
	K30F				K30F			
	TFT				TFT			
	GC **B 143**, HB **68**				GC **B 145**			
								
	v_c	VRR			v_c	VRR		
	395	9	**E O**	**M L**	395	9	**E O**	**M L**
	345	8	**E O**	**M L**	345	8	**E O**	**M L**
	330	8	**E O**	**M L**	330	8	**E O**	**M L**
	345	8	**E O**	**M L**	345	8	**E O**	**M L**
	245	6	**E O**	**M L**	245	6	**E O**	**M L**
	395	9	**E O**	**M L**	395	9	**E O**	**M L**
	345	8	**E O**	**M L**	345	8	**E O**	**M L**
	245	6	**E O**	**M L**	245	6	**E O**	**M L**
	165	4	**O E**	**M L**	165	4	**O E**	**M L**
	140	2	**O E**		140	2	**O E**	
	220	6	**E O**		220	6	**E O**	
	195	5	**E O**	**M L**	195	5	**E O**	**M L**
	140	2	**O E**		140	2	**O E**	
	220	6	**E O**		220	6	**E O**	
	140	5	**E O**		140	5	**E O**	
	140	4	**E O**		140	4	**E O**	
	185	4	**E O**		185	4	**E O**	
	110	4	**E O**		110	4	**E O**	
	330	12	**E O**	**M L**	330	12	**E O**	**M L**
	245	12	**E O**	**M L**	245	12	**E O**	**M L**
	395	12	**E O**	**M L**	395	12	**E O**	**M L**
	330	12	**E O**	**M L**	330	12	**E O**	**M L**
	330	12	**E O**	**M L**	330	12	**E O**	**M L**
	245	12	**E O**	**M L**	245	12	**E O**	**M L**
	295	12	**E O**	**M L**	295	12	**E O**	**M L**
	1310	12	**E O**	**M**	1310	12	**E O**	**M**
	1310	12	**E O**	**M**	1310	12	**E O**	**M**
	820	12	**E O**	**M**	820	12	**E O**	**M**
	785	12	**E O**	**M**	785	12	**E O**	**M**
	625	10	**E O**	**M**	625	10	**E O**	**M**
	785	12		**M L**	785	12		**M L**
	690	6	**E O**	**M**	690	6	**E O**	**M**
	590	8	**E O**		590	8	**E O**	
	625	12	**E O**	**M**	625	12	**E O**	**M**
	195	5	**E O**	**M**	195	5	**E O**	**M**
	140	4	**E O**		140	4	**E O**	
	85	3	**O E**		85	3	**O E**	
	105	3	**E O**		105	3	**E O**	
	50	2	**O E**		50	2	**O E**	
	65	2	**O E**		65	2	**O E**	
	185	5	**O E**		185	5	**O E**	
	155	4	**O E**		155	4	**O E**	
	40	2	**O E**		40	2	**O E**	
	195	5	**E O**	**M**	195	5	**E O**	**M**
	195	5	**E O**	**M**	195	5	**E O**	**M**
	120	2	**O E**		120	2	**O E**	
	100	2	**O E**		100	2	**O E**	
	100	2	**O E**		100	2	**O E**	
	330	12	**E O**		330	12	**E O**	

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

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Solid carbide cutting data without internal cooling

(wet machining symbol) = Cutting data for wet machining

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

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M = MQL
L = Dry

v_c = Cutting speed
VCRR = v_c rate chart HB page **54**
VRR = feed rate chart HB page **55**

Drilling depth / Designation / **Type** / Dimensions / Ø range (mm) / Cutting material / Coating / Page

Structure of main material groups and code letters

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		C > 0.25... ≤ 0.55 %	tempered	210	708	P3
		C > 0.55 %	annealed	190	639	P4
		C > 0.55 %	tempered	300	1013	P5
		machining steel (short-chipping)	annealed	220	745	P6
	Low alloy steel	annealed		175	591	P7
		tempered		300	1013	P8
		tempered		380	1282	P9
		tempered		430	1477	P10
	High-alloyed steel and high-alloyed 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, tempered		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
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	grey cast iron	low tensile strength		180	602	K3
		high tensile strength/austenitic		245	825	K4
	Cast iron with spheroidal graphite	ferritic		155	518	K5
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	GGV (CGI)			200	675	K7
N	Aluminum wrought alloys	cannot be hardened		30	–	N1
		hardenable, hardened		100	343	N2
	Cast aluminum alloys	≤ 12 % Si, not precipitation hardenable		75	260	N3
		≤ 12 % Si, precipitation hardenable, precipitation hardened		90	314	N4
		> 12 % Si, not precipitation hardenable		130	447	N5
	Magnesium alloys			70	250	N6
	Copper and copper alloys (bronze/brass)	non-alloyed, electrolytic copper		100	343	N7
		brass, bronze, red brass		90	314	N8
		Cu-alloys, short-chipping		110	382	N9
		high-strength, Ampco		300	1013	N10
S	Heat-resistant alloys	Fe-based	annealed	200	675	S1
			hardened	280	943	S2
		Ni or Co base	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	Thermoplasts	without abrasive fillers				O1
	Thermosetting plastics	without abrasive fillers				O2
	Plastic, glass-fiber reinforced	GFRP				O3
	Plastic, carbon fiber reinforced	CFRP				O4
	Plastic, aramide fiber reinforced	AFRP				O5
	Graphite (technical)			80 Shore		O6

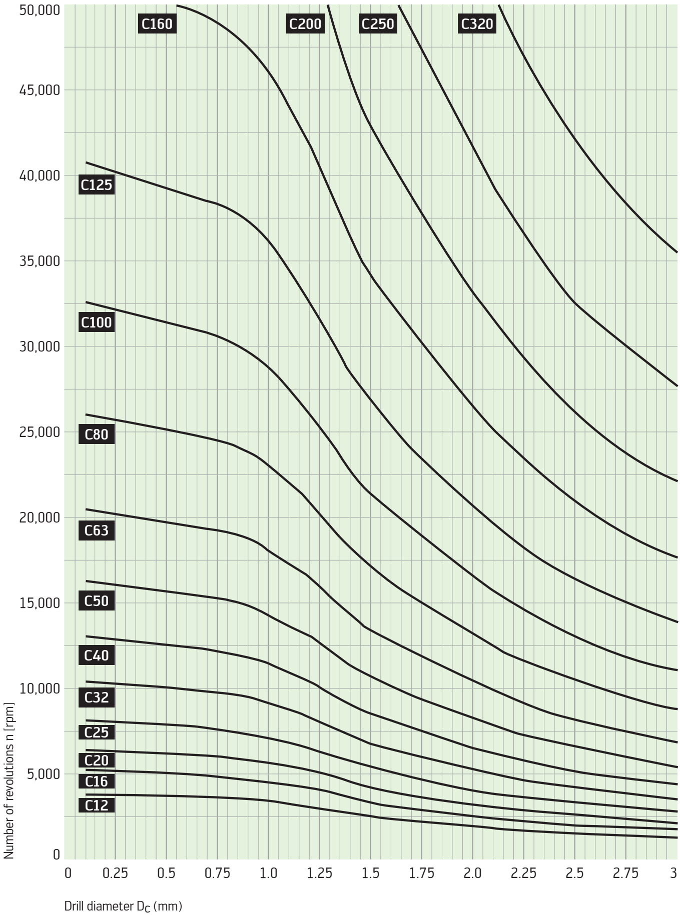
Page information refers to:

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

	3 x D_c							
	K3279XPL				A3279XPL · A3879XPL			
	X·treme Step 90				**X·treme**			
	Walter standard				DIN 6537 K			
	3.30 – 14.50				3.00 – 20.00			
	K30F				K30F			
	XPL				XPL			
	SC **B-22**				GC **B 62 / B 101**			
								
	v_c	VRR			v_c	VRR		
	110	12	**E O**	**M L**	110	12	**E O**	**M L**
	120	12	**E O**	**M L**	120	12	**E O**	**M L**
	110	12	**E O**	**M L**	110	12	**E O**	**M L**
	120	12	**E O**	**M L**	120	12	**E O**	**M L**
	95	10	**E O**	**M L**	95	10	**E O**	**M L**
	110	12	**E O**	**M L**	110	12	**E O**	**M L**
	120	12	**E O**	**M L**	120	12	**E O**	**M L**
	95	10	**E O**	**M L**	95	10	**E O**	**M L**
	63	7	**O E**		63	7	**O E**	
	48	5	**O E**		48	5	**O E**	
	63	9	**E O**		63	9	**E O**	
	80	9	**E O**		80	9	**E O**	
	48	5	**O E**		48	5	**O E**	
	63	9	**E O**		63	9	**E O**	
	40	7	**E O**		40	7	**E O**	
	53	6	**E O**		53	6	**E O**	
	90	16	**E O**	**M L**	90	16	**E O**	**M L**
	90	16	**E O**	**M L**	90	16	**E O**	**M L**
	110	16	**E O**	**M L**	110	16	**E O**	**M L**
	95	16	**E O**	**M L**	95	16	**E O**	**M L**
	110	16	**E O**	**M L**	110	16	**E O**	**M L**
	90	16	**E O**	**M L**	90	16	**E O**	**M L**
	100	16	**E O**	**M L**	100	16	**E O**	**M L**
	260	10	**E O**		260	10	**E O**	
	260	10	**E O**		260	10	**E O**	
	240	16	**E O**		240	16	**E O**	
	210	16	**E O**		210	16	**E O**	
	170	12	**E O**		170	12	**E O**	
	200	7	**E O**	**M**	200	7	**E O**	**M**
	170	12	**E O**		170	12	**E O**	
	190	16	**E O**	**M L**	190	16	**E O**	**M L**
	67	5	**E O**		67	5	**E O**	
	42	5	**O E**		42	5	**O E**	
	36	4	**O E**		36	4	**O E**	
	67	5	**E O**		67	5	**E O**	
	67	5	**E O**		67	5	**E O**	
	34	4	**O E**		34	4	**O E**	
	26	3	**O E**		26	3	**O E**	
	26	3	**O E**		26	3	**O E**	
	95	16	**E O**		95	16	**E O**	

HB = this handbook · GC = Walter General Catalog 2012 · SC = Walter Supplementary Catalog 2014

VCRR: RPM diagram
Solid carbide micro-drills

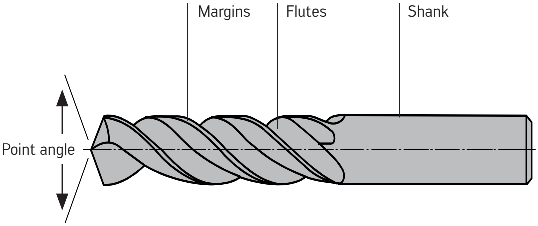


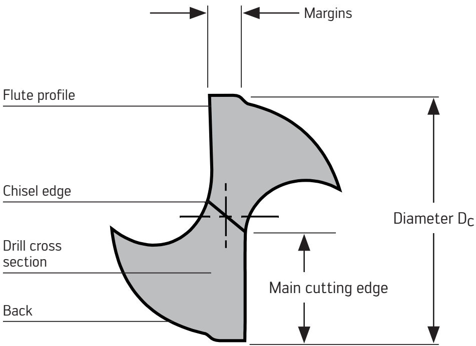
VRR: Feed rate charts for HSS and carbide drills, core drills, countersinks and center drills

VRR	Feed f (inch/rev) for diameter									
	0.25 0.0098 in	**0.4** 0.0157 in	**0.5** 0.0197 in	**0.6** 0.0236 in	**0.8** 0.0315 in	**1** 0.0394 in	**1.2** 0.0472 in	**1.5** 0.0591 in	**2** 0.079 in	**2.5** 0.098 in
1	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003
2	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004	0.0005	0.0007
3	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004	0.0005	0.0006	0.0008	0.0010
4	0.0001	0.0002	0.0003	0.0003	0.0005	0.0005	0.0007	0.0008	0.0011	0.0013
5	0.0002	0.0003	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0013	0.0017
6	0.0002	0.0003	0.0004	0.0005	0.0007	0.0008	0.0010	0.0012	0.0016	0.0020
7	0.0003	0.0004	0.0005	0.0006	0.0008	0.0009	0.0010	0.0015	0.0019	0.0023
8	0.0003	0.0005	0.0005	0.0007	0.0009	0.0010	0.0015	0.0015	0.0021	0.0026
9	0.0003	0.0005	0.0006	0.0007	0.0010	0.0010	0.0015	0.0020	0.0024	0.0030
10	0.0003	0.0005	0.0007	0.0008	0.0010	0.0015	0.0015	0.0020	0.0026	0.0033
12	0.0004	0.0007	0.0008	0.0010	0.0015	0.0015	0.0020	0.0025	0.0031	0.0039
16	0.0005	0.0009	0.0010	0.0015	0.0015	0.0020	0.0025	0.0030	0.0043	0.0051
20	0.0007	0.0010	0.0015	0.0015	0.0020	0.0025	0.0030	0.0040	0.0051	0.0067

VRR	Feed f (inch/rev) for diameter									
	4 0.157 in	**5** 0.197 in	**6** 0.236 in	**8** 0.315 in	**10** 0.394 in	**12** 0.472 in	**15** 0.591 in	**20** 0.787 in	**25** 0.984 in	**40** 1.575 in
1	0.0005	0.0007	0.0007	0.0008	0.0009	0.0010	0.0011	0.0013	0.0015	0.0019
2	0.0011	0.0013	0.0015	0.0017	0.0019	0.0020	0.0023	0.0026	0.0030	0.0037
3	0.0016	0.0020	0.0022	0.0025	0.0028	0.0030	0.0034	0.0039	0.0043	0.0055
4	0.0021	0.0026	0.0029	0.0033	0.0037	0.0039	0.0047	0.0051	0.0059	0.0075
5	0.0026	0.0033	0.0036	0.0043	0.0047	0.0051	0.0055	0.0067	0.0075	0.0094
6	0.0031	0.0039	0.0043	0.0051	0.0055	0.0059	0.0067	0.0079	0.0087	0.0110
7	0.0037	0.0047	0.0051	0.0059	0.0063	0.0071	0.0079	0.0091	0.0100	0.0130
8	0.0043	0.0051	0.0059	0.0067	0.0075	0.0083	0.0091	0.0105	0.0120	0.0150
9	0.0047	0.0059	0.0063	0.0075	0.0083	0.0091	0.0100	0.0120	0.0135	0.0165
10	0.0051	0.0067	0.0071	0.0083	0.0094	0.0100	0.0115	0.0130	0.0145	0.0185
12	0.0063	0.0079	0.0087	0.0098	0.0110	0.0120	0.0140	0.0155	0.0175	0.0220
16	0.0083	0.0105	0.0115	0.0135	0.0150	0.0160	0.0180	0.0210	0.0240	0.0300
20	0.0105	0.0130	0.0145	0.0165	0.0185	0.0200	0.0230	0.0260	0.0300	0.0370

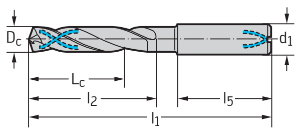
Designations



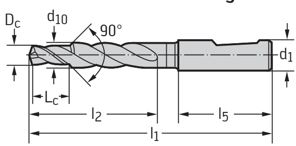


Designations in catalog

D_c	Cutting diameter
d_1	Shank diameter
d_{10}	Step diameter
L_c	Effective length
l_1	Overall length
l_2	Flute length
l_5	Shank length



Countersink angle



Cutting materials

HSS cutting materials

4 groups of high-speed steel are used for Walter Titex tools:

HSS	High-speed steel for general applications (twist drills, core drills, countersinks, reamers in some cases, center drills, multi-diameter step drills)
HSS-E	High-speed steel with 5% Co to withstand higher stress, especially thermal stress (high-performance twist drills, reamers in some cases)
HSS-E Co8	High-speed steel with 8% Co for maximum thermal loading capability, in accordance with American standard designation M42 (special tools)
HSS-PM	High-speed steel manufactured using powder metallurgy with an extremely high alloy content. Advantages: High degree of purity and uniformity of the joint, outstanding wear resistance and thermal loading capability (special tools)

	Material no.	Short name	Old standard designation	AISI ASTM	AFNOR	B.S.	UNI
HSS	1.3343	S 6-5-2	DMo5	M2	–	BM2	HS 6-5-2
HSS-E	1.3243	S 6-5-2-5	EMo5 Co5	M35	6.5.2.5	–	HS 6-5-2-5
HSS-E Co8	1.3247	S 2-10-1-8	–	M42	–	BM42	HS 2-9-1-8
HSS-PM	Trade name ASP						

Alloy table

	C	Cr	W	Mo	V	Co
HSS	0.82	4.0	6.5	5.0	2.0	–
HSS-E	0.82	4.5	6.0	5.0	2.0	5.0
HSS-E Co8	1.08	4.0	1.5	9.5	1.2	8.25
HSS-PM	Trade name ASP					

Carbide cutting materials

Carbides mainly consist of tungsten carbide (WC) as the hard material and cobalt (Co) as the binding material. In the majority of cases, the cobalt content is between 6 and 12%. The following rule generally applies: The higher the cobalt content, the tougher the material, but the less resistance to wear and vice-versa. Another determining factor in carbides is the grain size. The hardness increases as the grain size becomes finer.

		Co in %	Grain size	Hardness HV
K10	– Extremely wear-resistant substrate – Use in brazed drilling and boring tools	6	normal	1650
K20F	– Extremely wear-resistant substrate with fine grain size – Use in short-chipping materials such as cast iron workpieces	6–7	fine	1650–1800
K30F	– Extremely fine substrate, extremely tough and wear-resistant – Universal application for a variety of materials	10	finest	1550

Surface treatments and hard material coatings for increasing performance

Surface treatments

Steam treatment of tools made from HSS	Nitriding of tools made from HSS
Implementation Dry steam atmosphere, 520 to 580 °C **Effect** Adherent oxide layer consisting of Fe_3O_4 approx. 0.003 to 0.010 mm deep **Property** – Low tendency towards cold welding, increased surface hardness and therefore improved wear resistance – Increased corrosion resistance – Improved sliding properties due to better lubricant adhesion as a result of FeO crystals – Reduction in grinding stress	**Implementation** Treatment in media giving off nitrogen, 520 to 570 °C **Effect** Enrichment of surface with nitrogen and partially with carbon **Property** – Low tendency towards cold welding and build-up on the cutting edge – Increased hardness and therefore greater wear resistance

Hard material coatings

Surface coating has developed into a proven technological process for improving the performance of metal cutting tools. In contrast to surface treatment, the tool surface remains chemically unaltered and a thin layer is applied. With Walter Titex tools made from high-speed steel and carbide, PVD processes are used for the coating which operate at process temperatures of less than 600 °C and therefore do not change the basic tool material. Hard material layers have a higher hardness and wear resistance than the cutting material itself.

In addition, they:
- Keep the cutting material and the material to be machined apart
- Act as a thermal insulation layer

Coated tools not only have a longer service life, but they can also be used with higher cutting speeds and feed rates.

Surface treatment/ coating	Process/ coating	Property	Example tool
Uncoated	No treatment	–	
Steam oxide	Steam treatment	Universal treatment for HSS	
Oxide margin	Steam treatment	Universal treatment of margins for HSS	
TiN	TiN coating	Universal coating	
TIP	TiN tip coating	Special coating for optimum chip evacuation	
TFL	Tinal coating	High-performance coating with wide application area	
TFT	Tinal TOP coating	High-performance coating with particularly low friction	
TFP	Tinal tip coating	High-performance coating for optimum chip evacuation	
TTP	Tinal TOP tip coating	High-performance coating with particularly low friction	
TML	Tinal microcoating	Special coating for small drills with extremely low friction	
XPL	AlCrN coating	High-performance coating for maximum wear resistance	
DPL	Double coating	High-performance coating for maximum wear resistance	
DPP	Double tip coating	High-performance coating for maximum wear resistance	
AML	AlTiN microcoating	Special coating for small drills with extremely low friction	
AMP	AlTiN micro tip coating	Special coating for small drills with extremely low friction	
TMS	AlTiN thin coating	High-performance coating for solid carbide reaming tools	

Walter Titex X·treme drill family

Tool type	Remarks on field of application	Workpiece material group P Steel	M Stainless steel	K Cast iron	N NF metals	S Difficult-to-cut materials	H Hard materials	O Other	Drilling depth 2 x D_c
X·treme Pilot 150 	– Pilot drill, specially designed for X·treme DM.... – 150° point angle	••	••	••	••	••	••	••	A6181AML
X·treme M, DM8 ... DM30 	– Solid carbide micro deep-hole drill diameter 2.00–2.95 mm, 5 to 30 x D_c with internal cooling – D stands for “Deep” – M stands for “Micro” – For universal use	••	••	••	••	••	•	••	
Alpha® 4 Plus Micro 	– Solid carbide micro-drill diameter 0.75–1.95 mm, 8 and 12 x D_c with internal cooling – For universal use	••	••	••	••	••	•	••	
Alpha® 2 Plus Micro 	– Solid carbide micro-drill diameter 0.5–3 mm, 5 and 8 x D_c without internal cooling – For universal use	••		••	••	••	•	••	
X·treme Step 90 	– Solid carbide chamfer drill with internal cooling – Step length in accordance with DIN 8378 – Can be used universally with high cutting data	••	••	••	••	••	••		
X·treme Step 90 	– Solid carbide chamfer drill without internal cooling – Step length in accordance with DIN 8378 – Can be used universally with high cutting data	••	••	••	••	••	••	••	

Drilling depth

	$3 \times D_c$	$5 \times D_c$	$8 \times D_c$	$12 \times D_c$	$16 \times D_c$	$20 \times D_c$	$25 \times D_c$	$30 \times D_c$
		A3389AML	A6489AMP	A6589AMP	A6689AMP	A6789AMP	A6889AMP	A6989AMP
			A6488TML	A6588TML				
		A3378TML	A6478TML					
	*K3299XPL K3899XPL							
	K3879XPL							

One-piece = HA shank

* Two-piece = HA shank / HE shank

Walter Titex X·treme drill family

Tool type	Remarks on field of application	P Steel	M Stainless steel	K Cast iron	N NF metals	S Difficult-to-cut materials	H Hard materials	O Other	Drilling depth 2 x D_c
X·treme 	– Solid carbide drill in accordance with DIN 6537 short/long with internal cooling – Can be used universally with high cutting data	••	••	••	••	••	••		
X·treme 	– Solid carbide drill in accordance with DIN 6537 short/long without internal cooling – Can be used universally with high cutting data	••	••	••	••	••	••	••	
X·treme Plus 	– Solid carbide high-performance drill in accordance with DIN 6537 short/long with internal cooling – Can be used universally with maximum cutting data	••	••	••	••	••	••	•	
X·treme CI 	– Solid carbide high-performance drill in accordance with DIN 6537 long with internal cooling – Specially developed for cast iron materials – CI stands for "cast iron"			••					
X·treme Inox 	– Solid carbide drill in accordance with DIN 6537 short/long with internal cooling – Specially developed for stainless steels	••	••		•	••		•	
Alpha® Ni 	– Solid carbide drill in accordance with DIN 6537 long with internal cooling – Specially developed for Ni alloys	•	•			••	•		

Workpiece material group: P, M, K, N, S, H, O

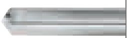
Drilling depth

	3 x D_c	5 x D_c	8 x D_c	12 x D_c	16 x D_c	20 x D_c	25 x D_c	30 x D_c
	*A3299XPL A3899XPL	*A3399XPL A3999XPL						
	*A3279XPL A3879XPL	*A3379XPL A3979XPL						
	A3289DPL	A3389DPL						
		A3382XPL						
	A3293TTP	A3393TTP						
		A3384						

One-piece = HA shank

* Two-piece = HA shank / HE shank

Walter Titex X·treme drill family

Tool type	Remarks on field of application	Workpiece material group P Steel	M Stainless steel	K Cast iron	N NF metals	S Difficult-to-cut materials	H Hard materials	O Other	Drilling depth 2 x D_c	
Alpha® Rc 	– Solid carbide drill in accordance with DIN 6537 short without internal cooling – Specially developed for hardened materials				••	••	••			
Alpha® Jet 	– Straight flute solid carbide drill in accordance with DIN 6537 long, 8 and 12 x D_c with internal cooling – For short-chipping cast iron and aluminum materials			••	••	•		••		
X·treme D8...D12 	– Solid carbide deep-hole drill, 8 x D_c and 12 x D_c with internal cooling – D stands for "deep" – Can be used universally with high cutting data	••	••	••	••	••	••	•		
Alpha® 44 	– Solid carbide drill 8 x D_c with internal cooling – UFL® profile – For universal use	••	•	•	••	••		••		
Alpha® 22 	– Solid carbide drill 8 x D_c without internal cooling – UFL® profile – For universal use	••		••	••	••				
X·treme Pilot Step 90 	– Stepped pilot drill, specially designed for Alpha® 4 XD, X·treme D & DH and XD70 technology with internal cooling – 150° point angle – 90° countersink angle	••	••	••	••	••	••	••	K3281TFT	

Drilling depth

	$3 \times D_c$	$5 \times D_c$	$8 \times D_c$	$12 \times D_c$	$16 \times D_c$	$20 \times D_c$	$25 \times D_c$	$30 \times D_c$
	A3269TFL							
		A3387	A3487	A3687				
			A6489DPP	A6589DPP				
			*A3486TIP A3586TIP					
			A1276TFL					

One-piece = HA shank

* Two-piece = HA shank / HE shank

Walter Titex X·treme drill family

Tool type	Remarks on field of application	P Steel	M Stainless steel	K Cast iron	N NF metals	S Difficult-to-cut materials	H Hard materials	O Other	Drilling depth 2 x D_c
		Workpiece material group							
XD Pilot 	– Pilot drill, specially designed for Alpha® 4 XD, X·treme D & DH and XD70 technology with internal cooling – 150° point angle	••	••	••	••	••	••	••	A6181TFT
X·treme Pilot 180 	– Pilot drill, specially designed for Alpha® 4 XD, X·treme D & DH and XD70 technology with internal cooling – 180° point angle – Specially developed for inclined and convex surfaces	••	••	••	••	••	••	••	A7191TFT
X·treme Pilot 180C 	– Pilot drill, specially designed for Alpha® 4 XD, X·treme D & DH and XD70 technology with internal cooling – Specially developed for inclined and convex surfaces – The conical design means that there is no shoulder between the pilot hole and the deep hole (important with crankshafts) – 180° point angle	••	••	••	••	••	••	••	K5191TFT
Alpha® 4 XD16...30 	– Solid carbide deep-hole drill 16 to 30 x D_c with internal cooling – For universal use	••	••	••	••	••	•	••	
X·treme DH20–DH30 	– Solid carbide deep-hole drill, 20 x D_c and 30 x D_c with internal cooling – D stands for “deep” – H stands for “heavy-duty materials” (steel that is difficult to cut), e.g. crankshafts	••	••	••	•	••	•		
X·treme D40–D50 	– Solid carbide deep-hole drill, 40 x D_c and 50 x D_c with internal cooling – For universal use	••	•	••	••	•			

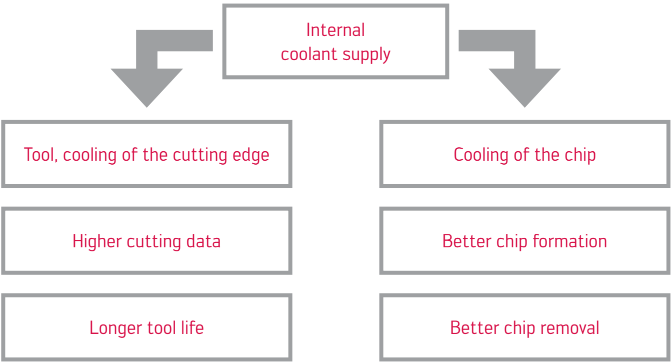
	Drilling depth									
	3 x D_c	5 x D_c	8 x D_c	12 x D_c	16 x D_c	20 x D_c	25 x D_c	30 x D_c	40 x D_c	50 x D_c
					A6685TFP	A6785TFP	A6885TFP	A6985TFP		
						A6794TFP		A6994TFP		
									A7495TTP	A7595TTP

One-piece = HA shank

Internal coolant supply

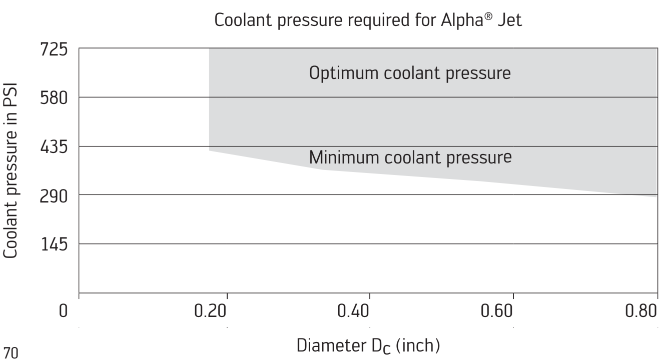
Effect of the internal coolant supply

– Standard for solid carbide high-performance tools today
– Helical flow through the tool; the helix angle matches the course of the flutes
– The internal coolant supply has an effect on the tool (cutting edge) and aids the machining process directly (chip formation)



Coolant pressure required

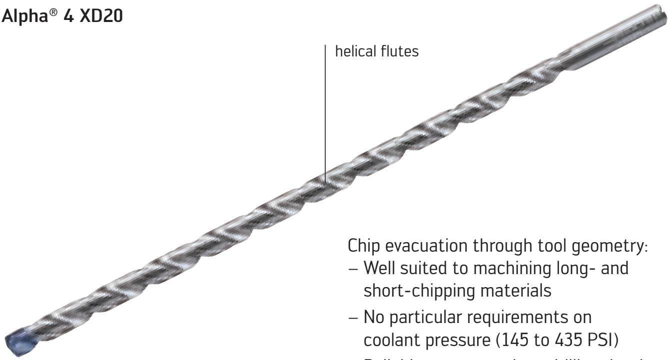
– The coolant pressure required for Walter Titex solid carbide drills with internal cooling is 145 to 435 PSI.
– The only exception is the Alpha® Jet type: The straight flutes require higher pressure (see diagram).



Internal coolant supply and chip removal

Comparison of a tool with helical flutes (Alpha® 4 XD20) and a tool with straight flutes (Alpha® Jet)

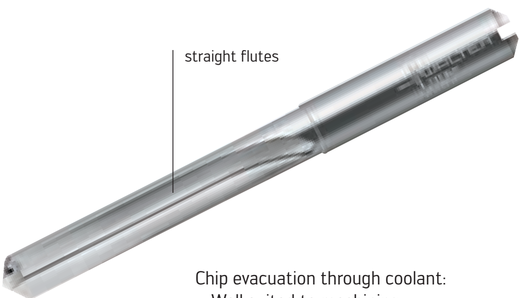
Alpha® 4 XD20



Chip evacuation through tool geometry:

- Well suited to machining long- and short-chipping materials
- No particular requirements on coolant pressure (145 to 435 PSI)
- Reliable up to very deep drilling depths

Alpha® Jet



Chip evacuation through coolant:

- Well suited to machining short-chipping materials
- High coolant pressure required (see diagram on opposite page)
- Reliable up to drilling depths of approx. 20 x D_C

Shank shapes

Shank DIN 6535 HA

- Parallel shank without flat
- Optimum concentricity
- First choice for solid carbide tools, HSC machining, deep-hole drilling and micromachining

Suitable adaptors:
- Hydraulic expansion chuck
- Shrink-fit chuck

Shank DIN 6535 HE

- Parallel shank with flat
- Second choice for solid carbide tools

Suitable adaptors:
- Whistle-notch chuck
- Hydraulic expansion chuck with bush

Parallel shank

- Parallel shank with shank diameter the same as cutting diameter
- Most common shank design in HSS tools
- Rarely used in solid carbide tools

Suitable adaptors:
- Collet chuck

Tapered shank DIN 228 A (Morse taper)

- Tapered shank
- Used fairly frequently in HSS tools

Clamping devices

Hydraulic expansion chuck

- Concentricity 0.003–0.005 mm
- Uniform wear and therefore longer service life
- Outstanding operational smoothness
- Especially suitable for solid carbide tools with standard shank shape HA
- Able to transfer high torques
- Outstanding process reliability
- Very good damping properties
- Optimum hole quality (surface, precision)
- Relatively dirt-resistant
- Easy to use
- Suitable for HSC machining

Shrink-fit chuck

- Concentricity 0.003-0.005 mm
- Very evenly distributed wear and therefore longer service life
- Outstanding operational smoothness
- Especially suitable for solid carbide tools with standard shank shape HA
- Suitable for HSC machining

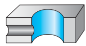
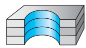
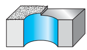
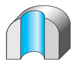
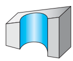
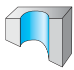
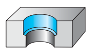
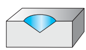
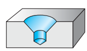
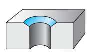
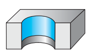
Whistle-notch chuck

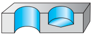
- Concentricity approx. 0.01 mm
- Especially suitable for HSS and solid carbide tools with standard shank shape HE
- Able to transfer high torques thanks to positive fit

Collet chuck

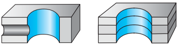
- Concentricity approx. 0.025 mm
- Especially suitable for HSS tools with parallel shank

Drilling operations

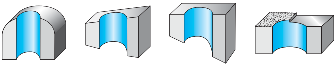
Operation	Subgroup	Description	Example
Drilling	Continuous drilling	Drilling into solid material. This is what the majority of drilling tools are designed for. Drilling tools are also often used as step drills in special applications.	
	Interrupted cut	Drilling into solid material. The drilling process is interrupted, e.g. because the tool meets a cross hole or the hole is being drilled through several components. In these cases, the stability of the tool is extremely important. It can be advantageous to have four margins.	 
	"Rough" surface finish	Drilling into solid material. The top and/or bottom of the component to be machined is rough or uneven (e.g. curved or inclined surfaces). In these cases, the stability of the tool is extremely important. It can be advantageous to have four margins. A pilot tool with a 180° point angle can be used if the hole entry is uneven.	
	Hole entry on a curved surface		
	Hole entry on an uneven or inclined surface		
	Hole exit on an uneven or inclined surface		
Counter-boring	A hole has already been drilled in the component and requires further machining, or there are consecutive different-sized holes. There are special tools for this kind of machining. Standard drilling tools may potentially be used. In contrast to continuous drilling, varying chip formation must be considered. The cutting data also need to be adapted. Increased wear is to be expected on edges of the drill bit.		
Spot drilling	Drilling a hole for the purpose of centering on NC machines, e.g. for the final drilling operation.		
Centering	Drilling a hole for the purpose of centering, e.g. for the final drilling operation.		
Counter-sinking	For countersinking pre-drilled holes for countersunk-head screws and countersunk-head rivets; also for deburring.		
Reaming	For making holes with limited diameter tolerances and a fine surface quality. The process is similar to counterboring, but with significantly better hole quality. An additional operation that can be avoided by designing components to meet production requirements and by using carbide drilling tools, if necessary.		



X·treme Plus, e.g. A3389DPL

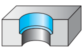


X·treme D12, e.g. A6589DPP

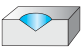


X·treme, e.g. A3299XPL

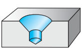
Application	Limits/measures
Interrupted cut	– Reduce the feed (approx. 0.25 to 0.5 x f) – Use a tool with four margins
Curved surface	– Reduce the feed (approx. 0.25 to 0.5 x f) – Use a tool with four margins – If required, pilot drill or mill the surface (180°)
Hole entry on an inclined surface	– Reduce the feed (approx. 0.25 to 0.5 x f) – Use a tool with four margins (inclination up to 5°) – If required, pilot drill or mill the surface (inclination greater than 5°)
Hole exit on an inclined surface	– Reduce the feed (approx. 0.25 to 0.5 x f) – Use a tool with four margins – Inclined surfaces up to 45° inclination possible



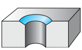
e.g. E1111

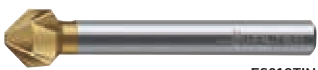


e.g. E1174

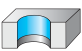


e.g. K1114





e.g. E6819TIN



e.g. F2481TMS

Surface quality

Factors affecting the surface quality

Under the same conditions, solid carbide tools produce better-quality surfaces than HSS tools.

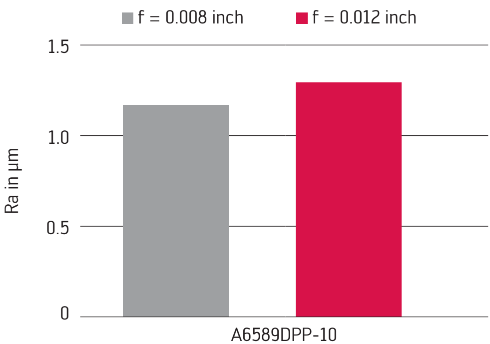
In addition:
- The shorter the drill, the better the surface quality. Therefore the tool used should always be as short as possible – this also applies to the accuracy of the hole.
- The feed has a significantly greater effect on the surface quality than the cutting speed.

Achievable surface quality using a solid carbide drill as an example

Operating parameters (drilling without centering):

Tool:	X·treme D12 (A6589DPP)
Diameter:	10 mm
Drilling depth:	100 mm
Material:	C45
Coolant:	Emulsion 6%

v_c = 328 SFM
p = 290 PSI



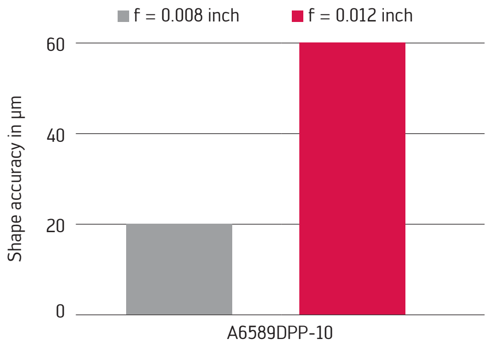
Accuracy of the drilled hole

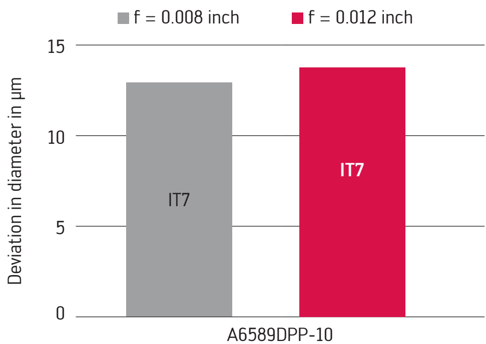
Factors affecting the accuracy of the drilled hole

Under the same conditions, solid carbide tools create more accurate holes than HSS tools.

The factors that affect surface quality also affect the accuracy of the drilled hole (see previous page).

The measured values depicted below were obtained using the same tools and cutting data as on the previous page.





In this example, the tolerance class IT7 is achieved under optimum conditions.

Hole run-off

Hole run-off

Under the same conditions, solid carbide tools wander significantly less than HSS tools. Hole run-off increases with the length of the tool and the depth of the hole. This is the reason why the tool used should always be as short as possible.

The following table compares the deviations in position from the hole entry to the hole exit at a drilling depth of 30 x D_C for different types of tools.

Diameter: 0.315 inch (8 mm)
Drilling depth: 9.450 inch (240 mm)
Material: C45

Hole no.	XD Technology		Gun drill		HSS drill	
	X	Y	X	Y	X	Y
1	0.0008	0.0016	0.0000	0.0012	0.0020	-0.0075
2	0.0000	-0.0008	0.0008	0.0031	0.0177	-0.0091
3	0.0008	-0.0020	-0.0004	0.0039	0.0130	-0.0091
4	0.0016	-0.0035	0.0020	0.0016	0.0291	-0.0161
5	0.0031	0.0020	0.0000	0.0035	0.0291	-0.0264
6	-0.0020	0.0035	0.0028	0.0020	0.0236	-0.0307
7	0.0008	-0.0024	-0.0008	0.0024	0.0130	-1.0630
8	-0.0004	-0.0028	0.0016	0.0012	-0.0075	-0.0098
9	-0.0024	0.0020	-0.0012	0.0055	-0.0094	-0.0035
Average	0.0018		0.0019		0.0150	

H7 hole tolerance

Holes with an H7 tolerance class

Achieving an IT (International Tolerance) class of 7 (H7 is a very common tolerance for holes) with a drilling tool eliminates the need for subsequent fine machining, such as reaming, in many applications. The manufacturing tolerances of solid carbide drilling tools are inherently so small that this tolerance class could be achieved. However, the tool is only one aspect of the application that affects the accuracy of the drilled hole. The machine components and machining conditions all have an effect on the achievable accuracy of the drilled hole (see table).

	Influential factors	Example of the effect
Hole	– Diameter – Drilling depth	Tolerance class IT 7 for diameters of 5 mm–12 µm, for diameters of 12 mm–18 µm
Machine	– Stability under dynamic load – Stability under thermal load – Level of maintenance – Controller – Measuring sensor	The more stable the machine, the more accurate the operation. The same applies to the accuracy of the controller and the measuring sensor in the machine.
Spindle	– Concentricity – Stability under dynamic load – Stability under thermal load – Level of maintenance	Extremely good concentricity is required and the condition of the spindle must be known.
Clamping devices	– Design type – Concentricity – Stability under dynamic load – Stability under thermal load – Level of maintenance	Not every clamping device can be used for high-precision machining. A hydraulic expansion chuck is the first choice when drilling (also see HB "Clamping devices" section on page **73**).
Tool	– Material (e.g. HSS or solid carbide) – Tool geometry, e.g. point grinding and the number of margins – Manufacturing tolerances – Level of wear	Solid carbide tools achieve higher degrees of accuracy than HSS tools. The level of wear plays a very large role.
Cutting data	– Correct cutting speed – Correct feed – Chip removal – Coolant	Incorrect cutting data can result in imprecise holes. The feed has a greater effect on the hole than the cutting speed.
Workpiece	– Material – Condition of the material, e.g. homogeneity – Cross holes – Surface quality – Inclined hole entry and/or hole exit – Stability, e.g. wall thickness – Stability under dynamic load – Stability under thermal load	The shape and the material have a considerable effect on the accuracy of the drilled hole.
Clamping arrangement	– Stability under dynamic load – Stability under thermal load	A poor clamping arrangement has a significant effect on the accuracy.

Coolant / MQL / dry

Use of coolants

Use of tools with internal and external cooling
(usually emulsion containing 5–7% oil)
The “active” area on the tool is rinsed with coolant
– The coolant is circulated and re-used

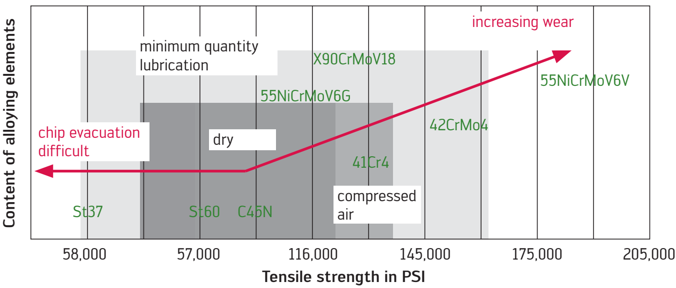
MQL – Minimum quantity lubrication (usually with an internal coolant supply)
– A small quantity of coolant is supplied directly to the cutting edge
– There is no closed circuit – the coolant is used up almost completely; the component, the chips and the tool are virtually dry after machining.
– Compressed air is normally used as a carrier medium

Dry machining
– No lubricant used at all; cooling with compressed air if required

For materials suitable for MQL/dry machining

- Brass alloys
- Magnesium alloys
- Cast iron materials
- Aluminum alloys (mainly cast alloys)

Dry machining of steel materials



For tools suitable for MQL/dry machining

- Most tools from the Alpha® and X·treme families are suitable
- An optimized elliptical or round shank end should be used with MQL machining (see image)

MQL shank ends


DIN 69090

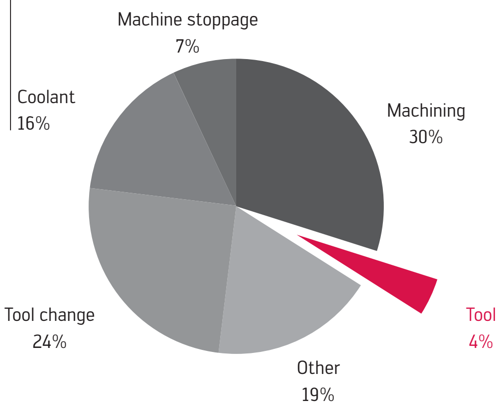

elliptical shape


round shape

Advantages of MQL/dry machining

- More environmentally friendly than conventional cooling lubricant as coolant is not used
- Less of a health hazard as operators are not exposed to biocides in cooling lubricants
- No disposal costs

Using MQL or dry machining enables the proportion of production costs spent on coolant to be considerably reduced.



Requirements for MQL/dry machining

Component
- Material (see opposite page)
- Wall thickness (due to possible deformation caused by heat)

Tool (see cutting data tables)
- Special tool with shank end optimized for MQL machining, if required

Machine
- Prevention of localized temperature increases
- Minimum quantity lubrication (single-channel or dual-channel system)
- The processing of chips must be optimized for dry machining, as a significant proportion of the heat generated by the chips must be removed
- Chips must not be washed away by the coolant

HSC/HPC machining

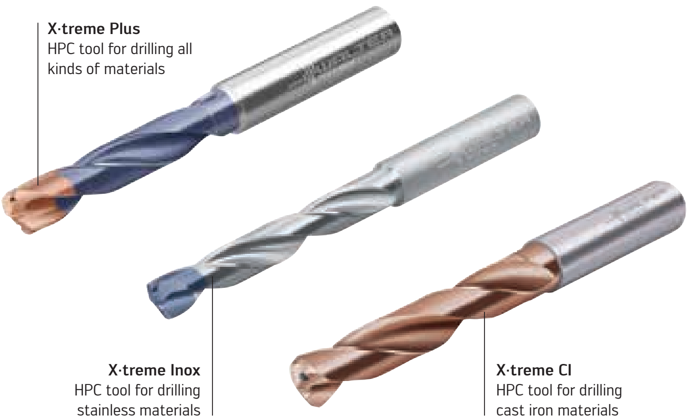
What does HSC/HPC machining stand for?

HSC stands for High-Speed Cutting, i.e. machining at high speeds. The term is most often used with milling cutters. With milling, HSC mainly involves increasing cutting speeds at small axial and radial cutting depths. Large surfaces are machined in a short space of time.

HPC stands for High-Performance Cutting, i.e. increasing the metal removal rate. High-performance drilling therefore usually involves HPC machining, as both the cutting speed and the feed are optimized and increased in order to obtain the highest possible feed rate and therefore productivity.

Tools suitable for HPC machining

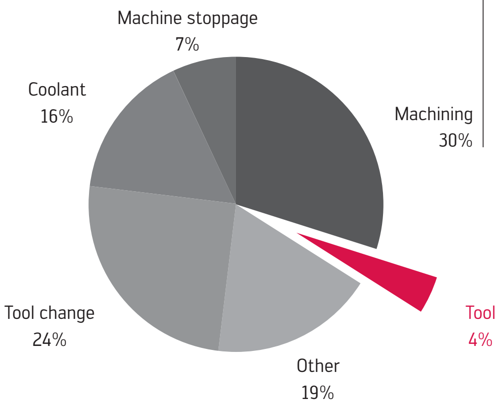
- Solid carbide drills
  - With high-performance coatings (with a few exceptions, e.g. uncoated tools when drilling short-chipping aluminum)
  - Tools with internal cooling (drilling depths greater than approx. 2 x Dc)
  - Optimized geometry with a high degree of stability and the lowest-possible cutting force
- Tools from the Walter Titex X·treme family are suitable
- Extremely high cutting data are achieved with X·treme Plus (universal use), X·treme Inox (for stainless materials) and X·treme CI (for cast iron materials) at drilling depths of up to 5 x D_C
- For greater drilling depths, the X·treme D8 and D12 for drilling depths of 8 x D_C and 12 x D_C are the most suitable
- For even greater drilling depths of up to 50 x D_C, the Alpha® 4 XD16 to Alpha® 4 XD30 and the X·treme D40/D50 are suitable tools



Advantages of HSC/HPC machining

– Highest possible metal removal rate
– Increased productivity reduces machining costs
– Spare machine capacity
– Fast job handling

HPC machining can reduce machining costs considerably.



Requirements for HSC/HPC machining

Component
– Suitable material
– High degree of stability (→ low deformation under high cutting forces)

Tool (see page to the left and cutting data tables)

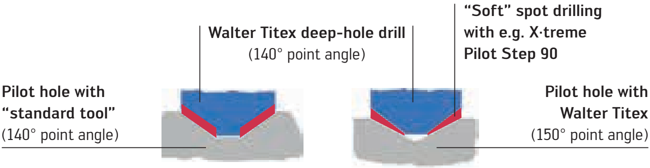
Machine
– High degree of stability
– Fast axes
– High drive power
– Little change in shape caused by heat transfer
– Internal cooling is required with a few exceptions

Deep-hole drilling – Pilot holes

Walter Titex solid carbide deep-hole drills

Walter Titex has been making solid carbide deep-hole drills since 2003. Drilling depths of 30 x D_C were reliably achieved as early as 2005. Drilling depths of up to 70 x D_C have been achieved since 2010 (see HB "Product information – Solid carbide drills – Walter Titex XD70 Technology" section on page **32**).

Deep-hole drilling using Walter Titex carbide tools is always without pecking, i.e. the drilling operation is not interrupted.



The pilot hole

The pilot hole has a significant effect on:
- Process reliability
- Hole quality
- Service life of the deep-hole drill

A pilot hole should be drilled when the final drilling depth will be 16 x D_C or more. Essentially, a pilot hole can be created with any solid carbide tool that has the same point angle as the deep-hole drill to be used subsequently. Its diameter must also be the same as that of the deep-hole drill.

Walter Titex pilot drills

Walter Titex deep-drilling technology encompasses not only solid carbide deep-hole drills but also special pilot drills (see HB "Product information – Solid carbide drills – Other Walter Titex pilot drills" section on page **31**). Walter Titex pilot drills have the following advantages over "conventional" carbide drills:
- Higher degree of stability
- Point angle adjusted to the application
- Diameter tolerance adjusted to the application
- Special conical design

These properties offer the following benefits:
- Even greater process reliability
- Further optimized hole quality
- Significantly longer service life of the deep-hole drills thanks to protection of the peripheral cutting edges and "soft" spot drilling of the deep-hole drills (see image above)

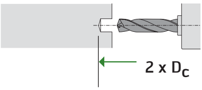
Drilling strategy 1:
XD Technology ≤ 30 x D_c

suitable for:

– A6685TFP	– A6985TFP
– A6785TFP	– A6794TFP
– A6885TFP	– A6994TFP

P	M	K	N	S	H	O
✓	✓	✓		✓	✓	✓

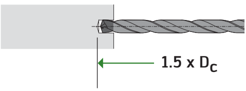
1 Pilot drilling 1



145 - 435 PSI
on

2 x D_c
A6181TFT
A7191TFT
K5191TFT
K3281TFT

2 Piloting

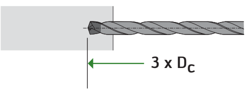


off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

3 Spot drilling

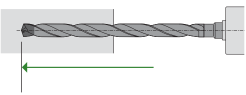


145 - 435 PSI
on

XD Technology

v_c = 25–50%
v_f = 25–50%

4 Deep-hole drilling

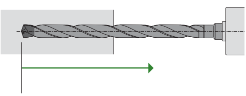


145 - 435 PSI
on

XD Technology

v_c = 100%
v_f = 100%

5 Retracting



off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

V_c / V_f → GPS

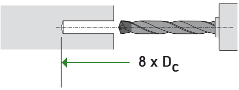
Drilling strategy 2:
XD Technology ≤ 30 x D_C

suitable for:

– A6685TFP	– A6885TFP
– A6785TFP	– A6985TFP

P	M	K	N	S	H	O
			✓			

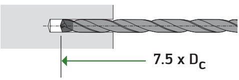
1 Pilot drilling



145 - 435 PSI
on

8 x D_C
A6489DPP

2 Piloting

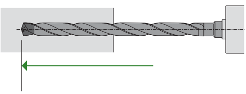


off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

3 Deep-hole drilling

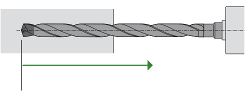


145 - 435 PSI
on

XD Technology

v_c = 100%
v_f = 100%

4 Retracting



off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

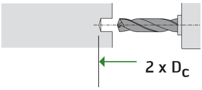
V_C / V_f → GPS

Drilling strategy 3:
XD Technology ≤ 50 x D_c

suitable for:
– A7495TTP
– A7595TTP
– Special boring tools up to 50 x D_c

P	M	K	N	S	H	O
✓		✓	✓			

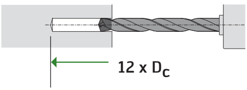
1 Pilot drilling 1



145 - 435 PSI
on

2 x D_c
A6181TFT
A7191TFT
K3281TFT

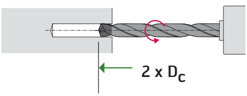
2 Pilot drilling 2



145 - 435 PSI
on

12 x D_c
A6589DPP

3 Piloting

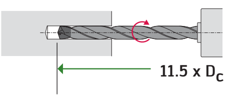


off

XD Technology

With counterclockwise rotation:
n_{max} = 100 rpm
v_f = 40 inch/min

4 Piloting

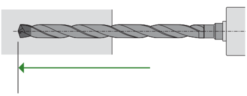


off

XD Technology

Continue operation with clockwise rotation:
n_{max} = 100 rpm
v_f = 40 inch/min

5 Deep-hole drilling

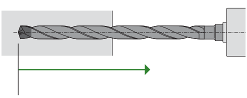


290 - 580 PSI
on

XD Technology

v_c = 100%
v_f = 100%

6 Retracting



off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

V_c / V_f → GPS

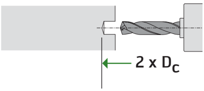
Drilling strategy 4:
XD Technology ≤ 50–70 x D_c

suitable for:

– Special boring tools ≥ 50 x D_c

P	M	K	N	S	H	O
✓		✓	✓			

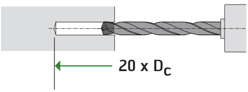
1 Pilot drilling 1



145 - 435 PSI
on

2 x D_c
A6181TFT
A7191TFT
K3281TFT

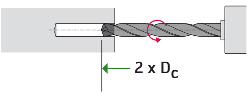
2 Pilot drilling 2



145 - 435 PSI
on

20 x D_c
A6785TFP

3 Piloting

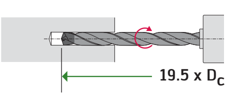


off

XD Technology

With counterclockwise rotation:
n_{max} = 100 rpm
v_f = 40 inch/min

4 Piloting

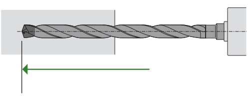


off

XD Technology

Continue operation with clockwise rotation:
n_{max} = 100 rpm
v_f = 40 inch/min

5 Deep-hole drilling

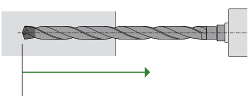


290 - 580 PSI
on

XD Technology

v_c = 100%
v_f = 100%

6 Retracting



off

XD Technology

n_{max} = 100 rpm
v_f = 40 inch/min

V_c / V_f → GPS

Drilling strategy 5: Micro XD Technology ≤ 30 x D_c

suitable for:

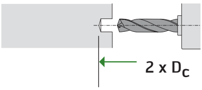
– A6489AMP	– A6789AMP
– A6589AMP	– A6889AMP
– A6689AMP	– A6989AMP

P	M	K	N	S	H	O
✓	✓	✓	✓	✓	✓	✓

1 Pilot drilling

145-435 PSI
on

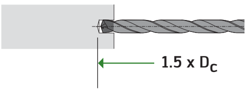
2 x D_c
A6181AML



2 Piloting

off

XD Technology

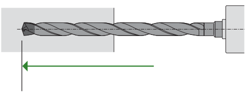


n_{max} = 100 rpm
v_f = 40 inch/min

3 Deep-hole drilling

145-435 PSI
on

XD Technology

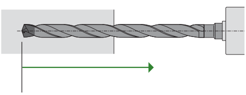


v_c = 100%
v_f = 100%

5 Retracting

off

XD Technology



n_{max} = 100 rpm
v_f = 40 inch/min

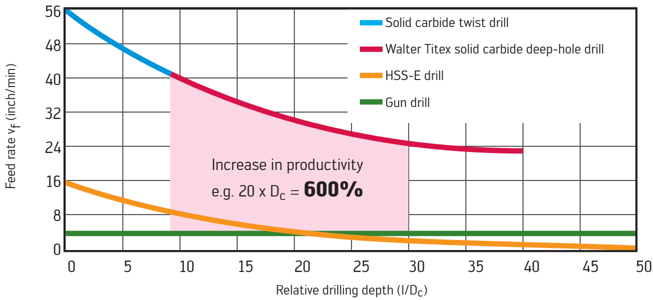
V_c / V_f → GPS

Deep-hole drilling – Solid carbide and gun drills

Comparing solid carbide deep-hole drills and gun drills

Drilling deep holes using gun drills is a common and reliable procedure.

In many applications, these tools can be replaced with solid carbide deep-hole drills. This enables the machining speed and therefore productivity levels to be increased enormously, as in some cases higher feed rates can be achieved using helical solid carbide drills (see image).



In addition to increasing productivity, using **Walter Titex** solid carbide deep-hole drills has the following positive effects on the production of parts/ components with deep holes:

- Shortened process chain
- Complete machining in one clamping arrangement
- No outsourcing required
- Shorter lead times
- High versatility
- Easy to use
- No particular requirements on cooling lubricant
- No particular requirements on the coolant pressure
- Sealing of the work room is not necessary thanks to the low level of coolant pressure required
- No investment in deep-drilling machines required
- Use on machining centers
- No need to purchase drill bushes, steady-rest bushes or sealing rings
- No problems with cross holes

Micromachining

Walter Titex solid carbide micro-drills

Walter Titex offers a comprehensive range of drilling tools for use in micromachining. The smallest solid carbide high-performance tools have a diameter of 0.020 inch (0.5 mm) without an internal coolant supply and a diameter of 0.030 inch (0.75 mm) with an internal coolant supply (see "Tools – Solid carbide – Micromachining" section). The largest micro-tool has a diameter of 0.118 in (2.99 mm).

The range includes internally cooled and externally cooled tools. Drilling depths of up to 30 x D_C can be achieved with tools from the catalogue range. Externally cooled Alpha® 2 Plus Micro tools can even achieve drilling depths of up to 8 x D_C in many materials without pecking.

The dimensions of the tools are adjusted to the particular conditions when drilling small-diameter holes in accordance with Walter Titex standards. A longer shank ensures that the tool is not obscured by the clamping device (visual check). This also allows any potential interference contours to be avoided.

Solid carbide high-performance tools for small diameters are available in both the established Alpha® range and the newer X·treme drill family (see HB "Product information – Solid carbide drills – Walter Titex X·treme M, DM8..30" section from page **28** onwards).

The following points should be taken into consideration when using solid carbide micro-drills:

- The coolant must be filtered (filter size < 20 µm, typical size 5 µm)
- A coolant pressure of 290 PSI is sufficient, higher pressures are possible
- There is a risk of the coolant pumps overheating due to the small volume of fluid flowing through them
- Use oil or emulsion as a coolant
- The surfaces of the workpieces should be as flat and smooth as possible, as bumps generate higher lateral forces (risk of the tool breaking or rapid wear)
- The use of hydraulic-expansion adaptors or shrink-fit adaptors is recommended
- The drilling strategy should always be followed when drilling deep holes (see page 86 onwards) and the correct X·treme Pilot 150 pilot tool used (type A6181AML).

Wear

Optimum time for regrinding

Tool stopped at the last minute

The peripheral cutting edge will soon break, which then poses a risk to the components

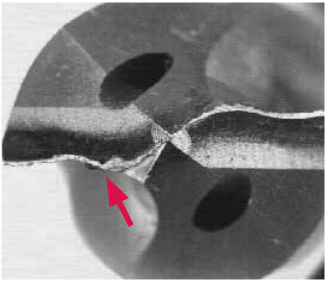
Condition shortly before the end of the tool's service life

Components at risk

Optimum time

The tool can be reconditioned several times

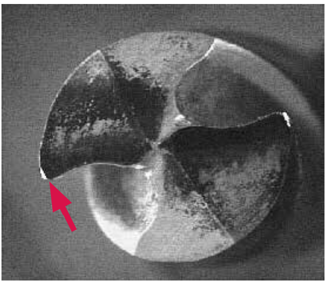
Chisel edge wear



Action
– Send for reconditioning

Shortening of the tool
– Approx. 0.012 to 0.020 inch (0.3 to 0.5 mm) depending on wear

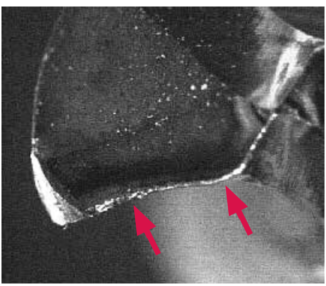
Wear on the peripheral cutting edge



Action
– Send for reconditioning

Shortening of the tool
– Approx. 0.012 to 0.020 inch (0.3 to 0.5 mm) depending on wear

Severe wear on the main and peripheral cutting edges

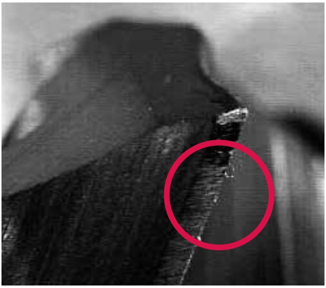


Action
– Remove the tool from the machine sooner
– Send for reconditioning

Shortening of the tool
– Approx. 0.040 inch (1.0 mm) below the chamfer wear

Wear

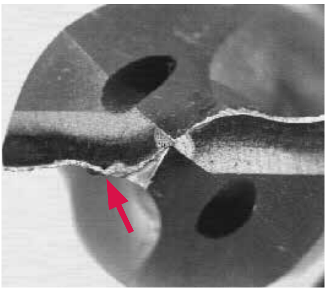
Wear on the chamfers



Action
- Remove the tool from the machine sooner
- The chamfer is deformed
- Send for reconditioning

Shortening of the tool
- Depends on the damage to the chamfers

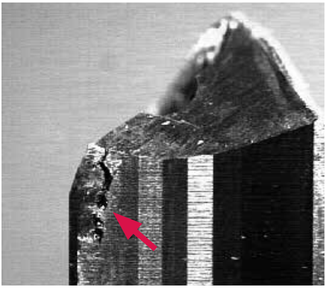
Wear on the chisel edge and main cutting edge



Action
- Send for reconditioning

Shortening of the tool
- 0.020 inch (0.5 mm) under the peripheral cutting edge

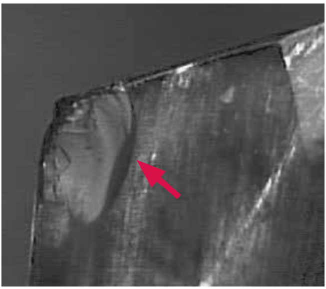
Extreme material deposits and chipping



Action
– Remove deposits
– Send for reconditioning

Shortening of the tool
– Approx. 0.012 to 0.020 inch (0.3 to 0.5 mm) depending on wear

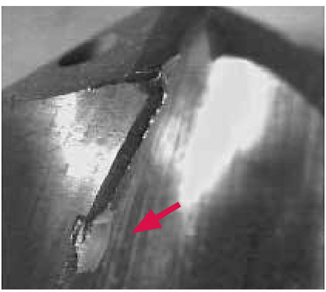
Chipping at the corners of the main cutting edge



Action
– Shortening of the tool and grinding of a new point
– Send for reconditioning

Shortening of the tool
– At least 0.040 inch (1.0 mm) under the chipping

Cracks/chipping on the chamfer



Action
– Send for reconditioning

Shortening of the tool
– Grinding of a new point

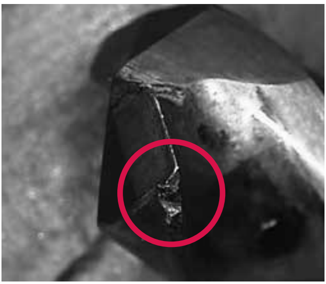
Wear

Chipping on the peripheral cutting edges

Action
- Remove the tool from the machine sooner
- Send for reconditioning

Shortening of the tool
- 0.040 inch (1.0 mm) under the chipping

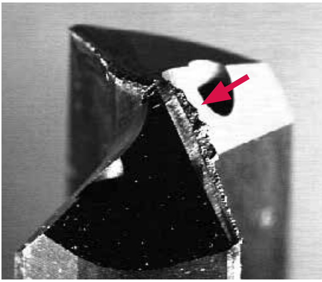
Chipping on the chamfer



Action
- Send for reconditioning

Shortening of the tool
- Set the tip back until the damage has been removed completely

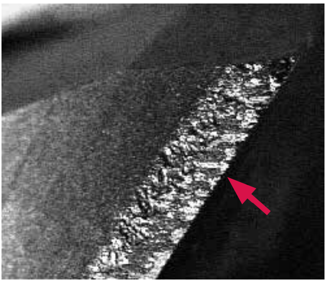
Deposits on the main cutting edge with damage



Action
– Send for reconditioning

Shortening of the tool
– Regrind the point, shorten by approx. 0.012 to 0.020 inch (0.3 to 0.5 mm) depending on wear

Deposits on the chamfer with damage

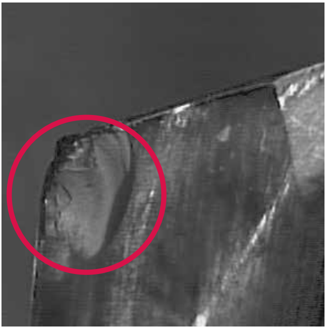


Action
– Send for reconditioning

Shortening of the tool
– Shorten and recondition the tool

Problems – Causes – Solutions

Chipped peripheral cutting edges



– Excessive edge wear causing the corner to chip
  - Recondition promptly

– Workpiece springs up when through-hole drilling, tool therefore catches
  - Reduce the feed rate for through-hole drilling (-50%)

– Inclined exit during through-hole drilling results in interrupted cut
  - Reduce the feed rate for through-hole drilling (-50%)

– Through-hole drilling of a cross hole results in interrupted cut
  - Reduce the feed rate for through-drilling of the cross hole (-50% to -70%)

– Centering with too small a point angle, tool therefore drilling with the edges first
  - Pre-center with point angle > point angle of drill

– Mechanical overload of peripheral cutting edges
  - Reduce the feed

– Material has hard surface
  - Reduce the feed rate and cutting speed for drilling on entry (and, if applicable, on exit if hard on both sides) (-50% in both cases)

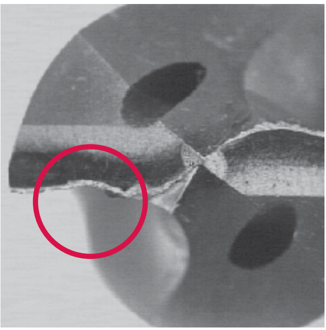
– Material too hard
  - Use special tool for hard/ hardened materials

Destroyed peripheral cutting edges

– Excessive edge wear
  • Recondition promptly

– Peripheral cutting edges overheated
  • Reduce the cutting speed

Center region destroyed



– Excessive wear in the center causing it to chip
  • Recondition promptly

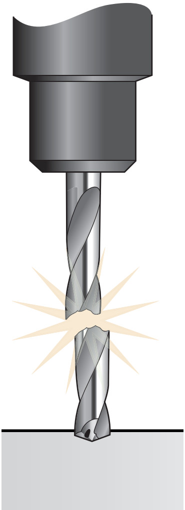
– Mechanical overload of point
  • Reduce the feed

– Material has hard surface
  • Reduce the feed rate and cutting speed for drilling on entry (-50%)

– Material too hard
  • Use special tool for hard/ hardened materials

Problems – Causes – Solutions

Drill bit breakage



– Excessive wear causing breakage due to overloading
  - Recondition promptly

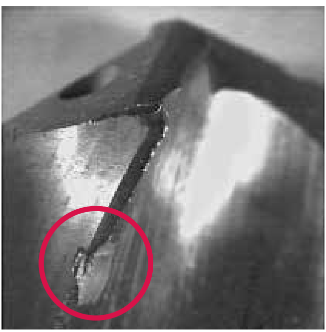
– Chip accumulation
  - Check that the flute length is at least equal to drilling depth +1.5 x d
  - Use a drill bit with better chip transport properties

– Drill bit wanders on entry (e.g. because bit is too long, entry surface is not flat, entry surface is inclined)
  - Center or pilot drill

– On lathes: Alignment error between rotary axis and drill axis
  - Use an HSS(-E) drill bit or a drill bit with a steel shank instead of a solid carbide tool

– Workpiece not clamped with adequate stability
  - Improve workpiece clamping

Chipping on cylindrical margins

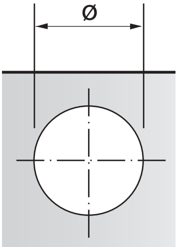


– Handling error

– Keep tools in their original packaging

– Keep tools apart/prevent contact between them

Hole too large



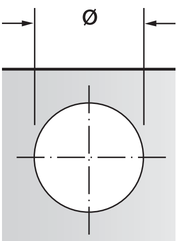
– Excessive center wear or irregular wear
  - Recondition promptly

– Drill bit wanders on entry (e.g. because bit is too long, entry surface is not flat, entry surface is inclined)
  - Center-mark

– Concentricity error of the chuck or the machine spindle
  - Use a hydraulic expansion chuck or shrink-fit chuck
  - Check and repair the machine spindle

– Workpiece not clamped with adequate stability
  - Improve workpiece clamping

Hole too small

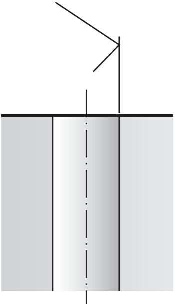


– Excessive wear of cylindrical margins or edges
  - Recondition promptly

– Hole not round
  - Reduce the cutting speed

Problems – Causes – Solutions

Poor surface finish



– Excessive wear of the peripheral cutting edge or cylindrical margins
  - Recondition promptly

– Chip accumulation
  - Check that the flute length is at least equal to drilling depth +1.5 x d
  - Use a drill bit with better chip transport properties

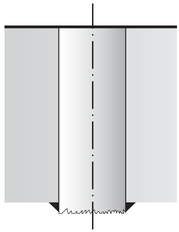
Poor chip formation

– Excessive wear of the main cutting edge affecting chip formation
  - Recondition promptly

– Chips are too thin as the feed rate is too low
  - Increase the feed

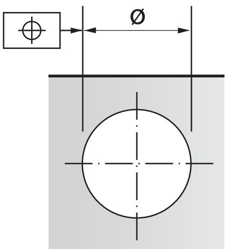
– Inadequate cooling causing the chips to overheat
  - Use internal cooling instead of external cooling
  - Increase the pressure of the internal coolant supply
  - Program interruptions in the feed motion, if necessary

Burr on the hole exit



– Excessive wear on the peripheral cutting edge
  - Recondition promptly

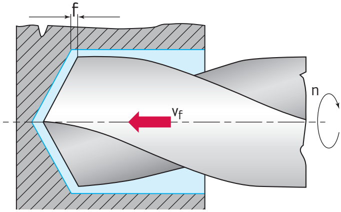
Entry position outside tolerance

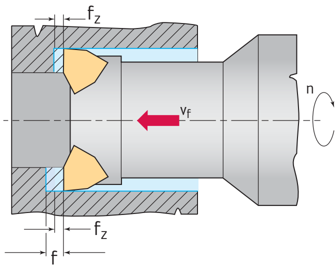


– Excessive center wear
  - Recondition promptly

– Drill bit wanders on entry (e.g. because bit is too long, entry surface is not flat, entry surface is inclined)
  - Center-mark

Drilling calculation formula





Number of revolutions

$$n = \frac{v_c \times 12}{D_c \times \pi} \quad \text{[rpm]}$$

Cutting speed

$$v_c = \frac{D_c \times \pi \times n}{12} \quad \text{[ft/min]}$$

Feed per revolution

$$f = f_z \text{ x } Z \quad \text{[in]}$$

Feed rate

$$v_f = f \text{ x } n \quad \text{[in/min]}$$

Metal removal rate (continuous drilling)

$$Q = v_f \text{ x } \pi \text{ x } (D_c / 2)^2 \text{ [in}^3\text{/min]}$$

Power requirement

$$Pmot = \frac{D_c \text{ x } V_c \text{ x } f \text{ x } k_c}{132{,}000 \text{ x } \eta} \quad \text{[HP]}$$

Torque

$$M_c = \frac{D_c^2 \text{ x } f_z \text{ x } k_c}{8} \quad \text{[in lbs]}$$

Specific cutting force

$$k_c = k_{cw}1.1 \text{ x } h^{-m_{cw}} \quad \text{[lbs/in}^2\text{]}$$

Chip thickness

$$h = f_z \text{ x sin}$$

n	Speed	rpm
D_c	Cutting diameter	in
Z	Number of teeth	
v_c	Cutting speed	ft/min
v_f	Feed rate	in/min
f_z	Feed per tooth	in
f	Feed per revolution	in
A	Chip cross section	in^2
Q	Metal removal rate	in^3/min
P_{mot}	Power requirement	HP
M_c	Torque	in lb
h	Chip thickness	mm
η	Machine efficiency (0.7 – 0.95)	
κ	Approach angle	°
$k_c1.1$*	Specific cutting force related to a chip section of 1.0 in	$lbs/inch^2$
m_c*	Increase in the k_c curve	

* For m_c and $k_c1.1$ see table in GC on page **H 7**

Hardness comparison table

Tensile strength Rm in N/mm²	Brinell hardness HB	Rockwell hardness HRC	Vickers hardness HV	PSI
150	50		50	22,000
200	60		60	29,000
250	80		80	37,000
300	90		95	43,000
350	100		110	50,000
400	120		125	58,000
450	130		140	66,000
500	150		155	73,000
550	165		170	79,000
600	175		185	85,000
650	190		200	92,000
700	200		220	98,000
750	215		235	105,000
800	230	22	250	112,000
850	250	25	265	120,000
900	270	27	280	128,000
950	280	29	295	135,000
1,000	300	31	310	143,000
1,050	310	33	325	150,000
1,100	320	34	340	158,000
1,150	340	36	360	164,000
1,200	350	38	375	170,000
1,250	370	40	390	177,000
1,300	380	41	405	185,000
1,350	400	43	420	192,000
1,400	410	44	435	200,000
1,450	430	45	450	207,000
1,500	440	46	465	214,000
1,550	450	48	480	221,000
1,600	470	49	495	228,000
		51	530	247,000
		53	560	265,000
		55	595	283,000
		57	635	
		59	680	
		61	720	
		63	770	
		64	800	
		65	830	
		66	870	
		67	900	
		68	940	
		69	980	

Page information refers to:
HB = this handbook · GC = Walter General Catalogue 2012 · SC = Walter Supplementary Catalog 2014

Thread tapping core diameters

M ISO metric coarse pitch thread

Designation (DIN 13)	Female thread core diameter (mm)		Drill size (mm)
	min	6H max	
M 2	1.567	1.679	1.60
M 2.5	2.013	2.138	2.05
M 3	2.459	2.599	2.50
M 4	3.242	3.422	3.30
M 5	4.134	4.334	4.20
M 6	4.917	5.153	5.00
M 8	6.647	6.912	6.80
M 10	8.376	8.676	8.50
M 12	10.106	10.441	10.20
M 14	11.835	12.210	12.00
M 16	13.835	14.210	14.00
M 18	15.294	15.744	15.50
M 20	17.294	17.744	17.50
M 24	20.752	21.252	21.00
M 27	23.752	24.252	24.00
M 30	26.211	26.771	26.50
M 36	31.670	32.270	32.00
M 42	37.129	37.799	37.50

MF ISO metric fine pitch thread

Designation (DIN 13)	Female thread core diameter (mm)		Drill size (mm)
	min	6H max	
M 6 x 0.75	5.188	5.378	5.25
M 8 x 1	6.917	7.153	7.00
M 10 x 1	8.917	9.153	9.00
M 10 x 1.25	8.647	8.912	8.75
M 12 x 1	10.917	11.153	11.00
M 12 x 1.25	10.647	10.912	10.75
M 12 x 1.5	10.376	10.676	10.50
M 14 x 1.5	12.376	12.676	12.50
M 16 x 1.5	14.376	14.676	14.50
M 18 x 1.5	16.376	16.676	16.50
M 20 x 1.5	18.376	18.676	18.50
M 22 x 1.5	20.376	20.676	20.50

UNC Unified Coarse Thread

Designation (ASME B 1.1)	Female thread core diameter (mm)		Drill size (mm)
	min	2B max	
No. 2-56	1.694	1.872	1.85
No. 4-40	2.156	2.385	2.35
No. 6-32	2.642	2.896	2.85
No. 8-32	3.302	3.531	3.50
No. 10-24	3.683	3.962	3.90
$^{1}/_{4}$ -20	4.976	5.268	5.10
$^{5}/_{16}$ -18	6.411	6.734	6.60
$^{3}/_{8}$ -16	7.805	8.164	8.00
$^{1}/_{2}$ -13	10.584	11.013	10.80
$^{5}/_{8}$ -11	13.376	13.868	13.50
$^{3}/_{4}$ -10	16.299	16.833	16.50

UNF Unified Fine Thread

Designation (ASME B 1.1)	Female thread core diameter (mm)		Drill size (mm)
	min	2B max	
No. 4-48	2.271	2.459	2.40
No. 6-40	2.819	3.023	2.95
No. 8-36	3.404	3.607	3.50
No. 10-32	3.962	4.166	4.10
$^{1}/_{4}$ -28	5.367	5.580	5.50
$^{5}/_{16}$ -24	6.792	7.038	6.90
$^{3}/_{8}$ -24	8.379	8.626	8.50
$^{1}/_{2}$ -20	11.326	11.618	11.50
$^{5}/_{8}$ -18	14.348	14.671	14.50

G Pipe thread

Designation (DIN EN ISO 228)	Female thread core diameter (mm)		Drill size (mm)
	min	max	
G $^{1}/_{8}$	8.566	8.848	8.80
G $^{1}/_{4}$	11.445	11.890	11.80
G $^{3}/_{8}$	14.950	15.395	15.25
G $^{1}/_{2}$	18.632	19.173	19.00
G $^{5}/_{8}$	20.588	21.129	21.00
G $^{3}/_{4}$	24.118	24.659	24.50
G 1	30.292	30.932	30.75

Thread forming core diameters

M ISO metric coarse pitch thread

Designation (DIN 13)	Female thread core diameter (DIN 13-50) (mm)		Pilot drill size (mm)
	min	7H max	
M 1.6	1.221	-	1.45
M 2	1.567	1.707	1.82
M 2.5	2.013	2.173	2.30
M 3	2.459	2.639	2.80
M 3.5	2.850	3.050	3.25
M 4	3.242	3.466	3.70
M 5	4.134	4.384	4.65
M 6	4.917	5.217	5.55
M 8	6.647	6.982	7.40
M 10	8.376	8.751	9.30
M 12	10.106	10.106	11.20
M 14	11.835	12.310	13.10
M 16	13.835	14.310	15.10

MF ISO metric fine pitch thread

Designation (DIN 13)	Female thread core diameter (DIN 13-50) (mm)		Pilot drill size (mm)
	min	7H max	
M 6 x 0.75	5.188	5.424	5.65
M 8 x 1	6.917	7.217	7.55
M 10 x 1	8.917	9.217	9.55
M 12 x 1	10.917	11.217	11.55
M 12 x 1.5	10.376	10.751	11.30
M 14 x 1.5	12.376	12.751	13.30
M 16 x 1.5	14.376	14.751	15.30

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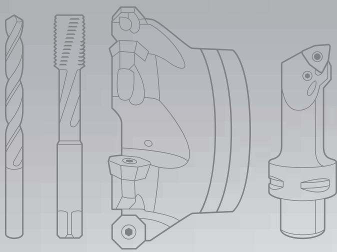

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